



காமராஜர் துறைமுக நிறுவனம்

कामराजर पोर्ट लिमिटेड

Kamarajar Port Limited

(A Minl Ratna Government of India Undertaking)

KPL/MS/Env/FP-EC/2015

Date: 28.09.2017

To

Director

(IA.III Section)

Ministry of Environment, Forest and Climate Change

Indira Paryavaran Bhawan

Jor Bagh Road,

New Delhi-110003.

Kind Attn: Shri Kushal Vashist

Sir,

Subject: Kamarajar Port Limited- Development of the facilities envisaged in the port Master plan (Phase-III) – Submission of additional information as sought by the Expert Appraisal Committee.

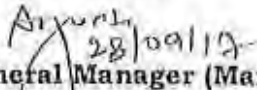
Ref: Minutes of the 21st Meeting of Expert Appraisal Committee (Infra-2) held on 21-24th August, 2017.

Please find enclosed the point wise details/documents to the additional information as sought by the Expert Appraisal Committee (Infra-2) for your kind perusal.

It is requested to kindly arrange to include the proposal in the next EAC (Infra-2) meeting.

Thanking You.

Yours sincerely,


28/09/17
General Manager (Marine Services)

Registered Office & Trade Facilitation Centre :
4th Floor, Super Specialty Diabetic Centre
(erstwhile DLB Building)
Rajaji Salai, Chennai - 600 001.
Ph : 044-25251666-70 Fax : 044-25251665
CIN: U45203TN1999G01043322

பெரியகுரு கார்போரல் & சுவாஸ்திய சுகித்யா கெந்த் :
சுபீரீ மெடிசல், சூப்பர் ச்பெசலிட்டி டயாபட்டிக் செந்தர்,
(ஃபீர் எல் டிபி கில்டிங்)
ராஜாஜி சலாஃ, சென்ஃ-600 001.
ஃன : 044-25251666-70 ஃக்ச : 044-25251665

website : www.ennoreport.gov.in e-mail : info@epi.gov.in
Kamarajar Port - India's Port of the Millennium

Port Office : Vallur Post, Chennai - 600 120
Ph : 044-27950030-40 Fax : 044-27950002

புர்ட் கார்போரல் : வல்லூர் புர்ட், சென்ஃ - 600 120
ஃன : 044-27950030-40 ஃக்ச : 044-27950002

KAMARAJAR PORT LIMITED
(A Miniratna Govt of India)

Subject: Kamarajar Port Limited- Development of the facilities envisaged in the port Master plan (Phase-III) – Submission of additional information as sought by the Expert Appraisal Committee.

Ref: Minutes of the 21st Meeting of Expert Appraisal Committee (Infra-2) held on 21-24th August 2017.

S.No	Description of the additional information sought by EAC	Response of KPL
(i)	Certified compliance report issued by MoEF&CC, Regional office on Environmental conditions stipulated in the existing environmental clearances.	Please find enclosed the copies of the certified compliance report issued by Regional Office of MoEF&CC is enclosed as Annexure -1
(ii)	Point wise reply to the SCZMA letter	Please find enclosed the Point wise reply to the SCZMA letter is enclosed as Annexure -2
(iii)	Reply to the complaint made by Conservation Action Trust	Please find enclosed the Point wise reply to the complaint made by Conservation Action Trust as Annexure -3
(iv)	Point wise reply to the complaint made by Conservation Action Trust	
(v)	Details and status of Court cases pending in courts	The details and status of court cases pending in courts is enclosed as Annexure -4
(vi)	Submit the set of following documents required as per para 4.2 (i) of CRZ Notification, 2011	
(a)	Form-1 (Annexure –IV) of the notification	The comprehensive EIA report covering all these points is enclosed to this letter.
(b)	Rapid EIA report including marine and terrestrial component except for construction projects listed under 4© and (d)	
(C)	Comprehensive EIA with cumulative	

	studies for projects in the stretches classified as low and medium eroding by MoEF based on scientific studies and in consultation with the state Governments and Union territory administration	
(d)	Disaster management Report, Risk Assessment Report and Management Plan	
(e)	CRZ map indicating HTL and LTL demarcated by one of the authorized agency (as indicated in para 2) in 1:4000 scale.	The CRZ map indicating HTL and LTL demarcation, CRZ-I, II, III and IV areas including other notified ecologically sensitive areas, project layout imposed on it, prepared by IRS, Anna University is enclosed as Annexure - 6
(f)	Project layout superimposed on the above map at (e) above.	
(g)	The CRZ map normally covering 7 km radius around the project site	
(h)	The CRZ map indicating the CRZ-I, II, III and IV areas including other notified ecologically sensitive areas	
(i)	No Object Certificate from the State Pollution Control Boards or Union territory Pollution Control Committees for the projects involving discharge of effluents, solid wastes, sewage and the like.	There is no effluent/waste discharged into sea. Accordingly this is not applicable.

Certified Copy of Compliance Report

Subject: Construction of New Satellite Port at Ennore near Madras in Tamil Nadu.

Ref: J-16011/9/87-IA.III dated 28.9.1992

Present status of the project:

The project work has been completed, commissioned and under operation

Date of Monitoring: 24.12.2016

S.No	Conditions	Compliance
(i)	The total land area of the Project should be limited to 400 Ha as proposed	<p>Not complied.</p> <p>The Port has acquired more land ie. now they have 1137.66 hectares of land area. No information was provided about the approval for the additional land.</p>
(ii)	Hill features of Karikkal and Bodiparai hills should not be destroyed for the construction of breakwater since this will drastically change the landscape.	<p>Refer below:</p> <p>No quarrying operation has been carried out in Bodiparai hill and only Karikkal Quarry was used for taking the rock material. The quarry operation was completed and restoration was taken up as informed.</p> <p>Chennai Port after completion of the construction of breakwaters the quarry was handed over to District Collector, Vellore Dist. Vide its letter No.11/6828/96/E dated 7.1.2002, along with abandonment Certificate for closure of Karikkal quarry issued by Directorate of Mines Safety Oorgaum.</p>
(iii)	Quarrying operations must be carried out with utmost care giving consideration to the topography, vegetation and drainage system in consultation with expert institutions like	<p>Reportedly Complied with.</p> <p>The Chennai Port Trust authorities informed that rehabilitation of the quarry site was taken</p>

	the Centre for Mining Environment, Indian School of Mines, Dhanbad. Quarrying site must be rehabilitated properly keeping in view such measures as proper terracing, additional top soil and reforestation. Major blasting in the port area should not be undertaken;	up and restored.
(iv)	A detailed Environment Management Plan should be prepared for each of the quarry site proposed and proper landscaping should form part of these operations. This should be included as a condition in the contracts. Its full implementation is the responsibility of the project authorities;	Reportedly complied with. It was informed that the EMP was prepared and implemented during quarry operations.
(v)	Alternate sources of water supply other than tapping of ground water through bore wells must be explored to avoid intrusion of salt water since fresh water is scarce in the island. A specific study should be undertaken on the ground water potential, recharge capacity, present drawal and future plans in an integrated manner. State/central ground Water Board should be fully involved in this study. The report should be submitted within one year.	Refer below: The water for construction, drinking, etc., was brought by the trucks and no deep bore wells were made in the project area. No information was provided about the specific study. However rainwater harvesting arrangement was made.
(vi)	Dredging operations must be undertaken in stages in consultation with some expert institution like CWPRS, in such a way as to ensure that these operations do not deteriorate the surface water quality which must be maintained within the prescribed standards. Water parameters should be measured on regular intervals to monitor water quality. Dredging material should not be used for filling up any water body;	Complied The dredged materials were not dumped in the water bodies. The dredged materials were used for reclamation of the low lying areas and beach nourishment along the coastline on the northern side of the north breakwater to mitigate erosion.
(vii)	Large scale dumping of waste shall not be undertaken by the Project Authorities without clearance from the environment	Complied No waste was dumped inside the port

	angle. This is to ensure that marine ecology of the area is not affected by dumping in the marshy lagoon/low level areas;	premises as informed and they are regularly monitoring the marine water quality inside the port.
(viii)	A green belt of appropriate width (say 200 meters) must be provided along the periphery of the port excluding the water area. Adequate provision for the initial cost for greening and maintenance has to be made in the project cost and subsequent annual budget for the port;	Not complied. As against the development of green belt for a width of 200 mts, about 60 mts wide, 2.5 km long area has been brought under green belt measuring about 15 hectares.
(ix)	Green belt development of 50 Ha of land instead of 25 Ha proposed inside the port should be developed. This may spread in different pockets in vacant areas and need not be concentrated on one area. Apart from this green belt area of about 5.00 million sq m available in the island should be sustained by providing proper maintenance. Appropriate fund allocation for initial cost for greening and maintenance of 50 Ha of land and 5.00 million sq m available in the island has to be provided for in the project cost and subsequent annual budget for the port.	Refer below: Green belt of 50 hectares spread over in different pockets and vacant places inside the port premises was developed and maintained as informed. No information was provided about and 5.00 million sq m available in the island has to be provided for in the project cost and subsequent annual budget for the port.
(x)	Suitable low lying areas should be identified for mangrove plantation and provision of the required amount must be made for this purpose in the project cost by the project authorities;	Refer below: The project proponent in association with Forest Department has identified and planted mangroves between Ennore and Pulicat as informed at that time.
(xi)	The project authorities must ensure that no cutting of trees take up place in the project area.	Refer below: No cutting of trees was done as informed.
(xii)	With the operation of Ennore Port as a measure of decongestion of Madras port the traffic in Madras port must be gradually reduced. Ministry of Surface Transport, Madras Port Trust and Ennore Port Trust must ensure that adequate measures in this regard are taken.	Complied. Handling of Thermal coal for TNEB was completely shifted from Chennai port to Ennore port and adequate measures were taken.
(xiii)	To control dust pollution from coal, following measures must be adopted (a) totally enclosed continuous loaders /	Complied. The following measures are taken to control

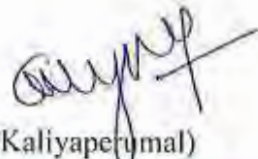
	<p>unloaders and conveyor system should be adopted</p> <p>(b) dust extraction system should be provided at all transfer points</p> <p>© to minimize dust generation during stacking, loading, transferring operations as well as to minimize wind blown dust from the stack yard, proper water spraying should be done.</p>	<p>the dust</p> <p>Coal from the ship is unloaded through shore based gantry cranes with grab un-loaders and fed to the conveyor through hopper. The coal is transported through elevated closed conveyor system to the thermal power plant. No coal is stored inside port.</p> <p>Sprinkling of water during unloading operations.</p> <p>Cleaning of the operational area/jetty after every unloading operation to prevent piling up of material.</p> <p>Minimize stock pile heights and cargo fall heights during loading.</p>
(xiv)	<p>Air pollution monitoring stations at strategic locations must be set up in the port area and in the neighborhood for monitoring dust/particulate matter at regular intervals. Adequate funds must be allocated towards this in the project cost.</p>	<p>Complied.</p> <p>The project proponent has engaged an external agency to carry out the periodical monitoring, testing and analysis of Ambient air quality and work zone air quality in the port premises and for this an adequate has been allocated..</p>
(xv)	<p>To contain noise levels within the prescribed standards roofed conveyor belts should be deployed. Noise pollution in the port area should be reduced by putting up sound barriers at suitable locations. To protect the workers from high noise levels ear muffs/plugs should be provided.</p>	<p>Complied.</p> <p>Noise levels at the work zones were monitored regularly and also providing PPE likes ear muffs/plugs to workers working near to machineries.</p>
(xvi)	<p>Water pollution monitoring stations at strategic points must be set up in the project area to monitor water quality and marine pollution at regular intervals.</p>	<p>Complied.</p> <p>The project authorities had engaged M/s. Richardson & Cruddas (1972) Ltd (a Govt of India Undertaking) from April 2005 to 2009 followed by M/s. Ramky Environmental Engineers, Hyderabad. Since the year 2013 till date port has engaged M/s. Hubert Enviro</p>

		Care Pvt Ltd., Chennai for the periodical monitoring, testing and analysis of ground water and marine water quality inside the port premises.
(xvii)	To contain accidental spillage of oil, the project authorities should deploy oil booms, multipurpose anti pollution craft, oil recovery cum reception craft, chemical dispersant and other equipment such as shovels, swabs, waste collection bags, etc.	Complied. Necessary chemicals, booms, dispersants, etc. were readily available for containment of any accidental spill. Oil spill contingency plan is prepared as per the National Oil Spill Disaster Contingency plan (NOS-DCP).
(xviii)	An environment division must be set up in Ennore port headed by Environment Manager with appropriate strength of Environment Engineers, Forest officers, forest guards and other laboratory staff. An environmental laboratory for Air Water and solid waste monitoring must be set up with adequate equipment and qualified staff. Adequate fund for establishment of laboratory must be provided in the project cost. The annual recurring cost for the laboratory and Environmental Division must be provided for in the annual budget of the port.	Refer below: Only one officer (Manager level) has been given the charge of Environmental In charge along with another officer who has been given an additional works. No laboratory has been setup. All the monitoring works are carried out by external laboratories. Adequate amount has been allocated for Environmental Management purpose.
(xix)	The Ennore Port Trust authorities must draw up a Disaster Management Plan and get it approved by the nodal department of the state Government and forward it to the Ministry for approval.	Complied. Port has prepared Disaster Management Plan through M/s. Environmental Technical Services Pvt. Ltd, New Delhi. A Crisis Management Plan was prepared and submitted to Ministry. Mock drills are conducted regularly.
(xx)	Adequate measure must be taken to protect the Pulicat Lake, a bird sanctuary for several species of resident and migratory water birds and having potential for fishing as an important economic activity of the area.	Refer below: The Pulicat lake is situated about 20 kms away from the location of the Ennore port.
(xxi)	A Monitoring Committee will be set up	Complied.

	by the project authorities to review the implementation of the above conditions with representatives from MoEF, State forest Department, State pollution Control Board and representative of Port Authority.	A monitoring committee with representatives from Ministry of Environment & Forests, State Forest Department, State Environment Department, State Pollution Control Board, Tamil Nadu Electricity Board and port officials was constituted. They conducted ten Environmental Monitoring Committee meetings and reviewed the implementation of the MoEF conditions.
(xxii)	The quality of treated effluents, solid wastes, emissions and noise levels, etc., must confirm to the standards laid down by the competent authorities including Central/State Pollution Control Board and under the Environment (Protection) Act 1986 whichever area more stringent.	Complied. The environmental parameters are monitored by external agency and as per the results the results are within the limit.
(xxiii)	The project authorities must ensure that project oustees if any must be adequately compensated and rehabilitated.	Reportedly complied. The Project oustees were properly compensated and rehabilitated at the time of land acquisition by the TNEB, Govt. of Tamil Nadu.
3.	Adequate financial provision must be made in the Project estimates and the annual budget to meet the financial requirement for the implementation of aforesaid safeguards. The funds so provided item wise should not be diverted for any other purpose.	Complied. The Environmental expenditure for the year 2012-13 is Rs.33,90,570/- The expenditure for the year 2013-14 is Rs.38,99,364/-. The expenditure for the year 2014-15 is Rs.47,21,592 lakhs. The expenditure for the year 2015-16 is Rs.47,00,229 lakhs. (The expenditure is for the coal berths CB1 & CB2 and for the General Cargo Berth)
4.	In case of any deviations/alterations in the project proposal from those submitted to	Complied

this Ministry for clearance and on the basis of EIA findings these stipulations may be modified and/or new ones imposed for ensuring environmental protection.	The deviation is ratified by Ministry of Environment, Forest and Climate Change vide letter No.J-16011/9/87-IA-III dated 3.1.2001. <i>Annex: II</i> .
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This has the approval of Addl. PCCF(C) vide diary No.1737dated29.12.2016.


 (Dr. C. Kaliyaperumal)
 Director(S)
 Dr. C. KALIYAPERUMAL, M.E., PhD
 Director (S)
 Government of India
 Ministry of Environment, Forests & Climate Change
 Regional Office (South Eastern Zone)
 HEPC Building, No.34, Cathedral Garden Road,
 Nungambakkam, Chennai-600 034.

....

Paryavaran Bhavan, CGO Complex,
Lodi Road, New Delhi- 110 003.

Dated the 28th September, 1992:

OFFICE MEMORANDUM

Sub :- Construction of New Satellite Port at Ennore
near Madras in Tamil Nadu

.....

Reference is invited to Ministry of Surface Transport's letter No. PD/11013/1/92-MPT dated 29th October, 1991 on the above subject.

2. The proposal has been examined and is accorded clearance from environmental angle subject to the following conditions:

- (i) The total land area of the project should be limited to 400 hectares as proposed;
- (ii) Hill features of Karikal and Bodaparai hills should not be destroyed for requirement of stone for the construction of breakwater, since this will drastically change the local landscape;
- (iii) Quarrying operations must be carried out with utmost care giving consideration to the topography, vegetation and drainage system in consultation with expert institutions like the Centre for Mining Environment, Indian School of Mines Dhanabad. Quarrying sites must be rehabilitated properly keeping in view such measures as proper terracing, addition of top soil and reforestation. Major blasting in the port area should not be undertaken;
- (iv) A detailed Environmental Management Plan should be prepared for each of the quarry sites proposed and proper land scaping should form a part of these operations. This should be included as a condition in the contracts. Its full implementation is the responsibility of the project authorities;
- (v) Alternate sources of water supply other than tapping of ground water through bore wells must be explored to avoid intrusion of salt water since fresh water is scarce in the Island. A specific study should be undertaken on the ground water potential, recharge capacity, present drawal and future plans in an integrated manner.

....2/-

State/Central Ground Water Boards should be fully involved in this study. The report should be submitted within one year;

- (vi) Dredging operations must be undertaken in stages in consultation with some expert institution like Central Water and Power Research Station (CWPRS) Khadak-Vasala, Pune, in such a way as to ensure that these operations do not deteriorate the surface water quality which must be maintained within the prescribed standards. Water quality parameters viz. turbidity, dissolved oxygen, ammoniacal nutrients in waters should be measures on regular intervals to monitor water quality. Dredging material should not be used for filling up any water-body;
- (vii) Large scale dumping of wastes shall not be undertaken by the project authorities without clearance from environmental angle. This is to ensure that marine ecology of the area is not affected by dumping in the marshy lagoon/ low level areas;
- (viii) A green belt of appropriate width (say 200 metres must be provided all along the periphery of the port excluding the water areas. Adequate provision for the initial cost for greening and maintenance has to be made in the project cost and subsequent annual budget for the port;
- (ix) 125 AC Green belt development of 50 hectares of land instead of 25 hectares proposed inside the port should be developed. This may be spread in different pockets in vacant areas and need not be concentrated in one area. Apart from this a green belt area of about 5.0 million square metres available in the island should be sustained by providing proper maintenance. Appropriate fund allocation for initial costs for greening and maintenance of 50 hectares of land and 5.0 million square metres available green belt in the island has to be provided for in the project cost and subsequent annual budgets for the port;
- (x) Suitable low-lying areas should be identified for mangrove plantation and provision of the required amount must be made for this purpose in the project cost by the project authorities;
- (xi) The project authorities must ensure that no cutting of trees takes place in the project area;

- (xii) With the operation of the Ennore Port, as a measure of decongestion of Madras Port, the traffic in Madras Port must be gradually reduced. Ministry of Surface Transport, Madras Port Trust and Ennore Port Trust must ensure that adequate measures in this regard are taken;
- (xiii) To control dust pollution from coal following measures must be adopted :
- Totally enclosed continuous loaders/unloaders and conveyor system should be adopted;
 - dust extraction system should be provided at all transfer points;
 - to minimise dust generation during stacking, loading, transferring operations, as well as to minimise wind blown dust from the stack yard proper, water spraying should be done.
- (xiv) Air pollution monitoring stations at strategic locations must be set up in the port area and in the neighbourhood for monitoring of dust/particulate matter at regular intervals. Adequate funds must be allocated towards this in the project cost;
- (xv) To contain noise levels within the prescribed standards roofed conveyor belts should be deployed. Noise pollution in the port area could be reduced by putting up sound barriers at suitable locations. To protect the workers from high noise levels ear muffs/plugs should be provided;
- (xvi) Water pollution monitoring stations at strategic points must be set up in the project area to monitor water quality and marine pollution at regular intervals;
- (xvii) To contain accidental spillage of oil, the project authorities should deploy oil booms, multipurpose anti-pollution craft, oil recovery cum reception craft, chemical dispersant and other equipments such as shovels, swabs, waste collection bags etc.;
- (xviii) An Environmental Division must be set up in the Ennore Port headed by an Environmental Manager with appropriate strength of Environment Engineers, Forest Officers, Forest Guards, and other laboratory staff. An Environmental Laboratory for Air, Water and solid waste monitoring must be set up with adequate equipment and qualified staff. Adequate funds for

establishment of the Laboratory must be provided in the project cost. The annual recurring cost for the laboratory and Environmental Division must be provided for in the annual budget of the Port;

- (xix) The Ennore Port Trust authorities must draw up a Disaster Management Plan and get it approved by the nodal department of the State Government and forward it to this Ministry for approval;
- (xx) Adequate measures must be taken to protect the Pulicat Lake, a Bird Sanctuary, for several species of resident and migratory Water-Birds and having potential for fishing as an important economic activity of the area;
- (xxi) A monitoring committee will be set up by the project authorities to review the implementation of the above conditions with representative from Ministry of Environment and Forests, State Forest Department, State Environment Department, State Pollution Control Board and representative of Port Authority;
- (xxii) The quality of treated effluents, solid wastes, emissions and noise levels etc., must conform to the standards laid down by the competent authorities including Central/State Pollution Control Board and under the Environment (Protection) Act, 1986, whichever are more stringent; and,
- (xxiii) The project authorities must ensure that project oustees if any must be adequately compensated and rehabilitated.

3. Adequate financial provision must be made in the project estimates and the annual budget to meet the financial requirement for the implementation of the aforesaid safeguards. The funds so provided itemwise should not be diverted for any other purpose.

4. In case of any deviation/alterations in the project proposal from those submitted to this Ministry for clearance and on the basis of Environmental Impact Assessment findings these stipulations may be modified and/or new ones imposed for ensuring environmental protection.

5. These stipulations will be enforced among others under the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981 and the Environment (Protection) Act, 1986.

I. K. Kamboj

(I.K. KAMBOJ)
JOINT DIRECTOR (SCIENTIFIC)

To

✓ The Secretary,
Ministry of Surface Transport,
Parivahan Bhavan,
Parliament Street,
NEW DELHI - 110 001.

Copy to:

1. Chairman, Madras Port Trust, Rajaji Salai, Madras-600001
2. Chairman, Tamil Nadu Pollution Control Board, 32, Santhos High Road, 3rd & 4th Floors, Madras-600 004.
3. Secretary and Commissioner, Forest and Environment Department, Govt. of Tamil Nadu, Fort St. George, Madras- 600 009.
4. Chief Conservator of Forests, Regional Office of Southern Zone, Ministry of Environment and Forests, No. 463, 1st Main, Third Block, Third Stage, Basaveswari Nagar, Bangalore- 560 079.
5. Chairman, Central Pollution Control Board- CBD-cum-Office Complex, Parivash Bhavan, East Arjun Nagar, Shahdara, Delhi- 110 032.
6. DIG(FC), Regional Office Incharge, Ministry of Environment and Forests, Paryavaran Bhavan, New Delhi.
7. Guard file.

(I.K. KAMBOJ)
JOINT DIRECTOR (SCIENTIFIC)

Annexure

OFFICE OF THE
PROJECT DIRECTOR, ENnore PORT PROJECT
CHIEF ENGINEER, MAJOR PORT TRUST

16 DEC 2001

No. J-16011/9/87-1A-1
Government of India
Ministry of Environment & Forests



Paryavaran Bhavan
C.G.O. Complex, Lodhi Road,
New Delhi-110003

January 3, 2001



To
The Chairman,
Chennai Port Trust,
Rajaji Salai
Chennai - 600001

Sub: Construction of new port at Ennore - Regularisation of deviations to the original clearance granted by Ministry of Environment & Forests and its additional impact assessment - regarding.

Sir,

The undersigned is directed to refer to your letter no. 19/28984(5)/85/E dated 13th November, 2000 regarding the subject mentioned above. The information furnished along with your above referred letter have been examined. It is noted that the change in scope of the project has essentially been caused to accommodate LNG carriers and keeping in view the perspective plan of development of Ennore Port. It is also noted that the master plan consultants have finalised the future Stage-II development of the Ennore Port. NIOT has been entrusted to carry out studies on the movement of sand at the nourishment area.

In view of the above, Ministry of Environment and Forests hereby takes on record the changes made in the scope of the project for construction of a new port at Ennore subject to the following additional conditions.

- (i) The studies being undertaken by NIOT regarding movement of sand at the nourishment area should be completed early and report on the studies made by NIOT may be submitted to this Ministry. The recommendations which may emerge out of the studies carried out by NIOT shall be implemented effectively.
- (ii) The master plan for development of Ennore Port (Stage-II) should be finalised. A comprehensive EIA study should be carried out taking into consideration the developmental scenarios covered under the master plan so finalised. The report should be submitted to this Ministry within one year.
- (iii) Necessary budget provision may be made in the revised cost estimates for effective implementation of the environmental safeguards stipulated by this Ministry as mentioned above and those already stipulated vide this Ministry's clearance letter of even no. dated 28th September, 1992.


Further, immediate action may be taken to comply with the condition No. (XVI), (XIX) and (XX) contained in this Ministry's clearance letter of even no. dated 28th

Dr. B. J. C.
R.P.
RECEIVED
16/1/01
E.E.P.
E.E.P.
C.
20/1/01
AL PW 48
20/1/01

September, 1992. Consultants/Expert Agencies must be appointed without further delay for carrying out the requisite studies/monitoring work and the compliance status submitted to this Ministry.

You are hereby requested to submit an action taken report on the above stated conditions within 4 weeks of the receipt of this letter.

Yours faithfully,



(Dr. S.K. Aggarwal)
Additional Director

Certified Copy of Compliance Report

Sub: Ennore Port Expansion Proposals-Development of Terminals for marine liquids, coal, iron and containers in Second phase and associated capital dredging at Ennore Port Environmental clearance.

Ref: F.No. 10-28/2005-IA-III dated 19th May 2006.

Present status of the project:

The Project Authority has carried out capital dredging for the development of marine liquids, coal, iron and container terminals in second phase. As given in the EC 6 million m³ of dredged material from the navigational channel and 9.5 million m³ from the basin have been dredged and out of this 4 million m³ of dredged material was used for reclamation of low lying area within the port limit, 3 million m³ has been put for the beach nourishment and remaining 8.5 million m³ of dredged has been put in to the sea. Maintenance has not been carried out since 2009 onwards as informed.

Out of 2 container terminal 1 terminal work is about to be completed and the other terminal work will take about one year to complete. The other terminals construction works are completed and commissioned except iron ore terminal. This iron ore terminal has not yet commissioned due to ban on iron ore mining and also proposed to convert this terminal in to coal handling terminal.

Date of Monitoring: 24.12.2016

A. Specific Condition

Sr.No	Condition	Compliance
1	All the conditions stipulated in the No Objection Certificate from "Tamil Nadu State Pollution Control Board vide their letter No.T12/TNPCB/Misc/F.3322/TVLR/05 dt. 7/12/06 should be strictly implemented.	Reported the Complied. The PA inform that all the conditions stipulated in the No Objection Certificate obtained from "Tamil Nadu State Pollution Control Board vide their letter No.T12/TNPCB/Misc/F.3322/TVLR/05 dt. 7/12/06 are should be strictly implemented,
2	Groins and other suitable structures should be constructed to prevent the closing of the mouth of Ennore creek.	Complied. M/s. KPL has created a sand trap in the channel entrance to prevent siltation into the port basin and Munising accretion /Stabilizations of land formed on south break water based on the study

		carried out by IIT, Chennai.
3	The DPR and the technical details to be awarded to the BOT operators should provided to MoEF for post project monitoring within 6 months from the date of receipt of this letter.	<p>Compiled</p> <p>The BOT Operators are only Liquid Terminal, Iron Ore and Coal Terminals. DPR for Marine Liquid terminal was submitted vide letter dated EPL/MS/49/2007 dated 3/7/2007. The DPR for Iron ore and Coal terminals was submitted vide Ltrs .No EPL/MS/49/2008 dt. 13/3/2008.</p>
4	The marine terminal should be set up outside CRZ area	<p>Complied.</p> <p>The terminal area has been developed outside CRZ area as stipulated.</p>
5	Recommendations of Risk analysis report should be strictly implemented and a comprehensive quantitative Risk Analysis should be carried out before operationalizing the project.	<p>Refer below:</p> <p>M/s. Ennore Tank Terminals Pvt. Ltd. One of the BOT operator operating petroleum products and chemicals has carried out Risk Analysis through M/s. Central Leather Research Institute during 2007 . The firm has also carried out third party Safety Audit during 2014.</p> <p>M/s. Chettinad International Coal Terminal Pvt Ltd has also carriedout risk analysis. BOT operators and KPL are conducting mock drills once in three months. Mock drills are also conducted with other neighboring industries.</p>
6	Approval from Chief Controller of Explosives should be obtained for hazardous chemicals storage, transfer and related activities.	<p>Complied</p> <p>For the Marine Liquid Terminal, license was obtained for the Storage Terminal from the Chief Controller of Explosives Licence No. P/HQ/TN/15/4648(P19 1324) dated 18/10/08 and renewed during 2013, vide letter dated 17.4.2013. The validity of the above licence is till 31.12.2022</p>
7	The reclamation of the port area should be carried out with the dredged material. Dredged material should not be dumped into the sea. No reclamation should be carried outside the port limits	<p>Refer below:</p> <p>The dredged material was used for beach nourishment and filling up of low lying area within port limits. Further they have stored the dredged</p>

		<p>material on the southern side also and this material also lifted and used for filling the low lying areas.</p> <p>However, MoEF vide letter dated 6th September, 2006 has directed subsequently that dredged material which is not suitable for reclamation and beach nourishment should be disposed of in the sea.</p> <p>Some quantity (about 11 lakh m³) of dredged material was dumped in the port land 6 to 7 months before in the CRZ area along the port approach road on the southern side of KPL at different places. Against this a case was filed by NGOs in NGT, Application No. 8 of 2016. NGT directed KPL to remove the dumped material immediately within 4 weeks. KPL has not started to remove the material and they have requested 2 more weeks time to remove the same that is by 31.1.2017,</p>
8	The coastal protection works should be carried out after detailed hydrodynamic modeling studies and it should be ensured that no erosion or accretion takes place in other areas due to the shore protection works.	<p>Complied.</p> <p>KPL has carried out the study through Central Water and Power Research Station, Pune and the project proponent is taking necessary actions such as Construction of sand traps, beach nourishment etc. based on the findings of the study report.</p>
9	Reclamation of 500 acres should be carried out only for port development. The height of the reclaimed area will be maintained above the maximum flood level.	<p>Complied.</p> <p>Reclamation carried out for the creation of stock yards for coal and iron ore to about 4.5 m height, which is about 2 m above flood level.</p>
10	The wave tranquility study and the ship maneuvering studies carried out should be taken into account while operating the port.	<p>Complied</p> <p>Wave tranquillity study and ship manoeuvring studies were carried out and the port is in operational.</p>
11	The project proponent should ensure that during construction and operation of the port there will be no impact on the livelihood of the fisherman. The fisherman should be provided free access to carry out the fishing activity.	<p>Refer Below:</p> <p>Due to port operations though the PA stated that there is no adverse impact on fishing activities, there is a case filed in the NGT to this effect also.</p>
12	All necessary precaution while undertaking	Reportedly complied.

	construction and operation of the port should be taken keeping in view the bathymetric changes caused due to tsunami.	There were no bathymetry changes due to Tsunami as informed and after Tsunami bathymetry study was carried out.
13	All development in the port should be carried out in accordance with the Coastal Regulation Zone Notification, 1991 and approved Coastal Zone Management Plan of Tamil Nadu.	Reportedly complied. The PA informed that all development activities are carried out in accordance to CRZ Notification.
14	The project proponent should undertake a comprehensive hydrodynamic modeling study with regard to river diversion and submit the report to the Ministry within 6 months from the date of receipt of this letter. Further, the unit should comply with all the findings/recommendations of the study.	Refer below: Hydrodynamic study was carried out by NIOT, Chennai and the recommendations finding of the study are implemented as informed.
15	Construction of labour camps should be located outside Coastal Regulation Zone areas and should be provided with adequate cooking and sanitation facilities.	Complied The PA informed that some labours came from local and going back after their work. Some labours stayed in the labour camp which was located outside the project area and they have been provided adequate cooking and sanitation facilities.
16	The project-affected people, of any should be properly compensated and rehabilitated.	No details made available

B. General Conditions

S. No	Conditions	Compliance
1	Development of the proposed channel should be undertaken meticulously conforming to the applicable Central/ local rules and regulations including Coastal Regulation Zone Notification, 1991 and its amendments. All the construction designs/drawings relating to the proposed development activities must have approvals of the concerned State Government Department/Agencies.	Complied. All constructions and plans are approved by Port itself as a regulatory authority as informed.
2	A well equipped laboratory with suitable instruments to monitor the quality of air and water shall be set up as to ensure that the quality of ambient air and water	Refer below: There is no laboratory to monitor the Environmental parameters. Marine biologist also has not been appointed.

	<p>conforms to the prescribed standards. The laboratory will also be equipped with qualified manpower including a marine biologist so that the marine water quality is regularly monitored in order to ensure that the marine life is not adversely affected as a result of implementation of the said project. The quality of ambient air and water shall be monitored periodically in all the seasons and the results should be properly maintained for inspection of the concerned pollution control agencies. The periodic monitoring reports at least once in 6 months must be send to this Ministry (Regional Office at Bangalore) and Pollution Control Committee.</p>	<p>Whereas the project proponent has engaged an external approved agency for monitoring various environmental parameters inside the port. Ambient air quality at seven locations on weekly twice basis, marine water quality at 5 locations on monthly basis are monitored through external lab and the reports are submitted to state Pollution Control Board every month and Regional Office of the Ministry of Environment & Forests, Chennai once in six months. The operator of the Marine Liquid Terminal M/s. Ennore Tank Terminals Pvt. Ltd. and the operator of the coal terminal M/s. Chettinad International Coal Terminal Pvt are also monitoring environmental parameters.</p>
3	<p>Adequate provisions for infrastructure facilities such as water supply, fuel for cooking, sanitation etc. must be provided for the laborers during the construction period in order to avoid damage to the environment. Colonies for the laborers should not be located in Coastal Regulation Zone area. It should also be ensured that the construction workers do not cut trees including mangroves for fuel wood purpose.</p>	<p>Refer below: The PA informed that some labours came from local and went back after their work. Some labours stayed in the labour camp which was located outside the CRZ area and they have been provided adequate infra structure facilities such as cooking and sanitation facilities during construction.</p>
4	<p>To prevent discharge of sewage and other liquid wastes into the water bodies, adequate system for collection and treatment of the wastes must be provided. No sewage and other liquid wastes without treatment should be allowed to enter into the water bodies.</p>	<p>Complied Port handles coal, POL products and exports of automobiles. No effluent or liquid waste is generated due to the above operations. Solid waste is generated from the ships are collected, segregated and sent to various recyclers for further beneficial use. No wastes are dumped into water bodies. The operator M/s. CICTPL has installed Sewage Treatment Plant at the stack yard. M/s. ETTPL has installed ETP at the tankfarm. The sanitary wastes are disposed through septic tank and soak pits.</p>
5	<p>Appropriate facility should be created for the collection of solid and liquid wastes generated by the barges/vessels and their safe treatment and disposal should be</p>	<p>Complied Kamarajar port is having Port "Waste Oil & Sewage Disposal Policy-2015" for the disposal of waste oil through empanelled</p>

	ensured to avoid possible contamination of the water bodies.	list of CPCB approved waste oil recyclers. M/s. Supreme Petro Products Pvt. Ltd., Chennai is the firm empanelled till date. Port has engaged a contractor for the collection and disposal of solid waste generated inside the port and from ships. The collected wastes like plastics, metals, wood, paper, cans, etc are segregated and sent to approved re-cyclers / industries for further beneficial use or re-cycling. Hazardous waste generated from the oil terminal is sent to TSDF at Gummudipoondi.
6	Necessary navigational aids such as channel markers should be provided to prevent accidents. Internationally recognized safety standards shall be applied in case of barge/vessel movements	Complied. Navigational aids are available. The channel length has been increased and additional navigational aids are provided.
7	The project authorities should take appropriate community development and welfare measures for villagers in the vicinity of the project site, including drinking water facilities. A separate fund should be allocated for this purpose.	Complied. As part of community development and welfare measures, Port has constructed new school building at a neighboring Kattupalli village. Ennore port has also provided access road and street light facility to the nearby Kattupalli village. A school building for Attipattu village was constructed during the year 2010-11 under CSR and provided furniture, toilet facility for school during 2011-12 under CSR. Road improvement work at AttipattuPudu Nagar village was carried during 2011-12. EPI has engaged 20 members of women Self Help Group belonging to Attipattu village during September 2011. Port has engaged about 100 members of women Self Help Group belonging to the nearby Kattupalli for taking up of plantation and maintenance of green belt. The amount spent on CSR activities carried out during 2012-13 is Rs.2.54 crores and during 2013-14 is Rs.4.07,41,176. During 2014-15 is Rs.

		<p>3.19, 50, 482.</p> <p>An amount of Rs. 2,64,465 was spent to provide safe drinking water facility to Govt. Adidraavidar High School at vallur village.</p> <p>During 2015-16 is Rs. 7,29,51,960/-. The estimated amount for the CSR activities for the financial year 201-17 is Rs.8.43 crores.</p>
8	The quarrying material required for the construction purpose shall be obtained only from the approved quarries/borrow areas. Adequate safeguard measures shall be taken to ensure that the overburden and rocks at the quarry side do not find their way into water bodies.	<p>Refer below:</p> <p>There is no requirement of quarrying material for this project as informed.</p>
9	For employing unskilled, semi skilled and skilled workers for the project, preference shall be given to local people.	<p>Complied</p> <p>Port is pursuing the terminal operators or BOT operators to give priority to the locals in giving job opportunities. Out of the total of approx.950 employees engaged by Port and BOT operators are approx. 735 belong to the local areas. Out of these about 120 are unskilled, 100 are semi-skilled and 480 are skilled</p>
10	The recommendations made in the Environmental Management Plan and Disaster Management Plan, as contained in the Environmental Impact Assessment and Risk analysis Reports of the project shall be effectively implemented.	<p>Complied</p> <p>KPL informed that all the EMP and DMP recommendations are implemented.</p>
11	A separate Environmental Management Cell with suitable qualified staff to carry various environments should be set up under the charge of a senior Executive who will report directly to the Chief Executive of the Company.	<p>Refer below:</p> <p>Only one officer (Manager level) has been given the charge of Environmental In charge along with another officer who has been given an additional works. All the monitoring works are carried out by external laboratories. The BOT operators are monitoring the environmental quality at their respective terminals and it is monitored by KPL authorities as informed.</p>
12	The funds earmarked for environment	Complied.

	<p>protection measures should be maintained in a separate account and there should be no diversion of these funds for any other purpose. A year-wise expenditure on environmental safeguards should be reported to this Ministry.</p>	<p>The fund allocated for Environmental management Plan by KPL, year wise is as follows: 2014-15= Rs.30,36,262/- 2015-16 = Rs. 60,72,033/- Year 2016-2017 (Planning)= Rs.43,00,000/-</p> <p>The fund allocated for Environmental management Plan for the Marine Liquid Terminal terminal for the year 2016-17 is Rs. 4356000/-</p>
13	<p>Full support should be extended to the officers of this Ministry's Regional Office at Bangalore and the officers of the Central and State Pollution Control Boards by the Project proponent during this inspection for monitoring purposes, by furnishing full details and action plans including the action taken reports in respect if mitigative measures and other environmental protection activities.</p>	<p>Complied KPL has extended full support during the site visit.</p>
14	<p>In case there is an intention of deviation or alteration in the project including the implementing agency, a fresh reference should be made to this Ministry for modification in the clearance conditions or imposition of new ones for ensuring environmental protection. The project proponent should be responsible for implementing the suggested safeguard measures,</p>	<p>(a). Specific condition (vii) was amended as "The dredged material not suitable for reclamation of the low lying areas of the port land and beach nourishment should be disposed of in the sea at the designated disposal site"vide MoEF letter No. 10-28/2005-1A-III dated 6.9.2006.</p> <p>(b). The quay length of the container terminal was increased from 700m to 1000m length vide MoEF letter No. 10-28/2005-1A.III dated 10.9.2007.and again modified in to 730 m for container and 270 m for multi pose cargo container vide MoEF letter No. 10-28/2005-1A.III dated 24.12.2014.</p>
15	<p>This Ministry reserves the right to revoke this clearance, if any of the conditions stipulated are not complied with to the satisfaction of this Ministry.</p>	<p>Agreed upon.</p>
16	<p>This Ministry or any other competent</p>	<p>Agreed upon.</p>

	authority may stipulate any additional conditions subsequently, if deemed necessary for environmental protection, which shall be complied with.	
17	The Project proponent should advertise at least in two local newspapers widely circulated in the region around the project, one of which shall be in the vernacular language of the locality concerned informing that the project has been accorded environmental clearance and the copies of clearance letters are available with the state pollution Control Board and may also be seen at web site of the Ministry of Environment & Forests at http://www.envfor.nic.in . The advertisement should be forwarded to the Regional office of this Ministry at Bangalore.	Complied Advertised in two local newspaper of which one was in the vernacular Tamil and English newspapers on 2/6/2006. Copies of the same were submitted to MoEFCC, RO.
18	The project proponents should inform the Regional Office as well as Ministry the date of financial closure and final approval of the project by the concerned authorities and the date of start of development work.	Complied. The PA has informed the Regional Office as well as Ministry the date of financial closure and final approval of the project by the concerned authorities and the date of start of development work.

This has the approval of Addl PCCF(C) vide diary No.1737 dated 29.12.2016


(Dr. C. Kaliyaperumal)
Director(S)

Certified Copy of Compliance Report

Sub: Coastal Regulation Zone –Expansion of port and allied activities at Ennore Port area by M/s Ennore Port Limited, Chennai- proposal recommended to Government of India, Ministry of Environment and Forest, New Delhi for Environmental Clearance under Coastal Regulation Zone Notification, 1991:Tamil Nadu State Coastal Zone Management Authority Clearance

Ref: No. 30060/EC.3/2005-1 dated 06.12.2005.

Date of Monitoring: 24.12.2016

S. No	Conditions	Compliance
1	No reclamation of water bodies should be undertaken.	Refer below: KPL authorities informed that no water body has been reclaimed for the development
2	To ensure that the natural drainage of the terrain is not affected by filling of low lying areas with dredge spoils thus leading to inundation or water logging.	Refer below: Some quantity (about 1lakh m3) of dredged material was dumped in the port land 6 to 7 months before in the CRZ area along the port approach road on the southern side of KPL at different places. Against this a case was filed by NGOs in NGT, Application No, 8 of 2016. NGT directed KPL to remove the dumped material immediately within 4 weeks. KPL has not started to remove the material and they have requested 2 more weeks time to remove the same that is by 31.1.2017.
3	To explore the possibilities of dumping the dredged spoil north of northern breakwaters in areas prone to sea erosion by creating sand dunes and / or for beach nourishment	Complied. About 4.0 million m3 of dredged material was dumped in the north of northern breakwater for beach nourishment till date as informed,

4	The mangroves present near the project area should not be disturbed and action plan to conserve them may be indicated	<p>Refer below:</p> <p>The PA informed that mangroves present in the project area were not disturbed during the construction activities. During the operational phase, the cargo is transferred through an elevated closed conveyor system. However this conveyer system is passing through mangrove areas. No action plan to conserve the mangrove has been prepared yet.</p>
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This has the approval of Addl PCCF(C) vide diary No.1737 dated 29.12.2016.


 (Dr. C. Kaliyaperumal)
 Director(S)
 Dr. G. KALIYAPERUMAL, M.E., PhD
 Director (S)
 Government of India
 Ministry of Environment, Forests & Climate Change
 Regional Office (South Eastern Zone)
 HEPC Building, No.34, Cathedral Garden Road,
 Nungambakkam, Chennai-600 034.

CMD 3730R
22-05-06



No.10-28/2005-IA-III
Government of India
Ministry of Environment and Forests
(IA-III Division)

Paryavaran Bhavan,
CGO Complex, Lodhi Road,
New Delhi - 110003.

Dated the 19th May, 2006

Sub: Ennore Port Expansion Proposals - Development of Terminals for marine liquids, coal, iron, and containers in Second phase and associated capital dredging at Ennore Port Environmental Clearance - regarding.

Reference is invited to your letter No.30060/EC.3/2005-1, dated 6.12.2005 and No.7317/EC.3/2006-1, dated 29.3.2006 from Environment and Forests Department, Government of Tamil Nadu regarding the above project. Subsequent letters No.EPL/74/2005, dated 2.8.2005, dated 8.12.2005, dated 16.12.2005, dated 1.2.2006, dated 27.2.2006, dated 17.3.2006 from M/s Ennore Port Trust has also been taken into account. No Objection Certificate from Tamil Nadu State Pollution Control Board vide their letter No.T12/TNPCB/Misc/F.3322/TVLR/05, dated 7.12.2005 has also been obtained.

The project pertains to expansion of the Port and development facilities in the Ennore Port. M/s Ennore Port Limited (EPL) have proposed to undertake capital dredging to deepen the port and navigational channel as part of their II Phase of development. The above facilities have been proposed, *inter-alia*, to shift the dusty cargo from Chennai Port, which is within urban limits. The capital dredging in the navigational channel is estimated to be about 6.00 million metric cube and in the basin about 9.5 million metre cube. About 4 million metre cube dredged material will be utilised for reclamation of the low lying areas within the Port limits in order to create operational back up areas. The rest 11.5 million metre cube of dredged material will be disposed of at appropriate locations in the open sea, for beach nourishment and land development north of Northern breakwaters. In order to maintain the channel maintenance dredging will be carried out through out the year and the dredged material of 0.6 million metre cubes will be disposed of into the sea.

The requirement of the dredging of the Port basin, berthing areas and channel arises as existing depths in the Ennore Port basin and approach channels are (-)15.5 metres and (-)16 metres respectively which is inadequate to handle vessels of 1,50,000 DWT with 16.5 metre draught. Hence the requirements of the depth are, along the berth - 18 metres below CD, turning basin 18.5 below CD and approach channel 20 metre and 19 metres below CD in the outer and inner channel respectively.

Apart from the dredging, the EPL also proposes to expand the Port area for creating:

- (i) An iron ore berth to handle 12 Million Metric Tonnes Annually (MTPA).
- (ii) The coal berth to handle 8 MTPA.
- (iii) The container terminal to handle 3 MTPA.
- (iv) Marine liquid terminal to handle about 3 MTPA of liquid cargo, comprising of LPG, POL products and chemicals such as benzene, styrene and Linear Alkyl Benzene (LAB), etc.

The following facilities have also been proposed to be undertaken:

- i) Railways - Railway sidings connecting the nearby Athipattu Station with Ennore Port for movement of cargoes.
- ii) Storage yard/staking yard - the staking areas for iron ore and coal are proposed to be located at about 2.5 kms outside the port and west of Ennore Creek.
- iii) A conveyor corridor connects the berths and stack yards.
- iv) In order to create the stack yard, the existing land from (+) 1.4 metre will be raised to about (+) 2.5 metre cd.

Total estimated cost of the project is around Rs.1,550 crores. Public Hearing has been conducted for the project on 15.7.2005.

The proposal has been examined in the Ministry of Environment & Forests and environmental clearance to this project is hereby accorded under Coastal Regulation Zone, Notification, 1991 and Environmental Impact Assessment Notification, 1994 subject to effective implementation of the following conditions:

A. SPECIFIC CONDITIONS:

- (i) All the conditions stipulated in the No Objection Certificate from Tamil State Pollution Control Board vide their letter No.T12/TNPCB/Misc/F.3322/TVLR/05, dated 7.12.2005 should be strictly implemented.
- (ii) Groins and other suitable structures should be constructed to prevent the closing of the mouth of Ennore creek.
- (iii) The DPR and the technical details to be awarded to the BOT operator should be provided to MoEF for post project monitoring within 6 months from the date of receipt of this letter.
- (iv) The marine terminal should be set up outside CRZ area.
- (v) Recommendations of Risk analysis report should be strictly implemented and a comprehensive quantitative Risk Analysis should be carried out before operationalizing the project.
- (vi) Approval from Chief Controller of Explosives should be obtained for hazardous chemicals storage, transfer and related activities.
- (vii) The reclamation of the port area should be carried out with the dredged material. Dredged material should not be dumped into the sea. No reclamation should be carried outside the port limits.
- (viii) The coastal protection works should be carried out after detailed hydrodynamic modelling studies and it should be ensured that no erosion or accretion takes place in other areas due to the shore protection works.
- (ix) Reclamation of 500 acres should be carried out only for port development. The height of the reclaimed area will be maintained above the maximum flood level.
- (x) The wave tranquility study and the ship manuring studies carried out should be taken into account while operating the port.
- (xi) The project proponent should ensure that during construction and operation of the port there will be no impact on the livelihood of the fisherman. The fishermen should be provided free access to carry out the fishing activity.
- (xii) All necessary precaution while undertaking construction and operation of the port should be taken keeping in view the bathymetric changes caused due to tsunami.
- (xiii) All development in the port should be carried out in accordance with the Coastal Regulation Zone Notification, 1991 and approved Coastal Zone Management Plan of Tamil Nadu.
- (xiv) The project proponent should undertake a comprehensive hydrodynamic modelling study with regard to river diversion and submit the report to the Ministry within 6 months from the date of receipt of this letter. Further, the unit should comply with all the findings/recommendations of the study.

- (xv) Construction labour camps should be located outside Coastal Regulation Zone areas and should be provided with adequate cooking and sanitation facilities.
- (xvi) The project affected people, of any should be properly compensated and rehabilitated.

B. GENERAL CONDITIONS:

- (i) Development of the proposed channel should be undertaken meticulously conforming to the existing Central/local rules and regulations including Coastal Regulation Zone Notification, 1991 and its amendments. All the construction designs/drawings relating to the proposed development activities must have approvals of the concerned State Government Department/Agencies.
- (ii) A well-equipped laboratory with suitable instruments to monitor the quality of air and water shall be set up as to ensure that the quality of ambient air and water conforms to the prescribed standards. The laboratory will also be equipped with qualified manpower including a marine biologist so that the marine water quality is regularly monitored in order to ensure that the marine life is not adversely affected as a result of implementation of the said project. The quality of ambient air and water shall be monitored periodically in all the seasons and the results should be properly maintained for inspection of the concerned pollution control agencies. The periodic monitoring reports at least once in 6 months must be send to this Ministry (Regional Office at Bangalore) and Pollution Control Committee.
- (iii) Adequate provisions for infrastructure facilities such as water supply, fuel for cooking, sanitation etc. must be provided for the laborors during the construction period in order to avoid damage to the environment. Colonies for the laborors should not be located in Coastal Regulation Zone area. It should also be ensured that the construction workers do not cut trees including mangroves for fuel wood purpose.
- (iv) To prevent discharge of sewage and other liquid wastes into the water bodies, adequate system for collection and treatment of the wastes must be provided. No sewage and other liquid wastes without treatment should be allowed to enter into the water-bodies.
- (v) Appropriate facility should be created for the collection of solid and liquid wastes generated by the barges/vessels and their safe treatment and disposal should be ensured to avoid possible contamination of the water bodies.
- (vi) Necessary navigational aids such as channel markers should be provided to prevent accidents. Internationally recognized safety standards shall be applied in case of barge/vessel movements.
- (vii) The project authorities should take appropriate community development and welfare measures for villagers in the vicinity of the project site, including drinking water facilities. A separate fund should be allocated for this purpose.
- (viii) The quarrying material required for the construction purpose should be obtained only from the approved quarries/borrow areas. Adequate safeguard measures shall be taken to ensure that the overburden and rocks at the quarry site do not find their way into water bodies.
- (ix) For employing unskilled, semi skilled and skilled workers for the project, preference should be given to local people.
- (x) The recommendations made in the Environmental Management Plan and Disaster Management Plan, as contained in the Environmental Impact Assessment and Risk Analysis Reports of the project shall be effectively implemented.
- (xi) A separate Environmental Management Cell with suitable qualified staff to carry out various environment should be set up under the charge of a Senior Executive who will report directly to the Chief Executive of the Company.

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- (xii) The funds earmarked for environment protection measures should be maintained in a separate account and there should be no diversion of these funds for any other purpose. A year-wise expenditure on environmental safeguards should be reported to this Ministry.
- (xiii) Full support should be extended to the officers of this Ministry's Regional Office at Bangalore and the officers of the Central and State Pollution Control Boards by the project proponent during this inspection for monitoring purposes, by furnishing full details and action plans including the action plans including the action taken reports in respect of mitigative measures and other environmental protection activities.
- (xiv) In case there is an intention of deviation or alternation in the project including the implementing agency, a fresh reference should be made to this Ministry for modification in the clearance conditions or imposition of new ones for ensuring environmental protection. The project proponents should be responsible for implementing the suggested safeguard measures.
- (xv) This Ministry reserves the right to revoke this clearance, if any of the conditions stipulated are not complied with to the satisfaction of this Ministry.
- (xvi) This Ministry or any other competent authority may stipulate any additional conditions subsequently, if deemed necessary for environmental protection, which shall be complied with.
- (xvii) The project proponent should advertise atleast in two local newspapers widely circulated in the region around the project, one of which shall be in the vernacular language of the locality concerned informing that the project has been accorded environmental clearance and copies of clearance letters are available with the State Pollution Control Board and may also be seen at Website of the Ministry of Environment & Forests at <http://www.envfornic.in>. The advertisement should be made within 7 days from the date of issue of the clearance letter and a copy of the same should be forwarded to the Regional Office of this Ministry at Bangalore.
- (xviii) The project proponents should inform the Regional Office as well as the Ministry the date of financial closure and final approval of the project by the concerned authorities and the date of start of Land Development Work.


The above mentioned stipulations will be enforced among others under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, the Hazardous Chemicals (Manufacture, Storage and Import) Rules, 1989, the Coastal Regulation Zone Notification, 1991 and its subsequent amendments and the Public Liability Insurance Act, 1991 and the Rules made thereunder from time to time. The project proponents should also ensure that the proposal complies with the provisions of the approved Coastal Zone Management Plan of Tamil Nadu and Supreme Court's order dated 18th April, 1996 in the Writ Petition No.664 of 1993 to the extent the same are applicable to this proposal.

(A. Senthil Vel)
Additional Director


To,
✓ The Chairman-cum-Managing Director,
Ennore Port Limited,
15, Kasturirangan Road,
Alwarpet, Chennai - 600018.

Copy to:

1. The Chief Conservator of Forests (Central), Ministry of Environment & Forests, Regional Office (Southern Zone) Kendriya Sadan, 4th Floor, E&F Wings, 17th Main Road, 1 Block, Koranmangla, Bangalore - 560034.
2. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD-cum-Office Complex, East Arjun Nagar, Delhi - 110032.
3. The Secretary to Government, Environment and Forests (EC.3) Department, Government of Tamil Nadu, Secretariat, Chennai - 600 009.
4. The Chairman, Tamil Nadu Pollution Control Board, 76, Mount Salai, Guindy, Chennai - 600 032.
5. DIG (SU), Regional Office Cell, Ministry of Environment & Forests, New Delhi.
6. Guard File.
7. Monitoring Cell.
8. Director (EI), Ministry of Environment & Forests, New Delhi.


 (A. Senthil Vel)
 Additional Director

(For specific conditions (vii) amended on 6.9.2006)


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Environment and Forests (EC3)
Department, Secretariat, Chennai-9

Letter No.30060/EC.3/2005-1, dated 6.12.2005

From
Thiru Surjit K. Chaudhary, IAS.,
Secretary to Government

Sreevase karnan A.C.E.
le

To
The Chairman,
National Coastal Zone Management Authority,
Ministry of Environment and Forests Department,
Paryavaran Bhavan, Lodi Road,
New Delhi - 110 003. (W.E.)

Sir,

Sub : Coastal Regulation Zone - Expansion of port
and allied activities at Ennore Port area by
M/s.Ennore Port Limited, Chennai -proposal
recommended to the Government of India,
Ministry of Environment and Forests, New
Delhi for environmental clearance under
Coastal Regulation Zone Notification, 1991 -
Regarding.

Ref : From the Director of Environment, Letter
No.394/2005/P1, dated 2.11.2005.

I am directed to state that the Director of Environment has
stated that M/s. Ennore Port Limited, Chennai have proposed to
undertake capital dredging to deepen the port and navigational channel to
accommodate cape size vessels for handling iron-ore at its proposed
terminal as part of their second phase development. This will enable to
suspend handling of iron-ore at Chennai Port. It is informed that there is a
need to shift dusty cargo such as iron-ore and coal from the
Chennai Port, which is within urban limits, to areas of lesser impact. Hence,

M/s. Ennore Port Limited, has proposed to expand its cargo handling operations and have also proposed to construct berths for iron-ore, coal, marine liquid, containers and VLCC. M/s. Ennore Port Limited has proposed dredging in the proposed berthing areas and deepening of the port basin and navigational channel to provide the necessary draft in the proposed berth locations. The estimated capital dredging in the navigational channel will be about 6.00 million m³ and in the basin about 9.5 million m³. Therefore, the total estimated quantity of dredging will be about 15.5 million m³. The duration of the dredging has been estimated to be over six months within the port basin and twelve months in the navigational channel. It is proposed to use about 4 million m³ of dredged material within the port area for filling up of low lying areas for creating operational back up areas. It is proposed to dump 11.5 million m³ of dredged material at appropriate locations in the open sea, beach nourishment and land development north of northern breakwaters. It is informed that maintenance dredging will be carried out throughout the year and the dredged material of about 0.5 million m³ will be disposed off into the sea. The expansion proposals of M/s. Ennore Port Ltd, Chennai also has construction of

- i. an iron-ore berth to handle 12 million metric tons annually (MTPA).
- ii. a coal berth to handle 8 MTPA.
- iii. a container terminal to handle 3 MTPA and
- iv. a marine liquid terminal to handle about 3 MTPA of liquid cargo comprising of LPG, POL products and Chemicals such as Benzene, Styrene and LAB etc.,

The proposed berth will be designed for a draft of 16.5 m. The length of the proposed iron-ore berth will be 525m. The lengths of the proposed coal, marine liquid and container terminal will be 325m, 300m and 700m respectively. The expansion proposed by M/s. Ennore Port Limited is inside their Port Permits in Tuzhuvakkam Village, Ponnani Taluk, Thiruvallur District which is a designated Port area. The area comes under CRZ-II. As per Coastal Regulation Zone Notification, 1991 "Operational constructions for ports, harbours and light houses and construction activities such as jetties, wharves, quays and slipways, pipelines conveying systems including transmission lines" are permissible in Coastal Regulation Zone. The District Coastal Zone Management Committee has also recommended the proposals of M/s. Ennore Port Limited, The total cost of the project is Rs. 1550.00 crores.

2.. The Director of Environment has further stated that the proponents have made a presentation about their project before the expert members of the Tamil Nadu State Coastal Zone Management authority on 24.10.2005. The State Coastal Zone Management Authority, in its 35th meeting held on 26.10.2005, resolved to forward the proposal seeking Environmental Clearance for Port expansion and allied activities at Ennore Port area proposed by M/s. Ennore Port Ltd., Chennai to the Ministry of Environment and Forests, Government of India, for consideration subject to the following specific conditions:

- 1) No reclamation of water bodies should be undertaken.
- 2) To ensure that the natural drainage of the terrain is not affected by filling of low lying areas within dredged spoils thus leading to inundation or water logging.
- 3) To explore the possibilities of dumping the dredged spoil north of northern breakwaters in areas prone to sea erosion by creating sand dunes and/ or for beach nourishment.
- 4) The mangroves present near the project area should not be disturbed and action plan to conserve them may be indicated.

Based on this, the Director of Environment, has sent the proposal of M/S Ennore Port Limited, Chennai for their proposed expansion of port and allied activities at Ennore Port area to Government with the request to recommend the project to the Ministry of Environment and Forests, Government of India for issue of Environmental clearance, under Coastal Regulation zone Notification, 1991.

3. I am, therefore, directed to state that this Government accepts the proposal of the Director of Environment, and recommend the proposal of M/s. Ennore Port Limited, Chennai for expansion of port and allied activities at Ennore port area at an estimate cost of Rs.1550.00 crores with the following documents, to the National Coastal Zone Management Authority, Government of India, Ministry of Environment and Forests for according environmental clearance under Coastal Regulation Zone Notification, 1991, as resolved in the Tamil Nadu State Coastal Zone Management Authority in its 35th meeting held on 26.10.2005.

I Application (Form A)

II. Detailed feasibility reports

- (I) Development of a marine liquid terminal.
- (II) Development of a coal terminal.

/4/

- (III) Development of an Iron ore terminal.
- (IV) Development of a container terminal.
- (V) Capital dredging for development of terminals in second phase.

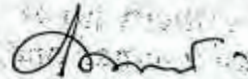
III. Environmental Impact of risk assessment of Ennore Port expansion proposals including associated capital dredging (Report prepared by NIOT - July 2004) Separate volume.

IV. Duly filled in questionnaire for environmental appraisal.

V. Crisis management plan (separate volume).

VI. The General conditions which are to be followed by M/s. Ennore Port Limited, Chennai.

Yours faithfully,



for Secretary to Government

Copy to

The Director of Environment, Chennai-15

M/s. Ennore Port Limited,

No.15, Kasturi Rangan Road, Alwarpet,

Chennai-600018

(with the request to send 20 copies of the project report to the National Coastal Zone Management authority, Government of India, Ministry of Environment and Forests, New Delhi for scrutiny.)

Certified Copy of Compliance Report

Sub: Ennore Port Expansion Proposals-Development of Terminals for marine liquids, coal, iron and containers in Second phase and associated capital dredging at Ennore Port.

Ref: MoEF Letter No. 10-28/2005-IA-III dated 10th September 2007.

Present Status of the Project:

The Project Authorities (PA) has increased the quay length of container terminal from 700m to 1000m. They have carried out dredging of additional berth area of 300m and also carried out capital dredging. The dredged material is used for the reclamation of low lying area in the port and for beach nourishment. Out of 2 container terminal 1 terminal work is about to be completed and the other terminal work will take about one year to complete. The other terminals construction works are completed and commissioned except iron ore terminal. This iron ore terminal has not yet commissioned due to ban on iron ore mining and also proposed to convert this terminal in to coal handling terminal.

Date of Monitoring: 24.12.2016

A. Specific Conditions

S.No	Conditions	Compliance
(i)	It should be ensured that no mangroves are destroyed during reclamation.	Refer below: As informed no mangroves were present in the project site during that time when this project was executed. However some quantity (about 11akh m3) of dredged material was dumped in the port land 6 to 7 months before in the CRZ area along the port approach road on the southern side of KPL at different places. Against this a case was filed by NGOs in NGT, Application No. 8 of 2016. NGT directed KPL to remove the dumped material immediately within 4 weeks. KPL has not started to remove the material and they have requested 2 more weeks time to remove the same that is by 31.1.2017.
(ii)	The proposed extension to the project should not cause any shoreline change abutting Ennore Port.	Complied. The proposed extension of the project was addition of 300m to the existing quay length of 700m which is within the existing breakwaters. Hence there no shoreline changes are expected.
(iii)	Adequate provision for beach nourishment and sand by pass should be provided.	Complied. Sand trap is provided to trap the sand entering in to the basin.

(iv)	The dredged material obtained should be utilized for filling up of backup area.	Complied. About 3.0 million cubic meter of dredge material was used for back filling activities and about 1 million cubic meter was used for beach nourishment.
(v)	All conditions stipulated in the environmental clearance letter of even number dated 19.5.2006 should be strictly complied with.	Partly complied. Some of the conditions are not yet complied and the details are furnished in the concerned report.
(vi)	The additional dredged material of 4 million cu mts obtained from the project should not be disposed of into the sea.	Complied. As given in point No.3 above the dredged material was used for beach nourishment and filling up of back up area and not disposed in to the sea.
(vii)	The reclaimed area should be used as container stackyards only.	Complied Reclaimed area is under construction to use as container stack yard.
(viii)	Adequate drainage facilities should be provided in the reclaimed area along with collection and treatment system for treating the run off from the container stackyard.	Refer below: The storm water facilities are under construction.
(ix)	Necessary approvals/clearances should be obtained from the Tamil Nadu Coastal Zone Management Authority and Tamil Nadu Pollution Control Board before implementing the project.	Complied All necessary approvals from TNPCB and other departments have been obtained.

B. General Conditions

S. No	Conditions	Compliance
(i)	Construction of the proposed structures should be undertaken meticulously conforming to the existing Central/local rules and regulations including Coastal Regulation Zone Notification 1991 & its amendments. All the construction designs/drawings relating to the proposed construction activities must have approvals of the concerned State Government Departments/	Complied. All the constructions and plans are approved by Port itself as a regulatory authority as informed

	Agencies.	
(ii)	Adequate provisions for infrastructure facilities such as water supply, fuel, sanitation, etc. should be ensured for construction workers during the construction phase of the project so as to avoid felling of trees/mangroves and pollution of water and the surroundings.	Complied. No labor colony is inside the port. The PA informed that some labours came from local and going back after their work. Some labours stayed in the labour camp which is located outside the project area and they have been provided adequate cooking and sanitation facilities.
(iii)	The project authorities must make necessary arrangements for disposal of solid wastes and for the treatment of effluents by providing a proper wastewater treatment plant outside the CRZ area. The quality of treated effluents, solid wastes and noise level etc. must conform to the standards laid down by the competent authorities including the Central/State Pollution Control Board and the Union Ministry of Environment and Forests under the Environment (Protection) Act, 1986, whichever are more stringent.	Being complied. No effluents are generated inside the port due to operations. Port and ship generated solid wastes are collected and disposed to authorized recyclers.
(iv)	The proponent shall obtain the requisite consents for discharge of effluents and emissions under the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981 from the Tamil Nadu Pollution Control Board before commissioning of the project and a copy of each of these shall be sent to this Ministry.	Refer below: Tamil Nadu Pollution Control Board has accorded Consent to Operate to handle to a capacity of 18MTPA vide Consent Order No. 3437 and 3381 dated 19.1.2011 under Water and Air Acts which is valid upto 2015. An amendment is requested to handle containers of 16.8 MTPA.
(v)	The proponents shall provide for a regular monitoring mechanism so as to ensure that the treated effluents conform to the prescribed standards. The records	Reportedly complied. The PA informed that regular monitoring mechanism and analysis reports are kept available for statutory authorities.

	of analysis reports must be properly maintained and made available for inspection to the concerned State/Central officials during their visits.	
(vi)	In order to carry out the environmental monitoring during the operational phase of the projects, the project authorities should provide an environmental laboratory well equipped with standard equipment and facilities and qualified manpower to carry out the testing of various environmental parameters.	Refer below: There s no laboratory facilities available including qualified manpower to carry out the testing of various environmental parameters. Whereas the environmental parameter monitoring is carried out through external agencies.
(vii)	The sand dunes and mangroves, if any, on the site should not be disturbed in any way.	Refer below: No sand dunes or mangroves were inside the port project site. Whereas mangroves are located outside the project in port areas.
(viii)	A copy of the clearance letter will be marked to the concerned Panchayat/local NGO, if any, from whom any suggestion/representation has been received while processing the proposal.	Refer below: No suggestion or representation was received from Panchayat/local NGO while processing the proposal as informed.
(ix)	The Tamil Nadu Pollution Control Board should display a copy of the clearance letter at the Regional Office, District Industries centre and Collectors Office/Tehsildars office for 30 days.	Reportedly complied.
(x)	The funds earmarked for environment protection measures should be maintained in a separate account and there should be no diversion of these funds for any other purpose. A year-wise expenditure on environmental safeguards should be reported to this Ministry's Regional Office at Bangalore and the State Pollution Control Board.	Complied. The fund allocated for Environmental management Plan from the main budget is not diverted for any other purpose as informed. Year wise expenditure is as follows: 2014-15= Rs.30,36,262/- 2015-16 = Rs. 60,72,033/- Year 2016-2017 (Planning)= Rs.43,00,000/-
(xi)	Full support should be extended	Extended full support during the visit.

	to the officers of this Ministry's Regional Office at Bangalore and the officers of the Central and State Pollution Control Boards by the Project proponent during their inspection for monitoring purposes, by furnishing full details and action plans including the action taken reports in respect of mitigative measures and other environmental protection activities.	
(xii)	In case of deviation or alteration in the project including the implementing agency, a fresh reference should be made to this Ministry for modification in the clearance conditions or imposition of new ones for ensuring environmental protection.	Complied. The quay length of the container terminal of 1000m length was bifurcated into 730m quay length to handle containers of 16.8 MTPA and in the remaining 230m to develop Multi Cargo terminal to handle 2.0 MTPA of cargo. Environmental clearance for the above was obtained from MoEF&CC vide letter dated 10-28/2005-IA.III dated 24.12.2014.
(xiii)	This Ministry reserves the right to revoke this clearance, if any of the conditions stipulated are not complied with to the satisfaction of this Ministry.	Agreed upon.
(xiv)	This Ministry or any other competent authority may stipulate any other additional conditions subsequently, if deemed necessary for environmental protection, which shall be complied with.	Agreed upon.
(xv)	The Project proponent should advertise at least in two local newspapers widely circulated in the region around the project, one of which shall be in the vernacular language of the locality concerned informing that the project has been accorded environmental clearance and the copies of clearance letters are available with the state pollution	Complied. Advertisement were given in two local newspaper on 17.9.2008 and copies of the same were submitted to RO.

	Control Board and may also be seen at web site of the Ministry of Environment & Forests at http://www.envfor.nic.in . The advertisement should be made within 7 days from the date of issue of the clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Bangalore.	
(xvi)	The project proponents should inform the Regional Office at Bangalore as well as the Ministry the date of financial closure and final approval of the project by the concerned authorities and the date of start of Land Development Work.	Informed.
7	All other statutory clearances including Public Liability Insurance should be obtained	Refer below: Consent validity was up to 2015 and later on it has not been renewed but the PA has submitted the application for renewal. No information was provided about the Public Liability Insurance.

This has the approval of Addl PCCF(C) vide diary No.1737 dated 29.12.2016.


 (Dr. C. Kaliyaperumal)
 Director(S)

Certified Copy of Compliance Report

Sub: Coastal Regulation Zone –Ennore Port Expansion proposal –Increase of Quay length of already approved container terminal proposed by M/s Ennore Port Limited, Application for Environmental Clearance under Coastal Regulation Zone: Reg: Tamil Nadu State Coastal Zone Management Authority Clearance

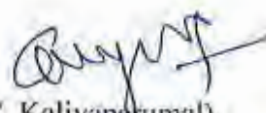
Ref: No. 17250/EC-3/2009-1 dated 26.10.2009

Date of Monitoring: 24.12.2016

S.No	Conditions	Compliance
1.	The composition of the dredged materials should be duly analyzed and examined to find out the availability of any toxic contents.	Complied. <ul style="list-style-type: none">• Port has carried out a study through Institute of Ocean Management, Anna University, Chennai entitled "Assessment of Water, Sediment & Biota in Ennore Port" during January 2009.• The study revealed that the toxic heavy metals are found to be well within the safety limits and as such do not pose any problem to the marine environment.• Sediment quality is also continuously monitored during dredging operations.• Port is also monitoring monthly marine water quality for various physio-chemical parameters including heavy metals.
2	Based on the analysis, a suitable methodology for the disposal of dredging material has to be evolved out.	Complied, National Institute of Ocean Technology (NIOT), Chennai has carried out EIA and Risk assessment for the second phase expansion proposals, which is inclusive of Modeling studies has identified a marine disposal area (5 km x 5 km area) for disposal of dredged material. Monitoring of physio-chemical and biological parameters are monitored around the dumping site by M/s R&C.

		The study has identified a location for the safe disposal of dredged material with a holding capacity of 18.0 million cubic meters.
3	A permanent air quality monitoring station should be established to check and maintain the air quality within the permissible level.	Complied. Seven number of permanent AAQ stations were established to check and maintain the air quality. PA have engaged an external agency for monitoring the environmental parameters inside the port premises. Continuous online AAQ stations are also has been setup and the real time data is transmitted to Care Air Centre. The AAQ parameters are within the limits.
4	A study should be carried out to ascertain the occurrence of coastal erosion / coastal accretion due to the dredging / dumping of dredged materials in the low lying coastal areas and if so, its extent of implication and the steps required to prevent erosion, mitigate the adverse impacts, etc.	<ul style="list-style-type: none"> • Desk studies for shoreline management for the proposed phase – II development at Ennore Port” was carried out by CWPRS, (September 2009; Technical Report- 4658) • The study recommended creation of sand trap at the entrance and it has been created. • Regular dredging of the sand trap and dredging the sand accumulated at the mouth of the Ennore creek would be required to keep the inlet open. • This would enable minimizing further accretion / stabilization of land already formed on the south of the south breakwater. Regular dredging of sand accumulated at the creek mouth is being carried out by TNEB.

This has the approval of Addl PCCF(C) vide diary No1737 dated 29.12.2016.


 (Dr. C. Kaliyaperumal)
 Director(S)
 Dr. C. KALIYAPERUMAL, M.E., PhD
 Director (S)
 Government of India
 Ministry of Environment, Forests & Climate Change
 Regional Office (South Eastern Zone)
 HEPC Building, No.34, Cathedral Garden Road,
 Nungambakkam, Chennai-600 034.



No.10-28/2005-IA-III
Government of India
Ministry of Environment and forest
(IA-III Division)

ANNEXURE - 11



Paryavaran Bhavan,
CGO Complex, Lodhi Road,
New Delhi - 110003.

Dated the 10th September, 2007

Sub: Ennore Port Expansion Proposals - Development of Terminals for marine liquids, coal, iron, and containers in Second phase and associated capital dredging at Ennore Port Environmental Clearance -regarding.

This is in super session to this Ministry's letter of even number dated 19.5.2006 pertaining to the subject mentioned above.

2. Reference is invited to the letters from M/s. Ennore Port Limited received vide letter No.EPL/OP/15.5/001, dated 6.6.2007 and No.EPL/74/2005, dated 16.3.2007 have been considered.

3. The project involves,-

(i) Increase in the quay length of the proposed container terminal from the already approved 700 mts to 1000 mts in order to handle additional 0.5 million TEU per annum.

(ii) For dredging for additional berth area of the 300 mts (1000-700) along the already approved dredging for 700 mts along the landside.

(iii) Capital dredging for the above extension, additional 4 million cu m to provide a depth of -15 MCD on account of additional 300 m of quay length.

4. The present proposal involves extending further 300 mts of the quay length which will result in additional 4 million cu m of dredging. The 4 million dredged material will be used to reclaim the port area and also for beach nourishment.

5. The proposal was considered by Expert Appraisal Committee at its meeting held on 22nd to 24th August, 2007 and was recommended.

6. Accordingly, environmental clearance from Environmental Impact Assessment Notification, 2006 and Coastal Regulation Zone Notification, 1991 as amended from time to time is hereby accorded to this project subject to effective implementation of the following conditions:-

(A) Specific Conditions:

- (i) It should be ensured that no mangroves are destroyed during reclamation.
- (ii) The proposed extension to the project should not cause any shoreline change abutting Ennore Port.
- (iii) Adequate provision for beach nourishment and sand bypass should be provided.
- (iv) The dredged material obtained should be utilized for filling up of back up area.
- (v) All conditions stipulated in the environmental clearance letter of even number dated 19.5.2006 should be strictly complied with.

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- (vi) The additional dredged material of 4 million cu mts obtained from the project should not be disposed of into the sea.
- (vii) The reclaimed area should be used as containers stackyard only.
- (viii) Adequate drainage facilities should be provided in the reclaimed area along with collection and treatment system for treating the run off from the container stackyard.
- (ix) Necessary approvals/clearances should be obtained from the Tamil Nadu Coastal Zone Management Authority and Tamil Nadu Pollution Control Board before implementing the project.

B. General Conditions

- (i) Construction of the proposed structures should be undertaken meticulously conforming to the existing Central/local rules and regulations including Coastal Regulation Zone Notification 1991 & its amendments. All the construction designs / drawings relating to the proposed construction activities must have approvals of the concerned State Government Departments / Agencies.
- (ii) Adequate provisions for infrastructure facilities such as water supply, fuel, sanitation etc. should be ensured for construction workers during the construction phase of the project so as to avoid felling of trees/mangroves and pollution of water and the surroundings.
- (iii) The project authorities must make necessary arrangements for disposal of solid wastes and for the treatment of effluents by providing a proper wastewater treatment plant outside the CRZ area. The quality of treated effluents, solid wastes and noise level etc. must conform to the standards laid down by the competent authorities including the Central/State Pollution Control Board and the Union Ministry of Environment and Forests under the Environment (Protection) Act, 1986, whichever are more stringent.
- (iv) The proponent shall obtain the requisite consents for discharge of effluents and emissions under the Water (Prevention and Control of Pollution) Act, 1974 and the Air (prevention and Control of Pollution) Act, 1981 from the Tamil Nadu Pollution Control Board before commissioning of the project and a copy of each of these shall be sent to this Ministry.
- (v) The proponents shall provide for a regular monitoring mechanism so as to ensure that the treated effluents conform to the prescribed standards. The records of analysis reports must be properly maintained and made available for inspection to the concerned State/Central officials during their visits.
- (vi) In order to carry out the environmental monitoring during the operational phase of the project, the project authorities should provide an environmental laboratory well equipped with standard equipment and facilities and qualified manpower to carry out the testing of various environmental parameters.
- (vii) The sand dunes and mangroves, if any, on the site should not be disturbed in any way.
- (viii) A copy of the clearance letter will be marked to the concerned Panchayat/local NGO, if any, from whom any suggestion/representation has been received while processing the proposal.
- (ix) The Tamil Nadu Pollution Control Board should display a copy of the clearance letter at the Regional Office, District Industries Centre and Collector's Office/Tehsildar's Office for 30 days.

- (x) The funds earmarked for environment protection measures should be maintained, in a separate account and there should be no diversion of these funds for any other purpose. A year wise expenditure on environmental safeguards should be reported to this Ministry's Regional Office at Bangalore and the State Pollution Control Board.
- (xi) Full support should be extended to the officers of this Ministry's Regional Office at Bangalore and the officers of the Central and State Pollution Control Boards by the project proponents during their inspection for monitoring purposes, by furnishing full details and action plans including the action taken reports in respect of mitigative measures and other environmental protection activities.
- (xii) In case of deviation or alteration in the project including the implementing agency, a fresh reference should be made to this Ministry for modification in the clearance conditions or imposition of new ones for ensuring environmental protection.
- (xiii) This Ministry reserve the right to revoke this clearance, if any of the conditions stipulated are not complied with to the satisfaction of this Ministry.
- (xiv) This Ministry or any other competent authority may stipulate any other additional conditions subsequently, if deemed necessary, for environmental protection, which shall be complied with.
- (xv) The project proponent should advertise at least in two local newspapers widely circulated in the region around the project, one of which shall be in the vernacular language of the locality concerned informing that the project has been accorded environmental clearance and copies of clearance letters are available with the State Pollution Control Board and may also be seen at Website of the Ministry of Environment & Forests at <http://www.envfor.nic.in>. The advertisement should be made within 7 days from the date of issue of the clearance letter and a copy of the same should be forwarded to the Regional Office of this Ministry at Bangalore.
- (xvi) The Project proponents should inform the Regional Office at Bangalore as well as the Ministry the date of financial closure and final approval of the project by the concerned authorities and the date of start of Land Development Work.

7. The above mentioned stipulations will be enforced among others under the Water Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, the Environment (protection) Act, 1986, the Hazardous Chemicals (Manufacture, Storage and Import) Rules, 1989, the Coastal Regulation Zone Notification, 1991 and its subsequent amendments and the Public Liability Insurance Act, 1991 and the Rules made thereunder from time to time. The project proponents should also ensure that the proposal complies with the provisions of the approved Coastal Zone Management Plan of Tamil Nadu State and the Supreme Court's order dated 18th April, 1996 in the Writ Petition No.664 of 1993 to the extent the same are applicable to this proposal.


(Dr. A. Senthil Vel)
Additional Director

To

The Chairman-cum-Managing Director,
Ennore Port Limited,
15, Kasturirangan Road,
Alwarpet, Chennai - 600018.

Copy to:

1. The Chief Conservator of Forests (Central), Ministry of Environment & Forests, Regional Office (Southern Zone) Kendriya Sadan, 4th Floor, E&F Wings, 17th Main Road, 1 Block, Koranmangla, Bangalore - 560034.
2. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD-cum-Office Complex, East Arjun Nagar, Delhi - 110032.
3. The Secretary to Government, Environment and Forests (EC.3) Department, Government of Tamil Nadu, Secretariat, Chennai - 600 009.
4. The Chairman, Tamil Nadu Pollution Control Board, 76, Mount Salai, Guindy, Chennai - 600 032.
5. DIG (SU), Regional Office Cell, Ministry of Environment & Forests, New Delhi.
6. Guard File.
7. Monitoring Cell.
8. Director (EI), Ministry of Environment & Forests, New Delhi.

(Dr. A. Senthil Vel)
Additional Director



Environment and Forests
(FR.1) Department
Secretariat, Chennai - 9.



Letter No.17250/EC-3/2009-1, dated :26.10.2009.

From
Thiru.Debendranath Sarangi, I.A.S.,
Principal Secretary to Government

To
The Chairman,
National Coastal Zone Management Authority,
Government of India,
Ministry of Environment and Forests,
Paryavaran Bhavan,
C.G.O. Complex,
Lodhi Road, New Delhi - 3.



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Sir,

Sub : Coastal Regulation Zone - Ennore Port Expansion
proposal - Increase of quay length of already
approved container terminal proposed by
M/s.Ennore Port Limited - Application for
environmental clearance under Coastal
Regulation Zone Notification - Regarding.

Ref : From the Director of Environment,
R.C.No.P1/900/2009, dated 8.9.2009.

I am directed to state that the District Environmental Engineer / Convenor, Tamil Nadu Pollution Control Board / District Coastal Zone Management Authority (DCZMA), Ambattur Industrial Estate, Tiruvallur District has forwarded a proposal received by M/s.Ennore Port Limited for the Increase of quay length, of already approved container terminal as part of Ennore Port Expansion. The District Coastal Zone Management Committee, Tiruvallur has sent the following details, in respect of the project with the recommendation of the District Coastal Zone Management Committee .

2. The Ministry of Environment & Forest (MOEF) have accorded Environmental Clearance on 19.05.2006 for the Ennore Port expansion proposal under the Coastal Regulation Zone Notification 1991 and under Environmental Impact Assessment Notification 1994 which includes the dredging of Port basin, berthing areas, approach

channel, inner and outer channel and for the facility to handle iron ore, coal, containers and Marine liquid terminal to handle liquid cargo, comprising of LPG, POL products and chemicals such as benzene, styrene and Linear Alkyl Benzene etc.,

3. Subsequently the Department of shipping, Government of India directed M/s. Ennore Port Limited to develop a world class container terminal with a quay length of 1000mts. Hence the port management has proposed to reconfigure the quay length of the container from 700 mts quay length to 1000mts. Consequent to the reconfiguration above the capacity will be increased to 18.0 Million Metric Tonnes per annum. Hence the unit has requested the Ministry of Environment and Forests to incorporate the above modification in the above said Environmental Clearance dated 19.05.2006. Accordingly, Ministry of Environment and Forests has also accorded the permission (vide their letter dated 10.09.2007) with the condition that necessary approval / clearance should be obtained from the Tamil Nadu State Coastal Zone Management Authority before implementing the project. Hence as per the conditions, the unit of M/s. Ennore Port Limited has requested for clearance to develop a world class container Terminal with a quay length of 1000 mts. The proposed project will be implemented only within the existing port limit and it will not involve any new land acquisition. The project cost is Rs.134 crores. The present proposal for the extension of further 300 mts of quay length will result in additional 4 million Cubic Metre of dredging and dredged material will be used for reclamation of the port area. The proposed site is falling in Coastal Regulation Zone I (ii) and Coastal Regulation Zone - II.

4. As per para 6 - Coastal Regulation Zone-I of the Coastal Regulation Zone Notification 1991, facilities those directly related water front or directly needing foreshore facilities can be allowed in Coastal Regulation Zone-I (ii) areas. However, as per para 3 (2) (ii) of the Coastal Regulation Zone Notification 1991, the above activity requires clearance from the Ministry of Environment and Forests, Government of India.

5. The subject has been placed before the 53rd meeting of the Tamil Nadu State Coastal Zone Management Authority held on 28.08.2009 and the Authority has passed resolution that the proposal may be forwarded to Ministry of Environment and Forest, Government of India.

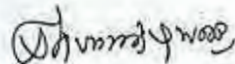
6. Accordingly, the Director of Environment, has sent the proposal to Government and requested to recommend the proposal to Ministry of Environment and Forests, Government of India subject to the following conditions as resolved in the 53rd meeting of the Tamil Nadu State Coastal Zone Management Authority held on 28.08.2009.

- a) The composition of the dredged materials should be duly analyzed and examined to find out the availability of any toxic contents.

- b) Based on the analysis, a suitable methodology for the disposal of dredging material has to be evolved out.
- c) A permanent air quality monitoring station should be established to check and maintain the air quality within the permissible level.
- d) A study should be carried out to ascertain the occurrence of coastal erosion / coastal accretion due to the dredging / dumping of dredged materials in the low lying coastal areas and if so, its extent of implication and the steps required to prevent erosion, mitigate the adverse impacts etc.,

7. Based on the recommendation of Tamil Nadu State Coastal Zone Management Authority in its 53rd meeting held on 28.08.2009, the Government accept the proposal of The Director of Environment in respect of The Ennore Port Limited for the Increase of quay length from 700 mts to 1000 mts of already approved container terminal as part of Ennore Port Expansion and forward the same to Government of India, Ministry of Environment and Forests for clearance under Coastal Regulation Zone Notification 1991 subject to the conditions stipulated in para 6 above along with the minutes of 53rd Tamil Nadu State Coastal Zone Management Authority meeting held on 28.08.2009.

Yours faithfully,



for Principal Secretary to Government

h
26/10/14

Copy to:

The Director of Environment,
Chennai - 15

The Chairman,

Ennore Port Limited,

P.T. ~~see~~ Changalvaraya Naicker Maligai,

1st Floor, 23, Rajaji Salai,

Chennai - 600 001.

(With a request to send 20 copies of proposal to The Chairman,
National Coastal Zone Management Authority,
New Delhi - 3)

Certified Copy of Compliance Report

Sub: CRZ and Environmental clearance for the construction of General Cargo Berth at Ennore port cargo terminal project, Ennore, Ponneri Taluk, District Tiruvallur, Tamil Nadu, M/s Ennore Port Ltd.

Ref: MoEF Letter No. 11-21/2009-IA-III dated 23.7.2009.

Present Status of the Project:

Construction of General Cargo berth is completed and is in operation. **The EC is to handle 2 lakh cars per year and project cargo/unfinished cargo of 0.5 million TPA. Whereas, the PA have handled more cars than the permitted numbers. The details are enclosed as Annexure-I.**

Date of Monitoring: 24.12.2016

Specific Condition

Sl.No.	Condition	Compliance
(i)	As the Ennore expressway is very busy. It is suggested to examine the details of traffic analysis and incorporate necessary improvement study the impact of additional traffic due to the proposed development	Reportedly compiled. The report on traffic analysis was carried out by M/s. Wilber Smith Association Pvt. Ltd. and the necessary improvements are incorporated and also implemented as informed. However a copy of the study report was not shown
(ii)	No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.	Reportedly compiled No construction work other than those permitted in Coastal Regulation Zone Notification is carried out in Coastal Regulation Zone area as informed.
(iii)	Oil spills if any shall be properly collected and disposed as per the Rules.	Complied Oil spills are properly collected and disposed as per the Rules.
(iv)	The project proponent shall set up separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of a Senior Executive.	Refer below: Only one officer (Manager level) has been given the charge of Environmental In charge along with another officer who has been given an additional works. All the

		monitoring works are carried out by external laboratories.
(v)	The project proponent shall take up mangrove plantation/green belt in the project area, wherever possible. Adequate budget shall be provided in the Environment Management Plan for such mangrove development	Partly complied. Mangrove plantation is not carried out by PA and separate budget has not been allocated whereas the green belt development is carried out by them in the project area by planting different other spp.
(vi)	The funds earmarked for environment management plan shall be included in the budget and this shall not be diverted for any other purposes.	Complied. Funds are earmarked in the budget for the various environmental activities like development of green belt, charges towards purchase of water for gardening, etc., The Environmental expenditure for the year 2012-13 is Rs.33,90,570/- The expenditure for the year 2013-14 is Rs.38,99,364/- The expenditure for the year 2014-15 is Rs.47,21,592 lakhs. The expenditure for the year 2015-16 is Rs.47,00,229 lakhs. The PA informed that funds earmarked have not been diverted for any other purposes.

General Condition

Sl.No.	Condition	Compliance
(i)	The construction of the structures should be undertaken as per the plans approved by the concerned local authorities/local administration, meticulously conforming to the existing local and Central rules and regulations including the provisions of Coastal Regulation Zone Notification dated 19.02.1991 and the approved Coastal Zone	Complied. All constructions and plans are approved by Port as a regulatory authority.

	Management Plan of Tamil Nadu.	
(ii)	Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.	Complied The PA informed that some labours came from local and going back after their work. Some labours stayed in the labour camp which was located outside the project area and they have been provided adequate cooking and sanitation facilities.
(iii)	Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.	Complied. Water quality was monitored during dredging by M/s R&C. Bottom sediment is fine sand, soft and silty clay in nature, hence, sediment suspension during dredging is medium. Moreover the type of dredgers used are Traylor Suction Hopper Dredger / Cutter Suction Hopper Dredger which minimized sediment suspension during dredging as it sucks the bottom sediments which carrying out dredging.
(iv)	Borrow sites for each quarry sites for road construction material and dump sites must be identified keeping in view the following:	
(a)	No excavation or dumping on private property is carried out without written consent of the owner	Complied. No excavation or dumping was carried out in the private property.
(b)	No excavation or dumping shall be allowed on wetlands, forest areas or other ecologically valuable or sensitive locations	Not complied. Some quantity (about 1 lakh m3) of dredged material was dumped in the port land 6 to 7 months before in the CRZ area along the port approach road on the southern side of KPL at different places. Against this a case was filed by NGOs in NGT, Application No. 8 of 2016. NGT directed KPL to remove the dumped material immediately within 4 weeks.

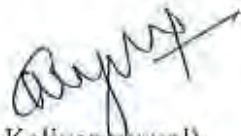
		KPL has not started to remove the material and they have requested 2 more weeks time to remove the same that is by 31.1.2017.
(c)	Excavation work shall be done in close consultation with the Soil Conservation and Watershed Development Agencies working in the area, and	Refer below: The PA informed that no excavation was carried out and only pile foundation was made.
(d)	Construction spoils including bituminous material and other hazardous materials must not be allowed to contaminate water courses and the dump sites for such materials must be secured so that they shall not leach into the ground water.	Complied. No construction spoils or any other hazardous materials except waste oil are generated during the construction process and it was disposed to authorized recyclers.
(v)	The construction material shall be obtained only from approved quarries. In case new quarries are to be opened, specific approvals from the competent authority shall be obtained in this regard.	Complied. They have purchased used Redy-mix concrete and for this Blue granite metal was obtained from approved quarry.
(vi)	Adequate precautions shall be taken during transportation of the construction material so that it does not affect the environment adversely.	Complied. Adequate measures were taken.
(vii)	Full support shall be extended to the officers of this Ministry/ Regional Office at Bangalore by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environmental protection activities.	Complied. Extended full support during the visit.
(viii)	Ministry of Environment & Forests or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environment and the same shall be complied with.	Agreed upon.
(ix)	The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied with the satisfaction of the Ministry	Agreed upon.
(x)	In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment and Forests.	Not complied. The PA has handled more cars than the permitted numbers.
(xi)	The project proponents shall inform the Regional	Complied.

	Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of land development work.	They informed <i>vide</i> letter No. EPL/MS/Env/GCB/1/08 dated. 7.12.2009.
(xii)	Tamil Nadu State Pollution Control Board shall display a copy of the clearance letter at the Regional Office, District Industries Center and Collector's Office/ Tehsildar's Office for 30 days.	Reportedly complied.
7	These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 1994, including the amendments and rules made thereafter.	Refer below: Consent validity was up to 2015 and later on it has not been renewed but the PA has submitted the application for renewal. No information was provided about the Public Liability Insurance.
8	All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wild (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities.	Complied. The PA informed that all other statutory clearances were obtained.
9	The project proponent shall advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Environmental Clearance and copies of clearance letters are available with the Tamil Nadu State Pollution Control Board and may also be seen on the website of the Ministry of Environment and Forests at http://www.envfor.nic.in . The advertisement should be made within 10 days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional Office of this Ministry at Bangalore.	Complied. Advertised in two local newspapers on 6.8.2009 and the copies of the same were submitted to RO.
10	Environmental Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.	Agreed upon.
11	Any appeal against this Environmental Clearance shall lie with the National Environment Appellate Authority, if preferred, within a period of 30 days	Refer below: A case was filed by NGOs with NGT, Application No. 8

	as prescribed under Section 11 of the National Environment Appellate Act, 1997.	of 2016. NGT directed KPL to remove the dumped material immediately within 4 weeks. KPL assured the court that the dumped material will be removed by 31.1.2017.
12	A copy of the Clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parishad/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.	Refer below: The PA informed that no suggestions / representations were received while processing the proposal.
13	The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely: SPM, RSPM, SO ₂ , NO _x (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public domain.	Not complied. They have not uploaded the status of compliance of the stipulated EC conditions, including results of monitored data on their website. The monitored data are not displayed at a convenient location near the main gate of the company in the public domain
14	The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.	Complied. Submitted the six monthly report to Regional Office of MoEF&CC.

15	The environmental statement for each financial year ending 31st March in Form – V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail.	Not complied. The environmental statement for each financial year ending 31st March in Form – V has not been submitted and also has not been put on the website of the company along with the status of compliance of EC conditions
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This has the approval of Addl PCCF(C) vide diary No.1737 dated 29.12.2016.


 (Dr. C. Kaliyaperumal)
 Director(S)
 Dr. C. KALIYAPERUMAL, M.E., PhD
 Director (S)
 Government of India
 Ministry of Environment, Forests & Climate Change
 Regional Office (South Eastern Zone)
 HEPC Building, No.34, Cathedral Garden Road,
 Nungambakkam, Chennai-600 034.

Certified Copy of Compliance Report

Sub: Coastal Zone Regulation Zone-Construction of Ennore Port Cargo terminal project proposed by M/s. Ennore Port Limited- Clearance under Coastal Zone Regulation Zone Notification 1991 Proposal forwarded-Tamil Nadu State Coastal Zone Management Authority Clearance.

Ref: No, 151/EC3/2009-1 dated 24.02.2009

Date of Monitoring: 24.12.2016

S. No	Condition	Compliance
1	There should not be any extraction of ground water in Coastal Regulation Zone	Complied No ground water is extracted in the CRZ area as informed.
2	The project activity should not affect the coastal ecosystem including marine flora and fauna	Complied, Only automobiles are handled in the project. No sewage or wastes are dumped in the port waters. KPL is monitoring marine water quality inside the port. Port has carried out studies through National Institute of Ocean Technology and Institute of Ocean Management. The study report reveals that heavy metals, water quality parameters are found to have no adverse impact on the environment.
3	The composition of the dredged materials should be duly analyzed and examined to find out the availability of any toxic contents.	Complied. <ul style="list-style-type: none">Port has carried out a study through Institute of Ocean Management, Anna University; Chennai entitled "Assessment of Water, Sediment & Biota in Ennore Port" during January 2009.The study revealed that the toxic heavy metals are found to be well within the safety limits and as such do not pose any problem to the

		<p>marine environment.</p> <ul style="list-style-type: none"> • Sediment quality is also continuously monitored during dredging operations. • Port is also monitoring monthly marine water quality for various physio-chemical parameters including heavy metals.
4	Based on the analysis, a suitable methodology for the disposal of dredging material has to be evolved out.	<p>Complied.</p> <p>National Institute of Ocean Technology (NIOT), Chennai has carried out EIA and Risk assessment for the second phase expansion proposals, which is inclusive of Modelling studies has identified a marine disposal area (5 km x 5 km area) for disposal of dredged material. The study has identified a location for the safe disposal of dredged material with a holding capacity of 18.0 million cubic meters.</p>
5	No blasting activities in Coastal Regulation Zone is permissible	<p>Complied.</p> <p>No blasting activity was carried out during the construction phase.</p>
6	The proponent shall not undertake any activity, which is violative of the provisions of Coastal Regulation Zone Notification 1991 and the subsequent amendments.	<p>Complied.</p> <p>The PA informed that only the approved activity as per CRZ Notification were carried out.</p>
7	The coastal Regulation Zone clearance will be revoked if any of the condition stipulated is not complied with	<p>Agreed upon.</p>

This has the approval of Addl PCCF(C) vide diary No.1737 dated 29.12.2016.


 (Dr. C. Kaliyaperumal)
 Director(S)
 Dr. C. KALIYAPERUMAL, M.E., PhD
 Director (S)
 Government of India
 Ministry of Environment, Forests & Climate Change
 Regional Office (South Eastern Zone)
 HEPC Building, No.34, Cathedral Garden Road,
 Nungambakkam, Chennai-600 034.

Point wise compliance report on Ministry's guidelines for the CRZ and Environmental clearance for the construction of General Cargo Berth at Ennore port cargo terminal project.

Ref: MoEF Letter No. 11-21/2009-IA-III dated 23.7.2009

Back ground information

MoEF had accorded environmental clearance vide letter No. 11-21/2009-IA-III dated 23rd July, 2009 for the development of a general cargo berth. The berth will be 250m length and 35m width to handle about 2 lakh cars per year and project cargoes & finished cargo of 0.5 million tons per year.

Status of the project:

Consent to Establish and Consent to Operate has been obtained from TNPCB.

A General Cargo Berth with Car parking area is developed for the export of Cars and handling project cargo, etc. The Environmental Clearance was received vide MoEF communication dated 23.7.2009 to handle about 2 lakhs cars / year and project cargo & finished cargo of 0.5 million tons / year.. Contract for Construction of berth was awarded on 18th June 2009 and the berth was completed and inaugurated on 28.1.2011. Construction of parking yard is complete.

The data of total cargo handled at General Cargo Berth during the last five year is given below.

Berth	Unit	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017(till Aug 16)
General Cargo Berth - Automobiles	Numbers	1,45,053	2,01,981	2,15,071	2,16,922	84,094
General Cargo Berth - Project Cargo	Metric Tonnes	624	-	-	-	481

Sl.No.	Specific Conditions	Remarks
(i)	As the Ennore expressway is very busy. It is suggested to examine the details of traffic analysis and incorporate necessary improvement study the impact of additional traffic due to the proposed development	Complied. The report on traffic analysis was sent to MoEF vide our letter dated 17.2.2010.
(ii)	No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.	Complied. No construction work other than those permitted in Coastal

4.0 SUMMARY AND CONCLUSIONS

The primary objective of the project is to develop a general cargo berth to handle clean cargoes like cars, engineering goods, machinery, project cargo etc. The berths will also be utilized to provide berthing facilities to vessels of Coast Guard, Indian Navy and other Government agencies.

Port activities can cause deterioration of air and marine water quality in the surrounding areas due to multifarious activities like handling of iron ore and coal through the port. Baseline studies on ambient air and noise quality, water quality, sediment quality including heavy metal concentrations, marine ecology including biological observations were carried out during November 2008, inside the Ennore harbor. The data was evaluated against known standards and criteria, (Annexure II) and have not identified any parameter that violates environmental standards mandated by the MoEF. The essential heavy metal concentration pattern with reference to the data from other areas shows lesser concentrations. The toxic heavy metals are found to be well within the safety limits and as such do not pose any problem to the marine environment.

The comparison of results with the study inside the port basin during 2004 by National Institute of Ocean Technology clearly indicates only a marginal difference in the concentration and that too are well within the safety limits. The coastal waters inside the port basin are not breeding or spawning grounds for commercially important species.



No. 11-21/2009-IA.III
Government of India
Ministry of Environment & Forests
(IA Division)

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi - 110 003.

Dated: 23rd July, 2009.

To
M/s. Ennore Port Limited,
P.T. Chengalwarayar Naicken Maligai I Floor,
23, Rajaji Salai,
Chennai - 600 001.

Subject: CRZ and Environmental Clearance for the construction of general Cargo berth at Ennore Port Cargo Terminal project, Ennore, Ponneri Taluk, District Tiruvallur, Tamil Nadu, M/s. Ennore Port Ltd.

This has reference to the letter No: 1151/EC.3/2009-1, dated 24.02.2009 of Principal Secretary, Environment and Forests (EC.3) Department, Tamil Nadu and your letter No. EPC/MS/Env/GCB/01/08, dated 25.09.2008 seeking prior CRZ and Environmental Clearance for the above project under the CRZ Notification, 1991 and EIA Notification - 2006. The proposal has been appraised as per prescribed procedure in the light of provisions under the CRZ Notification, 1991 and EIA Notification, 2006 on the basis of the mandatory documents enclosed with the application viz., the Questionnaire, EIA, EMP and the additional clarifications furnished in response to the observations of the Expert Appraisal Committee constituted by the competent authority in its meetings held on 22nd - 23rd October, 2008 and 21st - 22nd May, 2009.

2. It is interalia, noted that the proposal involves development of a general cargo berth for a length of 250 m and 35 m width to handle about 2 lakhs Cars/ year and project cargos & finished cargo of 0.5 million tons/year. The proposed project will be developed inside the existing Ennore Port, in the areas under the direct control and within the limits and boundaries of Ennore, Ponneri taluk, Tiruvallur district on a plot area of 43 acres. The main components of the proposed project are construction of berth and capital dredging of 1.00 million cum for a depth of 12 mts for berthing facilities. It is proposed to dump the dredge material, north of north break water as shore protection measure to prevent erosion and for beach nourishment for 2 km away from the sea and it will not affect the hydraulic flow of water in the sea. The total cost of the project is Rs. 110 crores.

3. The project attracts EIA Notification 2006, project activity 7(e) and also CRZ Notification 1991. The project site falls in Coastal Regulation Zone - I (ii) and Coastal Regulation Zone - II. Tamil Nadu Coastal Zone

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Management Authority has recommended the project. The Principal Secretary, Environment and Forests (EC.3) Department, Govt. of Tamil Nadu vide letter No.1151/EC.3/2009-1, dated 24.02.2009 informed that as per Coastal Regulation Zone Notification 1991, under para 3(2)(ii) the operation viz. constructions for ports, harbours and light houses and construction activities of jetties, wharves, slipways, pipelines and conveying systems requires environmental clearance from Ministry of Environment and Forests, Government of India. Further, as per para 3(2) (v) of Coastal Regulation Zone Notification, 1991 all activities with investment of five crore rupees or more require environmental clearance from Ministry of Environment, Government of India.

4. The Expert Appraisal Committee, after due consideration of the relevant documents submitted by the project proponent and additional clarifications furnished in response to its observations, have recommended for the grant of CRZ and Environmental Clearance for the project. Accordingly, the Ministry hereby accord necessary CRZ and Environmental Clearance for the above project as per the provisions of CRZ Notification, 1991 and EIA Notification - 2006 and its subsequent amendments, subject to strict compliance of the terms and conditions as follows:

5. SPECIFIC CONDITIONS :

- (i) As the Ennore expressway is very busy. It is suggested to examine the details of traffic analysis and incorporate necessary improvement study the impact of additional traffic due to the proposed development.
- (ii) No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.
- (iii) Oil spills if any shall be properly collected and disposed as per the Rules.
- (iv) The project proponent shall set up separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of a Senior Executive.
- (v) The project proponent shall take up mangrove plantation/green belt in the project area, wherever possible. Adequate budget shall be provided in the Environment Management Plan for such mangrove development.
- (vi) The funds earmarked for environment management plan shall be included in the budget and this shall not be diverted for any other purposes.



6. **GENERAL CONDITIONS :**

- (i) The construction of the structures should be undertaken as per the plans approved by the concerned local authorities/local administration, meticulously conforming to the existing local and Central rules and regulations including the provisions of Coastal Regulation Zone Notification dated 19.2.1991 and the approved Coastal Zone Management Plan of Tamil Nadu.
- (ii) Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.
- (iii) Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.
- (iv) Borrow sites for each quarry sites for road construction material and dump sites must be identified keeping in view the following:
 - (a) No excavation or dumping on private property is carried out without written consent of the owner.
 - (b) No excavation or dumping shall be allowed on wetlands, forest areas or other ecologically valuable or sensitive locations.
 - (c) Excavation work shall be done in close consultation with the Soil Conservation and Watershed Development Agencies working in the area, and
 - (d) Construction spoils including bituminous material and other hazardous materials must not be allowed to contaminate water courses and the dump sites for such materials must be secured so that they shall not leach into the ground water.
- (v) The construction material shall be obtained only from approved quarries. In case new quarries are to be opened, specific approvals from the competent authority shall be obtained in this regard.
- (vi) Adequate precautions shall be taken during transportation of the construction material so that it does not affect the environment adversely.

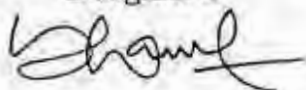
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- (vii) Full support shall be extended to the officers of this Ministry/ Regional Office at Bangalore by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environmental protection activities.
- (viii) Ministry of Environment & Forests or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environment and the same shall be complied with.
- (ix) The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied with the satisfaction of the Ministry.
- (x) In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment and Forests.
- (xi) The project proponents shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of land development work.
- (xii) Tamil Nadu State Pollution Control Board shall display a copy of the clearance letter at the Regional Office, District Industries Center and Collector's Office/Tehsildar's office for 30 days.

7. These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 1994, including the amendments and rules made thereafter.

8. All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities.

9. The project proponent shall advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Environmental Clearance and copies of clearance letters are available with the Tamil Nadu State Pollution Control Board and may also be seen on the website of the Ministry of Environment and Forests at <http://www.envfor.nic.in>. The advertisement should be made within 10 days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Bangalore.



10. Environmental Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.

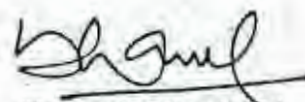
11. Any appeal against this Environmental Clearance shall lie with the National Environment Appellate Authority, if preferred, within a period of 30 days as prescribed under Section 11 of the National Environment Appellate Act, 1997.

12. A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parishad/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.

13. The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely; SPM, RSPM, SO₂, NO_x (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public domain.

14. The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.

15. The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail.



(Bharat Bhushan)
Director (IA-III)

23.07.2008

(17)
ATA (ENV)
Copy to:

1. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD-cum-Office Complex, East Arjun Nagar, Delhi-110 032.
2. The Chairman, Tamil Nadu Coastal Zone Management Authority and Principal Secretary, Govt. of Tamil Nadu, Environment and Forests (EC.3) Department, Secretariat, Chennai - 9.
3. The Chairman, Tamil Nadu State Pollution Control Board, Chennai.
4. The Secretary, Environment & Forests Department, Govt. of Tamil Nadu, Saint Geroge Port, Chennai.
5. The Director, Environment Department, Govt. of Tamil Nadu, Chennai.
6. The CCF, Regional Office, Ministry of Environment & Forests(SZ), Kendriya Sadan, IVth floor, E&F wings, 17th Main Road, Koramangala II Block, Bangalore - 560 034.
7. Guard File.
8. Monitoring File.

/

(Bharat Bhushan)
Director (IA-III)



Environment and Forests (EC.3) Department,
Secretariat, Chennai-9

Letter No: 1151/EC3/2009-1 Dated:24.02.2009

From
Thiru. Debendranath Sarangi, I.A.S.,
Principal Secretary to Government (I/c)

To
The Chairman,
National Coastal Zone Management Authority,
Government of India,
Ministry of Environment and Forests,
New Delhi - 110 003.(w.e.)

mf
4/3

Sir,

Sub: Coastal Regulation Zone - Construction of Ennore Port Cargo terminal project proposed by M/s. Ennore Port Limited - Clearance under Coastal Regulation Zone Notification 1991 Proposal - Forwarded.

Ref: From the Director of Environment, letter. No. P.1/2665/2008 dated 21.01.2009.

I am directed to state that the Director of Environment has sent the proposal as received from the District Environmental Engineer/Convenor, Tamil Nadu Pollution Control Board /District Coastal Zone Management Committee, Ambattur for the Construction of General Port Cargo terminal proposed by M/s. Ennore Port Limited, Chennai for Clearance under Coastal Regulation Zone Notification 1991.

2) The details of the project is as follows:-

The proposed project will be developed inside the existing Ennore Port, in the areas under the direct control and within the limits and boundaries at Ennore, Ponneri taluk, Tiruvallur district in 43 acres at a cost of Rs.110 crores. The proposal involves development of a general cargo berth for a length of 250 mts and 35 mts width to handle the Cars numbering about 2 lakhs / year and project cargos & finished cargo of 0.5 million tons/year. The main components of the proposed project are construction of berth and

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capital dredging of 1.00 million cu. Mts for a depth of 12mts for berthing facilities. It is proposed to dump the dredge material, north of north break water as a shore protection measure to prevent erosion. The unit has informed that the dredging material will be used for beach nourishment for 2km away from the sea and it does not affect the hydraulic flow of water in the sea. The project site falls in Coastal Regulation Zone -I (Low Tide Line to High Tide Line) and Coastal Regulation Zone -II.

3) The Director of Environment has further stated that the District Coastal Zone Management Authority (DCZMA) for Thiruvallur district has discussed the subject in their meeting held on 13.11.2008 and recommended the project for clearance under Coastal Regulation Zone Notification 1991. The District Coastal Zone Management Committee has indicated that the sediment analysis indicates low to average values for toxic heavy metals and silty in nature, shall not result in high water column concentrations due to the disturbance. The toxic metal concentrations are well within the background concentrations and can be safely disposed as dredged material or as a land fill.

4) As per Coastal Regulation Zone Notification 1991, under para 3(2)(ii) the operation viz- constructions for ports, harbours and light houses and construction activities of jetties, wharves, slipways, pipelines and conveying systems requires environmental clearance from Ministry of Environment and Forests, Government of India. Further as per para 3(2) (v) of Coastal Regulation Zone Notification 1991, all activities with investment of five crore rupees or more require environmental clearance from Ministry of Environment, Government of India.

5) The subject was placed before the 49th meeting of the State Coastal Zone Management Authority held on 12.01.2009 and the Authority has resolved to recommend the proposal to Ministry of Environment and Forests, Government of India subject to the following specific conditions:-

- i) The composition of the dredged materials should be duly analyzed and examined to find out the availability of any toxic contents.
- ii) Based on the analysis, a suitable methodology for the disposal of dredging materials to be evolved out.

6) The Director of Environment has therefore sent the proposals and requested that the above proposals may be recommended to the Ministry of Environment and Forests, Government of India for clearance under Coastal Regulation Zone Notification 1991 as resolved in the 49th meeting of the Tamil Nadu State Coastal Zone Management Authority held on 12.01.2009 subject to the following conditions and also the subject to

the conditions imposed by the District Coastal Zone Management Authority as referred above.

a)

- a) There should not be any extraction of ground water in Coastal Regulation Zone.
- b) The project activity should not affect the coastal ecosystem including marine flora and fauna.
- c) The composition of the dredged materials should be duly analyzed and examined to find out the availability of any toxic contents.
- d) Based on the analysis, a suitable methodology for the disposal of dredging materials to be evolved out.
- e) No blasting activities in Coastal Regulation Zone is permissible.
- f) There should not be any extraction of ground water in Coastal Regulation Zone.
- g) The proponent shall not undertake any activity, which is violative of the provisions of Coastal Regulation Zone Notification 1991 and the subsequent amendments.
- h) The Coastal Regulation Zone clearance will be revoked if any of the condition stipulated is not complied with.

7) In consonance with the recommendation of State Coastal Zone Management Authority the Government accept the request of the Director of Environment and forward the proposal of M/s. Ennore Port Limited for construction of Ennore Port Cargo terminal project together with the minutes of 49th meeting of Tamil Nadu State Coastal Zone Management Authority for clearance under Coastal Regulation Zone Notification 1991.

Yours faithfully,

P. Basappa
for Principal Secretary to Government (I/c)

25/12/13

Copy to

The Director of Environment, Chennai-15

The Managing Director, M/s. Ennore Port Limited

P.T. Chengalwarayar Naicker Maligai I floor

23, Rajaji Salai, Chennai 600 001.

(with a request to send 20 copies of proposal to Ministry of Environment and Forests ,
Government of India, New Delhi)

SF

Certified Copy of Compliance Report

Sub:Expansion and modernization of existing handling of Multicargo container terminal at Kamarajar port, Tamil Nadu by M/s. Kamarajar Port Limited- Environmental and CRZ Clearance.

Ref: F, No. 10-28/2005-1A-III dated 24.12.2014

Present Status of the Project:

The construction of Multi cargo container terminal is under progress

Date of Monitoring: 24.12.2016

A. Specific Conditions

S.No	Conditions	Compliance
1	"Consent for Establishment" for the present project, shall be obtained from State Pollution Control Board under Air (Prevention and Control of Pollution) Act, 1981 and Water (Prevention and Control of Pollution) Act, 1974.	Complied. Tamil Nadu Pollution Control Board has accorded Environmental clearance for the Multi cargo Terminal in the name of the BoT operator, M/s. Chettinad International Bulk Terminal pvt. Ltd vide Consent Order No. 15012566008 dated 25.05.2015; vide proceedings No. T16/TNPCB/F.0039AMB/RL/AMB/A/2015 dated 25.5.2015 under Air and, T16/TNPCB/F.0039AMB/RL/AMB/W/2015 dated 25.5.2015 under Water Act.
2	Quantity of cargo should be handled in accordance with the details provided in the form-1	Complied. The quantity of cargo will be handled as per the details mentioned in Form -1. (To handle clean cargoes like Granite, timber logs, Grains, bagged cargoes including sugar, cobble stone, steel cargoes, project cargo and small quantity of containers. of about 2 Million tons per annum)
3	All the recommendations and conditions stipulated by Tamil Nadu Coastal Zone Management Authority (TNCZMA) No. 30060/EC.3/2005-1 dated 06.12.2005, shall be complied with.	Partly complied. Some of the conditions are not yet complied and the details are in the respective report.
4	All the conditions as prescribed in the earlier Clearance letter no. 10-28/2005-1A-III dated 19.05.2006 and 10.09.2007, shall be complied.	Partly complied. Some of the conditions are not yet complied and the details are in the respective report.

5	All the recommendation of the EIA/EMP & Risk Assessment and Disaster Management Report shall be complied with letter and spirit. All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation submitted in the EIA report shall be submitted to MoEF&CC along with half yearly compliance report to MoEF&CC-RO	Agreed to comply. The PA have agreed to comply the recommendations of the EIA/EMP & Risk Assessment and Disaster Management Report. Matrix format has not been prepared and submitted to RO.
6	The commitment made by the Proponent to the issue raised during Public Hearing shall be implemented by the Proponent.	Refer below: The PA informed that no public hearing was conducted.
7	Corporate Environment Responsibility: a) The Company shall have a well laid down Environment Policy approved by the Board of Directors. b) The Environment Policy shall prescribe for standard operating process/producers to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions. c) The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions shall be furnished. d) To have proper checks and balances, the company shall have a well laid down system of reporting of non- compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large	Kamarajar Port Limited is having an Environmental Management System Policy approved by Chairman-cum Managing Director. Port has obtained EMS ISO 14001: 2004. Agreed to comply. Agreed to comply. Agreed to comply.

B. General Conditions

S.No	Conditions	Compliance
(i)	Appropriate measures must be taken while understanding digging activities to avoid any likely degradation of water quality.	Agreed to comply. Pile foundation is done and they are monitoring marine water quality.

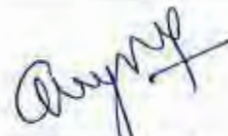
(ii)	Full support shall be extended to the officers of this Ministry/Regional Office at Chennai by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environmental protection activities.	Complied. They have extended full support during the visit.
(iii)	A six-Monthly monitoring report shall need to be submitted by the project proponent to the Regional Office of this Ministry at Chennai regarding the implementation of the stipulated conditions.	Complied. They are submitting the six monthly compliance report.
(iv)	Ministry of Environment, Forest & Climate Change or any other component authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environment and the same shall be complied with.	Agreed upon.
(v)	The Ministry reserves the right to revoke this clearance if any of the condition stipulated are not complied with the satisfaction of the Ministry.	Agreed upon.
(vi)	In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment, Forest & Climate Change.	Agreed upon.
(vii)	The project proponent shall inform the Regional Office as well as the Ministry the date of financial closure and final approval of the project by the concerned authorities and the date of start of land development work.	Refer below: Date of financial closure- 21.2.2015 Date of final approval of the project by concerned authorities- 24.02.2015 Date of start of land development works- 08.07.2015
(viii)	A copy of the clearance letter shall be marked to concerned Panchayat/local NGO, if any, from whom any suggestion/representation has been made received while processing the proposal.	Refer below: No suggestion / representation was received from the Panchayat / NGO while processing the proposal. However a copy of the clearance letter was forwarded to local Panchayat.
(ix)	The project proponent shall set up separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of a Senior Executive.	Refer below: Only one officer (Manager level) has been given the charge of Environmental In charge along with another officer who has been given an additional works. All the monitoring works are carried out by external laboratories.

(x)	The funds earmarked for environment management plan shall be included in the budget and this shall not be diverted for any purposes.	<p>Complied.</p> <p>The fund allocated for Environmental management Plan by KPL , year wise is as follows:</p> <p>2014-15= Rs.30,36,262/-</p> <p>2015-16 = Rs. 60,72,033/-</p> <p>Year 2016-2017 (Planning)= Rs.43,00,000/-</p> <p>The fund allocated for Environmental management Plan for the Marine Liquid Terminal terminal for the year 2016-17 is Rs. 4356000/-</p>
5	These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 1994, including the amendments and rules made thereafter.	<p>Refer below:</p> <p>Consent validity was up to 2015 and later on it has not been renewed but the PA has submitted the application for renewal. No information was provided about the Public Liability Insurance.</p>
6	All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authority.	<p>Agreed to comply.</p> <p>The PA has agreed to obtain all necessary approvals.</p>
7	The project proponent shall advertise in at least two local Newspaper widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Environmental and CRZ clearance and copies of clearance letters are available with the Tamil Nadu State Pollution Control Board and may also be seen on the website of the Ministry of Environment, Forest & Climate Change at http://www.envfor.nic.in . The advertisement should be made within Seven days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Chennai.	<p>Complied.</p> <p>The advertisement was given in the local Tamil newspaper Dinamani & New Indian Express paper on 04.02.2015 intimating about the accordance of Environmental & CRZ clearance for the project and submitted the copy of the same to RO.</p>

8	This clearance is subject to final order of the Hon'ble Supreme court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.	Agreed upon.
9	Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.	Agreed upon.
10	Status of compliance to the various stipulated environmental conditions and environment safeguards will be uploaded by the project proponent in its website.	Not complied. Status of compliance to the various stipulated environmental conditions and environment safeguards has not been uploaded by the project proponent in their website.
11	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, ZillaParisad/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.	Complied. The copy of the clearance letter was forwarded to local Panchayat as informed.
12	The proponent shall upload the status of compliance of the stipulated Clearance conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.	Not complied. Status of compliance to the various stipulated environmental conditions and environment safeguards has not been uploaded by the project proponent in their website.
13	The project proponent shall also submit six monthly reports on the status of compliance of the stipulated Clearance conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respect Zonal of CPCB and SPCB.	Complied. The PA submitting the six monthly compliance report to Regional Office of MoEF&CC both in hard copies as well as by e-mail.
14	The environment statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986,	Not complied. The environment statement for each financial year ending 31st March in Form-V has not been submitted and also it has not been uploaded on their website.

as amended subsequently, shall also be put on the website of the company along with the status of compliance of Clearance conditions and shall be sent to the respective Regional Office of MoEF&CC by e-mail.	
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This has the approval of Addl PCCF(C) vide diary No.1737 dated 29.12.2016



(Dr. C. Kaliyaperumal)
Director(S)

Dr. G. KALIYAPERUMAL, M.E., PhD
Director (S)

Government of India
Ministry of Environment, Forests & Climate Change
Regional Office (South Eastern Zone)
HEPC Building, No.34, Cathedral Garden Road,
Nungambakkam, Chennai-600 034.



F.No.10-28/2005-IA.III

Government of India

**Ministry of Environment, Forests & Climate Change
(IA.III Section)**

**Indira Paryavaran Bhawan,
Jor Bagh Road,
New Delhi - 110 003.**

Dated: 24th December, 2014

To

**The Chairman-cum-Managing Director,
M/s Kamarajar Port Limited,
P.T.Lee Chengalvaraya Naicker Maaligai (I Floor),
23, Rajaji Salai, Chennai - 600 001,
Tamil Nadu**



Subject: Expansion and modernization of existing handling of Multicargo container terminal at Kamarajar Port, Tamil Nadu by M/s Kamarajar Port Limited (formerly known as Ennore Port Ltd.) - Environmental and CRZ Clearance - Reg.

Sir,

This has reference to your letter no. EPL/MS/Env/MCB/2013 dated 02.06.2014 and subsequent letter dated 07.11.2014 seeking prior Environmental and CRZ Clearance on the above-mentioned subject.

2. The Ministry of Environment, Forests & Climate Change has considered the application. It is noted that the proposal is for grant of Environmental and CRZ Clearance for **Expansion and modernization of existing handling of Multicargo container terminal at Kamarajar Port, Tamil Nadu by M/s Kamarajar Port Limited (formerly known as Ennore Port Ltd.)**. The proposal was considered by the EAC in its meeting held on 30th June, 2014 - 2nd July, 2014. The proponent has informed that:

- i. The development of Kamarajar Port Project at a cost of Rs.1058.52 Crores was completed and commissioned in June 2001.
- ii. Two Coal Berths were constructed in Phase-I and are dedicated to handle thermal coal for the Thermal Power Stations of Tamil Nadu Electricity Board (TNEB) located at North Chennai (630 MW), Ennore (450 MW) and Mettur (840 MW). After the commissioning of Kamarajar Port, keeping in view the trade demand to handle other cargo items like LPG, POL, Chemicals, Edible Oils, Containers, etc., and the need for optimal utilization of the infrastructure already created in Phase-I, the Second Phase Expansion of Ennore Port was accorded Environmental Clearance vide letter No.10-28/2005-IA-III dated 19.05.2006 including associated capital dredging of 15.5 million cubic meters for the three projects viz., Marine Liquid Terminal (3 MTPA), Coal Terminal (8 MTPA) and Iron Ore Terminal (12 MTPA) vide MoEF letter No.10-28/2005-IA-III dated 10.09.2007.
- iii. MoEF vide letter no. 10-28/2005-IA-III dated 30.03.2014 has extended the validity of the clearance upto 09.09.2015.
- iv. The present proposal involves development of 730 mtr quay length for Container and to develop a Muticargo terminal of 2.0 MTPA capacity in the remaining 270 mtr quay length at Ennore Port Ltd., Tamil Nadu.

- v. The cargo handled in the multi cargo terminal will be clean cargoes like Granite, timber logs, Grains, bagged cargoes including sugar, cobble stone, steel cargoes, project cargo and small quantity of containers.
- vi. The capacity of cargo handled in the multi cargo berth will be 2.0 MTPA. However, there will not be any change in the overall length of the terminal of 1000m of the container terminal already approved by MoEF.
- vii. The major activity associated with the development of the multicargo terminal would be an increased quantity of cargo handling capacity from 18.0 MTPA to 18.8 MTPA i.e. a slight increase of 0.8 MTPA only.
- viii. The proposal does not require any additional dredging. Moreover, the development of multi cargo terminal does not alter in any way any of the environmental parameters since only clean cargo is going to be handled. Hence impact would remain the same as it has been projected earlier.
- ix. The project will not involve any new land acquisition or re-settlement/re-habilitation of population.
- x. The total cost of the multicargo berth of 270m length is Rs. 151 crores.
- xi. **Approvals:** The Tamil Nadu State Coastal Zone Management Authority has recommended the project vide letter No. 30060/EC.3/2005-1 dated 06.12.2005 and stated that the Project Proponent have proposed to undertake capital dredging to deepen the port and navigational channel to accommodate cape size vessels for handling iron-ore at its proposed terminal as part of their second phase development. This will enable to suspend handling of iron-ore at Chennai Port. It is informed that there is a need to shift dusty cargo such as iron-ore and coal from the Chennai Port, which is within urban limits, to areas of lesser impact.
- xii. **Wildlife issues:** There are no national Parks, wildlife sanctuary, biosphere reserves found in the 10 km buffer zone.
- xiii. There is no court cases/violation pending with the project proponent.

4. The proposal was considered by the Expert Appraisal Committee (EAC) and recommended in its 135th EAC meeting held on 30th June, 2014 – 2nd July, 2014 for granting Environmental and CRZ Clearance. The Ministry of Environment, Forests & Climate Change hereby accords Environmental and CRZ Clearance for the above-mentioned **Expansion and modernization of existing handling of Multicargo container terminal at Kamarajar Port, Tamil Nadu by M/s Kamarajar Port Limited (formerly known as Ennore Port Ltd.)** under the provisions of the EIA Notification, 2006 and CRZ Notification, 2011 and amendments thereto and Circulars issued thereon and subject to the compliance of the following specific conditions, in addition to the general conditions mentioned below:

A. SPECIFIC CONDITIONS:

- (i) "Consent for Establishment" for the present project, shall be obtained from State Pollution Control Board under Air (Prevention and Control of Pollution) Act, 1981 and Water (Prevention and Control of Pollution) Act, 1974.
- (ii) Quantity of cargo should be handled in accordance with the details provided in the Form-I.
- (iii) All the recommendations and conditions stipulated by Tamil Nadu Coastal Zone Management Authority (TNCZMA) No. 30060/EC.3/2005-1 dated 06.12.2005, shall be complied with.
- (iv) All the conditions as prescribed in the earlier Clearance letter no. 10-28/2005-IA-III dated 19.05.2006, and 10.09.2007, shall be complied with.

- (v) All the recommendation of the EIA/EMP & Risk Assessment and Disaster Management Report shall be complied with letter and spirit. All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MoEF&CC along with half yearly compliance report to MoEF&CC-RO.
- (vi) The commitment made by the Proponent to the issue raised during Public Hearing shall be implemented by the Proponent.
- (vii) Corporate Environment Responsibility:
 - a) The Company shall have a well laid down Environment Policy approved by the Board of Directors.
 - b) The Environment Policy shall prescribe for standard operating process/procedures to bring into focus any infringements/deviation/ violation of the environmental or forest norms/conditions.
 - c) The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions shall be furnished.
 - d) To have proper checks and balances, the company shall have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large.

B. GENERAL CONDITIONS:

- (i) Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.
- (ii) Full support shall be extended to the officers of this Ministry/Regional Office at Chennai by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environmental protection activities.
- (iii) A six-Monthly monitoring report shall need to be submitted by the project proponents to the Regional Office of this Ministry at Chennai regarding the implementation of the stipulated conditions.
- (iv) Ministry of Environment, Forests & Climate Change or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environment and the same shall be complied with.
- (v) The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied with the satisfaction of the Ministry.
- (vi) In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment, Forests & Climate Change.
- (vii) The project proponents shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of land development work.



- (viii) A copy of the clearance letter shall be marked to concerned Panchayat/local NGO, if any, from whom any suggestion/ representation has been made received while processing the proposal.
- (ix) The project proponent shall set up separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of a Senior Executive.
- (x) The funds earmarked for environment management plan shall be included in the budget and this shall not be diverted for any other purposes.

5. These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 1994, including the amendments and rules made thereafter.

6. All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities.

7. The project proponent shall advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Environmental and CRZ Clearance and copies of clearance letters are available with the Tamil Nadu State Pollution Control Board and may also be seen on the website of the Ministry of Environment, Forests & Climate Change at <http://www.envfor.nic.in>. The advertisement should be made within Seven days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Chennai.

8. This clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.

9. Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

10. Status of compliance to the various stipulated environmental conditions and environmental safeguards will be uploaded by the project proponent in its website.

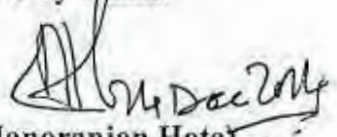
11. A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parish/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.

12. The proponent shall upload the status of compliance of the stipulated Clearance conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.

13. The project proponent shall also submit six monthly reports on the status of compliance of the stipulated Clearance conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.

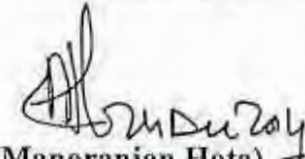


14. The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of Clearance conditions and shall also be sent to the respective Regional Office of MoEF&CC by e-mail.


(Dr. Manoranjan Hota)
Director

Copy to:

- (1) The Principal Secretary, Department of Environment and Forests, First Floor, Panagal Building, Saidapet, Chennai – 600 015, Tamil Nadu.
- (2) The Chairman, CPCB, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi – 110032.
- (3) The Director, Department of Environment, Government of Tamilnadu, Panagal Building, Ground Floor, Saidapet, Chennai-15, Tamil Nadu.
- (4) The Chairman, Tamil Nadu Pollution Control Board, No. 76, Mount Salai, Gundy, Chennai, Tamil Nadu.
- (5) Additional Principal Chief Conservator of Forests (C), Ministry of Environment, Forests and Climate Change, Regional Office, 1st Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai – 34.
- (6) Guard File.
- (7) Monitoring Cell.


(Dr. Manoranjan Hota)
Director

Certified Copy of Compliance Report

Sub: Development of additional coal berths (CB3 and CB4) at Kamarajar port, Tamil Nadu by M/s Kamaraj Port Ltd.(Formerly known as Ennore Port Ltd.) Environmental and CRZ Clearance.

Ref:11-51/2012-IA.III dated 12.03.2015.

Present Status of the Project:

The construction work of CB3 and CB4 are under progress.

Date of Monitoring: 24.12.2016

A. Specific Conditions

S.No	Conditions	Compliance
A (i)	"Consent for Establishment" shall be obtained from State Pollution Control Board under Air (Prevention and Control of Pollution) Act, 1981 and Water (Prevention and Control of Pollution) Act, 1974.	Complied. Tamil Nadu Pollution Control Board has accorded Consent to Establish for the project vide Consent Order No. 15061355540 dated 31.8.2015 and Proceedings No. T6/TNPCB/F.0044AMB/RL/AMB/W/2015 dated 31.8.2015 for Water and Proceedings No. T6/TNPCB/F.0044AMB/RL/AMB/A/2015 dated 31.8.2015 for Air.
(ii)	Dust screens shall be provided with a height of 2 meter above the maximum stack height. Water sprinkling shall be carried out for settling dust. Three layers of green belt of all growing trees shall be provided on all sides.	Refer below: Water sprinkling is carried out for dust suppression, They have agreed to grow three layers of greenbelt on all sides. Also agreed to provide 2 m height of stack.,
(iii)	Water sprinkler should be provided in the area of coal loading and unloading, storage and vehicle path/roads.	Agreed to comply. The construction of the project is under progress and agreed to implement.
(iv)	Energy conservation measures shall be provided which may include use of solar panels, wind mill etc.	Complied At present, port has installed solar panels with a total capacity of 20 KV and agreed to install windmill also.
(v)	There shall be no washing of conveyor belt.	Agreed to comply The construction is under progress and agreed to comply.

(vi)	All the conditions stipulated by Tamil Nadu Coastal Zone Management Authority (TNCZMA) vide letter No. 23187/EC.3/2014-I dated 16.12.2014, shall be complied with.	Agreed to comply. The construction is under progress and agreed to comply.
(vii)	All the recommendation of the EIA/EMP, Disaster Management Plan shall be strictly complied within letter and spirit. All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MoEF&CC along with half yearly compliance report to MoEF&CC-RO.	Agreed to comply. The construction is under progress and agreed to comply.
(viii)	Cargo shall be unloaded directly into hopper from the ship and transportation of coal shall be through covered/closed trucks/ rail only. Closed conveyor belt shall be used for loading the product in the barges.	Agreed to comply. Agreed to unloaded directly into hopper from the ships and will be transported through elevated closed conveyor systems to the stack yard / thermal power plant,
(ix)	The dredge material shall be reused for low level rising wherever possible and excess shall be dumped into sea at the designated dumping areas identified based on mathematical model studies.	Being complied. They are using dredged material for the development of stackyard and filling of the low lying land.
(x)	To prevent discharge of sewage and other liquid waste including ballast into marine environment, adequate system for collection, treatment and disposal of liquid waste must be provided.	Refer below: No liquid effluent is generated during the operations as informed. Soak pit and septic tanks are provided.
(xi)	Necessary arrangements for the treatment of the effluents and solid waste must be made and it must be ensured that the untreated effluents and solid wastes are not discharged into the water or on the beach; and no effluent or solid	Refer below: No effluents are generated while handling the cargo. At present ship and shore based Solid wastes are collected, segregated and sent to recyclers for further beneficial use.

	waste shall be discharged on the beach.	
(xii)	The quality of treated effluents, solids wastes, emission and noise levels and the like, from the project area must conform to the standards laid down by the competent authorities including the Central or State Pollution Control Board and under the Environment (Protection) Act, 1986.	Complied. KPL is monitoring ambient air, noise levels, marine water quality inside the port during construction activities and agreed to continue during operational phase also.
(xiii)	The project proponent shall set up separate Environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of a Senior Executive.	Refer below: Only one officer (Manager level) has been given the charge of Environmental In charge along with another officer who has been given an additional works. All the monitoring works are carried out by external laboratories.
(xiv)	The commitment made by the proponent to the issue raised during Public Hearing shall be implemented by the Proponent.	Refer below: No details made available.
(xv)	Corporate Environment Responsibility: a) The Company shall have a well laid down Environment Policy approved by the Board of Directors. b) The Environment Policy shall prescribe for standard operating process/producers to bring into focus any infringements / deviation / violation of the environmental or forest norms/conditions. c) The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance	Complied. a) & b). Kamarajar Port Limited is having an Environmental Management System Policy approved by Chairman cum managing Director. Port has obtained EMS ISO 14001: 2004. The non-compliances / violations will be reviewed by Board of Directors as informed. c). The hierarchical system to deal with environmental issues and for ensuring compliance with the environmental clearance conditions are furnished.

	<p>with the environmental clearance conditions shall be furnished.</p> <p>To have proper checks and balances, the company shall have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large.</p>	
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B. General conditions

S.No	Conditions	Compliance
B (i)	Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.	<p>Complied.</p> <p>The Project Proponent informed that appropriate measures are taken while undertaking digging activities to avoid any likely degradation of water quality and presently monitoring the marine water quality is carried out.</p>
(ii)	Full support shall be extended to the officers of this Ministry/Regional Office at Chennai by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environmental protection activities.	<p>Complied</p> <p>The PA has extended full support during the visit.</p>
(iii)	A six-Monthly monitoring report shall need to be submitted by the project proponent to the Regional Office of this Ministry at Chennai regarding the implementation of the stipulated conditions.	<p>Complied</p> <p>Six monthly compliance reports are regularly submitted to RO.</p>
(iv)	Ministry of Environment, Forest & Climate Change or any other component authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of	Agreed up on.

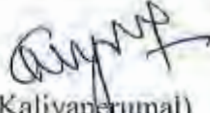
	environment and the same shall be complied with.	
(v)	The Ministry reserves the right to revoke this clearance if any of the condition stipulated are not complied with the satisfaction of the Ministry.	Agreed up on.
(vi)	In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment, Forest & Climate Change.	Refer below: There is no change as informed.
(vii)	The project proponent shall inform the Regional Office as well as the Ministry the date of financial closure and final approval of the project by the concerned authorities and the date of start of land development work.	Refer below: <u>Construction of Coal Berth No. 3</u> Coal berth No 3 for TNEB was planned for a capacity of 9 MTPA in an estimated cost of 209.68 crores. The agreement was signed between M/s ITD Cementation India Ltd., Date of financial closure- internal resources. Date of final approval of the project by concerned authorities- KPL Board approved on 9.6.2015 Date of start of land development works- 2.6.2015 <u>Construction of Coal Berth No. 4</u> Construction of Coal berth No 4 for TNEB was planned for a capacity of 9 MTPA in an estimated cost of 255.79 crores. The agreement was signed between M/s Afcons Infrastructure Ltd., Date of financial closure- internal resources. Date of final approval of the project by concerned authorities- KPL Board approved on 21.2.2015 Date of start of land development works- 19.8.2015
(viii)	A copy of the clearance letter shall be marked to concerned Panchayat/local NGO, if any, from whom any suggestion/representation has been made received while processing the proposal.	Complied. A copy of the clearance letter was forwarded to the local Panchayat.
(ix)	Full support should be extended to the officers of this Ministry's	Complied. They have extended full support during the visit.

	Regional Office at Chennai and the offices of the Central and Tamil Nadu State Pollution control Board by the project proponents during their inspection for monitoring purposes, by furnishing full details and action plans including the action taken reports in respect of mitigative measures and other environmental protection activities.	
(x)	The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to this Ministry and its concerned Regional Office.	<p>Complied.</p> <p>The fund allocated for Environmental management Plan by KPL, year wise is as follows:</p> <p>2014-15= Rs.30,36,262/-</p> <p>2015-16 = Rs. 60,72,033/-</p> <p>Year 2016-2017 (Planning)= Rs.43,00,000/-</p> <p>The fund allocated for Environmental management Plan for the Marine Liquid Terminal terminal for the year 2016-17 is Rs. 4356000/-</p>
5	These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 1994, including the amendments and rules made thereafter.	<p>Refer below:</p> <p>Consent validity was up to 2015 and later on it has not been renewed but the PA has submitted the application for renewal. No information was provided about the Public Liability Insurance.</p>
6	All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent	<p>Refer below:</p> <p>Diesel is not stored inside the project area as informed and agreed to obtain All other statutory clearances.</p>

	authority.	
7	<p>The project proponent shall advertise in atleast two local Newspaper widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Environmental and CRZ clearance and copies of clearance letters are available with the Tamil Nadu State Pollution Control Board and may also be seen on the website of the Ministry of Environment, Forest & Climate Change at http://www.envfor.nic.in. The advertisement should be made within Seven days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Chennai.</p>	<p>Complied.</p> <p>It was advertised in Tamil and English newspapers on 25.3.2015 in the New Indian Express and Dinamani and copies of the same were forwarded to RO..</p>
8	<p>This clearance is subject to final order of the Hon'ble Supreme court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.</p>	<p>Agreed upon.</p>
9	<p>Status of compliance to the various stipulated environmental conditions and environment safeguards will be uploaded by the project proponent in its website.</p>	<p>Not complied.</p> <p>The PA has not uploaded the status of compliance to the various stipulated environmental conditions and environment safeguards in their website so far.</p>
10	<p>Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.</p>	<p>Refer below:</p> <p>The PA informed that there is no Appeal against this EC. But the PA have dumped some quantity (about 1lakh m3) of dredged material was dumped in the port land 6 to 7 months before in the CRZ area along the port approach road on the southern side of KPL at different places. Against this a case was filed by NGOs in NGT, Application No. 8 of 2016. NGT directed KPL to remove the dumped material immediately within 4 weeks. KPL has</p>

		not started to remove the material and they have requested 2 more weeks time to remove the same that is by 31.1.2017.
11	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, ZillaParisad/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.	Complied: As informed a copy of the clearance letter was forwarded to the local Panchayat.
12	The proponent shall upload the status of compliance of the stipulated Clearance conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.	Complied. The PA is submitting six monthly compliance regularly to this office.
13	The environment statement for each financial year ending 31 st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of Clearance conditions and shall be sent to the respective Regional Office of MoEF&CC by e-mail.	Not complied. The environment statement for each financial year ending 31st March in Form-V was not submitted and also the same has not been uploaded on their website.

This has the approval of Addl PCCF(C) vide diary No.1737dated29.12.2016.


 (Dr. C. Kaliyaperumal)
 Director(S)
 Dr. C. KALIYAPERUMAL, M.E., PhD
 Director (S)
 Government of India
 Ministry of Environment, Forests & Climate Change
 Regional Office (South Eastern Zone)
 HEPC Building, No.34, Cathedral Garden Road,
 Nungambakkam, Chennai-600 034.

Certified Copy of Compliance Report

Sub: Environment-Coastal Regulation Zone- Kamaraj Port Expansion Proposal- Proposed Construction and development of two new additional berths of each having 9 MTPA capacity inside the premises of Kamaraj Port Ltd. Puzhuthivakkam village, Vallur Post, Chennai proposed by Kamarajar Port Ltd - Clearance under CRZ Notification 2011- Tamil Nadu Coastal Zone Management Authority

Ref: No, 23187/EC.3/2014-1, dated 16.12.2014

Date of Monitoring: 24.12.2016

S.No	Condition	Compliance
1	There should not be any sea water intrusion or erosion on the adjacent coastal areas due to the proposed construction of two additional berths, dredging and also due to the dumping of dredged material.	Refer below: The PA informed that there is no seawater intrusion due to the construction of berths and dredging activities. The berths are under construction inside the already existing break waters.
2	Dredged material should be dumped on the landward side and should not be dumped into sea (CRZ IV), intertidal area (CRZ IB) of the Buckingham canal and also in the salt pan areas as the salt pan areas are declared as CRZ-IB (intertidal zone) as per approved coastal Zone management plan of Tamil Nadu.	Not complied. The dredged material is dumped in the intertidal area of the Buckingham canal and also in the salt pan area and for that there is a case in NGT(Application No. 8 of 2016).
3	There should not be any impact of dispersal of dredged material on the adjacent L&T shipyard area especially the navigational channels of that shipyard.	Refer below: The boundaries of L&T shipyard are sufficiently away from the path of modeled plume drift.
4	A continuous proper air quality monitoring station should be under taken around the project area to implement corrective, mitigate measures immediately on the noticing of any adverse impact.	Complied. They have installed two continuous ambient air quality monitoring stations and the real time data is linked to TNPCC Care Air Centre.

5	Necessary adequate preventive measures should be undertaken to maintain the air quality PM10 level at Ennore Port within the standards and it should not cross the prescribed limit and suitable plan on handling of coal in the project area shall be implemented.	Complied. Water spring is carried out for the dust suppression and AAQ is also monitored and the levels are within the limit.
6	Necessary measures should be taken to control the noise level within the prescribed standard levels.	Complied. Ear plugs are provided to the workers and also agreed to take necessary measures to control the noise level within the prescribed standard levels during operation.
7	Closed conveyor system with latest technology should be established for coal handling as indicated in the report.	Refer below: Agreed to unload the coal from the ship and sent to the stockyard/thermal power station through elevated closed conveyor systems.
8	Green belt development shall be implemented.	Complied. So far they have taken up green belt development at various locations inside the port by planting more than 30,000 trees and the work is continuing.
9	There shall be no extraction of ground water	Refer below: No ground water is extracted inside the port for construction or for operational purpose and only open dug wells are made for horticulture purpose as informed.
10	As indicated in the revised report sufficient allocation of funds should be made to carryout outdoor Environment Social welfare activities.	Complied. The PA have allocated sufficient amount for CSR activities.

This has the approval of Addl PCCF(C) vide diary No.1737 dated 29.12.2016.


(Dr. C. Kaliyaperumal)
Director(S)

Dr. C. KALIYAPERUMAL, M.E., PhD
Director (S)
Government of India
Ministry of Environment, Forests & Climate Change
Regional Office (South Eastern Zone)
HEPC Building, No.34, Cathedral Garden Road,
Nungambakkam, Chennai-600 034.

F.No.11-51/2012-IA.III
Government of India
Ministry of Environment, Forests & Climate Change
(IA.III Section)

Indira Paryavaran Bhawan,
Jor Bagh Road,
New Delhi - 110 003

Dated: 12th March, 2015

To,
The General Manager (Marine Services),
M/s Kamarajar Port Ltd.,
P.T.Lee Chengalvaraya Naicker Maaligai (I Floor),
23, Rajaji Salai, Chennai - 600 001,
Tamil Nadu

Subject: Development of additional coal berths (CB3 and CB4) at Kamarajar Port, Tamil Nadu by M/s Kamarajar Port Ltd. (Formerly known as Ennore Port Limited) - Environmental and CRZ Clearance - Reg.

Sir,

This is with reference to your letter no. EPL/MS/Env/CB3&4/2013 dated 05.06.2014 and subsequent letters dated 06.10.2014 and 05.11.2014 seeking prior Environmental and CRZ Clearance on the above-mentioned subject.

2. The Ministry of Environment, Forests & Climate Change has considered the application. It is noted that the proposal is for grant of Environmental and CRZ Clearance for **Development of additional coal berths (CB3 and CB4) at Kamarajar Port, Tamil Nadu by M/s Kamarajar Port Ltd. (Formerly known as Ennore Port Limited)**. The proposal was considered by the EAC in its meetings held on 25th - 27th August, 2014 and 26th - 28th November, 2014. The proponent has informed that:

- i. Kamarajar Port (Formerly known as Ennore Port) is the 12th major port of India, which is located on the Coromandel Coast about 20 km North of Chennai Port, Chennai, Tamil Nadu. This port is also the first port to become a public enterprise.
- ii. To meet the coal requirement of the Thermal Power Plants of Tamil Nadu Electricity Board (TNEB) (restructured as Tamilnadu Generation and Distribution Corporation Limited - TANGEDCO in November 2010), Kamarajar Port Limited had proposed to construct additional coal berths CB-3 (9 MTPA capacity) and CB-4 (9 MTPA capacity) at Kamarajar Port, Tamil Nadu.
- iii. The total dredging area is 336 m × 150 m (CB-3) and 336 m × 184 m (CB-4). Quantity to be dredged for CB-3 is Land based: 0.3 million m³ and Marine based: 2.1 million m³. Anticipated dredged material quantity for CB-4 is Land based: 0.3 million m³ and Marine based: 1.0 million m³. The length and breadth of the proposed coal berths is 336 m long × 27.5 m

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wide. The design dredged level is (-) 18 m. CD for CB-3 & CB-4. The area of the coal stack yard is 57.94 acre.

- iv. The land portions were cut for creation of port facility at many ports namely New Mangalore Port Trust, Vishakapatnam Port Trust, Paradip Port Trust, Gangavaram Port Trust and Karaikal Port Trust.
- v. Coal will be transported to the Thermal Power Plant in an elevated conveyor system and also will be stocked in the stack yard. The conveyor system is fully covered with galvanised sheets and translucent sheets at regular intervals. Deck sheets at the bottom of the conveyor will be provided wherever necessary.
- vi. Water sprinklers will be provided for dust control at coal stock yard.
- vii. Dredged sand from the sand trap at Ennore creek should be disposed on north of port to prevent erosion of northern coast, which is practiced at vizag port.
- viii. The Project will be completed in 24 months.
- ix. The cost of the CB-3 is Rs.275.30 crore and CB-4 is Rs. 266.90 crore.
- x. The proposed coal berths falling in CRZ-IV A and CRZ-III. The conveyor belt falling in CRZ-1B, III and IV B.
- xi. **Approvals:** The Tamil Nadu Coastal Zone Management Authority has recommended the project vide letter no. 23187/EC.3/2014-1 dated 16.12.2014.
- xii. The Terms of Reference (ToR) for this project was approved by MoEF vide F.No.11-51/2012-IA.III dated 21.08.2012.
- xiii. **Public Hearing** was held on 18.02.2014 at Ennore Port premises.

3. The above project was considered by EAC in its meeting held on 25th - 27th August, 2014 and sought additional information viz. details of coal handling system from vessel to stockpile, details of sand trap and strategies for dredging of sand trap and disposal of dredge spoil with current situation, etc. PP submitted information vide letter dated 06.10.2014.

4. The proposal was considered by the Expert Appraisal Committee (EAC) and recommended in its 141st EAC meeting held on 26th - 28th November, 2014 for granting Environmental and CRZ Clearance. The Ministry of Environment, Forests & Climate Change hereby accords Environmental and CRZ Clearance for the above-mentioned **Development of additional coal berths (CB3 and CB4) at Kamarajar Port, Tamil Nadu by M/s Kamarajar Port Ltd. (Formerly known as Ennore Port Limited)** under the provisions of the Environment Impact Assessment Notification, 2006 and CRZ Notification, 2011 and amendments thereto and Circulars issued thereon and subject to the compliance of the following specific conditions, in addition to the general conditions mentioned below:

A. SPECIFIC CONDITIONS:

- (i) "Consent for Establishment" shall be obtained from State Pollution Control Board under Air (Prevention and Control of Pollution) Act, 1981 and Water (Prevention and Control of Pollution) Act, 1974.
- (ii) Dust screens shall be provided with a height of 2 meter above the maximum stack height. Water sprinkling shall be carried out for

settling dust. Three layers of green belt of tall growing trees shall be provided on all sides.

- (iii) Water sprinklers should be provided in the area of coal loading and unloading, storage and vehicle path/roads.
- (iv) Energy conservation measures shall be provided which may include use of solar panels, wind mill etc.
- (v) There shall be no washing of conveyor belt.
- ✓ (vi) All the conditions stipulated by Tamil Nadu Coastal Zone Management Authority (TNCZMA) vide letter No. 23187/EC.3/2014-1 dated 16.12.2014, shall be complied with.
- (vii) All the recommendation of the EIA/EMP, Disaster Management Plan shall be strictly complied within letter and spirit. All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MoEF&CC along with half yearly compliance report to MoEF&CC-RO.
- (viii) Cargo shall be unloaded directly into hopper from the ship and transportation of coal shall be through covered/closed trucks/ rail only. Closed conveyor belt shall be used for loading the product in the barges.
- ✓ (ix) The dredge material shall be reused for low level rising wherever possible and excess shall be dumped into sea at the designated dumping areas identified based on mathematical model studies.
- (x) To prevent discharge of sewage and other liquid wastes including ballast into marine environment, adequate system for collection, treatment and disposal of liquid wastes must be provided
- (xi) Necessary arrangements for the treatment of the effluents and solid wastes must be made and it must be ensured that the untreated effluents and solid wastes are not discharged into the water or on the beach; and no effluent or solid waste shall be discharged on the beach.
- (xii) The quality of treated effluents, solid wastes, emissions and noise levels and the like, from the project area must conform to the standards laid down by the competent authorities including the Central or State Pollution Control Board and under the Environment (Protection) Act, 1986.
- (xiii) The project proponent shall set up separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of a Senior Executive.
- (xiv) The commitment made by the Proponent to the issue raised during Public Hearing shall be implemented by the Proponent.

(xv) Corporate Environment Responsibility:

- a) The Company shall have a well laid down Environment Policy approved by the Board of Directors.
- b) The Environment Policy shall prescribe for standard operating process/procedures to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions.
- c) The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions shall be furnished.
- d) To have proper checks and balances, the company shall have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large.

B. GENERAL CONDITIONS:

- (i) Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.
 - (ii) Full support shall be extended to the officers of this Ministry/ Regional Office at Chennai by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environmental protection activities.
 - (iii) A six-Monthly monitoring report shall need to be submitted by the project proponents to the Regional Office of this Ministry at Chennai regarding the implementation of the stipulated conditions.
 - (iv) Ministry of Environment, Forests & Climate Change or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environment and the same shall be complied with.
 - (v) The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied with the satisfaction of the Ministry.
 - (vi) In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment, Forests & Climate Change.
 - (vii) The project proponents shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of land development work.
 - (viii) A copy of the clearance letter shall be marked to concerned Panchayat/local NGO, if any, from whom any suggestion/representation has been made received while processing the proposal.
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- (ix) Full support should be extended to the officers of this Ministry's Regional Office at Chennai and the offices of the Central and Tamil Nadu State Pollution Control Board by the project proponents during their inspection for monitoring purposes, by furnishing full details and action plans including the action taken reports in respect of mitigative measures and other environmental protection activities.
- (x) The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to this Ministry and its concerned Regional Office.

5. These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 1994, including the amendments and rules made thereafter.

6. All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities.

7. The project proponent shall advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Environmental and CRZ Clearance and copies of clearance letters are available with the State Pollution Control Board and may also be seen on the website of the Ministry of Environment, Forests & Climate Change at <http://www.envfor.nic.in>. The advertisement should be made within Seven days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Chennai.

8. This Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.

9. Status of compliance to the various stipulated environmental conditions and environmental safeguards will be uploaded by the project proponent in its website.

10. Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

11. A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parishad/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.



12. The proponent shall upload the status of compliance of the stipulated Clearance conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF&CC, the respective Zonal Office of CPCB and the SPCB.

13. The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of Clearance conditions and shall also be sent to the respective Regional Offices of MoEF&CC by e-mail.

Yours faithfully,


(Dr. Manoranjan Hota)
Director

Copy to:

1. The Secretary, Environment & Forests Department, Govt. of Tamil Nadu, Saint Geroge Port, Chennai.
2. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD-cum-Office Complex, East Arjun Nagar, Delhi-110 032.
3. The Member Secretary, Tamil Nadu State Pollution Control Board, Chennai.
4. The Director, Environment Department, Govt. of Tamil Nadu, Chennai.
5. Additional Principal CCF (C), Ministry of Environment, Forests and Climate Change, Regional Office, 1st Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai - 34.
6. Guard File.
7. Monitoring File.


(Dr. Manoranjan Hota)
Director



Environment & Forests (EC-3)
Department,
Secretariat, Chennai - 600 009

Letter No. 23187/EC.3/2014-1, Dated 16.12.2014



From
Thiru Hans Raj Verma, I.A.S.,
Principal Secretary to Government

To
The Chairman,
National Coastal Zone Management Authority,
Government of India,
Ministry of Environment, Forests, & Climate Change,
Agni Wing, 5th Floor,
Indira Paryavaran Bhawan,
Jor Bag Road, Aliganj,
New Delhi - 110 003. (w.e.)

Sir,

Sub: Environment - Coastal Regulation Zone -
Kamarajar Port Expansion proposal -
Proposed construction and development
of two new additional berths of each
having 9 MTPA capacity inside the
premises of Kamarajar Port Limited,
Puzhuthivakkam village, Vallur post,
Chennai proposed by Kamarajar Port
Limited - Clearance under CRZ
Notification 2011 - Reg.

Ref: From the Director of Environment letter
No. P1/1536/2014, dated 08.12.2014.

I am directed to state that the Member Secretary, Tamil Nadu State Coastal Zone Management Authority / Director of Environment has informed that the Kamarajar Port Limited, Chennai has already developed two coal berths CB1 and CB2 and is under operation since 2001, with the coal handling capacity of 16 MTPA in order to meet the coal requirement of thermal power plants of Tamil Nadu Electricity Board. Now the Kamarajar Port Limited has proposed to construct two more coal berths (CB3 and CB4) each of 9 MTPA capacity.

(P.t.o.)

2) Further he has stated that the areas of Coal Berths are CB3 - 336m X 150m & CB4 - 336 m X 184m. The project area is under the direct control and within the limits and boundary of M/s. Ennore Port Limited. Project area co-ordinates are Latitude 13° 15' 40" N and Longitude 80°20' 15" E. The Kamarajar Port Limited has reported that the construction of two new coal berths would not involve any new land acquisition or resettlement / rehabilitation of population. The Ennore Port Limited has also proposed to provide top side facilities like gantry cranes, conveyor systems and stack yard through Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) and the coal stackyard will be developed adjacent to the existing coal/ iron ore stack yard and single closed conveyor directly connecting to the proposed one of the coal berth and the stack yard. It is proposed to dredge 0.3 million m³ in the land area and 2.1 million m³ in marine area for CB3 berth and 0.3 million m³ in the land area and 1.0 million m³ in the marine area for CB4 berth. It is proposed to use excavated soil from the inner dock basis i.e., the land based dredging for land reclamation outside Port Main gate along the Port access road between NCTPS Railway line, NCTPS road and East of Ennore Creek. Part of the remaining dredged material will be disposed in the reclaimed area near Port main gate and adjacent to the existing coal/iron ore stack yard which is located about 2.5 km away from the Port boundary. The dredged material left after the disposal of above mentioned methods, will be disposed of in the marine disposal area, identified in Report for Phase II Development of Ennore Port, NIOT, 2004 which is located about 4 to 5 km away from Ennore Port in the perpendicular direction, into the sea. The proposed site is falling in inter tidal zone CRZ - I(B), CRZ-III and CRZ IV areas. The Project cost is Rs.542.20 crores.

3) Further, he has stated that the above project proposal was placed before the 80th meeting of the Tamil Nadu State Coastal Zone Management Authority held on 27.10.2014 and the Authority resolved to request the Kamarajar Port Limited to furnish the following additional details / documents for scrutiny.

- i) A detailed report should be furnished on shoreline changes due to the construction of two new additional berths and also dumping of dredging materials in the sea.
- ii) The details of composition and quality of dredging materials with reference to the quantum of dredging materials should be furnished. Further the disposal of dredging materials with reference to the dumping location and purpose shall be furnished.
- iii) The possible adverse impacts on the dumping of dredged material along the low line area of Buckingham Canal should be addressed properly as the dredged material will be loose and fine soil. In any case dredged material should not be dumped in the intertidal area of the Buckingham canal.
- iv) Details on impact of dispersal of dredge material on the adjacent L & T shipyard area especially the navigational channels of that shipyard need to be included in the report. If need be additional modeling studies should be undertaken.

- v) The EIA/EMP with reference to the air quality should be furnished with reference to the nearest villages, habitations like Puzhuthivakkam, which is around one km from the project site.
- vi) It is noticed that the air quality PM₁₀ level has already reached a higher level at Ennore Port with the present activities. Hence specific report should be furnished with reference to the PM₁₀ level due to the addition of two berths for the import of coal with a detailed plan on handling of coal in the project area.
- vii) The noise levels indicated in the project report in the Port area are also high for the existing activities. The issue should be properly addressed in the EIA/EMP reports.
- viii) It is noticed that the Environment Social Welfare activities a sum of Rs.9.00 lakh per annum only allocated out of the project cost of Rs.500 crore. The allocation should be revised suitably.
- ix) The fresh water requirement and source for fresh water shall be furnished.

4) The Kamarajar Port Limited has furnished additional documents/details on the above items in Ir. No. EPL/MS/Env/CB3 & CB4/2013 dated 17.11.2014.

5) Further he has stated that as per CRZ Notification 2011, vide para 3 (i) (a) & 3 (iv) (b) construction for the foreshore facilities in CRZ and land reclamation, bunding or disturbing /the natural course of seawater as a measure for control of erosion based on EIA studies is permissible activity. Further, as per CRZ Notification 2011, vide para 4 (i) (a) clearance shall be given for any activity within the CRZ if it requires waterfront and foreshore activities. However the proposal requires clearance from the Ministry of Environment and Forests, Government of India vide para 4 (ii) (f) of CRZ Notification 2011.

6) The above proposal was placed before the 81st meeting of the State Coastal Zone Management Authority held on 27.11.2014 and the Authority resolved to recommend the proposal to the Ministry of Environment and Forests, Government of India, subject to the following specific conditions:-

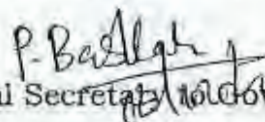
- a) There should not be any sea water intrusion or erosion on the adjacent coastal areas due to the proposed construction of two additional berths, dredging and also due to the dumping of dredged material.
- b) Dredged material should be dumped on the landward side and should not be dumped into the sea (CRZ-IV), intertidal area (CRZ-IB) of the Buckingham canal and also in the salt pan areas as the salt pan areas are declared as CRZ-IB (inter tidal zone) as per the approved Coastal Zone Management Plan of Tamil Nadu.
- c) There should not be any impact of dispersal of dredge material on the adjacent L & T shipyard area especially the navigational channels of that shipyard.

- d) A continuous proper air quality monitoring should be undertaken around the project area to implement corrective, mitigation measures immediately on the noticing of any adverse impact.
- e) Necessary adequate preventive measures should be taken to maintain the air quality PM_{10} level at Ennore Port within the standards and it should not cross the prescribed limit and suitable plan on handling of coal in the project area shall be implemented.
- f) Necessary measures should be taken to control the noise level within the prescribed standard levels.
- g) Closed conveyor system, with latest technology, should be established for coal handling as indicated in the report.
- h) Green belt development shall be implemented.
- i) There shall be no extraction of ground water.
- j) As indicated in the revised report, sufficient allocation of funds should be made to carryout outdoor Environment Social Welfare Activities.

7. Accordingly, the Director of Environment has sent a copy of proposal along with the reports, additional details, HTL map and minutes of the 80th and 81st meeting of TNSCZMA held on 27.10.2014 and 27.11.2014 and also requested that the proposals may be recommended to the Ministry of Environment and Forests, Government of India, for clearance under CRZ Notification 2011.

8. In line with the recommendation of the Tamil Nadu State Coastal Zone Management Authority, this Government recommend the proposal of Kamarajar Port Limited for the construction and development of two new additional berths of each having 9 MTPA capacity inside the premises of Kamarajar Port Limited, Puzhuthivakkam village, Vallur post, Chennai to the Chairman, National Coastal Zone Management Authority, Government of India, Ministry of Environment and Forests, New Delhi for clearance under CRZ Notification 2011, subject to the conditions stipulated at para 6 above.

Yours faithfully,


for Principal Secretary to Government.
16/11/14

Copy to:-

The Director of Environment, Chennai - 15.

✓ The General Manager,
Kamarajar Port Limited,
Vallur Post, Chennai- 600 120.

(With a request to furnish 20 copies of the
proposal to Government of India, Ministry of
Environment and Forests, New Delhi)
SF/SCs.

BY SPEED POST

EP/12.1/65/2/TN/2559
Government of India
Ministry of Environment, Forests and Climate Change
(Regional Office - Chennai)

1st and 2nd floor, HEPC Building,
No.34, Cathedral Garden Road,
Nungambakkam,
Chennai - 600034
E-mail: roefccc1@gmail.com
Tel: 044-28222325

Dated: 30th December, 2016

To

**The General Manager (Marine Services),
Kamarajar Port Limited,
(A Mini Ratna Govt. of India Undertaking), 4th Floor,
Super Specialty Diabetic Centre,
Near Clive Battery Bus Stop,
Rajaji Salai, Chennai - 600 001**

Sub: Certified copy of compliance report with respect to Kamarajar Port Ltd. Chennai

Ref: Your Letter No. EPL/MS/Env/MoEF&CC/2016 dated, 14.09.2016.

Sir,

With reference to above mentioned subject certified copies of the compliance report in respect of the following Environmental/CRZ Clearances are enclosed

1). Development of additional coal berths (CB3 and CB4) at Kamarajar port, Tamil Nadu. 11-51/2012-IA-III dated 12.03.2015.

2). Expansion proposals - development of terminals for marine liquids, coal, iron and containers in second phase and associated dredging at Ennore port. No. 10-28/2005-IA-III dated 19.05.2006.& No. 10-28/2005-IA-III dated 10.9.2007.

3).CRZ and Environmental Clearance for the construction of General Cargo Berth at Ennore Port cargo terminal project. 11-21/2009-IA-III dated 23.07.2009

4).Expansion and Modernization of existing handling of Multi Cargo Container terminal at Kamarajar Port, Tamil Nadu. 10-28/2005-IA-III dated 24.12.2014.

5).Expansion proposals - development of terminals for marine liquids, coal, iron and containers in second phase and associated dredging at Ennore port. 10-28/2005-IA-III dated 19.05.2006.

6). Environment-Coastal Regulation Zone- Kamaraj Port Expansion Proposal- Proposed Construction and development of two new additional berths of each having 9 MTPA capacity

Continued.....

inside the premises of Kamaraj Port Ltd. Puzhuthivakkam village, Vallur Post, Chennai proposed by Kamarajar Port Ltd -Clearance under CRZ Notification 2011. No. 23187/EC.3/2014-1, dated 16.12.2014.

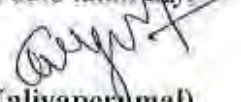
7). Coastal Regulation Zone -Ennore Port Expansion proposal -Increase of Quay length of already approved container terminal proposed by M/s Ennore Port Limited, Application for Environmental Clearance under Coastal Regulation Zone: No. 17250/EC-3/2009-1 dated 26.10.2009.

8). Coastal Zone Regulation Zone-Construction of Ennore Port Cargo terminal project proposed by M/s. Ennore Port Limited- Clearance under Coastal Zone Regulation Zone Notification 1991 Proposal forwarded- No. 151/EC3/2009-1 dated 24.02.2009.

9). Coastal Regulation Zone -Expansion of port and allied activities at Ennore Port area by M/s Ennore Port Limited, Chennai- proposal recommended to Government of India, Ministry of Environment and Forest, New Delhi for Environmental Clearance under Coastal Regulation Zone Notification, 1991. No. 30060/EC.3/2005-1 dated 06.12.2005.

10).Construction of New Satellite Port at Ennore near Madras in Tamil Nadu.No. J-16011/9/87-IA.III dated 28.9.1992.

Yours faithfully,



(Dr.C. Kaliyaperumal)

Director(S)

Dr. C. KALIYAPERUMAL, M.E., PhD

Director (S)

Government of India

Ministry of Environment, Forests & Climate Change
Regional Office (South Eastern Zone)
HEPC Building, No.34, Cathedral Garden Road,
Nungambakkam, Chennai-600 034.

GOVERNMENT OF INDIA
Ministry of Environment, Forest & Climate Change
(Regional Office, Chennai)

MONITORING REPORT

PART I

DATA SHEET

1	Project type: River valley/Mining/Industry/Thermal/Nuclera/Other Specify	Infrastructure and Miscellaneous projects- Ports and harbors
2	Name of the project	<p>1).Development of additional coal berths (CB3 and CB4) at Kamarajar port, Tamil Nadu.</p> <p>2). Expansion proposals development of terminals for marine liquids, coal, iron and containers in second phase and associated dredging at Ennore port.</p> <p>3).CRZ and Environmental Clearance for the construction of General Cargo Berth at Ennore Port cargo terminal project.</p> <p>4).Expansion and Modernization of existing handling of Multi Cargo Container terminal at Kamarajar Port, Tamil Nadu.</p> <p>5).Expansion proposals development of terminals for marine liquids, coal, iron and containers in second phase and associated dredging at Ennore port.</p> <p>6). Environment-Coastal Regulation Zone- Kamaraj Port Expanssion Proposal- Proposed Construction and development of two new additional berths of each having 9 MTPA capacity inside the</p>

		<p>premises of Kamaraj Port Ltd. Puzhuthivakkam village, Vallur Post, Chennai proposed by Kamarajar Port Ltd -Clearance under CRZ Notification 2011.</p> <p>7). Coastal Regulation Zone - Ennore Port Expansion proposal - Increase of Quay length of already approved container terminal proposed by M/s Ennore Port Limited, Application for Environmental Clearance under Coastal Regulation Zone: Reg.</p> <p>8). Coastal Zone Regulation Zone- Construction of Ennore Port Cargo terminal project proposed by M/s. Ennore Port Limited- Clearance under Coastal Zone Regulation Zone Notification 1991 Proposal forwarded-Tamil Nadu State Coastal Zone Management Authority Clearance..</p> <p>9). Coastal Regulation Zone - Expansion of port and allied activities at Ennore Port area by M/s Ennore Port Limited, Chennai- proposal recommended to Government of India, Ministry of Environment and Forest, New Delhi for Environmental Clearance under Coastal Regulation Zone Notification, 1991</p> <p>10). Construction of New Satellite Port at Ennore near Madras in Tamil Nadu.</p>
3	Clearance letter(s) OM No. and dated	<p>1).11-51/2012-IA,III dated 12.03.2015.</p> <p>2). No. 10-28/2005-IA-III dated 19.05.2006.& No. 10-28/2005-IA-III dated 10.9.2007.</p> <p>3).11-21/2009-IA-III dated 23.07.2009.</p> <p>4). 10-28/2005-IA-III dated</p>

		24.12.2014. 5). 10-28/2005-IA-III dated 19.05.2006. 6).No. 23187/EC.3/2014-1, dated 16.12.2014. 7). No. 17250/EC-3/2009-1 dated 26.10.2009. 8).No. 151/EC3/2009-1 dated 24.02.2009. 9). No. 30060/EC.3/2005-1 dated 06.12.2005, 10). J-16011/9/87-IA.III dated 28.9.1992.
4	Locations	
	a	District (s)
	b	State (s)
	c	Latitudes
	d	Longitudes
5	Address of correspondence	
	a	Address of concerned project Head (with Pin code & telephone/telex/fax numbers)
		General Manager (Marine Services), KAMARAJAR PORT LIMITED (A MiniRatna Govt. of India Undertaking), 4th Floor, Super Specialty Diabetic Centre, Near Clive Battery Bus Stop Rajaji Salai Chennai - 600 001 Phones: +91-44-25251666 (5lines) Fax: +91-44-25251665
6	Salient features	
	a	Of the project
		Development of coal berthBerths for iron ore, marine liquid terminal, container terminal, General Cargo terminal were constructed in the water front within the breakwaters and associated drudging. The coal and iron ore stackyard was developed outside the port.
	b	Of the environmental management plans
7	Breakup of the project area	
	a	Submerge area (forest & non-forest)
	b	Others
	Total land:	

			2787acres(1137.66 Ha)
8	Break up of the project affected population with enumeration of those losing houses/dwelling units only, agriculture land only, both dwelling units and agricultural land and landless labourers/artisans		Not applicable
	a	SC, ST/Adivasis	--
	b	Others	--
9	Financial Details		The terminal is under construction.
	a	Project cost as originally planned and subsequent revised estimates and the years of price reference	See Annexure-I <i>f</i>
	b	Allocations made for environmental management plans, with item wise and year wise breakup	"
	c	Benefit cost ratio/internal rate of return and the years of assessment	"
	d	Whether © includes the cost of environmental management as shown in (b) above.	"
	E	Total expenditure on the project so far	"
	f	Actual expenditure incurred on the environmental management plans so far	"
10	Forest land requirement		Not Applicable
	a	The status of approval for a diversion of forest land for non-forestry use	--
	b	The status of compensatory afforestation, if any	--
	c	The status of clear felling	--
	d	Comments on the viability and sustainability of compensatory afforestation programme in the light of actual field experience so far	--
11	The status of clear felling in non-forest area (such as submergence area of reservoir, approach road), if any, with quantitative information		Not Applicable
12	Status of construction		
	a	Date of construction	Coal Berth 3:02.07.2015 Coal Berth: 4 19.08.2015 Container Terminal:14.2.2014 Multi Cargo Terminal:27.2.2015
	b	Date of completion (actual and/or planned)	All activities are completed except Container Terminal and Multi Cargo Terminal and Coal Berth 3&4, Within 24 months from the date of commencement.
13	Reasons for the delay if the project is yet to start.		
14	Date of site visit		--
	a	The dates on which the project was monitored	14.06.2011

		by the Regional Office on previous occasions, if any	
	b	Date of site visit for this monitoring report	24.12.2016
15		Details of corresponding with project authorities for obtaining actions plans, information and status of compliance to safeguard	---


Present Status of the Project

The port has completed the construction of 6 berths and out of this 5 berths are under operation. One berth which was constructed to handle iron ore is not under operation. Out of the 5 operating berths, 3 are handling coal (Two coal berth by TNEB and one by M/s Chettinad International Coal terminals Ltd). Fourth berth is handling marine liquid Terminal and fifth one is handling General Cargo. Now another six berths are under construction for which EC has been obtained. Further they are planning to construct another 10 berths additionally.

An Application No. 8 of 2016 was filed before the Honorable National Green Tribunal (SZ) wherein the project proponent as Respondent No.8. In this regard Honorable National Green Tribunal (SZ) directed the project proponent to remove the dumped dredged material from the CRZ area within 4 weeks time from 18.11.2016 vide its order dated 18.11.2016. Accordingly they have not started to remove the material and assured the court that the dumped material will be removed by 31.1.2017.

The Port has acquired more land ie. now they have 1137.66 hectares of land area. As per the condition (i) in EC No. J-16011/9/87-IA.III dated 28.9.1992 the total land area of the Project should be limited to 400 Ha. No information was provided about the approval for the additional land. The details provided by the project authority for land acquisition is here with enclosed (Annexure-II).

This has the approval of Addl. PCCF(C) vide Diary No. 1737 dated 29.12.2016.


 (Dr. C. Kaliyaperumal)
 Director(S)
 Dr. C. KALIYAPERUMAL, M.E., PhD
 Director (S)
 Government of India
 Ministry of Environment, Forests & Climate Change
 Regional Office (South Eastern Zone)
 MEPC Building, No.34, Cathedral Garden Road,
 Nungambakkam, Chennai-600 034.



Priyilal KG <priyilal.kg@gmail.com>

Kamarajar Port Limited-Reg**sravan** <sravan@kplmail.in>

To: priyilal.kg@gmail.com

Cc: sellappan <ksellappa@gmail.com>


Thu, Dec 29, 2016 at 12:53 PM

Sir

The environmental expenditure for the three operating terminals and the **Estimated and actual cost of the terminals** is enclosed as attachment.

Thanks.

V. G. Sravan Kumar
Manager (Environment)
Kamarajar Port Limited (erstwhile Ennore Port Limited)
Mobile: 09940045594
www.ennoreport.gov.in

 **Environmental expenditure.docx**
14K

1. Environmental expenditure

M/s. Kamarajar Port Limited

Year	Amount (lakhs)
2012-13	Rs.33,90,570/-
2013-14	Rs.38,99,364/-
2014-15	Rs.47,21,592
2015-16	Rs.47,00,229
2016-17	Rs.32,50,471

M/s. Chettinad International Coal Terminal

Year	Amount (lakhs)
2014-15	Rs.47,21,592
2015-16	Rs.47,00,229
2016-17 (planning)	Rs.43,00,000

Marine Liquid Terminal: Rs. 43, 56,000/- (2016-17)

2. Estimated and actual cost of the terminals:

S.No	Name of the project	Estimated cost (Crores)	Actual cost (Crores)
1	Construction of coal berths CB1 & CB2	---	80.38
Second phase Projects (EC clearance dated 19.5.2016)			
2	Construction of container terminal	1270	On going
3	Chettinad International Coal Terminal (CICTPL)	399.13	351.08
4	Marine Liquid Terminal-	198.0	250
5	Sical Iron ore terminal	360	351.61
6	Construction of General Cargo Berth EC letter dated 23.7.2009	110.0	151.15
7	Development of multi cargo terminal (EC letter dated 24.12.2014)	151	On going
8.	Coal Berths Cb3 & CB4 ((EC letter dated 12.3.2015)	CB3- 275.30 CB4- 266.90	On going



Priyilal KG <priyilal.kg@gmail.com>

Kamarajar Port Limited.

sravan <sravan@kplmail.in>
To: priyilal.kg@gmail.com
Cc: ksellappa@gmail.com


Thu, Dec 29, 2016 at 11:31 AM

Sir

Please find as attachment the land details of Kamarajar Port Limited.

Regards.

-- V. G. Sravan Kumar
Manager (Environment)
Kamarajar Port Limited (erstwhile Ennore Port Limited)
Mobile: 09940045594
www.ennoreport.gov.in

 **Kamarajar Port Limited-Land.doc**
27K

Kamarajar Port Limited**Break up of project area.**

Total land as on date: 2787 acres

Break up:

1. Land transferred from Tamil Nadu Electricity Board : 995.05 Acres
2. Land transferred from Salt Department : 712.42 Acres
3. Land transferred from TIDCO : 947.65 Acres
4. Land transferred from Pvt Party (Patta land) : 32.65 acres
5. Poramboke land (Govt. of Tamil Nadu) : 99.51 acres

Total

2787.28 Acres

(1137.66 Ha)

ANNEXURE -2

1. The proposed activities involve capital dredging in port basin and Navigational channel resulting in a quantity of 33 MCM of dredged material and the dredging is proposed to be carried out for a period of 5 years. A dredge disposal site at a depth of 25-50m depth has been identified for disposal of dredged material amounting to 30 MCM and the disposal will be made in a phased manner for a period of 5 years. The disposal site measures about 30 sq km and the dumped dredged material is expected to rise the sea bed level from 0.5 to 1 m after completion of the dumping. The Authority felt that blanketing of 30 sq km seabed area with a cover of dredge soil upto 1m may affect drastically the benthic fauna of the area. Using the models, the dump area size should be designed in such a way that it extends from 20km or more from the 50m depth in the offshore area with a narrow band of dumping area say 100-200m width and low discharge rate, leading to marginal increase of sea bed level. Such an arrangement may minimize the damaging effect on fauna. Fine scale bathymetry data should be collected before initiation of dumping in the proposed site and repeated annually till completion of the dumping. A report in this regard has to be submitted to the Authority as a part of Compliance report that will be submitted to the MoEF&CC, GoI after obtaining Environmental Clearance.

The area for offshore disposal was chosen 5400 m x 5400 m spread over 5 km to 10 km offshore at varying depth from 25 to 50 m CD water depth. After the suggestions by the State CRZ Committee, it has been extended to 6000 m x 6000 m spread over the depth of 25 to 55 m CD. The increased area of disposal ground is shown in **Fig. 1**. The modelling study was carried out for the increased disposal area as detailed in Chapter 8 in the EIA report.

The modelling has been carried out for the disposal of 30 Million m³ of dredged spoil over the period of 2 years. The disposal is suggested at 16 nodal points covering an area of 6000 m x 6000 m in diagonal sequence. It is suggested that the dredge spoil barges may dispose the sediments at different locations in the disposal area in a sequential order starting from location 1 and continue upto location 16 and repeat this order in a cyclic manner. The modelling study indicates the change in seabed to an insignificant level by 0.26 m. However, in subsequent years, due to waves and currents, the dumped sediments will move from disposal location and spread further towards east. The seabed is expected to reach its original level in 2 years after the completion of disposal. The disposal location is shown in **Fig. 2**.

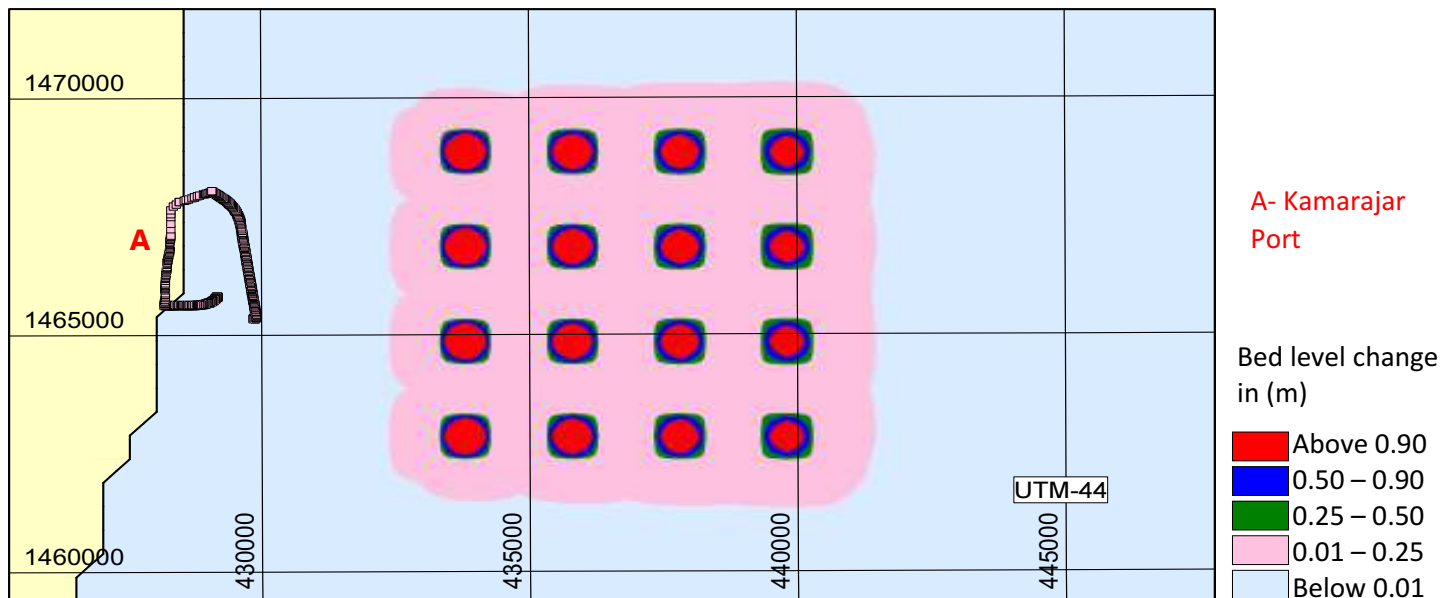


Fig. 2. Change in bed level

2. It should be ensured that the proposed construction of Truss does not affect free flow of water.

KPL ensures that the proposed construction of conveyor belt for the bulk terminals, pipeline trestle, etc will be an elevated structure. The trestle will be designed in such a way that it will not affect the free flow of water will be affected.

3. No interference of any kind to be done in Mangroves and Salt marsh areas, including construction of coal conveyor belt.

No mangroves will be disturbed in the phase III development as the development lies within the Port limits. All the activities in Phase III development are restricted within the demarcated port limits, where there are no mangroves. However, the abandoned salt pan land transferred to KPL by DIP, Ministry of Commerce, GoI, which is situated beyond the CRZ area will be used for port related activities like development of FTZ, dumping of dredged material.

4. Area under wetlands as elaborated by the EIA report need to be considered and managed as wetlands, and not reclaimed or built up in future.

No development will be made in the wetland areas in the future. The existing wetlands will be considered and managed effectively.

5. In addition to the mangroves, the existing patch of sand dune/beach vegetation within the Kamarajar Port Limited (KPL) premises needs to be scientifically studied, covering aspects such as checklist of flora and

fauna, diversity, representativeness, population trends, regeneration and recruitment trends, percentage coverage of invasive alien species and presence of breeding populations. The proposed afforestation / greenbelt programme needs to be based on the above assessment, with habitat specific greening plans being developed and implemented.

Study by NCSCM has been made (NCSCM approved by MoEF&CC) covering all these ecological aspects. All these activities has been covered and compliance made in the report and also in CRZ report.

6. The afforestation / green belt programme needs to be representative of the typical vegetation of the Ennore estuary, covering all the major habitat types including salt marshes. It is further recommended that a set of biological indicators be identified based on the scientific assessment and be used for monitoring the efficiency of the afforestation / greening programme.

It will be complied as suggested.

7. It is also recommended that impact assessment studies be commissioned that cover a select number of species as also the different phases of project execution. The Kamarajar Port Limited shall develop and implement ecological restoration programme with the support of the Tamil Nadu Forest Department, especially addressing wetlands and wetland biodiversity.

It will be complied as suggested.

8. In view of the location of the project within the landscape that encompasses a perennial river and its estuarine complex, it is recommended that a dedicated programme be developed and implemented on the hydrological services of the landscape, notably flood mitigation.

Yes. It will be complied and will be implmented as presented in te EIA report.

9. The concerns expressed during the public hearing that was held by the kamarajar Port need to be addressed during the project implementation. These would cover socio-economic as also ecological and environmental concerns.

Yes it will be complied.

10. Oil Spill Contingency Plan should be prepared and a team of trained men formed to be available 24 X 7 to tackle any disasters.

KPL has prepared an Oil Spil Contignecy plan in line with NOS-DCP. Port is also in the process of engaging a team of trained manpower available 24 x 7 to tackle any disasters.

11. A detailed plan for the source segregation and disposal of solid waste (Bio-degradable / non-degradable etc.,) generated shall be formulated. Further solid wastes such as plastics may be collected and disposed as per rules. ETP should be provided and treatment done meticulously.

Solid waste including plastics generated from the port and ships are being collected, segregated and sent to various approved recyclers for further beneficial use. ETP/STP shall be provided as per the requirement in accordance with TNPCB norms.

S.No	Comments of “CONSERVATION ACTION TRUST”	Reply from KPL
1.	The proposed project is for the development of Phase III of the port. Piecemeal development of this kind should not be allowed. The proposed project should be granted environment clearance.	The present proposal of Kamarajar Port is for the development of projects envisaged in the Port master plan. Ministry of shipping, New Delhi vide No. PD/22/1/2014-PD.I dated 27.10.2014 requested to prepare a master plan including all future projects of the port/ activities proposed to be undertaken during next 10 years and forward the same to MoEF & CC for obtaining the Environmental Clearance and CRZ clearance so that they can consider for granting the clearance in one go for the Master Plan.
2.	As observed from the compliance report dated 21 st December 2016 prepared by the Director, Regional Office of MoEF, the port has not complied with the EC condition which states that “The total land area of the Project should be limited to 400 Ha as proposed”. The port has acquired 1137.66 hectares of land area. The report also notes that “No information was provided about the approval for the additional land”	The land has been acquired by following the Government procedure. During development the land use plan will be submitted.
3.	From the compliance report, it is evident that the port has violated the EC. Strict action against the same	The part of the land is used for the development of iron ore and coal stockyard for which Environmental

	should be taken. Moreover, it is not clear if the acquired area has been brought under use and the land use pattern of the same has been changed.	and CRZ clearance was obtained from MoEF vide letter dated 10-28/2005-IA.III dated 19.05.2006. .Land use pattern is not changed.
4.	The project proponent should be directed to provide all the details of the additional lands acquired and mark the same on the approved CZMP maps prepared as per the CRZ notification 1991 and 2011.	The details of additional lands in possession with KPL are furnished as Attachment- 1 . The details of land procured from Tamil Nadu Electricity Board (TNEB, GoTN), Tamil Nadu Industrial Development Corporation (TIDCO, GoTN) and from Salt Dept. GoI are superimposed on the latest CRZ map prepared by Institute of Remote Sensing, Anna University, Chennai.
5.	It is also observed from the Compliance report that the project proponent has not developed Green Belt around the proposed project as per the approved EC. As per the EC, project proponent was required to develop a green belt of the width of 200 meters and the total area developed under green belt should be 50 ha. The project proponent has developed only 15 hectares of a green belt having a width of 200 meters and 2.5km long. The project proponent has not complied with the EC Conditions.	Port has engaged National Centre for Sustainable Coastal Management (A Unit under MoEF&CC) and carried out a study “Action Plan and Ecological studies for Kamarajar Port Ltd (KPL) - May 2017. The green belt area in the port is 0.72 sq. km i.e, 72 Ha. Port is developing green belt in a phased manner.
6.	The project proponent has carried out	No reclamation of land has been done

	reclamation of land beyond the low tide line. This has also altered the HTL.	between the LTL and HTL.
7.	A comprehensive impact assessment of the environmental damage caused by the port in all its years of functioning should be carried out.	The details are included in detail in the latest Comprehensive EIA report.
8.	The project proponent should be asked to carry out a detailed study of the sea erosion that its activities have caused along the coast using 1991 as baseline data.	The port is carrying out shoreline survey during pre and post monsoon season every year since 2006. The study confirmed that there is no erosion.
9.	In point (vi) of the above-referred compliance report, it is clearly stated that the dredged material is used for beach nourishment which clearly states that the port activities have affected the surrounding areas.	The reply of KPL for the said compliance report mentioned as, "The dredged material were not dumped in the water bodies. The dredged materials were used for reclamation of the low lying areas and beach nourishment along the coast line on northern side of the north break water to mitigate erosion". Moreover, as part of port development as suggested under Clause 20, Of the NOC issued by Tamil Nadu State Pollution Control Board vide letter No. T12/TNPCB/Misc./F.3322/TVLR/05 dated 7.12.2005 has directed "The possibilities of dumping the dredge spoil north of northern breakwater in areas prone to sea erosion by creating sand dunes and / or beach nourishment may also be explored".
10.	The proposed project along with the existing facilities should be demarcated on the approved CZMP maps of 1991 and 2011.	The proposed projects along with the existing facilities are demarcated on the approved CRZ prepared by Institute of Remote Sensing, Anna University, Chennai, one of the recognized agency by MoEF&CC. As

		per MoEF Notification site specific maps are prepared by the above organization and enclosed as Attachment-II
11.	The area is already under severe pressure as there are several hazardous industries operating in the area. The most polluting of them are the Thermal Power Plants that function in the area. The Thermal Power Plants have illegally converted the ecologically sensitive areas of Ennore Creek for ash dykes and other activities. Till date, there has been no action taken against the polluters by the concerned authorities.	The subject matter is not relevant to KPL.
12.	No projects in this area should be allowed without the carrying capacity study.	KPL has also included cumulative assessment study in the comprehensive EIA report.
13.	The project proponent should be asked to undertake a cumulative assessment of the area considering all the industries within 10km radius from the proposed project site.	Included in the EIA report.
14.	The project proponent should be asked to provide all the details regarding the reclamation of beaches, mangroves, and mudflats it has undertaken till date along with the permissions of the competent authorities.	KPL has not reclaimed any beaches, mangroves or mud flats. The present development of projects in the Phase-III will not affect the mangroves and mud flats. In the present proposal about 5-10 million cu.m of dredged material is

		<p>identified for land reclamation and the rest will be disposed in the sea.</p> <p>Clause (vii) and (ix) of the Environment & CRZ vide letter issued by MoEF&CC [No. 10-28/2005-IA.III dated 19.05.2006] for the Development of Terminals for marine liquids, coal, iron and containers in Second phase and associated capital dredging Project proposals directed the following:</p> <p>“The reclamation of the port area should be carried out with the dredged material.”</p> <p>“Reclamation of 500 acres should be carried out only for port development. The height of the reclaimed area will be maintained above the maximum flood level”.</p> <p>Land has been reclaimed for the construction of Coal and Iron ore stock yards.</p>
15.	<p>The port has till date also violated several environmental laws. As per the Times of India article dated 4th July 2017, TNPCB has directed the port to remove waste from Ennore Creek. we request the authorities to direct the project proponent to provide all the data of the dumping of dredged materials and restore such</p>	<p>As per the Hon’ble NGT directions, KPL has removed about 73000 cu.m of dredged material from the intertidal zone of salt lands recently transferred to KPL and restored the original level of salt lands at dumped area.</p>

	areas where the dredged material has been dumped.	
16.	The oil spill incident that took place off Kamarajar port on January 28 th , 2017, several reports have said that the Kamarajar port is responsible for the spill. Moreover, the port envisages to increase the total traffic it handles every day. This would lead to increased traffic and possibilities of the collision.	A mathematical model study of ship maneuvering simulations was carried out during April 2017 for the Master plan phase III projects by M/s Conceptia Software Technologies Pvt. Ltd, Bangaluru in Association with MARIN, The Netherlands All development studies are being carried out as per the Master Plan in different phases after obtaining the clearances from Statutory authorities. Traffic analysis was carried and the same is included in the EIA report.
17.	As per the newspaper articles, it is also observed that “Illegal map was used to clear port plan in Ennore Creek”.	KPL has not used any illegal map. The map was prepared by Institute of Remote Sensing, Anna University, Chennai one of the approved organizations by MoEF&CC.
18.	Details regarding the ballast water management should be provided by the project proponent.	The master’s of the ships adhere to all the applicable rules regarding the ballast water management.
19.	The proposed phase III of the project also includes dredging of the channel to enable free movement of the ships. These activities affect the marine ecology.	The depth of the existing channel is (-) 20m. In the Phase III development, the depth will be further increased to (-) 23m for the free movement and to bring bigger ships. At present there is affect of marine ecology. Hence by the increase of depth the effect on marine ecology is not anticipated and the same is explained in detail in the EIA report.
20.	The fisherfolk have also complained	KPL is not discharging any kind of

	about the pollution of the Ennore Creek that is affecting their livelihood.	wastes in the creek or in the marine waters. The proposed project will not have any influence at Ennore creek.
21.	The alterations of creeks have led to floods and have affected the biodiversity of the creek.	There will not be any alteration of creek during Phase III development.

ATTACHMENT-1

KAMARAJAR PORT LIMITED
(A Mini Ratna Govt of India Undertaking)

The details of lands in possession with Kamarajar Port Limited are as follows:-

S.NO	Description	Extent	Handed over on
1.	Land transferred from Tamil Nadu Electricity Board	995.05 Acres	28.10.1994
2.	Poramboke land (Govt.of Tamilnadu)TNEB	97.15 Acres	28.10.1994
3.	Poramboke land (Govt.of Tamilnadu) TIDCO	2.36 Acres	29.05.2002
4.	Land transferred from TIDCO	947.65 Acres	29.05.2002
5.	Land transferred from Pvt Party (Patta land) Vallur village	31.97 Acres	08.03.2005
6(1).	Land transferred from Salt Department	29.76 Acres	07.09.1996
6(2).	Land transferred from Salt Department	35.00 Acres	31.05.2010
6(3).	Land transferred from Salt Department	647.66 Acres	28.02.2014
7.	Land transferred railway siding (Athipattu Village)	0.69 Acres	21.10.2014
	Total	2787.29 Acres (1128.45 Ha)	

ANNEXURE 4

The following are the cases filed in the Hon'ble National Green Tribunal (NGT) South Zone, against the port. The details of the cases are as follows:

- (i) By Shri. R Ravimaran, Chennai (NGT Case No.8 of 2016),
- (ii) Meena Thanthai K R Selvaraj Kumar, Chennai (NGT Case No. 152 of 2016).
- (iii) Meena Thanthai K R Selvaraj Kumar, Chennai (NGT Case No. 172 of 2016).

With regard NGT Case No. 8/2006, as per the interim directions of Hon'ble NGT, KPL has submitted the compliance report to NGT and the same is enclosed as **Attachment -I**. However both the cases 8/2016 and 152/2016 are of similar in nature, both the cases were taken up simultaneously for hearing by Hon'ble NGT.

With regard to the Case No. 172/2016, Hon'ble NGT (SZ) has disposed the case. The details are enclosed at **Attachment- I**.

KPL has submitted the compliance report to Member Secretary, Tamil Nadu Pollution Control Board vide letter No. KPL/OP/B/95.09/2016-18 dated 09.08.2017. The copy of the same is enclosed at **Attachment-II**. At present all the dumped material has been removed. A brief note on the status is enclosed.

**BRIEF NOTE ON REMOVAL OF DREDGED MATERIALS IN THE KPL
LAND TRANSFERRED FROM SALT DEPARTMENT WITHIN CRZ AREA**

It was proposed to dump dredged spoil generated in the dredging phase –III in the area transferred from salt department which are located at the west of port access road and at the south side of NCTPS road. Accordingly, preparatory works were started at the above said areas. Total quantity of 73000 cum of dredged materials has been dumped in the area -1 at the south side of NCTPS road and at the west of Port Access Road. In the mean time, one Mr. R.Ravindran has filed petition (application No.08 of 2016) with Hon'ble NGT(SZ) stating that the dredged materials were dumped in the CRZ area. After hearing, Hon'ble NGT directed KPL to remove the dumped earth in the above said areas. KPL has removed the dumped material and informed the same to the Hon'ble NGT. However, the petitioner has raised objection before the Hon'ble NGT that KPL has not removed the materials fully. Therefore, the Hon'ble NGT has appointed Mr. T.Sai Krishnan as an Advocate Commissioner to inspect the area and to report. Accordingly, the Advocate Commissioner inspected the site and filed Report on 11.07.2017. On seeing the report and hearing the statement of KPL and legal counsel, directed to remove the residues of sand manually without damaging the mangroves. KPL has agreed for the same.

The Hon'ble NGT requested the Advocate Commissioner to visit the place once again and give the exact status that exists as on the date of inspection.

Action has been taken to remove the residue of dredged materials and the work was completed in the third week of Aug.2017. The Advocate Commissioner has visited the site on 01.09.2017 and submitted the report on 06.09.2017. In the report , the Advocate Commissioner has pointed out that the petitioner has reported that dredged sand are available around the roots of mangroves. The Hon'ble NGT has directed KPL to remove the same manually. Accordingly, the same has been removed and reported on 11.09.2017.

The Hon'ble NGT has satisfied with the report and informed that no further work to be undertaken in the said dumped area and directed the expert committee constituted by Hon'ble NGT to monitor the removal of ash slurry discharged by NCTPS/ TNEB to study and recommend for plantation of mangroves plants etc. Based on the recommendation of the said committee Hon'ble NGT will pass final order.

A.YOGESHWARAN
Advocate

Chamber:
368 New Law Chamber
High Court Buildings,
Chennai-600 104.
Mobile: 9566254546

21.01.2016

1. North Chennai Thermal Power Station
Rep by its Chief Engineer
Athipattu,
Chennai, Thiruvallur (District)
600 120.

2. Kamarajar Port Limited (Erstwhile Ennore Port Limited)
Rep by its Chairman cum Managing Director
4th Floor,
Super Speciality Diabetic Centre (erstwhile DLB building)
Near Clive Battery Bus Stop
Rajaji Salai, Chennai - 600 001

Sub: Appln.No.8/2016 (SZ), before the National Green Tribunal,
(South Zone), Chennai

R.Ravimaran, Ennore, Chennai.

... Applicant

Vs.

Union of India, MoEF & CC, New Delhi

... Respondents

The above application filed by our client R.Ravimaran, came up for admission before the Hon'ble National Green Tribunal, Southern Zone, Chennai on 18.01.2016. On hearing submissions, the Hon'ble Tribunal was pleased to issue an order of injunction restraining the 1st of you from discharging ash into the Buckingham canal and restraining the 2nd of you from dumping soil or debri into the Buckingham canal.

Counsel took notice on behalf of the 1st of you and the Hon'ble Tribunal was pleased to issue notice to the 2nd of you returnable by 11.02.2016.

Kindly appear before the above said Court on the above said date at 10.30 a.m. either in person or through your Pleader, failing which the matter will be heard and decided in your absence.

(A.Yogeshwaran)

Encl: Copy of appln.No.8/2016

BEFORE THE NATIONAL GREEN TRIBUNAL (SZ) CHENNAI

MEMORANDUM OF APPLICATION

(Under Section 18(1) read with Sections 14, 15 of National Green Tribunal Act 2010)

Application No.....of 2016

Between:

R.Ravimaran
S/o Ramachandran
No.42, Beach Road, Thazhankuppam
Ennore, Chennai - 600057

.. Applicant

Vs

Union of India,
Rep by its Secretary
The Ministry of Environment, Forests and Climate Change
Jorbagh, New Delhi & Ors

.. Respondents

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THROUGH

YOGESHWARAN. A

COUNSEL FOR APPLICANT

NO. 368, NEW ADDITIONAL LAW CHAMBERS

HIGH COURT BUILDINGS, MADRAS - 104

BEFORE THE NATIONAL GREEN TRIBUNAL (SZ) CHENNAI

MEMORANDUM OF APPLICATION

(Under Section 18(1) read with Sections 14, 15 of National Green Tribunal Act 2010)

Application No.....of 2016

Between:

R.Ravimaran
S/o Ramachandran
No.42, Beach Road, Thazhankuppam
Ennore, Chennai - 600057

.. Applicant

Vs

1. Union of India,
Rep by its Secretary
The Ministry of Environment, Forests and Climate Change
Jorbagh, New Delhi
2. Tamil Nadu Generation and Distribution Corporation (TANGEDCO)
Rep by its Chairman cum Managing Director
10 th floor, NPKRR Maaligal, 144, Anna Salai,
Chennai - 600 002
3. North Chennai Thermal Power Station
Rep by its Chief Engineer
Athipattu,
Chennai,
Thiruvallur (District)
600120.
4. Kamarajar Port Limited (erstwhile Ennore Port Limited)
Rep by its Chairman cum Managing Director
4th Floor,
Super Speciality Diabetic Centre (erstwhile DLB building)
Near Clive Battery Bus Stop
Rajaji Salai
Chennai - 600 001
5. The Tamil Nadu Pollution Control Board
Rep by its Member Secretary
76, Mount Salai, Guindy, Chennai - 600 032.
6. The District Environmental Engineer,
Tamilnadu Pollution Control Board,
77-A, South Avenue Road, Ambattur Industrial Estate,
Ambattur Taluk, Chennai - 600 058. Thiruvallur District
7. The Tamil Nadu Coastal Zone Management Authority
Rep by its Member Secretary
Panagal Building, Chennai

8. The Public Works Department
Rep by Its Secretary
Fort St George, Chennai

Respondents

TO,

**THE HON'BLE CHAIRMAN AND HIS COMPANION MEMBER OF THE
NATIONAL GREEN TRIBUNAL.**

**HUMBLE APPLICATION SUBMITTED
BY THE APPLICANT ABOVE NAMED**

The Applicant is R. Ravimaran S/o Ramachandran, residing at No.42, Beach Road, Thazhankuppam, Ennore, Chennai - 600057.

The applicant is a resident of Thazhankuppam village and is a fisherman. The applicant and others from his village depend on fishing for sustenance. The present application has been filed aggrieved by the illegal filling in of the Buckingham canal and the expansive backwaters by the 4th respondent and by the continuous discharge of ash and the material dredged from the port into the Buckingham canal and the backwaters by the 3rd respondent. It is submitted that the 3rd respondent power plant is owned, controlled and operated by the 2nd respondent. It is submitted that the filling in of the Buckingham canal and the backwaters is illegal and contrary to all laws and the discharge of fly ash by the thermal power plant is also contrary to the environmental clearances obtained by them.

The Address for service on the applicant is that of his counsel M/s A. Yogeshwaran, Neha Mirlam Kurian having offices at No. 368, New Additional Law Chambers, High Court Buildings, Madras - 104.

The Respondents are

1. Union of India,
Rep by its Secretary
The Ministry of Environment, Forests and Climate Change
Jorbagh, New Delhi
2. Tamil Nadu Generation and Distribution Corporation (TANGEDCO)
Rep by its Chairman cum Managing Director
10 th floor, NPKRR Maalgai, 144, Anna Salai,
Chennai - 600 002
3. North Chennai Thermal Power Station

Rep by Its Chief Engineer
Athipattu,
Chennai,
Thiruvallur (District)
600120.

4. KAMARAJAR PORT LIMITED (erstwhile Ennore Port Limited)

Rep by its Chairman cum Managing Director
4th Floor,
Super Speciality Diabetic Centre (erstwhile DLB building)
Near Clive Battery Bus Stop
Rajaji Salai
Chennai - 600 001

5. The Tamil Nadu Pollution Control Board

Rep by its Member Secretary,
76, Mount Salai, Guindy, Chennai - 600 032.

6. The District Environmental Engineer,

Tamilnadu Pollution Control Board,
77-A, South Avenue Road, Ambattur Industrial Estate,
Ambattur Taluk, Chennai - 600 058, Thiruvallur District

7. The Tamil Nadu Coastal Zone Management Authority

Rep by its Member Secretary
Panagal Building, Chennai

8. The Public Works Department

Rep by its Secretary
Fort St George, Chennai

The address for service on the respondents is as above.

1. The present application is being filed aggrieved by the illegal discharge of flyash by the 3rd respondent thermal power plant into the Buckingham canal and the illegal filling in of the canal and the backwaters by dumping soil by the 4th respondent (Port).
2. The Buckingham Canal is a 796 kilometres (494.6 mi) long fresh water navigation canal, running parallel to the Coromandel Coast of South India from Kakinada in East Godavari district in Andhra Pradesh to Villupuram District in Tamil Nadu. The canal connects most of the natural backwaters along the coast to the port of Chennai (Madras). It was constructed during the British Rule, and was an important waterway during the late nineteenth and the twentieth century. The 3rd Respondent power station is located on the Katupalli - Ennore Island. Between the island and the mainland is the expansive backwaters and the Kosastalalar river drains into this back waters. The Buckingham canal is a deeper channel cutting through this backwaters. The backwaters is contiguous to the Pulicat lagoon system. The Backwaters, referred to as "Paravai" in Tamil along with the Ennore creek and the Pulicat

lagoon is of great ecological importance and serves as a "flood sink". Reclaiming this wetland by filling with fly ash and dredged material will adversely affect a large portion of North Chennai since in times of high flooding and cyclone, this expansive water spread is essential for reducing the impact of flooding in Manali industrial area and the residential areas.

3. It is submitted that the 3rd respondent North Chennai power station (TPP) is a 1,830-megawatt (MW) coal-fired power station in Tamil Nadu, India, which is owned and operated by the Tamil Nadu Generation and Distribution Corporation (TANGEDCO), the 2nd respondent herein. The power station comprises three 210 megawatt coal-fired units which were commissioned between 1994 and 1996, as well as two 600 MW units commissioned in 2013. Tamil Nadu Generation & Distribution Corporation applied for a terms of reference for another 800 MW unit (Stage III) in 2012, with a proposed completion date of December 2017.
4. It is submitted that the TPP has been dumping ash slurry into the Buckingham canal and the back waters for several years and it is informed that notices have also been issued by the Pollution Control Board in this regard, however, the TPP has been continuing with the illicit dumping of ash in this manner, thereby gravely polluting the Buckingham canal which continues to run further, partially joining the Ennore creek and continuing towards the city of Chennai.
5. It is submitted that ash generated by TPPs, fly ash and bottom ash are serious pollutants, apart from containing Nickel (Ni) Cadmium (Cd) Antimony (Sb) Arsenic (As) Chromium (Cr) Lead (Pb), Mercury they are also radioactive, which fact has also been recognised by this Hon'ble Tribunal in its order in *Krishi Vigyan Arogya Sangha Vs The Ministry of Environment and Forests* decided on 20.09.2011. It is submitted that photographs taken on 13/01/2016 collected from the canal are annexed herewith as annexure - A1. It is submitted that the dumping of ash in this fashion amounts to violation of the environmental clearance issued by the 1st respondent and the clearance ought to be revoked for such blatant and repeated violations of the law, resulting in serious, irreversible contamination of the environment and destruction of marine ecology and destruction of the canal, creek, backwaters and impacting the livelihood of those dependent on the sea for sustenance, apart from poisoning fishes and other marine creatures, which are consumed by humans and animals alike, who are in turn poisoned by the bioaccumulation of toxins in these organisms. It also lowers soil fertility and contaminates surface and ground water as it can leach into the subsoil. When

fly ash gets into the natural draining system, it results in siltation and clogs the system. It also reduces the pH balance and portability of water. Fly ash interferes with the process of photosynthesis of aquatic plants and thus disturbs the food chain. Besides, fly ash corrodes exposed metallic structures in its vicinity. It is pertinent to submit that the backwaters and marshes on the other side of the road have also been covered with ash from the TPP which is also visible from the google earth images. The mangroves in the area have also been destroyed. The presence of mangroves entitles the protection of the area as CRZ - I.

6. It is submitted that apart from this dumping of ash, the 4th respondent began dumping of mud into the Buckingham canal and the backwaters and blocking it. It is submitted that the stretch along the TPP at Athipattu, Ennore around 8 days ago and due to protest by the fishermen, the contractors stopped work at the site. It is submitted that it is also learnt that officers of the 8th respondent also visited the site and have observed that the dumping of soil and filling in of the canal was illegal. It is submitted that the Buckingham canal and the backwaters is tidally influenced and as such no filling in can be permitted, which would affect the flow of water. Newspaper reports dated 06/01/2016 and photographs taken on 12/01/2016 are annexed herewith as Annexure A2. It is submitted that the 4th respondent has also resorted to illegal dumping and filling in of the backwaters along the Kosastalayar river, which is waterlogged and has been classified as inter tidal zone. The applicant reserves his right to file a separate application in respect of these violations by the 4th respondent and craves the liberty to file detailed pleadings in the present application. The illegal activity of the respondents are liable to be interfered with on the following among other

GROUND

- A. The dumping of ash by the 2nd and 3rd respondents is in violation of the Water (Prevention and Control of Pollution) Act, 1974, the Environment (Protection) Act, 1986 and the environmental clearances obtained by them.
- B. The dumping of ash has destroyed the canal and the backwaters has irreversibly contaminated the environment.
- C. The dumping of ash in this fashion amounts to violation of the environmental clearance issued by the 1st respondent and the clearance

ought to be revoked for such blatant and repeated violations of the law, resulting in serious, irreversible contamination of the environment and destruction of marine ecology and destruction of the canal, creek, backwaters and impacting the livelihood of those dependent on the sea for sustenance, apart from poisoning fishes and other marine creatures, which are consumed by humans and animals alike, who are in turn poisoned by the bioaccumulation of toxins in these organisms. It also lowers soil fertility and contaminates surface and ground water as it can leach into the subsoil. When fly ash gets into the natural draining system, it results in siltation and clogs the system. It also reduces the pH balance and portability of water. Fly ash interferes with the process of photosynthesis of aquatic plants and thus disturbs the food chain. Besides, fly ash corrodes exposed metallic structures in its vicinity.

- D. The backwaters and marshes on the other side of the road have also been covered with ash from the TPP.
- E. The dumping of ash has also destroyed mangroves in the area.
- F. The 4th respondent has no right to fill in and convert the Buckingham canal and reclaim the backwaters.
- G. The 4th respondent has illegally filled in the North Buckingham Canal Athipattu, thus blocking the flow of water.
- H. The statutory respondents have failed to perform their duties under the statute.

It is submitted that unless urgent action is initiated to clean up the ash dumped and to remove the soil dumped in the Buckingham canal, breakwater, greater harm would be caused to the environment. The respondents have no right to violate the law and the balance of convenience lies in favor of the applicant and in favor of grant of interim orders against the respondents, which will also enure in favor of the environment.

Limitation:

The Applicant declares that as per the National Green Tribunal Act 2010 this application is well within the prescribed time.

INTERIM RELIEF

Pending disposal of this application, this applicant prays that this Hon'ble

Tribunal be Pleased to:

- A. Direct closure of the 2nd respondent run 3rd respondent Thermal power plant for the illegal dumping of ash into the Buckingham canal and backwater.
- B. Direct respondents 1,5,6 to ensure immediate stoppage of discharge of ash from the 3rd respondent into the canal and the backwater.
- C. Direct Respondents 1,2,3, 5,6,7,8 to immediately clean up the canal and remove the ash illegally dumped into the canal.
- D. Injunct the 4th respondent, its agent, contractors etc from dumping soil or any material in the Buckingham canal or any water body.
- E. Direct the respondents 4,5,6,7 and 8 to immediately remove the illegally dumped soil in the Buckingham canal at Athipattu and restore status quo ante.
- F. Pass such further order or orders as may be necessary in the facts and circumstances of the case and thus render justice.

PRAYER

For the reasons stated above, It is humbly prayed that this Hon'ble Tribunal may be pleased to direct the:

- A. Direct closure of the 2nd respondent run 3rd respondent Thermal power plant for the illegal dumping of ash into the Buckingham canal.
- B. Respondent 1 to commission a study into the damage caused by the 2nd and 3rd respondents by continued dumping of ash into the environment.
- C. Direct the 2nd, 3rd and 4th respondent to pay compensation for the environmental harm caused.
- D. Direct respondent No.8 to maintain the canal and the backwaters free of any filling in or encroachment.
- E. Direct respondents 1,5,6 to maintain the Buckingham Canal, Creek, Kosasthalaiyar and backwaters free of contamination or pollution.
- F. And pass such further order or orders as may be fit, proper and necessary in the facts and circumstances of the case and thus render justice.

APPLICANT

COUNSEL FOR THE APPLICANT

VERIFICATION

I, R.Ravimaran ,the applicant herein, do hereby verify that the contents of the above paragraphs and grounds are true to the best of my Knowledge and that we have not suppressed any material fact.

Date : 13/01/2016

Place : Chennai

IN THE NATIONAL GREEN TRIBUNAL (SZ) , CHENNAI

APPLICATION NO. OF 2015

R.Ravimaran
S/o Ramachandran
No.42, Beach Road, Thazhankuppam
Ennore, Chennai - 600057

.. Applicant

Vs

Union of India,
Rep by its Secretary
The Ministry of Environment, Forests and Climate Change
Jorbagh, New Delhi & Ors

.. Respondents

VAKALAT

I, R.Ravimaran, do hereby appoint and retain

M/s YOGESHWARAN.A

Advocates to appear me in the above Application and to conduct and prosecute (or defend) the same and all proceedings that may be taken in respect of any application connected with the same or any decree or order passed therein including all applications for return of documents or the receipt to any moneys that may be payable to me in the said Appeal/Application and also in appeal under to the Supreme Court of India and in all applications for review Judgement.

I Certify that the contents of this vakalat at
were read out and explained
in my presence to the Executant who appears
perfectly to understand the same and made hi
/ her their signature in my presence

Executed before me this 13th day of January, 2016

ACCEPTED:

Counsel for Applicant

**The address for service of the said Counsel: No.368, New Addl. Law
Chambers, High Court, Chennai - 104**

BEFORE THE NATIONAL GREEN TRIBUNAL

SOUTHERN ZONE, CHENNAI

Application No. 8 of 2016 (SZ)

Applicant(s)

R. Ravimaran
Ernore, Chennai

Respondent(s)

1. Union of India,
rep. by its Secretary,
The Ministry of Environment, Forests
And Climate Change, New Delhi
2. Tamil Nadu Generation and
Distribution Corporation, rep. by its
Chairman cum Managing Director
Chennai
3. North Chennai Thermal Power
Station, rep by its Chief Engineer
Althipattu, Chennai
4. Kamarajar Port Ltd., rep. by its
Chairman cum Managing Director
Chennai
5. The Tamil Nadu Pollution Control
Board, rep. By its Member Secretary
Chennai
6. The District Environmental Engineer
Tamilnadu Pollution Control Board
Ambalur, Chennai
7. The Tamil Nadu Coastal Zone
Management Authority, rep. by its
Member Secretary, Chennai
8. The Public Works Department
Rep. by its Secretary
Fort St. George, Chennai

Legal Practitioners for Applicant(s)

Mr. Yogeshwaran. A

Legal Practitioners for Respondents

Mr G.M. Syed Nurulgh Shadi for R1
Mr Abdul Saleem for R2, R3 & R8
Mr M.T. Arunan for R4
Mrs Yasmeen Ali for R5 and R6
M/s M.K. Subramanian & P. Velmuri for R7

Note of the Registry	Orders of the Tribunal
Item No. 26	<p>Date 18th November, 2016.</p> <p>We have heard Mr. Yogeshwaran, learned counsel appearing for the applicant as well as Mr. T. Arunan, learned counsel appearing for the Kamarajar Port and the learned counsel appearing for the TANGEDCO.</p> <p>It has been explained in detail that the map which is attached to the papers indicating that the places identified as 1 and 2 for the proposed activities envisaged in Port Master Plan Phase III, are situated between High Tide Line (HTL) and Low Tide Line (LTL).</p> <p>We make it clear that not only there shall not be any further dumping in the area at places identified as 1 and 2, but the material which has been dumped by the Port earlier, shall be removed forthwith in any event, within a period of 4 weeks and report the same before this Tribunal on the next date of hearing.</p> <p>We also make it clear that while removing the dumped material, mangroves existing in the said area shall not be disturbed/removed. The site shall be made suitable for the purpose of spreading the mangroves.</p> <p>In so far as it relates to the place identified as No. 3 (marked in green), admittedly the said area is away from the Tidel Lines. CRZ area 3 (marked in blue) indicates the identification of site for proposed Coal Stock Yard (CSY) which is within the Port limits and therefore the site can be used by the Port for the purpose of dumping the material.</p> <p>In the meantime, learned counsel appearing for the applicant shall be entitled to file rejoinder to the reply dated 14.11.2016 filed by the Port Ltd.</p> <p>We also make it clear that as a matter of abundant caution, the recommendation of the Tamil Nadu Coastal Zone Management Authority (TNCZMA) dated 16.12.2014, in so far as it relates to paragraph 6(b)</p>


which is as follows:

- b) Dredged material should be dumped on the landward side and should not be dumped into the sea (CRZ-IV) intertidal area (CRZ-IB) of the Buckingham Canal and also in the salt pan areas as the salt pan areas are declared as CRZ-IB (inter tidal zone) as per the approved Coastal Zone Management Plan of Tamil Nadu.
- c) There should not be any impact of disposal of dredge material on the adjacent L & T shipyard area especially the navigational channels of that shipyard.

shall be scrupulously followed. This has also been confirmed by MoEF & CC in its order dated 12.03.2015 stating that all the conditions stipulated by the (INCZMA) vide its letter dated 16.12.2014, shall be complied with. The other conditions mentioned in the Government of India letter dated 12.03.2015 shall also be followed.

In the meantime, the State Pollution Control Board shall make a visit of the spot concerned and analyse the AAQ and file a report. We make it clear that in respect of damages already caused by releasing fly ash, the Pollution Control Board shall also take action against the authorities who are responsible for the same and inform to this Tribunal on the next date of hearing. The Board shall also explain as to the outcome of the Show Cause Notice issued by it to TANGEDCO and appropriate action taken in that regard.

Post this application on 22.12.2016


JM
(Justice Dr. P. Jyoti Bhat)


EM
(Shri P. S. Rao)

Certified that this is a true copy of the document of order as to the case the Application Appeal No. 8 of 2016 and that all the matters appearing therein have been legibly and faithfully copied with no modifications.

E. Aguilera
For Registrar (2016)
Southern Zone

995/16.
(1) Name of the applicant M. T. ARUNAV
(2) Date of presentation of application 11/12/16
(3) No. of pages 3 pages
(4) Copy fee charged for registration 2.0 + 1.5 = 0.5 /-
(5) Date of preparation of copy 7
(6) Date on which copy is ready 7
(7) Signature given for collection of copy A/12/16
(8) Date of delivery 7

For Registrar
E. Aguilera
Signature



BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL (SZ),
CHENNAI

APPLN. No. 8 of 2016

R.Ravimaran
Ennore,
Chennai

...Applicant.

-Vs-

1. Union of India,
MoEF & CC,
New Delhi
2. Tamil Nadu Generation and Distribution
Corporation (TANGEDCO)
Rep.by its Chairman cum Managing Director,
10th floor, NPKRR Maaligai,
144, Anna Salai,
Chennai-600002
3. North Chennai Thermal Power Station,
Rep.by its Chief Engineer,
Athipattu,
Chennai,
Thiruvallur (District)
600120.
4. Kamarajar Port Limited (Erstwhile Ennore Port Limited)
Rep.by its Chairman cum Managing Director,
4th floor
Super Speciality Diabetic Centre,
(erstwhile DLB building)
Near Clive Battery Bus Stop
Rajaji Salai,
Chennai-600001
5. The Tamil Nadu Pollution Control Board
Rep.by its Member Secretary,
76, Mount Salai, Guindy,
Chennai-600032.



6. The District Environmental Engineer,
Tamil Nadu Pollution Control Board,
77-A, South Avenue Road,
Ambattur Industrial Estate,
Ambattur Taluk, Chennai-600028

7. The Tamil Nadu Coastal Zone Management Authority,
Rep. by its Members Secretary,
Panagal Building, Chennai

8. The Public Works Department,
Rep. by its Secretary,
Fort St. George, Chennai

.... Respondents.

**REPORTING FULL COMPLIANCE BY THE 4TH RESPONDENT AS PER
THE DIRECTION OF THE HON'BLE TRIBUNAL ORDER DATED
18.11.2016**

The 4th Respondent begs to state as follows:

1. The address for service of all notices of the 4th Respondent is that of their legal Counsel Shri. M.T. Arunan and having his office at No.162, Additional Law Chambers, High Court buildings, Chennai - 104.

2. It is humbly submitted that the 4th Respondent, i.e., Kamarajar Port Limited, being a Government of India Public Sector Undertaking invited tender which was floated through e-procurement mode. Work order has been issued to the Lowest bidder (L1) on 06.01.2017 (Annexure -1).

4. It is humbly submitted that the contractor commenced the work on 10.01.2017. However, the work was prolonged due to pongal festival and protest over "Jallikkattu" and sudden demise of the then Chief Minister.

5. It is humbly submitted that the entire dumped materials in the 4th Respondent land area transferred from Salt Department i.e., area 1 & 2 has been completed (photos are attached as Annexure -2). The removal of dredging materials has been done without affecting the existing mangroves plants in CRZ IB area.



7. Under the fact and above said circumstances, it is humbly prayed that the Hon'ble Tribunal may be pleased to close this Application against the 4th Respondent Port and thus render justice.

Dated at Chennai on this day of March 2017.

Counsel for 4th Respondent



VERIFICATION

I, V.Krishnasamy S/o Vairavan, aged about 54 years and working as General Manager (Operations), Kamarajar Port Limited do hereby verify what is stated in the above paragraphs are true to the best of my knowledge and belief.

Verified at Chennai this the day of March 2017





காமராஜர் துறைமுக நிறுவனம்
कामराजर पोर्ट लिमिटेड
Kamarajar Port Limited
 (A Mini-Ratna Government of India Undertaking)

Work order No. KPL/OP/CONSTN/059/2016-17

KPL/OP/ B/95.15/2016-17

Dated: 06.01.2017

To

M/s. N.Mohamed Jamaluddin,
 No.23, South lock road, Ennore,
 Chennai-600057.

Sir,

Subject: Removing the dredged materials dumped in the KPL land transferred from salt department-Issue of Letter of Acceptance -Reg.

Ref : 1.KPL Tender No.KPL/OP/B/95.07/2016-17
2. Your bid submission letter dated 23.12.2016

Kamarajar Port Limited is pleasure to inform that your bid for "Removing the dredged materials dumped in the KPL land transferred from salt department" has been accepted at the quoted price of **Rs. 76,27,100/-** (Rupees Seventy six Lakhs twenty seven thousand and one hundred only).

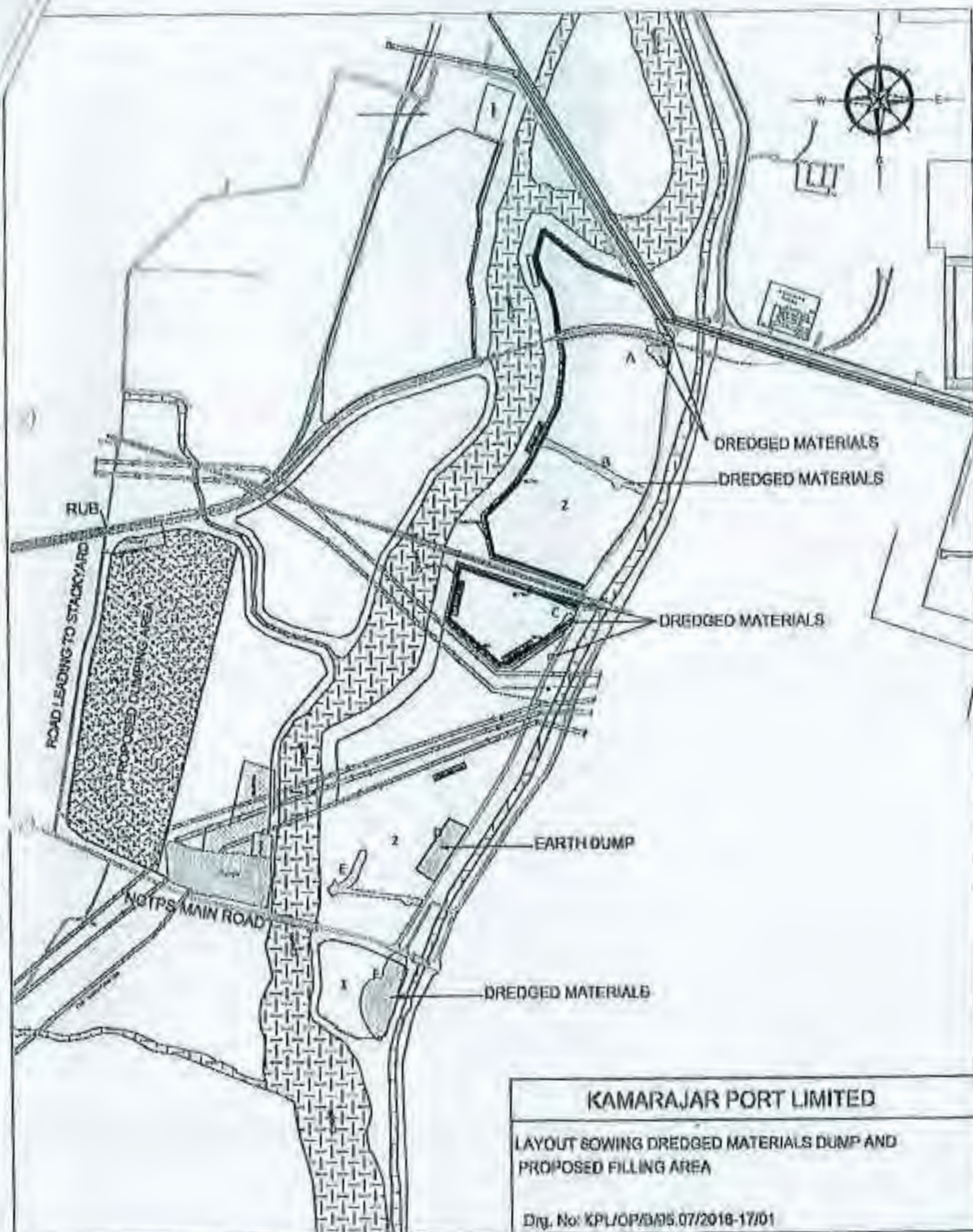
You are requested to furnish Performance Guarantee (5% of the contract price) of **Rs.3,81,355/-** (Rupees three Lakhs eighty one thousand three hundred and fifty five only) in the form of Bank Guarantee or Demand Draft within 21 (Fourteen) days of the receipt of this "Letter of Acceptance" in accordance with as per clause 30.1 of ITB of tender document and sign the Agreement within 14 (Fourteen) days in accordance with Clause 29.3 of ITB.

Deputy General Manager (C) is the Engineer-in-charge for this work. All other terms and conditions as stipulated in the tender document and subsequent clarifications shall be abided.

Yours faithfully,


P.Radhakrishnan
 Deputy General Manager (C)


 06/01/17



LOCATION - A



LOCATION - B



LOCATION - C



LOCATION - D



LOCATION - E



LOCATION - F



FORM I
(SEE RULE 8(1))

BEFORE THE HON'BLE NATIONAL GREEN BENCH TRIBUNAL AT
CHENNAI (SZ)

BETWEEN:

MEENAVA THANTHAI K.R.SELVARAJ KUMAR
MEENAVAR NALA SANGAM

(Registered under section 10 of the Tamil Nadu
Societies Act, in Sl.No. 205 of 2015 dated 26.06.2015)
Represented by its president,
M.R.THIVAGARAJAN,
S/o Late C.Rajalingam,
Office at No.15/8,
A.J.Colony, Royapuram, Chennai-600 013.

... Applicant

AND

1. **The Chief Secretary,**
Government of Tamil Nadu,
Secretariat,
Chennai- 600 009 and **10 others.**

... Respondents

MEMORANDUM OF APPLICATION

[UNDER SECTION 18(1) R/W SECTION 14 OF THE NATIONAL
GREEN TRIBUNAL ACT., 2010]

APPLICATION NO. 157 OF 2016

VOLUME 1

S.No	NATURE OF DOCUMENT	PAGE NO.
1.	Memorandum	1
2.	Application	2 - 11
3.	Verifying Affidavit	12 - 15
4.	Vakalath	16

Dated at Chennai on this the day of July 2016

COUNSEL FOR APPLICANT/APPLICANT

10, 11, 12
MR V
MR
5-7
8

1

(2)

**BEFORE THE HON'BLE NATIONAL GREEN BENCH TRIBUNAL AT
CHENNAI (SZ)**

MEMORANDUM OF APPLICATION
[UNDER SECTION 18(1) R/W SECTION 14 OF THE NATIONAL
GREEN TRIBUNAL ACT., 2010]

APPLICATION NO. OF 2016

BETWEEN :

MEENAVA THANTHAI K.R.SELVARAJ KUMAR
MEENAVAR NALA SANGAM

Represented by its president,
M.R.THIRYAGARAJAN ,
S/o Late C.Rajalingam,
Office at No.15/8,
A.J.Colony, Royapuram,
Chennai-600 013

... Applicant

AND

1. **The Chief Secretary,**
Government of Tamil Nadu,
Secretariat,
Chennai- 600 009.
2. **The State of Tamil Nadu**
Represented by its secretary to Government
Forest Department,
Fort St. George,
Chennai-600 009.
3. **The State of Tamil Nadu**
Represented by its secretary to Government
Fisheries Department,
Fort St. George,
Chennai-600 009.
4. **The State of Tamil Nadu**
Represented by its secretary to Government
Environment Department,
Fort St. George,
Chennai-600 009.

5. **The State of Tamil Nadu**
Represented by its secretary to Government
Public Works Department,
Fort St. George,
Chennai-600 009.
6. **The District Collector,**
Thiruvallur District,
Thiruvallur.
7. **The Revenue Division Officer,**
RDO Office,
Ponneri,
Thiruvallur District.
8. **The Chairman.**
Tamilnadu Pollution Control Board,
No.76, Mount Salai,
Guindy,
Chennai-600 032.
9. **The Executive Engineer,**
Water Resources Department,
Araniaaru Irrigation, Division, Chennai Mandal,
Chennai - 600 005.
10. **The Joint Chief Environmental Engineer,**
(Monitoring),
77A, South Avenue Road,
Ambattur Industrial Estate,
Ambattur,
Chennai-600 058.
11. **M/s.Adani Ennore Container Terminal Private Limited**
Represented by its Managing Director,
Having its principal office at,
No.23, P.T.Lee Chengalvarayan Building,
First Floor, Rajaji Salai,
George Town, Chennai - 600001.

... Respondents

1. The address of the Applicant is as given above for the service of notices of this application.

2. The address of the Respondents are as given above for the service of notices of this application.

3. The Applicant begs to present the Memorandum of Application on the grounds set as under:

Facts in Brief:

1. The Applicant is MEENAVA THANTHAI K.R.SELVARAJ KUMAR MEENAVAR NALA SANGAM, Represented by its President M.R.THİYAGARAJAN, Son of Mr.C.RAJALINGAM, Hindu, aged 50 Years, the applicant association is a public interested association concerned about the polluted activities of the 11th respondent herein.

2. The Applicant MEENAVA THANTHAI K.R.SELVARAJ KUMAR MEENAVAR NALA SANGAM, Represented by its President M.R.THİYAGARAJAN having office at No.15/8, A.J.Colony, Royapuram, Chennai-600 013.

3. The Applicant MEENAVA THANTHAI K.R.SELVARAJ KUMAR MEENAVAR NALA SANGAM is a registered body which was registered under section 10 of the Tamil Nadu Societies Act, 1975 (Tamil Nadu Act 27 of 1975) before the Registrar of Societies, Chennai North in Sl.No. 205 of 2015 dated 26.06.2015.

4. The Applicant is filling the above application for the interest of the people belonging to the fishermen community. In the interest of justice and welfare of the larger interest of the fisherman community and the general public in and around the Ennore area

complaining about the pollution and encroachment caused by the 11th Respondent resulting in loss of sea resources and loss of basic livelihood of the seashore fisherman particularly residing at Ennore and North Chennai.

5. The Applicant further state that first respondent is the overall controlling body and chief functionary for the state of Tamil Nadu.

6. The Applicant state that the second respondent is the overall authority of all over TamilNadu for Forest Department in the state and other related issues in respect of the said Department. The Applicant submit that the Sixth respondent is the District Administrative authority of Thiruvallur District to implement all the welfare programs as well as to look over the health hazard and other related issues. The Applicant submit that the Eighth respondent is an authority to check the pollution in the water, air and smoke emitted by the factories, aircrafts, ships, trains, etc. and to take action against the erring person who violating rules and regulations framed therein according to the notifications issued by the Ministry of Environment.

7. The Applicant further state that the 11th respondent is an Adani Ennore Container Terminal Private Limited who had obtained contract for construction a container Terminal from Kamarajar Port Limited. Kamarajar Port Limited is located on the Coromandel Coast about 24 km north of Chennai port. It is the 12th major Port of India, and the first port in India which is a public company. The Kamarajar Port Limited is the only corporatized major port and is registered as a company. Kamarajar Port Limited is evolving itself into a full-fledged port with the capacity to handle a wide range of products. The

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construction of Kamarajar port had cut off access to the sea for fishing and now the dumping mud in the Kosasthalaiyar River for the construction of Container Terminal by the Adani Port over a 50 acre of land in the Kosasthalaiyar River had made worse impact on ecology.

8. The Applicant further state that there are 21 fishery villages located in and around the Ennore area and the inhabitants are entirely depending upon the sea for their livelihood. The Applicant further submits that the people living in the said area are fishermen who are venturing into the sea for their survival and the marine organisms are their only source of income. The Applicant further state that a lot of damage has already been wreaked. A large portion of what used to be river bed has now been raised by dumping soils from 11th respondents dredging to construct an Container terminal. A road-cum-coal conveyor from the harbour to the stack-yard has all but dammed the river, sparing it a meager opening.

9. The Applicant further state that the 11th respondent action regarding the construction of Container terminal is causing pollution and destroyed the Kosasthalaiyar river, and has severely hampered fishing, in the process destroying the livelihood of fishermen. The fishing communities who were economically self-sufficient, are now dependent on exploitative low-paying factory jobs. The communities have been protesting this pollution for more than 15 years, but without much result. Further the Kosasthalaiyar River and Pulicat Lake with the Bay of Bengal, is an important aquatic

ecosystem. However, the encroachment and pollution caused have led to regular depletion of biodiversity in the region. The increasing pollution levels have affected the marine life, adversely affecting the livelihood of the fishing communities.

9A. The Applicant further Submit that there is a syndicate of companies who wanted to grab entire land of Kosasthalaiyar River therefore the applicant filled many number of application under Right to Information Act to furnish the details of they are constitution legal entity but due to they are Muscular, Financial and Political power they are holding up information given to the applicant therefore we restrict this application irrespect of 11th Respondent with a liberty to add the other companies attempting to grab the Kosasthalaiyar River and River bet for they are extension of Container Terminal.

10. The Applicant further state that the respondents therefore to ensure that the water pollution and the environmental pollution caused by the 11th respondent has to be permanently stopped by providing permanent solution. Since prevention is better than cure, instead of directing the 11th respondent not to cause destruction of water body and other natural resources, the attempt should be to strike a balance between development and preservation of ecology. Whenever it comes to the preservation of environment and natural resources there should be a joint effort by all concerned. It is not the look out of a section of the society alone in the matter of environmental or ecological issues. It should rather be taken as a social cause.

11. The Applicant further submit that the Kosasthalaiyar River originating from Arani and on rainy days due to flow of heavy water this Kosasthalaiyar River flourish with heavy water and leaves to Pazhaverkadu Lake.

12. The Applicant further submit that the 11th Respondent is indulging illegal activities of drugging sea sand from Kamarajar Port and dumping into Kosasthalaiyar River and wanted to Grab the entire Kosasthalaiyar River for his Container Terminal.

13. The Applicant further submit that as on date i did not know the particulars or Licence or Contract empowering the 11th Respondent do during this illegal activities.

14. The Applicant further submit that as periodical affects court verdict and dictum no authority his entitled to Grab the water bodies and river bodies therefore the present activities of the 11th Respondent dumping, drugging, sea sand into the Kosasthalaiyar River is highly contemporous.

15. The Applicant have therefore no other alternative that to pray for ad interim injunction restraining the 11th Respondent from dumping sea sand from drugging activities into the Kosasthalaiyar River.

16. The Applicant further submit that in the interest of the entire community the balance of convenient in the fall over of the society and if had the ad interim injunction his not granted his prayed for there would be grave irreparable loss to the society.

GROUND:

- i) The 1st to 10th Respondent are allowing the irregular activities of the 11th respondent which cause several hardship to the residents and the fishermen communities in the Ennore area and across the area.
- ii) The Respondents have not initiated any steps to look over the welfare of the fishermen hamlet and the local residents for their lively hood in spite of agitation conducted by the aggrieved people.
- iii) The above Respondents had failed to enforce their Constitutional duties and responsibilities to check the activities of the 11th respondent who is dumping soil in the Kosasthalaiyar River for the construction of Container Terminal over a extent of 50 acre and endanger the life of the Fishermen Community which in turn has vastly compromised the ability of the river to carry floodwaters .
- iv) The respondents failed to achieve the ecological balance health and social impact before the expansion plans.
- v) Due to the act of the 11th respondent it had affected the river Kosasthalaiyar, adversely affecting the livelihood of the fishing communities.

- vi) The 11th Respondent by violating the apex court order directing the authorities all over India not to grab water bodies, river bodies.
- vii) The 11th Respondent with Muscular, Financial and Political influence attempting to grab the land of Kosasthalaiyar River to extent this Container Terminal.

LIMITATION :

The applicant further declares that he had sent the representation dated 21-05-2016 to the 1 to 10 Respondents regarding the pollution caused by 11th respondent herein. Inspite of the representation the 1 to 10 respondents are not taken any action to stop the pollution caused by the 11th respondent and hence this application is within the period of limitation and the applicant declares that the subject matter is within the jurisdiction of this Hon'ble Tribunal.

INTERIM RELIEF:

- i) It is respectfully prayed that this Hon'ble Court may be pleased to appoint an advocate commissioner to hold an enquiry at Kosasthalaiyar River where the 11th respondent had made encroachment and had dumped soil over an extent of 50 acres. So that to reinstate the river in its natural extent.
- ii) It is also respectfully prayed that this Hon'ble Court pleased to grant ad interim injunction pending disposal of the above main petition restraining the 11th Respondent from dumping, drugging the sand in Kosasthalaiyar River originating from Arani to Pazhaverkadu lake (Via.Ennore).

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(11)

MAIN RELIEF PRAYED FOR:

It is therefore prayed that this Hon'ble Tribunal may be pleased to issue direction to the respondent 1 to 10 to initiate appropriate action against the 11th respondent for encroaching the Kosasthalaiyar River and dumping soil over an extent of 50 acre and adversely affecting the livelihood of the fishing communities in the ends of justice and pass such other order or orders as this Hon'ble may deem fit and proper in the circumstances of the case and thus render justice.

APPLICANT

COUNSEL FOR APPLICANT

VERIFICATION

I, **M.R.THİYAGARAJAN**, Son of Mr.C.Rajalingam, Hindu, aged 50 years, President **MEENAVA THANTHAI K.R.SELVARAJ KUMAR MEENAVAR NALA SANGAM**, having office at No.15/8, A.J.Colony, Royapuram, Chennai-600 013 hereby declare that the contents of paragraphs stated above are true to my personal knowledge and are believed to be true on legal advice and I have not suppressed any material fact.

Place : Chennai

Date :

APPLICANT

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**BEFORE THE HON'BLE NATIONAL GREEN BENCH TRIBUNAL AT
CHENNAI (SZ)**

MEMORANDUM OF APPLICATION

[UNDER SECTION 18(1) R/W SECTION 14 OF THE NATIONAL
GREEN TRIBUNAL ACT., 2010]

APPLICATION NO. OF 2016

BETWEEN :

MEENAVA THANTHAI K.R.SELVARAJ KUMAR

MEENAVAR NALA SANGAM

(Registered under section 10 of the Tamil Nadu
Societies Act, in Sl.No. 205 of 2015 dated 26.06.2015)

Represented by its president,

M.R.THIYAGARAJAN ,

S/o Late C.Rajalingam,

Office at No.15/8,

A.J.Colony, Royapuram,

Chennai-600 013.

... Applicant

AND

1. The Chief Secretary,

Government of Tamil Nadu,

Secretariat,

Chennai- 600 009 and 10 others.

... Respondents

VERIFYING AFFIDAVIT OF M.R.THIYAGARAJAN

I: **M.R.THIYAGARAJAN**, Son of Mr.C.Rajalingam, Hindu, aged
50 years, President **MEENAVA THANTHAI K.R.SELVARAJ KUMAR**
MEENAVAR NALA SANGAM, having office at No.15/8, A.J.Colony,

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Royapuram, Chennai-600 013, do hereby solemnly affirm and sincerely state as follows:

1. I state that I am the Applicant herein and as such am well acquainted with the facts of the case and submit as follows:
2. I do hereby declare and verify what are all stated in the Application paragraphs are true and correct to the best of my knowledge and belief.

Solemnly affirmed at Chennai on
this the day of July 2016 and
signed his name in my
presence.

BEFORE ME,

ADVOCATE, CHENNAI

BEFORE THE HON'BLE NATIONAL
GREEN BENCH TRIBUNAL AT
CHENNAI (SZ)

APPL. NO. 152 OF 2016

MEENAVA THANTHAI
K.R.SELVARAJ KUMAR
MEENAVAR NALA SANGAM
Represented by its president,
M.R.THIIYAGARAJAN ,

... Applicant

Vs

The Chief Secretary,
Government of Tamil Nadu,
Secretariat, Chennai- 600 009
and 10 others.

... Respondents

MEMORANDUM
OF APPLICATION

Recd by
W. M. A. S.
13-7-2017

MR.K.MAGESHWARAN
ENRT NO.937/2015
COUNSEL FOR APPLICANT

BEFORE THE NATIONAL GREEN TRIBUNAL

SOUTHERN ZONE, CHENNAI

Application No. 8 of 2016 (SZ)

Applicant(s)

R. Ravimaran
Ennore, Chennai

Respondent(s)

1. Union of India,
rep. by its Secretary,
The Ministry of Environment, Forests
And Climate Change, New Delhi
2. Tamil Nadu Generation and
Distribution Corporation, rep. by its
Chairman cum Managing Director
Chennai
3. North Chennai Thermal Power
Station, rep by its Chief Engineer
Alhipattu, Chennai
4. Kamarajar Port Ltd., rep. by its
Chairman cum Managing Director
Chennai
5. The Tamil Nadu Pollution Control
Board, rep. By its Member Secretary
Chennai
6. The District Environmental Engineer
Tamilnadu Pollution Control Board
Ambattur, Chennai
7. The Tamil Nadu Coastal Zone
Management Authority, rep. by its
Member Secretary, Chennai
8. The Public Works Department
Rep. by its Secretary
Fort St. George, Chennai

Legal Practitioners for Applicant(s)

Mr. Yogeshwaran, A

Legal Practitioners for Respondents

Mr.G.M. Syed Nurullah Sheriff for R1
Mr.Abdul Saleem for R2, R3 & R8
Mr.M.T.Arunan for R4
Mrs.Yasmeen Ali for R5 and R6
M/s.M.K. Subramanian & P.Velmani for R7

Application No.1 of 2017 (SZ)

Applicant(s)

R.L.Srinivasan
31/36, Porkali Amman Street
Kaatukuppam, Ennore,
Chennai 600057

Respondent(s)

1. Union of India, rep. by the Secretary,
Ministry of Environment, Forests &
Climate Change, Indira Paryavaran
Bhavan, Jor Bag Road, New Delhi
And others

Counsel appearing for applicant

M/s.Ritwick Dutta, Rahul
Choudhary, & G.Stanly Hebzon Singh

Counsel appearing for respondents

Mrs.Me. Saraswathy for R1

Application No. 152 of 2016 (SZ)

Applicant/s

Meenava Thanthai
K.R. Selvaraj Kumar
Meenavar Nala Sangam
Rep. by its President, M.R. Thiagarajan
Royapuram, Chennai – 13
Counsel appearing for appellant

Mr.K. Mageswaran

Respondents

1. The Chief Secretary
Govt. of Tamil Nadu
Secretariat, Chennai & others

Counsel appearing for respondents

Respondent No.1 is deleted as per
Order dated 27th February, 2017
Respondent Nos.2 to R5 are deleted
as per order dated 8th November, 2016

Mr.M.K.Subramanian & P.Velmani
For R6, R7 & R9
M/s.H.Yasmeen Ali for R8
Mrs.Rita Chandrasekar for R10
Respondent No.11 is deleted as per
Order dated 20.03.2017
Mr.M.T.Arunan for R12
M/s.R.Thirunavukarasu &
M.Swamalatha for R13.

Note of the Registry	Orders of the Tribunal
Item No.11 to 13	<p>Date: 20th March, 2017</p> <p>Application No.08 of 2016:</p> <p>The learned counsel appearing for the 4th respondent Kamarajar Port Limited has filed Compliance Report after serving copy to the learned counsel appearing for the other side in the above application.</p> <p>Application No.152 of 2016:</p> <p>The learned counsel appearing for M/s.Adani Ennore Container Terminal Pvt. Ltd. 7th respondent submits that he is only a Contractor for container development under Kamarajar Port Limited and they act only as per directions of Kamarajar Port Ltd. and not involved in dredging activity and therefore they are not necessary parties in this application. The learned counsel appearing for the applicant would fairly submit that the</p>

name of M/s.Adani Ennore Container Terminal Pvt. Ltd. may be deleted.
In view of the same, the 7th respondent M/s.Adani Ennore Container Terminal Pvt. Ltd. stands deleted.

The learned counsel appearing for the Pollution Control Board shall also file Status as to the steps taken against erring officials as it was recorded in our order dated 10.03.2017.

Post these applications on 28.04.2017.

.....JM
(Justice Dr.P.Jyothimani)

.....EM
(Shri P.S. Rao)



**BEFORE THE HON'BLE NATIONAL GREEN BENCH TRIBUNAL AT
CHENNAI (SZ)**

MEMORANDUM OF APPLICATION

[UNDER SECTION 18(1) R/W SECTION 14 OF THE NATIONAL GREEN
TRIBUNAL ACT., 2010]

APPLICATION NO. **172** OF 2016 **(SZ)**

BETWEEN :

MEENAVA THANTHAI K.R.SELVARAJ KUMAR

MEENAVAR NALA SANGAM

Represented by its president,
M.R.THIYAGARAJAN ,
S/o Late C.Rajalingam,
Office at No.15/8,
A.J.Colony,Royapuram,
Chennai-600 013

... Applicant

AND

1. **The Chief Secretary,**
Government of Tamil Nadu,
Secretariat,
Chennai- 600 009.
2. **The State of Tamil Nadu**
Represented by its secretary to Government
Forest Department,
Fort St. George,
Chennai-600 009.
3. **The State of Tamil Nadu**
Represented by its secretary to Government
Fisheries Department,
Fort St. George,
Chennai-600 009.
4. **The State of Tamil Nadu**
Represented by its secretary to Government
Environment Department,
Fort St. George,
Chennai-600 009.

5. **The State of Tamil Nadu**
Represented by its secretary to Government
Public Works Department,
Fort St. George,
Chennai-600 009.
6. **The District Collector,**
Thiruvallur District,
Thiruvallur.
7. **Kamarajar Port Limited**
Represented by its Chairman,
4th Floor, Super Speciality Diabetic Centre
(erstwhile DLB building)
Rajaji Salai, Chennai - 600 001
8. **The Chairman,**
Tamilnadu Pollution Control Board,
No.76, Mount Salai,
Guindy,
Chennai-600 032.
9. **The Executive Engineer,**
Water Resources Department,
Araniaaru Irrigation, Division, Chennai Mandal,
Chennai - 600 005.
10. **The Joint Chief Environmental Engineer,**
(Monitoring),
77A, South Avenue Road,
Ambattur Industrial Estate,
Ambattur,
Chennai-600 058.
11. **M/s. Chettinad International Coal Terminal Private Limited**
Represented by its Managing Director,
Having its principal office at,
No.603, Rani Seethai Hall,
Fifth Floor, AnnaSalai,
Chennai - 600006.

... Respondents

1. The address of the Applicant is as given above for the service of notices of this application.

2. The address of the Respondents are as given above for the service of notices of this application.
3. The Applicant begs to present the Memorandum of Application on the grounds set as under:

Facts in Brief:

1. The Applicant is MEENAVA THANTHAI K.R.SELVARAJ KUMAR MEENAVAR NALA SANGAM, Represented by its President M.R.THIYAGARAJAN, Son of Mr.C.RAJALINGAM, Hindu, aged 50 Years, the applicant association is a public interested association concerned about the polluted activities of the 11th respondent herein.
2. The Applicant MEENAVA THANTHAI K.R.SELVARAJ KUMAR MEENAVAR NALA SANGAM, Represented by its President M.R.THIYAGARAJAN having office at No.15/8, A.J.Colony, Royapuram, Chennai-600 013.
3. The Applicant MEENAVA THANTHAI K.R.SELVARAJ KUMARMEENAVAR NALA SANGAM is a registered body which was registered under section 10 of the Tamil Nadu Societies Act, 1975 (Tamil Nadu Act 27 of 1975) before the Registrar of Societies, Chennai North in SI.No. 205 of 2015 dated 26.06.2015.

4. The Applicant is filling the above application for the interest of the people belonging to the fishermen community. In the interest of justice and welfare of the larger interest of the fisherman community and the general public in and around the Ennore area complaining about the pollution and encroachment caused by the 11th Respondent resulting in loss of sea resources and loss of basic livelihood of the seashore fisherman particularly residing at Ennore and North Chennai.

5. The Applicant further state that first respondent is the overall controlling body and chief functionary for the state of TamilNadu.

6. The Applicant state that the second respondent is the overall authority of all over TamilNadu for Forest Department in the state and other related issues in respect of the said Department. The Applicant submit that the Sixth respondent is the District Administrative authority of Thiruvallur District to implement all the welfare programs as well as to look over the health hazard and other related issues. The Applicant submit that the Eighth respondent is an authority to check the pollution in the water, air and smoke emitted by the factories, aircrafts, ships, trains, etc, and to take action against the erring person who violating rules and regulations framed therein according to the notifications issued by the Ministry of Environment.

7. The Applicant further state that the 11th respondent is an M/s. Chettinad International Coal Terminal Private Limited, is operating and handling coal. It is the 11th who had an agreement with the M/s Ennore Port Limited for built and operate a coal handling facility in the port for 30 years under BOT basis. The 11th respondent has constructed the coal yard at the northwest of the ennore port. The eastern side of the coal yard bounded by Kosasthalaiyar river, Buckingham canal, pulicat lake. The southern end of the creek have a link with to bay of Bengal and the northern side of the creek joins with the pulicat lake. The 11th respondent has installed conveyer belt in order to transfer the coal to the stake yard. The Conveyer line starts from the uploading point from the coal berth and passes to the southern compound wall of the port and crosses the buckingham canal. The total length of the conveyer line is 3.03 km with 7 transfer tower. The 11th respondent had made encroachment in the Kosasthalaiyar River, Buckingham canal and had made road and bridge through the said river and canal to transfer the coal through the conveyer belt from the port to the stake yard had made worse impact on ecology.

8. The Applicant further state that there are 21 fishery villages located in and around the Ennore area and the inhabitants are entirely depending upon the sea for their livelihood. The Applicant further submits that the people living in the said area are fishermen who are venturing into the sea for their survival and the marine

organisms are their only source of income. The Applicant further state that a lot of damage has already been wreaked. A coal conveyor from the harbour to the stack-yard has all but dammed the river, sparing it a meager opening. Further at the rainy season there is a mixing of rain water run off from the coal yard with the Buckingham canal and finally convergence with pulicat lake.

9. The Applicant further state that the 11th respondent action regarding coal conveyor from the harbour is causing pollution and destroyed the Kosasthalaiyar river, and has severely hampered fishing, in the process destroying the livelihood of fishermen. The fishing communities who were economically self-sufficient, are now dependent on exploitative low-paying factory jobs. Further the Kosasthalaiyar River and Pulicat Lake with the Bay of Bengal, is an important aquatic ecosystem. However, the encroachment and pollution caused have led to regular depletion of biodiversity in the region. The increasing pollution levels have affected the marine life, adversely affecting the livelihood of the fishing communities. The Ennore creek and pulicat lake is a suitable place for bio diversity and nursery ground for planktons, fish and prawns, the coal conveyor from the harbour to the stack-yard has all made adverse effect to the bio diversity of the area.

10. The Applicant further Submit that the dust particles from the coal is carried away by the wind and is falling over the water bodies. The leachate due to rain or by continuous water sparking over the coal yard shall perlocate in to the ground and contaminated the ground water. the 11th respondent had not provided treatment system in order to prevent the percolation of leachate to the ground water.

11. The Applicant further Submit that there is No adequate effluent treatment system for the treatment of waste water collected from the coal stack yard. The Applicant further state that the 11th respondent herein used to drain the waste water effluent in to the nearby canal which in turn flow through the Kosasthalaiyar river, without adopting proper method of treatment in result of the said act the toxic items mixed in the river water which resulted in the death of marine organisms. The applicant further state that there is a syndicate of companies who wanted to grab entire land of Kosasthalaiyar River therefore the applicant filed many number of application under Right to Information Act to furnish the details of they are constitution legal entity but due to they are Muscular, Financial and Political power they are holding up information given to the applicant therefore we restrict this application irrespect of 11th Respondent with a liberty to add the other companies attempting to grab the Kosasthalaiyar River.

12. The Applicant further state that the respondents therefore to ensure that the water pollution and the environmental pollution caused by the 11th respondent has to be permanently stopped by providing permanent solution. The 7th respondent had issued a reply to the applicants RTI letter that the 7th respondent had given permission to the 11th respondent only for Built Operate Transfer contract and the 11th respondent had to obtain further applicable permits that may be required for construction and operation of the terminal. But the 11th respondent had never applied for the required permission from the authorities. Since prevention is better than cure, instead of directing the 11th respondent not to cause destruction of water body and other natural resources, the attempt should be to strike a balance between development and preservation of ecology. Whenever it comes to the preservation of environment and natural resources there should be a joint effort by all concerned. It is not the look out of a section of the society alone in the matter of environmental or ecological issues. It should rather be taken as a social cause.

13. The Applicant further submit that the Kosasthalaiyar River originating from Arani and on rainy days due to flow of heavy water this Kosasthalaiyar River flourish with heavy water and leaves to Pazhaverkadu Lake. The Applicant further submit that as periodical affects court verdict and dictum no authority his entitled to Grab the

water bodies and river bodies therefore the present activities of the 11th Respondent actions into the Kosasthalaiyar River is highly contemporaneous. The Applicant have therefore no other alternative that to pray for ad interim injunction restraining the 11th Respondent from polluting the Kosasthalaiyar River.

14. The Applicant further submit that in the interest of the entire community the balance of convenient in the fall over of the society and if had the ad interim injunction his not granted his prayed for there would be grave irreparable loss to the society.

GROUND:

- i) The 1st to 10th Respondent are allowing the irregular activities of the 11th respondent which cause several hardship to the residents and the fishermen communities in the Thiruvallur and across the area.
- ii) The Respondents have not initiated any steps to look over the welfare of the fishermen hamlet and the local residents for their lively hood in spite of agitation conducted by the aggrieved people.
- iii) The above Respondents had failed to enforce their Constitutional duties and responsibilities to check the activities of the 11th respondent who is polluting and encroaching the Kosasthalaiyar River for the coal conveyor from the harbour to the stack-yard has all made adverse effect to the bio diversity of the area and

endanger the life of the Fishermen Community which in turn has vastly compromised the ability of the river to carry floodwaters.

- iv) The respondents failed to achieve the ecological balance health and social impact before the expansion plans.
- v) Due to the act of the 11th respondent it had affected the river Kosasthalaiyar, adversely affecting the nursery ground for planktons, fish and prawns and the livelihood of the fishing communities.
- vi) The 11th Respondent by violating the apex court order directing the authorities all over India not to grab water bodies, river bodies.
- vii) The 11th Respondent with Muscular, Financial and Political influence attempting to grab the land of Kosasthalaiyar River for the coal conveyor from the harbour to the stack-yard.

LIMITATION :

The applicant further declares that he had sent the Representation dated 23.05.2016 to the 1 to 6 and 8 to 10 respondent regarding the pollution caused by 11th respondent herein. In spite of representation the 1 to 6 and 8 to 10 respondents are not taken any action to stop the pollution caused by the 11th respondent and hence this application is within the period of limitation and the applicant declares that the subject matter is within the jurisdiction of this Hon'ble Tribunal.

INTERIM RELIEF:

- i) It is respectfully prayed that this Hon'ble Court may be pleased to appoint an advocate commissioner to hold an enquiry at

(12)

Kosasthalaiyar River where the 11th respondent had made encroachment and had polluted the environment. So that to reinstate the river in its natural extent.

ii) It is also respectfully prayed that this Hon'ble Court pleased to grant ad interim injunction pending disposal of the above main petition restraining the 11th Respondent from polluting the Kosasthalaiyar River (Via. Ennore).

iii) It is respectfully prayed that this Hon'ble Court may be pleased to constitute expert committee in order to inspect and submit a report regarding the environmental pollution and the adopting methods of treating the water effluent by the 11th respondent company prior to the disposal of the same in order to ascertain the compliance of the rules and norms of the 11th respondent and to Test the pollution level in the area where the 11th respondent factory effluent is mixing.

iv) It is respectfully prayed that this Hon'ble Court pleased to grant ad interim injunction pending disposal of the above main petition restraining the 11th Respondent from polluting the Kosasthalaiyar River (Via. Ennore) from transferring the coal through conveyor belt from the harbour to the stack-yard.

MAIN RELIEF PRAYED FOR:

It is therefore prayed that this Hon'ble Tribunal may be pleased to issue direction to the 1 to 6 and 8 to 10 respondent to initiate appropriate action against the 11th respondent for

encroaching the Kosasthalaiyar River and from polluting the Kosasthalaiyar River (Via.Ennore) from transferring the coal through conveyer belt from the harbour to the stack-yard Thereby polluting and affecting the livelihood of the fishing communities and in the ends of justice and pass such other order or orders as this Hon'ble may deem fit and proper in the circumstances of the case and thus render justice.

APPLICANT

COUNSEL FOR APPLICANT

VERIFICATION

I, **M.R.THIYAGARAJAN**, Son of Mr.C.Rajalingam, Hindu, aged 50 years, President **MEENAVA THANTHAI K.R.SELVARAJ KUMAR MEENAVAR NALA SANGAM**, having office at No.15/8, A.J.Colony, Royapuram, Chennai-600 013 hereby declare that the contents of paragraphs stated above are true to my personal knowledge and are believed to be true on legal advice and I have not suppressed any material fact.

Place : Chennai
Date :

APPLICANT

(14)

**BEFORE THE HON'BLE NATIONAL GREEN BENCH TRIBUNAL AT
CHENNAI (SZ)**

MEMORANDUM OF APPLICATION
[UNDER SECTION 18(1) R/W SECTION 14 OF THE NATIONAL GREEN
TRIBUNAL ACT., 2010]

APPLICATION NO. **172** OF 2016 **(CSZ)**

BETWEEN :

MEENAVA THANTHAI K.R.SELVARAJ KUMAR

MEENAVAR NALA SANGAM

(Registered under section 10 of the Tamil Nadu
Societies Act, in SI.No. 205 of 2015 dated 26.06.2015)

Represented by its president,

M.R.THIYAGARAJAN ,

S/o Late C.Rajalingam,

Office at No.15/8,

A.J.Colony,Royapuram,

Chennai-600 013.

... Applicant

AND

1. The Chief Secretary,

Government of Tamil Nadu,

Secretariat,

Chennai- 600 009 and 10 others.

... Respondents

VERIFYING AFFIDAVIT OF M.R.THIYAGARAJAN

I, **M.R.THIYAGARAJAN**, Son of Mr.C.Rajalingam, Hindu, aged
50 years, President **MEENAVA THANTHAI K.R.SELVARAJ KUMAR**
MEENAVAR NALA SANGAM, having office at No.15/8, A.J.Colony,

Royapuram, Chennai-600 013, do hereby solemnly affirm and sincerely state as follows:

1. I state that I am the Applicant herein and as such am well acquainted with the facts of the case and submit as follows:
2. I do hereby declare and verify what are all stated in the Application paragraphs are true and correct to the best of my knowledge and belief.

Solemnly affirmed at Chennai on
this the day of July 2016 and
signed his name in my
presence.

}

BEFORE ME,

ADVOCATE, CHENNAI

BEFORE THE NATIONAL GREEN TRIBUNAL
SOUTHERN ZONE, CHENNAI

Application No.172 of 2016 (SZ)

In the matter of

1. Meenava Thanthai K.R.Selvaraj K.Umar
Meenavar Nala Sangam,
Rep. by its President M.R.Thiyagarajan
No.15/8, A.J.Colony, Royapuram,
Chennai 600013

Vs.

Applicants

1. The Chief Secretary,
Government of Tamil Nadu, Secretariat,
Chennai 600009
 2. The State of Tamil Nadu
Rep. by its Secretary to Government,
Forest Department, Fort. St. George,
Chennai 600009
 3. The State of Tamil Nadu,
Rep. by its Secretary to Government,
Fisheries Department,
Fort. St. George, Chennai 600009
 4. The State of Tamil Nadu,
Rep. by its Secretary to Government,
Environment Department,
Fort St. George, Chennai 600009
 5. The State of Tamil Nadu
Rep. by its Secretary to Government,
Public Works Department,
Fort St. George, Chennai 600009
 6. The District Collector,
Thiruvallur District, Thiruvallur.
-
7. Kamarajar Port Limited,
Rep. by its Chairman,
4th Floor, Super Speciality Diabetic Centre,
(Erstwhile DLB Building)
Rajaji Salai, Chennai 600001
 8. The Chairman,
Tamil Nadu Pollution Control Board,
No.76, Mount Salai, Guindy, Chennai 600032
 9. The Executive Engineer,
Water Resources Department,
Araniaaru Irrigation Division,
Chennai Mandal, Chennai 600005

10. The Joint Chief Environmental Engineer,
(Monitoring)
77A, South Avenue Road,
Ambattur Industrial Estate,
Ambattur, Chennai 600058

11. M/s.Chettinad International Coal Terminal
Pvt. Ltd.
Rep. by its Managing Director,
No.603, Rani Seethai Hall, Fifth Floor,
Anna Salai, Chennai 600006

Respondents

Counsel appearing for the applicant:

Mr.K. Mageshwaran

Counsel appearing for the respondents

M/s.M.K.Subramanian & P.Velmani for R1 to R6 & R9

Mr.M.T.Arunan for R7

Mrs.Yasmeen Ali for R8 & R10

M/s.T.Balaji, P.S.Ganesh,

Mr.Praveen Kumar for R11

ORDER

Present

Hon'ble Shri Justice Dr.P. Jyothimani, Judicial Member

Hon'ble Shri P.S.Rao, Expert Member

5th December, 2016

We have heard learned counsel appearing for the applicant as well as respondents.

The prayer in this application is for a direction against respondent Nos.1 to 10 to initiate action against respondent No.11 for encroaching and polluting Kosasthalaiyar River while transferring the coal through conveyor belt from harbour to stock yard, thereby affecting the livelihood of the fishing community.

2. Mr.Sridhar, learned counsel appearing for the applicant would submit that in respect of certain other issues relating to 11th respondent, the applicant has already moved this Tribunal.

3. In so far as this case is concerned, the records filed even by the applicant show that the 11th respondent has been carrying on transportation of coal from harbour to stock yard through the closed conveyor belt and there is no possibility of causing pollution. In fact on the last date of hearing when an issue was raised about the discharge of effluents by the 11th respondent into Kosasthalaiyar River, an undertaking was given by the learned counsel appearing for the 11th respondent that no untreated effluents will be discharged into the Kosasthalaiyar River. In view of the said undertaking, the conduct of the 11th respondent in not discharging the untreated effluents into Kosasthalaiyar River has been ensured.

4. Regarding the prayer in this application about the transfer of coal through conveyor belt from harbour to stock yard of 11th respondent, it is not the case of the applicant that the conveyor belt which according to 11th respondent is a closed one, there has been any leakage or the same has not been maintained properly.

5. We make it clear that the 11th respondent shall properly maintain the closed conveyor belt and shall see that no leakage takes place at any point of time. In the event of any such failure as stated by the 11th respondent, it will be always open to the applicant to approach this Tribunal for necessary relief. We also further make it clear that the disposal of this application does not in any way affect the right of the applicant to proceed with another application stated to have been filed by the applicant and pending before this Tribunal.

With the above direction, the application stands closed. There shall be no order as to cost.



Sd/-
Justice Dr. P. Jyothimani
Judicial Member

Sd/-
Shri P.S.Rao
Expert Member

(i) Copy of the application 1047/16
 (ii) Name of the applicant M. H. T. Arunan
 (iii) Date of presentation of application 16.12.16
 (iv) No. of copies 3
 (v) Category Urgent/Ordinary
 (vi) Date of preparation of copy 19.12.16
 (vii) Date on which copy is ready 19.12.16
 (viii) Date given for collection of copy 19.12.16
 (ix) Date of delivery 19.12.16

For Registrar

Awasanthi

Signature 19.12.16

Certified that this is a true copy of the
 document of order as in the case of
 (Application / Appeal No. 1047 of 2016)
 and that all the matters appearing therein
 have been legibly and faithfully copied
 with no modifications.

Awasanthi

For Registrar (NOT)

Southern Zone 19.12.16





காமராஜர் துறைமுக நிறுவனம்

कामराजर पोर्ट लिमिटेड

Kamarajar Port Limited

(A Mini Ratna Government of India Undertaking)

No: KPL/OP/B/95.09/2016-18

Date: 09.08.2017

To
The Member Secretary,
TamilNadu Pollution Control Board,
76, Mount Salai, Guindy,
Chennai-600032

Sir,

Sub: TNBC Board – TS 1 Section- M/s Kamarajar Port Limited, Puzhthivakkam
Village, Vallur Post, Ponneri Taluk, Tiruvallur Dt., Meeting held on
20.01.2017 in Conference Hall TNPCB - furnishing relevant records- Reg.
Ref: Member Secretary's Lr. No: TS1/TNPCB/F.9801/2017 dated 03.08.2017.

Kind attention is invited to the reference cited on the subject matter.

Regarding Sl.No-1: Most of the dredged material dumped in areas attracting CRZ has been removed. Action has been taken to completely remove the residue leftover of the dredged materials of the dumped materials and the same will be completed within 10 days.

Regarding Sl.No.2: Total quantity of dredged materials removed from the area attracting CRZ is about 73,000 cum and the same was disposed at area not attracting CRZ as shown in the drawing attached.

In this regard the copy of the work order dated 06.01.2017 for removing the dredged materials and compliance report submitted to Hon'ble National Tribunal are enclosed for your kind reference.

Yours faithfully,

P.Radhakrishnan
Deputy General Manager (C)

Encl: As above.

Copy to : GM(MS) / GM(Ops)

ES to CMD

} for information please.

Registered Office & Trade Facilitation Centre :

4th Floor, Super Speciality Diabetic Centre
(erstwhile DLB Building)
Rajaji Salai, Chennai - 600 001.
Ph : 044-25251666-70 Fax : 044-25251665
CIN: U45203TN1999GOI043322

पंजीकृत कार्यालय & व्यवसाय सुविधा केन्द्र :

चौथी मंजिल, सुपर स्पेशलिटी डायबेटिक सेन्टर,
(डी एल बी बिल्डिंग)
राजाजी सलाई, चेन्नई-600 001.
फोन : 044-25251666-70 फैक्स : 044-25251665

website : www.ennoreport.gov.in **e-mail :** info@epl.gov.in
Kamarajar Port - India's Port of the Millennium

Port Office : Vallur Post, Chennai - 600 120
Ph : 044-27950030-40 Fax : 044-27950002

पोर्ट कार्यालय : वल्लूर पोस्ट, चेन्नई - 600 120
फोन : 044-27950030-40 फैक्स : 044-27950002

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL
SOUTHERN ZONE, CHENNAI**

APPLICATION No.8 of 2016 (SZ)

Thiru.R. Ravimaran
Ennore
Chennai

...Applicant.

-Vs-

1. Union of India,
The Ministry of Environment, Forests and
Climate Change, Jorbagh,
New Delhi
2. Tamil Nadu Generation and Distribution
Corporation (TANGEDCO)
Rep.by its Chairman cum Managing Director,
10th Floor, NPKRR Maaligai,
144, Anna Salai,
Chennai-600 002
3. North Chennai Thermal Power Station,
Rep.by its Chief Engineer,
Athipattu, Chennai,
Thiruvallur (District)
Chennai-600 120
4. Kamarajar Port Limited (Erstwhile Ennore Port Limited)
Rep.by its Chairman cum Managing Director,
4th floor, Super Specialty Diabetic Centre,
(Erstwhile DLB building)
Near Clive Battery Bus Stop
Rajaji Salai, Chennai-600 001
5. The Tamil Nadu Pollution Control Board,
Rep.by its Member Secretary,
76, Mount Salai, Guindy,
Chennai-600 032.
6. The District Environmental Engineer,
Tamil Nadu Pollution Control Board,
77-A, South Avenue Road,
Ambattur Industrial Estate,
Ambattur Taluk, Chennai-600 028



Fort St. George,
Chennai-600 009.

6. The District Collector,
Thiruvallur District,
Thiruvallur

7. The Revenue Divisional Officer,
RDO Office, Ponneri
Thiruvallur District.

8. The Chairman,
Tamil Nadu Pollution Control Board,
No.75, Mount Salai,
Guindy, Chennai-600 032.

...Respondents.

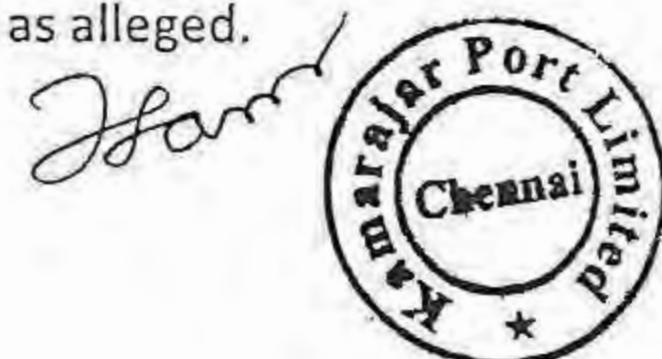
**REPLY TO THE REPORT FILED BY THE ADVOCATE
COMMISSIONER APPOINTED BY THE HON'BLE NATIONAL
GREEN TRIBUNAL (SZ) CHENNAI VIDE ORDER DATED 31st
MAY 2017**

The Respondent begs to state as follows:

1. The address for service of all notices of the 4th Respondent is that of their Legal Counsel Shri.M.T.Arunan for 4th Respondent is at No.162, Additional Law Chambers, High Court Buildings, Chennai-600 104.

2. It is submitted that regarding site No.1 & 2, it is informed that the dumped sand was removed by using mechanical equipment. If the mechanical equipment is operated very near to the mangroves area, destruction of mangroves will be inevitable. Hence certain quantity of dredged materials was leftover near mangroves area and the same has been observed by the Advocate Commissioner during the inspection. In the remaining area, some residues of the dredged material were leftover since it was removed by mechanical equipment. After the inspection, action has been taken immediately to remove the residues leftover of the dredged materials and most of the materials were removed (photo copies enclosed for perusal). Action is being taken to completely remove the residue of the dumped materials and the same will be completed within 10 days time.

3. It is further submitted that as for as the mud road is concerned, the road leading to the Kosasthalaiyar in the southern portion of Site No.2 was in existence before the transfer of land from Salt Department to KPL and it is not formed by KPL as alleged.





காமராஜர் துறைமுக நிறுவனம்

कामराजर पोर्ट लिमिटेड

Kamarajar Port Limited

(A Mini Ratna Government of India Undertaking)

Work order No. KPL/OP/CONSTN/059/2016-17

KPL/OP/ B/95.15/2016-17

Dated: 06.01.2017

To

M/s. N.Mohamed Jamaluddin,
No.23, South lock road, Ennore,
Chennai 600057.

Sir,

Subject: Removing the dredged materials dumped in the KPL land transferred from salt department-Issue of Letter of Acceptance -Reg.

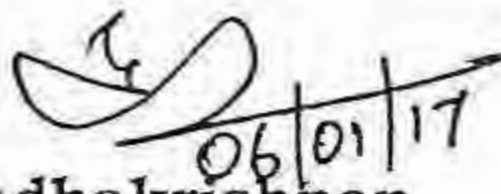
Ref :1.KPL Tender No.KPL/OP/B/95.07/2016-17
2. Your bid submission letter dated 23.12.2016

Kamarajar Port Limited is pleasure to inform that your bid for “**Removing the dredged materials dumped in the KPL land transferred from salt department**” has been accepted at the quoted price of **Rs. 76,27,100/-** (Rupees Seventy six Lakhs twenty seven thousand and one hundred only).

You are requested to **furnish Performance Guarantee (5% of the contract price) of Rs.3,81,355/- (Rupees three Lakhs eighty one thousand three hundred and fifty five only)** in the form of Bank Guarantee or Demand Draft within **21 (Fourteen) days** of the receipt of this “Letter of Acceptance” in accordance with as per *clause 30.1* of ITB of tender document and sign the Agreement within **14 (Fourteen) days** in accordance with *Clause 29.3* of ITB.

Deputy General Manager (C) is the Engineer-in-charge for this work. All other terms and conditions as stipulated in the tender document and subsequent clarifications shall be abided.

Yours faithfully,


P.Radhakrishnan
Deputy General Manager (C)


06/01/17

Registered Office & Trade Facilitation Centre :
4th Floor, Super Speciality Diabetic Centre
(erstwhile DLB Building)
Rajaji Salai, Chennai - 600 001.
Ph : 044-25251666-70 Fax : 044-25251665
CIN: U45203TN1999GOI043322

पंजीकृत कार्यालय & व्यवसाय सुविधा केन्द्र :
चौथी मंजिल, सुपर स्पेशलिटी डायबेटिक सेन्टर,
(डी एल बी बिल्डिंग)
राजाजी सलाई, चेन्नई-600 001.
फोन : 044-25251666-70 फैक्स : 044-25251665

website : www.ennoreport.gov.in e-mail : info@epl.gov.in
Kamarajar Port - India's Port of the Millennium

Port Office : Vallur Post, Chennai - 600 120
Ph : 044-27950030-40 Fax : 044-27950002
पोर्ट कार्यालय : वल्लूर पोस्ट, चेन्नई - 600 120
फोन : 044-27950030-40 फैक्स : 044-27950002



Area 1 - South side of NCTPS Road



Area 1 - South side of NCTPS Road

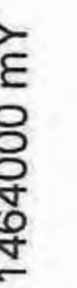


Area 2 -West side of Port Access Road



Area 2 -West side of Port Access Road

427000 mX



SPHEROID : WGS 84

Form-I for seeking clearance for project attracting CRZ notification**(I) Basic information:**

Name of the Project: DEVELOPMENT OF THE FACILITIES ENVISAGED IN THE PORT MASTER PLAN (PHASE III) OF KAMARAJAR PORT LIMITED.

Project Details:

S.No	Description	Qty in Nos.	Capacity (MTPA)
1	Automobile export / import terminal	2	6
2	Container terminal- 1000m quay length (3 berths)	1	24
3	Marine Liquid Terminal	1	5
4	IOC captive jetty	1	5
5	Bulk terminal	2	18
6	Multi cargo berth	1	2
7	And associated capital dredging for the above projects	33.0 million m ³	

S. No	Particulars	Remarks
1.	Location or site alternatives under consideration	Alternative site does not arise. This falls under the category of expansion. Already Phase I has been completed and Phase II is under progress. The present proposal is Phase III expansion. The port has been so planned to make provision for future developments in a phased manner in accordance with the port Master Plan. The proposed projects on expansion are already included in the port layout and within the port boundary limits under the direct control

		of Kamarajar Port Limited. The project will not involve any new land acquisition or re-settlement / re-habilitation.
2.	Size of the project (in terms of total area)	Project area: About 100 Ha. out of 1130 Ha.
3.	CRZ classification of the area	The proposed activity as envisaged in Port Master Plan (Phase-III), the facilities and the CRZ zone is as follows:

S.NO	FACILITIES	CRZ ZONE
i.	Development of additional 10 Berths	CRZ III, CRZ I B, CRZ IV A
ii.	Dredging & Disposal	CRZ III, CRZ I B, CRZ IV A
iii.	Development of Bulk Cargo Stack yard	NO CRZ ZONE
iv.	Development of Multi Cargo Stack yard	CRZ III
v.	Construction of Automobile Park yard	CRZ III
vi.	Construction of Container Park yard	CRZ III
vii.	Construction of MLT Storage tank	NO CRZ ZONE
viii.	Erection of Liquid Pipeline	CRZ III, CRZ I B, CRZ IV A
ix.	Construction of Bulk Cargo Conveyor belt	CRZ III, CRZ I B

S. No	Particulars	Remarks
4.	Location or site alternatives under consideration	Alternative site does not arise. This falls under the category of expansion. Already Phase I has been completed and Phase II is under progress. The present proposal is Phase III expansion. The port has been so planned to make provision for future developments in a phased manner in accordance with the port Master Plan. The proposed projects on expansion are already included in the port layout and within the port boundary limits under the direct control of Kamarajar Port Limited. The project will not involve any new land acquisition or re-settlement / re-habilitation.
5.	Size of the project (in terms of total area)	Project area: About 100 Ha. out of 1130 Ha.
6.	CRZ classification of the area	The proposed activities as envisaged in Port Master Plan (Phase-III) falls partly with 500m from HTL.
7.	Expected cost of the project	Rs. 64150 million
8.	Contact Information KAMARAJAR PORT LIMITED (Erstwhile Ennore Port Limited) 4 th Floor, Super Speciality Diabetic Centre (erstwhile DLB building) Near Clive Battery Bus Stop Rajaji Salai Chennai – 600 001 Phones: +91-44-25251666 (5 lines) Fax: +91-44-25251665 Email: info@epil.gov.in	

(II) Activity

1. Construction, operation or decommissioning of the Project involving actions, which will cause Physical changes in the locality (topography, land use, changes in water bodies, and the like)

S. No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)	No	All the marine facilities are planned within the enclosed and protected port basin by breakwater system. The backup facilities are planned at the port owned land within its boundary and in fact, the developments are all confined within the port seaward and landward boundary limits. Hence the assessment of the intensity of land use with respect to local land use plan is not applicable in this case.
1.2	Details of CRZ classification as per the Approved Coastal Zone Management Plan?	Yes	Please refer item No.3.0
1.3	Whether located in CRZ-I area?	No	Refer item No. 3.0.
1.4	The distance from the CRZ-I areas.	No	Refer item No.3.0
1.5	Whether located within the hazard zone as mapped by Ministry of Environment and Forests/National Disaster Management Authority?	Yes	Cyclone - very high damage risk zone B Tsunami Earthquake - Zone III i.e., moderate risk zone
1.6	Whether the area is prone to cyclone, tsunami, tidal surge, subduction, earthquake etc.?	Yes	Same as 1.5
1.7	Whether the area is prone for saltwater Ingress?	No	Open sea
1.8	Clearance of existing land, vegetation and Buildings?	Yes	All the backup facilities for the proposed development are planned within the port area and hence clearance of existing land doesn't arise.
1.9	Creation of new land uses?	No	As the proposed project is within port and its ancillary area, there will be no change in land use.
1.10	Pre-construction investigations e.g. bore hole, soil testing?	Yes	Already done. And more site specific Geotechnical and soil investigations are proposed to be

S. No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
			done as a part of investigation activities during detailed planning stage.
1.11	Construction works?	Yes	The expansion involves construction of 10 berths in port basin and its associated backup facilities planned at the port owned land within its boundary.
1.12	Demolition works?	No	Doesn't arise
1.13	Temporary sites used for construction works or housing of construction workers?	No	Workers camp will not be permitted inside the port limits.
1.14	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations	Yes	The required operational buildings associated with container terminal, automobile export, covered storage areas for multipurpose etc provided in the areas already earmarked for each facility.
1.15	Underground works including mining or Tunneling?	No	Nil
1.16	Reclamation works?	No	The total quantity of capital dredging for Phase III development will be $33 \times 10^6 \text{ m}^3$. KPL has proposed to dispose the entire volume at the designated offshore disposal location or to use a minor part of the dredge sediments for land reclamation/ beach nourishment if necessity arise. In that case, the dredging quantity of 5×10^6 - $10 \times 10^6 \text{ m}^3$ will be used for reclaiming the area between north of north break water to the northern boundary of the port (1.8 km length). Also the dredged sand can be utilized for reclaiming the land associated with Northern Rail Connectivity projects and other projects based on requirement. The rest of 23×10^6 - $28 \times 10^6 \text{ m}^3$ will be

S. No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
			disposed into the sea at a suitable location offshore.
1.17	Dredging/reclamation/land filling/disposal of dredged material etc.?	Yes	Same as 1.16
1.18	Offshore structures?	Yes	Wharves and jetties within the port basin together with the approaches will form part of offshore structures.
1.19	Production and manufacturing processes?	No	Not applicable
1.20	Facilities for storage of goods or materials?	Yes	Facilities for the storage liquid bulk cargo will be provided at the tank farm to be established on port land. Similarly for container storage, just behind the wharf, 500 m width of land is available which serve as container park. For car export, suitable areas are earmarked as open areas. For the storage of dry bulk cargo and routing of conveyor belts such as Coal, Iron ore, Limestone/Cement/Slag/Dolomite, HR Coil/Aluminium, storage areas are earmarked commensurate with location of berth vis a vis area required.
1.21	Facilities for treatment or disposal of solid Waste or liquid effluents?	Yes	The construction is planned in stages at different schedules. At any point in time, not more than 400 labour is expected. The average per capita solid waste generated will be of the order of 210 gm/person/day. Adequate facilities for disposal of solid waste and sewage shall be developed. The project activity pertains to cargo handling, storage and transport of cargo, no direct waste is generated. Reception facilities as

S. No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
			per MARPOL are already available.
1.22	Facilities for long term housing of operational workers?	No	As the project activities pertain to cargo unloading from the ships through mechanized shore based gantry cranes, the project does not attract any huge quantity of man power warranting long term housing facilities.
1.23	New road, rail or sea traffic during construction or operation?	Yes	The proposed port area is well connected by road and rail connectivity. During the Operation Phase sea traffic will prevail as it is the port expansion project.
1.24	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?	No	Not applicable
1.25	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	No	Not applicable
1.26	New or diverted transmission lines or Pipelines?	No	Not applicable
1.27	Impoundment, damming, culverting,realignment or other changes to the hydrology of watercourses or aquifers?	No	Not applicable
1.28	Stream and river crossings?	No	Nil
1.29	Abstraction or transfers of water form ground or surface waters?	No	Not applicable
1.30	Changes in water bodies or the land surface affecting drainage or run-off?	No	Not applicable
1.31	Transport of personnel or materials for construction, operation or decommissioning?	Yes	Men and material for the construction purpose is available locally. Road access is available for transportation. Approx 30-50 cars

S. No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
			& 10 bus trips per day during construction phase and approx 2-3 car trips & 6-10 buses per day trips during operation phase for carrying of passengers. Approx 50 truck trips per day of construction material during construction phase.
1.32	Long-term dismantling or decommissioning or restoration works?	No	Not applicable
1.33	Ongoing activity during decommissioning which could have an impact on the environment?	No	Not applicable
1.34	Influx of people to an area in either temporarily or permanently?	No	About 100-150 labour and technical staff will be employed during construction phase of the proposed berths. The construction labour coming from nearby areas shall go back to their houses on completion of their daily activities on completion of construction activities.
1.35	Introduction of alien species?	No	-
1.36	Loss of native species or genetic diversity?	No	-
1.37	Any other actions?	No	-

2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):

S. No.	Information/checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural land (ha)	No	-
2.2	Water (expected source &	No	During project construction and

	competing users) unit: KLD		operation phases water would be required for meeting domestic requirements for construction staff / technical staff. The total water requirement for meeting domestic requirements during construction phase shall be 135m ³ /day @ 135 lpcd. Labour population during operation phase: 15 lpcd x 100 = 1.5 m ³ /day. Arrangements are being made for the supply of water with Chennai Metro(CMWSSB) at a quantity of 1000 KLD.
2.3	Minerals (MT)	No	-
2.4	Construction material – stone, aggregates, sand/soil (expected source – MT)	Yes	The details of Construction material shall be finalized during execution of work.
2.5	Forests and timber (source – MT)	No	-
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)	Yes	The power for construction will be arranged from local source. However, provisions shall also be made for diesel generating set of adequate capacity to be used as back up during power cut and emergency.
2.7	Any other natural resources (use appropriate standard units)	No	-

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)	Yes	Marine liquid terminal and IOC jetty are the two installations handling POL, LPG etc under strict safety requirements as enforced by the statutory authorities including OISD. IOC are well versed in this kind of operation. As such no adverse impact to human health and

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
			the environment in general is envisaged.
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	No	The proposed project or its activities does not attract any changes in occurrence of disease or affect disease vectors.
3.3	Affect the welfare of people e.g. by changing living conditions?	No	The construction of the project will give a boost to employment opportunity in the area. The proposed project has no negative effect on the welfare of the people. There shall be no re-settlement / rehabilitation of population due to the project.
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.	No	No people will be affected by the project. The proposed project will be located inside the port premises, which is located in an uninhabited and remote area located away from the main city of Chennai. No hospitals or schools are located in the vicinity of the port.
3.5	Any other causes, that would affect local communities, fisher folk, their livelihood, dwelling units of traditional local communities etc	No	Nil

4. Production of solid wastes during construction or operation or decommissioning (MT/month)

S.No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	Yes	The waste generated during construction phase shall be used for land filling and restoration of the project site. The balance, if any shall be disposed at designated sites in an

			appropriate manner.
4.2	Municipal waste (domestic and or commercial wastes)	Yes	Garbage like floating materials, packaging, polythene or plastic materials etc collected from the ships are segregated and send to various recycling units. Hazardous waste is send to TSDF.
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)	No	Same as 3.1
4.4	Other industrial process wastes	No	-
4.5	Surplus product	No	-
4.6	Sewage sludge or other sludge from effluent treatment	Yes	During construction phase, septic tanks will be cleaned once in six months or at appropriate interval and the sludge so generated shall be disposed at the designated landfill site finalized in consultation with district administration.
4.7	Construction or demolition wastes	No	-
4.8	Redundant machinery or equipment	No	-
4.9	Contaminated soils or other materials	No	-
4.10	Agricultural wastes	No	-
4.11	Other solid wastes	No	-

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

S.No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources	Yes	The operation of various construction equipments requires combustion of fuel like diesel. The major pollutant which gets emitted as a result is SO ₂ . The short term increase in SO ₂ , even assuming all the equipments are operating at a common point is expected to be

S.No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
			quite low. Thus, no adverse impacts on ambient air quality are anticipated. During operation phase, most of the cargos handling equipments are electrically operated.
5.2	Emissions from production processes	No	Not applicable
5.3	Emissions from materials handling including storage or transport	Yes	Same as 5.1
5.4	Emissions from construction activities including plant and equipment	Yes	Same as 5.1
5.5	Dust or odours from handling of materials including construction materials, sewage and waste	Yes	Methods for controlling dust emission like water sprinkling in the construction site, use of proper transport methods such as conveyor belt for excavated material and screens around the construction site will be carried out.
5.6	Emissions from incineration of waste	No	-
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	No	-
5.8	Emissions from any other sources	No	-

6. Generation of Noise and Vibration, and Emissions of Light and Heat:

S.No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers	Yes	Noise will be generated during construction phase as a result of operation of construction equipment. The noise (dB(A)) likely to be generated due to operation of

			various construction equipment is given as below, Floating pontoon with mixer machine and crane-70; Winch machine-80; Transit mixer-75; Dumpers-75; Generators-85; Batching plant-90; Air compressors-90.
6.2	From industrial or similar processes	No	-
6.3	From construction or demolition	No	-
6.4	From blasting or piling	Yes	About 90 dB(A). No blasting is envisaged.
6.5	From construction or operational traffic	Yes	During construction phase, construction material will be brought to the project site mainly by road. This will lead to increase in vehicular movement for transportation of construction material. During project operation phase most of the operations are electrically operated, which does not create much noise. Detailed modeling studies shall be conducted to assess the increase in ambient noise level due to various sources during project construction or operation phases.
6.6	From lighting or cooling systems	No	-
6.7	From any other sources	No	-

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea

S.No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials	No	Emergency handling plan will be available while handling hazardous cargo from the MLTs since the port is already handling such cargo even now. The existing safety measures will be

			extended to the proposed 2-MLTs as well.
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)	No	No industrial sewage will be generated due to the project. Waste generated due to domestic and sanitary waste will be discharged through septic tank and soak pit.
7.3	By deposition of pollutants emitted to air into the land or into water	No	-
7.4	From any other sources	No	-
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	No	-

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment

S.No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	No	The port is already handling POL products at the existing MLT-1 and the same safety measures will be extended to the proposed additional 2 MLTs.
8.2	From any other causes	No	
8.3	Could the project be affected by natural disasters causing environmental damage (e.g., floods, Earthquakes, landslides, cloudburst etc)?	Yes	During the design stage, the possible effects of natural disasters will be considered and necessary precautionary measures would be built-in and implemented. However, landslide and cloudburst are rare occurrences not reported so far in the ports.

9. Factors which should be considered (such as consequential development) which could lead to Environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality

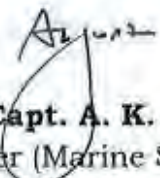
S.No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
9.1	Lead to development of supporting facilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.) housing development extractive industries supply industries other	Yes	About 100 - 150 persons are likely to be deployed during construction phase. The availability of infrastructure could be a problem during the initial construction phase. As a part of Environmental Management Plan, following facilities shall be developed for the construction staff/ technical staff likely to be deployed during project construction phase : • Potable water supply • Community toilets and sewage treatment • Solid waste collection and disposal facilities.
9.2	Lead to after-use of the site, which could have an impact on the environment	No	-
9.3	Set a precedent for later developments	Yes	Due to increased activities, the economy of the local population will improve significantly in the project area and its surrounding.
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects	No	-

III. Environmental Sensitivity

S.No.	Areas	Name/ Identity	Aerial distance (within 15 km.) Proposed project location boundary
1	Areas protected under international conventions, national or local legislation for	No	-

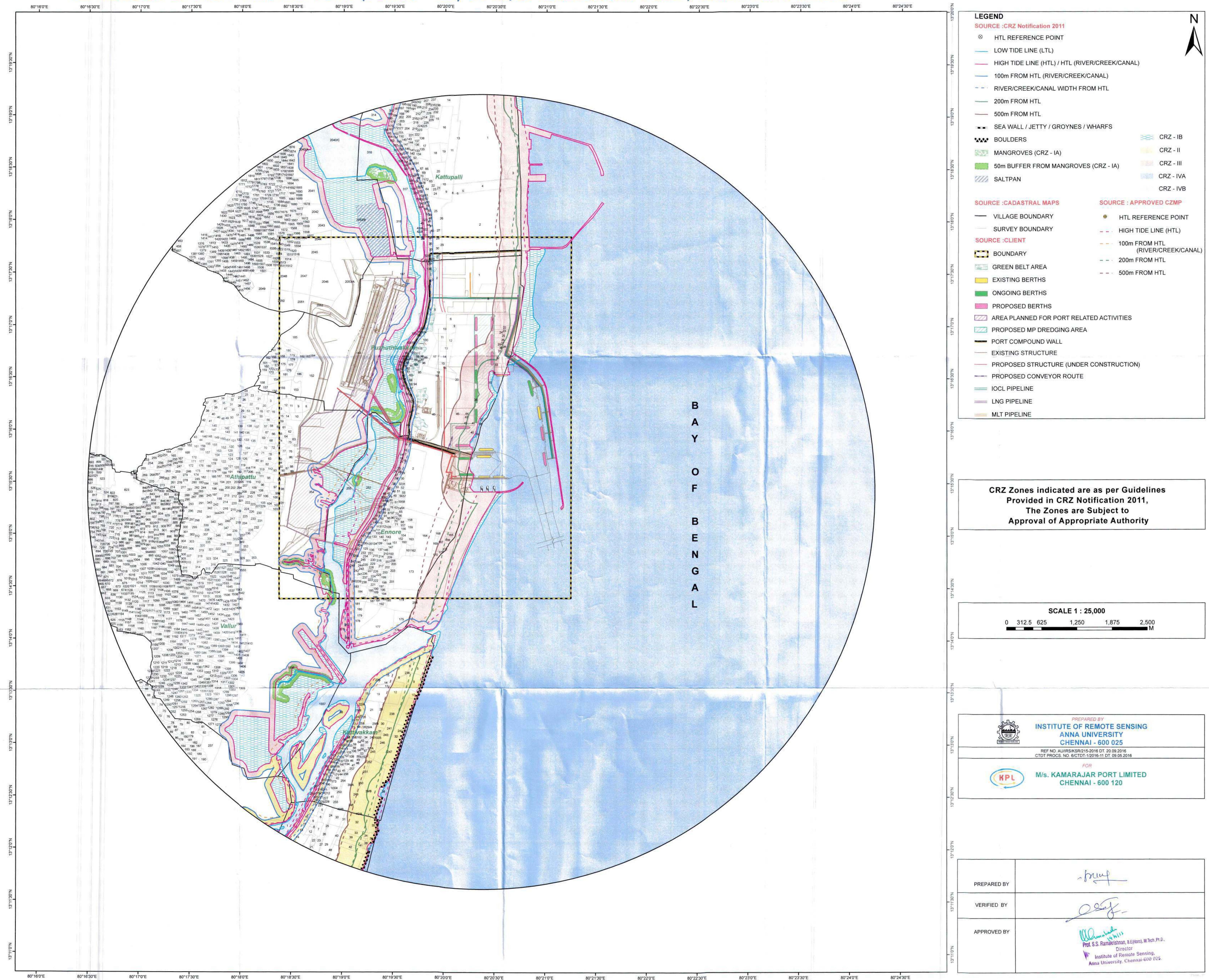
S.No.	Areas	Name/ Identity	Aerial distance (within 15 km.) Proposed project location boundary
	their ecological, landscape, cultural or other related value.		
2	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	Yes	<ul style="list-style-type: none"> • Kosathalaiyar River – 1.5 km West • Buckingham Canal – 1.3 km West • Ennore Creek – 1.4 km South
3	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	No	-
4	Inland, coastal, marine or underground waters	Yes	<ul style="list-style-type: none"> • Coastal waters of Bay of Bengal. • Kosathalaiyar River – 1.5 km West • Buckingham Canal – 1.3 km West • Ennore Creek – 1.4 km South
5	State, National boundaries	No	-
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	No	-
7	Defense installations	No	-
8	Densely populated or built-up area	No	
9	Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities)	No	
10	Areas containing important, high quality or scarce resources (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)	No	-
11	Areas already subjected to pollution or environmental damage. (those	No	-

S.No.	Areas	Name/ Identity	Aerial distance (within 15 km.) Proposed project location boundary
12	Areas susceptible to natural hazard which could cause the project to present environmental problems (earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions)	No	The present project and the port falls under seismic zone category II (Seismic Zoning Map of India), which has least chances for occurring of earthquakes. No high rise buildings will be constructed. The proposed project area is located in seismic zone category II (Seismic Zoning Map of India) as per IS 1893:2002. Adequate consideration for the seismic parameters shall be taken in the structural design of the Berth.


(Capt. A. K. GUPTA)
 General Manager (Marine Services)
 Kamarajar Port Limited
 (Erstwhile Ennore Port Limited)
 Port office: Near NCTPS Vallur post
 Chennai - 600 120

DEMARCATON OF HIGH TIDE LINE, LOW TIDE LINE (7Km RADIUS) FOR THE PROPOSED ACTIVITIES AS ENVISAGED IN PORT MASTER PLAN (PHASE - III) OF M/s. KAMARAJAR PORT, TAMILNADU STATE

Annexure-6



COMPREHENSIVE EIA AND EMP STUDIES FOR THE DEVELOPMENT OF THE FACILITIES ENVISAGED IN THE PORT MASTER PLAN - PHASE III FACILITIES

FINAL REPORT



**KAMARAJAR PORT LIMITED
CHENNAI**

Project Code: 533081516

SEPTEMBER 2017

ENVIRONMENTAL CONSULTANT



QS ISO 9001 Certified



QCI - NABET Accredited



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INDOMER COASTAL HYDRAULICS (P) LTD.

(ISO 9001 : 2015 CERTIFIED, NABET-QCI, NABL AND CDC- MoST ACCREDITED)

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Client	Kamarajar Port Limited, Chennai.				
Project Title	Comprehensive EIA and EMP studies for the Development of the facilities envisaged in the Port Master Plan - Phase III facilities.				
Project Code	533081516				
Abstract	<p>Kamarajar Port Limited is operating, at present, with six berths for handling coal, export/import of automobiles, Marine Liquid Terminal (MLT) etc. As Phase II development, six more berths for handling containers (two berths), LNG (one berth), coal (two berths) and multipurpose cargo (one berth) are under construction.</p> <p>In view of imminent growth potential as exemplified by the demand during the last few years, KPL has proposed to take up another set of following projects as Phase III development comprising of 10 berths, viz. i) Automobile import/export terminals - 2 Nos, ii) Container berths in 1000 m wharf (3 berths) - 1 No, iii) Marine Liquid Terminal - 2 No. iv) Dry bulk terminals - 2 Nos, v) Multi Cargo berth - 1 No.</p> <p>The comprehensive EIA and EMP studies has been conducted by Indomer Coastal Hydraulics (P) Ltd., Chennai, which is an ISO 9001:2015 organization, accreditation for preparation of DPR – Marine sector by Consultancy Development Centre, DSIR, Ministry of Science and Technology vide., CDC/ACC/2015/046, and NABET - QCI accredited organization vide NABET/ EIA/ 1417/ SA 009 for the sectors 27 and 33.</p> <p>The Public Hearing was conducted by the District Collector and TNPCB on 05.08.16. This report presents the final form of the Comprehensive EIA & EMP Report with three season studies covering pre monsoon, post monsoon and Fair weather periods in the year 2016 and 2017 and also after incorporating the necessary clarifications sought during the Public Hearing.</p>				
Foreword	The materials presented in the report carry the copy right of Kamarajar Port Limited, Chennai and Indomer Coastal Hydraulics (P) Ltd. and should not be altered or distorted or copied or presented in different manner by other organizations without the written consent from Kamarajar Port Limited and Indomer Coastal Hydraulics (P) Ltd.				
Document	Controlled				
References	Letter of Award No. KPL/MS/Env/FP/EC/2015 dt. 29.07.15				
Date	Report Type	Originator	Checked by	Approved by	Approver's Sign
15.09.17	Revised Final	√ V. Vaigaiarasi	Mr. K. Dharmalingam	Dr. P. Chandramohan	
25.01.17	Final	V. Vaigaiarasi/ E. Yeshwanthi	Mr. K. Dharmalingam	Dr. P. Chandramohan	
18.05.16	Draft	A.P. Anu	Mr. K. Dharmalingam	Dr. P. Chandramohan	
-	Project Code	533081516		Text pages	241
-	File Location	F:/2017 Projects/September 17/ 533. KPL		Tables	90
				Figures	57

Declaration by Experts contributing to the EIA

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

EIA Coordinator:




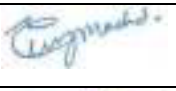

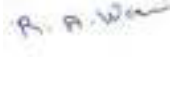
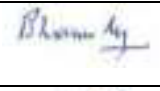

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Declaration by the Head of the Accredited Consultant Organization/authorized person

I, Dr. P. Chandramohan, hereby, confirm that the above mentioned experts were involved in preparation of this EIA report entitled "*Comprehensive EIA and EMP studies for the development of facilities envisaged in the Port Master Plan - Phase III facilities*". I also confirm that the consultant organization shall be fully accountable for any misleading information mentioned in this statement.

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NABET/EIA/1417/SA 009 & 27.04.16

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EXECUTIVE SUMMARY

E1. Background

The Kamarajar Port formerly known as Ennore Port was declared as the 12th Major Port of India under the Indian Ports Act, 1908 in March 1999. Subsequently, it was incorporated as Ennore Port Limited (EPL) under the Companies Act, 1956 in October 1999. This makes EPL, the only corporatized major port registered as a company in India. At a function held in June 2014, this was renamed as 'Kamarajar Port Limited (KPL) '. The total area of Kamarajar port is around 1130 Ha.

E2. Project Location

Kamarajar Port comes under the Minjur Block of Ponneri Taluk within Thiruvallur District in Tamil Nadu. The coastal region is plain and barren land with thorny bushes and sparse wild vegetation. The nearshore remains relatively steeper due to the action of high waves during monsoon seasons. The seabed in nearshore primarily comprises of sand without any complex bathymetric features. The annual net drift takes place in northerly direction.

The nearest Villages are Puzhuthivakkam (about 1.15 km West), Thazhankuppam (about 3.47 km Southwest), Nettukuppam (about 3.18 km Southwest) and Attipattu (about 3.68 km Southwest). The nearest city is Chennai located about 20 km southwest. The state highway connecting the port is about 8.4 km northwest and the airport nearby the port is Chennai airport at a distance of 34.0 km southwest. Ennore creek is located 2.7 km south and industrial belt Manali is located 13.4 km southwest. The major industry located close to the project site is North Chennai Thermal Power station (NCTPS) adjacent to port in South, IPPL LPG Terminal (about 3.8 km west), NTPC Tamil Nadu Energy Company Ltd. (about 4.9 km southwest) and L&T Shipbuilding yard (about 4.0 km north).

E3. Existing Port facilities

The Port Master Plan envisages development of 22 berths plus associated dredging connected with deepening of the approach channel, harbour basin and berth areas. Kamarajar Port commenced its Phase I operation with six berths for handling coal, export/import of automobiles, Marine Liquid Terminal (MLT) etc. As Phase II development, six more berths for handling containers (two berths), LNG (one berth), coal (two berths) and multipurpose cargo (one berth) are under construction.

E4. Proposed Port facilities

KPL has proposed to initiate action for the development of ten berths as Phase III concurrently with the Phase II facilities to achieve completion well ahead of schedule so as to meet the traffic demand at the right time.

The different activities proposed under Phase III are:

i) Development of additional 10 Berths , ii) Dredging & Disposal, iii) Erection of Liquid Pipeline, iv) Construction of Bulk cargo Conveyor belt, v) Development of Bulk Cargo Stack yard, vi) Construction of Multi Cargo stackyard vii) Construction of Automobile Park yard and viii) Construction of MLT Storage tank.

The details of the development of ten berths are: i) Automobile import/export terminals - 2 Nos. ii) Container berths -3 nos., iii) Marine Liquid Terminal - 1 No. iv) IOC Captive Jetty - 1 No. v) Dry bulk terminals (coal, ore and other type) - 2 Nos. vi) Multi Cargo berth - 1 No. The total planned throughput capacity of the port will be 142 MTPA including 60 MTPA in Phase III. The capital dredging involved is 33 Million cu.m.

E5. Earlier studies

The reports referred for the preparation of this report are: i) Environmental Impact & Risk Assessment of Kamarajar Port Expansion Proposals including associated Capital Dredging, July 2004, National Institute of Ocean Technology, ii) Supplementary report on Environmental Impact & Risk Assessment of Kamarajar Port Expansion Proposals including associated Capital Dredging, September 2010, National Institute of Ocean Technology, iii) Mathematical model studies for integrated morphological changes in the coastline between Ennore creek and L&T port including north of L&T port at Ennore, Tamil Nadu, January 2014 - Central Water and Power Research Station, Pune, iv) Disaster Management Plan for Kamarajar Port Limited, March 2014 - Environmental Technical Services Pvt. Ltd., v) Demarcation of HTL/LTL and CRZ mapping for the proposed additional two coal berths (CB III & CB IV) facilities in Kamarajar Port, Institute of Remote Sensing, Anna University, 2014, vi) Environmental Impact Assessment for Proposed Additional Coal Berths CB 3 (9 MTPA) and CB 4 (9 MTPA), Kamarajar Port, Tamil Nadu - Final EIA Report, June 2014 - Asian Consulting Engineers Private Limited., New Delhi, vii) Periodic Environmental Monitoring Reports for Kamarajar Port Ltd. for the year of 2015, Hubert Enviro Care Systems (P) Ltd., Chennai and Mathematical model studies for assessment of wave tranquility inside the port basin at Kamarajar Port, Tamil Nadu, 2016, Central Water and Power Research Station, Pune.

E6. EIA report

In compliance with the requirements, this final EIA report has been prepared comprising i) Assessment of existing Environmental status with respect to physical (currents, waves etc.) parameters, ii) Assessment of Ambient Air Quality stipulated with National Ambient Air Quality standards and impact of the project on Ambient Air Quality of the surrounding, iii) Assessment of marine water, ground water and surface water quality and impact of proposed activities on the same, iv) Prediction and evaluation of impact of the project in terms of short term and long term effects of different aspects of project construction and operation, v) Environmental Impact Assessment (EIA), vi) Cumulative Impact assessment covering 10 km radius vii) Environmental Management Plan (EMP) outlining control strategies for mitigation of adverse impacts, if any,

viii) Risk analysis and Disaster Management Studies for the proposed project activities and ix) Post Project Monitoring Plan (PPMP).

E7. Baseline data

The baseline data on **Terrestrial environment** were collected for three seasons covering Pre monsoon (April 2016), Post monsoon (October 2016) and Fair weather (March 2017) periods. The secondary baseline data collected for three seasons viz., South west monsoon (July – September 2013), Pre monsoon (April – May 2014) and Post monsoon (January – March 2014) by Asian Consultancy Engineers Private Ltd. are also considered. From the baseline data it can be seen that the measured parameters are well within the acceptable limit and as such the terrestrial environment is not polluted.

The baseline data for the **Marine environment** were collected for three seasons covering Pre monsoon (April 2016), Post monsoon (September 2016) and Fair weather (March 2017) periods and the secondary data available on the physical parameters such as Wind, Wave, Currents, Storm and Tsunami were compiled. From the baseline data on Water quality, Sediment quality, Phytoplankton, its biomass and diversity, Zooplankton, its biomass and diversity, Macro benthos, its biomass and diversity it is concluded that these parameters are well within the acceptable limit and as such the marine environment is not polluted. The coastal water is clean and productive.

E8. Modelling

In 2004, National Institute of Ocean Technology (NIOT), Chennai, India, had carried out modeling study as a part of 'Environmental Impact Assessment (EIA) and Risk Assessment (RA) Study for the Phase II development of Kamarajar Port' in order to identify the offshore disposal location for the capital dredging associated with Phase II development. The results of the modeling study revealed that the dredged material disposed off between 20 m and 30 m water depth at the suggested dump locations at the rate of 8 dumps per day, would result in negligible change to the bathymetry and sediment concentrations. The proposed disposal area is located between 20 m and 30 m water depth. The reported net sedimentation was about 0.2 m to 0.5 m in an area of 25 km² (5 km × 5 km).

Indomer has done the modelling studies in this report to identify and confirm the offshore disposal location for the capital dredging associated with Phase III development. The results of the modeling study revealed that the dredged material can safely be disposed between 25 m and 50 m water depth covering an area of 5.4 km × 5.4 km. The seafloor having a depth of 40 m will be decreased by 0.5 to 1.0 m and will remain 39.0 to 39.5 m. The seabed is expected to reach its original depth of 30 to 50 m in 5 years.

Central Water and Power Research Station (CWPRS), Pune, India had carried out Hydrodynamic modeling studies in 2009 to assess the impact of the Phase II Development on the shoreline. In all the three seasons, Northward transport was found to be dominant. The annual net transport was assessed to be about $0.50 \times 10^6 \text{ m}^3$ towards the northern direction. The results of the modelling study revealed that without any Sand Bypassing erosion was observed up to 4 km along the coastline

towards North from the Northern breakwater and the reported erosion was about 200 m. With Sand Bypassing (Beach Nourishment) of 0.4 to $0.5 \times 10^6 \text{ m}^3$ from South (about 300 m) to North (about 2 to 3 km) of Kamarajar port undesirable accretion/erosion on the South/ North side of the port can be avoided.

Central Water and Power Research Station (CWPRS), Pune, India had carried out Mathematical model studies for the wave tranquility inside the port basin for the facilities proposed under Phase III. The wave direction considered for tranquility study were 67.5° , 90° , 112.5° , 135° N. Maximum significant wave heights observed at different locations in the Kamarajar port were within permissible level. Good tranquility is observed in the port basin for the proposed Phase III development which is equal to almost calm sea for the whole year.

E9. River drainage system and seawater intrusion

Indomer has studied the water bodies around KPL such as Kosathalaiyar River, Buckingham canal and Ennore creek and the impact of the phase III development on these water bodies. The proposed phase III development of port and the addition of berths is confined within the port premises and it will not obstruct the existing hydraulic regime of the Kosasthalaiyar River and Buckingham canal. In addition, as CSR activity, KPL has proposed to deepen the Kosasthalaiyar River and improve the hydraulic section, to enhance the tidal flow and inturn the flood flow during monsoon in order to maintain good circulation in the riverine system around the project region.

Indomer also studied the interaction between seawater and groundwater phenomenon. The port is located between Ennore creek and Pulicat; with the Bay of Bengal in the east and Kosasthalaiyar River/ Buckingham canal with large brackish/ marshy land in the west. The entire marshy land remains as a Paleo coastal marine system influenced by brackish water due to the influence of excursion of tides and intrusion of seawater. The developments of Phase III berths are closer to the shore front by dredging a berthing basin close to HTL as a continuation of existing berths. The development of such port basin will not cause problems like sea intrusion into the existing condition of the aquifers.

E10. Cumulative impact assessment

The cumulative impact assessment study on Air quality, Noise, Water quality, Dredge disposal and fisheries has been carried out for the combined scenario of KPL phase III activities and the other facilities established by different industries in 10 km radius. The study reveals that the proposed phase III development of KPL will not increase the pollution and the levels of different parameters as assessed are well within the stipulated values of TN Pollution Control Board. The proposed facilities by KPL will not alter the existing land and marine environmental status.

E11. Impact assessment

The impacts on the Terrestrial environment including the land, air, noise, water, ecology and Socio economic status is discussed. The impacts due to Equipment mobilization, Material transport,

Erection and Assembling of land based facilities in the construction phase and Traffic movement and Operation of berths during operation phase are studied. It can be seen that the project will have temporary insignificant impacts on terrestrial environment both during Construction Phase and permanent insignificant impacts during Operation phase. The project will have insignificant impact on the Socioeconomic during the construction and operation phase. From the impact study it could be seen that the proposed development will not have any appreciable impact on environment and all the activities identified as part of the project have insignificant impacts.

In analyzing the impacts on the Marine environment, the influence of Construction of berths, Dredging & Disposal, Shoreline changes, Oil spill, Storms and Tsunami, Fisheries were considered. The coastline will be stable due to beach nourishment. The examination of water quality of this region indicated that they do not vary substantially indicating that the coastal waters are well mixed. Various results on the chemical and biological parameters indicate that the water is well oxygenated, nutrient rich and biologically productive at primary and secondary levels. The benthic fauna is moderately rich in diversity and numbers. The proposed development is only within the existing basin. As such the impact due to proposed marine facilities during construction stage and operational stage to the marine environment will be very insignificant.

E12. Environmental Management Plan

Kamarajar Port has a well-documented Marine & Terrestrial Environmental Management Plan (EMP). This plan is in place since commencement of operation of the port and improved further to suit the requirements arising out of enhanced port facilities during Phase II. It is suggested to implement the same EMP with suitable adjustments for the Phase III facilities.

EMP for Terrestrial environment is prepared by taking into account the construction and operation phases of the Phase III facilities. The plan includes measures to mitigate environmental and social impacts; plan of action for execution of mitigation measures; Environmental Monitoring Program; and budget allocated for environmental management. The mitigation measures for activities like Labour Management plan, Sewage Management, Solid Waste Management, Air Pollution Management, Rainwater harvesting system, Storm water drainage system, Green belt development are discussed.

For the Marine Environment, in order to limit the damage to benthos at initial stage, the bed should not be disturbed much and it is suggested that the explosives should not be used. The construction materials should be placed above one another by using proper hoisting machineries and should not be dropped on the seafloor. There should not be any sudden increase in flow velocity within the port basin.

To control the shoreline erosion, the port authorities have to continue the beach nourishment scheme for stabilizing downdrift coastline on the northern side. The existing system of monitoring the shoreline will be continued. Oil spill contingency plan is in place to handle any accidental spill. For this purpose, KPL is already having the required infrastructure/equipments such as boom, skimmer and dispersant chemicals.

E13. Post project monitoring

Post project monitoring is an important aspect in Environmental Management Plan. Monitoring program has to be continued during the construction and operational phases of the Phase III project. It may be repeated at periodic intervals as being done now after the commencement of the project, when the Phase III project is fully operational. Kamarajar Port is already having a well-established and documented post monitoring programme to assess the terrestrial parameters (Ambient air quality, Noise, Water quality, Land) and marine parameters (Water and sediment quality and Biological parameters) on a regular basis. The same system can be continued for the proposed Phase III expansion.

The monitoring programme has to be organized with qualified and experienced environmental team. The same standard procedure shall be followed in sample collection and analysis.

E14. CSR activities of KPL

KPL is involved in CSR activities to the villages nearby the Port and greatly involved in helping them through various welfare trusts and NGOs. Activities like providing skill training to fishermen, Road facilities to villages nearby, Conducting competition on knowledge through NGO, Providing facilities with PHC, Cash prize for national examination in CA, Contribution to construction of Nurses' Hostel for girls, providing educational facilities and drinking facilities are being done by KPL.

E15. Risk Assessment

The Risk Assessment study covers the aspects on i) Assessing risk levels due to the operations of the facility. ii) Identification of risk mitigation measures, iii) Suggestion of general safety improvement measures, iv) To help generating accident free hours and v) Identification of emergency scenarios and mitigation measures.

The factors like Site Meteorology, Climate, Rainfall, Temperature, Humidity, Wind and Atmospheric stability has been considered for the Risk Assessment. The risk and the disaster associated with Pipeline leakage, Vapour Cloud explosions, Loading arm failure, Road tanker failure, LPG pipeline rupture, risks associated with Coal stackyard, Car stackyard has been considered for analysis and the actions that are to be taken during such disaster is presented in the report. In addition for the natural disasters like Cyclone and Tsunami, a detailed disaster management plan and Preparedness plan is presented.

E16. Summary and Conclusions

The project is under operation since 2001 and the present proposal involves development of Phase III facilities as a part of Master Plan. All the developments are planned within the existing Port Basin. As described in the EIA report, there will not be any additional impact on the terrestrial and marine environment and the existing Environmental monitoring program and Management program can be continued.

1. INTRODUCTION

1.1. Background

The Kamarajar port formerly known as Ennore Port is the 12th major port of India, which is located at north Chennai in Tamil Nadu. This port was declared as a major port under the Indian Ports Act, 1908 in March 1999. Subsequently in October 1999 it was incorporated as Ennore Port Limited (EPL) under the Companies Act, 1956. This makes EPL, the only corporatized major port, which is registered as a company in India and later re-named as Kamarajar Port Limited during March 2012.

This was primarily conceived as a satellite port to decongest and improve the environmental quality at the bustling Chennai Port, besides being Asia's energy port. The location of the port is shown in Fig. 1.1. The satellite imagery of Kamarajar Port Layout is exhibited in Fig. 1.2. It is an artificial all-weather port with a large backup land, eco-friendly environment, state of the art navigational facilities, well-organized logistics systems and transport interface. The total area of Kamarajar port is around 1130 Ha.

Kamarajar port commenced its Phase I operation in 2001 with two coal berths for TNEB followed by additional coal berth, iron ore berth, marine liquid berth, general cargo automobile container in 2006 (in all with 6 berths). The Phase II expansion of the port facilities again with six berths primarily for handling containers (2 berths), coal (2 berths), LNG (1-berth) and Multi cargo (1-berth) are now under progress. Presently, KPL is in the process of developing additional 10 berths under Phase III as envisaged in the Port Master Plan.

1.2. Proposed developments at KPL under Phase III

The Phase III expansion contemplates creation of ten berths comprising two Automobile berths, three container berths, two Marine liquid terminals (including IOC captive jetty), two Bulk cargo terminals and one Multi cargo berth. The various facilities and activities under phase III are listed below.

- i) Development of additional 10 Berths
- ii) Dredging & Disposal
- iii) Development of Bulk Cargo Stack yard
- iv) Development of Multi Cargo Stack yard
- v) Construction of Automobile Park yard
- vi) Construction of Container Park yard
- vii) Construction of MLT Storage tank
- viii) Erection of Liquid Pipeline
- ix) Construction of Bulk cargo Conveyor belt

The proposed facilities under Phase III are marked and shown in Fig. 1.3.

Sl. No.	Type of Cargo	Phase III - Proposed	
		No. of berths	Capacity (MTPA)
1	Coal	1	9
2	Marine Liquid-Common Terminal	1	5
3	IOC Terminal	1	5
4	General cargo Automobile	2	6
5	Containers	3	24
6	Multipurpose cargo	1	2
7	Dry bulk (coal/ore/other type)	1	9
Total		10	60
Dredging			
8	Capital dredging	33 Mm ³	-

The Port Master Plan envisages over all development of 22 berths plus associated dredging connected with deepening of the approach channel, harbour basin and berth areas. It is now proposed to initiate action for the development of the remaining facilities concurrently in parallel with the Phase II facilities to achieve completion well ahead of schedule so as to meet the traffic demand at the right time. The aim is to complete all the master plan development projects by 2020-21.

This is a repeat exercise of Phase I and II, the type of cargo remaining the same except increase in volume as forecast in the 2007- Business Plan of the Port, warranting additional berths for the same type of cargo. It is now proposed to initiate the formalities connected with the obtainment of Environmental and CRZ clearances for all the ten berths so that the expansion could be taken up as a continuous process without any break.

i) Development of additional 10 Berths

The proposed ten berths comprising two Automobile berths, three container berths, two Marine liquid terminals (including IOC captive jetty), two Bulk cargo terminals and one Multi cargo berth.

ii) Dredging & Disposal

The total quantity of capital dredging for Phase III development will be 33×10^6 m³. KPL has proposed to dispose the entire volume at the designated offshore disposal location or to use a minor part of the dredge sediments for land reclamation/ beach nourishment if necessity arises. In that case, the dredging quantity of 5×10^6 - 10×10^6 m³ will be used for reclaiming the area between north of north break water to the northern boundary of the port (1.8 km length). Also the dredged sand can be utilized for reclaiming the land associated with Northern Rail Connectivity projects and other projects based on

requirement. The rest of $23 \times 10^6 - 28 \times 10^6 \text{ m}^3$ will be disposed into the sea at a suitable location offshore.

iii) Development of Bulk Cargo Stack yard

For the proposed two dry bulk terminals, a stackyard is proposed east of existing iron ore stackyard and west of Kosathalaiyar River (beyond the CRZ).

iv) Development of Multi Cargo Stack yard

The stackyard for handling multi cargo is proposed eastern side of the berth with an area of 21 acres.

v) Construction of Automobile Park yard

For handling of automobiles for the second and third automobile terminal, a parking yard has been proposed on the eastern side of the existing car parking yard with an area of about 23.22 acres and 30.00 acres respectively.

vi) Construction of Container Park yard

For handling containers, a container park of about 123.55 acres is allotted western side the proposed container berths.

vii) Construction of MLT Storage tank

To handle marine liquid cargo, an area of about 32.02 acres is allotted for the construction of tank farms on the northern side of the existing tank terminal which is of the same size as now proposed for the new terminal. The area will be able to accommodate about 60 tanks commensurate with the demand.

viii) Erection of Liquid Pipeline

The liquid pipeline from Multi Liquid Terminal – II will be erected to storage tank situated on the northern side of the existing tank terminal.

ix) Construction of Bulk cargo Conveyor belt

The cargo will be transported from Bulk cargo terminal I and II through closed conveyor belt system to the stackyard west of Kosathalaiyar River (beyond the CRZ).



Present pipeline routing – Oil and LPG



Beach nourishment

Shorefront proposed for port development

1.3. Earlier studies and Secondary data

The following reports prepared by KPL during various stages of development were made available to Indomer Coastal Hydraulics (P) Ltd., which is an ISO 9001:2015 and QCI (NABET) accredited organization vide NABET/ EIA/ 1417/ SA 009 for use as supporting data for the preparation of the present EIA report for the Phase III facilities. This Comprehensive EIA and EMP studies report has been prepared as per the MoEF&CC Guidelines. The terrestrial studies carried for three seasons covering Pre monsoon (April 2016), and Post monsoon (October 2016) and Fair weather (March 2017) periods. The marine studies carried for three seasons covering Pre monsoon (February 2016), Post monsoon (September 2016) and Fair weather (March 2017) periods.

Most of the secondary data and relevant data are collected from the recent reports available with KPL.

The following reports were referred for the preparation of this report.

- Environmental Impact & Risk Assessment of Kamarajar Port Expansion Proposals including associated Capital Dredging, July 2004, National Institute of Ocean Technology.
- Supplementary report on Environmental Impact & Risk Assessment of Kamarajar Port Expansion Proposals including associated Capital Dredging, September 2010, National Institute of Ocean Technology.
- Mathematical model studies for integrated morphological changes in the coastline between Ennore creek and L&T port including north of L&T port at Ennore, Tamil Nadu, January 2014 - Central Water and Power Research Station, Pune.
- Disaster Management Plan for Kamarajar Port Limited, March 2014 - Environmental Technical Services Pvt. Ltd.

- Demarcation of HTL/LTL and CRZ mapping for the proposed additional two coal berths (CB III & CB IV) facilities in Kamarajar Port, Institute of Remote Sensing, Anna University, 2014.
- Environmental Impact Assessment for Proposed Additional Coal Berths CB3 (9 MTPA) and CB4 (9 MTPA), Kamarajar Port, Tamil Nadu - Final EIA Report, June 2014 - Asian Consulting Engineers Private Limited., New Delhi.
- Periodic Environmental Monitoring Reports for Kamarajar Port Ltd. for the year of 2015, Hubert Enviro Care Systems (P) Ltd., Chennai.

1.4. CRZ mapping

The demarcation of High Tide Line (HTL), Low Tide Line (LTL) and Coastal Regulation Zone (CRZ) for the proposed activities has been awarded to Institute of Remote Sensing (IRS), Anna University, Chennai which is an approved agency/institution by MoEF&CC. A separate report entitled *"Demarcation of High Tide Line, Low Tide Line and Coastal Regulation Zone for the proposed activities as envisaged in port master plan (Phase – III) of Kamarajar port, Tamil Nadu"* has been enclosed separately. According to the CRZ map and the classification of CRZ notification, 2011, the proposed development falls under:

- i) CRZ – I B (intertidal area)
- ii) CRZ – III (A) (between HTL and 200 m)
- iii) CRZ III (B) (between 200 m and 500 m) and
- iv) CRZ IV (A) (12 nautical miles into the sea beyond HTL).

1.5. Approach

In letter No: 19-140/2014-IA.III dated 7/10/2014 addressed to the Secretary, Ministry of Shipping by MOEF & CC, it has been stated that separate EC and CRZ clearance would not be required for individual projects if the port has prepared a master plan

indicating all activities including phasing for implementation and accordingly obtained EC and CRZ clearance for the whole project after following the due procedures under EIA Notification 2006 and CRZ Notification 2011. Accordingly, the Form I and the Feasibility Report were submitted and the ToR for the Phase III Master Plan was obtained vide MoEF&CC letter No. F.No. 11-51/2012-IA.III dt. 08.01.16.

The relevant EIA studies were undertaken by Indomer Coastal Hydraulics (P) Ltd., Chennai, an ISO 9001:2015 organization and QCI (NABET) accredited organization vide NABET/ EIA/ 1417/ SA 009 for *Sector 27: Oil & Gas Transportation pipeline (crude and refinery/petrochemical products) passing through national parks/sanctuaries/coral reefs/ecologically sensitive areas including LNG Terminal and Sector 33: Ports, harbours, jetties, marine terminals, breakwaters and dredging*. This revised final EIA and EMP Report is prepared on the basis of i) TOR granted by MoEF&CC at the meeting held on 18 and 19th November 2015, ii) the guidelines contained in the "Ports & Harbours" EIA manual of 2010 and iii) Proceedings & Minutes of the Public Hearing.

Baseline data collected by Indomer are included and secondary data has been compiled from the earlier reports indicated above. Earlier studies and Secondary data on the physical and chemical environment collected during 2013 – 2014 have also been used for preparing the EIA report. The Public hearing proceedings are enclosed in Annexure I.

All calendar dates are referred in Indian style as dd.mm.yy. (eg. 05.09.17 for 05th September 2017) and the time is referred to Indian Standard Time in 24 hour clock, eg. 3 P.M. is written as 1500 hrs. The WGS 84 spheroid in Zone 44 is followed for surveys and for the presentation in this report. SI units are followed for fundamental and derived units. The depths are referred with respect to Chart Datum.

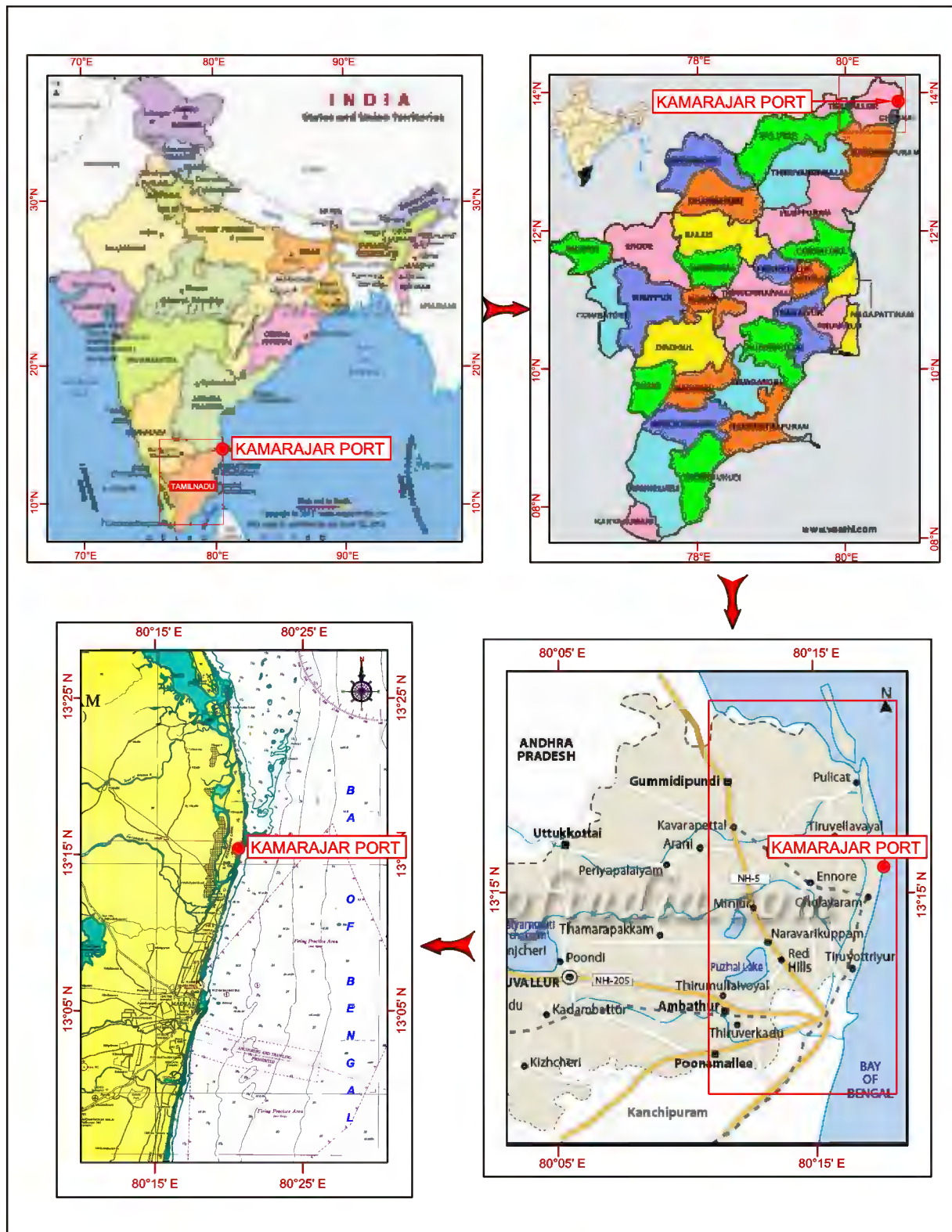


FIG. 1.1. LOCATION OF THE PORT



FIG. 1.2. SATELLITE IMAGERY OF KAMARAJAR PORT

2. ToR COMPLIANCES

During the 153rd Expert Appraisal Committee meeting held during 18th -20th November 2015, for the grant of ToR, the committee has proposed the following ToR for the Development of the facilities envisaged in the Port Master Plan (Phase III) for Kamarajar Port Limited. The ToR and their compliance status are presented below.

ToR no.	ToR	Reference
(i)	Details of proposed cutting into land and place of disposal of exploited material after scrutiny of duly approved Master Plan, be submitted.	For proposed land cutting Refer section 5.4.2 and for place of disposal refer section 8.2.2.
(ii)	Details of the forecast of number of vessels at outer anchorage, be submitted.	Refer section 5.5.2
(iii)	Details of the Ship navigation studies be submitted.	Carried out and the details are given in Chapter 8.4
(iv)	Reasons for selecting the site with details of alternate sites examined rejected/selected on merit with 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.	Existing Port Not applicable
(v)	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, 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.	Refer section 6.3.4
(vi)	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.	For Landuse refer Sections 6.3.3 and 6.3.4. No land acquisition and no rehabilitation of communities / villages.
(vii)	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.	Refer Chapter 9
(viii)	Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area.	Refer section 6.3 - Land Environment

(ix)	Submit the details of terrain, level with respect to MSL, filling required, source of filling materials and transportation details etc.	Refer section 6.3.5
(x)	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.	Refer section 6.2.
(xi)	Submit details regarding R&R involved in the project.	Not applicable since the development is within the port boundary.
(xii)	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.	CRZ report adopting 1:4000 scale is enclosed separately.
(xiii)	Submit the status of shore line change at the project site.	Refer section 8.1.3.
(xiv)	Details of the layout plan including details of channel, breakwaters, dredging, disposal and reclamation.	The details of channel, Breakwaters are included in Master Plan in Fig. 5.2. Details of dredging, disposal and reclamation are given in Section 5.4.
(xv)	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.	Included in the report.
(xvi)	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.	Refer section 11.3. Marine Environment
(xvii)	Details of oil spill contingency plan	Refer risk assessment report 1.9. Oil Spill Contingency Plan
(xviii)	Details of bathymetry study.	Refer section 7.3. Physical parameters. The Bathymetry chart is included in Fig. 7.2.
(xix)	Details of ship tranquillity study.	The wave tranquillity study is carried out by CWPRS and the details are presented in Section 8.3.
(xx)	Examine the details of water requirement, impact on competitive user, treatment details, use of treated waste water. Prepare a water balance chart.	Refer section 12.2. - Terrestrial EMP.
(xxi)	Details of rainwater harvesting and utilization of rain water.	Refer section 12.2.6.
(xxii)	Examine details of Solid waste generation treatment and its disposal.	Refer section 12.2.3. Solid waste Management
(xxiii)	Details of desalination plant and the study for outfall and intake.	Not envisaged
(xxiv)	Examine baseline environmental quality along with projected incremental load due to the proposed project/ activities.	Refer chapter - 6. Terrestrial Environment and chapter 7. Marine Environment
(xxv)	The air quality monitoring should be carried out according to	Refer section 6.5.1

	the notification issued on 16 th November, 2009.	
(xxvi)	Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.	Refer chapter - 12. EMP for Terrestrial and Marine Environment and chapter 13 Monitoring plan for Terrestrial and Marine Environment.
(xxvii)	Submit details of a comprehensive Risk Assessment and Disaster Management Plan including emergency evacuation during natural and man-made disasters.	Refer Risk Assessment and Disaster Management Plan report
(xxviii)	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.	NA
(xxix)	Examine the details of afforestation measures indicating land and financial outlay. Landscape plan, green 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.	Refer section 12.2.8. - Green Belt development. The activities connected with afforestation included in the report.
(xxx)	Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website "http://moef.nic.in/Manual/Port and harbour" .	Noted

3. SCOPE OF EIA

The scope of the EIA studies as per the ToR is to conduct study of the existing environmental status within the study area of 10 km radius from the proposed site for significant environmental components below.

- Assessment of Ambient Air Quality as stipulated in National Ambient Air Quality standards and impacts of the project on the same.
- Assessment of marine water, ground water and surface water quality parameters and impacts of proposed activities on the same.
- Assessment of existing Environmental status with respect to physical (currents, waves etc.) parameters.
- Assessment of Impact due to dredging and dredge disposal
- Assessment of hydrological aspects of Kosasthalaiyar River and Buckingham Canal, storm water discharge and seawater intrusion.
- Assessment of Cumulative Impact assessment covering 10 km radius.
- Prediction and evaluation of impact of the project in terms of short term and long term effects of different aspects of project construction and operation.
- Risk analysis and Disaster Management Studies, for the proposed project activities.
- Preparation of an Environmental Impact Assessment (EIA).
- Preparation of an Environmental Management Plan (EMP) outlining control strategies for mitigation of adverse impacts, if any.
- Outline a Post Project Monitoring Plan (PPMP) to ensure that the EMP achieves.

4. SOCIO-ECONOMIC ENVIRONMENT & CSR ACTIVITIES

The study report on socio- economic components of environment comprises various features viz., demographic structure, availability of basic amenities such as housing, education, medical facilities, drinking water facilities, post, telegraph and telephone facilities, communication facilities, recreational, cultural facilities, approach to villages etc. The study of these parameters helps in identifying, predicting and evaluating the likely impacts due to the proposed project activity in that region. The socio-economic profile of the study area is significant for the proposed project as it may cause both positive and negative impact on the area.

The study area lies within the Tiruvallur District. The District spreads over an area of about 3422 Sq.km. As per District wise Census 2011, the total population of Tiruvallur District is 37,28,104, out of which 18,76,062 are male and 18,52,042 are female. The Total Literate Population is 84.03 % numbering to 27,91,721 out of which 14,95,711 are male and 12,96,010 are female. The district is developing fast in terms of Industrial Development. The satellite imagery of Kamarajar Port habitation within 5 km and 10 km radius is shown in Fig. 4.1.

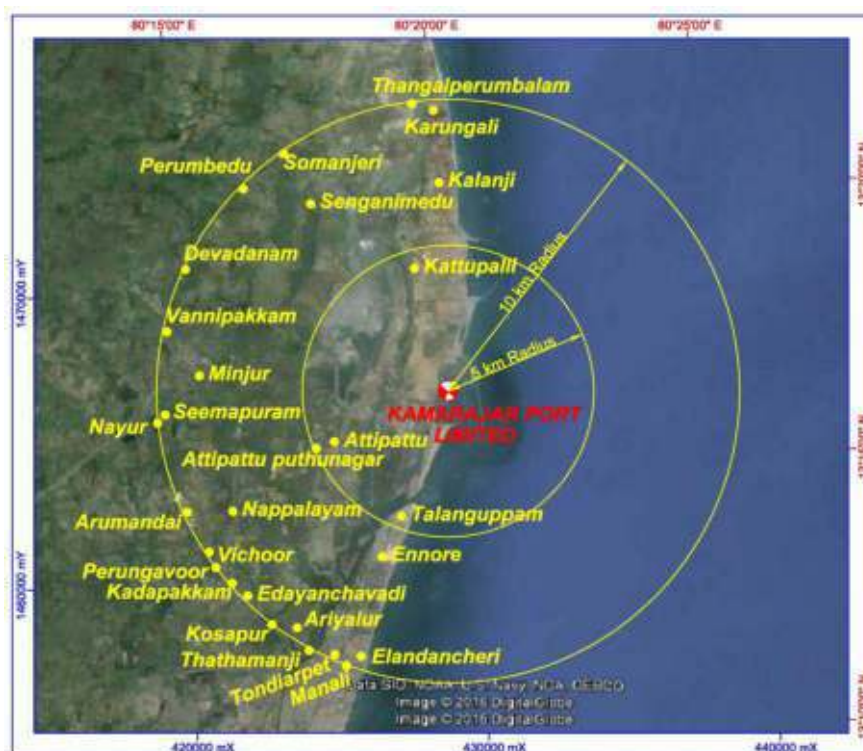


Fig. 4.1. Habitation around Kamarajar Port

The administrative division of Tiruvallur has 4 Revenue divisions, 12 Taluks, 14 Blocks, 5 Municipalities, 10 town Panchayats and 820 Revenue villages.

Overall it is envisaged that the proposed project will have more of positive impacts. The negative impacts, which are quite insignificant, are temporary on the surrounding areas in terms of Socio – Economic environment due to influx of population and strain on the infrastructure.

The data on baseline status of the study and basic information about the socio-economic profile generated in the process include:

- Demographic structure and literacy
- Educational Facilities
- Housing pattern
- Infrastructure base in the study area
- Occupational status
- Health and sanitation status
- Socio-economic status with reference to Quality of Life.

It is found from the survey that only four villages are in the core zone or within 5 km radius and other 27 villages are situated in the buffer zone i.e. in 10 km radius. The distance from KPL to different villages is shown in Table 4.1.

Table 4.1. Habitation found within the Study Area and distance from KPL

Sl. No.	Name of the Habitations	Distance form KPL (Km)
1	Ariyalur	9.6
2	Arumandai	9.9
3	Attipattu	3.6
4	Attipattu Pudu Nagar	4.2

Sl. No.	Name of the Habitations	Distance form KPL (Km)
5	Devadanam	9.9
6	Edayanchavadi	9.8
7	Elandancheri	9.6
8	Ennore	5.0
9	Kadapakkam	9.9
10	Kalanji	7.1
11	Kalpakkam	9.4
12	Karungali	9.6
13	Kattoor	9.9
14	Kattupalli	4.0
15	Kosapur	10
16	Manali new town	10
17	Minjur	8.5
18	Nayur	10
19	Nappalayam	8.5
20	Perumbedu	9.8
21	Perungavoor	9.9
22	Puzhuthivakkam	1.1
23	Senganimedu	7.9
24	Seemapuram	9.7
25	Somanjeri	9.9
26	Talanguppam	3.47
27	Thangalperumbalam	9.9
28	Thathamaji	10
29	Tondiarapet	9.8
30	Vannipakkam	9.8
31	Vichoor	9.8

4.1. Demography and Literacy

Demography

Based on field visit, it is found that there are 31 villages or habitations in the 10 km radius area of KPL. The total no of Households in these 31 villages are 17340 nos. The total population of the villages is 70423 out of which 35,620 are male and 34,790 are female.

The summary of the demography profile of habitations surveyed in and around the proposed project site is given in Table 4.2.

Table 4.2. Summary of Demographic Profile of Habitation within the Study Area

SI. No.	Habitation	Total no. of Households	Population			Literates		
			Male No.	Female No.	Total No.	Male No.	Female No.	Total No.
1	Ariyalur	697	1357	1336	2613	1088	887	1975
2	Arumandai	458	854	815	1669	693	583	1276
3	Attipattu	2762	5623	5411	11034	4454	3751	8205
4	Attipattu Pudu Nagar	280	658	598	1256	320	305	625
5	Devadanam	317	578	603	1181	407	326	733
6	Edayanchavadi	250	560	540	1100	288	198	486
7	Elandancheri	201	356	329	685	272	194	466
8	Ennore	250	457	443	990	310	230	540
9	Kadapakkam	787	1436	1505	2941	1194	1002	2196
10	Kalanji	77	126	134	263	73	72	143
11	Kalpakkam	277	582	554	1136	397	296	693
12	Karungali	58	97	106	203	51	51	102
13	Kattoor	900	1726	1699	3425	1319	1038	2357
14	Kattupalli	534	1096	815	1911	784	412	1196
15	Kosapur	190	358	422	780	277	264	551
16	Manali	88	166	145	311	96	64	160
17	Minjur	1450	2950	2650	5600	1153	1087	2240
18	Nayur	1187	2212	2304	4516	1550	1264	2814
19	Nappalayam	1020	2680	2920	5600	1474	726	2200
20	Perumbedu	732	1251	1357	2608	863	735	1598
21	Perungavoor	633	1096	1181	2277	843	722	1565

SI. No.	Habitation	Total no. of Households	Population			Literates		
			Male No.	Female No.	Total No.	Male No.	Female No.	Total No.
22	Puzhuthivakkam	165	399	387	786	173	149	322
23	Senganimedu	400	640	630	1270	344	186	530
24	Seemapuram	477	924	952	1876	676	563	1239
25	Somanjeri	233	405	425	830	234	203	437
26	Talanguppam	260	1350	1310	2660	564	500	1064
27	Thangalperumbalam	573	1083	1012	2095	744	549	1293
28	Thathamaji	217	406	403	809	290	233	523
29	Tondiarapet	359	789	734	1523	323	297	620
30	Vannipakkam	245	425	450	875	356	345	701
31	Vichoor	1960	2980	2620	5600	1820	980	2800
	Total	17340	35620	34790	70423	23430	18212	41650

(Source: Census of India, 2011)

Literacy

The literacy rate of the villages is relatively less comparing to the state literacy rate. In the study area, out of the total population 59% are literate. The male literates are more than the female literates accounting to 56% male against 44% of female literates.

4.2. Educational Facilities

The educational facility is provided by the public sector as well as the private sector. The ratio of public schools to private schools is 7:5. As of 2011 census, enrolment rates are 58% for pre-primary, 93% for primary, 69% for secondary, and 25% for tertiary education. Despite the high overall enrolment rate for primary education, among children of age 10, half could not read at a basic level, over 60% were unable to do division, and half dropped out by the age 14.

Educational facilities till 5th standard (Primary School) are available in and around most of the villages, and anganvadi centres are also available in most of the habitations. But for studying in High schools and higher secondary schools they have to travel 2 km to 20 km as there are no such schools nearby most of the habitations in the study area. The Colleges are more than 5 km to 10 km far away from all the habitations. KPL have donated tables and benches to Kattupalli School. The lists of schools in the respective habitation are given in Table 4.3 given below.

Table 4.3. Schools in the Habitations

Sl.No	Villages No.	Primary School No.	Middle School No.	Higher Secondary School No.
1	Ariyalur	3	1	Nil
2	Arumandai	1	Nil	Nil
3	Attipattu	1	1	0
4	AttipattuPudu Nagar	Nil	Nil	Nil
5	Devadanam	1	Nil	Nil
6	Edayanchavadi	1	Nil	1
7	Elandancheri	Nil	Nil	Nil
8	Ennore	1	Nil	2
9	Kadapakkam	1	Nil	Nil
10	Kalanji	Nil	Nil	Nil
11	Kalpakkam	1	1	Nil
12	Karungali	1	Nil	Nil
13	Kattoor	4	3	2
14	Kattupalli	1	Nil	Nil
15	Kosapur	1	Nil	Nil
16	Manali	1	1	1
17	Minjur	1	Nil	1
18	Nayur	7	1	Nil
19	Nappalayam	1	Nil	1
20	Perumbedu	2	2	2
21	Perungavoor	2	Nil	Nil
22	Puzhuthivakkam	Nil	Nil	Nil
23	Senganimedu	1	Nil	1
24	Seemapuram	1	1	Nil
25	Somanjeri	1	1	Nil
26	Talanguppam	1	1	1

27	Thangalperumbalam	2	Nil	Nil
28	Thathamaji	1	Nil	Nil
29	Tondiarapet	2	1	1
30	Vannipakkam	2	0	0
31	Vichoor	4	2	2
Total		46	17	14



Government high school at Minjur

4.3. Housing pattern

Almost all the villagers have Pucca houses and around 50% of the household have concrete roof, 40% tiled or asbestos roofs and 10% houses are thatched roofs. Most of the houses in Kattupalli and Thazhanpakam are tsunami houses provided by International NGOs after tsunami and the villagers of Ennore kuppam were rehabilitated by North Chennai Thermal Power Station, Chennai. The following table describes about the housing pattern of the villages around 10 km radius of KPL.

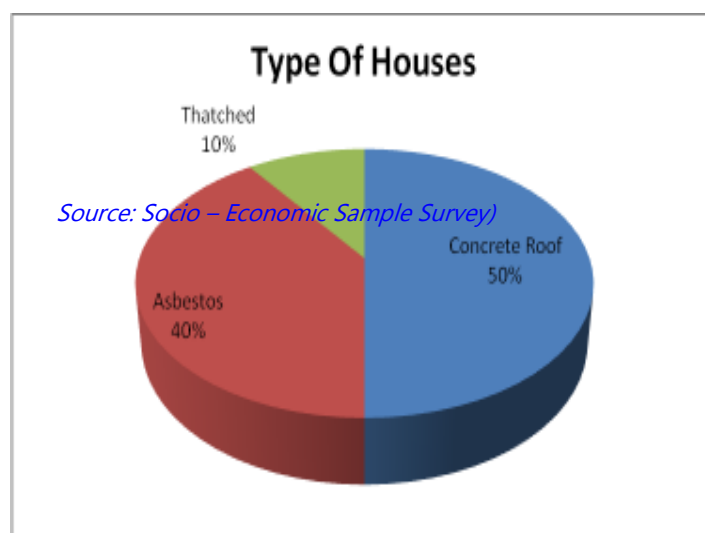


Fig.4.2. Housing Pattern

4.4. Infrastructure facilities

Infrastructural facilities are major components for the village development programmes. Field trips were undertaken to 31 villages in 10 km radius of KPL and it is found that electricity and road facilities are available in almost all the villages. The village like Kattupalli which is a Schedule cast dominated village, is deprived of drinking water & sanitation facilities. The village is also deprived of market place, Higher education & Health care facilities. Emergency healthcare, higher education, banking and Post office facilities are available in some of the villages but others have to travel up to around 20 km distance to avail these facilities . About 50% of the villages are complaining about scarcity of drinking water and also water for bathing and washing purposes. The availability of Postal & banking services in different villages is shown in Table 4.4.

Table 4.4. Postal and Banking services

Sl.No	Villages Name	No. of Post Office	No. of Bank
1	Ariyalur	Nil	Nil
2	Arumandai	Nil	Nil
3	Attipattu	2	Nil
4	AttipattuPudu Nagar	Nil	Nil
5	Devadanam	1	Nil

Sl.No	Villages Name	No. of Post Office	No. of Bank
6	Edayanchavadi	Nil	1
7	Elandancheri	Nil	Nil
8	Ennore	1	2
9	Kadapakkam	Nil	1
10	Kalanji	1	Nil
11	Kalpakkam	1	1
12	Karungali	1	Nil
13	Kattoor	1	1
14	Kattupalli	Nil	Nil
15	Kosapur	1	Nil
16	Manali	1	1
17	Minjur	2	2
18	Nayur	1	Nil
19	Nappalayam	Nil	Nil
20	Perumbedu	Nil	1
21	Perungavoor	1	1
22	Puzhuthivakkam	1	1
23	Senganimedu	1	1
24	Seemapuram	1	1
25	Somanjeri	Nil	Nil
26	Talanguppam	1	2
27	Thangalperumbalam	1	1
28	Thathamaji	Nil	Nil
29	Tondiarapet	1	2
30	Vannipakkam	1	Nil
31	Vichoor	1	Nil

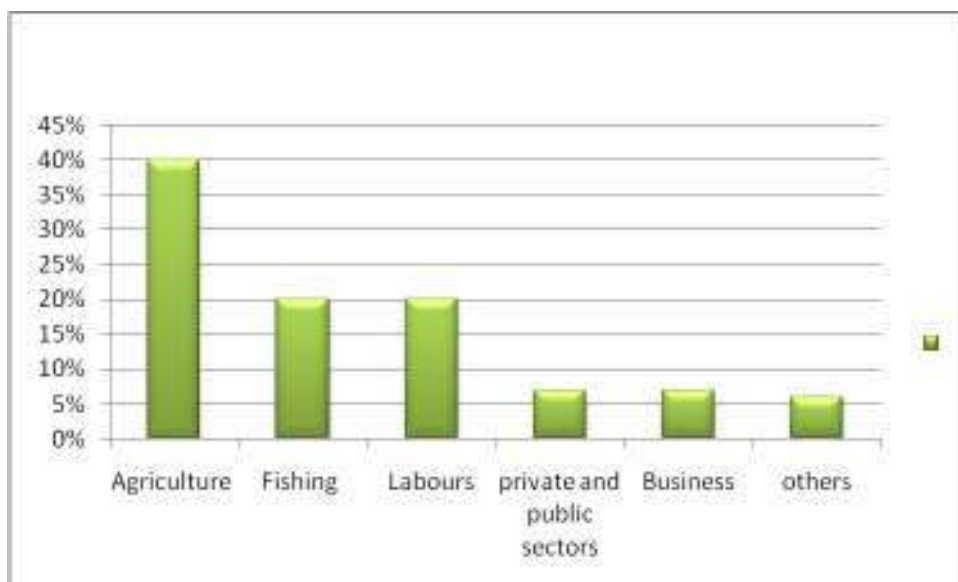
(Source: Census of India, 2011)

4.5. Occupation Pattern

Creation and development of nonfarm employment opportunities in the study area is rapid. About 40% of the villages have agriculture as their prime source of income. Apart from agriculture, 20% villagers are engaged in fishing and 20% are laborers. About 7% out of the total population are employed either in private or public sectors. 7% of the total populations are engaged in different business and other 6% are carpenters, shop keepers, mechanics, etc.

As the agricultural lands have been converted into factories, many people started working in different industries as laborers. This population of labors as well as technical workers and various other occupation patterns are growing visibly.

Though, out of the total 31 villages, four villages viz. Talangupam, Ennore, Elandancheri and Minjur are engaged in fishing. The two villages -Talangupam and Ennore in the southern sea shore areas of KPL, have difficulties in operating the boat because of the construction of rubble mound protection wall, which was asked by the local to protect from the sea erosion. The graphical representation of the occupation of people is shown in Fig. 4.3.



(Source: Socio - Economic Sample Survey)

Fig.4.3. Occupation Pattern

4.6. Health and sanitation status

Health status:

Water is an essential prerequisite for the existence of life, sanitation, human health and overall development of human beings. Fresh and marine water give food, access to potable water which are major contributors to general community health. Instead,

polluted water breeds mosquitoes, flies, rodents and other disease carrying vectors. The area adjoining the Ennore creek and Kosasthalaiyar are to some extent polluted because of effluent released from neighbouring industries. Some of the habitants living on the bank of the rivers are prone to diseases like skin problems, infectious diseases etc. The numbers of such persons vary from household to household. The illness of members in the sample households for the past one year from the date of survey is identified and they are classified under eight broad heads of diseases such as cough, TB and wheezing, skin diseases, typhoid, malaria, eye diseases, cancer and others. Cough, TB and wheezing is the most popular disease in the study area. Skin diseases are the second most categories of diseases among sick person. Disease like typhoid, malaria, flu follows above major diseases. From this it is clear that polluted water in the study area habitations is mainly responsible for the diseases like skin irritation, Typhoid, Malaria etc. There are sizable numbers of members of the sample households have been affected by air pollution from the neighbouring industries. Therefore diseases like cough, TB, wheezing and Asthma are widely prevalent among the sick members in Ennore area. There are 3.5 % of sick persons reported with problems of eye diseases and opined polluted water in Ennore Creek was the cause. In order to assess the awareness of the sick persons about their reasoning of the cause of diseases, they were asked about the major reason for their sickness. Three fifth of the sick persons have given river water pollution as the most important reason for their bad health. It is followed by industrial pollution, pollution due to effluents and other reasons. Sewage pollution becoming reason for illness found in households like Kattupalli. From this it is clear that the people of habitations feel that the fly ash from the thermal power station and the polluted water of the Ennore Creek are mainly responsible for the diseases of a majority of the sick persons.

However, the village people felt that there is no pollution emitted from Kamarajar port and it does not cause the health hazards.

The medical facilities available in the area are shown in Table 4.5.

Table. 4.5. Medical facilities available in the area

S. No.	Villages No.	Allopathic hospitals No.	Primary health centre No.	Maternity and child welfare centre No.
1	Ariyalur	1	1	Nil
2	Arumandai	1	1	1
3	Attipattu	1	Nil	Nil
4	AttipattuPudu Nagar	Nil	Nil	Nil
5	Devadanam	1	1	1
6	Edayanchavadi	Nil	Nil	Nil
7	Elandancheri	1	Nil	Nil
8	Ennore	2	1	1
9	Kadapakkam	1	1	1
10	Kalanji	1	1	1
11	Kalpakkam	1	1	1
12	Karungali	1	1	1
13	Kattoor	1	1	1
14	Kattupalli	1	1	1
15	Kosapur	1	1	1
16	Manali	1	1	1
17	Minjur	1	1	1
18	Nayur	1	1	1
19	Nappalayam	Nil	Nil	Nil
20	Perumbedu	1	1	1
21	Perungavoor	1	Nil	Nil
22	Puzhuthivakkam	1	1	1
23	Senganimedu	1	1	Nil
24	Seemapuram	1	1	1
25	Somanjeri	1	1	1
26	Talanguppam	Nil	Nil	Nil
27	Thangalperumbalam	1	1	1
28	Thathamaji	1	Nil	Nil
29	Tondiarapet	1	1	1
30	Vannipakkam	1	1	1
31	Vichoor	1	Nil	Nil

(Source: Census of India, 2011)

Sanitation status

The study area is having the seasonal river Kosasthalaiyar. Irrigation is done through tanks, tube wells and open wells. Most of the habitations have proper water supply system through common pipelines supplying drinking water from common overhead tanks available in all villages. Some of the habitations like Old Nappalayam face inadequate supply of drinking water.

The villages like Kattupalli face sanitation problem and lack of proper drainage system/ toilets. Out of the total villages, 50% households do not have toilets; they are using sea shore and open spaces for defecation which makes the area dirty and becoming a source of airborne diseases. In order to combat the evils of water borne diseases and lack of sanitary facilities affecting human beings, Government of India has launched Central Rural Sanitation Programme in 1986. This was an allocation based programme. Supply driven programme, subsidy were extended for constructing Individual House Hold Latrines (IHHL) and the implementation followed a centralized top down approach. Total Sanitation Campaign promotes campaign in the area for construction and maintaining household toilets but most of the people in the study area are either unaware or ignorant to the Government programme.



Focus Group Meeting at Vichoor village



Focus Group meeting at Kattupalli village



Focus Group meeting at Nappalayam village



Focus Group meeting at Edayanchavadi village



Socio - Economic Sample Survey at Kattupalli village



Socio - Economic Sample Survey at Edayanchavadi village



Roads connected to nearest NH from Nappalayam and Edayanchavadi villages



Drinking water supply through public taps at Edayanchavadi village

4.7. Socio-economic status with reference to Quality of Life

During survey, it was found that most of the people are of poor category and living a marginal life. The villages and hamlets which are dwelled by schedule cast and fisherman are deprived of basic amenities like drinking Water & toilets. The traditional skill based occupations like agriculture and fisheries are coming down as people do not like to continue their traditional job. In view of this, the people are changing their occupation to daily laborers and other jobs related to the needs of the industries in the area. On other hand, dependence on inconsistent agricultural and fishing sources has reduced the stress level of the people as they get wages and salary which has led to availability of modern amenities in about 50% of the houses. With all that it has been observed that the quality of the life is yet to match with modern life style.

4.8. Observation by the villagers

Focus Group discussions were conducted in five villages and it is found that the people are accepting the growth of the industrial area and also accepting the generation of jobs in and around but as per their views, the pollution has to be kept within the standard.

4.9. CSR activities of KPL

KPL has over the years, consciously and continuously endeavoured to contribute to community development and services. In order to achieve its vision KPL has taken up various activities particularly activities that contribute to the development of the villages located around the Port. With these objectives in mind the following corporate social responsibility initiatives which among several others include development of educational and road infrastructure like school buildings, furniture and sanitary facilities in Kattupalli Village and Athipattu Village have been completed to a large extend.

- Development of the approach road to Kattupalli Village roads and installation of street lights in the villages located near the Port. Provided computers, sports kits to school children.
- Provided sewing machines and tricycles to the poor and needy people.
- Conducted free medical camps in Kattupalli Village.
- Contributed to the employment of marginalised women in the nearby villages by providing them with employment by deploying them for housekeeping services through a women's self help group.
- Engaged in coastal cleanup activities and beach nourishment.
- Medical infrastructure for primary health centre at Athipattu Village.
- Financial support to Adyar Cancer Institute

KPL is involved in CSR activities to the villages nearby the Port and greatly involved in helping them through various welfare trusts and NGOs. Activities like providing skill training to fishermen, Road facilities to villages nearby, Conducting competition on knowledge through NGO, Providing facilities with PHC, Cash prize for national examination in CA, Contribution to construction of Nurses' Hostel for girls, providing educational facilities and drinking facilities are being done by KPL. The year wise CSR activities undertaken by KPL starting from 2013-14 are highlighted below.

CSR Activities of KPL during the FY 2013- 2014

KPL is involved in CSR activities to the villages nearby the Port and greatly involved in helping them through various welfare trusts and NGOs. Activities like providing skill training to fishermen, Road facilities to villages nearby, Conducting competition on knowledge through NGO, Providing facilities with PHC, Cash prize for national examination in CA, Contribution to construction of Nurses' Hostel for girls, providing educational facilities and drinking facilities are being done by KPL. The following are the CSR activities that are being done by KPL.

Drinking water facility - Rs.88, 25,198/-

Safe drinking water facility to the Government High school in Vallur village, Construction of LLR and pump room to Irular colony at Nandiyambakkam, Drinking water facility to Aryanvoyal school campus, deep borewell at Nandiyambakkam village, Vayalur and Neidavoyal, pumping facility and extension of pipeline in Nandiyambakkam village, Vayalur and Thiruvellaivoyal and Improvements/ Rejuvenation of ground water facility in Thiruvallur.

Education - Rs.55, 87,160/-

Construction of ICDS centres at middle school and irular colony of Nandiyambakkam village and Thiruvellaivoyal Village. Construction of compound walls & renovation of

buildings at various localities in Saidapet. Compound wall for Anganwadi building and SHG is building Thriuvellaivoyal village and Community Hall at Mappedu.

Health and family welfare - Rs.5, 67,179/-

Supply of medical equipments for primary health centre, Athipattu village and sponsoring of Community Health and Educational Services to NGO Udhavum Karangal.

Sanitation and public health - Rs.10, 87,852/-

Construction/renovation of Toilet blocks for boys & girls and an incinerator at high school of Kattupalli village and Civil works to Annai Fathima Child Welfare Centre, Karapakkam village.

Vocational/Skill training - Rs. 6, 95,200/-

Training in fishing related programme to educated youths and SHG by Institute of Fisheries Technology at Ponneri, Skill development training courses by MSME Development Institute, Computers and sewing machine to impart training to the differently abled people of Hope vision India, Ponneri.

Building of Roadways and pathways - Rs.2, 39, 78,587/-

Development of Road from Arterial road of Attipattu village towards Nandiyambakkam village, Arterial road from NCTPS pump house to Attipattu Railway station, Development of approach road to burial ground at Kodur village, Improvement of village road for vellampakkam village, kalpakkam Panchayat, Development of Bitumen road to the various streets and villages around the region Vayalur, Subbareddipalayam, Agaram, Melur, Kottaikuppam, Orrakkadu, Mappedu and Tirunindravur and Construction of bus shelter at Kattupalli village, Naloor village and at Tiruthani.

The total sum of amount spent during 2013 - 14 is Rs. 4, 07, 41,176/-

CSR Activities of KPL for the FY 2014 – 2015

Education - Rs. 1, 13, 07,842/-

Under the CSR activities, KPL provided funds to promote education to the nearby villages and also providing basic facilities to the schools and colleges likes of construction of class rooms, desktop computers to schools, Compound wall construction to primary schools, Classroom construction to Higher secondary schools, Pilot Initiative to some government schools and also providing Uniform clothes to the schools.

Drinking Water Facility – Rs. 39, 30,099/-

Drinking water to Government Higher secondary School at vallur, Installation of RO for safe drinking water to Middle school at Nandiyambakkam, Construction of LLR and Pump room to Irular colony, Nandiyambakkam, Water Purifier to the primary school at Vanipakkam, Supply of drinking water to a school at Aryanvoyal village, Construction of overhead tank at Aryanvoyal village and Construction of Overhead tank and sump at Kattuppalli village.

Sanitation & Health - Rs. 32, 92,884/-

Providing Incinerators to Jaigopal Garodia Girls High School at Ponneri, Construction and Renovation of Toilet Blocks and incinerator to High School of Kattuppalli Village, Construction of Integrated toilet to Nandiyambakkam Village and Pazhaverkadu and Engagement of service provider for the operational maintenance of toilet block at Government High School in Attipattu.

Health and Family Welfare - Rs. 21, 29,190/-

Construction of Primary Health Centre at Nandiyambakkam, Providing hormone analyzer to PHC at West Mambalam.

Training and Skills - Rs. 63, 25,800/-

Training on Sustainable conservation and management of wetlands in Pallikaranai, Enrollment as Member of Asian Institute of Transport Development, New Delhi, MSME – Skill training.

Other Activities - Rs. 49, 64,667/-

New building for ICDS centres at Nandiyambakkam Village and Thiruvellaivoyal Village and Relaying of Kitchen floor at ICDS centre in vellampakkam. Construction of Bus Shelter at Kalpakkam village, Naloor Village, Kattuppalli Village and Nandiyambakkam Village. Supplying of furniture to various locations of Ponneri Taluk, Saidapet, T.Nagar. Construction of road to burial ground at Kodur.

The total sum of amount spent during 2014 - 15 is Rs. 3, 19, 50,482/-

CSR Activities for the FY 2015-2016

There CSR activities for the FY 2015-2016 includes laying bitumen road to the various villages and streets, Providing street lights to the villages and streets, Establishing awareness against conservation of wetlands and providing skill training to the villagers, Supplying the needs of Public Health Centers and providing necessities to the ICDS Anganwadi in the villages of Ponneri, Nandiyambakkam and Attipattu villages, Developing sanitation facilities to the schools nearby. Proving education needs to the schools of Kattuppalli, Attipattu and Nandiyambakkam and other villages. Provision of water facilities to the villagers by providing deep bore wells and over head tanks and extension pipelines and pumps.

The amount for the CSR activities for the FY 2015 - 2016 is Rs. 7,29,51,960/-

Corporate Social Responsibility (CSR) proposals for the year 2015-16

Sl. No	Name of the project / activity	Awarded / Estimate value in Lakhs
1	Drinking Water	75.40
2	Education	61.01
3	Environmental Sustainability and Ecological Balance	30.00
4	Healthcare	71.80
5	Rural Development	372.37
6	Sanitation	31.74
7	Skill Development & Livelihood	70.32
8	Social Welfare	10.00
9	Sports	1.88
10	Others	5.00
Total		729.52

Proposed CSR works for the year 2016-17

S.No.	Village Name	Sector	Type of need/ work
1	Neithavayal	Infrastructure	1.Community Hall at Neithavayal
		Environment Sustainability	2. Renovation work in Pond Thamaraiikulam (Estimated Cost Rs.50.00 lakh) 50% of the work
		Water	3.Bore well -Mothambedu
		Health & sanitation	4.Primary Public Health Sub-Centre-Neithavayal
2	Merattur	Infrastructure	5.Bus Shelter at Merattur
		Education	6. Merattur Colony School Building (50%)
		-	7. Anganwadi Building
		Health	8. PH Sub-centre-Merattur
3	Vayalur	Drinking water	9. Chengalimedu Water Tank
		Environment Sustainability	10. Repairs to water bunds at Chengalimedu
		Sanitation	11. Integrated Women Sanitary Complex-Vayalur Colony
		Education	12. Anganwadi Building-Vayalur

4	Thiruvellaivayal	Infrastructure	13. Play Ground Compound Wall
		-	14. Community Hall cum Dining Hall
		Drinking Water	15. Water Tank-Thiruvellaivayal Main Colony (30000 ltrs.)
5	Thiruppalaivanam	Infrastructure	16. Community Hall
		-	17. Rural Haat (50% work)
		Education	18. Compound Wall for Higher Sec. School
6	Vanchivakkam	Infrastructure	19. Community Hall-Asanthapedu
		Drinking Water	20. Water Tank-Vanchivakkam
7	Thathaimanji	Infrastructure	21. Community Hall-Manuan New Colony
		Education	22. Additional Building for SC Welfare School
8	Kadappakkam	Road	23. Mel Colony Inner Road
		-	24. Andarmadam link road
		Infrastructure	25. Community Hall (50% work)
9	Kattur	Health & sanitation	26. Individual Toilet (100 nos.)
		Drinking Water	27. Deep Borewell -2 nos. with 2 KM pipeline
10	Athipattu	Environment Sustainability	28. Repairing of Bund-Athipattu
		Road	29. CC Road-Reddyar Palayam to Karampedu Road (600 Mtrs.)
		-	30. CC Road-Nehru Nagar to Thiruvalluvar St Junction (1.4 KM)
		Education	31. Anganwadi Building at Kamarajar Nagar
		Drinking water	32. Reddyar Palayam (30000 ltrs.)
			33. Dr.Ambethkar Nagar (30000 ltrs.)
11	Kattuppalli	Infrastructure	34. Community Hall-Kachipadi Colony
		-	35. Kachipadu Burial Ground Compound Wall

5. DESCRIPTION OF PORT FACILITIES AT KAMARAJAR PORT

Kamarajar Port was originally planned to handle thermal coal to meet the requirement of Tamil Nadu Electricity Board TNEB (presently TANGEDCO). Subsequently, the vast land resources available of around 2000 Acres with the port together with the road and rail connectivities provided the necessary impetus for the development of different facilities including iron ore, general cargo, container cargo, liquid terminal, automobile terminal etc. The details of various facilities built during phase I, which are in progress as phase II, the facilities proposed now at phase III are described below.

Traffic at Kamarajar Port

The location of KPL and the availability of the port land made an impression on Automobile industries towards KPL and also the restriction on Chennai Port for the movement of car carriers enhanced the export and import of automobiles in KPL. Almost maximum capacity is utilized in the port and it is necessary to initiate the development of another RORO berth. To meet the demand of Liquid Cargo in the Hinterland, Government of India oil companies like IOCL, BOL, HPCL etc. have shown interest for developing the terminals in KPL. The MLT-I has already reached the point of Optimum utilization the surplus cargo needs to be handled at MLT-II.

In the hinterland, lot of coal based industries need coal for manufacturing their products. Considering the growing common user coal demand, action is initiated for developing the second Bulk Terminal on DBFOT basis. There is a need for development of additional major world class container terminals in Indian ports, particularly terminals that can handle main line vessels of today and future. The present trend in growth of multi cargo traffic in India is very significant, warranting development of additional facilities to meet the surging demand in this sector of traffic.

5.1. PHASE I FACILITIES COMPLETED (1991-2012)

The port have started commissioning with two coal berths in the year 2001 after getting environmental and CRZ clearances from the Government. Two coal berths were constructed in series to meet the coal requirements of TNEB (presently TANGEDCO) and the port started commissioning as a full-fledged port with required infrastructure such as stackyard, conveyor etc. for the transportation of coal to the TNEB site located adjacent to the port. The port was then designed and planned with two coal berths. In addition, Non-TNEB customers also expressed their demand for coal handling facilities to meet their coal based needs. As the port showed continuous signs of growth over a period of time the demand for additional port facilities started pouring in which included port facilities for export of cars to European markets by Nissan in 2008.

In nutshell, the Phase I development of the port facilities are:

- i) Two coal berths exclusively for TNEB coal (one using shore based grab unloaders plus conveyors and the other with ship un-loaders and harbour mobile hoppers plus conveyors-now being modified similar to shore based grab unloaders).
- ii) Marine Liquid Terminal (on BOT basis under 30-year license to Ennore Tanker Terminal Pvt. Ltd. - commissioned during 2009) with all associated storage facilities.
- iii) Common-user coal terminal for Non-TNEB users with associated facilities on BOT basis under 30-year license basis to Chettinad International Coal Terminal Private Ltd. - commissioned during 2011)
- iv) Iron ore terminal (also on the same basis as item ii and iii above to Sical iron Ore Terminal Ltd. -SIOTL with MMTC as a joint partner added later- completed but not put to use due to ban on iron ore export)
- v) General cargo cum automobile export terminal which was constructed by KPL for car exports and for other general cargo. The berth will be able to accommodate the world' s largest car carrier of capacity of 8000 cars and a backup area of 144000 sq.m has been developed.

- vi) Turning circle with radius of 300 m and the depth of turning basin is (-) 15.5 m CD.

The Phase I development facilities which are operational consist of 6 berths with the following throughput capacity:

Table 5.1. Phase I Facilities - Throughput

Terminal	No. of berths	Throughput capacity (Million Tonnes)
TNEB coal	2	16
Common user coal terminal	1	8
Common user iron ore terminal	1	12
Common user marine Liquid terminal	1	3
General cargo cum automobile export terminal	1	1
Total	6	40

Fig.5.1 clearly reveals that the increasing trend in traffic is more on coal and other cargo. The ore traffic is almost absent at present due to ban imposed by Supreme Court on export of iron ore.

The Phase I operation of the port has sent positive signals amongst the user community illustrating port' s capability to go in a big way on the basis of record performance from 2010-11 to 2014-15 in terms of growth to an admirable extent of almost 35% per year (from 11 MT in 2010-11 to 30 MT in 2014-15).

It was decided to further expand these facilities by continually encouraging private sector participation in the creation of new facilities and this augured well for KPL becoming a full-fledged landlord port restricting its activities only to common facilities such as dredging and marine services. Accordingly, KPL initiated action during 2011-12 to take up the Phase II development.

5.2. PHASE II FACILITIES UNDER CONSTRUCTION (2014-2017)

In addition to the existing facilities KPL has obtained environmental and CRZ clearances for the following projects which are under construction.

5.2.1. Liquefied Natural Gas (LNG) Import Terminal of 5 MTPA capacity

IOCL in joint venture will develop an LNG Terminal with a capacity of 5 MTPA for storage and regasification of liquefied natural gas. The Union Cabinet approved leasing of land of Kamarajar Port Ltd for a liquid gas (LNG) import terminal being built by the joint venture led by IOC in which IOC will hold majority stake. The LNG jetty has been designed for handling Q-max vessels of 266,000 m³ size - which is the maximum size operating at present.

5.2.2. Two Container Terminals of 1.40 million TEU capacity

To cater the future growing container traffic needs, Kamarajar Port has decided to develop the Container Terminal. The length of the proposed terminal is 730 m with a planned capacity of 1.40 Million TEUs. The berth will be designed for accommodating and servicing container vessels of 14500 TEUs class having a dredge depth of (-) 16 m CD at the berth and (-) 17 m CD at the approach channel.

5.2.3. Multi Purpose Cargo Terminal of 2 MTPA capacity

KPL has taken a step to develop a multi cargo terminal to meet the EXIM traffic of Bulk and Project Cargos like turbines, generators, granites etc. The length of the proposed terminal is 270 m on the berthing face and 500 m width with all matching cargo handling equipment.

5.2.4. Two Coal Berths for TNEB each 9 MTPA

KPL has decided to develop two additional coal berths CB3 and CB4 considering the expansion of the existing thermal power plants of TNEB and new TNEB - NTPC JV project. Each of the coal berths has been proposed to be constructed with a capacity of 9 MTPA each.

Table 5.2. Phase II Facilities-Throughput

Terminal	No. of berths	Throughput capacity (Million Tonnes)
LNG terminal	1	5
Container terminal	2	16.8
Multipurpose terminal	1	2
TNEB coal terminal	2	18
Total	6	42

5.3. PHASE III FACILITIES PRESENTLY PROPOSED (2017 - 2022)

5.3.1. Development of two Berths for Automobile Export/Import - RoRo Terminals

Kamarajar Port has the location advantage and the availability of land in the port is making it a unique port for development. KPL has developed a General Cargo berth with 278 meters long with an adequate car parking yard which can accommodate about 10000 cars. Further, KPL had entered into an Agreement with Nissan, Ford and Toyota to export automobiles through KPL. Due to no congestion and no restrictions imposed for movement of Car carriers.

Automobile manufacturers have adopted a strategy of choosing Gujarat State in Western India and Tamil Nadu in Southern India as a priority manufacturing sites for automobiles for exports. Based on these ground realities it is estimated that the

future share of the Chennai Bengaluru region will be in the order of 60% of the exports from Indian as a whole. On this basis, the total number of exports of automobile from Southern India would be anywhere between 17 to 23 lakhs on this basis they have recommended development of 2 RO-RO terminals for Chennai Port and 3 for KPL. KPL has initiated to develop RO-RO terminals of 6 MTPA capacity in a phased manner to cater the automobile export share of Chennai Bengaluru region. The proposed Automobile export/import cum General Cargo berths are proposed just on the west side of the existing car berth in the new basin to be developed northward.

5.3.2. Development of additional two numbers of Marine Liquid Terminals

The MLT-I has already reached the point of Optimum utilization, the surplus cargo needs to be handled at MLT-II and captive Jetty. It is proposed to construct additional two number of liquid terminal of 10 MTPA capacity. The expected liquid cargo handled at MLT II are HSD, MS, CBFS, Lub / Base oil, POL, Chemicals, SKO, LPG and the captive jetty are POL and LPG. As per the port layout of Kamarajar Port, the Marine Liquid Terminal – II and the captive jetty are proposed at a location of about 1700 meters from the landfall point on the western side of the Northern breakwater and on the south of existing Marine Liquid Terminal – I. The berthing structure will be offset at a distance of about 135 m off the North breakwater. Each jetty will be an integrated structure consisting of 360 meters length of service / berthing platform and mooring facilities for handling smaller as well as larger vessels.

5.3.3. Development of two Bulk Terminals

The raw materials for the operating steel plants are being met through domestic as well as international sources. However, of late the reduction in the domestic production of the Iron ore and coal has put increased stress on the raw material imports from various sources, including but not limited to Western Australia, South

Africa, Canada, and Africa etc. The imported cargo is handled at various ports presently, including, Mormugao Port, Goa, Krishnapatnam Port, Kamarajar Port and Jaigarh Port, Ratnagiri, Maharashtra. Action has been initiated for the development of a Captive dry bulk terminal with a capacity of 9 MTPA.

Even though the port will be capable of handling dry bulk of 54 MTPA in 2017-18, it can only handle around 14 MTPA for common user coal (8 MTPA through CICTPL and 6 MTPA through SIOTL). In the Hinterland, lot of coal based industries need coal for manufacturing their products. Considering the growing common user coal demand, action is initiated for developing the second Bulk Terminal on DBFOT basis with a capacity of 9 MTPA.

5.3.4. Development of Additional Container Terminal II

To cater the future growing container Cargo traffic needs KPL has proposed construction of additional Container berth to accommodate three main line vessels or 4 to 5 feeder vessels with a capacity of 24 MTPA in a quay length of 1000 m. Backup area for stacking and receipt/ delivery of container from and to stackyard will be developed and allied equipments on berth consisting of quay cranes and yard equipment will be provided. It is proposed to have the container terminal on the western side of the harbour basin and to create another basin of width 350 m and length of 1000 m with a continuous berthing face in a north-south orientation. The terminal will commence from the northern edge of the ongoing container terminal.

5.3.5. Development of Multi cargo terminal

The present trend in growth of multi cargo traffic in India is very significant, warranting development of additional facilities to meet the surging demand in this sector of traffic. In order to cater the EXIM traffic, KPL has planned for development of multipurpose cargo terminal of capacity 2 MTPA on DBFOT basis. The commodities which are proposed to be handled at this terminal are Granite, Timber

logs (excluding pines), Grain (Maize, wheat), Bagged cargoes including sugar, Cobble stone, Steel cargoes and Project cargoes. The developer will have the option of handling fertilizer and FRM provided appropriate closed conveyor system and storage silos commensurate with the cargo requirement are installed.

Table 5.3. Phase III Facilities - Throughput

S. No.	Terminal	No. of berths	Throughput capacity (Million Tonnes)
1	Marine Liquid-Common Terminal	1	5
2	IOC Terminal	1	5
3	Automobile	2	6
4	Containers	3	24
5	Multipurpose cargo	1	2
6	Dry bulk (coal/ore/ other type)	2	18
Total		10	60

5.4. DREDGING, DREDGE DISPOSAL AND RECLAMATION

5.4.1. On-going capital dredging under Phase II

Phase II dredging consists of dredging in front of the container berths /multi cargo berth to a depth of (-) 16 m CD and its approaches to a depth of (-) 16.5 m CD. Similarly the coal berths and its approaches will be dredged to a depth of (-) 18 m CD and (-) 18.5 m CD respectively. An offshore dumping area of 5000 m x 5000 m has been identified as per the modeling study.

5.4.2. Additional dredging for Phase III development

KPL proposes to carry out capital dredging of the channel and basin area to accommodate the deep draft vessels under phase III. It is proposed carry out dredging in three stages as detailed below.

Table 5.4. Summary of capital dredging

Stages of dredging	Quantity of dredging 10 ⁶ m ³	Method of Dredge Disposal				Quantity of Land Cutting (10 ⁶ m ³)
		Reclamation		offshore		
		Min	Max	Min	Max	
Stage 1	16	2	5	13	15	Nil
Stage 2	9	2	3	6	8	0.75
Stage 3	8	1	2	4	5	1.75
Total	33	5	10	23	28	2.50

The total quantity of capital dredging for Phase III development will be $33 \times 10^6 \text{ m}^3$. KPL has proposed to dispose the entire volume at the designated offshore disposal location or to use a minor part of the dredge sediments for land reclamation/ beach nourishment if necessity arises. In that case, the dredging quantity of $5 \times 10^6 - 10 \times 10^6 \text{ m}^3$ will be used for reclaiming the area between north of north break water to the northern boundary of the port (1.8 km length). Also the dredged sand can be utilized for reclaiming the land associated with Northern Rail Connectivity projects and other projects based on requirement. The rest of $23 \times 10^6 - 28 \times 10^6 \text{ m}^3$ will be disposed into the sea at a suitable location offshore.

The various facilities and activities under phase III are listed below.

- i) Development of additional 10 Berths
- ii) Dredging & Disposal
- iii) Development of Bulk Cargo Stack yard
- iv) Development of Multi Cargo Stack yard
- v) Construction of Automobile Park yard
- vi) Construction of Container Park yard
- vii) Construction of MLT Storage tank
- viii) Erection of Liquid Pipeline
- ix) Construction of Bulk cargo Conveyor belt

5.5. FINAL MASTER PLAN

The following Table shows that out of the planned capacity of 22 berths, 6 numbers of berths have been completed in Phase I and another 6 number of berths are under construction as Phase II development and leaving 10 numbers of berths for Phase III. The final Master Plan envisaged for over all 22 berths is shown below and also in Fig 5.2.

Table 5.5. Final Master Plan

Sl. No.	Type of Cargo	Phase I - Completed		Phase II - In progress		Phase III - Proposed	
		No. of Berths	Capacity (MTPA)	No. of berths	Capacity (MTPA)	No. of berths	Capacity (MTPA)
1	Coal	TNEB 2 Non -TNEB 1	16 8	2	18	1	9
2	Marine Liquid- Common Terminal	1	3			1	5
3	IOC Terminal	-	-	-	-	1	5
4	Iron ore	1	12	-	-	-	-
5	General cargo Automobile	1	1	-	-	2	6
6	Containers	-	-	2	16.8	3	24
7	Multipurpose cargo	-	-	1	2	1	2
8	LNG	-	-	1	5	-	-
9	Dry bulk (coal/ore/other type)	-	-	-	-	1	9
Total		6	40	6	42	10	60
Grand total		22 berths		142 MTPA			
Dredging							
10	Capital dredging	17.80 Mm³	Completed	10 Mm³ 9 Mm³	Completed On going	25 Mm³ 8 Mm³	-

5.5.1. Port capacity by the end of phase III

KPL created a port capacity of 40 MTPA in Phase I and with present ongoing (under construction) Phase II development by 2016-17, the capacity would enhance by

another 42 MTPA totaling 82 MTPA. Phase III projects would bring about another 60 MTPA by 2020-21 and the total throughput capacity would increase to 142 MTPA or even more if more modernization measures are taken up to increase productivity commensurate with the demand and at par with fully developed ports.

5.5.2. Forecast of Vessels

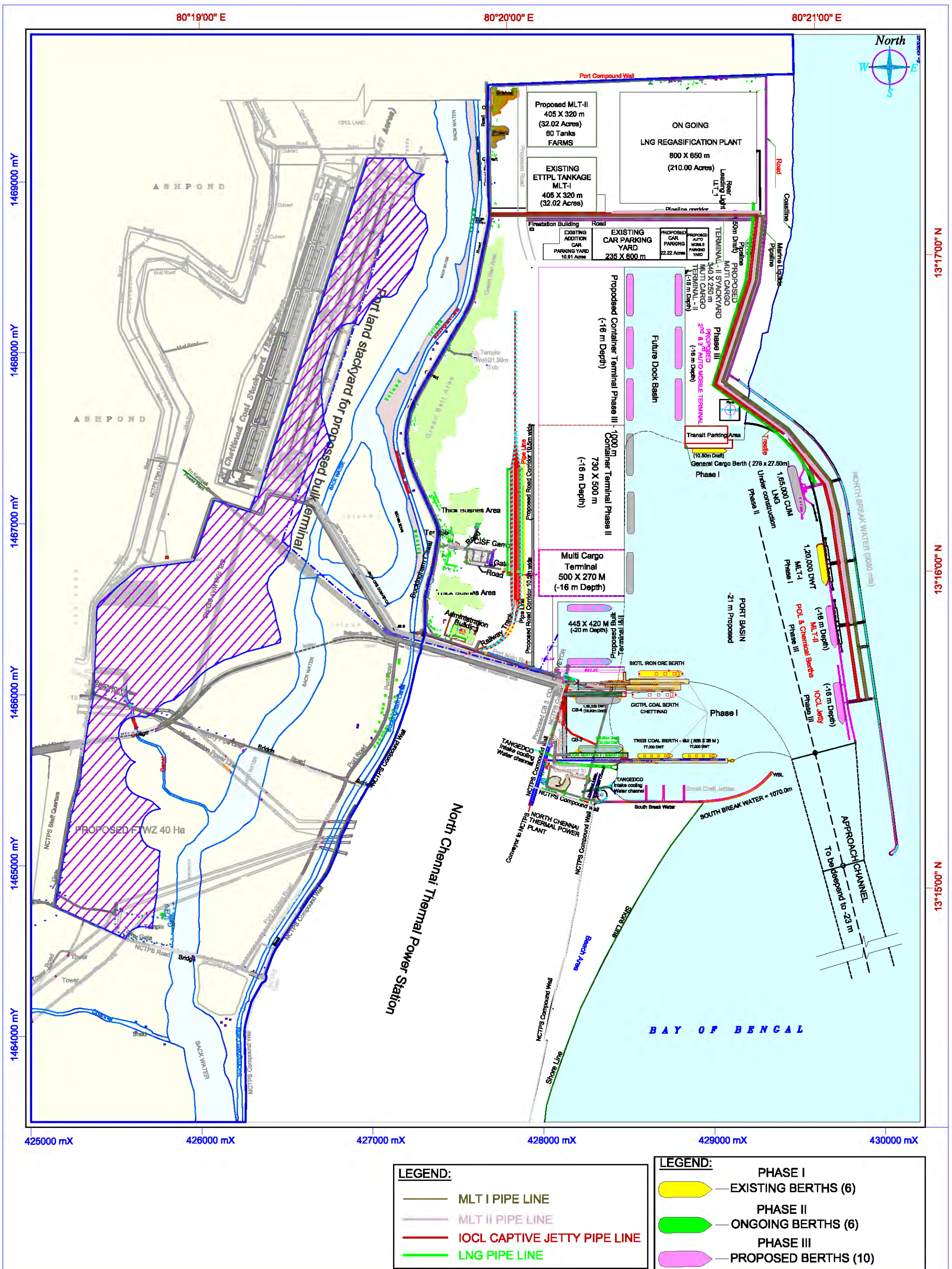
The details of the vessel forecast to meet the additional volume of cargo envisaged in the Phase III facilities are given in Table 5.6 below.

Table 5.6. Vessel forecast for the Phase III facilities

Type of Cargo	Capacity (MTPA)	Approximate parcel size	Approximate Number of vessel movements (in and out)
Liquid Bulk	10	6000 DWT	160 x 2
Dry Bulk	18	120000 DWT	150 x 2
Containers	24 (2 million TEUs)	18000 TEUs (per vessel)	110 x 2
Automobile/Multi cargo	8	30000 DWT	250 x 2
Total number of vessels (in and out)			1340



Fig. 5.1. Traffic at KPL



6. TERRESTRIAL ENVIRONMENT

6.1. Introduction

The proposed project site comes under the Minjur Block of Ponneri Taluk within Thiruvallur District in Tamil Nadu. The study area encompassing 10 km radial distance from the proposed project site is shown in Fig. 6.1.

Indomer has collected baseline data through Creative Engineers & Consultants, Chennai, NABL accredited organization, for first two seasons for Pre monsoon (April 2016) and Post monsoon (October 2016) and for Fair weather (March 2017) by Indomer as it received the NABL accreditation by then. The available secondary data in the following two reports prepared for KPL which were provided by KPL are also considered.

- i) Periodic Monitoring report of Hubert Enviro Care Systems Pvt. Ltd., Chennai, 2015.
- ii) EIA report for CB3 and CB4 by Asian Consulting Engineers Pvt. Ltd., Delhi, 2014.

6.2. Site and Surroundings

The important features like industries, road network, railway network, eco-sensitive area around the proposed project site within the study area are given below.

Distance of nearest Places:

Puzhuthivakkam - 1.15 km West

Thazhankuppam - About 3.47 km (South West)

Nettukuppam - About 3.18 km (Southwest).

Attipattu - About 3.68 km (Southwest)

Chennai - 20 km southwest

The state highway connecting the port is about 8.4 km northwest

The airport is at Chennai located 34.0 km southwest.

Ennore creek is located 2.7 km south and critically polluted area within the study area is Manali located 13.4 km southwest. The industries located close to the project site are North Chennai Thermal Power station (NCTPS) adjacent to port in South, Chettinad International Coal Terminal - BOT operator of KPL handling coal for common user Coal (About 3.0 km northwest), HPCL Terminal (About 3.8 km southwest), IPPL LPG Terminal (About 3.8 km west), NTPC Tamil Nadu Energy Company Ltd. (About 4.9 km southwest) and L & T Shipbuilding yard (about 4.0 km north).

6.3. Land Environment

6.3.1. Topography

NCTPS is located adjacent to the Kamarajar Port at south and L & T Ship Building Yard located north of the port. The western side bordered by Buckingham canal joining with Ennore creek. The Eastern side enclosed by existing Northern Breakwater and Southern Breakwater in the Bay of Bengal.

The photographs and surrounding features of the Kamarajar Port were shown in Fig. 6.2. The primary source of fresh water is the Kosasthalaiyar River (1.5 km West), which originates from the Shevaroy Mountains in Andhra Pradesh. The Ennore Creek is a tidal backwater adjoining the stretch of the coastline. The Buckingham Canal flows parallel to the shoreline adjoining the port area, which partially joins the Ennore Creek at its mouth and partially flows farther south to Chennai. The main Railway line connecting Chennai – Howrah is extended into the port area for the transportation of coal and other cargoes from Kamarajar Port to other parts of the hinterland. The

nearest Railway Stations are *Attipattu Pudunagar* located at around 4.2 km WSW and Ennore around 5 km SW.

6.3.2. Geology

The geological formations occurring in the coast are upper Gondwana consists of sand and silts, Quaternary sand and clay undulation by Achaean crystalline rocks (Charnockite). The study area was equally covered with half of sand & silt and half of alluvium soil deposits. The Minjur area is completely covered with coastal alluvium due to east coast shore line.

The project site and the study area are underlain with unconsolidated aquifer of recent age. The Lithology consists of river alluvium and flood plain deposits. Alluvium, forms a good aquifer system along the Araniyar and Kosathalaiyar River bed, is one of the major sources of water supply to urban areas of Chennai city and also to the industrial units. The yield prospect of the aquifer system is $> 200 \text{ m}^3/\text{day}$.

6.3.3. Land Use and Land cover- Phase II (under construction)

The land use land cover map for the study area of Phase II was prepared by processing the standard False Color Composite (FCC) of LANDSAT 8 satellite imagery, August 2013 with $15 \times 15 \text{ m}$ resolution. The land use land cover map is shown in Fig. 6.3. The land use classification is tabulated in Table 6.1. About half of the study area (50.78%) was covered by Bay of Bengal. Agricultural land, human settlement and industrial area covered an area of 20.31%, 9.71% and 8.43%, respectively on the total study area. Area covered by water body is about 3.01% constituted by Kosathalaiyar River, Buckingham canal and the Ennore creek. 2.47%, 1.95%, 1.72% and 1.62% of the study area were comprised of water logged area, plantation, wet land and salt pan respectively.

Table 6.1. Land Use Land Cover Classification around KPL under Phase II

S.No.	Class Name	Area (km ²)	Area (%)
1	Sea (Bay of Bengal)	159.49	50.78
2	Agricultural land	63.79	20.31
3	Settlement	30.51	9.71
4	Industrial area	26.49	8.43
5	Water body	9.47	3.01
6	Water logged land	7.75	2.47
7	Plantation	6.11	1.95
8	Wet land	5.40	1.72
9	Salt pan	5.09	1.62
Total		314.10	100.0

Source: EIA report for CB3 & CB4, ACE, 2014

6.3.4. Land Use and Land cover-Phase III

Subsequently, for Phase III development, the clearance process was initiated in 2015. Following this, a map showing the contour within the port boundary is shown in Fig 6.4.

Land use and land cover studies were undertaken using satellite images and field survey for ground truthing. The 1:25000 scale mapping of Land Use and Land Cover with crop pattern delineation in the buffer area of 10 km around the project area is shown in Fig. 6.5. Puzhuthivakkam, Athipattu, nandiambakkam, Neithavayal and kattupalli are the important nearby villages. In the study area dominant land use categories are land with scrub and without scrub covers the major portion within the 10 km radius. Next to scrub land the major land use pattern is an industry which lies on the western side of the project site at 5 km distance. Few patches of land in the north west and south west part of the region is bounded with agriculture crop land. Land use/land cover pattern and spatial distribution of aquaculture, salt pan, surface water bodies and wetlands are also present within 10 km radius of the project site.

The land use classification is tabulated in Table 6.2. About half of the study area (53.11%) was covered by Bay of Bengal. Land with scrub, industry and built up land covered an area of 7.91%, 7.81% and 6.18%, respectively of the total study area. Agriculture crop land and land without scrub covered an area of 5.36% and 5.36% respectively. Area covered by water body is about 3.05% constituted by Kortalaiyar River, Buckingham canal and the Ennore creek. 1.87%, 1.60% and 1.24% of the study area were comprised of kamarajar port area, L&T port area and reservoir/tanks respectively.

Table 6.2. Landuse map of kamarajar port - breakup in percentage wise – Phase III

Sl.NO	CATEGORY	PERCENTAGE
1	Abandoned aquaculture	0.18
2	Abandoned salt pan	0.47
3	Agriculture- cropland	5.36
4	Agriculture plantation	0.27
5	Aquaculture	0.61
6	Built-up land	6.18
7	Canal / drain / stream	0.06
8	Coal yard	0.34
9	Industry	7.81
10	Jetty	0.08
11	Kamarajar port	1.87
12	L&T port	1.60
13	Lake / pond / tank	0.96
14	Land with scrub	7.91
15	Land without scrub / vacant land	5.36
16	Mangroves	0.38
17	Reservoir / tanks	1.24
18	River / creek	3.05
19	Road	0.34
20	Salt affected	0.01
21	Salt pan	0.13
22	Sandy area,coastal	0.02
23	Sea	53.11
24	State highway	0.17
25	Village road	0.60
26	Wetland / water logged	1.87
	TOTAL	100.00

Source: IRS, Anna University

The comprehensive Land Use Plan for the development of Port - Phase III prepared by the KPL is shown in Fig. 6.6. The land use plan shows how the land is allocated for various uses for the storage of cargoes such as containers, general cargo, dry bulk etc. as proposed in the Phase III development of Port Master Plan.

In effect, the Land use has been suggested segregating its use based on the type of cargo and the likely impact that may be caused due to handling at the wharf and eventual storage at the designated places on the landward side for each type of cargo mix. Also, appropriate Landscaping is contemplated to minimize spreading of impacts to other storage.

6.3.5. Terrain

The terrain levels are shown in the contour map in Fig. 6.4. There will not be any removal of land or land cutting outside the port premises. The dredged materials by excavating the harbour basin at shore front will be partly used for filling and the major part will be disposed at offshore.

6.3.6. Soil – Pre monsoon, Post monsoon and Fair weather

Sampling location

Soil samples were collected through Creative Engineers & Consultants, Chennai, NABL accredited organization, for first two seasons for Pre monsoon (April 2016) and Post monsoon (October 2016) and for Fair weather (March 2017) by Indomer as it received the NABL accreditation by then. The samples were collected at 5 locations in each season. The soil quality analytical methods for pre monsoon, Post monsoon and Fair weather are given in Table 6.3. The soil sampling locations for Pre monsoon, Post monsoon and Fair weather are given in Table 6.4 and are shown in Fig. 6.7. The soil

quality analytical results for Pre monsoon, Post monsoon and Fair weather of the study area are given in Table 6.5.

Soil samples were collected at a depth of 0.5 to 1.0 m with the help of Auger. Physico-chemical parameters indicative of the soil quality were analyzed as per the standards and procedure prescribed in IS: 2720.

Table 6.3. Soil Quality Parameters and Test method – Pre monsoon, Post monsoon & Fair weather

S.No	Parameter	Test Method
1	Color	CEC-COP-SOIL-15
2	pH at 25°C	IS:2720 (Part-26) 1987 – (R-2002)
3	Electrical conductivity	IS : 14767 : 2000
4	Organic matter	IS : 2720 (Part-22) 1972 – (RA-2001)
5	Soil texture	USEPA-Soil.sci.soi.AM.J.Vol 65 may-June 2001
	Grain Size Distribution	USEPA-Soil.sci.soi.AM.J.Vol 65 may-June 2001
	Sand	USEPA-Soil.sci.soi.AM.J.Vol 65 may-June 2001
	Silt	USEPA-Soil.sci.soi.AM.J.Vol 65 may-June 2001
	Clay	USEPA-Soil.sci.soi.AM.J.Vol 65 may-June 2001
6	Sodium as Na	USEPA 3050 B
7	Potassium as K	USEPA 3050 B
8	Calcium as Ca	USEPA 3050 B
9	Magnesium as Mg	USEPA 3050 B
10	Phosphorous as P	IS 10158 – 1982 (RA 2003)
11	Total Nitrogen	IS 14684 – 1999

Table 6.4. Soil sampling Locations – Pre monsoon, Post monsoon & Fair weather

Location code	Location	Area Category	Distance from the study area (km)	Direction
S-1	Inside Kamarajar Port	Industrial	0.56	SW
S-2	Attipattu pudhunagar	Residential	4.23	WSW
S-3	Kattupalli village	Residential	5.20	NNW
S-4	Nandiambakkam Village	Residential	5.87	WNW
S-5	Ennore	Residential	5.41	SW

Table 6.5. Results of Soil Quality – Pre monsoon, Post monsoon & Fair weather

Sl. No.	Parameter	Unit	S1			S2			S3			S4			S5		
			Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather
1	Colour	%	Bright Brown	Bright Brown	Bright Brown	Bright Brown	Pale Yellow	Pale Yellow	Pale Yellow	Bright Brown	Bright Brown	Dark Greyish	Dark Greyish Yellow	Dark Greyish Yellow	Dark Greyish Yellow	Dark Greyish	Dark Greyish Yellow
2	Particle size distribution																
A	Sand	%	42.86	40.86	44.62	18.35	16.39	18.8	48.43	46.71	49.38	43.79	40.39	44.24	45.68	45.15	46.2
B	Silt	%	42.25	41.41	40.75	67.71	61.91	65.8	22.02	23.96	21.98	24.01	24.04	23.86	29.40	27.86	29.8
C	Clay	%	14.98	17.72	14.63	13.95	21.7	15.4	29.55	29.33	28.64	32.21	35.57	31.9	24.92	26.99	24
3	Texture	-	Loam	Loam	Loam	Silt loam	Silt loam	Silt loam	Sandy clay loam	Sandy clay loam	Sandy clay loam	Clay loam	Clay loam	Clay loam	Loam	Loam	Loam
4	Electrical Conductivity	µmhos/cm	51.27	50.86	58.2	33.38	36.12	34.8	65.52	61.47	76.4	113.4	91.47	114.6	280.5	254.20	242.4
5	pH at 25 C ⁰		8.10	7.69	8.04	4.60	5.02	4.8	8.01	7.98	8.09	7.02	7.46	7.82	10.1	9.87	9.24
6	Calcium as Ca	mg/kg	321	332	298	302	314	308	418	426	382	532	546	494	482	475	454
7	Magnesium as Mg	mg/kg	181	201	176	145	155	142	276	262	244	316	321	298	245	253	232
8	Sodium as Na	mg/kg	842	336	346	643	266	284	1023	432	468	1345	516	562	989	386	402
9	OC	%	0.17	0.28	0.24	0.13	0.17	0.14	0.31	0.39	0.34	0.49	0.51	0.46	0.24	0.28	0.32
10	Total- N	Kg/ha	412	215	242	233	130	142	717	350	384	941	452	468	497	245	284
11	Phosphorous as P ₂ O ₅	Kg/ha	3.8	0.81	0.98	3.5	0.62	0.88	2.9	0.8	0.96	5.6	1.47	1.68	7.2	1.16	1.28
12	Potassium as K ₂ O	Kg/ha	636	185.2	218	511	149	166	865	223	248	1024	298	312	748	221	242

Results:

The soil quality analytical results of the study area are given in Table 6.5.

Soil pH: Pre monsoon: Soil pH varied in the range of 4.60 to 10.1, which indicates highly acidic soils at location S-2 and highly alkaline at location S-5 and slightly alkaline to neutral of the remaining locations. Post monsoon: Soil pH varied in the range of 5.02 to 9.87, which indicates highly acidic soils at location S-3 and highly alkaline at location S-4 and slightly alkaline to neutral of the remaining locations. Fair weather: pH varied in the range of 4.80 to 9.24, which indicates acidic soils at location S-2 and highly alkaline at location S-5 and slightly alkaline to neutral of the remaining locations.

The alkalinity of the soil may be due to proximity to the marine water, which is saline/alkaline in nature.

Electrical conductivity: Pre monsoon: The electrical conductivity was in the range of 33.38 to 280.5 $\mu\text{mhos/cm}$. Post monsoon: The electrical conductivity was in the range of 36.12 to 254.2 $\mu\text{mhos/cm}$. Fair weather: The electrical conductivity was in the range of 34.8 to 242.4 $\mu\text{mhos/cm}$.

The soil EC (salinity) values indicate that there should have been rainfall before collection of soil samples as salinity is very low in spite of the fact that area should be saline due to proximity of sea.

Sodium, Calcium and Magnesium: Pre monsoon: Among basic cations predominance of sodium is seen (643 – 1345 mg/kg) followed by Ca (302 – 532 mg/kg) and Mg (145 – 316 mg/kg). Post monsoon: Among basic cations predominance of sodium is seen (266 – 516 mg/kg) followed by Ca (314 – 546 mg/kg) and Mg (155 – 321 mg/kg). Fair weather: Among basic cations predominance

of sodium is seen (284-562 mg/kg) followed by Ca (298-494 mg/kg) and Mg (142-298 mg/kg).

Hence potential of alkalinity hazard is there in the entire area, which may require application of ameliorating agent like gypsum.

Organic Matter: Pre monsoon: The organic matter in the soil of study area is in the range 0.13 to 0.49 %. Post monsoon: The organic matter in the soil of study area is in the range 0.17 to 0.51 %. Fair weather: The organic matter in the soil of study area is in the range 0.14 to 0.46 %.

Based on the organic matter status of soils, they are deficient (OC <0.5 %) in nitrogen. However, irrespective of soil type it appears that if SOC is below 1%, it may not be possible to obtain potential crop yields with sustainability. Also, with SOC less than 2%, soil aggregates are considered unstable.

Kjeldahl nitrogen, Phosphorous and Potassium: Pre monsoon: The total Kjeldahl nitrogen in the soil is in the range of 233-941 kg/ha. The Phosphorous in the soil is in range of 2.9 – 7.2 Kg/ha. The Potassium in the soil is in range of 511 – 1024 Kg/ha. Post monsoon: Total Kjeldahl nitrogen in the soil is in the range of 130 - 452 kg/ha. The Phosphorous in the soil is in range of 0.62 – 1.47 Kg/ha. The Potassium in the soil is in range of 149 – 298 Kg/ha. Fair weather: The total Kjeldahl nitrogen in the soil is in the range of 142 - 468 kg/ha. The Phosphorous in the soil is in range of 0.88 -1.68 kg/ha. The Potassium in the soil is in range of 166 – 312 kg/ha.

The soil phosphorus data reveal that soils are highly deficient in phosphorus status as values are <7.2 kg P₂O₅/ha in all seasons, but soils are very rich in potassium status as all the samples showed potassium content above 511 kg K₂O/ha during Pre monsoon and poor in potassium status as all the samples showed potassium content

less than 298 kg K₂O/ha during Post monsoon because of heavy rain and less than 312 kg K₂O/ha during SW monsoon.

From the above findings, it is inferred that soils are highly acidic to highly alkaline in a specific location. In case of acidic situation, liming (CaCO₃ application) is required, while in alkaline situation gypsum application as per gypsum requirement of soil. For greenbelt development application of organic manure @ 50t/ha and nitrogen and phosphorus at double the recommended dose should be applied for successful landscape/greenbelt development.

6.3.7. Soil Quality Monitoring – Earlier studies

Soil samples were collected by ACE from seven representative locations in the study area. The details of soil sampling locations are given in Table 6.6 and shown in Fig. 6.8.

Table 6.6. Soil Sampling Location – Earlier study

S.No	Sampling Locations	Code	Distance from the project Site (km)	Direction
1	Near Dredging Area	SS-1	0.51	SW
2	Near Proposed Site	SS-2	3.74	NW
3	Near Existing Area	SS-3	0.71	WSW
4	Attipattu Pudhu Nagar	SS-4	2.89	SW
5	Nappalyam Village	SS-5	8.18	SW
6	Vellur Village	SS-6	5.83	SW
7	Minjur Village	SS-7	7.96	WNW

Source: EIA report for CB3 & CB4, ACE, 2014

Soil Quality Results

The soil quality analytical results of the study area during southwest monsoon, post monsoon and pre monsoon Seasons are given in Tables 6.7, 6.8, and 6.9. Soil pH varied in the range 7.28 to 8.24, 7.52 to 8.07 and 7.12 to 8.18 in monsoon, post

monsoon and pre monsoon seasons respectively, which was near neutral to slightly alkaline in nature. The soil of the study area was observed as sandy loam. The soil sample from the location near the shoreline, namely SS-1, SS-2 and SS-3 were slightly alkaline in nature. This might be due to proximity to the marine water, which is saline in nature. Electrical conductivity was in the range of 545 to 1070 $\mu\text{S}/\text{cm}$, 534 to 879 $\mu\text{S}/\text{cm}$, 601 to 978 $\mu\text{S}/\text{cm}$ in Monsoon, Post Monsoon and Pre Monsoon seasons, respectively. Soil from SS-1 and SS-2 locations had high range of EC, because of its saline nature.

The organic carbon in the soil was in the range of 0.64 to 1.06%, 0.72 to 1.21 %, and 0.79 to 1.13% in south west monsoon, post monsoon and pre monsoon seasons, respectively. The total kjeldahl nitrogen in the soil of study area was in the range of 0.84 to 0.96%, 0.84 to 0.92 % and 0.78 to 0.95% in monsoon, post monsoon and pre monsoon seasons, respectively.

In general, the quality of soil remained the same irrespective of the season. The soil samples in the study area were sandy loam. It has near neutral to slightly alkaline pH and brownish appearance. Based on the organic carbon content, the soil was low to medium fertile in nature.

Table 6.7. Analysis Results of Soil Quality in Southwest monsoon Season

S. No	Parameter	Unit	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7
1	pH	-	8.0	8.24	8.23	7.28	7.34	7.88	7.32
2	Color	-	Light brown	Light brown	Light brown	Brown	Brown	Brown	Brown
3	EC	μS/cm	945	1070	1015	545	643	683	579
4	Organic Carbon	% by mass	0.64	0.78	0.64	0.84	1.06	0.94	1.04
5	Phosphorous	mg/100gm	0.60	0.59	0.56	0.80	0.71	0.65	0.52
6	Total kjeldahl Nitrogen	% by mass	0.94	0.90	0.84	0.89	0.96	0.84	0.84
7	Calcium	mg/100gm	164	181	176.8	154	201.6	194	256.7
8	Magnesium	mg/100gm	31.8	32.6	31	27.8	41	38	43.7
9	Potassium	mg/100gm	6.4	6.3	5.8	4.6	5.8	5.2	7.4
10	Sodium	mg/100gm	18.6	18.4	18.9	11.8	15	17.4	14.6
11	Texture	Sand	% by mass	74	88	82	30	64	60
		Clay	% by mass	18	8	10	16	12	30
		Silt	% by mass	8	4	8	54	24	10
12	Particle Size (2.0-0.05 mm)	% by weight	74	88	82	30	64	60	71.2
13	Particle Size (0.005-0.002 mm)	% by weight	8	4	8	54	24	10	16.4
14	Particle Size (<0.002 mm)	% by weight	18	8	10	16	12	30	12.4

Source: EIA report for CB3 & CB4, ACE, 2014

Table 6.8. Analysis Results of Soil Quality in Post Monsoon Season

S. No	Parameter		Unit	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6
1	pH		-	8.07	7.69	7.52	7.71	7.55	7.90
2	Color		-	Light brown	Brown	Brown	Brown	Brown	Brown
3	EC		μS/cm	879	794	534	601	613	625
4	Organic Carbon		% by mass	0.72	0.91	1.21	0.89	1.09	1.10
5	Phosphorous		mg/100gm	6.12	5.98	5.56	7.98	7.34	6.71
6	Total kjeldahl Nitrogen		% by mass	0.92	0.89	0.84	0.87	0.91	0.85
7	Calcium		mg/100gm	159	191	258	157	198	183
8	Magnesium		mg/100gm	33	30	35	26	39	40
9	Potassium		mg/100gm	5.8	6.0	6.9	4.9	5.5	5.3
10	Sodium		mg/100gm	17.9	13.8	12.9	10.5	14.6	12.1
11	Texture	Sand	% by mass	78	58	79	42	51	54
		Clay	% by mass	15	18	13	18	15	21
		Silt	% by mass	7	24	8	40	34	25
12	Particle Size (2.0-0.05 mm)		% by weight	78	83	58	42	51	54
13	Particle Size (0.005-0.002 mm)		% by weight	15	11	18	18	15	21
14	Particle Size (<0.002 mm)		% by weight	7	6	24	40	66	25

Source: EIA report for CB3 & CB4, ACE, 2014

Table 6.9. Analysis Results of Soil Quality in Pre Monsoon Season

S. No	Parameter		Unit	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6
1	pH		-	8.18	7.90	7.34	7.12	7.48	7.80
2	Color		-	Light Brown	Brown	Brown	Brown	Brown	Brown
3	EC		μS/cm	978	735	601	676	701	677
4	Organic Carbon		% by mass	0.79	0.81	1.13	0.79	1.00	1.01
5	Phosphorous		mg/100gm	6.59	5.88	5.31	7.31	7.10	6.18
6	Total kjeldahl Nitrogen		% by mass	0.87	0.78	0.89	0.81	0.95	0.80
7	Calcium		mg/100gm	148	180	261	144	179	175
8	Magnesium		mg/100gm	30	35	31	24	37	41
9	Potassium		mg/100gm	5.5	6.2	6.1	5.3	5.0	5.6
10	Sodium		mg/100gm	17.7	13.5	13.2	11.2	13.9	12.9
11	Texture	Sand	% by mass	80	62	75	48	55	50
		Clay	% by mass	11	16	15	20	11	24
		Silt	% by mass	9	22	10	32	34	26
12	Particle Size (2.0-0.05 mm)		% by weight	80	62	75	48	55	50
13	Particle Size (0.005-0.002 mm)		% by weight	11	16	15	20	11	24
14	Particle Size (<0.002 mm)		% by weight	9	22	10	32	34	26

Source: EIA report for CB3 & CB4, ACE, 2014

6.3.8. Seismicity

The map showing the earthquake zonation and seismic faults in India is shown in Fig. 6.9. It is evident from the map that the port site falls under Zone III – moderate risk zone.

6.4. Meteorological Data

6.4.1. Climate and Rainfall

The tropical coastal climate prevails in the project zone. Other than northeast monsoon period the climate in general will be warm and humid. There will be setting up of sea breeze during afternoon hours particularly in summer. The climate is classified as southwest monsoon, north east monsoon and fair weather monsoon. During the South West Monsoon season (July – September 2014), 425 mm of rainfall was recorded. The mean meteorological/ data of Chennai region (Minambakkam) for the year 1901 -2000 is tabulated in Table 6.10.

Table 6.10. Mean Meteorological Data for the Year 1901-2000

Month	Mean Temperature		Mean rainfall (mm)
	Maximum	Minimum	
January	28.8	20.4	35.3
February	30.5	21.1	13.0
March	32.6	23.0	14.5
April	34.7	25.8	15.9
May	37.4	27.6	42.4
June	37.3	27.4	53.9
July	35.3	26.1	99.6
August	34.5	25.5	129.9
September	33.9	25.2	123.5
October	31.8	24.2	284.6
November	29.4	22.6	353.0
December	28.4	21.2	146.3

(Source: IMD Website, <http://www.imd.gov.in/>)

6.4.2. Wind and Temperature

The predominant wind direction during the post monsoon and pre monsoon season was towards WNW - NW - NE. The wind rose diagram for both the seasons showing the predominant wind direction (from) is given in Fig. 6.10. The wind speed ranged from 0.50 m/s to 0.88 m/s. The temperature varied from 20.4° to 37.4°.

6.5. Air Environment

6.5.1. Ambient Air Quality Monitoring – Pre monsoon, Post monsoon & Fair weather

The Ambient Air quality was monitored through Creative Engineers & Consultants, Chennai, NABL accredited organization, for first two seasons for Pre monsoon (April 2016) and Post monsoon (October 2016) and for Fair weather (March 2017) by Indomer as it received the NABL accreditation by then.

The samples were collected at 5 locations in each season. The monitoring locations were selected based on the predominant wind direction, accessibility, topography, security for the installed high volume sampler and availability of reliable power supply. The main sources of air pollution in the study area are industrial emissions and vehicular emission. Four monitoring locations covered residential area and one location covered the port area. The locations of the Ambient Air Quality Monitoring Stations for Pre monsoon, Post monsoon and Fair weather are given in Table 6.11 and shown in Fig. 6.11.

Methodology

Ambient Air Quality Monitoring was conducted for Particulate Matter (PM₁₀ and PM_{2.5}), Sulphur dioxide (SO₂), Nitrogen dioxide (NO₂) and Carbon Monoxide (CO).

The Ambient Air Quality parameters were conducted during April 2016, October 2016 and March 2017. The samples were collected as per CPCB 2003 and analyzed as per the Guidelines for Ambient Air Quality Monitoring, CPCB, 2009. The air quality monitoring equipments were placed at open space, free from trees and vegetation, which otherwise will act as a sink of pollutants resulting in otherwise misleading lower values.

Table 6.11. Ambient Air Quality Monitoring Locations – Pre monsoon, Post monsoon and Fair weather

Location code	Location	Area Category	Distance (Km)	Direction
			From the study area	
A1	Inside Kamarajar Port	Industrial	0.56	SW
A2	Attipattu pudhunagar	Residential	4.23	WSW
A3	Kattupalli village	Residential	5.20	NNW
A4	Nandiambakkam Village	Residential	5.87	WNW
A5	Ennore	Residential	5.41	SSW

Ambient Air Quality Monitoring Results

Particulate Matter (PM_{10} and $PM_{2.5}$): Pre monsoon: The 24-hourly average PM_{10} level varied between 45.1 – 84.1 $\mu\text{g}/\text{m}^3$. The level of PM_{10} is well within the NAAQ standards, 2009. Table 6.12 gives details of the mean values of the 24-hourly average PM_{10} levels. The 24-hourly average $PM_{2.5}$ level varied in the range of 23.5 - 48.3 $\mu\text{g}/\text{m}^3$. The levels of $PM_{2.5}$ for all the sampling locations were well within the permissible limits. Table 6.13 gives details of the mean values of the 24-hourly average $PM_{2.5}$ levels.

Overall, the results of $PM_{2.5}$ and PM_{10} monitored were found to be well within permissible limits.

Post monsoon: The PM_{10} level of both first and second day varied in the range of 33.7 – 82.5 $\mu\text{g}/\text{m}^3$. The level of PM_{10} is well within the NAAQ standards, 2009. The

average PM_{2.5} level of both first and second day varied in the range of 21.2 - 44.1 µg/m³. The levels of PM_{2.5} for all the sampling locations were well within the permissible limits.

Fair weather: The 24-hourly average PM₁₀ level varied between 44.8 – 82.4 µg/m³. The level of PM₁₀ is well within the NAAQ standards, 2009. Table 6.12 gives details of the mean values of the 24-hourly average PM₁₀ levels. The 24-hourly average PM_{2.5} level varied in the range of 17.9 – 34.6 µg/m³. The levels of PM_{2.5} for all the sampling locations were well within the permissible limits. Table 6.13 gives details of the mean values of the 24-hourly average PM_{2.5} levels. Overall, the results of PM_{2.5} and PM₁₀ monitored were found to be well within permissible limits.

The results of the Ambient Air Quality Monitoring Stations during Pre monsoon, Post monsoon and Fair weather period are given in Tables 6.12 and 6.13.

Overall, the results of PM_{2.5} and PM₁₀ monitored were found to be well within permissible limits.

Table 6.12. Results of PM₁₀ monitored - Pre-monsoon, Post monsoon & Fair weather

Location code	Station Location	24-hourly Average PM ₁₀ (µg/m ³)									Permissible Limit
		Minimum			Maximum			Mean			
		Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weat her	Pre mon soon	Post mon soon	Fair weather	
A1	Inside Kamarajar Port	78.4	77.6	69.8	84.1	82.5	82.4	81.3	80.0	76.1	100
A2	Attipattu pudhunagar	70.1	33.7	58.4	73.4	68.7	72.2	71.8	51.2	65.3	100
A3	Kattupalli village	45.1	46.7	46.2	48.2	51.3	58.8	46.7	49.0	52.5	100
A4	Nandiambakkam Village	45.2	44.3	44.8	47.1	46.7	62.4	46.2	45.5	53.6	100
A5	Ennore	77.3	46.6	52.4	79.1	79.5	69.5	78.2	63.0	60.95	100

Table 6.13. Results of PM_{2.5} monitored - Pre monsoon, Post monsoon & Fair weather

Stn.	Station Location	24-hourly Average PM _{2.5} (µg/m ³)									
		Minimum			Maximum			Mean			Permis- sible Limit
		Pre mon- soon	Post mon- soon	Fair weath- er	Pre mon- soon	Post mon- soon	Fair weath- er	Pre mon- soon	Post mon- soon	Fair weath- er	
A1	Inside Kamarajar Port	45.1	38.5	27.9	48.3	44.1	34.6	46.7	41.3	31.3	60
A2	Attipattu pudhunagar	34.1	33.7	23.4	36.6	32.0	30.3	35.4	32.8	26.8	60
A3	Kattupalli village	26.1	22.3	18.5	28.2	23.8	24.7	27.2	23.0	21.6	60
A4	Nandiambakkam Village	23.5	21.2	17.9	24.6	21.2	26.2	24.1	21.2	22.1	60
A5	Ennore	37.3	35.9	21.0	39.3	37.1	29.2	38.3	36.5	25.1	60

Nitrogen Dioxide (NO₂): Pre monsoon: The mean of 24-hourly NO₂ level near the study area found varying between 6.9 - 13.6 µg/m³. The 24-hourly average values of NO₂ at all the locations were well within the prescribed limit of 80 µg/m³ stipulated for residential, rural and other areas.

Post monsoon: The NO₂ values for both first and second day were found to be varying between 7.6 - 13.6 µg/m³. The NO₂ at all the locations were well within the prescribed limit of 80 µg/m³ stipulated for residential, rural and other areas.

Fair weather: The mean of 24-hourly NO₂ level near the study area found varying between 9.6 – 21.2 µg/m³. The 24-hourly average values of NO₂ at all the locations were well within the prescribed limit of 80 µg/m³ stipulated for residential, rural and other areas.

The monitored NO₂ levels at each location for both pre monsoon, post monsoon and Fair weather are given in Table 6.14.

Table 6.14. Results of NO₂ monitored – Pre monsoon, Post monsoon & Fair weather

Stn.	Station Location	24-hourly Average NO ₂ (µg/m ³)									Permis- Sible Limit
		Minimum			Maximum			Mean			
		Pre Mon- soon	Post mon- soon	Fair weath- er	Pre mon- soon	Post mon soon	Fair weath- er	Pre mon soon	Post Mon soon	Fair weath- er	
A1	Inside Kamarajar Port	9.4	9.8	11.2	10.2	9.3	18.2	9.8	9.5	14.7	80
A2	Attipattu pudhunagar	6.9	8	10.4	7.6	8.2	16.4	7.3	8.1	13.4	80
A3	Kattupalli village	7.7	7.6	9.6	8.3	7.3	14.8	8.0	7.45	12.2	80
A4	Nandiambakkam Village	8.5	11.7	10.2	10.2	13.6	16.6	9.6	12.6	13.4	80
A5	Ennore	12.1	9.5	14.6	13.6	8.9	21.2	12.9	9.2	17.9	80

Sulphur Dioxide (SO₂): Pre monsoon: The mean of 24-hourly average values of SO₂ over the study area found to be varying between 4.1 - 11.5 µg/m³. SO₂ levels at all the locations were well within the permissible limit of 80µg/m³ stipulated for residential, rural & other areas.

Post monsoon: The SO₂ values for both first and second were found to be varying between 4.4 – 9.7 µg/m³. SO₂ levels at all the locations were well within the permissible limit of 80 µg/m³ stipulated for residential, rural & other areas.

Fair weather: The mean of 24-hourly average values of SO₂ over the study area found to be varying between 5.2-14.8 µg/m³. SO₂ levels at all the locations were well within the permissible limit of 80µg/m³ stipulated for residential, rural & other areas.

The monitored SO₂ levels at each location for both pre monsoon, post monsoon and Fair weather are given in Table 6.15.

Table 6.15. Results of SO₂ monitored - Pre monsoon, Post monsoon and Fair weather period

Stn.	Station Location	24-hourly Average SO ₂ (µg/m ³)									Permis- sible Limit
		Minimum			Maximum			Mean			
		Pre mon- soon	Post mon- soon	Fair weath- er	Pre mon- soon	Post mon- soon	Fair weath- er	Pre mon- soon	Post mon- soon	Fair weath- er	
A1	Inside Kamarajar Port	6.3	6.5	7.4	6.6	6.1	9.4	6.5	6.3	8.4	80
A2	Attipattu pudhunagar	4.1	5.2	6.4	4.8	4.9	8.2	4.5	5.0	7.3	80
A3	Kattupalli village	5.2	4.4	5.2	5.9	3.8	7.6	5.6	4.1	6.4	80
A4	Nandiambakkam Village	7.3	10.6	5.4	8.4	9.7	8.6	7.9	10.1	7.0	80
A5	Ennore	10.4	7.2	12.2	11.5	7.5	14.8	11.0	7.3	13.5	80

Carbon Monoxide (CO): Pre monsoon: The CO value in the study area was observed and found to be much below the detectable limit (DL 1144 µg/m³) at all five locations. Post monsoon: The CO value in the study area was observed and found to be much below the detectable limit (DL 1144 µg/m³) at all five locations. Fair weather: The CO value in the study area was observed to be much below the detectable limit (DL 0.1 µg/m³) at all five locations.

Selenium (Se): The selenium levels in the study region were observed to be below detectable limit (<1.0 ng/m³) at all five locations.

6.5.2. Ambient Air Quality Monitoring – Earlier studies

As per the CPCB guidelines for Ambient Air Quality Monitoring, 2003, ambient air quality was not monitored in monsoon season.

During the Post Monsoon Season, ambient air quality was monitored within the study area at six locations. The monitoring locations covered both industrial and residential area. The main sources of air pollution in the study area were found to be

industrial emissions and vehicular emissions. The locations of the Ambient Air Quality Monitoring Stations are given in Table 6.16 and shown in Fig. 6.12.

Table 6.16. Ambient Air Quality Monitoring Stations –Earlier study

Samples	Location	Area Category	Distance from the project Site (km)	Direction
AS-1	Inside Ennore Port	Industrial	0.19	NW
AS-2	Attipattu Pudhu Nagar	Residential	3.96	WSW
AS-3	Kattuppalli Village	Residential	4.92	NNW
AS-4	Nandiyambakkam Village	Residential	6.47	WNW
AS-5	Vallur-2	Residential	6.28	W
AS-6	Thazhankuppam Village	Residential	3.86	SSW

Source: EIA report for CB3 & CB4, ACE, 2014

Methodology

Monitoring values were reported for: Particulate Matter (PM₁₀ and PM_{2.5}), Sulphur Dioxide (SO₂), Oxides of Nitrogen (NO_x) and Carbon Monoxide (CO) covering the period of January to March 2014.

Results

Particulate Matter (PM₁₀ and PM_{2.5})

During the Post and Pre Monsoon seasons, the 24-hourly average PM₁₀ level varied between 30.5 - 62.7 µg/m³ and 32.9 – 77.1 µg/m³, respectively. The level of PM₁₀ was well within the NAAQ standards, 2009. Tables 6.17 and 6.18 gives details of the mean values of the 24-hourly average PM₁₀ levels during the post and pre monsoon seasons.

The 24-hourly average PM_{2.5} level during the Post and Pre Monsoon seasons varied in the range of 22.8 - 38.8 µg/m³ and 25.1-46.4 µg/m³, respectively. Similar to that of PM₁₀, the levels of PM_{2.5} for all the sampling locations were within the permissible

limits. Referring Tables 6.19 and 6.20 the details of the mean values of the 24-hourly average PM_{2.5} levels during the post monsoon and pre monsoon seasons were given, respectively.

Table 6.17. Summary of PM₁₀ levels monitored during post monsoon in the study area

Location Code	Location Station	24-hourly Average PM ₁₀ (µg/m ³)			
		Min.	Max.	Mean	Limit
AS-1	Inside Ennore Port	60.1	65.2	62.7	100
AS-2	Attipattu Pudhu Nagar	27.8	33.1	30.5	100
AS-3	Kattuppalli Village	40.2	44.9	42.6	100
AS-4	Nandiyambakkam Village	27.9	34.2	31.0	100
AS-5	Vallur-2	36.2	45.9	41.1	100
AS-6	Thazhankuppam Village	43.2	57.6	50.4	100

Source: EIA report for CB3 & CB4, ACE, 2014

Table 6.18. Summary of PM₁₀ levels monitored during pre monsoon in the study area

Location Code	Location Station	24-hourly Average PM ₁₀ (µg/m ³)			
		Min.	Max.	Mean	Limit
AS-1	Inside Ennore Port	75.2	78.9	77.1	100
AS-2	Attipattu Pudhu Nagar	30.2	35.8	33.0	100
AS-3	Kattuppalli Village	45.9	50.2	48.0	100
AS-4	Nandiyambakkam Village	29.8	36.1	32.9	100
AS-5	Vallur-2	40.9	47.8	44.4	100
AS-6	Thazhankuppam Village	42.8	53.9	48.4	100

Source: EIA report for CB3 & CB4, ACE, 2014

Table 6.19. Summary of PM_{2.5} levels monitored during post monsoon in the study area

Location Code	Location Station	24-hourly Average PM _{2.5} (µg/m ³)			
		Min.	Max.	Mean	Limit
AS-1	Inside Ennore Port	35.8	41.8	38.8	60
AS-2	Attipattu Pudhu Nagar	24.9	30.9	27.9	60
AS-3	Kattuppalli Village	20.3	25.3	22.8	60
AS-4	Nandiyambakkam Village	22.9	25.3	24.1	60
AS-5	Vallur-2	20.5	25.9	23.2	60
AS-6	Thazhankuppam Village	21.3	28.9	25.1	60

Source: EIA report for CB3 & CB4, ACE, 2014

Table 6.20. Summary of PM_{2.5} levels monitored during pre monsoon in the study area

Location Code	Location Station	24-hourly Average PM _{2.5} (µg/m ³)			
		Min.	Max.	Mean	Limit
AS-1	Inside Ennore Port	43.8	48.9	46.4	60
AS-2	Attipattu Pudhu Nagar	27.8	32.9	30.4	60
AS-3	Kattuppalli Village	25.3	27.8	26.6	60
AS-4	Nandiyambakkam Village	25.1	29.8	27.5	60
AS-5	Vallur-2	22.8	27.4	25.1	60
AS-6	Thazhankuppam Village	23.1	32.1	27.6	60

Source: EIA report for CB3 & CB4, ACE, 2014

Sulphur dioxide (SO₂)

The mean of 24-hourly average values of SO₂ over the study area was found to be varying between 8.3 - 20.9 µg/m³ and 10.2 - 20.9 µg/m³ during Post and Pre Monsoon seasons, respectively. SO₂ levels at all the locations were much below the permissible limit of 80µg/m³ stipulated for residential, rural & other areas. Tables 6.21 and 6.22 below gives the details of SO₂ levels during post and pre monsoon seasons, respectively.

Table 6.21. Summary of SO₂ levels during post monsoon in the Study Area

Location Code	Location Station	24-hourly Average SO ₂ (µg/m ³)			
		Min.	Max.	Mean	Limit
AS-1	Inside Ennore Port	12.9	19.3	16.1	80
AS-2	Attipattu Pudhu Nagar	8.8	11.8	10.3	80
AS-3	Kattuppalli Village	11.1	12.7	11.9	80
AS-4	Nandiyambakkam Village	8.1	10.3	9.2	80
AS-5	Vallur-2	7.5	9.1	8.3	80
AS-6	Thazhankuppam Village	18.9	22.9	20.9	80

Source: EIA report for CB3 & CB4, ACE, 2014

Table 6.22. Summary of SO₂ levels during pre monsoon in the Study Area

Location Code	Location Station	24-hourly Average SO ₂ (µg/m ³)			
		Min.	Max.	Mean	Limit
AS-1	Inside Ennore Port	15.9	20.1	18.0	80
AS-2	Attipattu Pudhu Nagar	9.8	13.1	11.5	80
AS-3	Kattuppalli Village	13.4	15.9	14.7	80
AS-4	Nandiyambakkam Village	10.5	12.8	11.7	80
AS-5	Vallur-2	9.6	10.8	10.2	80
AS-6	Thazhankuppam Village	17.9	23.8	20.9	80

Source: EIA report for CB3 & CB4, ACE, 2014

Overall the situation is well below the permissible level of 80 µg/m³.

Oxides of Nitrogen (NO_x)

The mean of 24-hourly NO_x level over the entire study area were found varying between 21.7 - 30.7 µg/m³ and 24.9 – 31.7 µg/m³ during post and pre monsoons, respectively. The 24-hourly average values of NO_x at all the locations were within the prescribed limit of 80 µg/m³ stipulated for residential, rural and other areas. The monitored NO_x levels at each location during the post and pre monsoons are tabulated in Tables 6.23 and 6.24 respectively.

Table 6.23. Summary of NO_x levels during post monsoon in the Study Area

Location Code	Location Station	24-hourly Average NO _x (µg/m ³)			
		Min.	Max.	Mean	Limit
AS-1	Inside Ennore Port	25.4	30.2	27.8	80
AS-2	Attipattu Pudhu Nagar	21.4	22.0	21.7	80
AS-3	Kattuppalli Village	23.7	25.9	24.8	80
AS-4	Nandiyambakkam Village	24.5	28.3	26.4	80
AS-5	Vallur-2	23.7	27.9	25.8	80
AS-6	Thazhankuppam Village	28.3	33.1	30.7	80

Source: EIA report for CB3 & CB4, ACE, 2014

Table 6.24. Summary of NO_x Levels during pre monsoon in the Study Area

Location Code	Location Station	24-hourly Average NO _x (µg/m ³)			
		Min.	Max.	Mean	Limit
AS-1	Inside Ennore Port	30.1	33.2	31.7	80
AS-2	Attipattu Pudhu Nagar	23.8	25.9	24.9	80
AS-3	Kattuppalli Village	25.1	28.1	26.6	80
AS-4	Nandiyambakkam Village	26.7	29.8	28.3	80
AS-5	Vallur-2	25.1	28.6	26.9	80
AS-6	Thazhankuppam Village	27.1	29.0	28.1	80

Source: EIA report for CB3 & CB4, ACE, 2014

The results are well below the permissible level of 80 µg/m³.

Carbon Monoxide (CO)

The CO value in the study area was observed and found to be below the detectable limit of about 1.15 mg/m³ in all the seasons.

6.6. Noise Environment

6.6.1. Noise quality monitoring – Pre monsoon, Post monsoon and Fair weather

Major sources of noise in the study area are (a) Noise made by normal human activities, (b) Noise made by bikes, cars, trucks etc., (c) Noise from existing port activities and (d) Natural noise, consisting of sounds made by birds, animals and insects. Ambient noise monitoring was conducted to assess the background noise levels in the study area for three seasons in which the first two seasons i.e. in April 2016 representing Pre Monsoon period, October 2016 representing Post monsoon by Indomer through Creative Engineers & Consultants, Chennai and the third season i.e. March 2017 representing Fair weather by Indomer. Noise level was monitored at five locations in each season and portable noise level meter was used to monitor the noise level for a period of 24 hours. The national ambient air quality standards of noise, CPCB, 2000 is given in Table 6.25. The noise monitoring locations selected for Pre monsoon, Post monsoon and Fair weather , the study is given in the Table 6.26 and shown in Fig. 6.13.

Table 6.25. Ambient Noise quality standards, 2000

Area code	Category of Area/Zone	Limit in dB (A) Leq	
		Day Time	Night Time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence	50	40

Day time: 6.00 a.m. to 10.00 p.m. Night time: 10.00 p.m. to 6.00 a.m

Methodology

Ambient noise level was measured by a portable sound level meter. Noise level measurement was carried as per IS: 4954 standards as given by Central Pollution Control Board (CPCB). Noise monitoring was conducted continuously over a period

of 24 hours to obtain L_{eq} values at uniform interval of one hour. Day time L_{eq} has been computed from the hourly L_{eq} values between 6.00 a.m. and 10.00 p.m. and night time L_{eq} from hourly L_{eq} values between 10.00 p.m. and 6.00 a.m. using the following formula:

$$Leq_{day} = 10 \log \frac{1}{16} \sum_{i=1}^{16} 10^{\frac{L_i}{10}} \quad Leq_{night} = 10 \log \frac{1}{8} \sum_{i=1}^8 10^{\frac{L_i}{10}}$$

Where, L_i = L_{eq} value of the i^{th} hourly time interval

Table 6.26. Noise Quality Monitoring Locations – Pre monsoon, Post monsoon & Fair weather

Location code	Location	Area Category	Distance from the study area (Km)	Direction
N1	Inside Kamarajar Port	Industrial	0.56	SW
N2	Attipattu pudhunagar	Residential	4.23	WSW
N3	Kattupalli village	Residential	5.20	NNW
N4	Nandiambakkam Village	Residential	5.87	WNW
N5	Ennore	Residential	5.41	SSW

Results

Pre monsoon: The noise level was monitored at five locations to evaluate the ambient noise level near the study area. The values of noise level which was recorded lies between 46.3 – 67.6 dB(A) at day time and 39.3 – 62.4 dB(A) at night time.

Post monsoon: The values of noise level which was recorded lies between 45.1 – 66.1 dB(A) at day time and 39.1 – 61.3 dB(A) at night time. The monitored results are given in Table 6.27.

Fair weather: The values of noise level recorded varied from 44.6-68.4 dB (A) at day time and 36.4-59.4 dB (A) at night time during Fair weather. The monitored results are presented in Table 6.29.

The highest Leq value was recorded inside the port, which may be due transportation of cargoes through heavy cargo carrier trucks. The average 24 hourly noise levels at all the five locations were within the limits of the ambient air quality with respect to Noise Level standard, 2000.

Table 6.27. Results of Ambient Noise Levels Monitored – Pre monsoon, Post monsoon & Fair weather

Stn.	Station Location	Area Category	Day			Noise Limit (Day)	Night			Noise Limit (Night)
			Pre mon-soon	Post mon-soon	Fair weath-er		Pre mon-soon	Post mon-soon	Fair weath-er	
			Leq	Leq	Leq		Leq	Leq	Leq	
N1	Inside Kamarajar Port	Industrial	67.6	66.1	68.4	75	62.4	61.3	59.4	70
N2	Attipattu pudhunagar	Residential	50.2	48.6	49.2	55	39.9	39.3	38.4	45
N3	Kattupalli village	Residential	48.7	45.1	44.6	55	41.0	39.1	36.4	45
N4	Nandiambakkam Village	Residential	46.3	47.6	48.1	55	39.3	39.1	39.4	45
N5	Ennore	Residential	51.0	55.1	52.4	55	41.5	41.3	40.8	45

6.6.2. Noise quality monitoring - Earlier studies

Ambient noise monitoring was measured by ACE at seven representative locations. The details of the locations are given in Table 6.28 and shown in Fig. 6.14.

Table 6.28. Location of the Noise Quality Monitoring Stations

Monitoring Location	Name of the Location	Distance & from the project Site (km)	Direction
NS-1	Attipattu Pudu Nagar	3.57	WSW
NS-2	Vallur-02	5.86	WSW
NS-3	Attipattu Village	5.28	W
NS-4	Near Proposed Site	2.67	SW
NS-5	Nappalayam Village	7.98	SW
NS-6	Near Highway	3.37	SW
NS-7	Main Entrance of Ennore Port	0.67	W

Day time: 6.00 a.m. to 10.00 p.m. Night time: 10.00 p.m. to 6.00 a.m

Source: EIA report for CB3 & CB4, ACE, 2014

Results

The values of noise level recorded varied from 41.6-72.4 dB (A) at day time and 32.3 – 58.7 dB(A) at night time during pre-monsoon season. During post-monsoon season, the values of noise level recorded varied from 39.1-71.8 dB (A) at day time and 30.4 – 52.0 dB(A) at night time. The monitored results are presented in Table 6.29.

Table 6.29. Summary of Ambient Noise Levels Monitored in the study area

Location Code	Station Location	Area Category	Day		Night	
			Leq	Limit	Leq	Limit
N1	Attipattu Pudhu Nagar	Residential	49.9	55	40.8	45
N2	Vallur-02	Residential	42.2	55	32.3	45
N3	Attipattu Village	Residential	41.6	55	32.7	45
N4	Near Proposed Site	Industrial	42.2	75	28.6	70
N5	Nappalayam Village	Residential	43.9	55	34.8	45
N6	Near Highway	Industrial	72.4	75	58.7	70
N7	Main Entrance of Ennore	Industrial	52.2	75	42.8	70

Source: EIA report for CB3 & CB4, ACE, 2014

6.7. Water Environment

6.7.1. Ground Water

In the port region, the coastal alluvium and river alluvium are overlying the crystalline rocks. Good aquifers are formed by the alluvium consisting of coarse sand, wherever the alluvium consists of coarse sand they form good aquifers. Area near the Kosasthalaiyar River has potential aquifers. The important source of water in this study area is ground water. It is utilized by the villagers for cooking, washing and other purpose. It is noted that every village were having hand pumps and few open wells to draw water for domestic use. The villages receive water from the Panchayat supply and in case of non-availability of water tankers are sent by the corporation to fulfill the water demand.

Hydrogeology

The data on hydrogeology of the Thiruvallur District, where the study area is located, has been taken from the District Water Brochure, Thiruvallur District published by South Eastern Coastal Region, Central Ground Water Board, Ministry of Water Resources, Government of India in 2007. Porous and fissured formations underlain the district and the aquifers are of two types namely,

- Unconsolidated & semi - consolidated formations and
- weathered, fissured and fractured crystalline rocks.

The hydrogeology map of Tiruvallur District is given in Fig. 6.15. The project site and the study area are underlain with unconsolidated aquifer of recent age. The Lithology consists of river alluvium and flood plain deposits. One of the major sources of water supply to the urban areas of Chennai city and to the industrial units is Araniyar and Kosasthalaiyar River. Alluvium forms a good aquifer system along the Araniyar and Kosasthalaiyar River bed. The yield prospect of the aquifer system is > 200 m³/day.

The depth to water level map during pre-monsoon (2006) and post monsoon (2007) is shown in Fig. 6.16 and 6.17 respectively. The depth to water level in the district varied between 2.38 - 7.36 m bgl during pre-monsoon (May 2006) and 0.79 - 5.30 m bgl during post monsoon (Jan 2007). The seasonal fluctuation shows a rise between 0.28 and 4.80 m bgl during post monsoon season.

The ground water exploitation state of the blocks in Thiruvallur district is given in Fig. 6.18. It can be concluded from the figure that the Minjur Block in which the project site is located falls under Over Exploited category.

6.7.2. Ground Water Monitoring – Pre monsoon, Post monsoon and Fair weather

Ground water samples were collected for three seasons from five locations; in which the first two seasons i.e. in April 2016 representing Pre Monsoon period, October 2016 representing Post monsoon were collected by Indomer through Creative Engineers & Consultants, Chennai and the third season i.e. March 2017 representing Fair weather was collected by Indomer. The ground water sample collected locations for all seasons are given in Table 6.30 and shown in Fig. 6.19. Among the collected samples, one was collected within port area and the remaining samples were collected nearby villages and their distance from the study area is given in below Table.

Table 6.30. Ground Water Sampling Locations –Pre monsoon, Post monsoon and Fair weather

Location code	Location	Distance From the study area(km)	Direction
GW1	Inside Kamarajar Port	0.56 (Industrial)	SW
GW2	Attipattu pudhunagar	4.23 (Residential)	WSW
GW3	Kattupalli village	5.20 (Residential)	NNW
GW4	Nandiambakkam Village	5.87 (Residential)	WNW
GW5	Ennore	5.41 (Residential)	SSW

Results

pH: Pre monsoon: The pH varied in the range from 6.53 – 7.22, which indicates that pH of the water samples are almost neutral. Post monsoon: The pH varied in the range from 6.59 – 7.14, which indicates that pH of the water samples are almost neutral. Fair weather: The pH varied in the range from 7.8 – 8.04, which indicates that pH of the water samples are slightly alkaline nature. All the locations are very close to sea shore area and sea water intrusion may be in these water locations.

Total dissolved solids: Pre monsoon: Out of five locations where samples were taken and analyzed, the results were within permissible range 2000 mg/l at locations 1,2,3 and 5 with minimum value of 63 mg/l and the maximum value of 3260 mg/l. At location 4, higher value of 3260 mg/l was observed, which could possibly be due to the presence of brackish water. Post monsoon: The TDS varied in the range of 126 – 1754 mg/l. It indicated that the TDS values are within the acceptable limit. All other parameters were within the acceptable limits. Fair weather: Out of five locations where samples were taken and analyzed, the results were within permissible range 2000 mg/l at locations varied from 484-1598 mg/l. At location 2, higher value of 1598 mg/l was observed, which could possibly be due to the presence of brackish water. All other parameters were within the acceptable limits. The results of ground water quality are given in Table 6.31.

The results of ground water for Pre monsoon, Post monsoon and Fair weather are given in Table 6.31.

Table 6.31. Ground Water Quality Results - Pre monsoon, Post monsoon and Fair weather

S.No	Parameter	Unit	GW-1			GW-2			Protocol	Acceptable Limit IS 10500:2012
			Pre monsoon	Post monsoon	Fair Weather	Pre monsoon	Post monsoon	Fair weather		
A	Physical parameters									
1	Color	Hazen	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	IS:3025 (Part-4) 1983	5.0-15
2	pH	-	6.53	6.59	7.80	7.16	6.94	7.94	IS:3025 (Part-11) 1983	6.5-8.5
3	Electrical Conductivity	(µmhos /cm)	107.4	210.3	738	733.4	430.4	2458	2510 B APHA 2 nd Edition 2012	-
B	Chemical Parameters									
4	Total Dissolved Solids	mg/l	63.0	126	484	433	250	1598	IS:3025 (Part-16) 1984	500-2000
5	Total Suspended solids	mg/l	8.0	6	2.2	BDL(D.L.2.0)	BDL(D.L.2.0)	2.6	IS:3025 (Part-17) 1984	-
6	Iron as Fe	mg/l	BDL (D.L.0.01)	0.07	1.5	0.02	BDL(D.L.0.01)	1.9	APHA 22 nd Edition 3500 Fe-B	0.3
7	Chloride as Cl	mg/l	12.7	34.2	80	170.2	50.9	80	IS:3025 (Part-32) 1988	250-1000
8	Fluoride as F	mg/l	BDL(D.L.0.1)	0.22	58	0.18	0.12	60	APHA 22 nd Edition 4500 F-D	1-1.5
9	Sulphates as SO ₄ ²⁻	mg/l	BDL(D.L.5.0)	8.8	152	28.3	18.9	154	APHA 22 nd Edition 4500 SO ₄ ²⁻	200-400
10	Nitrate as NO ₃	mg/l	BDL (D.L.1.0)	BDL(D.L.1.0)	BDL(D.L.0.01)	1.67	4.21	0.02	IS:3025 (Part-34) 1988	45.0
11	Phenolic Compound as C ₆ H ₅ OH	mg/l	Absent	Absent	142	Absent	Absent	780	IS:3025 (Part-43) 1992	0.001-0.002
12	Mercury as Hg	mg/l	BDL (D.L.0.001)	BDL (D.L.0.001)	0.24	BDL (D.L.0.001)	BDL (D.L.0.001)	0.18	IS:3025 (Part-48) 1994	0.001
13	Arsenic as As	mg/l	BDL(D.L.0.0)	BDL(D.L.0.0)	6.78	BDL(D.L.0.01)	BDL(D.L.0.0)	65.8	IS:3025 (Part-37) 1988	0.01

			1)	01))	01)			
14	Lead as Pb	mg/l	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.1.0)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.1.0)	APHA 22 nd Edition – 3111B	0.01
15	Zinc as Zn	mg/l	BDL(D.L.0.02)	BDL(D.L.0.02)	BDL(D.L.0.001)	BDL(D.L.0.02)	BDL(D.L.0.02)	BDL(D.L.0.001)	IS:3025 (Part-49) 1994	5.0-15.0
16	Chromium as Cr	mg/l	BDL(D.L.0.05)	BDL(D.L.0.05)	BDL(D.L.0.001)	BDL(D.L.0.05)	BDL(D.L.0.05)	BDL(D.L.0.001)	APHA 22 nd Edition - 3111-D	0.05
17	Cadmium as Cd	mg/l	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	IS:3025 (Part-41) 1992	0.003

Continue...

Table 6.31. Ground Water Quality Results - Pre monsoon, Post monsoon and Fair weather

S.No	Parameter	Unit	GW-3			GW-4			GW-5			Protocol	Acceptable Limit IS :10500:2012
			Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather		
A	Physical parameters												
1	Color	Hazen	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	IS:3025 (Part-4) 1983	5.0-15
2	pH	-	6.71	6.71	7.99	7.22	7.14	8.00	6.83	6.95	8.04	IS:3025 (Part-11) 1983	6.5-8.5
3	Electrical Conductivity	(µmhos /cm)	362.2	789.7	1186	5191	1264	1408	1219	2829	2420	2510 B APHA 2 nd Edition 2012	-
B	Chemical Parameters												
4	Total Dissolved Solids	mg/l	214.0	575	768	3260	760	918	719	1754	1582	IS:3025 (Part-16) 1984	500-2000
5	Total Suspended	mg/l	BDL(D.L.2.0)	BDL(D.L.2.0)	2.8	2.0	BDL(D.L.2.0)	2.1	BDL(D.L.2.0)	6	2.7	IS:3025 (Part-17) 1984	-

	solids												
6	Iron as Fe	mg/l	0.02	0.01	2.2	0.12	BDL(D.L.O.01)	1.7	0.04	0.10	2.0	APHA 22 nd Edition 3500 Fe-B	0.3
7	Chloride as Cl	mg/l	47.9	245	124	925	215	120	198	660	126	IS:3025 (Part-32) 1988	250-1000
8	Fluoride as F	mg/l	BDL(D.L.O.1)	0.42	98	0.38	0.55	96	0.13	0.63	98	APHA 22 nd Edition 4500 F-D	1-1.5
9	Sulphates as SO ₄ ²⁻	mg/l	19.8	26.5	378	986	121	384	199	385	498	APHA 22 nd Edition 4500 SO ₄ ²⁻	200-400
10	Nitrate as NO ₃	mg/l	BDL(D.L.1.0)	1.09	0.02	4.96	2.95	0.12	1.92	2.13	0.04	IS:3025 (Part-34) 1988	45.0
11	Phenolic Compound as C ₆ H ₅ OH	mg/l	Absent	Absent	47.9	Absent	Absent	198	Absent	Absent	709	IS:3025 (Part-43) 1992	0.001-0.002
12	Mercury as Hg	mg/l	BDL(D.L.O.001)	BDL(D.L.O.001)	0.32	BDL(D.L.O.001)	BDL(D.L.O.001)	0.38	BDL(D.L.O.001)	BDL(D.L.O.001)	0.13	IS:3025 (Part-48) 1994	0.001
13	Arsenic as As	mg/l	BDL(D.L.O.01)	BDL(D.L.O.01)	10.4	BDL(D.L.O.01)	BDL(D.L.O.01)	5.8	BDL(D.L.O.01)	BDL(D.L.O.01)	7.8	IS:3025 (Part-37) 1988	0.01
14	Lead as Pb	mg/l	BDL(D.L.O.01)	BDL(D.L.O.01)	BDL(D.L.1.0)	BDL(D.L.O.01)	BDL(D.L.O.01)	BDL(D.L.1.0)	BDL(D.L.O.01)	BDL(D.L.O.01)	BDL(D.L.1.0)	APHA 22 nd Edition – 3111B	0.01
15	Zinc as Zn	mg/l	BDL(D.L.O.02)	BDL(D.L.O.02)	BDL(D.L.0.001)	0.97	0.97	BDL(D.L.O.001)	0.32	0.32	BDL(D.L.O.001)	IS:3025 (Part-49) 1994	5.0-15.0
16	Chromium as Cr	mg/l	BDL(D.L.O.05)	BDL(D.L.O.05)	BDL(D.L.0.001)	BDL(D.L.O.05)	BDL(D.L.O.05)	BDL(D.L.O.001)	BDL(D.L.O.05)	BDL(D.L.O.05)	BDL(D.L.O.001)	APHA 22 nd Edition - 3111-D	0.05
17	Cadmium as Cd	mg/l	BDL(D.L.O.01)	BDL(D.L.O.01)	BDL(D.L.0.01)	BDL(D.L.O.01)	BDL(D.L.O.01)	BDL(D.L.O.01)	BDL(D.L.O.01)	BDL(D.L.O.01)	BDL(D.L.O.01)	IS:3025 (Part-41) 1992	0.003

6.7.3. Ground Water – Earlier Study

Ground water samples were reported for five locations which are given in Table 6.32 and Fig. 6.20. Five samples of ground water were collected by ACE from the study area. Three of them were within the port area, the other two sampling locations were Nappalallayam Village and Vallur. The results of water quality analysis for three seasons are presented in Tables 6.33 to 6.35.

Table 6.32. Ground Water Sampling Locations

Station No	Name of the Sampling Location	Distance from the Project Site (km)	Direction
GW1	Inside Ennore Port	0.08	WSW
GW2	Nandiyambakkam Village	6.61	WNW
GW3	EnnoreKuppam	3.86	SSW
GW4	Kattupalli Village	4.89	NNW
GW5	Vallur – 02	4.50	WSW

Source: EIA report for CB3 & CB4, ACE, 2014

In general, the concentration of parameters like TDS, EC etc. was higher during the Pre Monsoon season when compared with the Monsoon and Post Monsoon seasons. This might be because of the ground water recharge leading to dilution during the Monsoon season. The ground water samples taken from the port area had high TDS, Conductivity, Total Hardness and Chloride due to its proximity to Bay of Bengal when compared with the ground water sampling locations located away from the shoreline. Sampling location GW 4, which is located near Kosathalaiyar river had water quality in compliance with the IS 10500:2012 standards and was potable. The water quality of GW 5 was in compliance with the IS 10500:2012, but it cannot be used for drinking purpose without prior treatment due to the presence of total coli form and fecal coli form.

Table 6.33. Ground Water Quality Monitoring Results for monsoon Season

S.No.	Parameter	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	Acceptable Limit IS:10500:2012
1	Color	Hazen	<5.0	<5.0	<5.0	<5.0	<5.0	5.0-15
2	pH	-	7.81	7.54	7.92	7.65	7.7	6.5 – 8.5
3	Conductivity	μS/cm	1215	793	1326	1022	708	
4	Iron	mg/l	0.18	0.11	<0.1	<0.1	0.12	0.3
5	Chloride (as Cl)	mg/l	107	54	123	82	57	250-1000
6	Fluoride (as F)	mg/l	<0.6	<0.6	<0.6	<0.6	<0.6	1.0-1.5
7	Total Dissolved Solids	mg/l	802	516	902	695	418	500-2000
8	Sulphate	mg/l	69.2	26.3	78.6	36.9	20.2	200-400
9	Nitrate (as NO ₃)	mg/l	10.2	6.4	8.1	<0.5	5.4	45
10	Phenolic Compounds	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.001-0.002
11	Mercury (as Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
12	Arsenic	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.01
13	Lead	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	0.01
14	Zinc	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	5 to 15
15	Chromium	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	0.05
17	Cadmium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	
18	Total Suspended Solids	mg/l	8	9	<4.0	5	<4.0	0.003
19	Total Coli forms	MPN/100 ml	82	<2.0	73	<2.0	<2.0	
20	Fecal Coli forms	MPN/100 ml	Present	Absent	Present	Absent	Absent	--

Source: EIA report for CB3 & CB4, ACE, 2014

Table 6.34. Ground water quality monitoring results for post monsoon season

S. No.	Parameter	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	Acceptable Limit IS:10500:2012
1	Color	Hazen	<5.0	<5.0	<5.0	<5.0	<5.0	5.0-15
2	pH	-	8.11	7.94	7.83	7.55	7.75	6.5 – 8.5
3	Conductivity	μS/cm	2003	1921	1881	743	795	
4	Iron	mg/l	0.12	0.15	<0.1	<0.1	0.14	0.3
5	Chloride (as Cl ⁻)	mg/l	217	147	271	50	69	250-1000
6	Fluoride (as F ⁻)	mg/l	<0.6	<0.6	<0.6	<0.6	<0.6	1.0-1.5
7	Total Dissolved Solids	mg/l	1265	1181	1171	489	527	500-2000
8	Sulphate	mg/l	89.2	85.3	92.9	21.1	39.8	200-400
9	Nitrate (as NO ₃ ⁻)	mg/l	18.2	12.9	8.3	9.5	11.3	45
10	Phenolic Compounds	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.001-0.002
11	Mercury (as Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
12	Arsenic	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.01
13	Lead	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.01
14	Zinc	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	5 to 15
15	Chromium	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05
16	Phosphate	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	
17	Cadmium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.003
18	Total Suspended Solids	mg/l	5.3	6	<4.0	5.5	4.9	
19	Total Coliforms	MPN/100 ml	120	1400	12	<2.0	31	--
20	Fecal Coliforms	MPN/100 ml	Present	Present	Absent	Absent	Present	

Source: EIA report for CB3 & CB4, ACE, 2014

Table 6.35. Ground water quality monitoring results for pre monsoon season

S. No.	Parameter	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	Acceptable Limit IS:10500:2012
1	Color	Hazen	<5.0	<5.0	<5.0	<5.0	<5.0	5.0-15
2	pH	-	8.23	8.02	7.99	7.81	7.78	6.5 – 8.5
3	Conductivity	μS/cm	2686	2338	2216	670	912	
4	Iron	mg/l	0.18	0.19	<0.1	<0.1	0.09	0.3
5	Chloride (as Cl ⁻)	mg/l	267	171	290	58	72	250-1000
6	Fluoride (as F ⁻)	mg/l	<0.6	<0.6	<0.6	<0.6	<0.6	1.0-1.5
7	Total Dissolved Solids	mg/l	1571	1492	1331	389	579	500-2000
8	Sulphate	mg/l	102.3	90.3	98.4	19.3	45.2	200-400
9	Nitrate (as NO ₃ ⁻)	mg/l	22.4	15.4	9.5	10.1	12.6	45
10	Phenolic Compounds	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.001-0.002
11	Mercury (as Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
12	Arsenic	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.01
13	Lead	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.01
14	Zinc	mg/l	<0.5	0.59	<0.5	<0.5	<0.5	5 to 15
15	Chromium	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05
16	Phosphate	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	
17	Cadmium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.003
18	Total Suspended Solids	mg/l	9.2	6.1	<4.0	5.8	5.2	
19	Total Coliforms	MPN/100ml	140	1600	8	<2.0	12	--
20	Fecal Coliforms	MPN/100ml	Present	Present	Absent	Absent	Present	

Source: EIA report for CB3 & CB4, ACE, 2014

The above results reveal that all the parameters are well within the permissible limits shown against each parameter.

6.7.4. Surface Water

The study area consists of excellent network of drainage system, interlinked with one another. In Ponneri taluk, Kosasthalaiyar is the important river. It has substantial flow during monsoon period. Kosasthalaiyar River connects Cholavaram tank and Red Hill tank. After filling various reservoirs and tanks along its course, it meets finally Bay of Bengal through Ennore creek.

The Buckingham canal is around 420 km long brackish water navigation canal running parallel to east coast from Kakinada in Andhra Pradesh to Puducherry, which passes through the study area for the proposed project. The drainage pattern of the study area is shown in Fig. 6.21.

6.7.4.1. Surface Water Quality -Pre monsoon, Post monsoon and Fair weather

Surface water samples were collected for three seasons from five locations; in which the first two seasons i.e. in April 2016 representing Pre Monsoon period, October 2016 representing Post monsoon were collected by Indomer through Creative Engineers & Consultants, Chennai and the third season i.e. March 2017 representing Fair weather was collected by Indomer. Five samples of surface water were reported wherein two were from upstream and downstream of Kosasthalaiyar River, two were from upstream and downstream of natural drainage nearer to Kattupalli road and one was from the Ennore creek area. The sampling locations are given in Table 6.36 and shown in Fig. 6.22. The results of water quality analysis are presented in Table 6.37

Table 6.36. Surface Water Sampling Location – Pre monsoon, Post monsoon & Fair weather

Station No.	Name of the Sampling Location	Distance Direction from the Project Site (km)
SW1	Buckingham Canal Upstream	1.72 - WSW
SW2	Buckingham Canal Downstream	3.88 - SW
SW3	Kosasthalaiyar River upstream	8.44- SW
SW4	Kosasthalaiyar River Downstream	7.16 - SW
SW5	Ennore Creek	3.59 - SW

Results

Pre monsoon: The pH varied in the range from 7.34 – 7.86, which indicates that pH of the water samples are almost neutral. The TDS varied in the range of 540 – 3511 mg/l. The concentration of Conductivity of the collected samples was found to be varying in the range of 936 - 5402 μ S/cm. The calcium varied in the range of 48.6 – 137 mg/l. The Iron concentration varied in the range of 0.04 – 0.12 mg/l. Fluoride, and total nitrogen of the analyzed samples were in the range of 0.46 – 0.81 mg/l and 14 – 39 mg/l, respectively. BOD and COD were in the range of 7 - 12 mg/l and 9 - 29 mg/l respectively.

Mercury, Arsenic, Lead, and Cadmium were of Below Detectable Limit (BDL (D.L. 0.01)). The concentration of Zinc was found to be varying in the range of 0.06 – 0.14 mg/l. Chromium was found to be Below Detectable Limit (BDL (D.L. 0.05)).

Post monsoon: The pH varied in the range from 7.48 – 8.06, which indicates that pH of the water samples are almost neutral. The TDS varied in the range of 630 – 3540 mg/l. The concentration of Conductivity of the collected samples was found to be varying in the range of 1027 - 5532 μ S/cm. The calcium varied in the range of 51.4 – 182 mg/l. The Iron concentration varied in the range of 0.03 – 0.16 mg/l. Fluoride,

and total nitrogen of the analyzed samples were in the range of 0.55 – 0.86 mg/l and 15.9 – 34.6 mg/l, respectively. BOD and COD were in the range of 7 - 14 mg/l and 8-39.8 mg/l respectively.

Mercury, Arsenic, Lead, and Cadmium were of Below Detectable Limit (BDL (D.L. 0.01)). The concentration of Zinc was found to be varying in the range of 0.06 – 0.16 mg/l. Chromium was found to be Below Detectable Limit (BDL (D.L. 0.05)).

Fair weather: The pH varied in the range from 7.62-8.13, which indicates that pH of the water samples are almost neutral. The TDS varied in the range of 698 – 3588 mg/l. The concentration of Conductivity of the collected samples was found to be varying in the range of 1148-5486 μ S/cm. The calcium varied in the range of 58-168 mg/l. The Iron concentration varied in the range of 0.07-0.15 mg/l. The magnesium varied in the range of 14.8-98.4 mg/l. Fluoride, and total nitrogen of the analyzed samples were in the range of 0.68-0.86 mg/l and 14.6-32.8 mg/l, respectively. BOD and COD were in the range of 6-12 mg/l and 4-56 mg/l respectively. (High BOD at all locations, may be due to discharge of effluents, domestic sewage into the surface water source).

Mercury, Arsenic, Lead, and Cadmium were of Below Detectable Limit (BDL (D.L. 0.01)). The concentration of Zinc was found to be varying in the range of 0.09 – 0.1 mg/l. Chromium was found to be Below Detectable Limit (BDL (D.L. 0.01)).

In general, the concentration of most of the parameters like TDS, Conductivity, Sulphate, COD, BOD etc. were higher during the fair-weather season. The levels of TDS, Conductivity, Sulphate, COD, BOD and all other significant parameters were high at the sampling location due to the confluence of the Buckingham Canal and Kosasthalaiyar River laden with industrial effluent at the Creek & lake area with the Bay of Bengal.

Table 6.37. Surface water quality monitoring results for the Pre monsoon, Post monsoon and Fair weather

S. No.	Parameter	Unit	SW-1			SW-2			SW-3			Acceptable Limit	Test Method
			Pre monsoon	Post monsoon	FW	Pre monsoon	Post monsoon	FW	Pre monsoon	Post monsoon	FW		
1	pH	-	7.46	7.69	7.88	7.34	7.86	7.98	7.76	8.06	8.13	6.50-8.50	IS:3025(P-11)
2	Conductivity	µS/cm	2080	2339	2486	1986	2135	2600	936	1027	1148	-	IS:3025(P-14)
3	Calcium	mg/l	110	182	168	98.0	102	124	52.0	66.6	78	<200	IS:3025(P-40)
4	Iron	mg/l	0.06	0.03	0.07	0.04	0.08	0.09	0.09	0.12	0.14	<50	IS:3025(P-53)
5	Fluoride	mg/l	0.81	0.86	0.68	0.72	0.78	0.86	0.46	0.55	0.68	<1.5	IS:3025(P-60)
6	Total Dissolved Solids	mg/l	1281	1410	1640	1180	1302	1710	540	630	698	<2100	IS:3025(P-16)
7	Magnesium	mg/l	80.0	89.4	98.4	84.7	66.8	86	42.3	18.8	22.4	<100	IS:3025(P-46)
8	Sulphate	mg/l	68.4	77.2	79.6	52.1	59.7	64.2	32.0	46.2	42.8	<1000	IS:3025(P-24)
9	Total Nitrogen	mg/l	25.0	28	14.6	23.0	26.1	24.8	16.0	18.1	24.6	-	IS:3025(P-34)
10	Phenolic Compounds	mg/l	Absent	Absent	BDL(D.L.0.001)	Absent	Absent	BDL(D.L.0.0)	Absent	Absent	BDL(D.L.0.001)	<0.005	IS:3025(P-43)
11	Mercury	mg/l	BDL(D.L.0.00)	BDL(D.L.0.001)	BDL(D.L.0.001)	BDL(D.L.0.001)	BDL(D.L.0.001)	BDL(D.L.0.0)	BDL(D.L.0.001)	BDL(D.L.0.001)	BDL(D.L.0.001)	<0.001	IS:3025(P-48)
12	Arsenic	mg/l	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.0)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	<0.2	IS:3025(P-37)
13	Lead	mg/l	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.0)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	<0.1	IS:3025(P-47)
14	Zinc	mg/l	0.07	0.06	0.09	0.06	0.07	BDL(D.L.0.0)	BDL(D.L.0.02)	BDL(D.L.0.02)	0.1	<15	IS:3025(P-49)
15	Chromium	mg/l	BDL(D.L.0.05)	BDL(D.L.0.05)	BDL(D.L.0.01)	BDL(D.L.0.05)	BDL(D.L.0.05)	BDL(D.L.0.0)	BDL(D.L.0.05)	BDL(D.L.0.05)	BDL(D.L.0.01)	<0.05	IS:3025(P-52)
16	Dissolved Oxygen	mg/l	5.6	5.8	5.6	5.5	5.6	5.7	5.7	5.85	4.7	<4	IS:3025(P-38)
17	Phosphate	mg/l	BDL(D.L.0.1)	BDL(D.L.0.1)	BDL(D.L.0.1)	BDL(D.L.0.1)	BDL(D.L.0.1)	BDL(D.L.0.1)	BDL(D.L.0.1)	BDL(D.L.0.1)	BDL(D.L.0.1)	-	IS:3025(P-31)
18	Potassium	mg/l	14.0	16	12	10.0	12	10	7.0	11	8	-	IS:3025(P-45)
19	Cadmium	mg/l	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.0)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	<0.01	IS:3025(P-41)
20	Total Suspended Solids	mg/l	16.0	20	28	12.0	14	20	36.0	42	38	-	IS:3025(P-17)
21	COD	mg/l	21	27.9	56	19.0	23.9	19.6	9.0	12	16	-	IS:3025(P-58)
22	BOD	mg/l	7.0	9	12	6.0	7	6	BDL(D.L.2.0)	BDL(D.L.2.0)	BDL(D.L.2.0)	<3	IS:3025(P-45)

*FW-Fair Weather

Continue...

Table 6.37. Surface water quality monitoring results for the Pre monsoon, Post monsoon and Fair weather

S. No.	Parameter	Unit	SW-4			SW-5			Acceptable Limit	Test Method
			Pre monsoon	Post monsoon	FW	Pre monsoon	Post monsoon	FW		
1	pH	-	7.61	7.98	8.00	7.86	7.48	7.62	6.50-8.50	IS:3025(P-11)
2	Conductivity	µS/cm	1019	1120.00	1184	5402	5532.00	5486	-	IS:3025(P-14)
3	Calcium	mg/l	48.6	51.40	58	137	149.00	138	<200	IS:3025(P-40)
4	Iron	mg/l	0.12	0.16	0.15	0.08	0.11	0.09	<50	IS:3025(P-53)
5	Fluoride	mg/l	0.54	0.65	0.72	0.74	0.69	0.77	<1.5	IS:3025(P-60)
6	Total Dissolved Solids	mg/l	601	685.00	784	3511	3540.00	3588	<2100	IS:3025(P-16)
7	Magnesium	mg/l	25.4	12.70	14.8	125	56.40	52.8	<100	IS:3025(P-46)
8	Sulphate	mg/l	36.0	45.50	48.6	396	406.00	386	<1000	IS:3025(P-24)
9	Total Nitrogen	mg/l	14.0	15.90	16.8	39.0	34.60	32.8	-	IS:3025(P-34)
10	Phenolic Compounds	mg/l	Absent	Absent	BDL(D.L.0.001)	Absent	Absent	BDL(D.L.0.001)	<0.005	IS:3025(P-43)
11	Mercury	mg/l	BDL(D.L.0.001)	BDL(D.L.0.001)	BDL(D.L.0.001)	BDL(D.L.0.001)	BDL(D.L.0.001)	BDL(D.L.0.001)	<0.001	IS:3025(P-48)
12	Arsenic	mg/l	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	<0.2	IS:3025(P-37)
13	Lead	mg/l	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	<0.1	IS:3025(P-47)
14	Zinc	mg/l	BDL(D.L.0.02)	BDL(D.L.0.02)	BDL(D.L.0.01)	0.14	0.16	BDL(D.L.0.01)	<15	IS:3025(P-49)
15	Chromium	mg/l	BDL(D.L.0.05)	BDL(D.L.0.05)	BDL(D.L.0.01)	BDL(D.L.0.05)	BDL(D.L.0.05)	BDL(D.L.0.01)	<0.05	IS:3025(P-52)
16	Dissolved Oxygen	mg/l	5.9	6.10	5.1	5.8	5.60	4.9	<4	IS:3025(P-38)
17	Phosphate	mg/l	BDL(D.L.0.1)	BDL(D.L.0.1)	BDL(D.L.0.1)	BDL(D.L.0.1)	BDL(D.L.0.1)	BDL(D.L.0.1)	-	IS:3025(P-31)
18	Potassium	mg/l	5.0	7.00	6	21.0	24.00	18	-	IS:3025(P-45)
19	Cadmium	mg/l	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	BDL(D.L.0.01)	<0.01	IS:3025(P-41)
20	Total Suspended	mg/l	41.0	36.00	28	30.0	28.00	22	-	IS:3025(P-17)
21	COD	mg/l	12.0	8.00	4	29.0	39.80	34	-	IS:3025(P-58)
22	BOD	mg/l	BDL(D.L.2.0)	BDL(D.L.2.0)	BDL(D.L.2.0)	12.0	14	10	<3	IS:3025(P-45)

*FW-Fair Weather

6.7.5. Surface Water - Monitoring Results- Earlier study

The Surface water sampling were reported wherein two were from upstream and downstream of Kosasthalaiyar River, two were from upstream and downstream of natural drainage nearer to Kattupalli road and one was from the Ennore creek area. The sampling locations are given in Table 6.38.

The collected samples of different seasons were analyzed for the respective parameters and results are summarized below. During monsoon season, the concentration of TDS and Conductivity of the collected samples were found to be varying in the range of 441-23,300 mg/l and 743-39,042 $\mu\text{S/cm}$. In post monsoon season, TDS and Conductivity of the analyzed samples were in the range of 263-27,178 mg/l and 424-40,684 $\mu\text{S/cm}$, respectively. Phenolic compounds, Mercury, Arsenic, Lead, Chromium and Cadmium were of Below Detectable Limit (BDL). The presence of Total Coli form ($2.0 \times 10^1 - 1.1 \times 10^3$ MPN/100 ml) and Fecal Coli form confirms the discharge of sewage into the water body.

In the pre monsoon season, the TDS and Conductivity of the analyzed samples were in the range of 490-30,154 mg/l and 851-45,100 $\mu\text{S/cm}$, respectively. The levels of TDS, Conductivity, Sulphate, Nitrate, COD, BOD and all other significant parameters were high at the Ennore Creek sampling location; this is due to the confluence of the Buckingham Canal and Kosasthalaiyar River at the Ennore Creek area with the Bay of Bengal. Phenolic compounds, Mercury, Arsenic, Lead, Chromium and Cadmium were of Below Detectable Limit. The presence of Total Coli form ($8.0 \times 10^2 - 1.9 \times 10^3$ MPN/100 ml) and Fecal Coli form confirms the discharge of sewage into the water body. Presence of high concentration of TDS, Conductivity, Sulphate in the Upstream and Downstream of Buckingham Canal and Kosasthalaiyar River confirms the contamination of the water body by industrial effluent. The sampling locations are shown in Fig. 6.23. The results of water quality analysis are presented in Tables 6.39 to 6.41.

Table 6.39. Surface water quality monitoring results for the monsoon season

S. No.	Parameter	Unit	SW-1	SW-2	SW-3	SW-4	SW-5	Test Method
1	pH	-	7.45	7.62	7.11	7.16	7.89	IS:3025 (P-11)
2	Conductivity	μS/cm	5921	9311	871	743	39042	IS:3025 (P-14)
3	Calcium	mg/l	230.9	289.2	77.2	71.6	471.1	IS:3025 (P-40)
4	Iron	mg/l	0.41	1.32	0.51	0.31	1.8	IS:3025 (P-53)
5	Fluoride	mg/l	1.5	4	1.2	1.7	3.2	IS:3025 (P-60)
6	Total Dissolved Solids	mg/l	4104	5823	594	441	23300	IS:3025 (P-16)
7	Magnesium	mg/l	55.1	98.3	23.1	20.3	1434	IS:3025 (P-46)
8	Sulphate	mg/l	57.2	80.3	39.3	32.1	1189	IS:3025 (P-24)
9	Total Nitrogen	mg/l	25.2	33.6	19.1	13.2	40.9	IS:3025 (P-34)
10	Phenolic Compounds	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	IS:3025 (P-43)
11	Mercury	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	IS:3025 (P-48)
12	Arsenic	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	IS:3025 (P-37)
13	Lead	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	IS:3025 (P-47)
14	Zinc	mg/l	1.8	2.9	1.1	2.6	3.6	IS:3025 (P-49)
15	Chromium	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	IS:3025 (P-52)
16	Dissolved Oxygen	mg/l	6.2	5.9	6.5	6.6	5.8	IS:3025 (P-38)
17	Phosphate	mg/l	0.73	1.01	0.98	0.82	1.05	IS:3025 (P-31)
18	Potassium	mg/l	43.1	60.8	19.8	10.9	65.3	IS:3025 (P-45)
19	Cadmium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	IS:3025 (P-41)
20	Total Suspended Solids	mg/l	10	25	22	11	41	IS:3025 (P-17)
21	COD	mg/l	15.2	30.1	19.4	14.3	52.6	IS:3025 (P-58)
22	BOD	mg/l	4.9	7.3	6.5	4.1	5.6	IS:3025 (P-45)
23	Total Coliforms	MPN/100 ml	1.6×10^3	1.8×10^3	1.6×10^3	7.7×10^2	2.1×10^3	IS:1622
24	Fecal Coliforms	MPN/100 ml	Present	Present	Present	Present	Present	IS:1622

Source: EIA report for CB3 & CB4, ACE, 2014

Table 6.40. Surface Water quality monitoring results for the post monsoon season

S. No.	Parameter	Unit	SW-1	SW-2	SW-3	SW-4	SW-5	Test Method
1	Color	Hazen	<5	<5	6	<5	8	IS:3025 (P-4)
2	pH	-	7.92	8.01	7.89	7.63	7.98	IS:3025 (P-11)
3	Conductivity	μS/cm	12431	14757	2108	424	40684	IS:3025 (P-21)
4	Calcium	mg/l	132	120	98	61	149	IS:3025 (P-14)
5	Iron	mg/l	0.61	0.81	0.28	0.12	1.8	IS:3025 (P-53)
6	Fluoride	mg/l	1.6	1.8	1.2	0.1	3.8	IS:3025 (P-32)
7	Total Dissolved Solids	mg/l	8150	9987	1285	263	27178	IS:3025 (P-60)
8	Sulphate	mg/l	295	219	101	85	452	IS:3025 (P-16)
9	Nitrate	mg/l	23.2	25.9	20.2	16.1	43.9	IS:3025 (P-24)
10	Phenolic Compounds	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	IS:3025 (P-34)
11	Mercury	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	IS:3025 (P-43)
12	Arsenic	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	IS:3025 (P-48)
13	Lead	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	IS:3025 (P-37)
14	Zinc	mg/l	2.4	2.4	2.6	<0.05	2.8	IS:3025 (P-47)
15	Chromium	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	IS:3025 (P-49)
16	Dissolved Oxygen	mg/l	6	5.8	6	6.1	5.9	IS:3025 (P-52)
17	Phosphate	mg/l	1.05	0.91	0.92	0.8	1.03	IS:3025 (P-45)
18	Potassium	mg/l	45.3	47.7	26.1	22.4	59.1	IS:3025 (P-45)
19	Cadmium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	IS:3025 (P-41)
20	Total Suspended Solids	mg/l	27	18	14	10	35	IS:3025 (P-17)
21	COD	mg/l	13.3	10.2	11.3	3.8	21.8	APHA 9221
22	BOD	mg/l	5.3	3.5	4.1	1.2	8.1	APHA 9221
23	Total Coliforms	MPN/100 ml	0.9 × 10 ³	1.4 × 10 ²	1.2 × 10 ²	2.0 × 10 ¹	1.1 × 10 ³	APHA 9221
24	Fecal Coliforms	Per 100 ml	Present	Present	Present	Present	Present	APHA 9221

Source: EIA report for CB3 & CB4, ACE, 2014

Table 6.41. Surface water quality monitoring results for the pre monsoon season

S. No.	Parameter	Unit	SW-1	SW-2	SW-3	SW-4	SW-5	Test Method
1	pH	-	7.23	7.81	7.51	7.36	8.12	IS:3025 (P-11)
2	Conductivity	μS/cm	19736	21913	1420	851	45100	IS:3025 (P-14)
3	Calcium	mg/l	73.2	140.9	100.2	62.2	521	IS:3025 (P-40)
4	Iron	mg/l	0.41	1.4	0.28	0.34	1.7	IS:3025 (P-53)
5	Fluoride	mg/l	1.4	4.2	1.9	2.3	4.9	IS:3025 (P-60)
6	Total Dissolved Solids	mg/l	651	1219	981	490	30154	IS:3025 (P-16)
7	Magnesium	mg/l	127.3	201.3	58.1	24.2	1652	IS:3025 (P-46)
8	Sulphate	mg/l	43.1	61.4	85.8	35.5	1650	IS:3025 (P-24)
9	Total Nitrogen	mg/l	21.3	35.2	28.9	18.6	53.2	IS:3025 (P-34)
10	Phenolic Compounds	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	IS:3025 (P-43)
11	Mercury	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	IS:3025 (P-48)
12	Arsenic	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	IS:3025 (P-37)
13	Lead	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	IS:3025 (P-47)
14	Zinc	mg/l	1.3	3.2	2.4	2.9	3.9	IS:3025 (P-49)
15	Chromium	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	IS:3025 (P-52)
16	Dissolved Oxygen	mg/l	6.2	5.2	5.9	6	4.5	IS:3025 (P-38)
17	Phosphate	mg/l	1.02	1.15	0.87	0.94	1.19	IS:3025 (P-31)
18	Potassium	mg/l	23.1	65.3	46.8	12.8	68.2	IS:3025 (P-45)
19	Cadmium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	IS:3025 (P-41)
20	Total Suspended Solids	mg/l	24	29	12	14	43	IS:3025 (P-17)
21	COD	mg/l	21.3	32.7	17.1	16.7	58.7	IS:3025 (P-58)
22	BOD	mg/l	7.3	9.0	3.5	3.9	5.8	IS:3025 (P-45)
23	Total Coliforms	MPN/100 ml	1.4 × 10 ³	1.7 × 10 ³	1.4 × 10 ³	8.0 × 10 ²	1.9 × 10 ³	IS:1622
24	Fecal Coliforms	MPN/100 ml	Present	Present	Present	Present	Present	IS:1622

Source: EIA report for CB3 & CB4, ACE, 2014

In general the concentration of most of the parameters like TDS, Conductivity, Sulphate, Nitrate, COD, BOD etc. were higher during the pre monsoon season. The levels of TDS, Conductivity, Sulphate, Nitrate, COD, BOD and all other significant parameters were high at the Ennore Creek sampling location due to the confluence of the Buckingham Canal and Kosasthalaiyar River laden with industrial effluent at the Ennore Creek area with the Bay of Bengal.

To sum up, the results obtained through post monitoring exercise carried out during the pre-monsoon and post monsoon period have revealed that the baseline status of various vital parameters such as Air Quality, Noise, Water Quality (both surface and ground water) etc. remain well within the permissive levels prescribed by standards and that the system is still capable of accommodating further increase arising out of the proposed developments under Phase III of Port Master Plan. The post-monitoring programme is a continuous exercise undertaken by KPL as part of its EMP.

6.8. Ecology and Biodiversity

Flora

Three types of flora general coastal flora, mangrove and agricultural crops were observed. Sparse mangroves of *Avicennia* sp. were observed near Ennore creek area. The list of flora observed in the project site is given in Table 6.42. The common species which were found in the study area were *Cocus nucifera*, *Casurina equisetifolia*, *Azadirachta indica*, *Acacia nilotica*.

Table 6.42. List of Flora in the Study Area

Sl. No	Local Name	Scientific Name
1	Veppa Maram	<i>Azadirachta indica</i>
2	Karuvelam	<i>Acacia nilotica</i>
3	Gulmohar	<i>Delonix regia</i>
4	Peepal	<i>Ficus religiosa</i>
5	Erukkan	<i>Calotropis gigantea</i>
6	Savukku Maram	<i>Casuarina equisetifolia</i>
7	Thenna Maram	<i>Cocus nucifera</i>
8	Siridam	<i>Albizia lebbbeck</i>
9	Porasum	<i>Butea monosperma</i>

Source: EIA report for CB3 & CB4, ACE, 2014

Fauna

The major species of fauna present in the study area are given in Table 6.43.

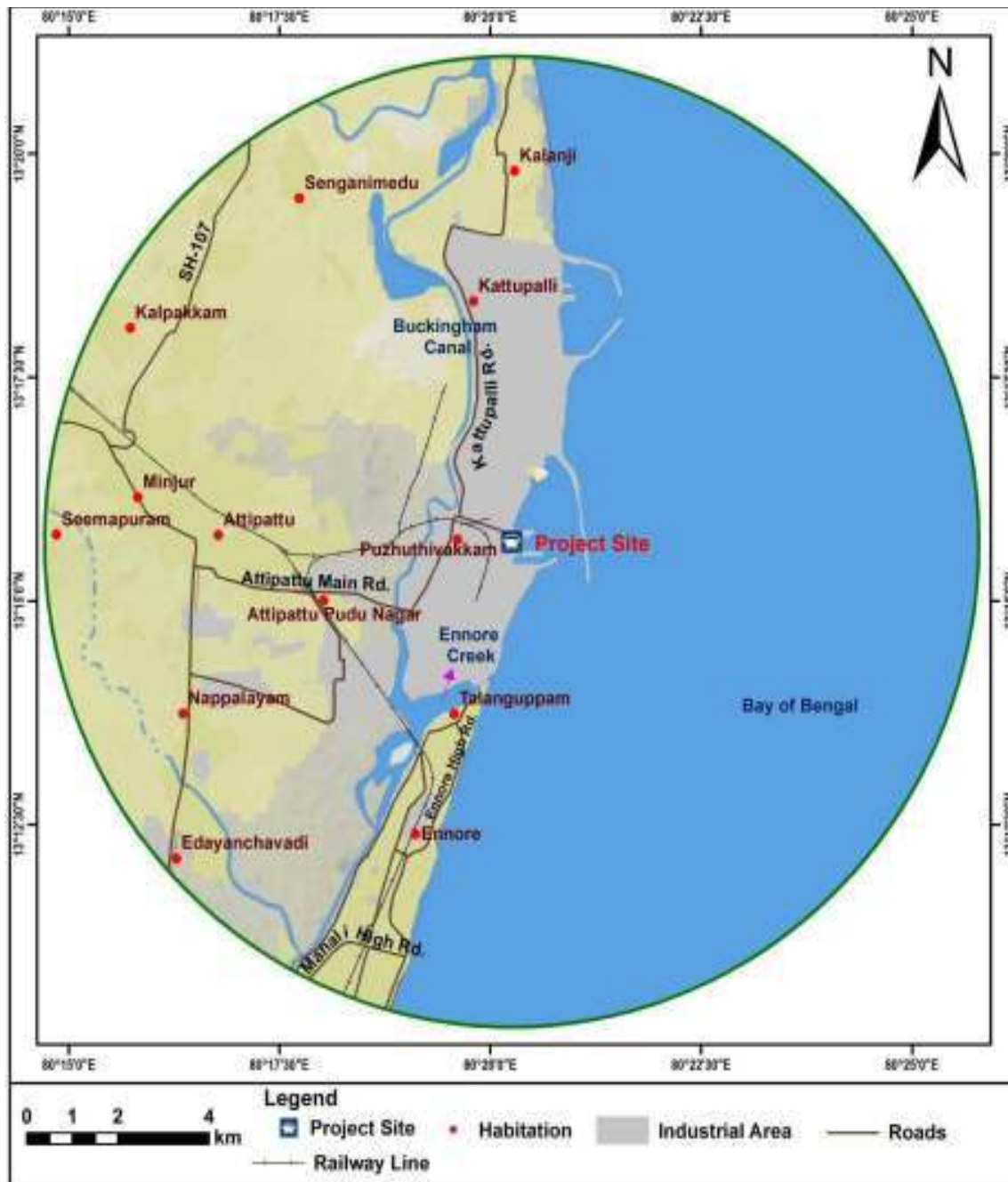
Table 6.43. List of Fauna in the Study Area

Sl.No.	Common Name	Scientific Name
Mammals		
1	Squirrel	<i>Funambulus palmarum</i>
2	Mongoose	<i>Herpestes javanicus</i>
3	Mouse	<i>Apodemus sylvaticus</i>
Reptiles		
4	Chameleon	<i>Chamaeleo zeylanicus</i>
5	Lizard (garden)	<i>Calotes versicolor</i>
6	House lizard	<i>Hemidactylus frenatus</i>
Birds		
7	Cattle egret	<i>Babulcus ibis</i>
8	Kite	<i>Haliastur Indus</i>
9	Mynah	<i>Acridotheres tristis</i>
10	Heron	<i>Ardeola grayii</i>
11	House swift	<i>Apus affinis</i>
Arthropods		
12	Millipede	<i>Spirobolida</i>
13	Crab	<i>Portunus sp.</i>

Source: EIA report for CB3 & CB4, ACE, 2014

Domesticated Animals

The animal husbandry is as important as agriculture in the study area. Animals like cows, buffaloes, goats, dogs, cats and pigs are domesticated.



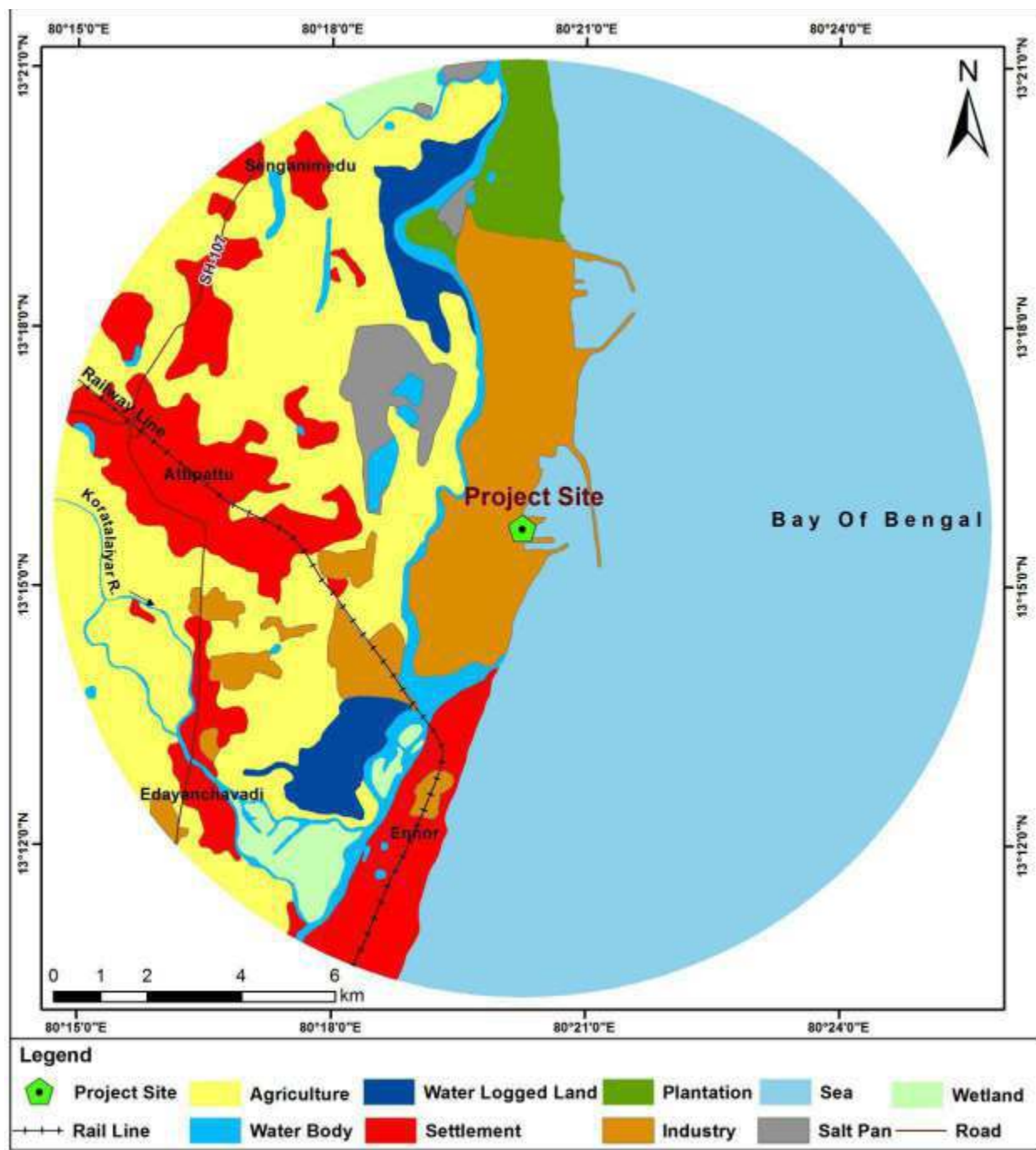
Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.1. Study area for the proposed project



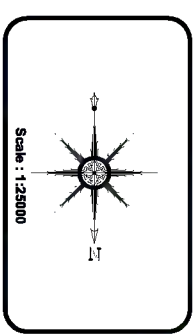
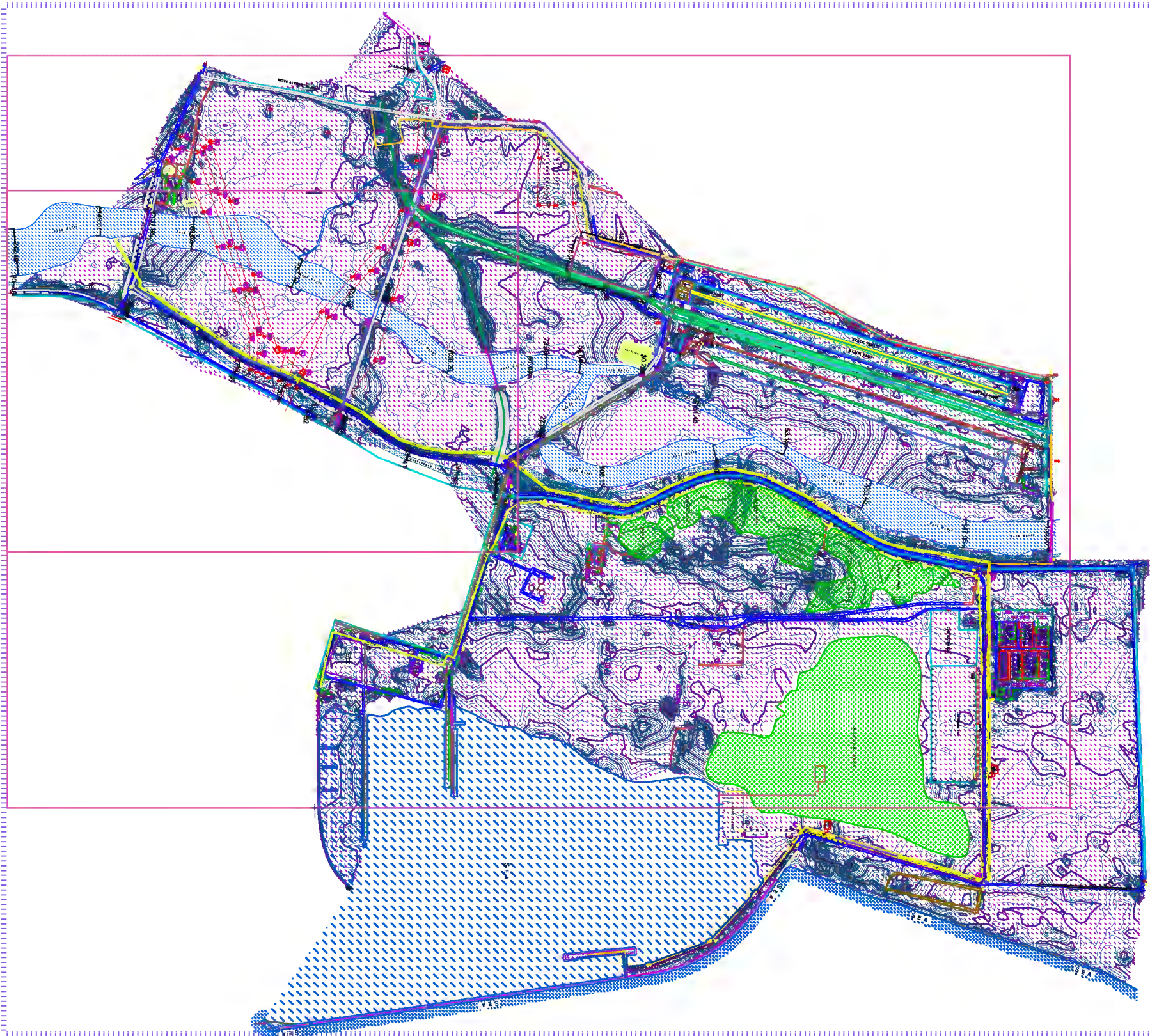
Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.2. Surrounding features of the Kamarajar Port



Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.3. Land Use Land Cover map Phase II (under construction)



Notes:-

- # All dimension in meter.
- # Boundary shown by client
- # Grid Interval 25m x 25m
- # Contour Interval
- Major - 1m
- Minor - 0.2m

Legend:-

No.	Particular name	Block
1.	Electrical pole	
2.	Lamp Post	
3.	Transformer	
4.	Electrical Junction Box	
5.	Flag Post	
6.	Name Board	
7.	High Tension Power Line	
8.	Other Tree	
9.	Coconut Tree	
10.	Mango Tree	
11.	Railway Track Line	
12.	11 Kv Line	
13.	Conveyor Line	
14.	Embankment	
15.	LPG Gas Pipe Line	
16.	Old Pipe Line	
17.	Other Pipe Line	
18.	Over Head Electrical Line	
19.	Bitumen Road	
20.	Cement Road	
21.	Mud Road	
22.	Major Line	
23.	Minor Line	

Surveyed by:

MAJESTIC SURVEYORS & ENGINEERS,
PLOT No-1652, DOOR No-1151,
7th FLOOR, TROUBLE SHOOT, 500 11A,
3RD CROSS, 1ST STAGE, 1ST FLOOR,
P.O. BOX, 645/1151, C.E.L. : 9884277037,
Kamarajar Port Limited, Chennai-605 006.

Source:

Kamarajar Port Limited.

Fig. 6.4. CONTOUR & TOPO MAP

LAND USE / LAND COVER MAP (10Km RADIUS) FOR THE PROPOSED ACTIVITIES AS
ENVISAGED IN PORT MASTER PLAN (PHASE - III) OF M/s. KAMARAJAR PORT, TAMILNADU STATE

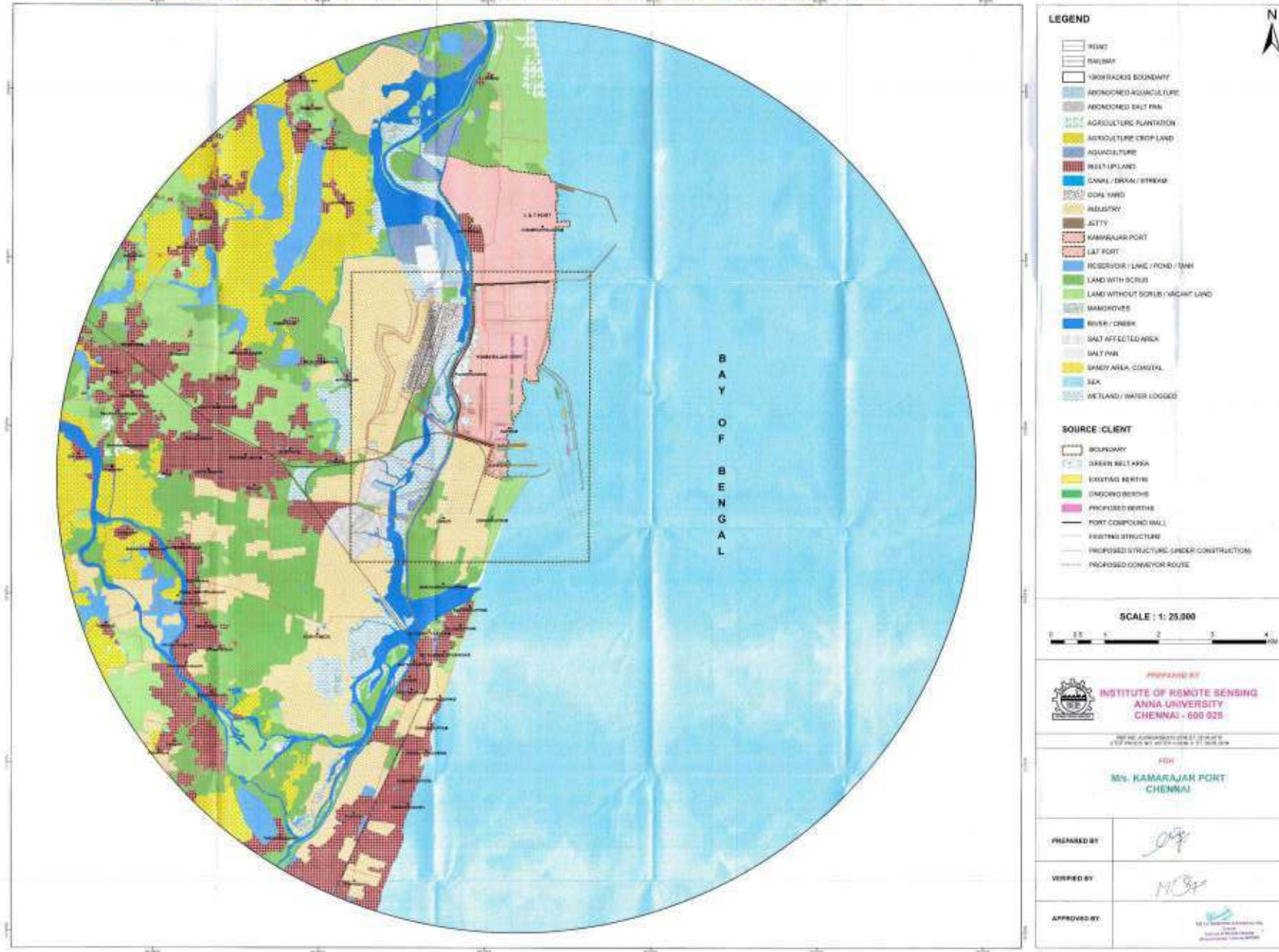


FIG. 6.5 LANDUSE MAP - PHASE III

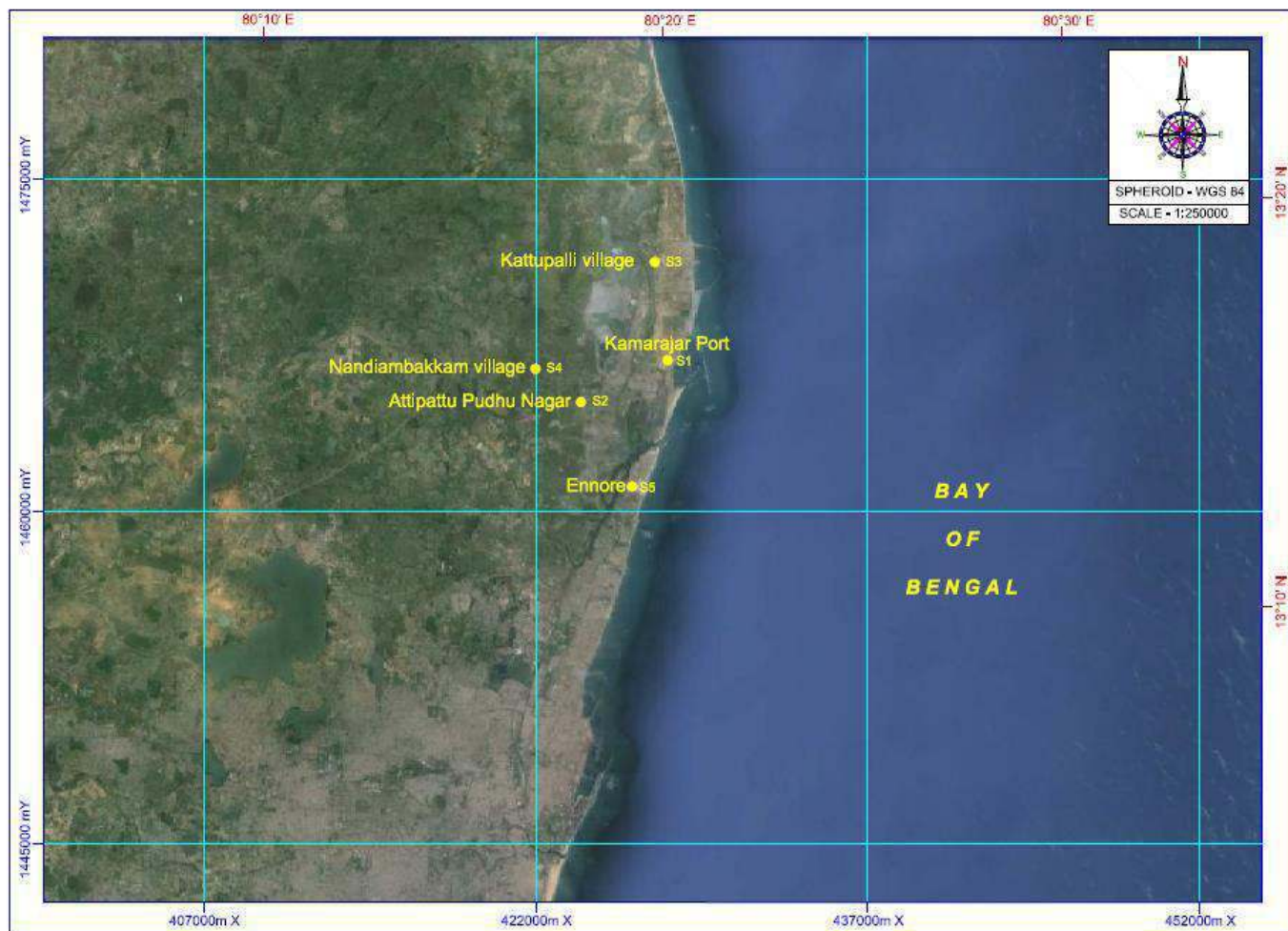
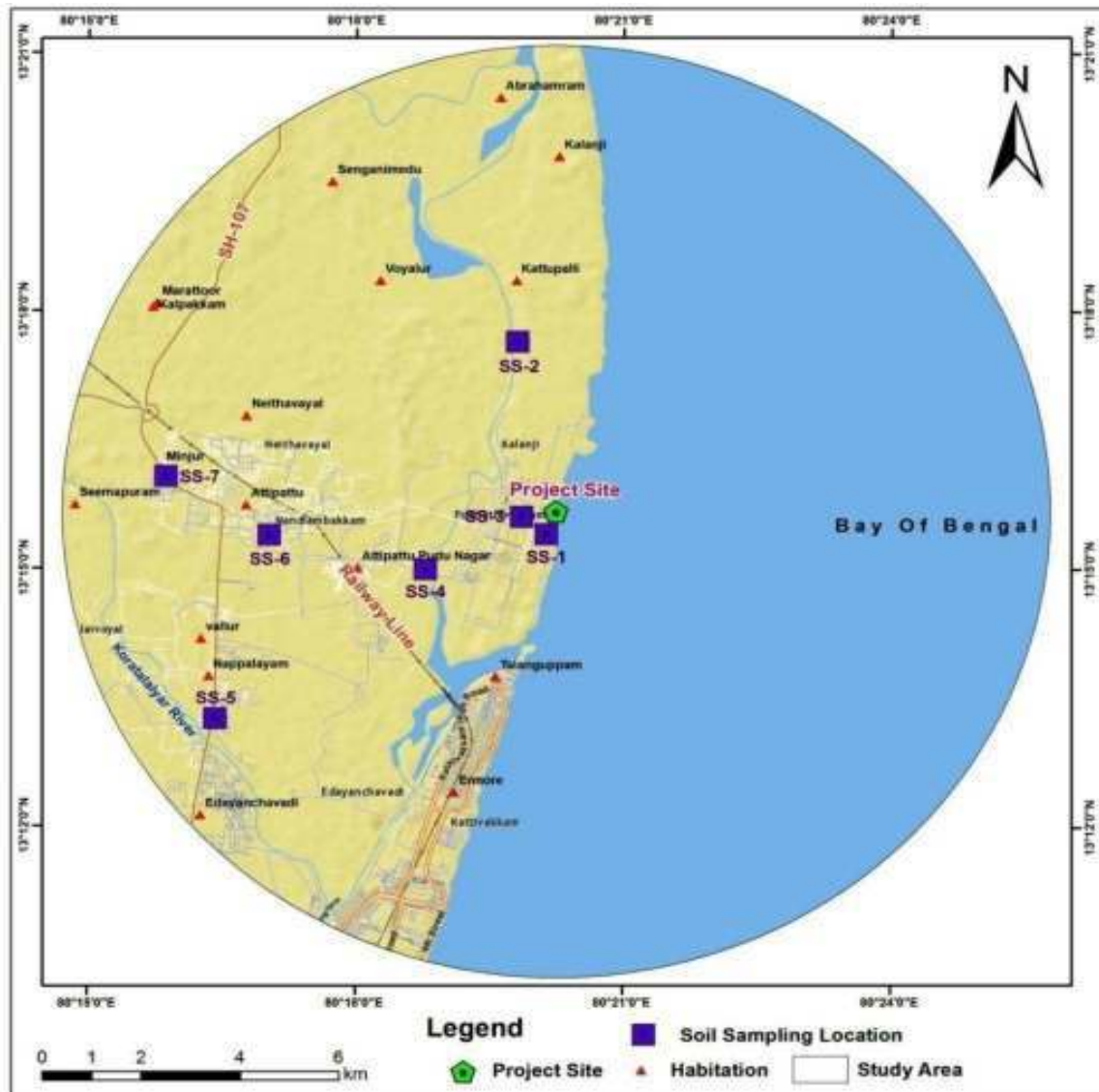


Fig. 6.7. Soil sampling locations – Pre monsoon, Post monsoon and Fair weather



Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.8. Soil sampling locations-Earlier study

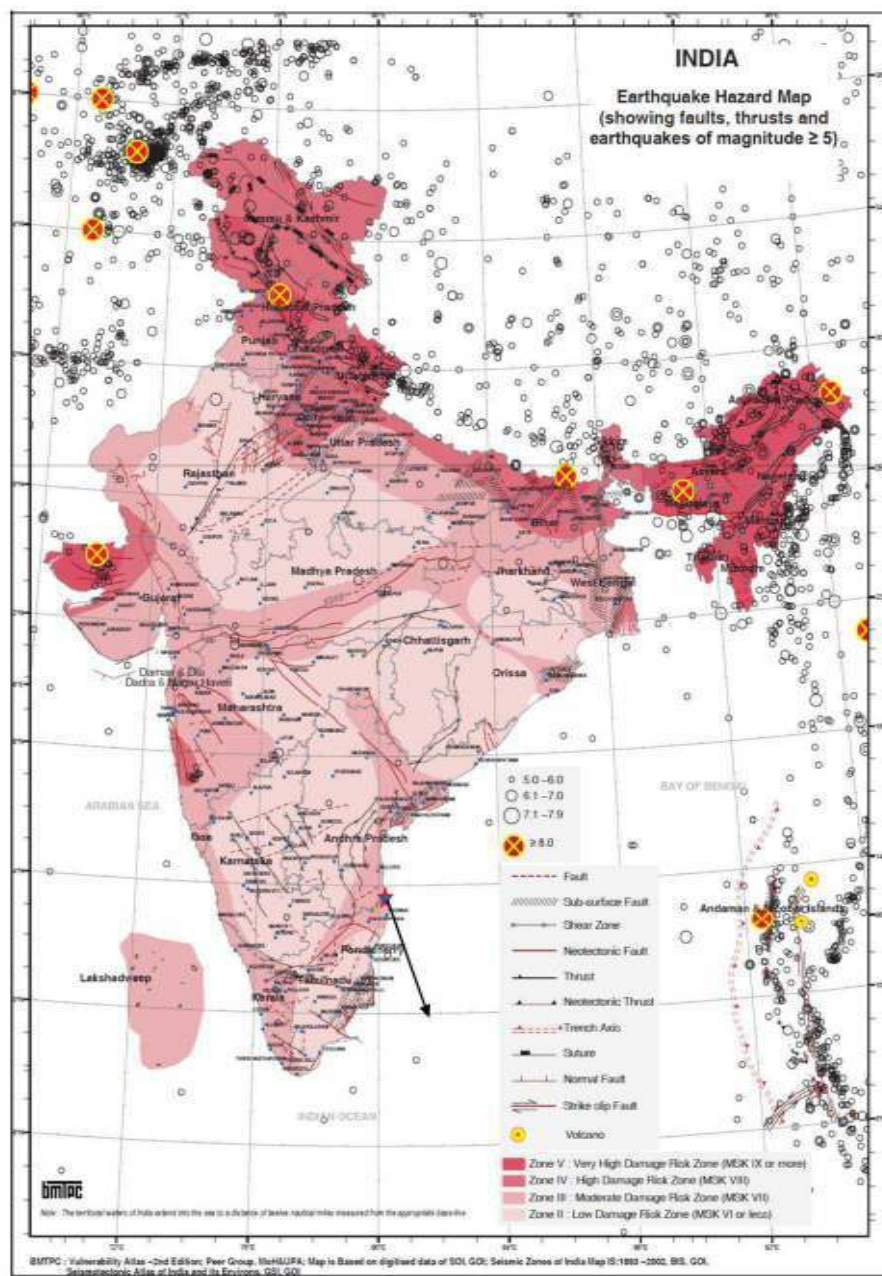
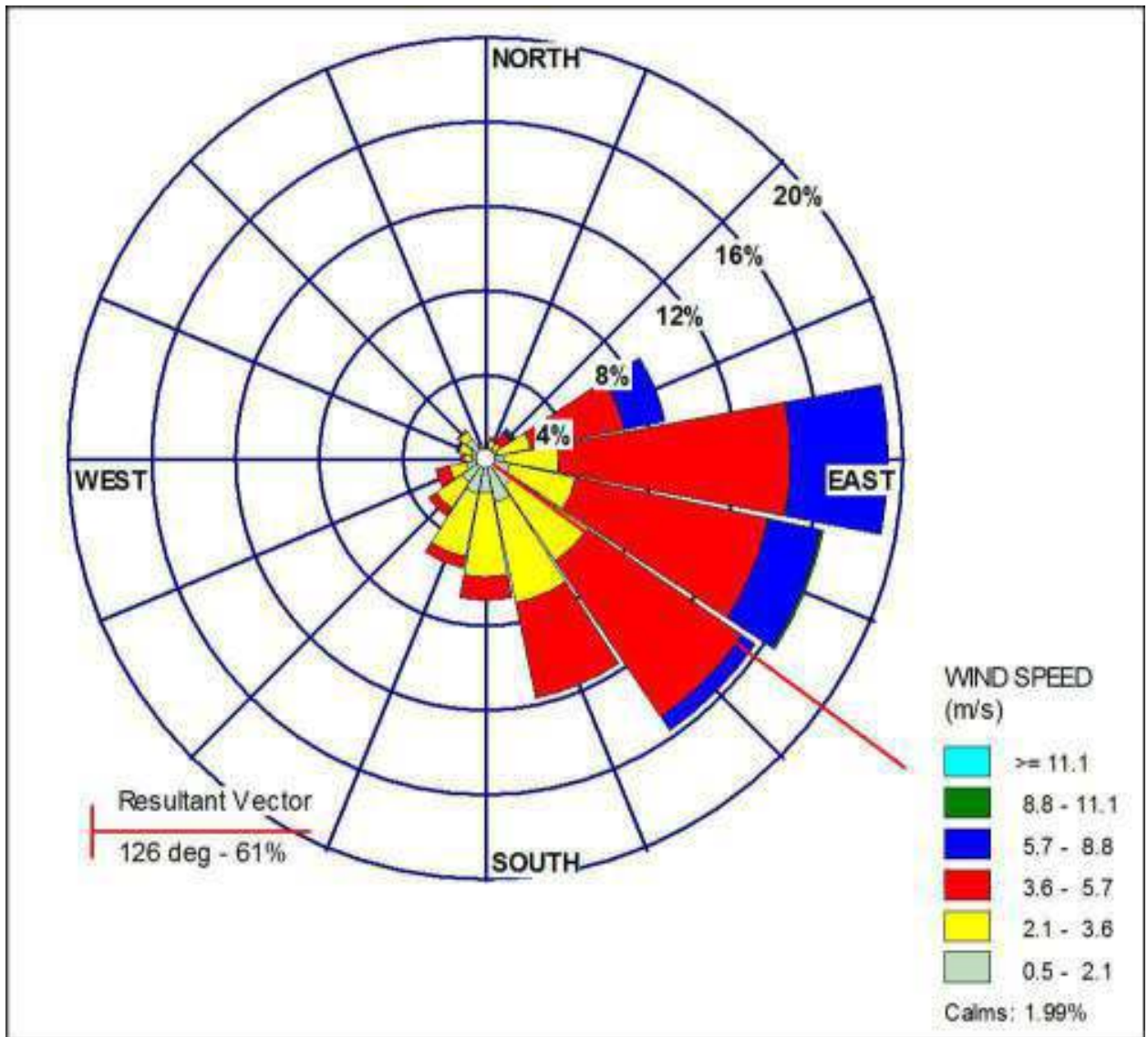


Fig. 6.9. Earthquake zones and seismic faults in India (BMTPC, 2006)



Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.10. Wind rose diagram

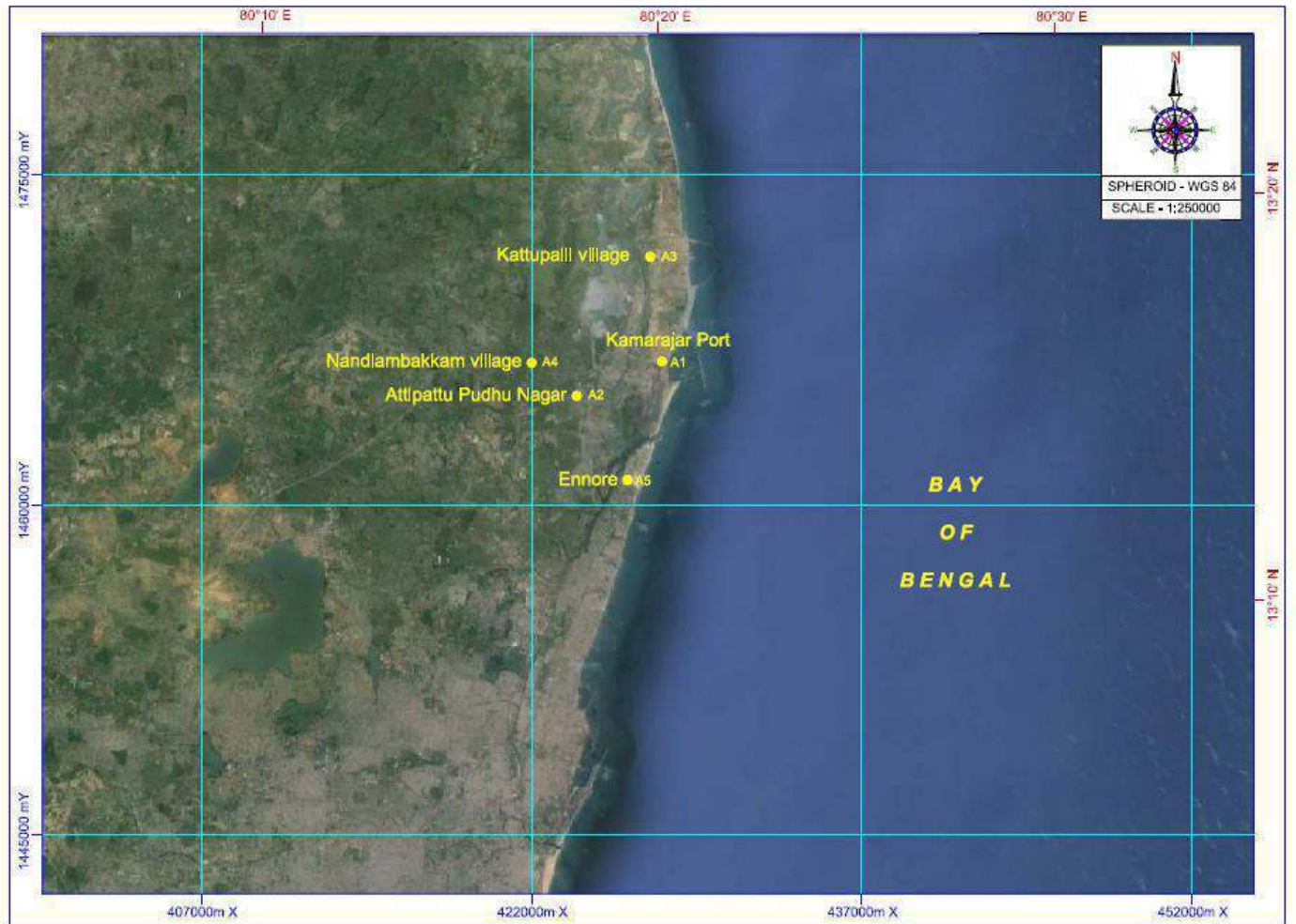
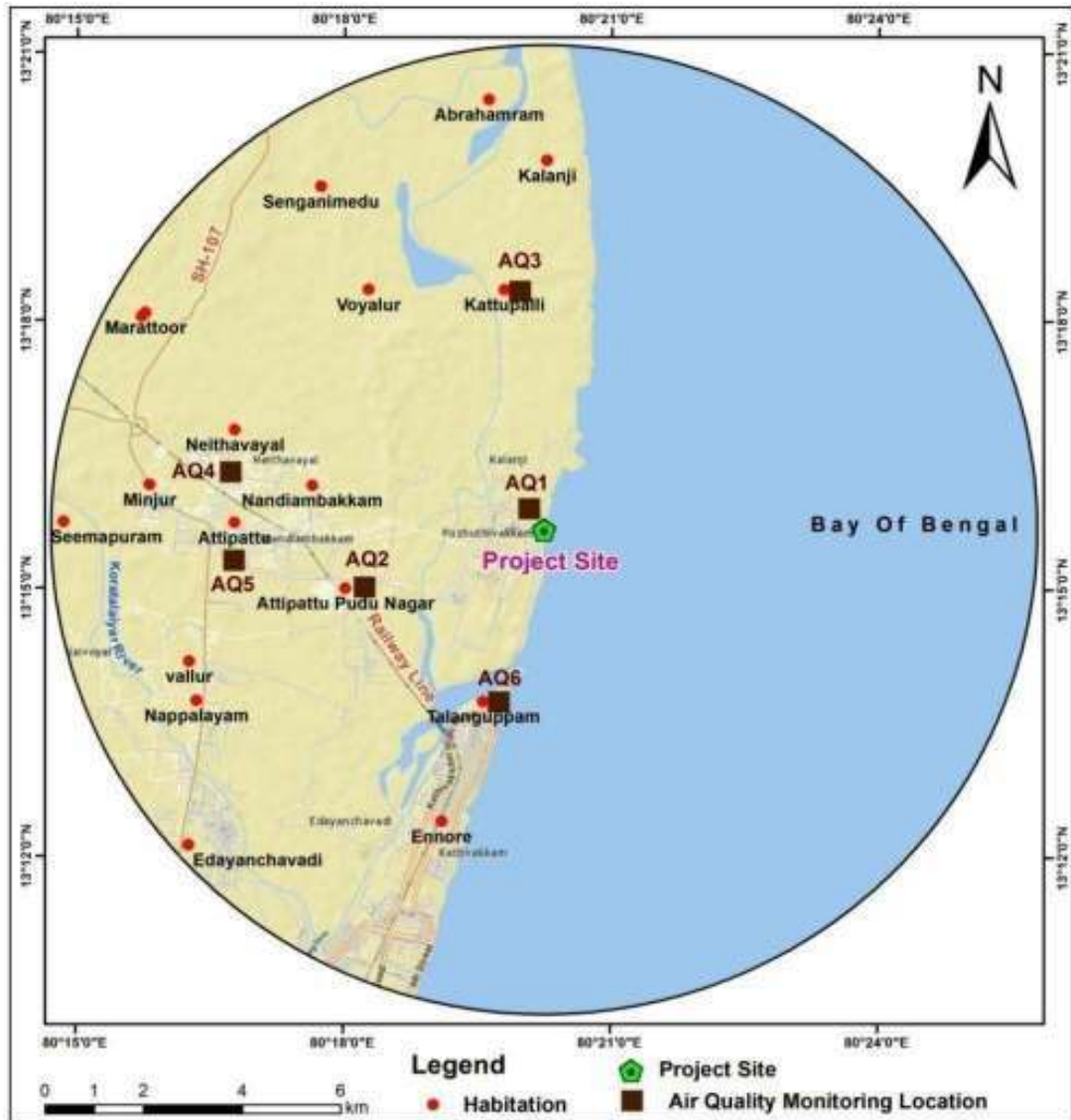


Fig. 6.11. Air quality monitoring locations – Pre monsoon, Post monsoon and Fair weather



Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.12. Air quality monitoring locations –Earlier study

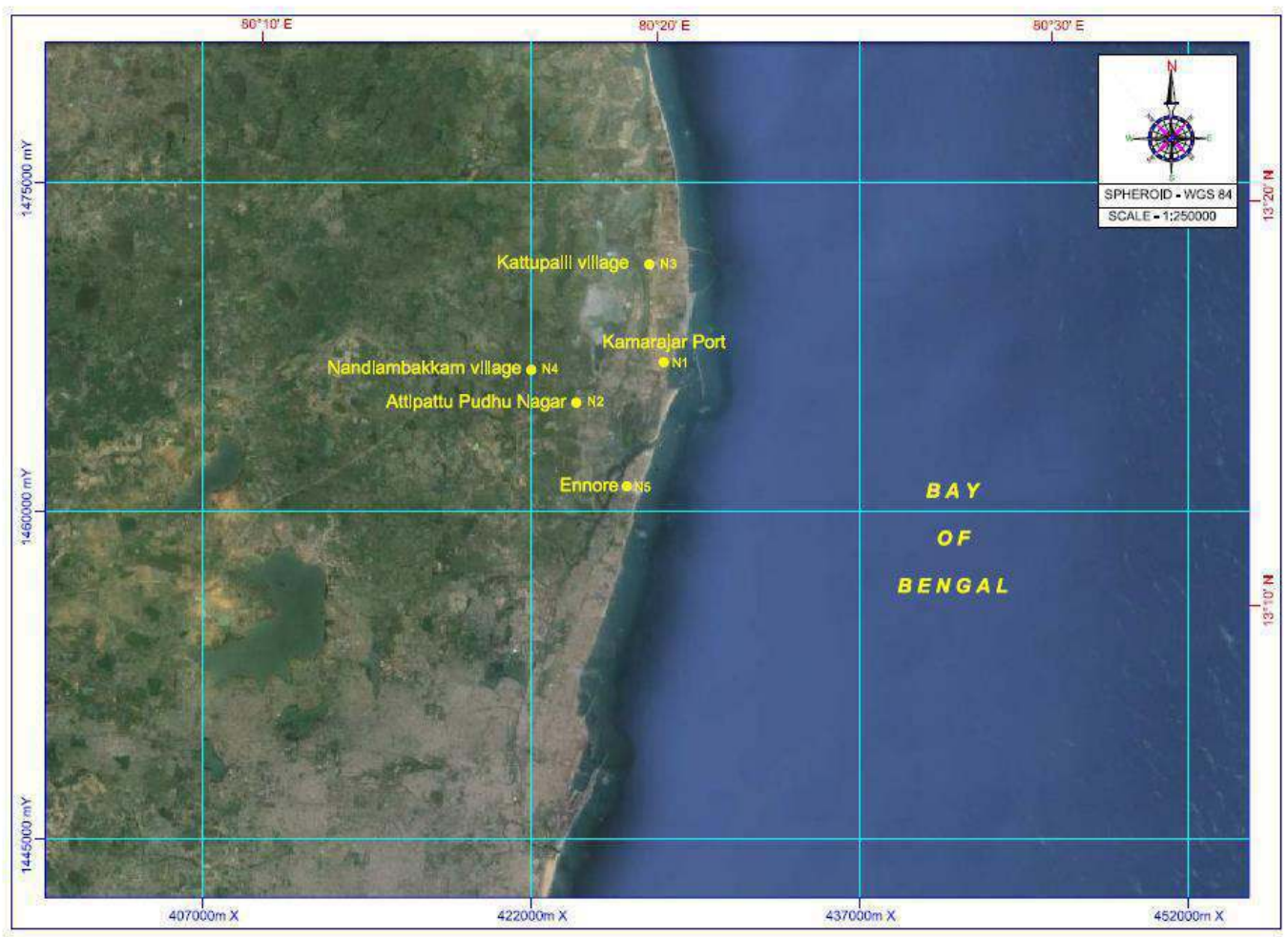
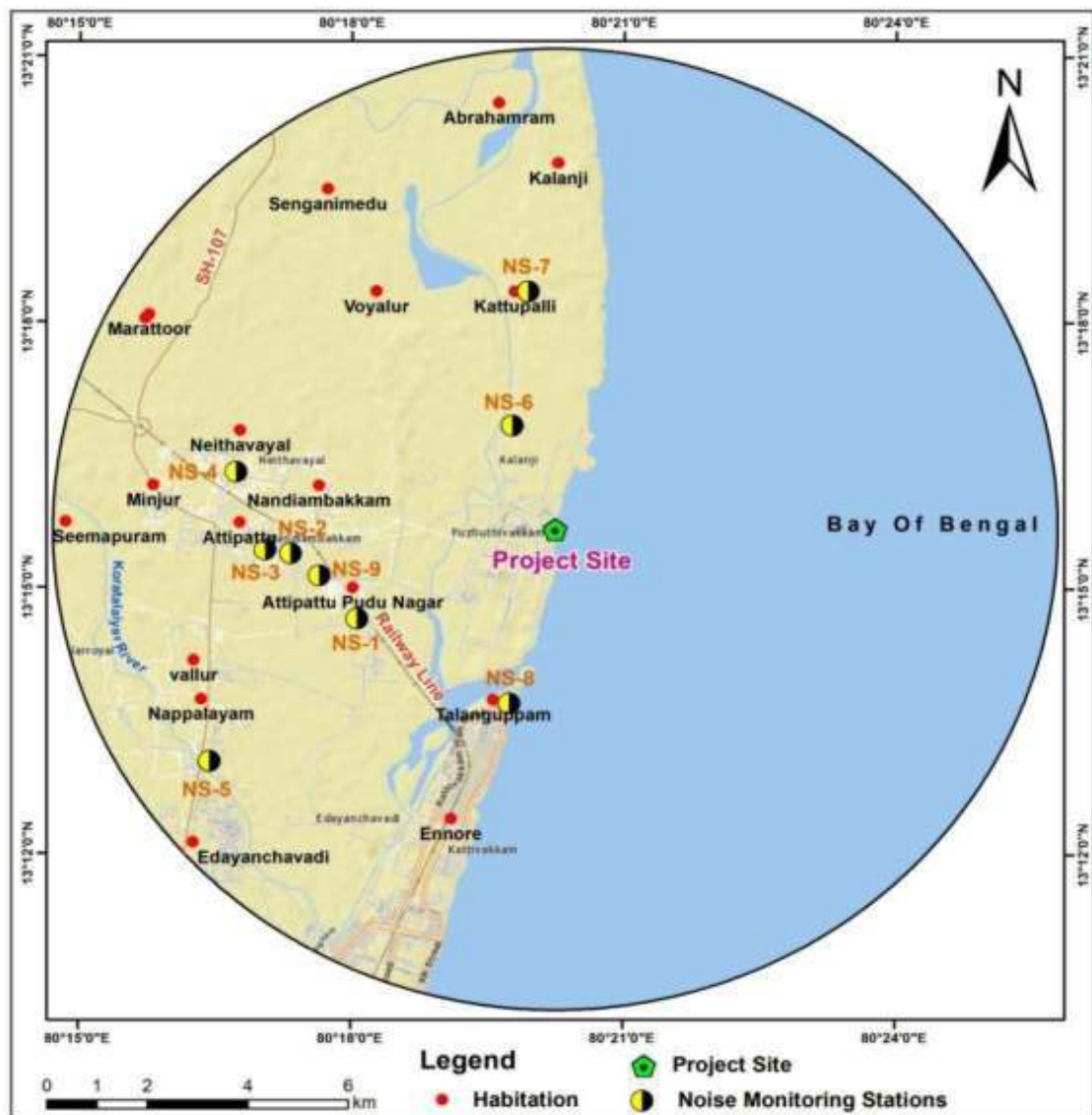
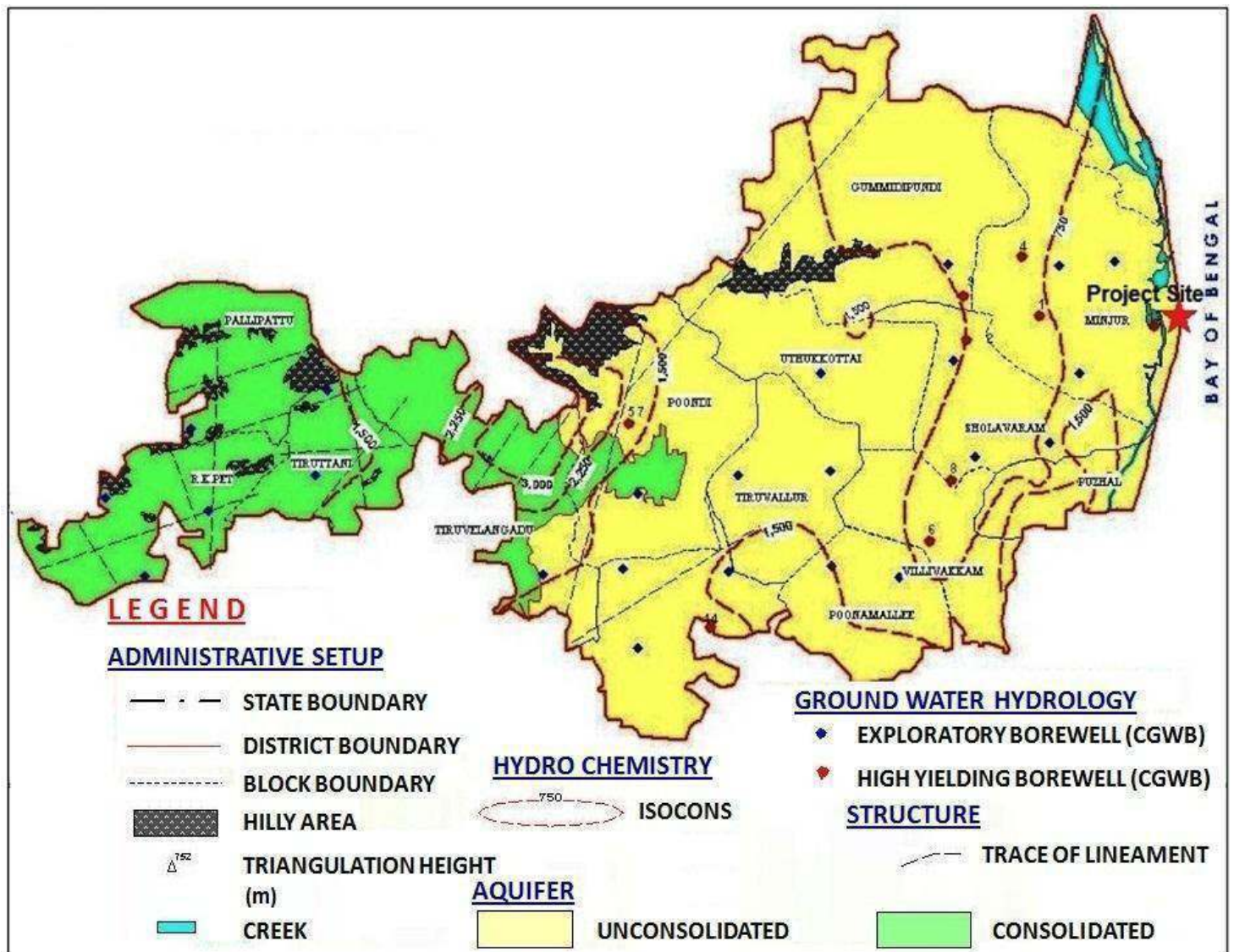


Fig. 6.13. Noise monitoring locations – Pre monsoon, Post monsoon and Fair weather



Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.14. Noise Monitoring locations –Earlier study



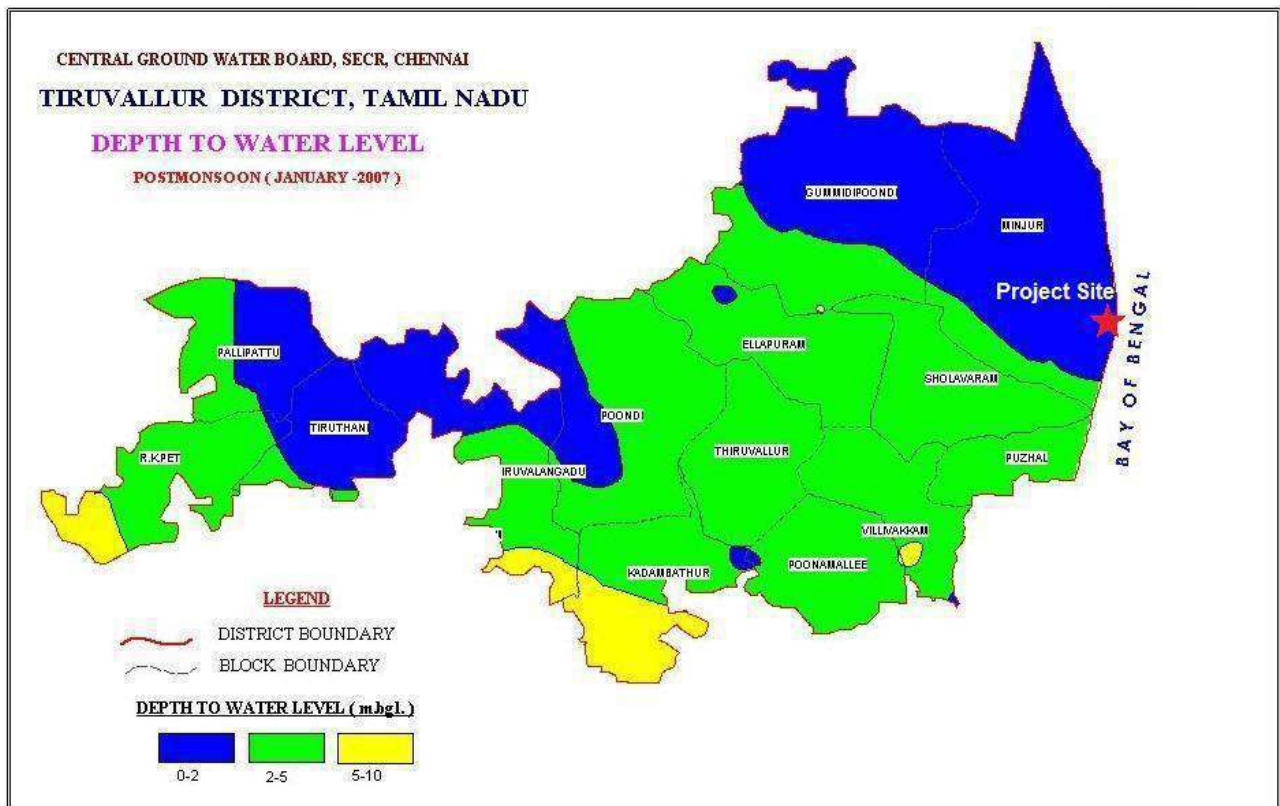
Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.15. Hydrogeology map of Thiruvallur District



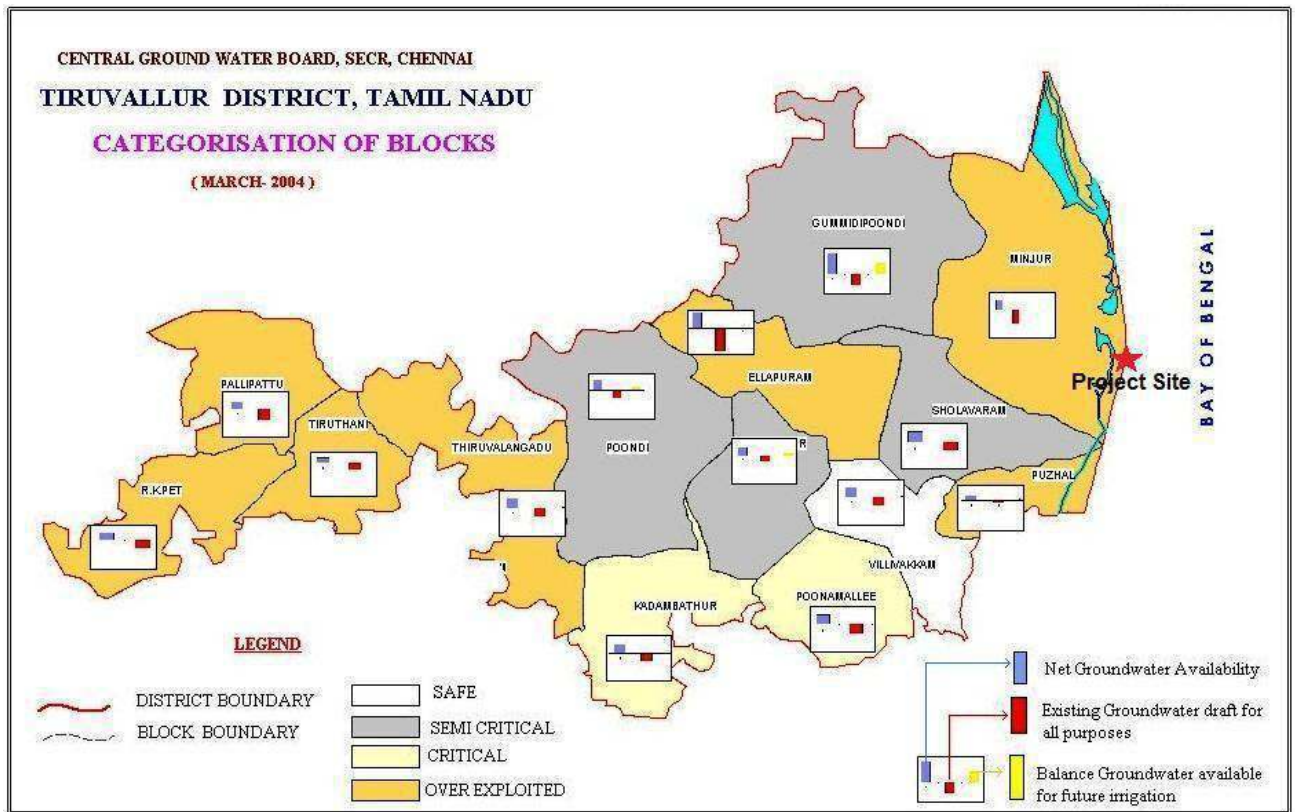
Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.16. Depth to water level map during pre-monsoon (2006)



Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.17. Depth to water level map during post-monsoon (2007)



Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.18. Ground water exploitation state of the blocks in Thiruvallur district

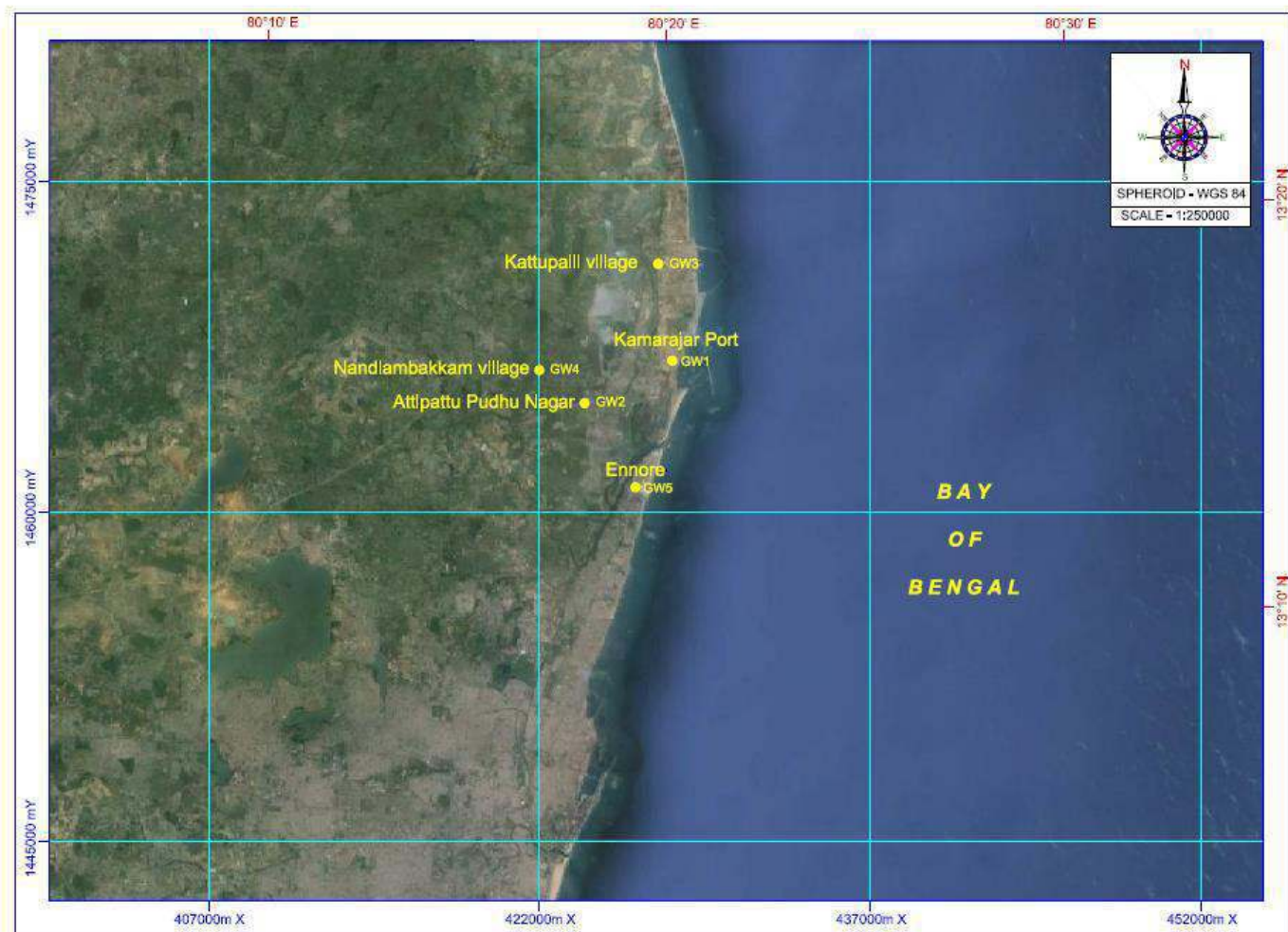
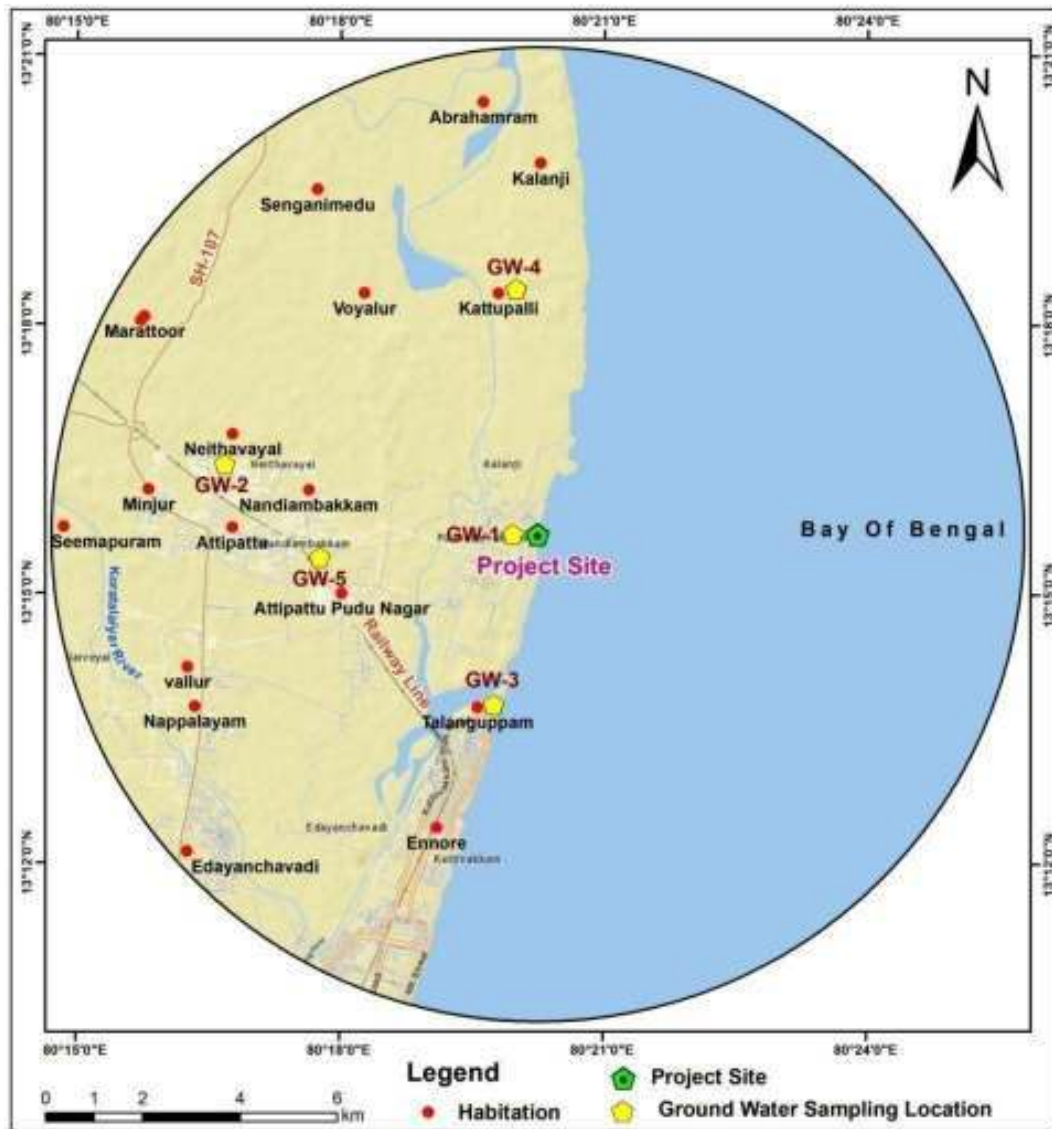
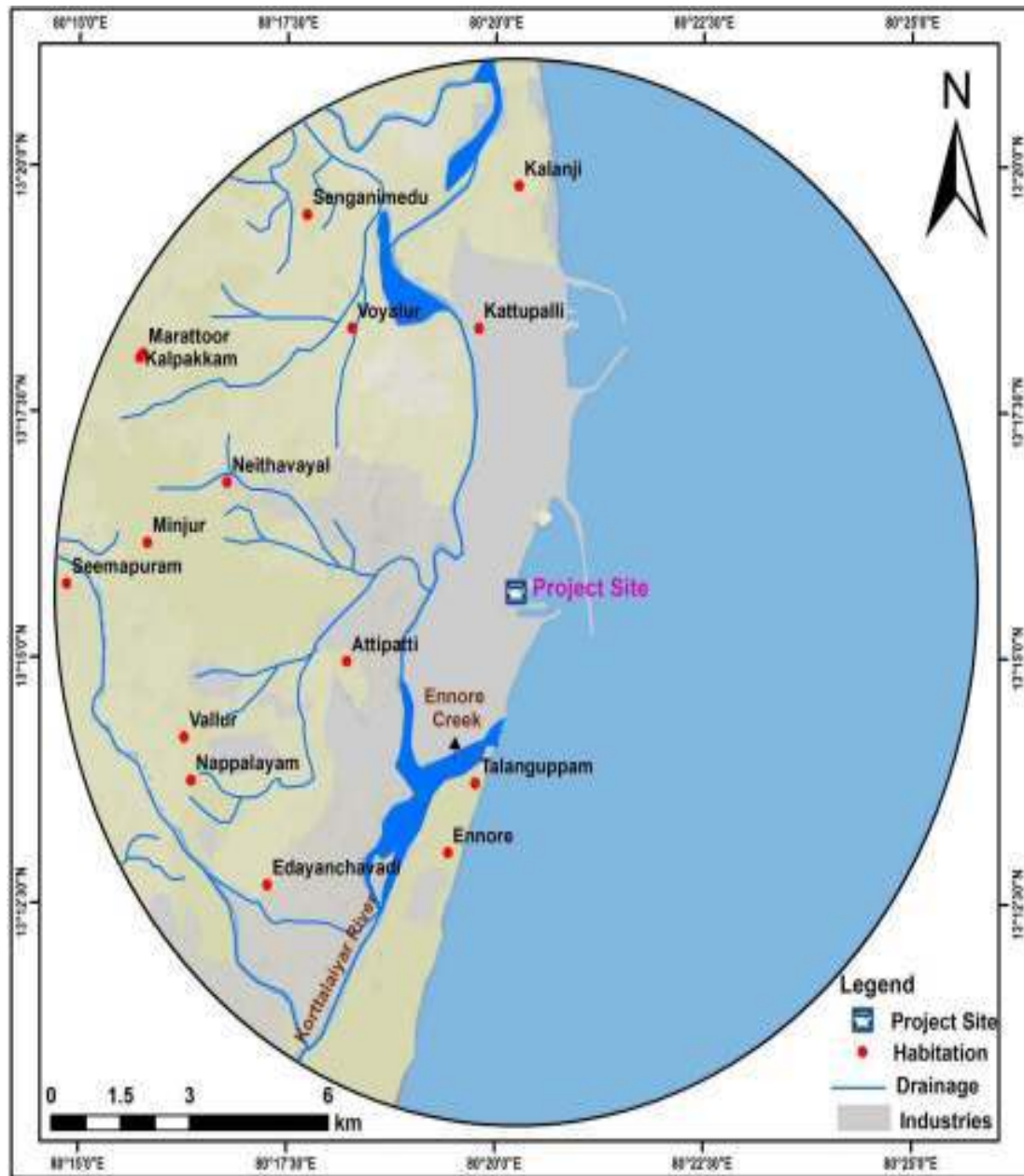


Fig. 6.19. Ground water sampling locations – Pre monsoon, Post monsoon and Fair weather



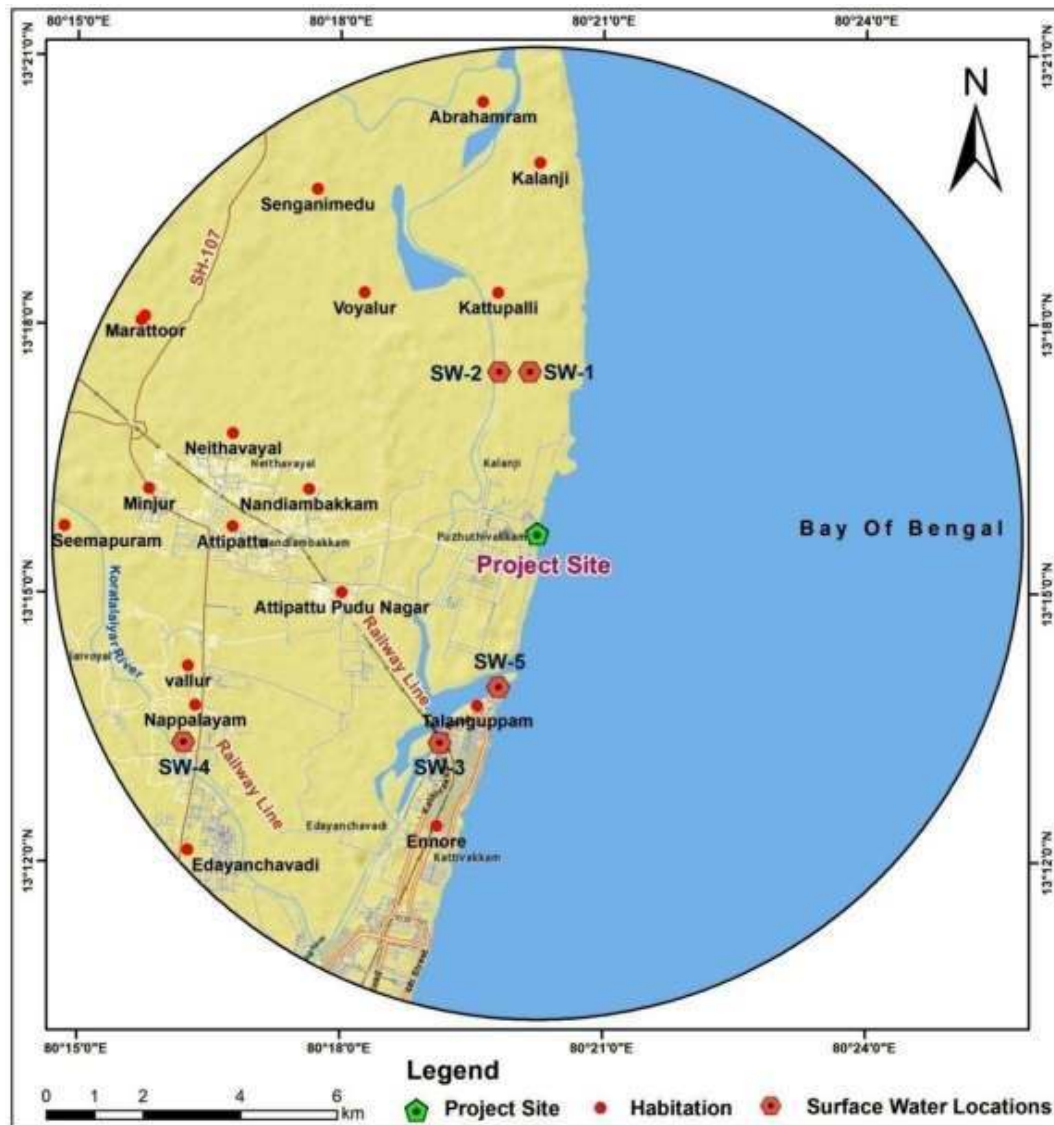
Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.20. Ground water sampling locations –Earlier study



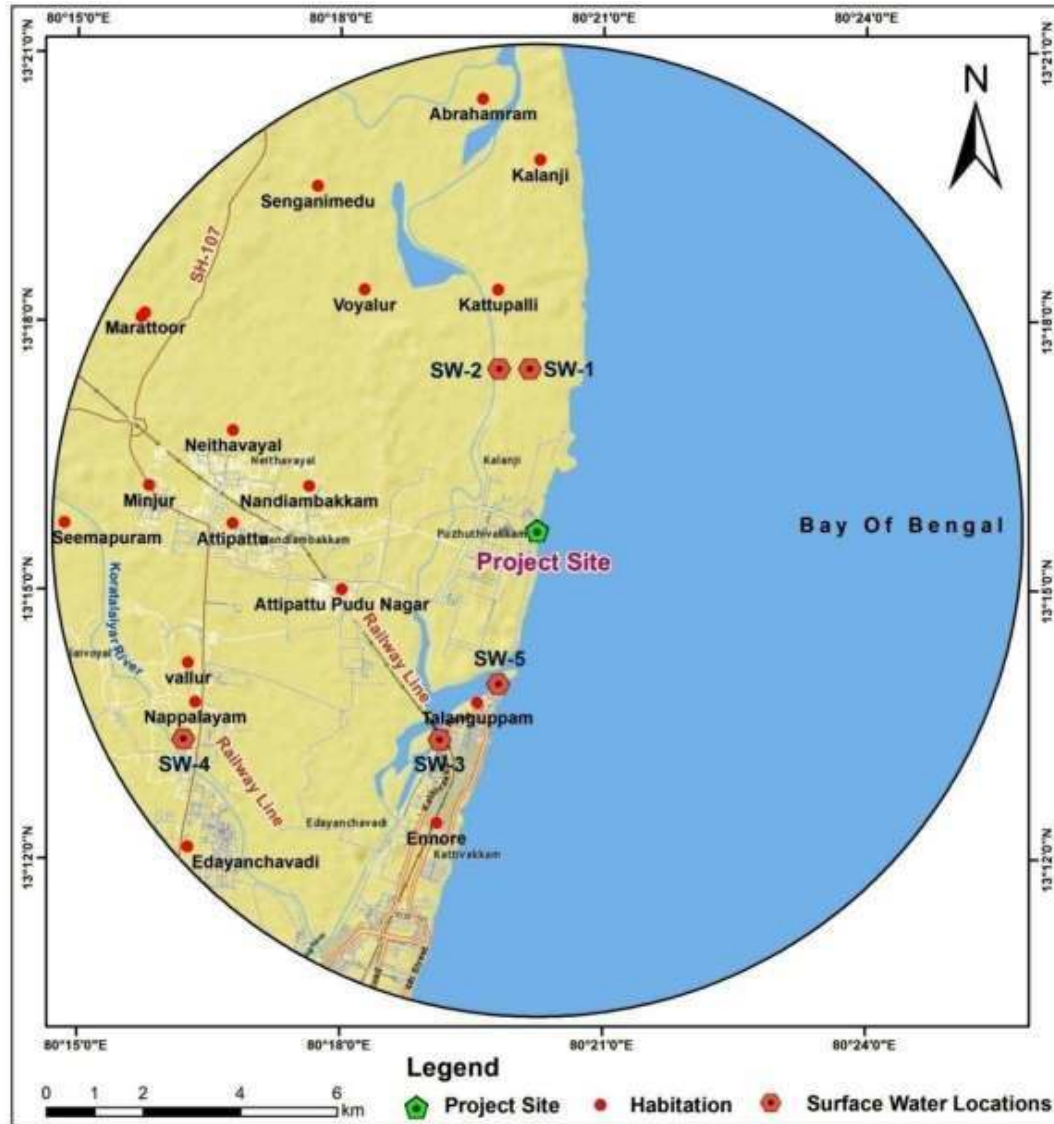
Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.21. Drainage pattern of the study area



Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.22. Surface water sampling locations- Pre monsoon, Post monsoon and Fair weather



Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 6.23. Surface water sampling locations- Earlier study

7. MARINE ENVIRONMENT

7.1. Description of Marine environment

The coastal region is plain and barren land with thorny bushes and sparse wild vegetation. It is a long and straight coastline comprises of fairly wide beaches with well-defined foreshore and elevated backshore. The oceanography of this region is influenced by 3 climatic conditions, viz., southwest monsoon (June -September), northeast monsoon (Mid October - Mid March) and fair weather period (April - May). Unlike the northern part of the east coast of India, this part of the coast is influenced more by the northeast monsoon than those during the other two seasons. The nearshore remains more dynamic and turbulent due to persistent action of seasonal wind, high waves and coastal currents during NE monsoon season. The segment of coastline was affected by the Tsunami in December 2004. Also it is subjected to the vagary Cyclones and Storm surge during NE monsoon period. The nearshore remains relatively steeper due to the action of high waves during monsoon seasons. The seabed in nearshore primarily comprises of sand without any complex bathymetric features except the Ennore shoals. Sand shoals are observed at offshore which have been formed over the geological years due to the alluvial sediments discharged through Ennore creek and Pulicat Lake.

The coastal current within 5 km distance from the shore is greatly influenced by wind and tides. The distribution of temperature and salinity indicates that the nearshore water is well mixed without stratification. The influence of littoral drift is significant and the annual net drift takes place in northerly direction. The urban influenced coastal belt extends from Mahabalipuram in the south to Pulicat Lake in the north wherein the northern stretch from Ennore creek (Kosathalaiyar River mouth) to Pulicat Lake almost forms as a barren land. This stretch is presently being developed for industrial purpose.

Pulicat Lake which lies 16 km north of the project area open into the sea with a tidal inlet mouth on the north close to Pazhaverkadu where there is an active seawater ingress system influenced by the tides entering through Pulicat Lake mouth as well as Ennore creek.

7.2. Baseline data

The marine environment of the project region at open sea has been studied for the evaluation of baseline information as per the norms stipulated by the Ministry of Environment and Forests, Govt. of India. The baseline data were collected for three seasons in order to prepare the comprehensive EIA report, i.e. in February 2016 representing Pre Monsoon period, September 2016 representing post monsoon period and in March 2017 representing Fair weather. The chemical and biological samples were collected at seven locations in open sea from two different depth viz. surface and bottom. The details of the sampling locations are presented in Table 7.1 and also shown in Fig. 7.1.

The water quality parameters Temperature, pH, Salinity, DO, BOD, Total suspended solids, Turbidity, Nitrite-N, Nitrate-N, Total Nitrogen, Total phosphorus, Inorganic phosphate were analyzed onboard at site by Indomer. The other water quality parameters colour, odour, Total Dissolved Solids (TDS) and heavy metals on Cadmium, Lead, Mercury, Zinc, Iron, Arsenic, Copper, Chromium, Oil and grease and Total Petroleum Hydrocarbons and sediment quality parameters viz. Organic matter, Total phosphorous, Total Nitrogen, Calcium carbonate, Texture and heavy metals on Cadmium, Lead, Total Chromium, Mercury, Phenolic compounds and Total Petroleum Hydrocarbons were analyzed by Creative Engineers and Consultants, Chennai, accredited by National Accreditation Board for Laboratory (NABL) where as the third season was analyzed by Indomer which received subsequently accreditation by National Accreditation Board for Laboratory (NABL).

The details of the studies carried out in the coastal region on physical, chemical and biological aspects are explained below. The method of collection and analysis protocols are given in Annexure II.

Table 7.1. Measurement locations and details (Three seasons)

Stn. No	Water depth (m)	Measurement level*
S1	14.0	<i>S, B</i>
S2	8.0	<i>S, B</i>
S3	15.0	<i>S, B</i>
S4	14.0	<i>S, B</i>
S5	17.0	<i>S, B</i>
S6	16.0	<i>S, B</i>
S7	10.0	<i>S, B</i>

**S=surface; B=bottom*

7.3. Physical parameters

Bathymetry

The bathymetry chart was prepared by taking the datum in WGS 84 spheroid in 1:10000 scale. The maps are prepared in UTM co-ordinates (Zone 44) and supplemented by geographical co-ordinates (latitudes and longitudes in degrees, minutes and seconds). The bathymetry chart covering an area of Port Basin and Approach channel as shown in Fig. 7.2. The bathymetry survey was conducted in February 2016. The depths are presented in 50 m x 50 m grid with respect to Chart Datum (CD). The maximum depth of 19 m was noticed in basin area.

Tide

The tides near study area is semi diurnal with an average spring tidal range of 1.0 m and a neap tidal range of 0.4 m. The various tide levels with respect to Chart

Datum (CD) for Chennai region as presented in Surveyor General of India publications are given below:

Mean High water Spring	:	1.15 m
Mean High Water Neap	:	0.84 m
<i>Mean Sea Level</i>	:	<i>0.65 m</i>
Mean Low Water Neap	:	0.43 m
Mean Low Water Spring	:	0.14 m

Wave

The data compiled based on the ship observed deep-water waves over the region between the latitude 10°N - 15°N, and longitude 80°E - 85°E is considered. The occurrence of predominant wave characteristics is presented in Table 7.2. It is observed that the significant wave heights varied from 0.5 m to 1 m during February to April, from 1 m to 3.0 m during May to September and from 1m to 2 m during rest of the year. The zero crossing periods of the waves varied between 5 and 8 s. The project area is located on the region which is significantly influenced during the northeast monsoon. The wave climate remains rough from May to November. The occurrence of storms and depressions during northeast monsoon often increases the wave activity in this region.

Table 7.2. Monthly wave characteristics off Chennai

Month	Hs (m)	Tz (s)
January	1.0 – 1.5	5 – 7
February	0.5 – 1.0	5 – 6
March	0.5 – 1.0	5 – 6
April	0.5 – 1.0	5 – 6
May	1.0 – 2.5	5 – 7
June	1.0 – 2.5	5 – 8
July	1.0 – 2.5	5 – 6
August	1.0 – 3.0	5 – 6
September	1.0 – 2.5	5 – 6
October	0.5 – 2.0	5 – 6

Month	Hs (m)	Tz (s)
November	1.0 – 2.0	5 – 6
December	1.0 – 2.0	5 – 6

Current

At a distance 750 m from shore, the current speed persisted between 0.02 and 0.20 m/s. The current direction reversed with tides. At a distance 1500 m from shore, the current speed persisted between 0.03 and 0.25 m/s. The current direction remained within the sector of N and E.

It shows that, in general the currents are moderate and has the major influence of wind followed by tides. The wind appears to have significant impact on the direction of flow. The currents flow parallel to the coastline, with a slight tendency towards the shore. Shoreward tendency is normally observed during rough seas due to mass transport by waves and shoreward wind.

Salinity and temperature

The available literature (*Rao, 1995*) on annual variation for the offshore region indicates that the temperature varies between 27° C in December and 30° C in May (Table 7.3). During southwest monsoon period (June-September), no wide fluctuation in temperature was observed.

The available literature (*Wyrski, 1971*) on annual variation of surface salinity for this offshore region indicates that the salinity values ranged between 32.3 ppt and 34.5 ppt over different months of the year. The vertical salinity gradient is not relevant in shallow coastal waters off Minjur (Chennai) and also no appreciable density stratification can be expected in this region.

Table 7.3. Monthly distribution of salinity and sea surface temperature

Month	Temperature (°C)	Salinity (ppt)
January	27.0	32.0
February	27.0	32.0
March	27.5	34.0
April	29.0	34.0
May	30.0	34.0
June	29.0	34.0
July	28.0	34.5
August	28.0	34.5
September	28.0	33.5
October	28.0	33.5
November	28.0	33.0
December	27.0	33.0

Littoral Drift

The monthly volume of littoral drift at project region is shown in Table 7.4. The sediment transport rates were high ($>1.98 \times 10^5 \text{ m}^3/\text{month}$) in May and December. It was lowest ($< 0.75 \times 10^5 \text{ m}^3/\text{month}$) in March. The littoral drift was towards north from April to October and towards south during the remaining months of the year. The annual northerly transport is $0.98 \times 10^6 \text{ m}^3/\text{year}$ and the annual southerly transport is $0.51 \times 10^6 \text{ m}^3/\text{year}$. The net sediment transport is $0.47 \times 10^6 \text{ m}^3/\text{year}$.

Table 7.4. Long shore sediment transport rate along Chennai coast

Month	Quantity (m ³ / month)
January	155790
February	84199
March	7376
April	-91894
May	-198016
June	-178516
July	-125861
August	-149160
September	-157813
October	-76053
November	68486
December	196906
(-) Transport in northerly direction	

7.4. Seawater Quality – Pre monsoon, Post monsoon and Fair weather

The baseline data were collected for three seasons in order to prepare the comprehensive EIA report, i.e. in February 2016 representing Pre Monsoon period, September 2016 representing Post monsoon period and in March 2017 representing Fair weather period. It is compared with the earlier data on seawater and seabed sediment quality from the report prepared for the Coal berths proposed in Phase II "Environmental Impact assessment for proposed additional coal berths CB3(9 MTPA) & CB4 (9 MTPA), Ennore Port, Tamil Nadu" by Asian Consulting Engineers Private Limited, New Delhi.

The details of the sampling locations are presented in Table 7.1 and shown in Fig. 7.1. The analytical data for seawater quality is tabulated in Tables 7.5 and 7.6.

Result

Temperature: Pre monsoon: The sea surface temperature varied from 27° C to 29° C at all 7 locations. There was no significant variation in temperature with the distance from the shore. Post monsoon: The temperature varied from 29° C to 31° C at all 7 locations. Fair weather: The sea surface temperature varied from 27° C to 29° C at all 7 locations. There was no significant variation in temperature with the distance from the shore.

pH: Pre monsoon: The pH of the seawater samples varied from 7.91 to 8.08. The result shows that the pH values lie within the range of normal sea water. Post monsoon: The pH of the seawater samples varied from 7.81 to 8.08. The result shows that the pH values lie within the range of normal sea water. Fair weather: The pH of the seawater samples varied from 8.01 to 8.19. The result shows that the pH values lie within the range of normal sea water.

Salinity: Pre monsoon: The estimated salinity values of the collected water samples shows that it varied between 35.0 ppt and 36.0 ppt at all 7 locations. The results indicate that the salinity range lie within the range of normal sea water. Post monsoon: The estimated salinity of the collected water samples varied between 35.0 ppt and 37.0 ppt at all 7 locations. The results indicate that the salinity range lie within the range of normal sea water. Fair weather: The estimated salinity values of the collected water samples shows that it varied between 34.0 ppt and 35.0 ppt at all 7 stations. The results indicate that the salinity range lie within the range of normal sea water.

Dissolved Oxygen (DO): Pre monsoon: DO values varied from 4.96 to 5.76 mg/l at all locations. Post monsoon: Dissolved Oxygen values varied from 4.4 to 6.6 mg/l at all locations. Fair weather: DO values varied from 5.3 to 6.8 mg/l at all locations.

Biochemical Oxygen Demand (BOD): Pre monsoon: The BOD values varied from 1.12 to 3.04 mg/l. The low BOD values indicate that oxidisable organic matter brought to the near shore waters is effectively assimilated in coastal waters. The narrow range of variation in BOD values indicate that the water column is well mixed in the project area. The minimum value was observed at station S4 (bottom) and the maximum was at S6 (bottom). Post monsoon: The BOD values varied from 1.8 to 2.4 mg/l. The low BOD values indicate that oxidizable organic matter brought to the near shore waters is effectively assimilated in coastal water. The narrow range of variation in BOD values indicate that the water column is well mixed in the project area. The minimum value was observed at station S1, S4 and S6 (surface) and the maximum was at S7 (surface and bottom). Fair weather: The BOD values varied from 1.4 to 2.2 mg/l. The low BOD values indicate that oxidizable organic matter brought to the near shore waters is effectively assimilated in coastal waters. The narrow range of variation in BOD values indicate that the water column is well mixed in the project area.

Nitrite-Nitrogen ($\text{NO}_2\text{-N}$), Nitrate -Nitrogen ($\text{NO}_3\text{-N}$) and Total nitrogen: pre monsoon: The concentration of nitrite ($\text{NO}_2\text{-N}$), nitrate ($\text{NO}_3\text{-N}$) and total nitrogen observed were <0.01, <1.0 mg/l and <1.0 mg/l respectively at all 7 stations. Post monsoon: The concentration of nitrite ($\text{NO}_2\text{-N}$), nitrate ($\text{NO}_3\text{-N}$) and total nitrogen values varied from 0.02 – 0.12 mg/l, 0.44 – 1.63 mg/l and 0.6 - 1.8 mg/l respectively at all 7 stations. Fair weather: The concentration of nitrite ($\text{NO}_2\text{-N}$), nitrate ($\text{NO}_3\text{-N}$) and total nitrogen observed were ranged from 0.007-0.018 mg/l; 0.68-1.09 mg/l and 0.69-1.11 respectively at all 7 stations.

Total Suspended Solids: Pre monsoon: Total Suspended Solids in seawater originate either from autochthonous (biological life) or allochthonous (derived from terrestrial matter) sources. It varied from <2 mg/l to 12 mg/l at all 7 stations. Post monsoon: Total Suspended Solids in seawater originate either from autochthonous (biological life) or allochthonous (derived from terrestrial matter) sources. It varied from 2 mg/l to 26 mg/l at all 7 stations. Fair weather: Total Suspended Solids in seawater

originate either from autochthonous (biological life) or allochthonous (derived from terrestrial matter) sources. It varied from 4.4-15.6mg/l at all 7 stations.

Trace metal concentration

Concentrations of trace metals in water are often close to the background level due to their efficient removal from the water column through hydrolysis and adsorption by suspended particulate matter. Hence, bottom sediments serve as an ultimate sink for several trace metals and their analyses can serve as useful indicator of metal pollution. The nominal presence of trace metals, which occur in seawater, are found to be necessary to promote growth of marine organisms. The concentration levels of Cadmium, Lead, Chromium and Mercury measured at all 7 locations across the depth are presented in Table 7.6.

Cadmium (Cd): Pre monsoon: The total cadmium concentration in the study region was found to be < 0.01 mg/l at all 7 locations. Post monsoon: In the study region cadmium concentration was <0.01 mg/l at all 7 locations. Fair weather: The total cadmium concentration in the study region was found to be <0.01 mg/l at all 7 locations.

Chromium (Cr): Pre monsoon: The total chromium concentration in the study region was found to be < 0.05 mg/l at all 7 locations. Post monsoon: In the study region chromium concentration was <0.05 mg/l at all 7 locations. Fair weather: The total chromium concentration in the study region was found to be <0.01 mg/l at all 7 locations.

Mercury (Hg): Pre monsoon: The concentration of mercury was found to be <0.002 mg/l at all 7 locations. Post monsoon: The concentration of mercury was found to be <0.002 mg/l at all 7 locations. Fair weather: The concentration of mercury was found to be <0.001 mg/l at all 7 locations.

Lead (pb): Pre monsoon: The lead concentration found to be <0.02 mg/l at all 7 locations. Post monsoon: The lead concentration found to be <0.02 mg/l at all 7 locations. Fair weather: The lead concentration found to be <0.01 mg/l at all 7 locations.

Copper (Cu): Pre monsoon: The copper concentration in the study region was found to be < 0.02 mg/l at all 7 locations. Post monsoon: In the study region chromium concentration was <0.02 mg/l at all 7 locations. Fair weather: The copper concentration in the study region was found to be < 0.01 mg/l at all 7 locations.

Arsenic (As): Pre monsoon: The arsenic concentration in the study region was found to be <0.01 mg/l at all 7 locations. Post monsoon: In the study region arsenic concentration was <0.01 mg/l at all 7 locations. Fair weather: The arsenic concentration in the study region was found to be < 0.01 mg/l at all 7 locations.

Zinc (Zn): Pre monsoon: The zinc concentration varied from 0.09 to 0.18 mg/l at all 7 locations. Post monsoon: The zinc concentration varied from 0.11 to 0.25 mg/l at all 7 locations. Fair weather: The zinc concentration varied from 0.07 to 0.11 mg/l at all 7 locations.

Iron (Fe): Pre monsoon: The iron concentration varied from <0.02 to 0.11 mg/l at all 7 locations. Post monsoon: The iron concentration varied from 0.01 to 1.16 mg/l at all 7 locations. Fair weather: The iron concentration varied from 0.11 to 0.21 mg/l at all 7 locations.

Oil and grease as (C_6H_5OH): The concentration of oil and grease was found to be <2.0 mg/l at all 7 locations during Pre monsoon, Post monsoon and Fair weather seasons.

Total Petroleum Hydrocarbons: In the study area the dissolved and dispersed Petroleum hydrocarbons was found to be <0.1 mg/l at all 7 locations during pre monsoon, post monsoon and Fair weather seasons.

Table 7.5. Sea Water Quality

Stations		Temp. (°C)			Salinity (ppt)			Color (Hazen)			Odour			Total Dissolved solids (mg/l)			pH			Total suspended solid (mg/l)			Turbidity (NTU)		
		Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weat her	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post Mon soon	Fair weather
S1	S	29.0	29.0	28.0	35.0	36	34.0	<2.0	<10	<2.0	*	*	*	39760	36640	39820	7.91	7.96	8.01	4.0	8.0	4.4	<1.0	5.8	1.1
	B	28.0	29.0	27.0	36.0	36	35.0	<2.0	12	<2.0	*	*	*	38890	37860	39820	7.94	7.82	8.07	8.0	9.0	8.4	2.0	8.3	3.3
S2	S	28.0	30.0	29.0	35.0	36	34.0	<2.0	12	<2.0	*	*	*	39080	37150	39100	7.99	7.94	8.12	12.0	10.0	6.4	<1.0	6.5	2.8
	B	27.0	29.0	27.0	36.0	36	35.0	<2.0	15	<2.0	*	*	*	40540	37100	39090	7.95	7.89	8.09	3.0	20.0	11.4	2.0	15.2	4.5
S3	S	28.0	30.0	28.0	35.0	36	34.0	<2.0	<10	<2.0	*	*	*	39130	37790	39150	8.08	7.99	8.08	<2.0	8.0	5.2	<1.0	4.9	1.5
	B	28.0	29.0	28.0	36.0	36	35.0	<2.0	15	<2.0	*	*	*	37660	37680	39140	8.04	7.81	8.10	2.0	10.2	10.4	<1.0	8.2	5.2
S4	S	28.0	30	29.0	36.0	37	35.0	<2.0	<10	<2.0	*	*	*	39190	37080	39200	8.03	8.05	8.19	3.0	7.0	6.4	2.0	5.1	2.8
	B	27.0	29	27.0	36.0	37	35.0	<2.0	<10	<2.0	*	*	*	39080	37960	39190	8.03	7.93	8.12	<2.0	13.0	15.6	3.0	8.3	4.9
S5	S	29.0	30	29.0	35.0	37	34.0	<2.0	<10	<2.0	*	*	*	38960	37940	39010	7.92	8.08	8.07	<2.0	9.0	6.4	<1.0	6.7	1.8
	B	28.0	29	28.0	36.0	35	35.0	<2.0	12	<2.0	*	*	*	39390	39210	39020	7.96	7.89	8.09	4.0	26	11.2	<1.0	12.2	6.5
S6	S	29.0	31	29.0	36.0	36	35.0	<2.0	<10	<2.0	*	*	*	40510	37890	40640	7.95	8.04	8.12	4.0	2.0	6.2	<1.0	0.7	3.2
	B	28.0	30	28.0	36.0	36	35.0	<2.0	<10	<2.0	*	*	*	39910	37110	40650	7.94	8.01	8.11	<2.0	9.0	11.6	<1.0	1.2	6.2
S7	S	29.0	30	28.0	35.0	35	35.0	<2.0	<10	<2.0	*	*	*	39650	37860	39680	8.01	8.02	8.06	2.0	6.0	4.6	<1.0	2.2	1.6
	B	28.0	29	27.0	36.0	36	35.0	<2.0	<10	<2.0	*	*	*	39720	37220	39710	7.99	8.02	8.09	12.0	3.0	9.6	<1.0	1.8	5.5

*Agreeable

Continue...

Table 7.5. Sea Water Quality

Stations		DO (mg/l)			BOD (mg/l)			NO ₂ -N (mg/l)			NO ₃ -N (mg/l)			Total Nitrogen (mg/l)			Sulphate (mg/l)		
		Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post Mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weat her	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather
S1	S	5.28	6.0	5.6	2.08	1.8	2.1	<0.01	0.06	0.012	<1.0	0.87	1.09	<1.0	1.0	1.11	1708	2426	1395.2
	B	5.12	4.8	5.5	1.28	2.0	2.0	<0.01	0.07	0.009	<1.0	1.19	1.03	<1.0	1.4	1.05	1637	2269	1425.4
S2	S	5.12	6.4	5.9	1.60	2.2	2.1	<0.01	0.05	0.011	<1.0	1.63	0.93	<1.0	1.8	0.95	1673	2143	1315.7
	B	4.96	5.2	5.3	2.08	2.0	1.9	<0.01	0.03	0.009	<1.0	1.13	0.85	<1.0	1.3	0.87	1237	2316	1406.8
S3	S	5.28	6.6	6.4	1.76	2.0	2.0	<0.01	0.05	0.014	<1.0	1.06	1.04	<1.0	1.2	1.08	2356	2074	1498.2
	B	5.12	4.4	6.1	2.24	2.2	1.9	<0.01	0.11	0.008	<1.0	0.81	0.96	<1.0	1.0	0.97	2097	2154	1386.5
S4	S	5.44	6.5	6.8	1.60	1.8	2.2	<0.01	0.04	0.018	<1.0	0.44	0.89	<1.0	0.6	0.91	2144	2177	1497.6
	B	5.28	4.8	6.0	1.12	2.2	2.1	<0.01	0.05	0.012	<1.0	0.5	1.09	<1.0	0.6	1.11	1897	1993	1568.5
S5	S	5.12	5.6	6.3	1.92	2.0	2.0	<0.01	0.05	0.011	<1.0	0.56	1.05	<1.0	0.7	1.06	1991	2062	1435.2
	B	5.12	4.8	6.3	1.60	2.2	1.9	<0.01	0.12	0.011	<1.0	0.88	0.87	<1.0	1.1	0.89	2050	2051	1396.4
S6	S	5.76	6.3	6.5	2.24	1.8	2.0	<0.01	0.03	0.010	<1.0	0.75	0.78	<1.0	0.8	0.82	2026	2143	1406.8
	B	5.60	5.6	6.2	3.04	2.0	1.9	<0.01	0.02	0.011	<1.0	0.84	0.68	<1.0	0.9	0.69	2886	2269	1512.9
S7	S	5.60	5.6	5.8	1.76	2.4	1.5	<0.01	0.03	0.008	<1.0	0.75	0.85	<1.0	0.9	0.86	2026	2316	1289.5
	B	5.44	5.8	5.6	1.60	2.4	1.4	<0.01	0.02	0.007	<1.0	0.63	0.70	<1.0	0.7	0.71	2168	2074	1398.2

Table 7.6. Concentration of Heavy Metals, Phenol and Petroleum Hydrocarbons in seawater

Stations		Heavy metals (mg/l)														
		Cadmium as Cd			Chromium as Cr			Lead as Pb			Mercury as Hg			Zinc as Zn		
		Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather
S1	S	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.12	0.22	0.10
	B	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.13	0.16	0.11
S2	S	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.14	0.25	0.09
	B	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.13	0.21	0.09
S3	S	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.12	0.18	0.11
	B	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.11	0.14	0.10
S4	S	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.09	0.23	0.09
	B	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.18	0.25	0.11
S5	S	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.14	0.22	0.10
	B	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.14	0.19	0.07
S6	S	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.13	0.23	0.07
	B	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.14	0.24	0.07
S7	S	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.11	0.19	0.11
	B	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.02	<0.02	<0.01	<0.002	<0.002	<0.001	0.15	0.11	0.09

Continue....

Table 7.6. Concentration of Heavy Metals, Phenol and Petroleum Hydrocarbons in seawater

Stations		Heavy metals (mg/l)									Oil and grease as C ₆ H ₅ OH(mg/l)			Total Petroleum Hydrocarbons (µg /l)		
		Iron as Fe			copper as Cu			Arsenic as As			Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post Mon soon	Fair weather
		Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather						
S1	S	0.10	0.23	0.18	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
	B	0.09	0.09	0.17	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
S2	S	0.09	0.17	0.21	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
	B	0.11	0.24	0.21	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
S3	S	<0.01	0.21	0.18	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
	B	0.08	1.16	0.16	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
S4	S	0.08	0.05	0.19	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
	B	0.10	0.12	0.17	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
S5	S	0.03	0.09	0.20	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
	B	0.06	0.73	0.15	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
S6	S	0.02	0.09	0.16	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
	B	0.04	0.01	0.11	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
S7	S	0.02	0.01	0.13	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1
	B	0.04	0.15	0.14	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<2.0	<2.0	<2.0	<0.1	<0.1	<0.1

7.5. Sea Water Quality – Earlier study

Seawater and Sediment sampling locations are shown in Fig. 7.3. The analytical data of the quality of water are tabulated in Table 7.7, Table 7.8 and Table 7.9 in Monsoon, Post Monsoon seasons and Pre monsoon Season.

During the Monsoon Season, the observed pH value was in the range of 7.36 - 7.88. The salinity ranged from 32.1 – 34.0 ppt, the lowest value was near Ennore Creek, at which the water from the Kosasthalaiyar river and Buckingham Canal meets the Bay of Bengal. The concentration of D.O. ranged from 4.38 – 6.39 mg/l and it was the lowest near Ennore Creek. The value of BOD was high near Ennore Creek, when compared with other locations. Similar trend was observed during Post Monsoon and Pre Monsoon seasons also.

Poly Aromatic Hydrocarbons (PAHs) namely, acenaphthylene, bromo-naphthalene, acenaphthene, fluorene, pyrene, benzo(a)pyrene, dibenzo(a,h)anthracene and indeno (1,2,3) pyrene were found to be below detectable range of 0.1 µg/l in all the seasons.

During the Post Monsoon Season, the pH was in the range of 7.81 – 8.07 and the salinity ranged from 34.8 – 35.9 ppt. The concentration of D.O. ranged from 5.48 – 6.72 mg/l. The value of BOD was high near Ennore Creek (3.1 mg/l), when compared with other locations due to the contamination of Ennore Creek area with untreated sewage. During Pre Monsoon Season, the salinity was observed to be in the range of 34.9 – 36.0 ppt and D.O. was in the range of 5.11 – 6.55mg/l.

Table 7.7. Sea Water Quality Monitoring Results for Monsoon Season

S. No.	Parameter	Unit	SWS-1	SWS-2	SWS-3	SWS-4	SWS-5	SWS-6	SWS-7
1	Color	Hazen	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
2	pH	-	7.88	7.36	7.81	7.92	7.81	7.66	7.86
3	Salinity	ppt	32.2	32.1	33.3	34.1	34.9	34.8	34.0
4	Dissolved Oxygen	mg/l	4.38	6.11	5.58	6.39	5.67	6.00	5.49
5	Oil & Grease	mg/l	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
6	PAH	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
7	BOD	mg/l	1.3	2.1	3.2	2.1	2.9	1.9	4.8
8	Chlorophyll	mg/m ³	0.9	0.6	0.8	0.7	0.6	0.7	0.6

Source: EIA report for CB3 & CB4, ACE, 2014

Table 7.8. Sea Water Quality Monitoring Results for Post Monsoon Season

S.No.	Parameter	Unit	SWS-1	SWS-2	SWS-3	SWS-4	SWS-5	SWS-6	SWS-7
1	Color	Hazen	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
2	pH	-	8.01	7.81	7.97	8.04	7.84	7.88	7.91
3	Salinity	ppt	34.8	35.1	35.3	35.9	35.5	35.2	35.9
4	Dissolved Oxygen	mg/l	5.52	5.64	6.04	5.84	5.48	6.72	6.00
5	Oil & Grease	mg/l	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
6	Mercury	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
7	PAH	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
8	BOD	mg/l	3.1	1.9	2.3	2.2	1.8	1.5	1.7
9	Chlorophyll	mg/m ³	1.1	0.7	0.9	1.0	0.4	0.7	0.8

Source: EIA report for CB3 & CB4, ACE, 2014

Table 7.9. Sea Water Quality Monitoring Results for Pre Monsoon Season

S.No.	Parameter	Unit	SWS-1	SWS-2	SWS-3	SWS-4	SWS-5	SWS-6	SWS-7
1	Color	Hazen	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
2	pH	-	7.91	8.07	7.86	7.94	7.88	7.81	7.95
3	Salinity	Ppt	34.1	33.8	34.9	35.9	35.4	35.8	36.0
4	Dissolved Oxygen	mg/l	5.11	5.32	5.98	6.03	5.67	6.55	5.94
5	Oil & Grease	mg/l	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
6	Mercury (as Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

S.No.	Parameter	Unit	SWS-1	SWS-2	SWS-3	SWS-4	SWS-5	SWS-6	SWS-7
7	PAH	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
8	BOD	mg/l	4.8	3.9	3.2	2.9	2.7	1.8	1.9
9	Chlorophyll	mg/m ³	0.8	1.1	0.9	1.2	0.7	1.0	1.1

Source: EIA report for CB3 & CB4, ACE, 2014

7.6. Seabed Sediment Quality - Pre monsoon, Post monsoon and Fair weather

The baseline data were collected for three seasons in order to prepare the comprehensive EIA report, i.e. in February 2016 representing Pre monsoon period, September 2016 representing Post monsoon period and in March 2017 representing the Fair weather period. It is compared with the earlier data on seawater and seabed sediment quality from the report prepared for the Coal berths proposed in Phase II "Environmental Impact assessment for proposed additional coal berths CB3(9 MTPA) & CB4(9 MTPA), Ennore Port, Tamil Nadu" by Asian Consulting Engineers Private Limited, New Delhi.

The sampling locations are shown in Fig. 7.1. Analyses of seabed sediment texture and physico-chemical properties are given in Table 7.10.

Organic Matter: Pre monsoon: The Organic Matter content in the sediments varied from -0.03 to 0.45 % at all 7 locations. The minimum was recorded at S6 while the maximum was recorded at S7. Post monsoon: The Organic Matter content in the sediments varied from 0.22 to 0.85 % at all 7 locations. The minimum was recorded at S7 while the maximum was recorded at S5. Fair weather: The Organic Matter content in the sediments varied from 0.28 to 0.40 % at all 7 locations. The minimum was recorded at S7 while the maximum was recorded at S5.

Calcium Carbonate: Pre monsoon: The carbonate content in the sediments varied from 8.2 to 11.2 % at all 7 locations. The minimum was recorded at stn. S3 while the

maximum was recorded at S6. Post monsoon: The carbonate content in the sediments varied from 10.8 to 12.7 % at all 7 locations. The minimum was recorded at stn. S2 and S5 while the maximum was recorded at S4. Fair weather: The carbonate content in the sediments varied from 8.2 to 10.3 % at all 7 locations. The minimum was recorded at stn. S2 while the maximum was recorded at S7.

Total Nitrogen: Pre monsoon: Total nitrogen concentration ranged from 0 to 80.5 mg/kg. The minimum (0 mg/kg) was recorded at stns. S3, S4, S5 and S6 while the maximum (80.5 mg/kg) was recorded at stn.S7. Post monsoon: Total nitrogen concentration ranged from 44.7 to 188 mg/kg. The minimum was recorded at stn. S6 while the maximum 188 mg/kg was recorded at stn.S2. Fair weather: Total nitrogen concentration ranged from 32.4 to 56.1 mg/kg. The minimum was recorded at stns.S5 and while the maximum was recorded at stn. S6.

Total Phosphorus: Pre monsoon: Total phosphorus concentration ranged from 0.23 to 1.84 mg/kg. The minimum (0.23 mg/kg) was recorded at S4 while the maximum (1.84 mg/kg) was recorded at S3. Post monsoon: Total phosphorus concentration ranged from 0.41 mg/kg to 1.24. The minimum was recorded at S7 while the maximum 1.24 mg/kg was recorded at S1. Fair weather: Total phosphorus concentration ranged from 0.72 to 1.30 mg/kg. The minimum was recorded at S3, while the maximum was recorded at S7.

The concentration of lead, cadmium, mercury, total chromium, oil & grease, phenol and total petroleum hydrocarbons in bottom sediments are presented in Table 7.10.

Lead (Pb): Pre monsoon: The lead concentration of the study area varied from 5.68 to 7.02 mg/kg at all 7 locations. Post monsoon: The lead concentration of the study area ranged from 7.9 to 13.6 mg/kg. The minimum was recorded at S3 while the maximum was recorded at S4. Fair weather: The lead concentration of the study area

ranged from 5.34 to 6.88 mg/kg at all 7 locations. The minimum was recorded at S1 while the maximum was recorded at S4.

Cadmium (Cd): Pre monsoon: The concentration of cadmium in the study region varied from 0.73 to 1.1 mg/kg at all 7 locations. Post monsoon: The concentration of cadmium in the study region varied from 1.28 to 2.41 mg/kg at all 7 locations. Fair weather: The concentration of cadmium in the study region varied from 0.68 to 1.01 mg/kg at all 7 locations.

Mercury (Hg): Pre monsoon: The concentration of mercury in the study area was found below detectable level at all 7 locations. Post monsoon: The concentration of mercury in the study area was found below detectable level at all 7 locations. Fair weather: The concentration of mercury in the study area was found below detectable level (<0.05) at all 7 locations.

Total Chromium (Cr): Pre monsoon: The concentration of total chromium in the study area varied between 42.1 and 68.3 mg/kg at all 7 locations. Post monsoon: The concentration of total chromium in the study area varied between 21.80 and 36.30 mg/kg at all 7 locations. Fair weather: The concentration of total chromium in the study area varied between 38.6 and 62.9 mg/kg at all 7 locations. The minimum was recorded at S1 while the maximum was recorded at S4.

Phenolic compounds: Pre monsoon: The concentration of Phenolic compounds in the study area was found below detectable level at all 7 locations. Post monsoon: The concentration of Phenolic compounds in the study area was found below detectable level (1.0 mg/kg) at all 7 locations. Fair weather: The concentration of Phenolic compounds in the study area was found below detectable level (<0.5 mg/kg) at all 7 locations.

Total Petroleum hydrocarbons: Pre monsoon: Total petroleum hydrocarbons were found below detectable level at all 7 locations. Post monsoon: Total petroleum hydrocarbons were found below detectable level at all 7 locations. Fair weather: Total petroleum hydrocarbons were found below detectable level (<0.5 mg/kg) at all 7 locations.

The concentrations of heavy metals, phenols and petroleum hydrocarbons in the sediment samples showed extremely low values in the open sea. It indicates that there is no accumulation of pollutants and there is no contamination in sediment.

Table 7.10 Seabed Sediment Quality

Sl. No.	Parameter		Unit	SSS-1	SSS-2	SSS-3	SSS-4	SSS-5	SSS-6	SSS-7	
1	Organic matter	Pre monsoon	%	0.32	0.24	-0.12	0.08	0.19	-0.03	0.45	
		Post monsoon		0.45	0.82	0.42	0.36	0.85	0.27	0.22	
		Fair weather		0.32	0.39	0.29	0.31	0.4	0.31	0.28	
2	Total phosphorus	Pre monsoon	mg/kg	1.23	1.46	1.84	0.23	0.38	0.49	0.33	
		Post monsoon		1.24	0.98	1.18	0.52	0.80	0.80	0.41	
		Fair weather		1.09	1.21	1.3	0.98	0.86	0.86	0.72	
3	Total nitrogen	Pre monsoon	mg/kg	-	26.9	0.0	0.0	0.0	0.0	80.5	
		Post monsoon		52.6	188	79.0	79.8	165	44.7	52.4	
		Fair weather		42.2	51.5	49.2	45.6	32.4	56.1	42.3	
4	Texture	Sand	Pre monsoon	% by Mass	25.61	57.45	51.82	6.80	10.36	12.16	4.73
			Post monsoon		1.77	5.35	2.77	34.74	28.27	5.46	53.49
			Fair weather		75.20	63.53	72.62	62.13	72.72	39.29	89.84
		Clay	Pre monsoon	% by Mass	61.90	4.62	8.86	30.65	73.06	72.53	80.09
			Post monsoon		56.10	44.39	49.48	36.82	35.53	90.14	20.08
			Fair weather		-	-	-	-	-	-	-

Sl. No.	Parameter			Unit	SSS-1	SSS-2	SSS-3	SSS-4	SSS-5	SSS-6	SSS-7
		Silt	Pre monsoon	% by Mass	12.50	37.93	39.32	62.55	16.58	15.31	15.17
			Post monsoon		42.13	50.26	47.75	28.44	36.21	4.40	26.43
			Fair weather		18.04	26.79	3.76	7.75	8.44	49.37	5.15
5	Calcium carbonate	Pre monsoon		% by Mass	9.5	8.8	8.2	9.1	10.2	11.2	9.1
		Post monsoon			12.5	10.8	11.4	12.7	10.8	11.5	12.4
		Fair weather			8.5	8.2	9.1	9.6	8.5	9.6	10.3
6	Phenolic compounds	Pre monsoon		mg/kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Post monsoon			BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Fair weather			BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)
7	Cadmium	Pre monsoon		mg/kg	1.1	0.87	0.73	1.06	0.95	0.83	0.91
		Post monsoon			2.41	1.67	1.28	1.91	1.82	2.31	1.56
		Fair weather			0.98	0.86	0.68	1.01	0.98	0.85	0.82
8	Lead	Pre monsoon		mg/kg	5.68	6.63	5.96	7.02	6.97	5.76	6.65
		Post monsoon			9.6	12.1	7.9	13.6	10.6	12.4	8.8
		Fair weather			5.34	6.54	5.87	6.88	6.72	5.69	6.56
9	Total chromium	Pre monsoon		mg/kg	42.1	53.2	45.6	68.3	61.2	44.3	54.5

Sl. No.	Parameter		Unit	SSS-1	SSS-2	SSS-3	SSS-4	SSS-5	SSS-6	SSS-7
		Post monsoon		28.50	36.30	32.10	21.80	25.60	27.50	30.90
		Fair weather		38.6	48.9	39.8	62.9	56.7	41.6	52.5
10	Mercury	Pre monsoon	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Post monsoon		BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Fair weather		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
11	Petroleum hydro carbon	Pre monsoon	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Post monsoon		BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Fair weather		BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)

7.7. Seabed sediment Quality – Earlier study

The results of Sediment quality Monitoring were carried out using Van-veen grab sampler for analysis of sediment texture and physic-chemical properties which were given in Table 7.11, Table 7.12 and Table 7.13.

The textural analysis of the sediment in the study area showed clayey nature. The samples along the Kamarajar Port breakwater (North of Northern Breakwater) were loamy sand to sandy loam in nature.

In the Monsoon season, the observed pH value was in the range of 7.76 to 8.12. The phosphorous, TKN and Potassium concentration varied from 1.08 to 2.67 mg/kg, 0.08% to 0.17% by mass and 3.8 to 6.1 mg/kg respectively.

pH value observed during the Post Monsoon season was in the range of 7.95 to 8.89. The Total Kjeldahl Nitrogen was in the range of 0.10 to 0.21 % by mass. In the Pre Monsoon season, the observed pH value was in the range of 7.90 to 8.35. The TKN and Potassium concentration varied from 0.11 to 0.18 % by mass and 3.8 to 5.9 mg/kg respectively.

Table 7.11. Sediment Quality Monitoring Result in Monsoon Season

S.No.	Parameter		Unit	SSS-1	SSS-2	SSS-3	SSS-4	SSS-5	SSS-6	SSS-7
1	pH		-	8.10	8.12	8.08	7.76	7.91	7.86	7.78
2	Phosphorous		mg/100gm	2.64	1.29	1.46	2.67	1.08	2.43	1.30
3	Total Kjeldahl Nitrogen		% by Mass	0.11	0.12	0.08	0.17	0.13	0.10	0.09
4	Potassium		mg/100gm	4.1	6.1	4.2	3.8	4.6	4.9	4.5
5	Texture	Sand	% by Mass	14	35	13	12	44	27	74
		Clay	% by Mass	10	47	11	15	29	43	16
		Silt	% by Mass	76	18	76	70	27	30	10
6	Particle Size(<0.002mm)		% by Weight	10	47	11	15	29	43	16
7	Particle Size (2.0-0.05)mm		% by Weight	14	35	13	12	44	27	74
8	Particle Size (0.05-0.002mm)		% by Weight	76	18	76	70	27	30	10

Source: EIA report for CB3 & CB4, ACE, 2014

Table 7.12. Sediment Quality Monitoring Result in Post Monsoon Season

S.No.	Parameter		Unit	SSS-1	SSS-2	SSS-3	SSS-4	SSS-5	SSS-6	SSS-7
1	pH		-	8.28	8.50	8.33	7.95	8.89	8.35	8.21
2	Phosphorous		mg/100gm	2.11	1.58	2.05	1.98	2.15	1.98	1.73
3	Total Kjeldahl Nitrogen		% by Mass	0.21	0.16	0.14	0.19	0.10	0.11	0.10
4	Potassium		mg/100gm	3.2	5.7	5.1	4.6	4.1	5.2	3.9
5	Texture	Clay	%by Mass	12.5	19.7	35.9	69.8	5.9	10.5	18.7
		Sand	%by Mass	75.2	61.3	24.3	12.5	78.2	34.9	69.2
		Silt	%by Mass	12.3	19.0	39.8	17.7	15.9	54.6	12.1
6	Particle Size(<0.02mm)		% by Weight	12.5	19.7	35.9	69.8	5.9	10.5	18.7
7	Particle Size (2.0-0.05)mm		% by Weight	75.2	61.3	24.3	12.5	78.2	34.9	69.2
8	Particle Size (0.05-0.02mm)		% by Weight	12.3	19.0	39.8	17.7	15.9	54.6	12.1

Source: EIA report for CB3 & CB4, ACE, 2014

Table 7.13. Sediment Quality Monitoring Result in Pre Monsoon Season

S.No.	Parameter		Unit	SSS-1	SSS-2	SSS-3	SSS-4	SSS-5	SSS-6	SSS-7
1	pH		-	8.13	8.25	8.35	8.01	7.95	7.92	7.90
2	Phosphorous		mg/100gm	2.43	1.58	1.71	2.32	1.33	1.49	1.32
3	Total Kjeldahl Nitrogen		% by Mass	0.13	0.18	0.14	0.17	0.11	0.16	0.15
4	Potassium		mg/100gm	3.8	5.9	4.8	4.1	4.3	4.5	4.8
5	Texture	Sand	%by Mass	17	29	15	17	40	23	70
		Clay	%by Mass	9	43	18	13	23	40	13
		Silt	%by Mass	74	28	67	70	63	63	17
6	Particle Size(<0.002mm)		% by Weight	9	43	18	13	23	40	13
7	Particle Size (2.0-0.05mm)		% by Weight	17	29	15	17	40	23	70
8	Particle Size (0.05-0.02mm)		% by Weight	74	28	67	70	63	63	17

Source: EIA report for CB3 & CB4, ACE, 2014

7.8. Biological parameters – Pre monsoon, Post monsoon and Fair weather

The biological parameters considered in the present study are Primary production, phytoplankton biomass and population, zooplankton biomass and population, macro benthic biomass and population carried out by Indomer for three seasons covering Pre monsoon (February 2016), Post monsoon (September 2016) and Fair weather (March 2017). The sampling locations are shown in Fig. 7.4. The method of collection and analysis are given in Annexure II.

Results

Phytoplankton and primary productivity

Pre monsoon: Phytoplankton is the primary source of food in the marine environment. The concentration and numerical abundance of the phytoplankton indicate the fertility of a region. The plankton population depends primarily upon the nutrients present in the sea water and the sunlight for photosynthesis. This primary production is an important source of food for the higher organisms in the marine environment. The measured primary productivity results are shown in Table 7.14. The results indicate that the area is moderately productive and the values varied from 240 to 480 mgC/m³/day at all locations. The recorded average value is 394 mgC/m³/day.

Various phytoplankton groups were observed and their percentage compositions are shown in Table 7.15. The floral diversity fluctuated from 18 to 37 species at all sampling stations (stns.S1 to S7). Bacillariophyceae (Diatoms) formed the major group followed by Dinophyceae (Dinoflagellates) and Cyanophyceae. Phytoplankton population analyzed at various stations showed that their numerical abundance varied from 81 to 161 nos/l at all sampling stations (Table 7.16). The highest phytoplankton population was observed at stn.S6 and the minimum at stn.S4. The biomass varied from 42.7 to 85.6

ml/100 m³. Lower value of biomass (42.7 ml/100 m³) was recorded at stn.S4 and the maximum value of biomass (85.6 ml/100 m³) recorded at stn.S6 (Table 7.17).

Centrales (62.27%) of Diatoms was dominant in this region followed by Pennales (19.30%), Dinophyceae (15.69%) and Cyanophyceae (2.74%). *Chaetoceres carvicutus* was the most dominant species with 12.58% also recorded all the sampling locations. The other dominant species in this region were *Asterionella* sp. (10.34%) followed by *Skeletonema costatum* (4.23%), *Chaetoceres* sp. (3.86%), *Triceratium rediculatum* (3.24%), *Pleurosigma normanii* (3.36%), *Ceratium furca* (4.11%) and *Prorocentrum micans* (3.24%).

Based on the Primer software, the Shannon - Wiener (H') diversity clearly showed the diverse nature of project area (3.909 – 4.520). The similarity in species composition and abundance varied from 36.12% to 76.14% with an average similarity percentage of 56.80%.

Post monsoon: Phytoplankton is the primary source of food in the marine environment. The concentration and numerical abundance of the phytoplankton indicate the fertility of a region. The plankton population depends primarily upon the nutrients present in the sea water and the sunlight for photosynthesis. This primary production is an important source of food for the higher organisms in the marine food chain.

The measured primary productivity results are shown in Table 7.14. The results indicate that the area is moderately productive and the values varied from 330 to 480 mg C/m³/day at all locations. The recorded average value is 390 mg C/m³/day.

A total of 33 phytoplankton taxon were identified from the samples collected during this survey (Table 7.15). The species composition fluctuated from 15 to 21 species at all sampling stations (stns. S1 to S7). Bacillariophyceae (diatoms) formed the major group

followed by Dinophyceae (dianoflagellates) and Cyanophyceae. Phytoplankton population analyzed at various stations showed that their numerical abundance varied from 69 to 120 nos./l at all sampling stations (Table 7.16). The maximum phytoplankton population was observed at stn. S7 and the minimum at stn. S3. The biomass varied from 20.5 to 51.3 ml/100 m³. Lower value of biomass was recorded at stn. S3 and the higher value of biomass recorded at stn. S6 (Table 7.17).

Centrales (50.95%-diatoms) was dominant in this region followed by Pennales (27.69%), Dinophyceae (16.14%) and Cyanophyceae (5.22%). *Thalassiothrix frauenfeldii* (8.39%) was the most dominant diatom species during the sampling period. The other dominant species in this region were *Chaetoceres carvicetus* (7.19%), *Ceratium furca* (5.54%), *Trichodesmium erythraeum* (5.22%), *Asterionella* sp. (4.91%), *Triceratium rediculatum* (4.59%), *Pleurosigma normanii* (4.27%), *Navicula* sp. (4.11%), *Coscinodiscus wailesii* and *Nitzschia* sp. (3.80%).

Based on the Primer software, the Shannon - Wiener (H'), diversity clearly showed the diverse nature of the project area (2.70-3.15). The similarity in species composition and abundance varied from 18.33% to 66.33% with an average similarity percentage of 13.54%.

Fair weather: Phytoplankton is the primary source of food in the marine environment. The concentration and numerical abundance of the phytoplankton indicate the fertility of a region. The plankton population depends primarily upon the nutrients present in the sea water and the sunlight for photosynthesis. This primary production is an important source of food for the higher organisms in the marine environment.

The measured primary productivity results are shown in Table 7.14. The results indicate that the area is moderately productive and the values varied from 390 to 480 mgC/m³/day at all locations. The recorded average value is 446 mgC/m³/day.

Various phytoplankton groups were observed and their percentage compositions are shown in Table 7.15. The floral diversity fluctuated from 23 to 26 species at all sampling stations (stns S1 to S7). Bacillariophyceae (Diatoms) formed the major group followed by Dinophyceae (Dinoflagellates) and Cyanophyceae. Phytoplankton population analyzed at various stations showed that their numerical abundance varied from 101 to 149 nos/l at all sampling stations (Table 7.16). The highest phytoplankton population was observed at stns. S7 and the minimum at stns. S2. The biomass varied from 25.3 to 33.6 ml/100 m³. Lower value of biomass was recorded at stns. S2 and the maximum value of biomass recorded at stns. S3 (Table 7.17).

Centrales (62.21%) of Diatoms was dominant in this region followed by Pennales (26.03%) and Dinophyceae (11.76%). *Thalassiosira subtilis* was the most dominant species with 9.13% also recorded all the sampling locations. The other dominant species in this region were *Bacillaria* sp. (8.33%) followed by *Bellerochea mellues* (7.42%), *Odontella mobiliensis* (7.19%), *Rhizosolenia alata* (6.28%), *Asterionella* sp. (5.25%) and *Coscinodiscus* sp. (3.77%).

Based on the Primer software, the Shannon - Wiener (H') diversity clearly showed the diverse nature of project area (4.12-4.67). The similarity in species composition and abundance varied from 58.2% to 80.8% with an average similarity percentage of 70.9%.

Zooplankton

Pre monsoon: The zooplankton diversity fluctuated from 30 to 40 species. Various zooplankton groups and their percentage composition observed at various stations are shown in Table 7.18. The zooplankton data indicated a high standing stock in the area of observation. Zooplankton population analysis at sampling stations showed that their numerical abundance varied from 115632 to 1061864 nos./100 m³ (Table 7.18). The highest zooplankton population was observed at stn.S5 and the minimum at stn.S3. The percentage occurrence of various groups varied from place to place. The zooplankton biomass at collected sampling stations varied from 16.9 to 89.2 ml/100m³ and the maximum value was observed at stn.S5. The minimum was observed at stn.S3.

The dominant zooplankton species were *Acartiaerythraea*(22.14% - 31.86%), Polychaete larvae (0.28% - 8.42%), *ParacalanusParvus* (3.30% - 10.04%), *Copepod nauplii*(0.37% - 11.11%), *Crustacean nauplii*(4.27% - 17.11%), *Evadne sp.* (9.73% - 17.22%) and *Oikopleura sp.* (2.95% - 8.79%) also recorded at all sampling stations. *Tintinnopsis* sp., *Favella sp.*, *Diphyssis* sp., *Sagittas* sp., Bivalve veliger larvae, Gastropods veliger larvae, Molluscan eggs, *Acartia sp.*, *Acrocalanus sp.*, *Corycaeus danae*, *Oithona brevicornis*, *Brachyuran zoea*, *Lucifer sp.*, Mysid larvae, *Penilia sp.* And Fish eggs were recorded at all stations with less numbers.

The Shannon - Wiener (H') diversity clearly showed the rich diversity of the project area (3.546 - 4.032). The similarity in species composition and abundance among station varied from 72.73% - 85.50% with an average similarity percentage of 79.55%. The dominance plot for all the stations showed sigma shaped curves indicating normal condition of the environment.

Post monsoon: The zooplankton diversity fluctuated from 18 to 22 species. Various zooplankton groups and their percentage composition observed at various stations are shown in Table 7.18. The zooplankton data indicated a high standing stock in the area of observation. Zooplankton population analysis at sampling stations showed that their numerical abundance varied from 42280 to 254558 nos./100 m³ (Table 7.18). The highest zooplankton population was observed at stn. S5 and the minimum at stn. S3. The percentage occurrence of various groups varied from place to place. The zooplankton biomass at collected sampling stations varied from 31.4 to 79.3 ml/100m³ with the maximum value observed at stn. S5 and the minimum at stn. S4.

Copepods were by far the most abundant group accounting for 48.02% (Calanoids 39.09%; Cyclopoids 4.70% and Harpacticoids 4.23%) of total zooplankton biomass. Other common groups were Crustaceans (19.73%), Chordates (11.49%), Polychaetes (6.20%), Tintinnids (5.65%), Chaetognaths (3.13%), Cnidarians (2.75%), Molluscs (2.71%) and Bryozoans (0.31) as the regular constituents in the survey areas.

The Shannon - Wiener (H') diversity clearly showed the rich diversity of the project area (2.85 - 3.94). The similarity in species composition and abundance among station varied from 32.46% - 65.93% with an average similarity percentage of 51.52%. The dominance plot for all the stations showed sigma shaped curves indicating normal condition of the environment.

Fair weather: The zooplankton diversity fluctuated from 30 to 37 species. Various zooplankton groups and their percentage composition observed at various stations are shown in Table 7.18. The zooplankton data indicated a high standing stock in the area of observation. Zooplankton population analysis at sampling stations showed that their numerical abundance varied from 115632 to 1061864 nos./100 m³ (Table 7.18). The highest zooplankton population was observed at stns. S5 and the minimum at stns. S3.

The percentage occurrence of various groups varied from place to place. The zooplankton biomass at collected sampling stations varied from 47.0 to 65.9 ml/100m³ and the maximum value was observed at stns. S3. The minimum was observed at stns. S7.

The dominant zooplankton species were *Acartia erythraea* (13.2% - 21.5%), *Copepod nauplii* (7.1% - 17.8%), *Paracalanus Parvus* (3.7% - 8.4%), *Acartia* sp. (2.7% - 5.4%), *Crustacean nauplii* (2.3% - 8.3%), *Favella* sp. (1.7% - 6.3%) also recorded at all sampling stations.

The Shannon - Wiener (H') diversity clearly showed the rich diversity of the project area (3.96-4.31). The similarity in species composition and abundance among station varied from 67.48% - 83.98% with an average similarity percentage of 74.23%. The dominance plot for all the stations showed sigma shaped curves indicating normal condition of the environment.

Benthos

Pre monsoon: Benthic faunal population in an environment depends on the nature of the substratum and the organic matter content of the substratum. Subtidal benthos: The total sub tidal benthic population recorded in this region was 1283 nos/m² collected from sampling stations (stns. S1 – S7). Among the transects, the highest number of benthic fauna was recorded at stn.S1 with 304 nos / m² and the lowest was at Stn.S4 with 128 nos / m². The sub tidal benthic fauna was dominated by polychaete groups with 1171 nos/m² followed by Amphipods (64 nos/m²) and Cumacea (48 nos/m²) (Table 7.19).

Post monsoon: Benthic faunal population in an environment depends on the nature of the substratum and the organic matter content of the substratum. Sub-tidal benthos: The sediment characteristics of the study area showed fine sand. The total sub tidal benthic population recorded in this region was 1536 nos./m² from sampling stations (stns. S1 – S7). Among the stations, the highest number of benthic fauna was recorded at stn. S7 with 304 nos./m² and the lowest at stn. S4 with 160 nos./m². The sub tidal benthic fauna was dominated by polychaete groups with 1240 nos./m² followed by amphipods (174 nos./m²), cumaceans (72 nos/m²) and bivalves (48 nos./m²) (Table 7.19).

Fair weather: Benthic faunal population in an environment depends on the nature of the substratum and the organic matter content of the substratum. Sub-tidal benthos: The sediment characteristics of the study area showed fine sand. The total sub tidal benthic population recorded in this region was 1136 nos/m² collected from sampling stations (stns.S1-S7). The highest number of benthic fauna was recorded at stns. S1 with 192 nos / m² and the lowest was at stns. S4 with 128 nos / m². The sub tidal benthic fauna was dominated by polychaete groups with 736 nos/m² followed by crustacean (192 nos/m²), bivalves (144 nos/m²) and gastropods (64 nos/m²) (Table 7.19).

Inference-Pre monsoon:

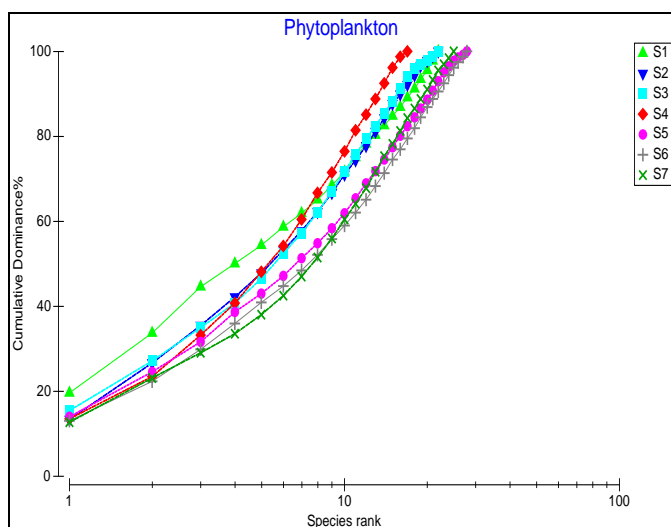
Phytoplankton: Based on the Primer software, the Shannon - Wiener (H') diversity clearly showed the diverse nature of project area (3.909 – 4.520). The similarity in species composition and abundance varied from 36.12% to 76.14% with an average similarity percentage of 56.80%.

Phytoplankton diversity indices calculated for Stations. S1 to S7

Stns.	S	N	D	J'	H'(log2)	-Lambda'
S1	22	92	4.644	0.896	3.996	0.922
S2	22	90	4.667	0.926	4.130	0.941
S3	22	103	4.531	0.921	4.106	0.938
S4	17	81	3.641	0.956	3.909	0.938
S5	28	142	5.448	0.923	4.436	0.947
S6	28	161	5.313	0.940	4.520	0.952
S7	25	134	4.900	0.950	4.413	0.951

S- Total number species (richness); N- total number of individuals; d- Margalef's richness index; J'- Pielou's evenness index; H'- Shannon-Wiener diversity index; 1- Lambda'- Simpsons's diversity index.

Dominance curve for Phytoplankton



Bray – Curtis similarity for Phytoplankton collection from different Locations

Stns.	S1	S2	S3	S4	S5	S6	S7
L1							
L2	56.93						
L3	55.53	42.31					
L4	44.86	37.32	41.42				
L5	61.38	72.98	50.50	49.68			
L6	66.82	65.58	53.21	52.79	65.24		
L7	65.61	76.14	55.98	36.12	71.92	70.37	

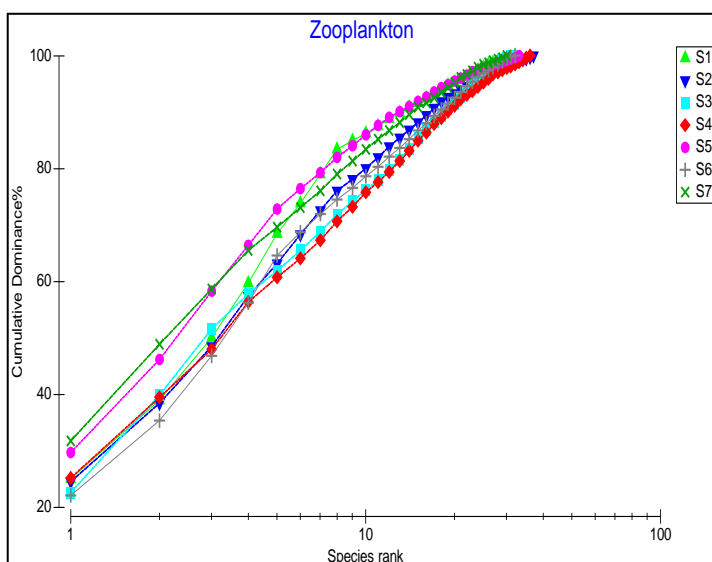
Zooplankton: The Shannon - Wiener (H') diversity clearly showed the rich diversity of the project area (3.546 – 4.032). The similarity in species composition and abundance among station varied from 72.73% - 85.50% with an average similarity percentage of 79.55%. The dominance plot for all the stations showed sigma shaped curves indicating normal condition of the environment.

Zooplankton diversity indices calculated for Locations. S1 to S7

Stns.	S	N	D	J'	$H'(\log 2)$	1-Lambda'
S1	32	268942	2.480	0.736	3.681	0.880
S2	37	320322	2.840	0.753	3.923	0.890
S3	31	115632	2.573	0.799	3.956	0.892
S4	36	138505	2.956	0.780	4.032	0.892
S5	33	1061864	2.306	0.703	3.546	0.854
S6	32	197986	2.542	0.791	3.953	0.898
S7	30	673954	2.161	0.726	3.564	0.848

S- Total number species (richness); N- total number of individuals; d- Margalef's richness index; J'- Pielou's evenness index; H'- Shannon-Wiener diversity index; 1- Lambda'- Simpsons's diversity index.

Dominance curve for Zooplankton



Bray – Curtis similarity for Zooplankton collection from different Locations

<i>Stns.</i>	<i>S1</i>	<i>S2</i>	<i>S3</i>	<i>S4</i>	<i>S5</i>	<i>S6</i>	<i>S7</i>
L1							
L2	85.50						
L3	77.81	78.02					
L4	74.88	78.89	83.79				
L5	72.73	75.96	77.50	76.50			
L6	80.40	82.70	84.50	82.82	81.25		
L7	78.02	78.07	76.37	78.77	81.49	84.69	

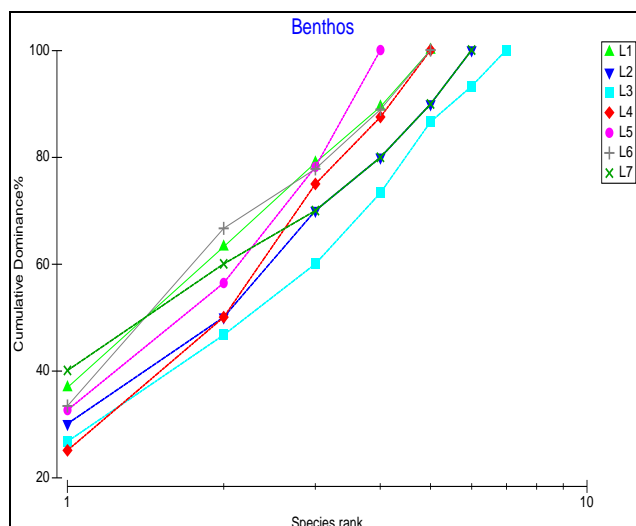
Benthos: The Shannon-Wiener diversity was low in the project area *(1.978 – 2.657). Similarly, the Margalef richness (d) values were also low (0.601 – 1.095). However, the evenness was similar in all stations. The similarity in species composition and abundance among stations widely varied from 25.01 to 71.37% with an average similarity percentage of 50.17%. The dominance plot for all the stations showed steep rise curves possibly because of low number of organisms as there is no apparent disturbance or pollution in the environment.

Benthic community diversity indices calculated for Stations. S1 to S7

<i>Stns.</i>	<i>S</i>	<i>N</i>	<i>d</i>	<i>J'</i>	<i>H'(log2)</i>	<i>1-Lambda'</i>
S1	5	304	0.700	0.922	2.142	0.750
S2	6	160	0.985	0.946	2.446	0.805
S3	7	240	1.095	0.946	2.657	0.830
S4	5	128	0.824	0.969	2.250	0.787
S5	4	147	0.601	0.989	1.978	0.747
S6	5	144	0.805	0.910	2.113	0.746
S7	6	160	0.985	0.898	2.322	0.765

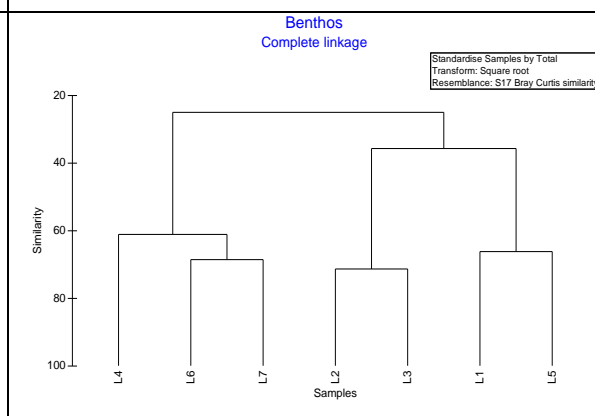
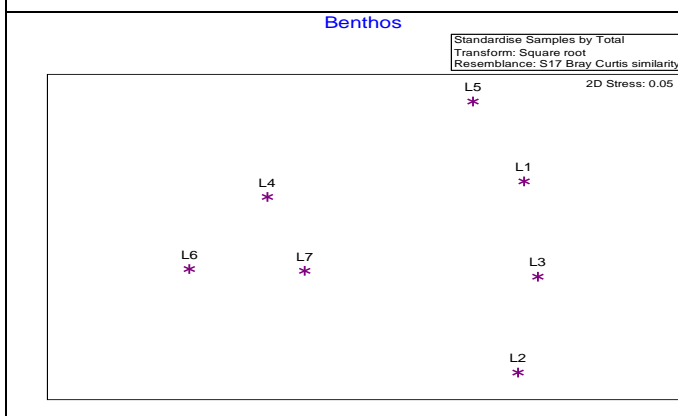
S- Total number species (richness); N- total number of individuals; d- Margalef's richness index; J'- Pielou's evenness index; H'- Shannon-Wiener diversity index; 1- Lambda'- Simpsons's diversity index.

Dominance curve for Benthos



MDS plot for Benthic animals recorded in various Stns.

Dendrogram of Benthic species recorded in various Stns.



Bray – Curtis similarity for Benthos collection from different Locations

Stns.	S1	S2	S3	S4	S5	S6	S7
S1							
S2	51.80						
S3	66.94	71.37					
S4	53.87	33.21	55.08				
S5	66.22	35.72	56.00	40.65			
S6	30.45	33.59	25.01	61.14	32.15		
S7	56.45	58.96	49.06	63.65	43.75	68.59	

Inference – Post monsoon: The Shannon-Wiener diversity was low in the project area *(2.34 – 2.89). Similarly, the Margalef richness (d) values were also low (0.785 – 0.860). However the evenness was similar in all stations. The similarity in species composition and abundance among stations widely varied from 21.35 to 69.30% with an average similarity percentage of 43.16%. The dominance plot for all the stations showed steep rise curves possibly because of low number of organisms as there is no apparent disturbance or pollution in the environment.

Phytoplankton diversity indices calculated for Locations. S1 to S7

stns.	S	N	D	J'	H'(log2)	1-Lambda'
S1	8	34	1.99	0.900	2.70	0.84
S2	9	40	2.17	0.969	3.07	0.89
S3	10	45	2.36	0.922	3.06	0.89
S4	7	31	1.75	0.963	2.70	0.86
S5	9	59	1.96	0.939	2.98	0.87
S6	10	58	2.22	0.949	3.15	0.89
S7	10	78	2.07	0.909	3.02	0.86

Bray – Curtis similarity for Phytoplankton collection from different Locations

stns.	S1	S2	S3	S4	S5	S6	S7
S1							
S2	18.33						
S3	66.01	20.02					
S4	40.53	43.90	30.05				
S5	35.30	59.44	51.71	21.92			
S6	56.00	48.35	62.23	46.00	29.72		
S7	51.19	36.13	61.02	37.94	66.33	32.10	

Zooplankton diversity indices calculated for Locations. L1 to L7

stns.	S	N	D	J'	H'(log2)	1-Lambda'
S1	20	179019	1.57	0.660	2.85	0.784
S2	18	74546	1.52	0.889	3.71	0.901
S3	18	42280	1.60	0.824	3.44	0.843
S4	21	54619	1.83	0.787	3.46	0.849
S5	22	151602	1.76	0.884	3.94	0.905
S6	20	102871	1.65	0.755	3.26	0.795
S7	21	254558	1.61	0.753	3.31	0.811

Bray – Curtis similarity for Zooplankton collection from different Locations

stns.	S1	S2	S3	S4	S5	S6	S7
S1							
S2	32.46						
S3	45.46	50.75					
S4	42.05	38.39	59.48				
S5	52.00	58.54	56.27	55.07			
S6	47.56	44.82	49.78	41.49	63.23		
S7	65.93	52.07	53.64	54.88	59.64	60.50	

Benthic community diversity indices calculated for Locations. L1 to L7

stns.	S	N	d	J'	H'(log2)	1-Lambda'
S1	6	200	0.94	0.91	2.34	0.785
S2	8	208	1.31	0.90	2.69	0.818
S3	8	216	1.30	0.96	2.89	0.860
S4	7	160	1.18	0.956	2.68	0.840
S5	6	200	0.94	0.926	2.39	0.791
S6	7	248	1.09	0.957	2.69	0.836
S7	8	304	1.22	0.933	2.80	0.845

Bray – Curtis similarity for Benthos collection from different Locations

stns.	S1	S2	S3	S4	S5	S6	S7
S1							
S2	21.35						
S3	42.14	41.63					
S4	28.70	33.08	35.18				
S5	50.78	54.19	51.51	24.67			
S6	35.31	53.01	54.27	39.04	27.04		
S7	45.47	58.56	62.91	28.97	49.33	69.30	

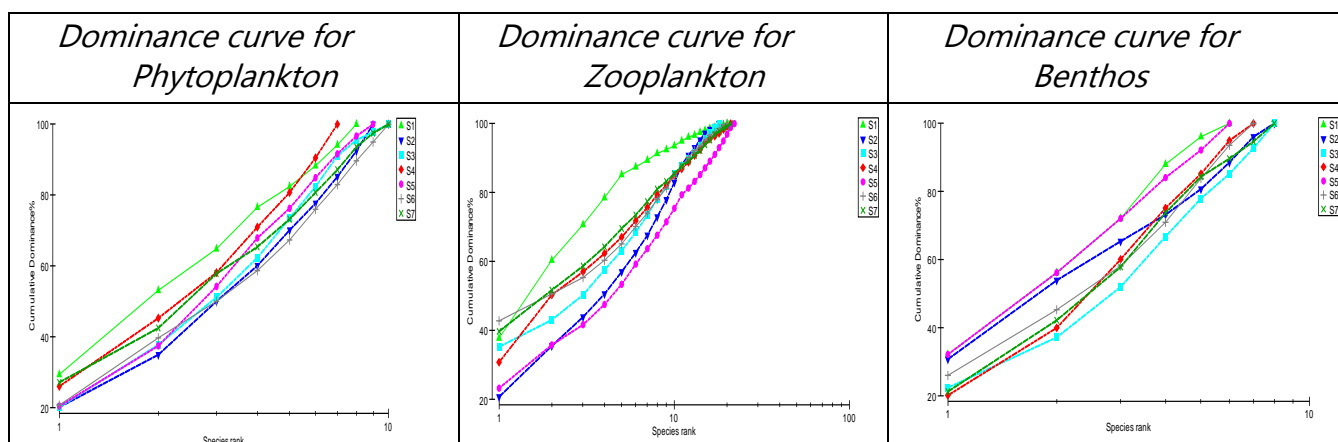


Table 7.14. Primary productivity in coastal waters

Station	Gross Photosynthetic activity			Net Photosynthetic activity			Primary production (mgC/m ³ /day)		
	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather
S1	1.28	1.6	1.3	0.48	1.28	0.8	360	480	390
S2	1.28	1.3	1.6	0.64	1.04	0.9	480	390	480
S3	0.96	1.2	1.3	0.48	0.96	0.7	360	360	390
S4	1.76	1.6	1.5	0.64	1.28	0.6	480	480	450
S5	1.12	1.1	1.5	0.32	0.88	0.9	240	330	450
S6	1.12	1.2	1.6	0.48	0.96	0.5	360	360	480
S7	1.44	1.1	1.6	0.64	0.88	1.1	480	330	480
Average							390	375	465

Inference – Fair weather: The Shannon-Wiener diversity was low in the project area *(2.45 - 3.10). Similarly, the Margalef richness (d) values were also low (0.97-1.55). However, the evenness was similar in all stations. The similarity in species composition and abundance among stations widely varied from 14.72 to 76.91% with an average similarity percentage of 43.39%. The dominance plot for all the stations showed steep rise curves possibly because of low number of organisms as there is no apparent disturbance or pollution in the environment.

Phytoplankton diversity indices calculated for stations S1 to S7

Stns. No.	S	N	D	J'	H'(log2)	1-Lambda'
S1	23	123	4.57	0.943	4.26	0.948
S2	21	101	4.33	0.952	4.18	0.947
S3	26	129	5.14	0.939	4.41	0.952
S4	25	118	5.03	0.936	4.35	0.950
S5	24	136	4.68	0.953	4.37	0.953
S6	22	120	4.39	0.924	4.12	0.937
S7	28	149	5.40	0.971	4.67	0.963

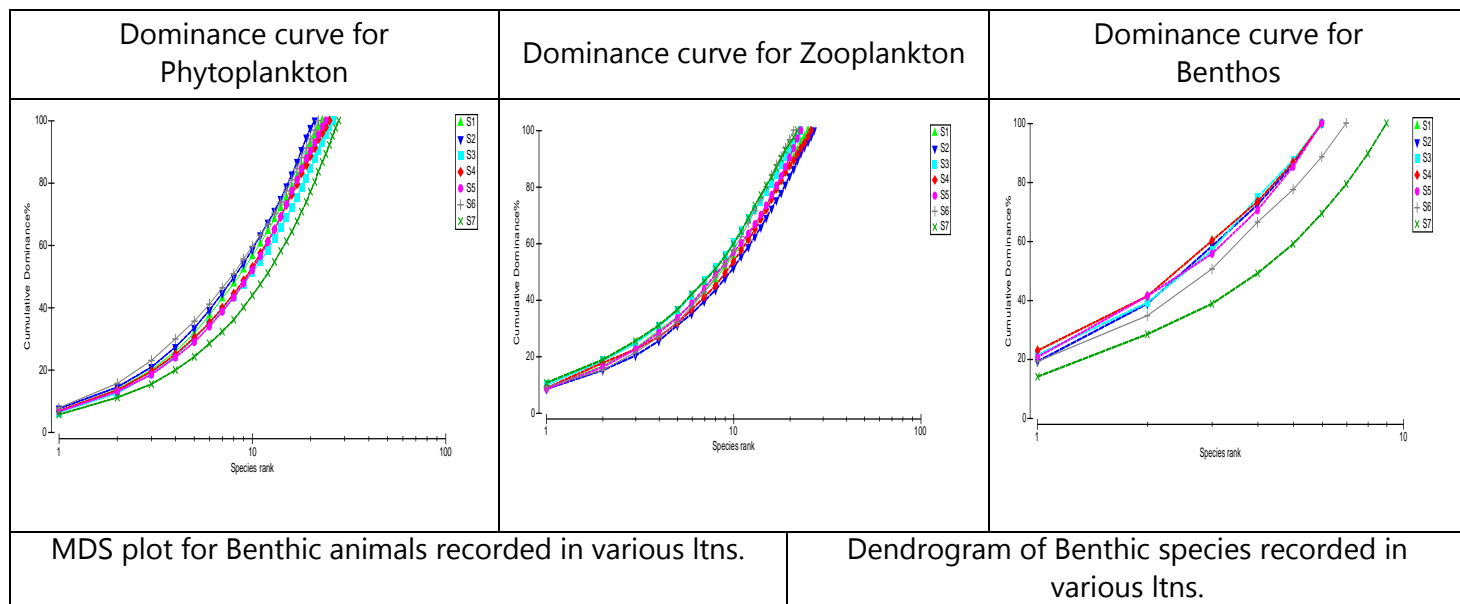
Zooplankton diversity indices calculated for stations S1 to S7

Stns. No.	S	N	D	J'	H'(log2)	1-Lambda'
S1	25	194531	1.97	0.893	4.15	0.923
S2	27	159483	2.17	0.907	4.31	0.932
S3	23	166934	1.83	0.881	3.98	0.912
S4	26	189046	2.06	0.881	4.14	0.918
S5	23	199081	1.80	0.922	4.17	0.929
S6	21	184817	1.65	0.943	4.14	0.931
S7	22	162368	1.75	0.887	3.96	0.910

Benthic community diversity indices calculated for stations S1 to S7

Stns. No.	S	N	d	J'	H'(log2)	1-Lambda'
S1	6	160	0.99	0.946	2.45	0.805
S2	6	144	1.01	0.968	2.50	0.821
S3	6	176	0.97	0.960	2.48	0.815
S4	6	160	0.99	0.946	2.45	0.805
S5	6	128	1.03	0.967	2.50	0.819
S6	7	192	1.14	0.958	2.69	0.838
S7	9	176	1.55	0.977	3.10	0.881

S- Total number species (richness); N- total number of individuals; d- Margalef' s richness index; J'- Pielou' s evenness index; H'- Shannon-Wiener diversity index; 1- Lambda'- Simpsons' s diversity index.



Bray – Curtis similarity for Phytoplankton collection from different Locations

Stns. No.	S1	S2	S3	S4	S5	S6	S7
S1							
S2	58.2						
S3	69.4	67.0					
S4	76.2	73.1	72.6				
S5	72.5	64.7	75.5	67.2			
S6	75.6	67.7	69.5	67.0	67.2		
S7	76.7	66.5	80.8	76.1	74.5	70.1	

Bray – Curtis similarity for Zooplankton collection from different Locations

Stns. No.	S1	S2	S3	S4	S5	S6	S7
S1							
S2	75.35						
S3	83.98	74.95					
S4	75.72	77.67	75.38				
S5	71.06	76.67	69.43	74.45			
S6	67.48	71.22	74.79	75.19	74.87		
S7	72.51	75.60	73.28	74.02	71.63	73.53	

Bray – Curtis similarity for Benthos collection from different Locations

Stns. No.	S1	S2	S3	S4	S5	S6	S7
S1							
S2	39.49						
S3	35.57	19.57					
S4	71.61	40.91	30.97				
S5	26.32	56.90	44.89	14.72			
S6	27.98	27.85	73.39	39.57	34.11		
S7	72.79	46.04	49.59	76.91	35.58	46.35	

Table 7.15. Location wise Composition of Phytoplankton

Sl. No.	Genus / Species	S1			S2			S3			S4			S5			S6			S7		
		Pre Mon soon	Post mons oon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post Mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather
PHYLUM: Heterokontophyta																						
Class: Bacillariophyceae (Diatoms)																						
1	<i>Asterionella sp.</i>	+	-	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	-
2	<i>Bacteriastrumh yalinum</i>	-	-	-	+	+	+	+	-	-	-	+	+	+	+	+	+	-	+	+	-	+
3	<i>Bellerochaemel lues</i>	+	-	-	+	-	-	+	+	+	+	-	+	+	-	+	+	+	+	+	+	-
4	<i>Chaetocersp.</i>	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
5	<i>C. affinis</i>	-	+	+	-	-	+	-	+	+	+	-	-	+	-	-	+	+	+	-	-	-
6	<i>C. carvicetus</i>	+	+		+	+		+	+		+	+		+	+		+	+		+	+	
7	<i>C. coarctatus</i>			+			+			+			+			+			+			+
8	<i>C. peruvianus</i>	+	-	-	+	-	+	-	-	-	-	+	+	+	+	+	+	-	-	+	-	+
9	<i>C. lorenzianus</i>	+	-	-	+	-	-	-	-	-	-	-	-	+	-	-	+	-	-	+	-	
10	<i>Climacodium sp.</i>	-	-	-	-	-	-	+	-		+	-	-	+	-		+	-	-	-	-	-
11	<i>Coscinodiscus sp.</i>	+	+	+	-	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+
12	<i>C. centralis</i>	-	-	-	+	+	+	-	-	-	+	-	-	+	+	+	+	-	-	-	-	+
13	<i>C. marginatus</i>	-	-	+	-	-	-	-	-	+	-	-	+	-	-	-	-	-	+	-	-	-
14	<i>C. walesii</i>	+	-	-	+	-		+	-	-	+	-	-	-	-	-	-	-	-	+	-	-
15	<i>Dityumbrightw elli</i>	-	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+
16	<i>Odontellamobil iensis</i>	-	-	-	+	-	+	+	-	-	-	+	+	+	-	+	+	-	-	-	+	+
17	<i>O. sinensis</i>	-	-	-	-	+	+	-	-	+	-	-	-	-	+	+	+	-	+	+	-	+

18	<i>Planktoniella sol</i>	-	+	+	+	-	+	-	-	-	-	+	+	+	-	-	-	-	-	-	+	+
19	<i>Rhizosolenia alata</i>	+	+	+	-	-	-	+	+	+	+	+	-	-	+	+	+	+	-	+	+	+
20	<i>R. imbricata</i>	+	+		-	-		-	-		-	-		-	-		-	+		-	-	
21	<i>R. setigera</i>	+	+	+	+	+	+	+	+	+	-	-	-	+	+	+	-	-	-	+	+	+
22	<i>R. stoltherfothii</i>	+	+	+	+	+	+	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+
23	<i>Schroterelladelicatula</i>	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-
24	<i>Skeletonemacastatum</i>	-	-	+	+	-	+	-	-	+	-	-	+	+	-	+	+	-	+	+	-	-
25	<i>Thalassiosira subtilis</i>	-	-	-	+	+	+	-	-	-	+	+	+	+	-	-	+	-	+	-	-	+
26	<i>Triceratium rediculatum</i>	+	+	+	-	-	-	+	+	+	-	-	-	+	+	+	+	-	+	+	-	-
Order: Centrales		13	11	12	16	9	14	13	9	12	11	10	13	20	12	15	19	9	13	16	10	14
25	<i>Amphora</i> sp.	+	-	+	+	-	+	-	-	-	-	-	+	+	-	-	+	-	-	+	-	-
26	<i>Bacillaria</i> sp.	+	-	-	+	-	-	+	-	+	+	-	+	-	-	-	+	+	+	+	+	+
27	<i>Gyrosigma</i> sp.	-	-	-	+	-	-	+	-	-	-	-	-	+	-	-	+	-	-	+	-	
28	<i>Navicula</i> sp.	+	-	+	+	+	-	-	-	-	+	-	-	+	+	+	-	+	-	-	-	+
29	<i>N. membareana</i>	-	+	+	-	-	+	+	+	+	+	+	+	-	+	+	+	+	-	+	+	+
30	<i>Nitzschia</i> sp.	-	-	-	-	+	+	+	-	-	-	-	-	+	+	+	+	+	+	+	-	-
31	<i>Nitzschia lorenchianus</i>	-	-	+	-	-	-	-	-	+	-	-	+	-	-	-	-	-	+	-	-	+
32	<i>Pleurosigma elongatum</i>	-	-	+	+	-	+	+	-	-	-	+	+	-	+	-	+	+	+	-	+	+
33	<i>Pleurosigma elongatum</i>	-	-	-	-	-	+	-	-	+	-	-	-	-	-	+	-		-	-	-	+
34	<i>P. normanii</i>	+	+	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+	+	+	+	-
35	<i>Thalassionema nitzschioides</i>	+	-	-	+	-	-	+	+	+	-	-	+	+	-	-	+	+	+	-	+	-
36	<i>Thalassiothrix frauenfeldii</i>	-	+	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+	-	+	+	+



37	<i>T.longissima</i>	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Order: Pennales		6	4	7	8	3	7	8	4	6	4	3	7	7	5	6	10	7	6	7	7
36	<i>Ceratumfurca</i>	+	+	+	+	-	-	+	-	+	-	+	+	+	+	+	+	-	-	+	-
37	<i>C. macroceros</i>	+	-	-	-	+	+	+	-	-	-	-	+	+	+	+	+	+	+	+	-
38	<i>C. tripos</i>	-	-	+	+	+	-	-	-	+	-	+	+	+	-	-	+	+	+	+	-
39	<i>Cladopyxis</i> sp.	-	-	-	+	-	-	+	-	-	+	-	-	-	-	-	+	-	-	+	-
40	<i>Dinophysiscav data</i>	+	+	+	-	-	-	-	+	+	-	-	-	+	-	+	+	-	+	+	-
41	<i>Protoperidiniu msp.</i>	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	-	+
42	<i>Protoperidiniu m divergen</i>	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	+
43	<i>Prorocentrum micans</i>	+	+	+	-	-	-	+	-	+	-	-	+	+	+	+	-	-	+	+	+
Dinophyceae		5	4	5	4	3	3	4	2	5	2	3	6	6	4	5	6	3	5	6	3
43	<i>Trichodesmium erythreum</i>	+	-	-	+	-	-	+	-	-	-	-	-	+	-	-	+	-	-	+	-
44	<i>T. theibuatii</i>	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	+	-	-	+	-
Cyanophyceae (Blue-greens)		1	1	-	1	1	-	2	-	-	1	-	-	1	-	-	2	1	-	2	1
Total		25	20	24	29	16	24	27	15	23	18	16	26	27	21	26	37	20	24	31	21

Table.7.16. Location wise numerical abundance of Phytoplankton (nos/l)

Sl.No	Genus / Species	S1			S2			S3			S4			S5		
		Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather
PHYLUM: Heterokontophyta																
Class: Bacillariophyceae (Diatoms)																
1	<i>Asterionellasp.</i>	10	-	9	12	6	0	8	4	0	-	-	5	15	10	12
2	<i>Bellerochaemellues</i>	2	4	12	-	-	9	1	2	11	3	4	13	-	-	6
3	<i>Chaetoceressp.</i>	-	-	3	4	4	0	12	-	7	-	-	4	10	10	7
4	<i>C. affinis</i>	-		0	-		5	4		2	3		1	-		2
5	<i>C. carvicetus</i>	18	8	4	12	-	3	16	9	2	11	-	0	20	12	6
6	<i>C. peruvianus</i>	3	-	-	1	-	-	3	-	-	-	-	-	3	-	-
7	<i>Climacodium</i> sp.	-	-	-	-	-		-	-		4	-		5	-	-
8	<i>Coscinodiscussp.</i>	2	-	6	2	-	8	5	6	0	-	-	6	1	2	0
9	<i>C. centralis</i>	-	-	3	4	8	0	-	-	5	4	4	0	4	-	6
10	<i>C. wailesii</i>	13	10		1	3	-	1	1	-	-	-	-	-	5	-
11	<i>Dityumbrightwelli</i>	-	-	5	5	6	0	-	-	3	-	-	4	5	4	0
12	<i>Odontellamobiliensis</i>	2	2	9	-	-	8	5	5	12	6	6	6	-	-	9
13	<i>O. sinensis</i>	-	-	0	-	-	2		-	1	-	-	1	-	-	0
14	<i>Planktoniella sol</i>	-	-	3	3	3	0	-	-	2	3	3	0	5	5	5
15	<i>Rhizosolenia</i> sp.	-	-	3	-	-	4	-	-	3	-	-	4	-	-	5
16	<i>Rhizosoleniaalata</i>	2	2	8	-	-	6	5	5	10	-	-	8	-	-	9
17	<i>R. setigera</i>	2	2	2	-	-	0	3	4	4	3	3	3	6	8	8
18	<i>R. stoltherfothii</i>	4	-	-	2	-	-	-	-	-	-	-	-	4	-	-
19	<i>Schroterelladelicatula</i>	-	-	-	-	-		-	-	-	-	-	-	3	-	-
20	<i>Skeletonemacastatum</i>	3	-	0	8	-	3	3	-	4	-	-	3	6	-	0
21	<i>Thalassiosirasubtilis</i>	-	-	13	-	3	8	-	-	10	8	8	9	-	-	14
22	<i>Triceratiumrediculatum</i>	3	4	-	-	-	-	6	8	-	-	-	-	-	-	-
Centrales		64	32	80	54	33	56	72	44	76	45	28	67	87	56	89
21	<i>Amphora</i> sp.	2	-	0	-	-	3	1	-	3	-	-	2	3	-	0
22	<i>Bacillaria</i> sp.	2	2	8	2	4	12		-	13	1	3	12	1	-	7
23	<i>Gyrosigma</i> sp.		-		3	3		1	1			-		3	3	
24	<i>Navicula</i> sp.	4	4	0	5	10	4	-	-	2	6	8	8	5	-	6
25	<i>Nitzschia</i> sp.	-	10	10	-	-	0	3	4	5	-	-	2	4	8	1
26	<i>Ni. lorenchianus</i>			0			3			4			0			3



Sl.No	Genus / Species	S1			S2			S3			S4			S5		
		Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather
27	<i>Pleurosigmaelongatum</i>	-	8	0	6	6	6	6	-	3	-	-	3	-	-	6
28	<i>P. normanii</i>	3	3	3	4	4	0	-	-	3	5	10	0	3	4	2
29	<i>Thalassionemanitzschiodes</i>	-	-	4	-	-	3	4	4	0	-	-	5	-	-	5
30	<i>Thalassiothrixfrauenfeldii</i>	-	10	2	3	4	3	-	-	3	-	12	4	2	15	2
31	<i>T.longissima</i>	5		0	-			3			8			1		
Pennales		16	37	23	23	31	34	18	9	36	20	33	36	22	30	32
31	<i>Ceratiumfurca</i>	3	6	3	3	3	0	-	-	4	-	5	2	6	6	0
32	<i>C. macroceros</i>	-	-	1	2	2	1	6	6	3	2	-	1	2	2	4
33	<i>C. tripos</i>	-	4	0	-	-	3	2	5	4	4	4	0	3	-	5
34	<i>Dinophysiscaudata</i>	2	3	3	3	4	4	-	-	-	-	2	2	3	2	2
35	<i>Protoperdinium</i> sp.	3	3	5	-	-	-	5	5	6	5	-	5	4	4	4
36	<i>Prorocentrummicans</i>	2		4	4		3	-		0	-		5	10		0
Dinophyceae		10	16	16	12	19	11	13	16	17	11	11	15	28	14	15
37	<i>Trichodesmiumerythreum</i>	2	4		1	1		-	-		5	8		5	3	
Cyanophyceae (Blue-greens)		2	4		1	1		-	-		5	8		5	3	
Total		92	89	123	90	74	101	103	69	129	81	80	118	142	103	136

Continue...

Table.7.16. Numerical abundance of Phytoplankton (nos/l) at stn. S6 and S7

Sl.No	Genus / Species	S6			S7			Total			%		
		Pre mon soon	Post mon soon	Fair weather	Pre Mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather
PHYLUM: Heterokontophyta													
Class: Bacillariophyceae (Diatoms)													
1	<i>Asterionellasp.</i>	21	11	13	17	-	7	83	31	46	10.34	4.91	5.25
2	<i>Bellerocheamellues</i>	2	4	8	3	6	6	11	20	65	1.37	3.16	7.42
3	<i>Chaetocerssp.</i>	-	-	-	5	5	5	31	19	26	3.86	3.01	2.97
4	<i>C. affinis</i>	5		5	-		0	12		15	1.49		1.71
5	<i>C. carvicetus</i>	10	-	3	14	21	14	101	50	32	12.58	7.91	3.65
6	<i>C. peruvianus</i>	-	-	-	6	-	-	16	-	-	1.99	-	-
7	<i>Climacodium</i> sp.	5	-		-	-	-	14		-	1.74	-	-
8	<i>Coscinodiscussp.</i>	2	4	7	5	6	6	17	18	33	2.12	2.85	3.77
9	<i>C. centralis</i>	3	3	3	-	-	5	15	15	22	1.87	2.37	2.51
10	<i>C. wailiesii</i>	-	5	-	-	-	-	15	24	-	1.87	3.80	-
11	<i>Dityumbrightwelli</i>	8	-	2	6	12	4	24	22	18	2.99	3.48	2.05
12	<i>Odontellamobiliensis</i>	3	3	11	3	3	8	19	19	63	2.37	3.01	7.19
13	<i>O. sinensis</i>	-	-	0	-	-	4	-	-	8	-	-	0.91
14	<i>Planktoniella sol</i>	-	-	3	6	6	4	17	17	17	2.12	2.69	1.94
15	<i>Rhizosolenia</i> sp.	-	-	2	-	-	3		-	24	-	-	2.74
16	<i>Rhizosoleniaalata</i>	6	6	6	-	-	8	13	13	55	1.62	2.06	6.28
17	<i>R. setigera</i>	3	-	0	2	12	5	19	29	22	2.37	4.59	2.51
18	<i>R. stoltherfothii</i>	4	-	-	3	-	-	17	-	-	2.12	-	-
19	<i>Schroterelladelicatula</i>	-	-	-	-	-	-	3	-	-	0.37	-	-
20	<i>Skeletonemacastatum</i>	6	-	5	8	-	4	34	-	19	4.23	-	2.17
21	<i>Thalassiosirasubtilis</i>	5	5	15	-	-	11	13	16	80	1.62	2.53	9.13
22	<i>Triceratiumrediculatum</i>	12	12	-	5	5	-	26	29	-	3.24	4.59	-
Centrales		95	53	83	83	76	94	500	322	545	62.27	50.95	62.21
21	<i>Amphora</i> sp.	-	-	0	6	-	4	12	-	545	1.49	-	62.21
22	<i>Bacillaria</i> sp.	5	5	14	4	-	7	15	14	12	1.87	2.22	1.37
23	<i>Gyrosigma</i> sp.	2	-		2	2		11	9	73	1.37	1.42	8.33

Sl.No	Genus / Species	S6			S7			Total			%		
		Pre mon soon	Post mon soon	Fair weather	Pre Mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather
24	<i>Navicula</i> sp.	3	4	4	-	-	3	23	26		2.86	4.11	
25	<i>Nitzschia</i> sp.	-	-	3	2	2	4	9	24	27	1.12	3.80	3.08
26	<i>Ni. lorenchianus</i>			2			3			25			2.85
27	<i>Pleurosigmaelongatum</i>	4	4	0	4	-	5	20	18	15	2.49	2.85	1.71
28	<i>P. normanii</i>	6	-	3	6	6	6	27	27	23	3.36	4.27	2.63
29	<i>Thalassionemanitzschiod</i> <i>es</i>	-	-	2	-	-	0	4	4	17	0.50	0.63	1.94
30	<i>Thalassiothrixfrauenfeldii</i>	4	4	0	3	8	3	12	53	19	1.49	8.39	2.17
31	<i>T.longissima</i>	5	-	-	-	-		22	-	-	2.74	-	-
Pennales		29	17	28	27	18	35	155	175	228	19.30	27.69	26.03
31	<i>Ceratiumfurca</i>	15	15	3	6	-	4	33	35	16	4.11	5.54	1.83
32	<i>C. macroceros</i>	4	-	3	5	5	0	21	15	13	2.62	2.37	1.48
33	<i>C. tripos</i>	-	-	0	-	8	4	9	21	16	1.12	3.32	1.83
34	<i>Dinophysiscaudata</i>	6	-	-	3	2	2	17	13	13	2.12	2.06	1.48
35	<i>Protoperidinium</i> sp.	3	6	0	-	-	6	20	18	26	2.49	2.85	2.97
36	<i>Prorocentrummicans</i>	4	-	3	6	-	4	26	-	19	3.24		2.17
Dinophyceae		32	21	9	20	15	20	126	102	103	15.69	16.14	11.76
37	<i>Trichodesmiumerythream</i>	5	6	-	4	11	-	22	33	-	2.74	5.22	-
Cyanophyceae (Blue-greens)		5	6	-	4	11	-	22	33	-	2.74	5.22	-
Total		161	97	120	134	120	149	803	632	876	100	100	100

Table 7.17. Phytoplankton biomass and population in different sampling locations

Stations	Season	No. of genera or species	Population (nos/l)	Biomass (ml/l)
S1	Pre monsoon	22	92	48.9
	Post monsoon	20	89	41.9
	Fair weather	24	123	31.9
S2	Pre monsoon	22	90	50.3
	Post monsoon	16	74	37.3
	Fair weather	24	101	25.3
S3	Pre monsoon	22	103	45.0
	Post monsoon	15	69	20.5
	Fair weather	23	129	33.6
S4	Pre monsoon	17	81	42.7
	Post monsoon	16	80	40.1
	Fair weather	26	118	29.7
S5	Pre monsoon	28	142	78.1
	Post monsoon	21	103	48.6
	Fair weather	26	136	31.1
S6	Pre monsoon	28	161	85.6
	Post monsoon	20	97	51.3
	Fair weather	24	120	29.6
S7	Pre monsoon	25	134	54.2
	Post monsoon	21	120	49.3
	Fair weather	25	149	28.2

Table 7.18. Station wise numerical abundance of Zooplankton (nos/100m³)

Sl.No.	Genus/ Species	S1			S2			S3			S4		
		Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather
PHYLUM: PROTOZOA													
Order: Tintinnids (Ciliate groups)													
1	<i>Tintinnopsis</i> sp.	2085	2024	4823	684	1684	1437	2118	3118	6421	2029	3029	7067
2	<i>Favellasp.</i>	1390	1090	3215	4107	-	10057	1271	1571	3210	2537	2137	8834
3	<i>Eutintinnustenuis</i>	-	-	-	1369	-	2874	-	-	-	1522	1022	5300
4	<i>Dictyocystasp.</i>	-	-	-	2053	1684		847	747	-	1015	1115	
PHYLUM: CNIDARIA													
5	<i>Diphyssisp.</i>	2085	2085	4823	4791	3791	4310	1271	2271	3210		507	1767
PHYLUM: Bryozoa													
6	<i>Cyphonautes larvae</i>	695	695	-	684	-	-	-	-	-	-	-	-
PHYLUM: CHAETOGNATHA													
7	<i>Sagittasp.</i>	1390	1390	3215	6160	5160	4310	847	947	1605	2537	2537	8834
PHYLUM: ANNELIDA													
Class: Polychaeta													
8	Polychaete larvae	11814	11814	3215	16427	-	2874	7200	-	-	11669	10669	-
HYLUM: MOLLUSCA													
9	Bivalve veliger larvae	2780	-	6431	4107	4107	10057	1271	-	3210	6088	-	8834
10	Gastropods veliger larvae	1390	0.52	3215	2053	-	5747	2118	-	3210	3551	-	5300
11	<i>Creseissp</i>	-	-	-	-	-	-	-	-	-	-	-	-
12	Molluscan eggs	695	-	-	1369	3791	-	847	-	-	1015	1015	-
PHYLUM: ATHROPODA													

Sl.No.	Genus/ Species	S1			S2			S3			S4		
		Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather
Class: Crustacea													
Order: Copepoda													
Sub- order: Calanoida													
13	<i>Acartiaerythraea</i>	67408	67408	25723	78713	-	27299	26260	-	33708	35008	-	31802
14	<i>Acartiasp.</i>	3475	3475	8039	10951	10951	4310	2118	-	6421	2537	-	8834
15	<i>Acrocalanus</i> sp.	2085	2085	4823	4107	-	2874	2965	2388	8026	1522	-	5300
16	<i>Centropagesfurcatus</i>	-	-	-	2738	-	7184	1271	-	3210	2537	-	8834
17	<i>Centropages</i> sp.	-	-	-	-	-	-	-	-	-	507	-	1767
18	<i>Calanopia minor</i>	695	695	1608	1369	1369	2874	-	-	-	1522	1522	5300
19	<i>Eucalanusattenuatus</i>	1390	-	3215	684	684	1437	1694	694	4815	1015	-	3534
20	<i>Labidoceraacuta</i>	-	-	-	3422	-	4310	-	-	-	507	-	1767
21	<i>Paracalanusparvus</i>	25712	-	16077	32170	-	7184	4659	-	12841	4566	3566	7067
22	<i>Pseudodiaptomus</i> sp.	695	695	1608	1369	3791	2874	-	-	-	507	507	1767
23	<i>Temoradiscaudata</i>	2085	2085	4823	2053	-	5747	3388	2388	9631	1522	-	5300
24	Copepod nauplii	29882	-	33762	28747	-	17241	1271	-	22472	507	567	33569
Sub - order: Cyclopoida													
25	<i>Corycaeus</i> catus	695	695	-	684	-	-	424	624	-	-	-	-
26	<i>Corycaeus</i> danae	3475	-	8039	4791	4791	2874	2118	1518	6421	1015	1015	-
27	<i>Oithona</i> brevicornis	2085	-	4823	6160	3791	-	1271	624	3210	507	507	1767
28	<i>Oithona</i> spinirostris	1390	-	3215	1369	-	2874	424	-	1605	507	-	-
Sub - order: Harpacticoida													
29	<i>Macrosetella</i> sp.	-	-	-	2053	2053	5747	847	847	1605	507	507	1767
30	<i>Euterpina</i> sp.	13899	13899	8039	6845	-	-	-	-	-	1015	1015	3534
Other Crustaceans													

Sl.No.	Genus/ Species	S1			S2			S3			S4		
		Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather	Pre mon soon	Post mon soon	Fair weather
31	Brachyuran zoea	4170	4170	9646	6160	6160	4310	3812	3812	11236	3551	-	7067
32	Barnacle naupli	-	-	-	684	-	1437	-	-	-	-	-	-
33	Crustacean nauplii	14593	-	16077	13689	-	10057	13554	-	9631	11669	-	7067
34	<i>Lucifer</i> sp.	3475	3475	8039	2053	3791	5747	2118	-	6421	507	-	1767
35	Mysid larvae	1390	-	3215	684	684	1437	847	847	1605	2537	2537	-
36	<i>Evadne</i> sp.	37526	40526	-	44490	-	-	19907	14907	-	19787	-	-
37	<i>Penilia</i> sp.	1390	-	-	1369	-	-	1694	-	-	4566	-	-
PHYLUM: CHORDATA													
38	<i>Oikopleura</i> sp.	23628	18628	4823	18480	15480	-	4235	3235	3210	4566	-	5300
39	Fish eggs	2780	-	-	684	784	-	2118	2118	-	2029	2029	-
40	Fish larvae	695	695	-	-	-	-	847	847	-	1015	507	-
Total		268942	179019	268942	320322	74546	320322	115632	42280	115632	138505	54619	138505
Biomass (ml/100m ³)		62.6	52.12	57.8	47.9	46.5	47.4	16.9	36.4	65.9	30.4	31.4	49.7

Continue...

Table 7.18. Station wise numerical abundance of Zooplankton (nos/100m³) at stn. S5 to stn. S7

Sl.No.	Genus/ Species	S5			S6			S7		
		Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather
PHYLUM: PROTOZOA Order: Tintinnids (Ciliate groups)										
1	<i>Tintinnopsissp.</i>	2974	2974	4594	2015	-	6601	9940	9940	9105
2	<i>Favellasp.</i>	8923	-	4594	1008	-	3300	3976	3976	3035
3	<i>Eutintinnustenuis</i>	-	5949	10720	-	1511	4950	-	-	-
4	<i>Dictyocystasp.</i>	-	2974	-	504	-	-	-	-	-
PHYLUM: CNIDARIA										
5	<i>Diphyssisp.</i>	14872	5949	3063	2519	5038	8251	5964	3976	6070
PHYLUM: Bryozoa										
6	<i>Cyphonautes larvae</i>	-	-	-	-	-	-	1988	1988	-
PHYLUM: CHAETOGNATHA										
7	<i>Sagittasp.</i>	5949	5949	10720	1008	1008	3300	9940	9940	9105
PHYLUM: ANNELIDA										
Class: Polychaeta										
8	Polychaete larvae	2974	8923	4594	8060	8060	-	23857	13857	-
HYLUM: MOLLUSCA										
9	Bivalve veliger larvae	2974	2974	4594	5038	5038	-	19881	-	-
10	Gastropods veliger larvae	20821	-	-	2015	-		5964	-	6070
11	<i>Creseissp</i>	-	-	-	-	-	-	-	-	-
12	Molluscan eggs	8923	-		1008	1008	-	1988	3976	-
PHYLUM: ATHROPODA										
Class: Crustacea										

Sl.No.	Genus/ Species	S5			S6			S7		
		Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather
Order: Copepoda										
Sub- order: Calanoida										
13	<i>Acartiaerythraea</i>	315289	35289	30628	43829	43829	31353	214712	100712	34901
14	<i>Acartia</i> sp.	5949	-	10720	3023	-	9901	13917	13917	6070
15	<i>Acrocalanus</i> sp.	2974	-	4594	2015	5038	6601	1988	1988	1517
16	<i>Centropagesfurcatus</i>	5949	-	10720	2519	-	8251	-	-	-
17	<i>Centropages</i> sp.	-	-	-	-	-	-	-	-	-
18	<i>Calanopia minor</i>	2974	2974	4594	1511	-	4950	5964	1988	6070
19	<i>Eucalanusattenuatus</i>	-	-	-	3526	3526	9901	1988	1988	1517
20	<i>Labidoceraacuta</i>	8923	-	4594	1008	-	3300	9940	-	9105
21	<i>Paracalanusparvus</i>	86258	-	15314	16625	-	13201	45726	-	13657
22	<i>Pseudodiaptomuserricaudatus</i>	17847	1784	4594	-	-	-	5964	5964	6070
23	<i>Temoradiscaudata</i>	-	-	-	3023	5038	9901	3976	-	3035
24	Copepod nauplii	29744	2974	24502	18640	-	13201	27833	-	19727
Sub - order: Cyclopoida										
25	<i>Corycaeus</i> catus	5949	5949	-	-	-	-	-	-	-
26	<i>Corycaeusdanae</i>	2974	2974	4594	3526	3526	-	3976	3976	3035
27	<i>Oithona</i> brevicornis	8923	2974	6126	2519	-	8251	5964	-	-
28	<i>Oithona</i> spinirostris	2974	-	4594	-	1511	-	-	5964	-
Sub - order: Harpacticoida										
29	<i>Macrosetella</i> sp.	8923	8923	15314	2015	4030	6601	5964	5064	6070
30	<i>Euterpina</i> sp.	-	-	-	-	-	-	-	-	-
Other Crustaceans										
31	Brachyuran zoea	68412	6641	-	4030	4030	-	3976	3976	3035

Sl.No.	Genus/ Species	S5			S6			S7		
		Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather	Pre monsoon	Post monsoon	Fair weather
32	Barnacle naupli	-	-	-	-	-	-	-	-	-
33	Crustacean nauplii	175491	-	4594	26196	2619	11551	115308	-	4552
34	<i>Lucifer</i> sp.	2974	2974	4594	1008	1008	3300	1988	-	1517
35	Mysid larvae	29744	8923	-	3023	3023	9901	15905	8905	3035
36	<i>Evadne</i> sp.	127900	-	-	22670	-	-	65606	30606	-
37	<i>Penilia</i> sp.	20821	-	-	4030	-	-	11928	-	-
PHYLUM: CHORDATA										
38	<i>Oikopleura</i> sp.	38667	18660	6126	6549	-	8251	19881	17881	6070
39	Fish eggs	11898	8923	-	1511	1511	-	7952	3976	-
40	Fish larvae	2974	2974	-	504	504	-	-	-	-
Total		1061864	151602	1061864	197986	102871	197986	673954	254558	673954
Biomass (ml/100m ³)		89.2	79.3	59.8	45.3	45.4	47.9	55.7	51.01	47.0

Table 7.19. Macro benthic population

Sl. No.	Groups	S1			S2			S3			S4			S5			S6			S7		
		Pre mon soon	Post mon soon	FW	Pre mons oon	Post mon soon	FW	Pre mon soon	Post mon soon	FW	Pre mon soon	Post mon soon	FW	Pre mon soon	Post mon soon	FW	Pre mon soon	Post mon soon	FW	Pre mon soon	Post mon soon	FW
Phylum: ANNELIDA																						
Class: Polychaeta																						
1	Family: Oweniidae <i>Oweniasp.</i>	32	48	-	16	-	-	-	16	-	-	-	-	-	-	-	16	32	-	32	16	-
2	Family: Spionidae <i>Prinospiosp.</i>	48	-	16	-	-	32	32	16	-	16	32	-	32	-	16	16	-	-	16	-	16
3	Family: Pisionidae <i>Pisoneidens sp.</i>	-	-	48	32	48	-	16	-	32	32	16	32	-	-	-	48	16	32	64	64	32
4	Family: Nereidae <i>Perineris sp.</i>	80	64	-	16	-	16	48	16	-	32	8	-	48	16	32	-	-	-	16	32	-
5	Family: Eunicidae <i>Eunice sp.</i>	-	32	-	-	24	-	-	-	-	-	-	-	35	24	-	16	24	-	-	48	-
6	Family: Cirratulidae <i>Chaetozone</i>	-	8	32	-	-	-	-	48	32	32	32	16	-	-	-	48	48	16	16	16	16
7	Family: Cossuridae <i>Cossura sp.</i>	112	-	-	48	64	-	64	32	32	-	-	48	32	64	16	-	-	-	16	16	32
8	Family: Nephtyidae <i>Nephtys sp.</i>	-	-	-	-	16	-	-	-	-	-	16	-	-	-	-	-	32	-	-	-	-
9	Unidentified polychaetes	-	32	0	32	8	16	32	24	-	-	-	32	-	16	-	-	-	16	-	-	16
Phylum: ARTHROPODA																						
Class: Crustacea																						
10	Amphipods	32	-	-	-	16	32	16	32	48	16	-	-	-	48	16	-	32	32	-	48	-
11	Cumacea	-	-	32	16	-	-	32	-	-	-	-	16	-	-	-	-	-	-	-	-	16
12	<i>Emerita sp.</i>		16	-	-	-	-	-	-	-	-	24	-	-	32	-	-	-	-	-	-	-
Phylum: MOLLUSCA																						
Class: Bivalvia																						
13	Unidentified bivalve	-	-	16	-	16	32	-	-	-	-	32	16	-	-	-	-	-	-	-	-	16
14	<i>Sunetta sp.</i>	-	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-	32	-	-	16
Class: Gastropod																						



15	<i>Umbonium</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-	-	-
16	<i>Littorina</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-	16
Total		304	200	160	160	208	144	240	216	176	128	160	160	147	200	128	144	248	192	160	304	176

**FW-Fair weather period*

7.9. Fishery

Tamil Nadu has got a coastline of 1076 km and the continental shelf area covers 41,400 sq.km extending up to 40-60 km. This coastline is the third longest in India after Andaman & Nicobar and Gujarat. The coast line of Tamil Nadu covers 13 out of 32 districts and starts from Chennai in the north to Kanyakumari in the south. According to the survey conducted by the Tamil Nadu Fisheries Department, The total fisher's population in Tamil Nadu as per Marine Fishermen Census 2010 is 787474. Thiruvallur district fishermen population of 55517 and Chennai district is 61837 total fishermen population, respectively. The district wise details of males, females and total population are given in Table 7.20. Fisher folk population two districts are given below Table 7.21. The fishery of the region is assessed based on the data obtained from the Department of Fisheries, Govt. of Tamil Nadu.

Table 7.20. Marine Fishermen Population in districts of Chennai and Thiruvallur

Districts	Population		
	Male	Female	Total
Thiruvallur	28051	27466	55517
Chennai	31477	30360	61837

Table 7.21. Marine fisherfolk Population from 2013-2015

Sl. No	Districts	2013-2014	2014-2015	2015-2016
1	Chennai	57999	59170	67068
2	Tiruvallur	64288	65586	60507

A variety of fishing crafts like, Motorized non mechanical, motorized mechanical, non-motorized are used in this region. The total number of crafts (2131 in Ponneri

and 1773 in Chennai) such Motorized non mechanical, motorized mechanical, non-motorized are the most commonly used (Table 7.22).

Table 7.22. Registered fishing Crafts

Districts	2013-2014				2014-2015			
	Motorized non Mechanical	Motorized mechanical	Non Motorized	Total	Motorized non Mechanical	Motorized mechanical	Non Motorized	Total
Ponneri	1957	0	0	1957	2131	0	0	2131
Chennai	1042	669	34	1745	1074	654	45	1773

Estimation of Marine Fish Production

During the period 2010-2015, the fish production in Chennai ranged from 34283.11 to 37017.80 tons and the Thiruvallur district ranged from 9643.83 to 13023.36 tons respectively. The detail of district wise fish production is given in Table 7.23. The data clearly shows increased marine fish production during 2014-2015 when compared to previous years.

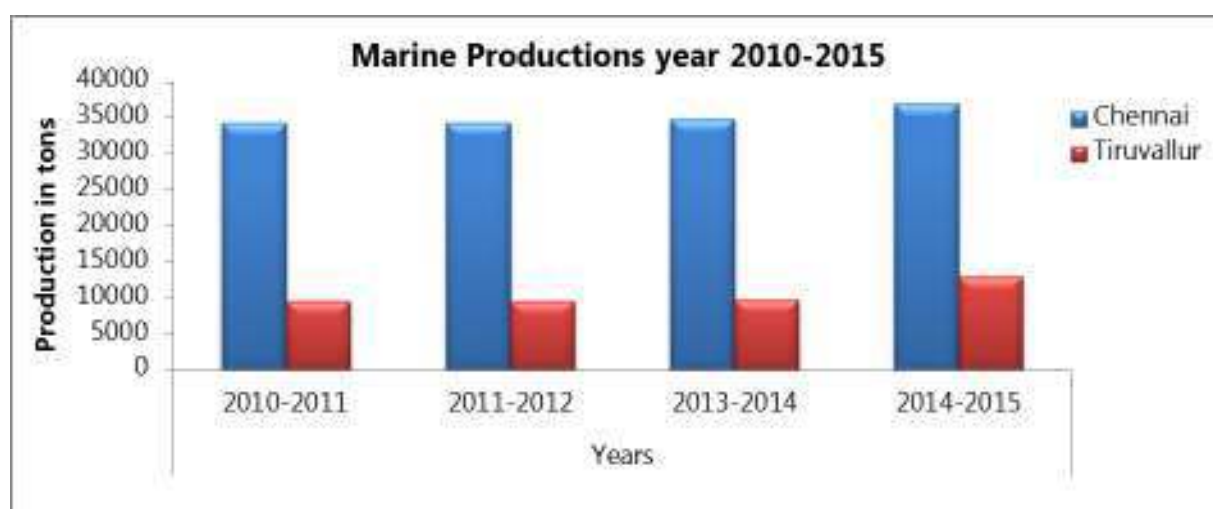


Table 7.23. Estimated Marine Fish Production - By Districts for the Year 2010-15

Sl. No.	District	Years			
		2010-2011	2011-2012	2013-2014	2014-2015
1	Chennai	34283.11	34437.38	34886.36	37017.80
2	Tiruvallur	9643.83	9686.90	9812.35	13023.36

In general, the dominant fish species of the Chennai and Thiruvallur region are such as, Silver bellies, Perches, Oil Sardines, Penaeid Prawns and others fish species. Species wise marine fish production from Chennai and Thiruvallur area during 2013-2014 and 2014-2015 is shown in Table 7.24.

Table 7.24. Estimation of marine fish production (In Tonnes) for Chennai and Thiruvallur District (2013-2014 and 2014-2015)

S.NO	SPECIES	2013-2014		2014-2015	
		Chennai	Thiruvallur	Chennai	Thiruvallur
1	Sharks	746.02	209.00	791.35	254.33
2	Skates & Rays	704.65	198.21	747.53	241.10
3	Eels	2.04	0.57	2.16	0.69
4	Cat fishes	362.78	102.05	384.61	123.88
5	Chirocentrus	1327.69	373.46	1407.58	453.36
6	Lesser Sardines	1281.58	360.50	2991.09	2070.01
7	Silver bellies	2783.69	783.03	1358.70	437.62
8	Hilsa Ilisha	1.02	0.28	1.07	0.31
9	Anchoveilla	1431.67	402.72	1517.84	488.89
10	Thrissocles	397.67	111.86	422.57	136.76

11	Clupeids	1629.05	458.24	1726.59	555.78
12	Saurida & saurus	97.67	27.47	103.55	33.35
13	Hemirhamphus & Belone	212.79	59.86	226.08	73.15
14	Flying fish	341.85	96.16	362.42	116.73
15	Perches	2260.71	635.92	2413.42	788.63
16	Red Mullet	1240.24	348.87	1314.87	423.50
17	Polynemids	163.95	46.12	173.82	55.99
18	Sciaenids	1109.29	312.03	1176.04	378.78
19	Ribbon fish	294.90	82.95	312.65	100.70
20	Caranx	1189.79	334.68	1261.39	406.27
21	Chironemus	153.49	43.17	163.21	52.89
22	Trachynotus	83.72	23.55	88.76	28.59
23	Elacate	127.46	35.86	135.13	43.53
24	Oil Sardubus	2790.67	784.99	2949.17	943.49
25	Gaza	27.91	7.85	29.59	9.53
26	Lactarius	16.42	4.62	17.41	5.61
27	Pomfrets	181.39	51.03	192.31	61.94
28	Mackerel	1015.11	285.54	1076.19	346.63
29	Seerfish	949.10	266.98	1006.21	324.09
30	Tunnies	589.890	165.91	625.29	201.40
31	Sphyreana	277.45	78.05	294.15	94.75
32	Mullet	223.25	62.80	236.69	76.23
33	Bregmaceres	181.39	51.03	192.31	61.94
34	Soles	624.41	175.64	661.99	213.21
35	Penaied Prawns	2623.23	737.89	2781.08	895.75
36	N.P.Prawns	701.16	197.23	743.35	239.42
37	Lobsters	55.81	15.70	59.17	19.06

38	Crabs	2361.61	664.30	2503.72	806.41
39	Cephalo pods	537.20	151.11	569.53	183.43
40	Miscellaneous	2266.30	637.49	2385.43	756.62
41	Drepane	65.76	18.50	69.72	22.45
42	Lethrinus	568.59	159.94	602.81	194.15
43	Sillago	408.13	114.80	432.59	139.26
44	Balisters	456.97	128.54	484.46	156.03
45	Ora	20.94	5.85	22.21	7.12
	Total	34886.35	9812.35	37017.80	13023.36

Source: Department of Fisheries, Government of Tamil Nadu

Marine Fishing Villages

The total number of fishing villages in Chennai district and Thiruvallur district is given in Table 7.25.

Table 7.25. Marine fishing village

Sl. No.	District	Sl. No.	District	Sl. No.	District
	Chennai		Thiruvallur		Thiruvallur
1	Ashok Nagar	1	Battikuppam	45	Kathivakkam Periakuppam
2	Poondi Thangammal Colony	2	Bethaniyakuppam	46	Kathivakkam Chinnakuppam
3	Annanagar	3	Arambakkam	47	Ernavurkuppam
4	Poogavanam Kuppam	4	Venkatesaperumal nagar	48	Indhira Gandhikuppam
5	Nagoorar Thottam	5	Rakkampalayam	49	Kasikoilkuppam
6	Pallavan Nagar	6	Vallampedu Kuppam	50	Kasi Visalakshipuram
7	Power Kuppam	7	* Madukkalkuppam	51	Kasi Viswanatharkoil Kuppam
8	Pudhumanai Kuppam	8	Mettukuppam	52	Palagaithottikuppam
9	Kasipuram A Black	9	Sunnambukulam	53	Pattinatharkoil Kuppam
10	Kasipuram B Black	10	Karakadu	54	Thiruvottiurkuppam

11	C G Colony	11	* Sirumburkuppam	55	Ondikuppam
12	YMCA Kuppam	12	Chinna Mangodu	56	Thiruchinankuppam
13	Vinayagapuram	13	Peria Mangodu	57	Lakshmipuram
14	VOC Nagar	14	Pudhukuppam	58	Nallathanneer Odaikuppam
15	Singaravel Nagar	15	Annamalaichery	59	Chennavaram
16	Muthamizh Nagar	16	Aurivakkam (East & West)	60	Chinna Nathan
17	Kasimanagar	17	Kulathumedu	61	Peria Obalapuram
18	Jeevarathinam Nagar	18	Jamilabath	62	Narasampalayam
19	AJ Colony	19	Thonirevu	63	Obasamuthiram
20	Kasithottam	20	Senjaianmanagar	64	Kuzhinaival
21	Bentiemen Garden	21	Kottaikuppam	65	Pallipalayam
22	GM Pettai	22	Andikuppam	66	Agaram
23	Pudukamaraj Nagar	23	Nadoor Madhakuppam	67	Pakkam
24	Attapalayam	24	Karaiyar Street	68	Thootimedu
25	Panaimarathotti	25	Israelkuppam	69	Polachiamman Kulam
26	Royapuram	26	Edamanikuppam	70	Dr Ambedkar Nagar
27	Mattankuppam North	27	Pasiyavaram	71	Edamani Village
28	Mattankuppam South	28	Goonamkuppam	72	Rahamath Nagar
29	Appaiya Chettiat	29	Thirumalainagar	73	Siru Palavergadu
30	Ayothikuppam	30	Sembasipallikuppam	74	Chengazhuneermedu
31	Nadukuppam	31	Light House Kuppam	75	Kadapakkam
32	Nochikuppam	32	Light House Nadukuppam	76	Oorampedu
33	Nochi Nagar	33	Karimanal	77	Kattur Karumari (Kattur)
34	Dooming Kuppam	34	Arangamkuppam	78	Kalanchi
35	Selvaraj Kiramam	35	Vairavakuppam	79	Ulaganathapuram
36	Bhavani Kuppam	36	Sathankuppam		
37	Nambiukkai Nagar	37	Koraikuppam		
38	Mullimanagar	38	Kamarajnagar kattupalli		

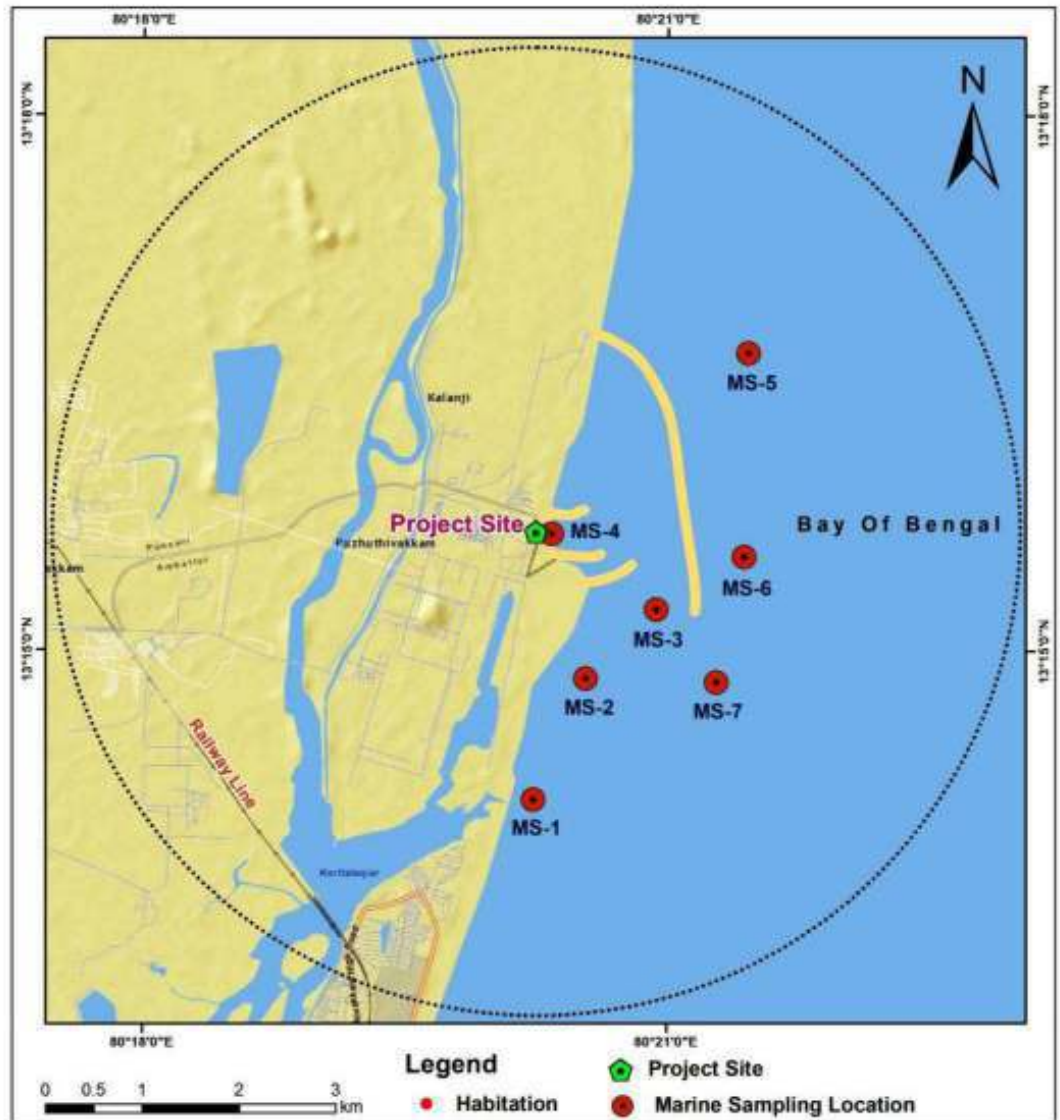
39	Srinivasapuram	39	Sivanpadai kuppam		
40	Narayanaswamy Garden	40	Kattukuppam		
41	Oorrur Kuppam	41	Ennorekuppam		
42	Alcotkuppam	42	Mugathuvarakuppam		
43	Odaikuppam	43	Nettukuppam		
44	Thiruvanmiyur Kuppam	44	Thazhankuppam		

*Note: * Indicated villages Fishermen Migrated*

Source: Department of Fisheries, Government of Tamil Nadu



FIG. 7.1. LOCATION OF SEAWATER AND SEABED SEDIMENT SAMPLES - KAMARAJAR PORT



Source: EIA report for CB3 & CB4, ACE, 2014

Fig. 7.3. Sea Monitoring Locations-Earlier study



FIG. 7.4. LOCATION OF BIOLOGICAL SAMPLES - KAMARAJUR PORT

8. MODELLING STUDIES

As per the ToR issued by MoEF&CC, the modeling study on Flow circulation, Wave tranquility; Dredging and Dredge spoil disposal, Littoral drift & Shoreline changes and Ship navigation study are to be carried out.

For Phase II Development of Kamarajar Port, Central Water and Power Research Station (CWPRS), Pune, India in 2009, had carried out Hydrodynamic modeling studies to assess the impact of the port development on the shoreline. For CB3 & CB4 desk studies has been conducted by CWPRS to assess the effect of development on the shoreline at Kamarajar Port. The summary of the CWPRS' s study is presented in this section. In 2004, National Institute of Ocean Technology (NIOT), Chennai, India, had carried out modeling study as a part of 'Environmental Impact Assessment (EIA) and Risk Assessment (RA) Study for the Phase II development of Kamarajar Port in order to identify the offshore disposal location for the capital dredging associated with Phase II development. The study carried out by NIOT is also presented in this section. For the proposed development of Kamarajar Port, Central Water and Power Research Station (CWPRS), Pune, India in March 2016 had conducted mathematical model studies to examine wave tranquility in the port. The study for assessment of wave tranquility in the port carried out by CWPRS is included in this section.

8.1. Hydrodynamic Modeling Study by CWPRS

The summary of the CWPRS's study is presented below.

8.1.1. Assessment of Near Shore Wave Pattern

The near shore wave pattern at the project site for Phase II development was recognized by assessing the ship based deep water wave data through OUTRAY mathematical modeling. The model area was taken as 40 km × 45 km, which extended up to 200 m water depth. Grid size was taken as 250 m.

It was observed that during SW monsoon, the predominant wind directions were SSE (90%) and SE (5%). In case of NE monsoon, the predominant directions were E (49%), ESE (13%), SE (8%) and SSE (29%). The predominant wind direction during non-monsoon season was same as that of NE monsoon season, with varying percentage of occurrence. In all the three seasons the maximum wave height was found to be 3.5 m.

8.1.2. Assessment of Littoral Drift

The Littoral Process and Coastline Kinetics (LITPACK) software was used to simulate littoral drift, its distribution and shoreline change assessment. Two profiles, namely North profile and South profile, were used to understand the littoral drift above and below the project site. The assumed profile line is shown in Fig 8.1. The annual and seasonal transport rate is given in Table 8.1. In all the three seasons, Northward transport was found to be dominant. The annual net transport was assessed to be about 0.50 MCM towards the Northern direction.

Table 8.1. Annual and Seasonal Transport Rates (in MCM)

Profile	Season	Northward	Southward	Net	Gross
South Profile	SE monsoon	3.4	0.00	-0.34	0.34
	NE monsoon	0.11	0.07	-0.04	0.18
	Non-monsoon	0.16	0.02	-0.14	0.18
	Annual	0.61	0.09	-0.52	0.70
North Profile	SE monsoon	0.29	0.00	-0.29	0.29
	NE monsoon	0.13	0.08	-0.05	0.21
	Non-monsoon	0.15	0.02	-0.13	0.17
	Annual	0.57	0.10	-0.47	0.67

Note: +ve sign indicates Southward transport, -ve sign indicates Northward transport

Source: Mathematical Model Studies for Simulation of Littoral Drift and Shoreline Changes for the Proposed Phase II Development at Kamarajar Port, Tamil Nadu, Technical Report No. 4657, CWPRS, 2009.

The cross shore distribution of littoral drift was also analyzed for North and South profile. The distance was calculated from the High Water Line, which was considered to be the shoreline. With respect to the South profile, during SW, NE and non monsoon seasons, the Northward transport occurred up to 300 m from the shore and the maximum transport was at 100 m from the shore. In case of North profile, Northward transport occurred up to 500 m and the maximum transport was found to be about 200 m from the shore, for all the three seasons.

8.1.3. Assessment of Shoreline Changes

The shoreline change was simulated using LITPACK software. Shoreline of about 14.4 km, inclusive of 6 km in the Northern side and 6 km in the Southern side from the Kamarajar Port. The study area was divided into 721 grids of 20 m grid size. The length of Northern breakwater and Southern breakwater are 3.2 km and 1.1 km, respectively. The effective blocking length of North and South breakwaters were considered to be 1.5 km and 1.0 km, respectively.

To calibrate the model, initially shoreline evolution was carried out for the shoreline prior to construction of port and for three years after the construction of port. The cross shore and longshore changes obtained through modeling was matching with the shoreline change assessment carried out with comparison of satellite imageries. The net and gross sediment transport at the Kamarajar port coastline was in the range of 0.5 MCM and 0.7 MCM, respectively, towards the North direction.

Simulation was carried out for three scenarios namely, without sand bypassing (beach nourishment), with sand bypassing and reclamation. The model was run for a period of 10 years. The results are presented in the following sections.

Without Sand Bypassing

The net transport was observed to be in the North direction; hence the accretion was reported to be near the South breakwater and erosion near the North breakwater. After 10 years, accretion of about 100 m into the sea, with a distance of about 3 km towards the South from the Southern breakwater was anticipated through modeling output. Erosion was observed up to 4 km along the coastline towards North from the Northern breakwater and the reported erosion was about 200 m Fig 8.2 shows the output of the shoreline change modeling for without sand bypassing scenario.

With Sand Bypassing (Beach Nourishment)

Simulation model was carried out for sand bypassing from South of Southern breakwater to North of Northern breakwater. The quantity of sand to be bypassed annually was taken as 0.1 MCM, 0.2 MCM, 0.3 MCM and 0.4 MCM. Fig. 8.3 shows the modeling output for 0.4 MCM. After analysis of the output, it was proposed that annual sand bypassing of 0.4 to 0.5 MCM from South (about 300 m) to North (about 2 to 3 km) of Kamarajar port will avoid undesirable accretion/ erosion on the South/ North side of the port.

8.2. Modeling study on dredge disposal

8.2.1. For phase I & II - NIOT

Modeling was carried out by NIOT in 2004, to identify marine disposal area for disposal of 18.0 MCM of dredged material. Only 9.0 MCM has been disposed off in the marine disposal area identified by NIOT. The phase II project was found to generate 3.7 MCM of dredged material. The marine dumping location identified by the NIOT was adequate for the phase II project.

Eight marine dumping locations in varying water depths of 10 m, 20 m and 30 m were considered for the modeling. The dumping locations are shown in Fig 8.4. The modeling was carried out using MIKE 21 software, which is a two dimensional hydrodynamic, sediment transport model. The model bathymetry was based on the NHO charts for Ennore. Specifications of the model input are given below:

- Model Grid spacing – 200m × 200m
- Model dimension – 150 grids × 240 grids (30 km × 48 km)
Assumed dump quantity is 7500 m³ /dump × 8 dumps/day for 300 days
(Based on KPL's dredging plan).
- Total quantity to be disposed is about 18.0 MCM.

Boundary conditions along the North-South Direction: Flux obtained by multiplication of Current meter time series by the area of boundary. Time series simulates variations as well as reversals. The boundary file used in the model is given in Fig. 8.5.

- Conditions along the Eastern Boundary: Flux = Zero

The current vector obtained from the model (predicted) was compared with the field measurements (observed, for calibration of the model hydrodynamics. Fig 8.6 shows the Northerly and Southerly current vectors obtained from the model.

At 10 m depth

The hydrodynamic modeling output consisting of average sediment concentration and net sediment concentration for 10 m water depth dumping area was carried out. It was observed from the output, that the dumped material settles down at the place of dumping itself without spreading over due to very low settling velocities

resulting in high concentrations. The net sedimentation at the site of dumping was about 40 mm. Hence, dumping has to be carried out in deeper depth.

At 20 m Depth

Similarly, modeling was carried out for 20 m water depth dumping area. As per the model output, the dredge dump resulted in 250 mg/l to 500 mg/l concentration of suspended solids at the dumping location for each dump. During Northerly current, the area of spread was found to be 7.28 km² and during Southerly it was 7.04 km². In both the cases, the line of spread was parallel to the coast, which was about 5 km and 7 km length for Northerly and Southerly current. While the lateral spread was observed to be 1.5 km and 1.0 km, respectively.

At 30 m Depth

In case of 30 m water depth, the dredge dump spread over an area of about 11 km² and 10.4 km² in the Northerly and Southerly Current, respectively. A net sedimentation of 0.5 m and 0.2 m was observed during the Northerly and Southerly Current, respectively. The linear spread of sediment was parallel to the coast up to a length of 10 km and 8 km in the Northerly and Southerly current, the lateral spreading was observed to be 1.1 km and 1.3 km. The modeling output of the same is shown in Figs. 8.7 and 8.8.

After analyzing disposal at different water depths, it was recommended in the EIA Report for Phase II Development of Kamarajar Port, NIOT, 2004, that the dredged material be disposed off between 20 – 30 m water depth at the suggested dump locations at the rate of 8 dumps per day, which would result in negligible change to the bathymetry and sediment concentrations. For the phase II project the NIOT suggested marine dredged dumping location will be utilized.

The NIOT recommended marine disposal location, which is proposed to be utilized for this project is shown in Fig.8.9. The proposed marine disposal area is located between 20 m and 30 m water depth. The reported net sedimentation was about 0.2 m to 0.5 m in an area of 25 km² (5 km × 5 km). In an area of 50 km², the net sedimentation was found to be 0.3 m, which was anticipated to be well within the bathymetric differences.

8.2.2. For phase III – Indomer

The modelling study has been carried out for extended location of the offshore disposable site after the suggestion given by the State CRZ Committee. The area for offshore disposal was chosen earlier covering 5400 m x 5400 m stretched over 5 km to 10 km offshore from 25 to 50 m water depth. *After the suggestions given by the State CRZ Committee*, it has been extended to 6000 m x 6000 m area stretching over the depth of 25 to 55 m.

Model domain: The tide and wind induced flow field over the study area was simulated using MIKE 21-HD module. The coarse resolution model domain in the study area, stretches between the longitudes 80°03'16.64" E and 80°03'15.55" E and latitudes 12°31'13.86" N and 13°59'20.69" N covering an area of approximately 160 km x 80 km. The grid spacing is 500 m in both X and Y directions. The finer resolution grid covers an area of approximately 21 km x 18 km with a spacing of 50 m in both x and y directions.

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

The tide and wind induced flow fields over the project area are determined using HD (hydrodynamic) module of MIKE 21 suite.

Boundary conditions: The coarse resolution model is forced by the tidal water level variations along the open sea boundaries. For the generation of these boundary conditions, the MIKE 21 KMS data base was used. These boundary conditions for the coarse resolution model are prescribed as time series of tidal water level variations along the open boundaries of the model. For the coarse resolution model, the DHI - KMS tides at Krishnapatnam and Kalpakkam have been applied along the northern boundary and along the southern boundary of the model respectively. Along the eastern boundary the tide levels linearly interpolated between Krishnapatnam and Kalpakkam have been imposed.

Calibration: The model is calibrated using simulated tides and measured tides. A good agreement was observed between the simulated tides and the measured tides.

Simulations: The flow of currents was simulated for one year. The typical results for month of March are shown in Fig. 8.10. These current speed and direction are plugged into PA model.

Dredge spoil for Phase III

MIKE 21 PA, the module in the MIKE 21 application suite, is used to study the dispersion pattern of the dredge spoil disposed at selected location in offshore.

Capital Dredging: The port basin will be cut and dredged to accommodate 10 berths as shown in Fig. 8.11. KPL proposes to carry out capital dredging of the channel and basin area to accommodate the deep draft vessels under phase III. It is proposed carry out dredging in three stages as detailed below.

Summary of capital dredging

Stages of dredging	Quantity of dredging 10 ⁶ m ³	Method of Dredge Disposal				Quantity of Land Cutting (10 ⁶ m ³)
		Reclamation		offshore		
		Min	Max	Min	Max	
Stage 1	16	2	5	13	15	Nil
Stage 2	9	2	3	6	8	0.75
Stage 3	8	1	2	4	5	1.75
Total	33	5	10	23	28	2.50

The capital dredging will be carried out along the approach channel; length of the channel will be increased from 5 km to 7.2 km, width will remain the same as 300 m and the depth will be increased from (-) 20 m CD to (-) 23 m CD. The total volume of materials to be dredged from the basin and approach channel will be $33.0 \times 10^6 \text{ m}^3$. KPL has proposed to dispose the entire volume at the designated offshore disposal location or to use a minor part of the dredge sediments for land reclamation/ beach nourishment if necessity arises. In that case, the dredging quantity of $5 \times 10^6 - 10 \times 10^6 \text{ m}^3$ will be used for reclaiming the area between north of north break water to the northern boundary of the port (1.8 km length). Also the dredged sand can be utilized for reclaiming the land associated with Northern Rail Connectivity projects and other projects based on requirement. The rest of $23 \times 10^6 - 28 \times 10^6 \text{ m}^3$ will be disposed into the sea at a suitable location offshore. It is assumed that the capital dredging and corresponding disposal of dredge spoil is planned over the period of 5 years from 2017-2022.

Model description

MIKE 21 Particle Analysis (PA) module is based on the Lagrangian discrete parcels method in which an ensemble of particles is followed instead of solving the Eulerian advection-diffusion equation. The properties of the released particles are described by distribution of grain sizes or settling velocities. It is possible to specify the

sediments released at a specified depth, and the particles settle with a settling velocity.

Results

The area for offshore disposal was chosen earlier covering 5400 m x 5400 m stretched over 5 km to 10 km offshore at varying depth from 25 to 50 m CD water depth. *After the suggestions given by the State CRZ Committee*, it has been extended to 6000 m x 6000 m stretching over the depth of 25 to 55 m CD. The increased area of disposal ground is shown in Fig. 8.12.

The modelling has been carried out for the disposal of 30 Million m³ of dredged spoil over the period of 2 years. The disposal is suggested at 16 nodal points covering an area of 6000 m x 6000 m in diagonal sequence. It is suggested that the dredge spoil barges may dispose the sediments at different locations in the disposal area in a sequential order starting from location 1 and continue upto location 16 and repeat this order in a cyclic manner. The modelling study indicates the change in seabed will be to the insignificant level by 0.26 m. However, in subsequent years, due to waves and currents, the dumped sediments will move from disposal location and spread further towards east. The seabed is expected to reach its original level in 2 year after the completion of disposal. The change in bed level is shown in Fig. 8.13 and the disposal location is shown in Fig. 8.14.

8.3. Modeling on wave tranquility

Mathematical model studies for the wave propagation inside the port basin for the facilities proposed under Phase III were carried out by Central Water and Power Research Station, Pune, 2016. More details on wave tranquility studies were given in 'Mathematical model studies for assessment of wave tranquility inside the port basin at Kamarajar Port, Tamil Nadu' prepared and submitted by CWPRS, Pune.

Near-shore Wave conditions

The predominant directions of wave approach at port entrance will be from ENE, E, ESE and SE. Percentage occurrence of wave heights and direction during Southwest Monsoon, Northeast Monsoon, Non Monsoon and Entire year is given in Tables 8.2 to 9.5 and shown in Fig. 8.15. Referring to Table 8.2, During Southwest Monsoon. It is seen that predominant directions of waves are from ESE and SE directions with percentage 4.7% and 77.1% respectively with maximum wave height of the order of 4 m. Referring Table 8.3, during Northeast Monsoon the waves approach predominantly from ENE and SE directions with percentage 29.1% and 19.0% respectively with maximum wave height of the order of 4 m. In Non-Monsoon period (Table 8.4), waves approach predominantly from ENE, E, ESE and SE directions with occurrence of 26.54%, 5.18%, 9.97% and 37.1% respectively and waves upto 3.5 m. The entire year frequency distribution of wave (Table 8.5) indicate that waves approach from ENE, E, ESE and SE with percentages 19.52%, 2.91%, 5.45% and 41.84% respectively and with the maximum wave height of 4m was observed.

Table 8.2. Percentage occurrence of wave heights and direction during South-West Monsoon (June to September)

Wave Ht(m)	0.5	1	1.5	2	2.5	3	3.5	4	Total
Direction								Calm	13.5
67.5° N(ENE)	0.83	0.78	0.55	0.41	0.41	0.16	0.04	0.02	3.2
90°N (East)	0.78	0.6	0.04	0.08	0.01	0.03	0.04	0	1.58
112.5°N(ESE)	0.72	1.76	1.09	0.7	0.27	0.17	0	0	4.71
135°N(SE)	14.07	28.27	20.81	9.69	3.19	0.44	0.48	0.12	77.1
Total	16.4	31.41	22.49	10.88	3.88	0.8	0.56	0.14	100

Table 8.3. Percentage occurrence of wave heights and direction during North-East Monsoon (October-January)

Wave Ht(m)	0.5	1	1.5	2	2.5	3	3.5	4	Total
Direction								Calm	47.81
67.5° N(ENE)	4.21	10.36	8.91	3.93	0.78	0.4	0.44	0.04	29.1
90°N (East)	0.54	0.41	0.38	0.43	0.03	0.1	0	0.01	1.9
112.5°N(ESE)	0.25	0.94	0.34	0.38	0.22	0.1	0	0	2.23
135°N(SE)	5.53	7.36	3.91	1.3	0.72	0.1	0.04	0	19
Total	10.53	19.07	13.54	6.04	1.75	0.7	0.48	0.05	100

Table 8.4. Percentage occurrence of wave heights and direction during Non-Monsoon (February-May)

Wave Ht(m)	0.5	1	1.5	2	2.5	3	3.5	Total
Direction							Calm	21.22
67.5° N(ENE)	8.05	10.95	5.08	1.78	0.35	0.25	0.08	26.54
90°N (East)	1.25	2.15	1.07	0.55	0.06	0.08	0.02	5.18
112.5°N(ESE)	2.58	3.96	1.89	0.88	0.44	0.07	0.15	9.97
135°N(SE)	9.73	12.55	8.76	4.67	1.25	0.04	0.1	37.1
Total	21.61	29.61	16.8	7.88	2.1	0.44	0.35	100

Table 8.5. Percentage occurrence of wave heights and direction during Entire year (January-December)

Wave Ht(m)	0.5	1	1.5	2	2.5	3	3.5	4	Total
Direction								Calm	30.26
67.5° N(ENE)	4.35	7.27	4.89	2.02	0.5	0.28	0.19	0.02	19.52
90°N (East)	0.79	1.08	0.54	0.37	0.03	0.07	0.02	0.01	2.91
112.5°N(ESE)	1.06	2.23	1.06	0.66	0.28	0.12	0.04	0	5.45
135°N(SE)	8.82	14.9	10.88	5.13	1.7	0.16	0.21	0.04	41.84
Total	15.02	25.4	17.37	8.18	2.51	0.63	0.46	0.07	100

Wave tranquility in Kamarajar Port basin

Wave tranquility studies for the entire port facilities were carried out by Central Water and Power Research Station, Pune, 2016. The wave direction considered for tranquility study were 67.5°, 90°, 112.5°, 135° N. Maximum significant wave heights observed at different locations in the Kamarajar port were within permissible level. Wave heights at all the proposed berths were seen to be within the permissible tranquility limit for all the incident wave directions except for wave incidence from SE (135°N) direction (Figs. 8.16 to 8.19). Good tranquility is observed in the port basin for the proposed Phase III development which is equal to almost calm sea for the whole year.

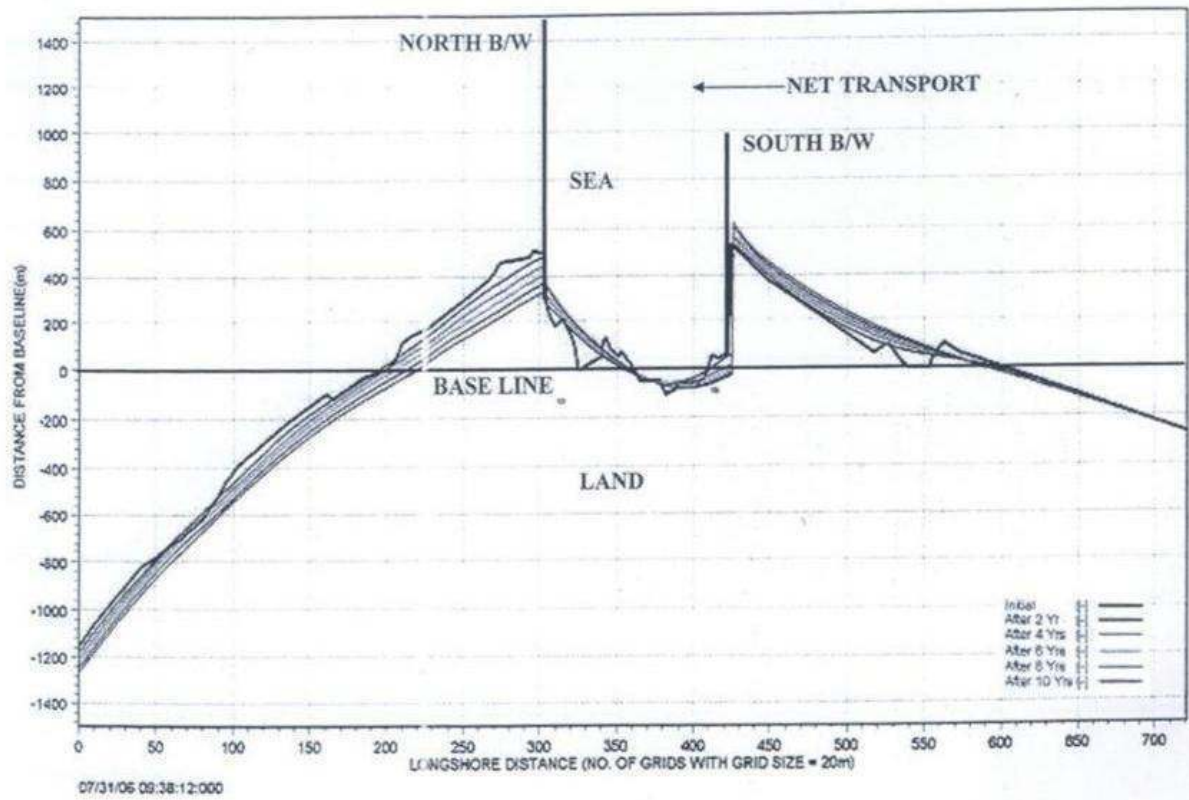
8.4. Ship navigation study

Same type of carriers pertaining to Phase II will be using the facilities in Phase III. As such no new additional navigation studies appear to be necessary.



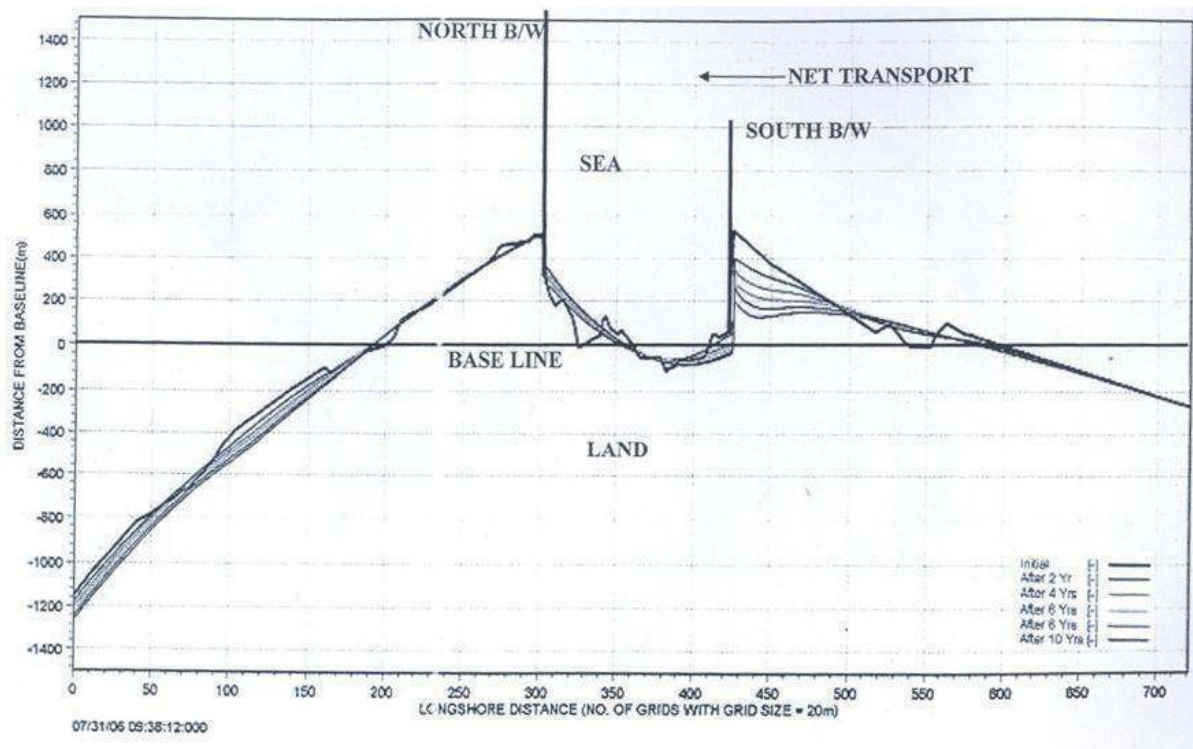
(Source: Mathematical Model Studies for Simulation of Littoral Drift and Shoreline Changes for the Proposed Phase II Development at Kamarajar Port, Tamil Nadu, Technical Report No. 4657, CWPRS, 2009)

Fig. 8.1. South and North profiles considered for Drift Computation



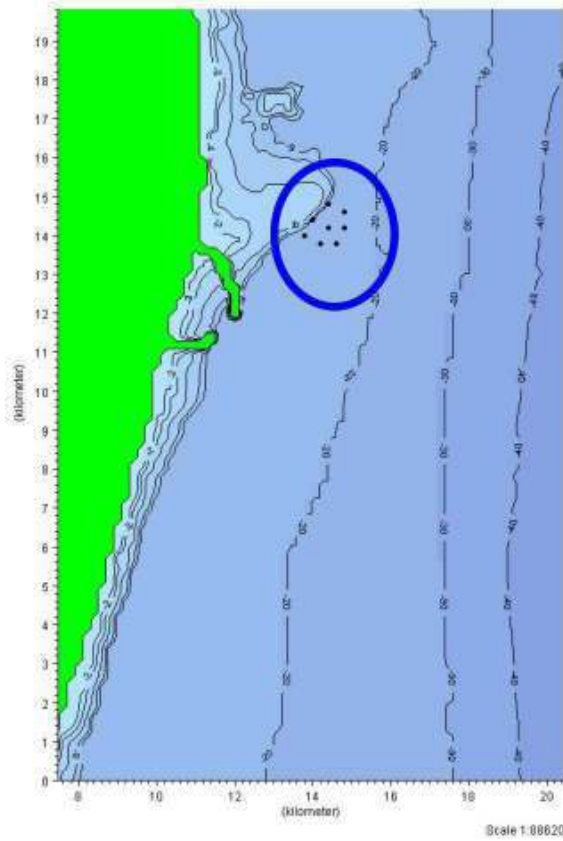
(Source: Mathematical Model Studies for Simulation of Littoral Drift and Shoreline Changes for the Proposed Phase II Development at Kamarajar Port, Tamil Nadu, Technical Report No. 4657, CWPRS, 2009)

Fig. 8.2. Shoreline changes after 2,4,6,8 and 10 years without bypassing

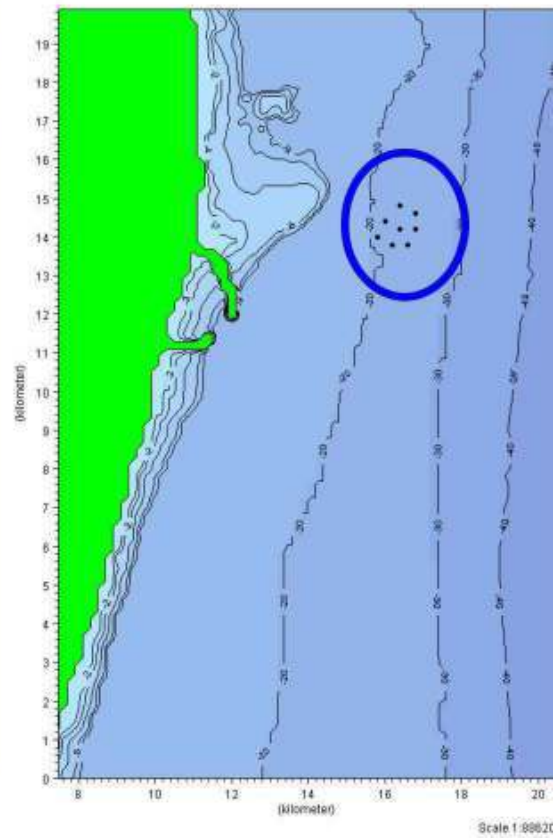


(Source: *Mathematical Model Studies for Simulation of Littoral Drift and Shoreline Changes for the Proposed Phase II Development at Kamarajar Port, Tamil Nadu, Technical Report No. 4657, CWPRS, 2009*)

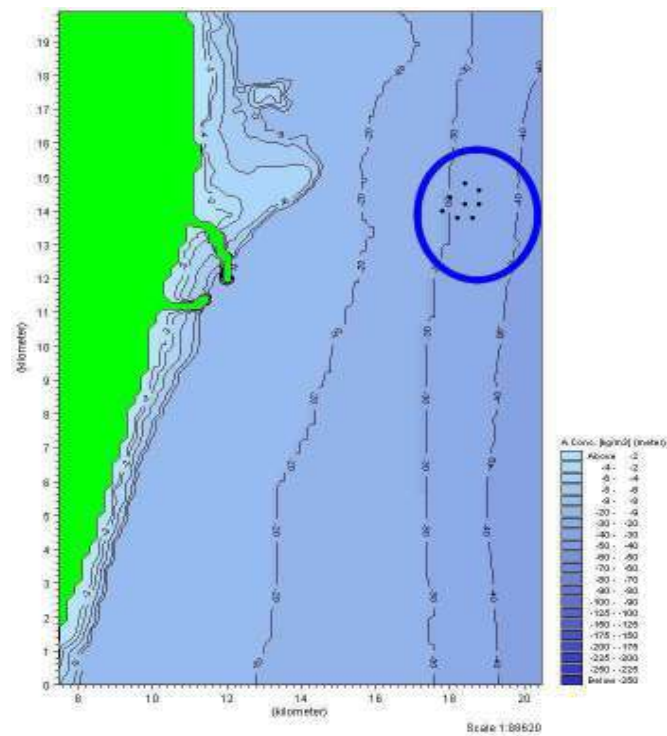
Fig. 8.3. Shoreline changes after 2,4,6,8 and 10 years with bypassing 0.4 MCM



Dump Locations in 10m water depth



Dump Locations in 20m water depth



Dump Locations in 30m water depth

Fig. 8.4. Marine disposal locations considered for modeling at 10 m, 20 m, 30 m water depth
(Source: EIA report for the Phase II Development of Ennore Port, NIOT, 2004)

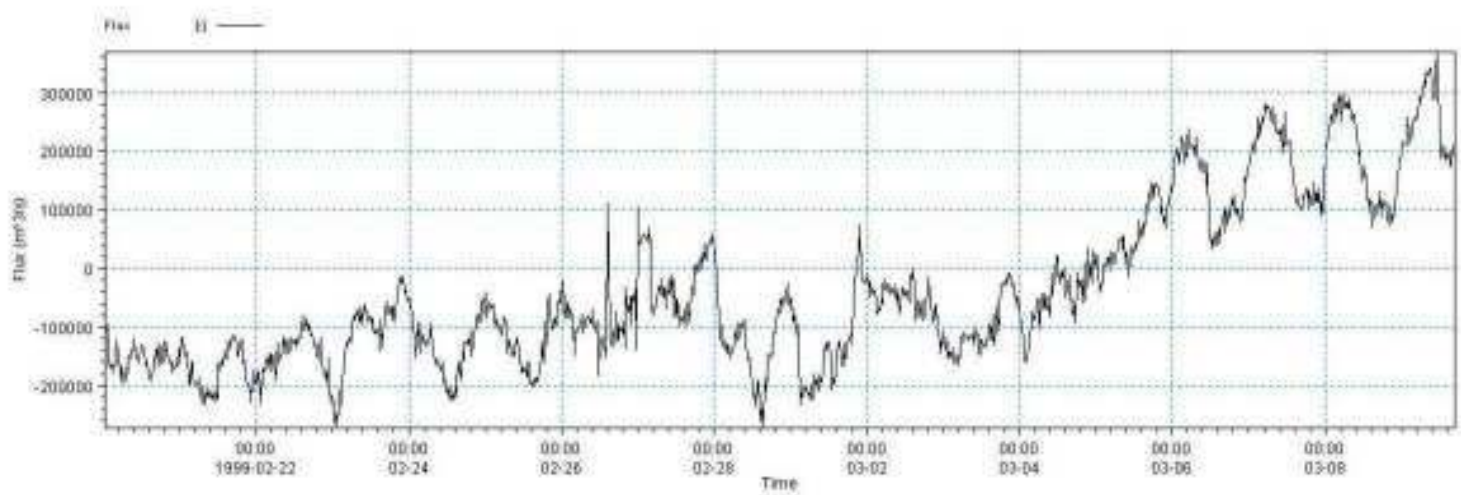
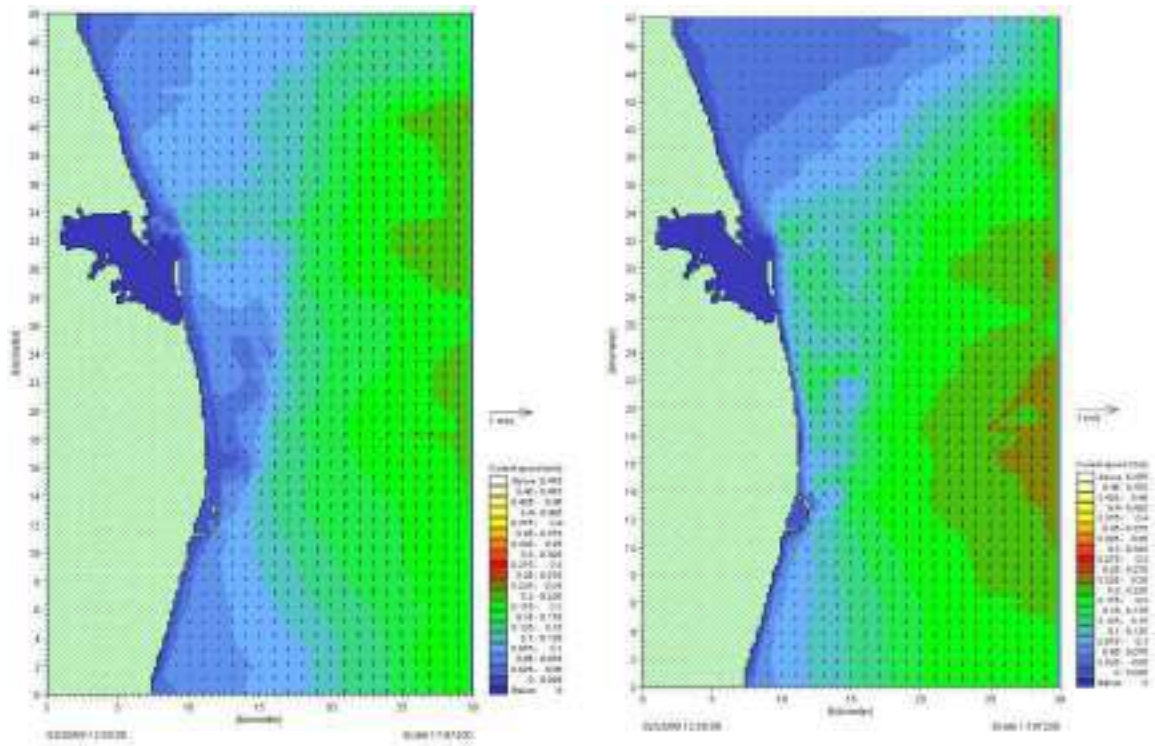


Fig. 8.5. Dumps locations in different water depths
(Source: EIA report for the Phase II Development of Ennore Port, NIOT, 2004)

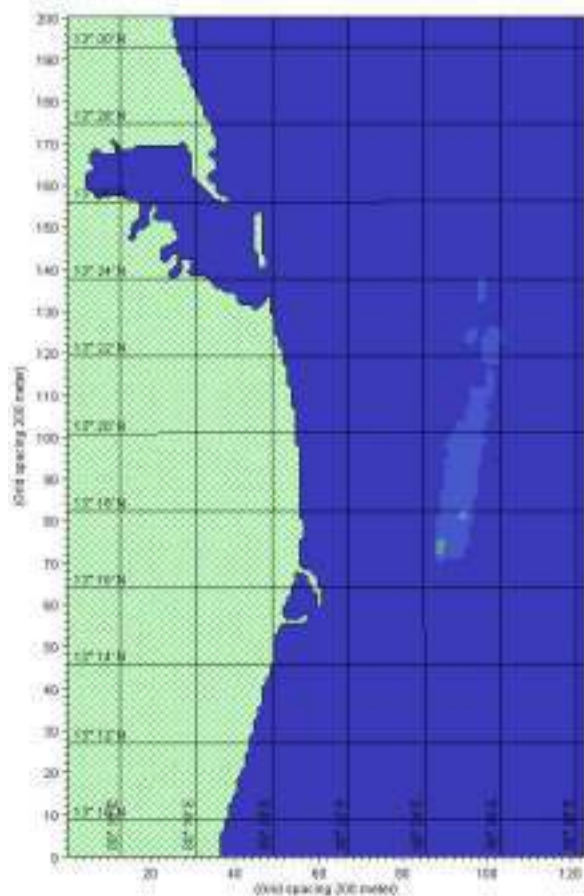


a) Northerly Current

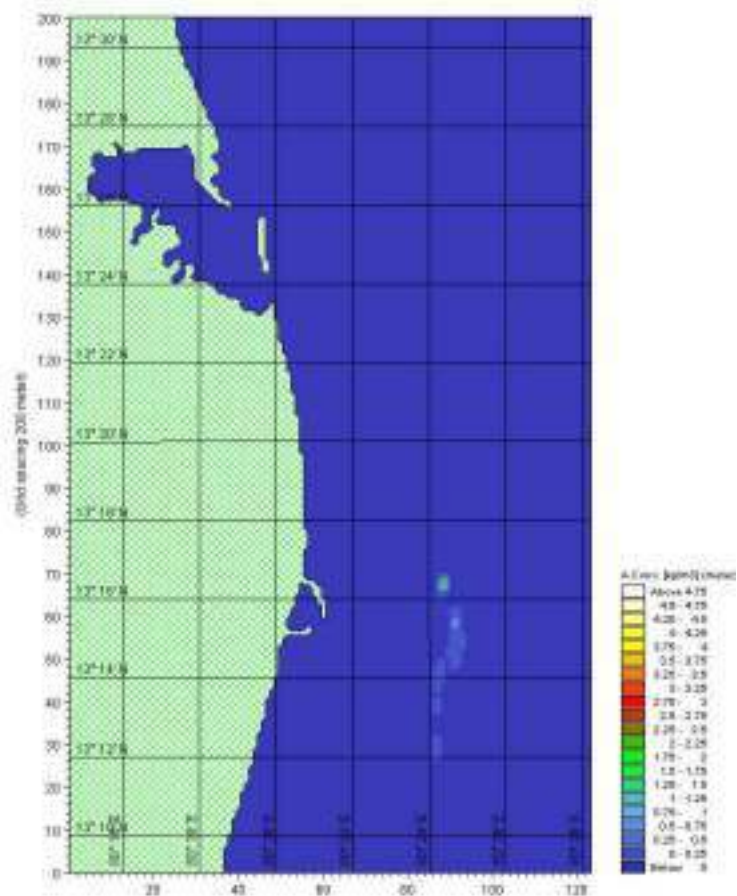
b) Southerly Current

Fig. 8.6. Current vectors obtained from model showing northerly and southerly currents

(Source: EIA report for the Phase II Development of Ennore Port, NIOT, 2004)

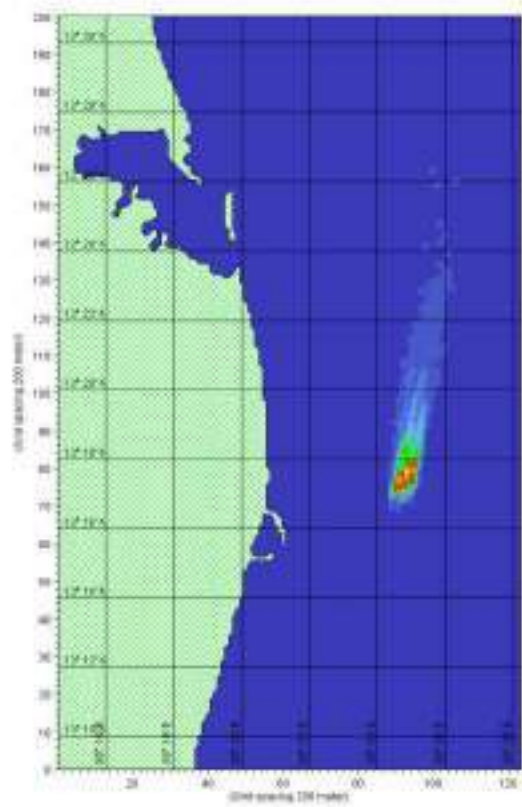


a) Northerly Current

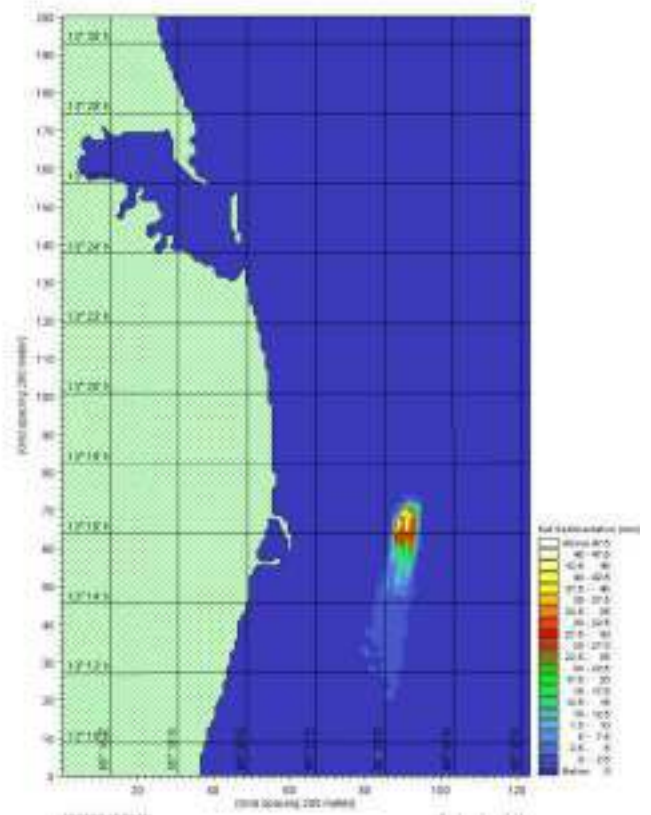


b) Southerly Current

Fig. 8.7. Average Sediment concentration- At 30 m water depth
(Source: EIA report for the Phase II Development of Ennore Port, NIOT, 2004)



a) Northerly Current



b) Southerly Current

Fig. 8.8. Net Sediment Concentration- At 30m water depth
 (Source: EIA report for the Phase II Development of Ennore Port, NIOT, 2004)

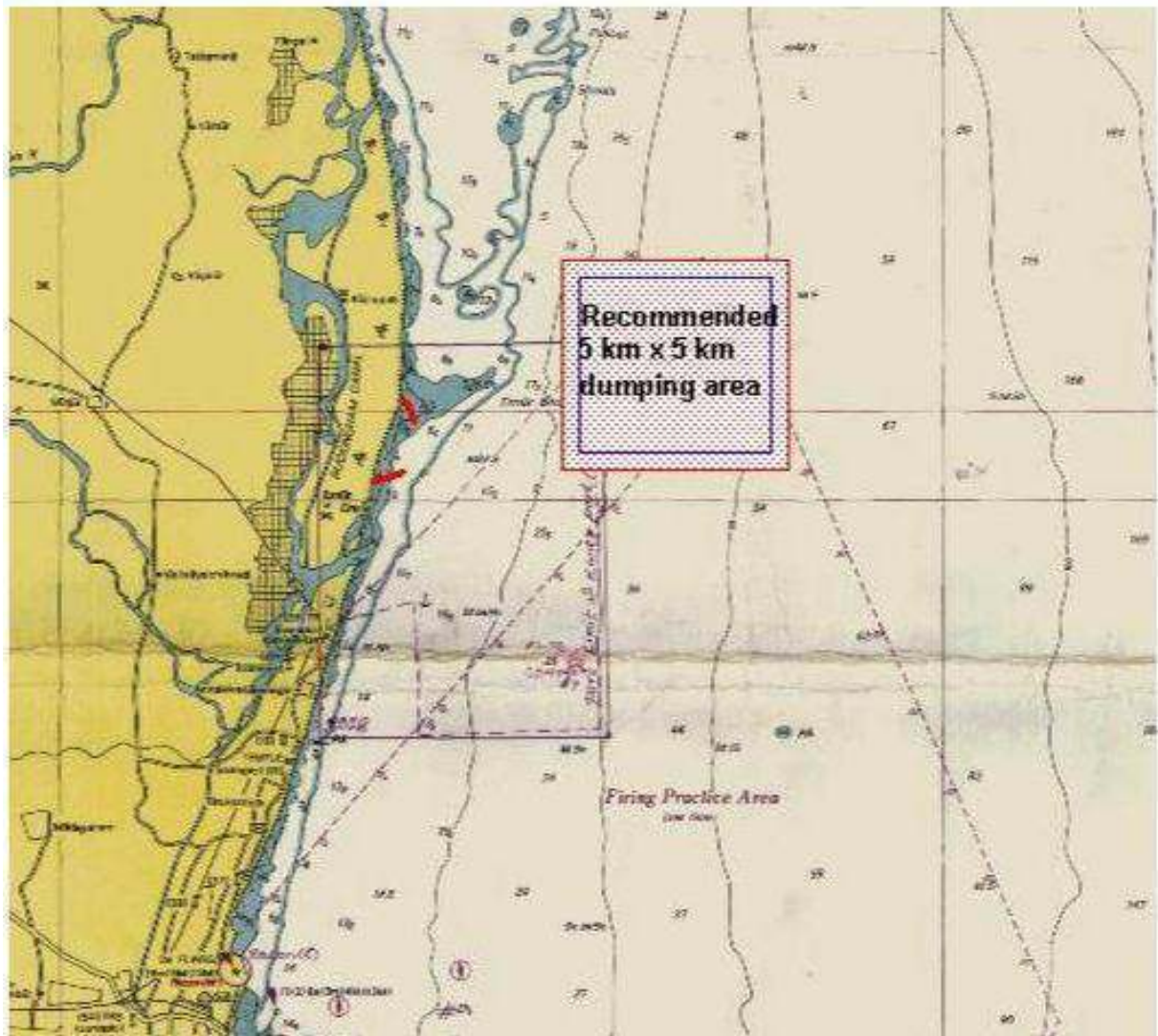


Fig. 8.9. Recommended dredged material marine disposal area
(Source: EIA report for the Phase II Development of Ennore Port, NIOT, 2004)

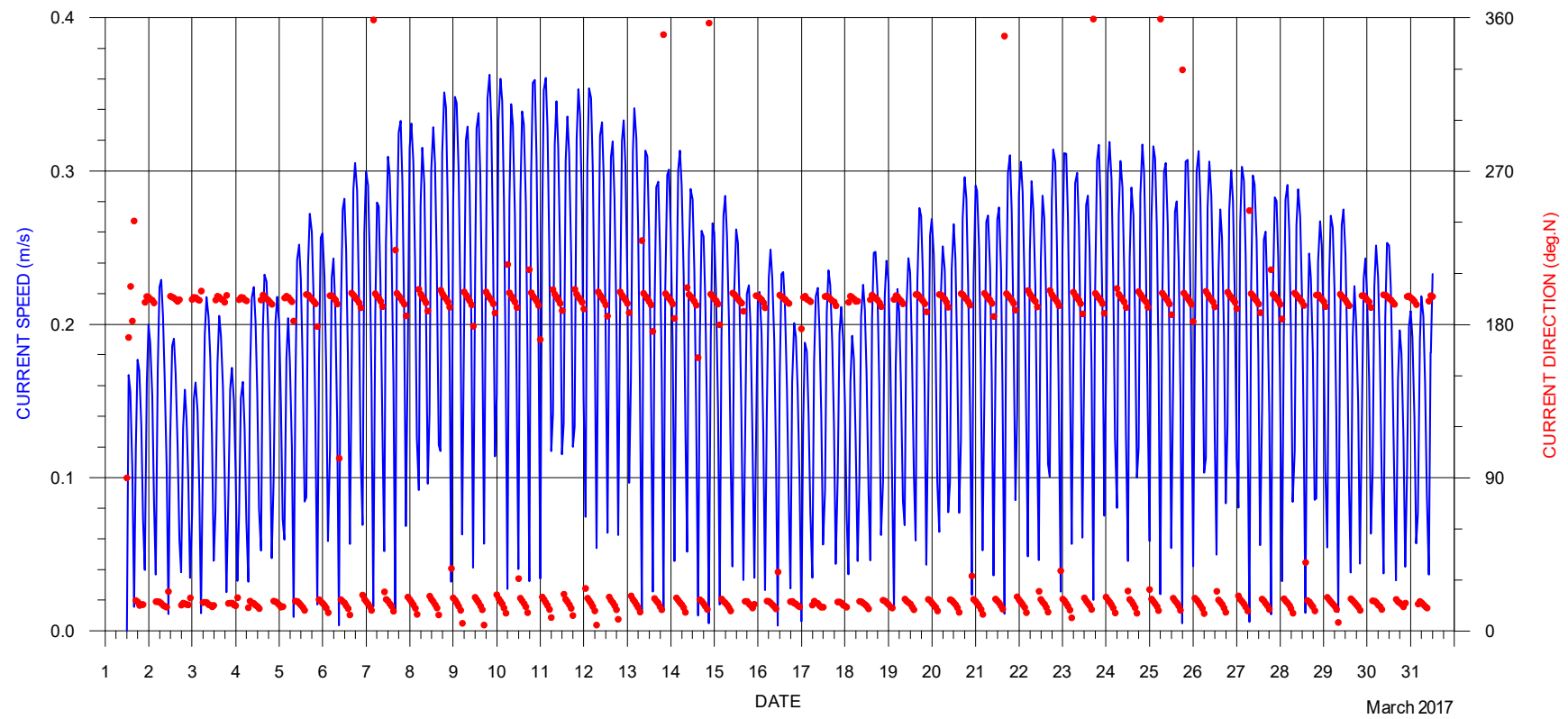


FIG.8.10. SIMULATED CURRENT SPEED AND DIRECTION AT 5 km OFFSHORE (DREDGE DISPOSAL LOCATION)

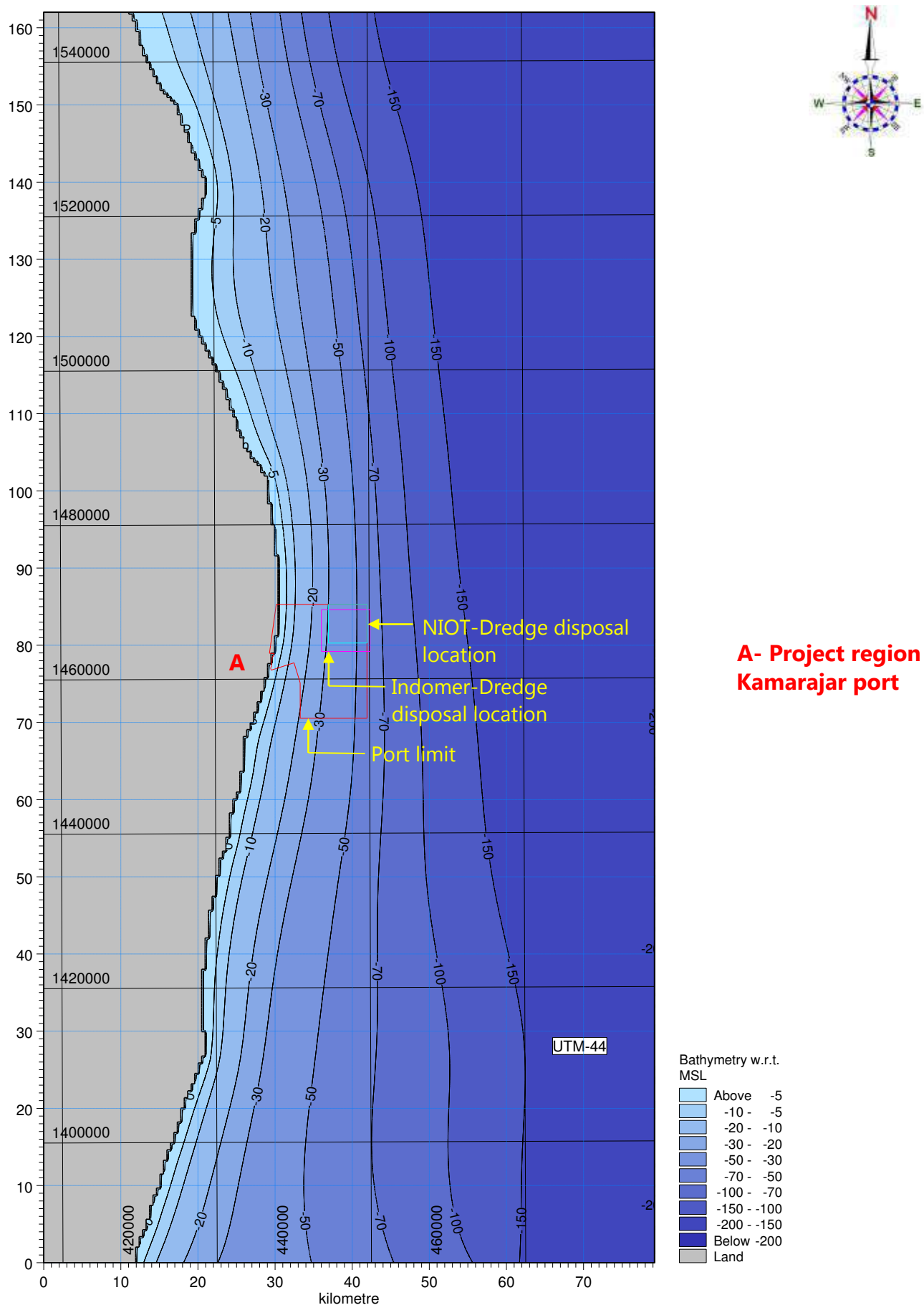


Fig. 8.12. Dredge disposal location

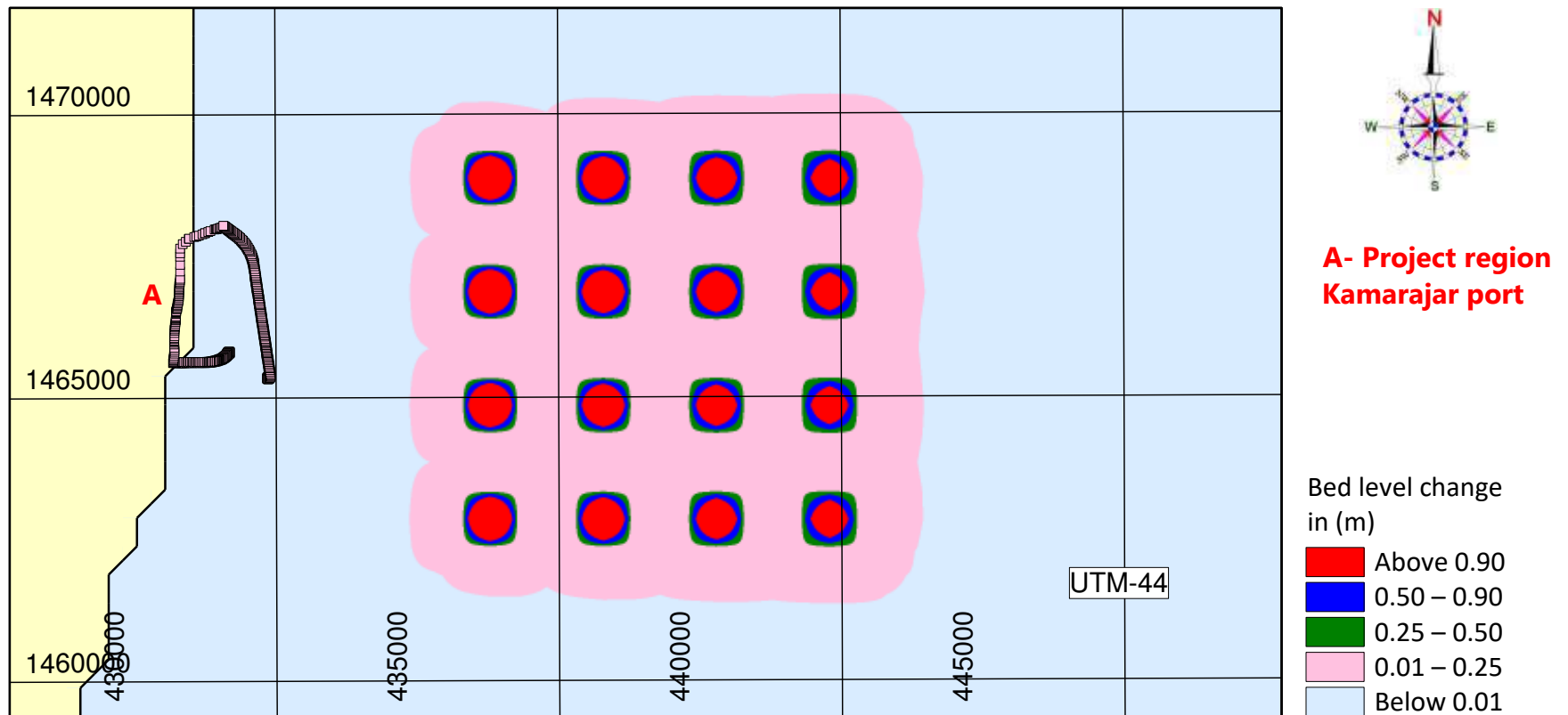
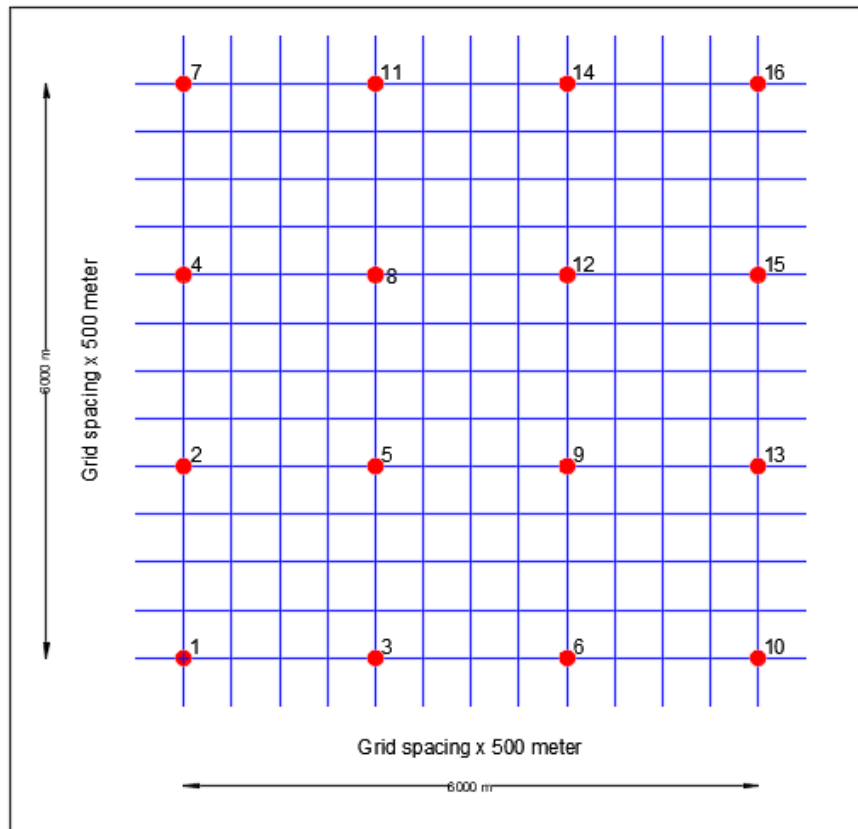


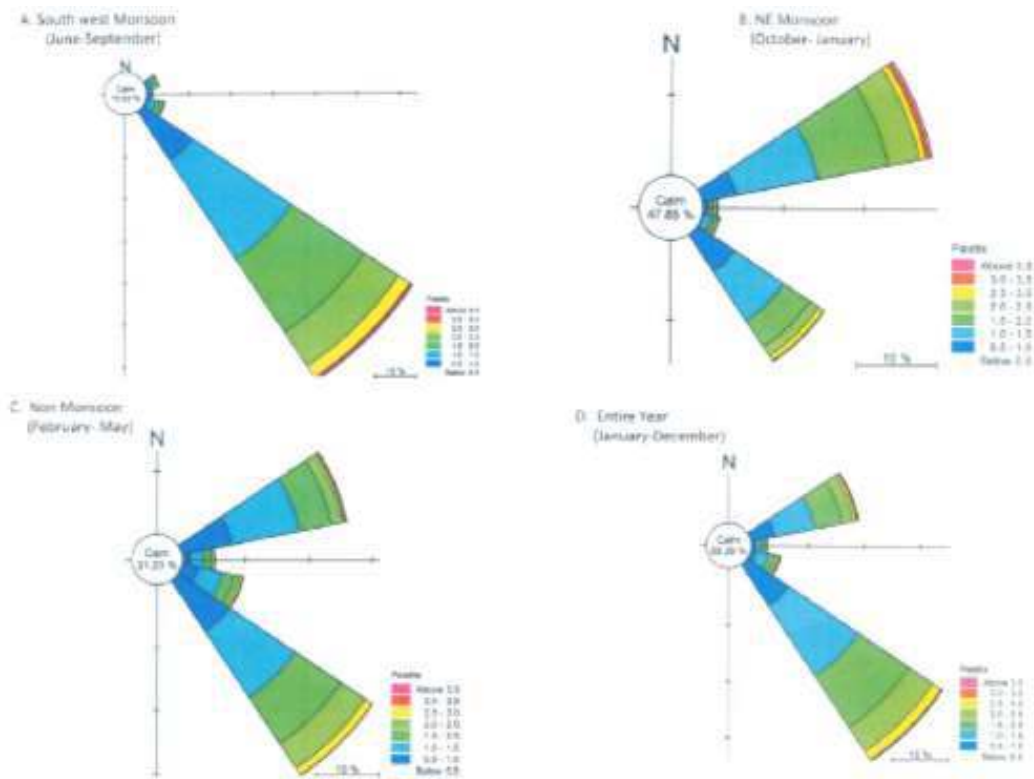
Fig. 8.13. Change in bed level



Coordinates of disposal location

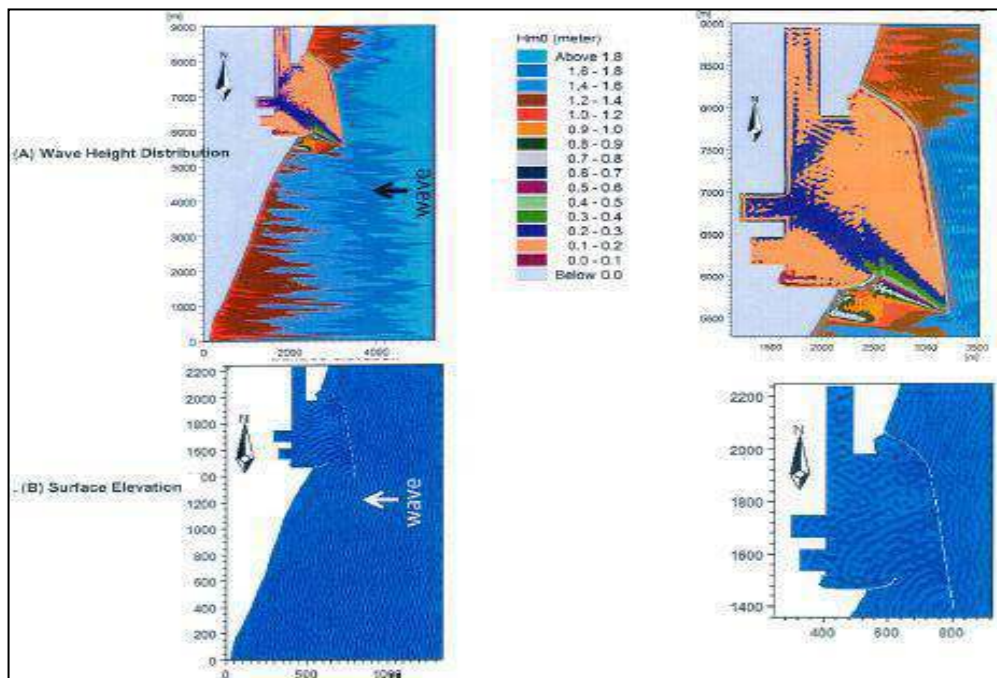
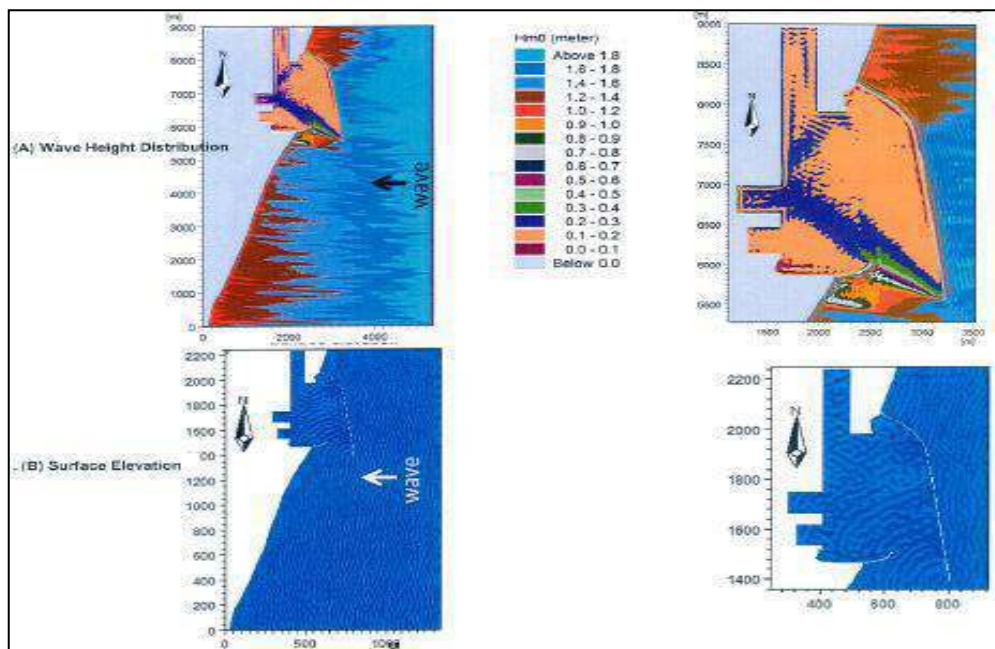
Sl.No	Spheroid: WGS 84		Volume of disposal (m ³)
	UTM – X (m)	UTM – Y (m)	
1	433761.1	1462879.5	30 x10 ⁶
2	433783.0	1464886.1	30 x10 ⁶
3	435782.6	1462872.3	30 x10 ⁶
4	433804.9	1466878.0	30 x10 ⁶
5	435789.7	1464864.2	30 x10 ⁶
6	437774.9	1462865.2	30 x10 ⁶
7	433799.2	1468870.0	30 x10 ⁶
8	435796.8	1466872.9	30 x10 ⁶
9	437781.7	1464871.9	30 x10 ⁶
10	439781.1	1462843.2	30 x10 ⁶
11	435803.9	1468862.9	30 x10 ⁶
12	437788.8	1466863.8	30 x10 ⁶
13	439788.4	1464864.7	30 x10 ⁶
14	437781.1	1468855.8	30 x10 ⁶
15	439795.5	1466856.6	30 x10 ⁶
16	439802.6	1468848.6	30 x10 ⁶

Fig. 8.14. Proposed configuration for dredge spoil disposal



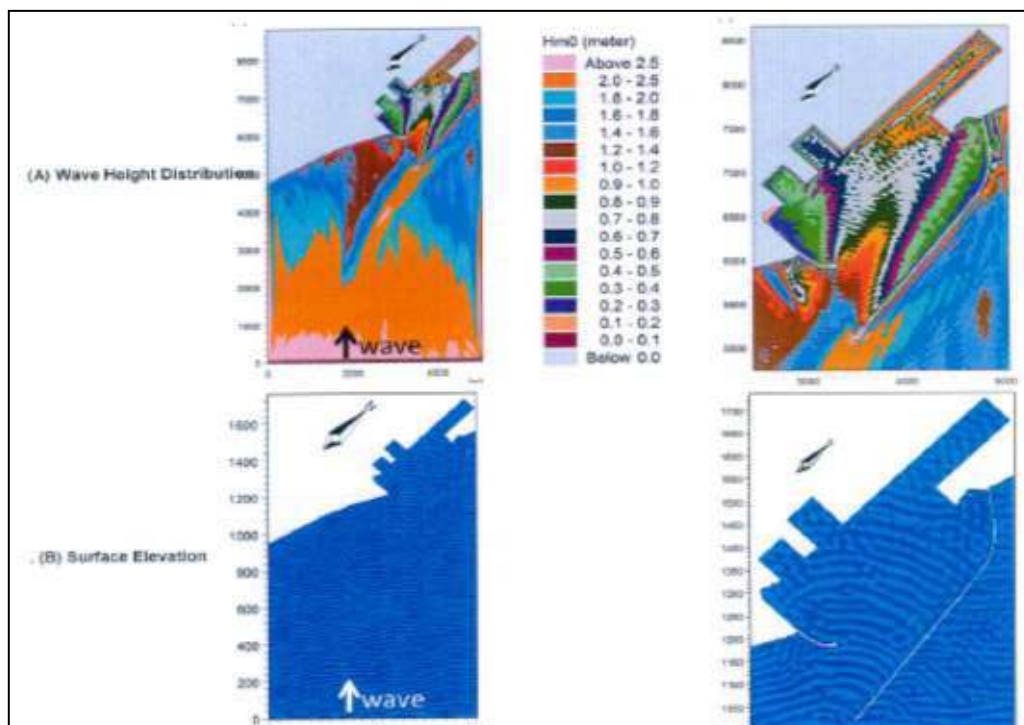
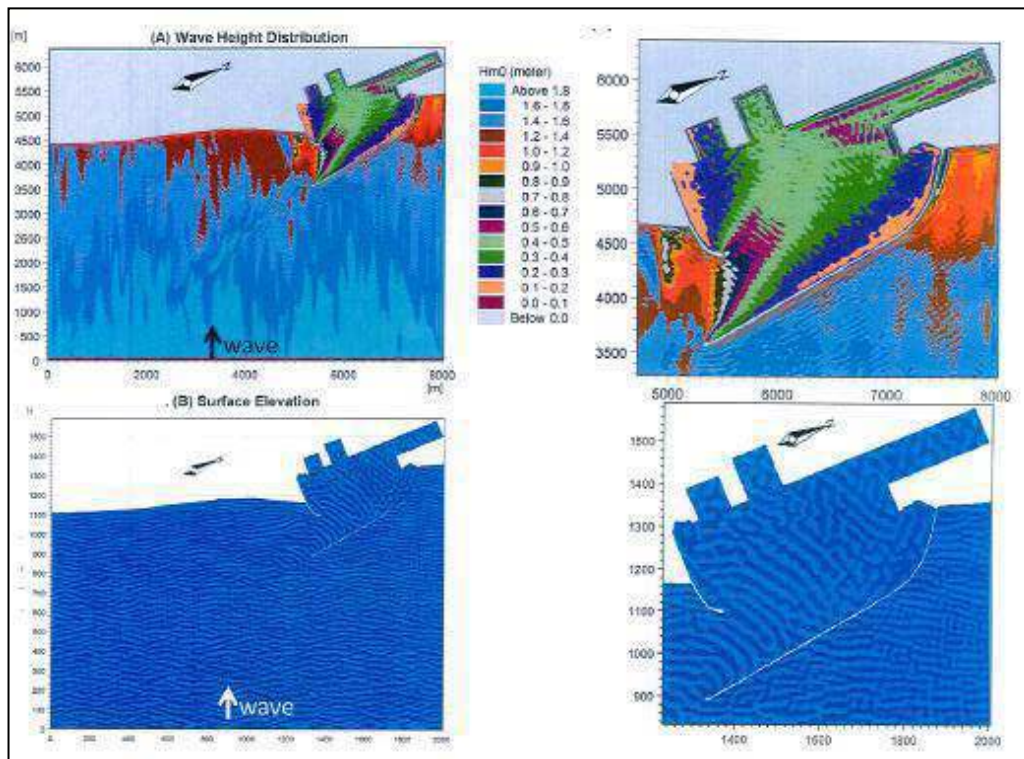
(Source: Mathematical model studies for assessment of wave tranquility inside the port basin at Kamarajar Port, Tamil Nadu, CWPRS, 2016)

Fig.8.15. Near Shore wave Rose Diagrams



(Source: Mathematical model studies for assessment of wave tranquility inside the port basin at Kamarajar Port, Tamil Nadu, CWPRS, 2016)

Fig.8.16 & 8.17. Wave Height Distribution and Surface Elevation for Waves from 67.5° and from 90°



(Source: Mathematical model studies for assessment of wave tranquility inside the port basin at Kamarajar Port, Tamil Nadu, CWPRS, 2016)

Fig 8.18 & 8.19. Wave Height Distribution and Surface Elevation for Waves from 112.5° and from 135°

9. RIVER DRAINAGE SYSTEM & SEAWATER INTRUSION

Hydrology: Kosasthalaiyar River originates from the Shevaroy Mountains and flows through south Andhra Pradesh and north Tamil Nadu. It takes a course of 136 km long and joins the Bay of Bengal through Ennore creek mouth and Pulicat lake mouth. It is presently a seasonal river carrying a limited discharge during southwest monsoon (June - September) and large discharge during northeast monsoon (November - January). The runoff from the catchment area spread over the Shevaroy Mountain drains through Kandaleru River, Pennar River, Kosasthalaiyar River and Cooum River. More check dams are built across the Kosasthalaiyar River along the course of its flow both in Andhra Pradesh and Tamil Nadu and it discharges into the sea only the excess flood during the monsoon. Since the Kosasthalaiyar River joins the sea both at Ennore creek and Pulicat Lake, the stretch of 20 km between these two points remain brackish due to the exchange of tidal waters.

Morphology: Irrespective of the river flow at far upstream, there will be a tidal flow at tail end section, with reversing currents flowing north and south over the tidal periods. The tide enters through the Ennore creek as well as Pulicat lake simultaneously and makes a circulatory current system along its stretch, where-in the project region is located in between.

The Buckingham canal, the longest waterways running parallel to Kosasthalaiyar River gets merged close to project location. The Kosasthalaiyar River and Buckingham canal makes a large wetland on the western side of the project location. Large salt pan and tidal marshes are present in the region acting as a water reservoir to hold the seawater during spring tide and flood water during heavy rain. The entrapped elevated coastal segment of about 20 km length and 2 km width located between the Bay of Bengal and Kosasthalaiyar River/ Buckingham Canal has been developed as an Industrial belt by Tamil Nadu Government. The various industries like NCTPS,

L&T Shipbuilding yard, Chennai Metro Water Desalination plant and Ennore port are located patch of the land.

Flood: In case of heavy rain in this region, the flood water received in Kosasthalaiyar River will be drained into the sea partly through Ennore creek and partly into Pulicat Lake. Only the rest of the flood water after discharging through the Ennore creek, flows along this segment towards the Pulicat lake. Therefore, the segment of Kosasthalaiyar River and the Buckingham Canal running by the side of Ennore port plays a limited role in receiving the flood and discharging into sea.

The hydraulic section of Buckingham canal is almost destroyed between Kakinada and Puducherry. The Government has taken the necessary action to revive the flow and navigation. Presently, the hydraulic/tidal flow along the Buckingham canal particularly close to the project is very insignificant. Therefore in case of any excess rain in the vicinity of Chennai, like the one happened in November – December, 2015. the existing cross section of Kosasthalaiyar and Buckingham canal plays a limited role in discharging large flood into the sea. Normally, the flood water gets stored up into the large low lying land/tidal flats and keeps slowly discharging the storm water into the sea over a period. This is the nature of hydraulic regime existing in this region due to the presence of Kosasthalaiyar River and Buckingham Canal. The hydraulic section of Buckingham canal, Kosasthalaiyar River and Ennore creek is shown in Fig. 9.1.

The proposed phase III development of port and the addition of berths is strictly confined within the port premises and it will not obstruct the existing hydraulic regime of the Kosasthalaiyar River and Buckingham canal. In addition, KPL has proposed to deepen the Kosasthalaiyar River and improve the hydraulic section, to enhance the tidal flow and inturn the flood flow during monsoon an in order to maintain good circulation in the riverine system around the project region.

Seawater intrusion: The land mass of 20 km long and 2 km wide is located between Ennore creek and Pulicat; with the Bay of Bengal in the east and Kosasthalaiyar River/ Buckingham canal with large brackish/ marshy land in the west. The entire marshy land remains as a Paleo coastal marine system influenced by brackish water due to the influence of excursion of tides and intrusion of seawater. Although the surface water remains fresh, the aquifer at deeper level remains as saline due to the influence of Bay of Bengal on the east and brackish water of Kosasthalaiyar River/ Buckingham Canal on the west. Further the development of Phase III berths are closer to the shore front by dredging a berthing basin within 500 m from the HTL as a continuation of existing berths. The development of such port basin will not cause problems like sea intrusion into the existing condition of the aquifers. The pattern of Groundwater table is shown in Fig. 9.2.



FIG. 9.1. HYDRAULIC SECTION OF BUCKINGHAM CANAL, KOSASTHALAYAR RIVER AND ENNORE CREEK

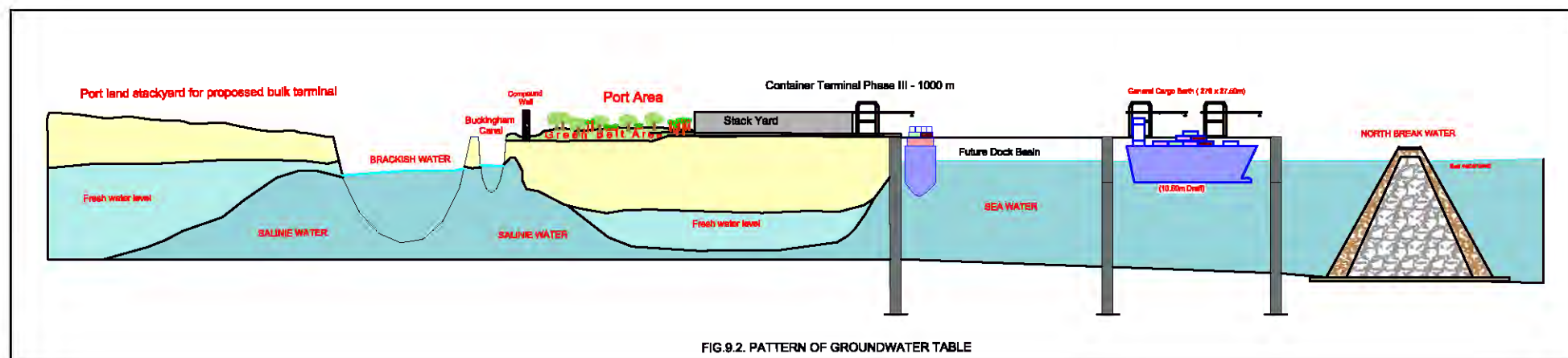


FIG.9.2. PATTERN OF GROUNDWATER TABLE

10. CUMULATIVE IMPACT ASSESSMENT

10.1. Introduction

Kamarajar Port Limited is operating at present, with six berths for handling coal, export/import of automobiles, Marine Liquid Terminal (MLT) etc. As Phase II development, six more berths for handling containers (two berths), LNG (one berth), coal (two berths) and multipurpose cargo (one berth) are under construction. The Phase III expansion contemplates creation of ten berths comprising two Automobile berths, three container berths, two Marine liquid terminals (including IOC captive jetty), two Bulk cargo terminals and one Multi cargo berth. There are various other industries located in the vicinity of 10 km radius from the Kamarajar Port. The cumulative impact assessment study has been carried out for the combined scenario of KPL phase III activities and the other facilities established by different industries in 10 km radius.

10.2. Presence of industries in 10 km radius

The proposed marine facilities by KPL under phase III will comprise automobile berths, container berths, marine liquid terminals, bulk cargo terminals and multi cargo berth. The location of Kamarajar port and other industries falling within 10 km radius are shown in Fig. 10.1. The details of these industries with respective to the marine facilities and amenity to KPL are listed below.

Table 10.1. Industries in 10 km radius of KPL

Sl. No.	Industry	Distance from KPL (km)	Facilities
i	North Chennai Thermal Power Station (NCTPS)	1.3	Coal-fired power station.
ii	L&T Ship Building Yard	4.0	Shipyards complex, Container Port and

Sl. No.	Industry	Distance from KPL (km)	Facilities
			Modular Fabrication Facility.
iii	NTECL- NTPC-Tamil Nadu Energy Company Limited-Vallur Thermal Power Plant	4.9	Coal based power plant
iv	Chennai Water Desalination Plant (CWDL)	5.6	Desalination plant
v	Ashok Leyland	5.8	Automobiles
vi	Ennore Thermal Power Station (ETPS)	7.5	Coal based power plant

North Chennai Thermal Power Station (NCTPS): It is a 1830 MW coal-fired power plant which is owned and operated by the Tamil Nadu Generation and Distribution Corporation (TANGEDCO). It is located immediately on the northern side of the port around 1.3 km from the proposed wharf. The power station comprises three 210 megawatt coal-fired units which were commissioned between 1994 and 1996, followed by another two 600 MW units commissioned in 2013. Coal for the power station is supplied from Mahanadhi Coalfields Limited (Talchar & IB Valley) in Odisha and Eastern Coalfields Limited at Ranikanj in West Bengal. The remainder part of the coal is "mainly" imported from Indonesia.

TANGEDCO consumes approximately 16 million tonnes of coal per year for the generation of defined capacity of power. The coal transported through the ports namely Haldia, Paradip and Vizag are discharged at Ennore Port and Tuticorin Port. The coal unloaded at KPL is transported directly to NCTPS by conveyer belt. As such, there is no stockyard inside the KPL/Ennore.

The berth numbers CB1 and CB2 which are developed during the phase I development are exclusively used to unload coal for NCTPS. Similarly berth numbers CB3 and CB4 which are being developed during the phase II development will be used to unload coal for NCTPS/ NTECL.

Phase III development which are being developed for bulk cargo/ coal will be used for NCTPS/Non TNEB coal.

At present, 16 MT volume of coal is being handled at KPL for NCTPS and it will be increased to 18 MT volume after the completion of Phase II development.

KPL is a green port. Therefore, there is no Air and noise pollution reported while handling of coal from NCTPS. The periodic observations carried out in KPL vicinity of 10 km radius conformed that there is no significant air and noise pollution due to the operation of NCTPS.

L&T Ship building yard: The shipyard is located at Kattupalli village, about 4 km north of KPL. The shipyard complex also includes a container port and Modular Fabrication Facility. The shipyard is equipped with a large stockyard, a state-of-the-art yard with automatic blasting and priming line, plasma cutting machine and advanced hydraulic press/forming machines and large assembly workshops with heavy material handling facility. The yard's build strategy maximizes pre-outfitting at the block level. Marine coating shops and pipe shops are designed to handle the complete load of the yard. A dedicated machine shop and electrical shop are available for Ship Repairs, Refits and Conversion activities.

L&T has two breakwaters at northern side and southern side. The length of the northern breakwater is approximately 1070 m and southern breakwater is 1060 m. The approach channel is approximately 1415 m long and 200 m wide and it will be dredged to a depth of (-) 16.7 m CD.

The type of operation in L&T shipping yard does not cause pollution on air, noise and water. The dredging material is disposed at designated offshore location identified by scientific study. Therefore the activities of L&T shipyard will not have any influence on the operation of KPL.

Chennai Water Desalination Plant (CWDL): It is a reverse osmosis technology water desalination plant located at Minjur, a northern suburb of Chennai. The seawater is drawn in the Bay of Bengal and the product water is supplied to the city of Chennai. The plant is located at around 5.6 km north of KPL. It is built on a 60-acre site and the largest desalination plant in India. Water from the plant is also used for industrial purposes like Ennore Port, NCTPS and other industries located in the vicinity. However, during droughts it serves as a key water supply facility for the Chennai city.

The CWDL intake is designed to draw seawater having ambient salinity of around 35 PSU at the rate of 9875 m³/hour (237 MLD) through an intake system. The intake head will be located at 9 m water depth at a distance of 570 m from the shore. The brine rejects is of the order of 5710 m³/hour (137 MLD) with a salinity of 70 PSU which will be released into the sea through a multi port diffuser located at 9 m water depth, at a distance of 650 m into the sea.

The discharged volume of seawater back into sea undergoes high dilution and reaches the ambient value which does not cause any impacts on marine environment. Also it will not cause any pollution on the Air and Noise environment.

NTECL- Vallur Thermal Power Plant: Vallur Thermal Power Station is located at Ashipattu Pudunagar village, about 4.9 km from KPL. The power plant is called NTPC-Tamil Nadu Energy Company Limited, a joint venture between NTPC Limited and TANGEDCO and has three units with 500 MW each. Tamil Nadu is the major beneficiary of power generated from this facility (about 750 MW), while the rest is supplied to Andhra Pradesh, Karnataka, Kerala, and Puducherry. Coal for the power plant is brought from Odisha/ imported through ships to Kamarajar Port, from where it is transported by conveyor belt to reach the plant. Periodic observation carried out by the KPL in the vicinity of 10 km radius also confirmed that there is no significant impact on air and noise pollution due to the operation of NTPC-Tamil Nadu Energy Company Limited.

Ashok Leyland: Ashok Leyland is a leading Truck manufacturing company which is located 5.8 km south of KPL. It is the second largest commercial vehicle company in India in the medium and heavy commercial vehicle (M&HCV) segment. The company claims to carry more than 60 million passengers a day, more people than the entire Indian rail network. In the trucks segment Ashok Leyland primarily concentrates on the 16 ton to 25 ton range of trucks. However Ashok Leyland has presence in the entire truck range starting from 7.5 tons to 49 tons. With a joint venture with Nissan Motors of Japan, the company made its presence in the Light Commercial Vehicle (LCV) segment (<7.5 tons).

Study shows that there is no impact on the air and water environment due to the operational activity carried out by Ashok Leyland.

Ennore Thermal Power Station: The Ennore Thermal Power Station is a coal based power plant located in Tamil Nadu. It is located 7.5 km away from KPL. It is one of the four major thermal power plants of Tamil Nadu established by TANGEDCO. Presently it has an installed capacity of 450 MW (600,000 hp). The necessary coal arrives through ship to the Ennore Port. However, the construction of the 1,000 MW plants in the premise began in the year 2007. The Station presently consists of two 60-MW and three 110-MW units. A 500-MW coal-based unit was proposed, and its development started in the month of November 2007.

Periodic observation was carried out in the KPL vicinity of 10 km radius and conformed that there is no significant impact on the air and noise environment due to the operation of NCTPS. However, the plant ETPS has closed its operation as per the Government notification in November 2016.

10.3. Cumulative impact on Air quality

The Ambient Air quality study was carried out around the study area at five locations. The sampling location has been selected based on industrial emissions and vehicular emission. Four monitoring locations were covered residential area and one location is covered the port area. The study shows that there is no adverse impact on the air quality standards.

10.4. Cumulative impact on Noise

The study on noise level was carried out at five locations. The average 24 hourly noise levels at all the five locations were within the limits of the ambient air quality with respect to Noise Level standard, 2000. And also Ambient noise monitoring was measured at seven representative locations during pre and post monsoon. The values of noise level at all seven locations were within the ambient noise level.

10.5. Cumulative impact on water quality

The dumping ground for dredge disposal from kamarajar port is chosen nearly 5 to 10 km offshore at varying depth from 25 to 50 m CD water depth and it will not cause any change in the nearshore water quality as the dredged sediments are dumped offshore.

Chennai Water Desalination Plant is taking seawater and discharges it into offshore which will not therefore affect the nearshore regime. Adjacent to that, North Chennai Thermal Power Station discharges warm water effluents into the sea through marine outfall at a farther distance without harming the water quality in the nearshore region.

As all the discharges/disposal from the respective local industries is localized within their permissible limit, they do not alter the quality of nearby coastal waters. Hence, the cumulative impact due to the development of the proposed facilities and the surrounding industries is quite insignificant.

Moreover, the dredged material have been analyzed for heavy metals, petroleum hydrocarbons, oil and grease and phenol and they were found to be in traces and will not alter the chemistry of water at the disposal site significantly. Although the construction of berths causes temporary impact during construction stage, they will not alter the water quality on long run during the operational stage. Hence it is concluded that the various discharges/disposal being released from different industries will not have any cumulative impact on the coastal waters off Ennore.

10.6. Cumulative impact of dredge disposal

The dumping ground for dredge disposal from KPL is located at offshore at the designated place determined through model studies. The major dredging quantity will be disposed into the sea at a suitable location. A part of the dredged sediments is used for reclamation of the port area. Also the dredged sediment is utilized for reclaiming the land associated with Northern Rail Connectivity projects and other projects based on requirement.

L&T ship building yard is disposing the dredge material at a designated location offshore and partly using it for shore stabilization.

ETPS is carrying out the dredging at Ennore creek in order to maintain the tidal regime. The dredge sediment is used for beach nourishment and stabilization of the beach on the southern side of the Ennore creek.

Hence the dredge disposal at these offshore locations will not have any significant impact on the land and marine environment.

10.7. Cumulative impact on fisheries

Most of the commercial fishing is done at depths beyond 20 m at more than 5 km offshore. The establishment of port activities is within 2 km from the shore and hence it will not have any impact on the fishing activity. All the port projects will comply with various national and international regulations. The chances of polluting the nearshore are very limited and therefore there will not be any impact on the local fisheries.

10.8. DISCUSSIONS AND CONCLUSIONS

The cumulative impact assessment carried out in 10 km radius around the proposed phase III development of KPL shows that the levels of different parameters as assessed are well within the stipulated values of TN Pollution Control Board. The proposed facilities by KPL will not alter the existing land and marine environmental status.



FIG.10.1. SURROUNDING INDUSTRIAL AREA NEAR KAMARAJAR PORT- 10 km RADIUS

11. IMPACT ASSESSMENT AND MITIGATION MEASURES

Before going in depth concerning assessment of impact and the matching mitigation measures that would be put in place, a brief account of the ground realities will help appreciation of the issue in its entirety.

The proposed Phase III facilities comprise:

Container terminal	3
Liquid bulk terminals	2
Drybulk terminals	2
Automobile export/import terminals	2
Multipurpose cargo terminal	1
Dredging	33 x 10 ⁶ m ³

Under Phase I, 3-coal berths (dry bulk), 1-iron ore berth (drybulk), and 1-General cargo/Automobile export/import, 1 Marine liquid terminal-in all six berths including dredging were completed in stages and are functioning now. The Phase II facilities comprising 2-container berths, 1-LNG terminal, 2-coal berths and 1-General cargo berth are under construction and will be constructed by 2016-17. As stated in many contexts and as brought out at the MoEF&CC meeting held in November 2015 while seeking TOR for the Phase III facilities, it is reiterated now also that the proposed facilities are expansion of the existing facilities for the same type of cargo except that the volume will increase by 60 MTPA from the approved level of 82 MTPA under Phase I and II put together.

In other words, the type of cargo will be the same and so there will be no need for prediction of new impacts. What is necessary will be the augmentation of the existing mitigation measures commensurate with the increased volumes of cargo. However, for completeness of the exercise, discussion is included on all the vital parameters both during construction and operational phases.

Baseline status of Land, Air, water, Noise and Marine environment

In Chapter 6, the baseline status of various vital parameters pertaining to Land, Air, Water and Marine environment has been briefly discussed based on post monitoring field measurements for three seasons for all parameters except air quality-which has been done for three seasons viz. pre monsoon, post-monsoon and Fair weather period. The results reveal that the present level of impact inducted to various parameters is well within the permissible limits and norms prescribed by various authorities. The system appears to have sufficient cushion to absorb the impact arising out of the proposed additional volume of 60 MTPA.

11.1. Terrestrial Environment - Construction phase

11.1.1. Air Environment

Potential Impact

- Fugitive dust emission and dust generation from concrete mixing, cement handling, welding and operations of construction machinery.
- Generation of dust from handling and transportation of fine & coarse gravel in uncovered trucks.
- Dust emission due to transportation of construction materials in unpaved roads.
- Emission of air pollutants like CO, SO₂, NO_x from vehicles, heavy machineries and DG sets.

Mitigation Measures

- Methods for controlling dust emission are water sprinkling in the construction site, use of proper transport methods, such as a conveyor belt, for excavated material and screens around the construction site will be carried out.

- Trucks hauling dirt, rock or other granular or particulate material to construction site should have their loads limited, trimmed, or wetted and covered to prevent material from being spilled / scattered or wind blown over public streets.
- Fugitive dust emissions will be controlled by application of water sprinkling on unpaved roads.
- Engines and exhaust systems of all vehicle and equipment will be maintained so that exhaust emissions do not reach statutory limits.
- All the labours/employees working in and around dust generating area will compulsorily wear Personal Protective Equipments like dust masks and safety goggles to avoid respiratory ailments and eye irritation, respectively.
- Only the vehicles that conform to emission norms (air/noise) of CPCB and that has valid Pollution under Control (PUC) certificates will be used.
- Appropriate plantation in open areas and road side will be carried out to minimize air pollution.
- The security gate personnel will be instructed to check every truck carrying dust generating material to ensure above protection measures.

11.1.2. Land Environment

Potential Impact

- Disposal of construction debris and other wastes from construction activities.
- Soil contamination may take place due to movement of vehicles and solid waste generated from the labour camp setup during pre-construction phase stage.
- Storing and transporting of building materials during the construction phase of the project activity would imply change over the land use pattern.
- Disposing of unused materials in the construction stage may have an impact on the land environment.
- Movement of heavy load trucks will cause impact.

Mitigation Measures

- Disposal of construction debris and other wastes from construction activities could be offset by including them in land reclamation.
- All waste generated at the construction site and at the labour camp will be collected and disposed off in an appropriate manner in a dump site or recycled or reused wherever possible.
- The stockpiles, construction camps etc. during construction period will be located to the extent possible on land, which are devoid of vegetation.
- Any kind of material resulting from clearing and grading will not be deposited near the approach roads, streams and any other position which may obstruct the passage, therefore no change is anticipated on the land use due to and /or natural water drainage.
- Rather than disposing the unused construction debris, it can be used in other development activities.
- Movements of vehicles have to be regulated only over the pavement road.
- Appropriate plantation in open areas and road side will be carried out for soil cover protection.

11.1.3. Water Environment

Potential Impact

- Construction work in water would cause re-suspension of sediment and turbid water. Re-suspension of sediments in water leads to an increase in the level of suspended solid.
- Disposal of dredged material if any on land may possibly cause leakage of unwanted substances.
- Usage of more water will lead to generation of sewage.
- The water oozed out of the construction areas may find way to contaminate the ground water.

Mitigation Measures

- Adopt effective sediment control measures before starting work to prevent the entry or re-suspension of sediment in the water body.
- No ground water will be extracted during the construction phase.
- Appropriate sanitation facilities to be provided at the construction site for the proper collection and disposal of sewage.
- Existing natural drainage channel in the port area shall be protected and maintained.

11.1.4. Noise

Potential Impact

- The major noise generating sources will be DG sets, crusher excavators, crane, blasting, concrete mixer / dredgers etc.
- Noise generated from construction activities will be predominantly confined within port site and it will impact construction workers at site.
- Movement of vehicles and operation of heavy machineries might generate in noise and vibration.
- Dredging activity will result in noise generation, which will be for short term only.
- Noise and vibration will be generated from the generator sets also.
- Construction activities will also result in increase in noise level and activities like hammering, operation of heavy machineries will generate vibration, which might affect the user/operator.

Mitigation Measures

- During construction, noise level will be maintained below threshold levels stipulated by Central Pollution Control Board (CPCB) by selecting appropriate equipment, machinery and using enclosures.

- Noise could be considerably reduced by adoption of low noise equipment or installation of sound insulation fences.
- Only well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used. Any equipment emitting high noise, wherever possible, is oriented so that the noise is directed away from sensitive receptors.
- Plants are good barrier of noise. Adequate plantation will be done in the port premises.
- High noise generating activities such as piling and drilling will be scheduled to minimize noise impacts.
- Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. especially construction personnel involved in pile driving operations. Rotation of personnel is also being adopted.
- Periodic maintenance will be carried out for the equipments used in the developmental works.
- Overall, the impact of generated noise on the environment is likely to be insignificant, reversible and localized in nature and mainly confined to the day hours as sufficient noise control measures would be undertaken.
- Appropriate plantation in open areas and road side will be carried out to reduce noise pollution.

11.1.5. Socio-Economic Environment

Potential Impact

- Increase in movement of heavy vehicles and trucks may severely affect the normal life of local people.
- Dust emission from the vehicles carrying cargoes might affect the local population.

Mitigation measures

- Land for the project is located in existing port premises and involves no rehabilitation and resettlement. No staff colony will be established, and hence there will be no significant changes in socio-economic aspects.
- General growth in commercial activities will take place in the project area.
- Preference will be given to local labours while selecting labours during construction phase which will have a positive impact.
- Only the vehicles that conform to emission norms (air/noise) of CPCB and have valid Pollution under Control (PUC) certificates will be used.
- Fugitive dust emissions will be controlled by application of water sprinkling on unpaved roads.

11.1.6. Occupational Health and Safety

Potential Impact

- Generation of dust during construction and dredging activity might lead to respiratory ailments in labours/ workers.
- Noise generated during the construction activities, operation of DG sets might lead to auditory ailments.

Mitigation Measures

- Workers will be strictly enforced to wear personal protective equipments like dust mask, ear muffs or ear plugs, whenever and wherever necessary/ required.

11.1.7. Biological Environment (Coastal and Marine Ecology)

Potential Impact

- Construction activities may disturb marine fishes and bottom benthic animals.

- Dredging causes migration of bottom biota and dumping of dredged material covers bottom habitat, both of which may reduce fishery resources.
- During site clearance, the existing trees and shrubs will be removed.

Mitigation Measures

- Controlled method of dredging using appropriate bucket/cutter suction dredgers may be carried out confined to only port area in order to minimize destruction on sub-tidal benthic community.
- The net enclosures (silt screens) with booms should be placed around the dredging area in order to control the spread of the turbid plume. Regular monitoring of the turbidity and sediment concentration may be carried by water sampling and OCM satellite imageries.
- Green belt development can be carried out to compensate the loss of vegetation during site clearance.

11.2. Terrestrial Environment- Operation phase

11.2.1. Air Environment

Potential Impact

- The number of heavy duty trucks carrying cargoes will increase which in turn will lead to increase in emission of air pollutants like CO, SO₂, NO_x.
- Loading, unloading and transportation of cargoes will result in dust generation.
- Increase in emission of PM₁₀ and PM_{2.5} due to storage and handling of containers, dry bulk cargoes and general cargo.
- Respiratory ailments to workers handling the above cargo.

Mitigation Measures

- Only the vehicles that conform to emission norms (air/noise) of CPCB and have valid Pollution under Control (PUC) certificates will be used.

- To mitigate adverse impacts due to fugitive emissions, storage area of the cargo will be developed with plantation as appropriate.
- Bulk material should be transported in closed trucks to avoid wind entrainment.
- On-site vehicle speeds are controlled to reduce excessive dust suspension in air and dispersion by traffic and transport vehicles are periodically washed to remove accumulated dirt.
- Ambient air quality monitoring stations were already installed at five sampling locations within the proposed project area and further sampling locations may be increased as per requirements and hence continuously monitored to establish ambient air quality data base.
- Diesel generator and vehicles to be serviced and maintained regularly to avoid generation of air pollutants.
- Bulk cargoes like coal will be transported through elevated closed conveyor system to avoid coal dust generation while transportation of the same.
- Workers handling drybulk will compulsorily wear Personal Protective Equipments like dust masks and safety goggles to avoid respiratory ailments and eye irritation, respectively.

11.2.2. Land Environment

Potential Impact

- Additional domestic waste and ship waste will be generated from the proposed facilities which can have impact on the land environment.
- Compaction of soil due to movement of vehicles.
- Once the proposed berths are commenced, the cargo handling would occupy larger area to store the automobiles which are to be imported or exported.
- The container berths would occupy more space than the usual because of loading, unloading and transportation.

- The imported coal will then be transported to the stack yard using a conveyor belt to the land which will later get accumulated to store coal.

Mitigation Measures

- Bio-degradable waste can be used as manure in greenbelt.
- Ship generated waste and other wastes such as metal scrap can be recycled and sold to authorized agencies.
- Proper sanitation facilities and bins will be provided in the port area for collection of sewage/solid waste.
- Movement of vehicles to be restricted to paved road only.
- In order to increase the soil stability Bio-shield can be developed.
- Operational activities will comprise construction of buildings, laying of roads, electricity and water line and other such structures that are normally associated with port development project. Therefore no change is anticipated on the land use due to such activities in the study area.

11.2.3. Water Environment

Potential Impact

- Possible discharges from ships that could be sources of water pollution are bilge water, ball ash water oily wastes, sewage, garbage and other residues in a ship.
- Spill of oils, lubricants and fuel may be the other sources of water pollution.
- Water requirements -Labour population during operation phase: $15 \text{ lpcd} \times 150 = 2.25 \text{ m}^3/\text{day}$ which leads to increase in pressure on the local water demand.

Mitigation Measures

- Bilge water from the vessel will not be directly released into the surrounding environment. Instead, a holding tank will be installed to retain

any bilge water on board unit. It will be pumped into a waste barge and which will be periodically cleaned.

- Monitoring of salinity concentration will be undertaken as part of the regular water quality and biodiversity monitoring programs.
- The proposed projects are planned in phased manner and therefore maximum water requirement at a time will be less than the 1000 KLD. Arrangements are being made for the supply of water with Chennai Metro (CMWSSB) at a quantity of 1000 KLD and this can be suitably increased depending upon the need.
- No extraction of ground water will be permitted.
- A proper storm water drainage system with pre treatment for removal of coal dust will be installed, prior to its discharge into rain water harvesting system.

11.2.4. Noise

Potential Impact

- The cumulative noise levels due to the combined operation of loading/unloading of bulk cargoes, transportation of automobiles, operation of heavy machineries and generators will result in generation of noise.

Mitigation Measures

- For the high noise generating equipment/zones, proper acoustic barriers/enclosures/ shelters shall be provided.
- Latest equipments will be used for loading/unloading of bulk cargoes and will be maintained periodically.
- Diesel generator set will be kept in acoustic enclosure to contain noise. Diesel generator will be used only during power failure.
- Employees working in noisy environment will be made to wear ear muffs/ear plugs to avoid any adverse impact of noise on them.
- Only vehicles with valid Pollution Under Control (PUC) certificate from CPCB authorized testing center will be used for transportation purpose.

- Personnel exposed to noise levels beyond threshold limits are provided with protective gear like earplugs, muffs, etc.
- Periodic maintenance of the equipment to be used in the developmental works will be carried out. Worn out parts will be replaced and rotating parts are lubricated to minimize noise emissions.

11.2.5. Socio-Economic Environment

Potential Impact

- As the proposed projects are located within the port area and as the nearest habitation is located about 2-3 km (South) from the port boundary separated by Ennore Creek and NCTPS, No significant adverse impact is envisaged due to proposed project.
- Similar to the construction phase, employment generation will be a positive impact in the operation phase as well.

11.2.6. Occupational Health and Safety

Potential Impact

- Generation of dust during handling and storage of cargoes like coal will lead to respiratory ailments. Fire hazard due to coal handling and storage.

Mitigation Measures

- Workers will be strictly enforced to wear personal protective equipment like dust mask and safety goggles.
- Safety training will be given to all workers exposed to fire hazards and mock drills will be conducted regularly.
- Display of visible signage's at places of fire hazard.

11.2.7. Biological Environment (Coastal and Marine Ecology)

Potential Impact

- Water pollution and bottom contamination resulting from these effluents lead to deterioration of aquatic biota and fishery resources.
- Storage of cargoes in stock yard might result in dust generation, which will increase the particulate matter concentration in the nearby areas, which might affect the flora and fauna in the area adjacent to port.
- Similar to capital dredging, maintenance dredging might also lead to migration of marine faunal species to other areas. As the proposed project site is within the breakwater sheltered area, significant major impact on the aquatic organism is not envisaged.

Mitigation Measures

- Periodic monitoring of marine water quality and appropriate measures will be taken if there is any degradation in marine water quality.
- Green belt development will be carried out in the port area to contain dust generation and to enhance the aesthetics of the area.
- Silt curtains will be used during maintenance dredging in marine area to contain the spread sediments, which might cause disturbance to marine faunal species.

11.3. Marine Environment

11.3.1. Prediction of impacts

While the identification of the impacts provides the status of anticipated impact on the environment, the prediction of impact will give the extent to which these conditions can alter the environment. Based on the prediction, mitigation measures can be evaluated to minimize the impact on the environment. The activities which need the prediction of impacts are:

- i) Construction of berths,
- ii) Dredging,
- iii) Disposal of dredge spoil,
- iv) Impacts on shoreline
- v) Oil spill,
- vi) Storms, Tsunami and other man made hazards
- vii) Kosathalaiyar River
- viii) Ground water
- ix) Ecologically sensitive areas and Critically polluted area

i) Construction of berths

Temporary impact on fishing activities

During the construction of berth, the bottom living communities like intertidal and sub-tidal benthos present in berth region will get temporarily disturbed due to increased turbidity in the water quality and inturn affect the fishes during the construction period. Once the construction is over, the system will slowly return to its normal status.

Potential impacts on water quality: Pile driving, deposition of rubble, dredging, sand compaction and other construction work in water cause re-suspension of sediments and turbid water. Re-suspension of sediments in water leads to an increase in the level of suspended solids and in the concentration of organic matter, possibly to toxic or harmful levels.

It also reduces sunlight penetration. Work vessels are a possible cause of oil spills, garbage discharge, and leakage of other substances into water. Diffusion from concrete work in water and overflows from landfills may be possible sources of water pollution.

Potential impacts on bottom contamination: Construction work and dredging disturb bottom sediments and induce re-suspension, dispersal and settlement of such sediments. Dumping of dredged material directly alters bottom configuration and biota and may disperse toxic or harmful chemicals around the disposal site. Dredging removes bottom habitat and may lead to a loss of fishery resources.

Potential impacts on marine/coastal ecology: Disturbance from construction activities may cause displacement of fishery resources and other mobile bottom biota. Dredging removes bottom biota and dumping of dredged material covers bottom habitat, both of which may reduce fishery resources. Settlement of resuspended sediments on fragile marine fauna and flora damages the ecosystem particularly coral reefs, which are formed by the extracellular product of symbiotic plants. The organisms attached to submerged structures need dissolved oxygen for respiration and the plants need sunlight for photosynthesis.

Piles, concrete surfaces, rubble mounds and other similar structures in water could form new habitats, which may introduce undesirable species. If toxic substances and other contaminants are re-suspended through dredging or dumping, they may lead to contamination of fishery and shellfishery resources.

Noise and vibration: One of the major impacts of pile driving on the marine organisms especially on fishes is the underwater sound pressure waves generated during hammering of the piles. Studies conducted elsewhere (even though limited) clearly indicate that pile driving causes a condition known as "barotraumas" (pathologies associated with exposure to drastic changes in pressure) in fish and mammals in the sea. These include hemorrhage and rupture of internal organs, including the swim bladder and kidneys in fish. Death can be instantaneous, occur within minutes after exposure or occur several days later. Bubble expansion in blood vessels can cause hemorrhage. Fish can also die when exposed to lower sound pressure levels if exposed for longer periods of time (eg. 50-56% for gouramis

(Trichogaster sp.) when exposed to continuous sounds at 192 dB (re: 1 u Pa) at 400 Hz and 198 dB at 150 Hz. These sounds can also result in acoustic “stunning” a potentially lethal effect resulting in a physiological shutdown of body functions. Loud sounds (300–4000 Hz at 142 dB) can have detrimental effects on fish by causing stress, increasing risk of mortality by reducing predator avoidance capability, and interfering with communication necessary for navigation and reproduction.

Pile driving may result in “agitation” of fish indicated by a change in swimming behavior. They may exhibit “startle response” to the first few strokes of the pile. The startle response is a quick burst of swimming that may be involved in avoidance of predators. A fish that exhibits a startle response is not in any way injured, but it is exhibiting behavior that suggests it perceives a stimulus indicating potential danger in its immediate environment. Fish do not exhibit a startle response every time they experience a strong hydro-acoustic stimulus. The startle response is likely to extinguish after a few pile strikes. For some species, such as Salmon, the pile driving operations may result in a disruption of normal migratory behavior.

The various factors which are known to influence the impact on fish are: (i) Size and force of hammer strike; (ii) Distance from the pile; (iii) Depth of the water around the pile; (iv) Depth of the fish in the water column; (v) Amount of air in the water; (vi) The texture of the surface of the water (size and number of waves on the water surface); (vii) Bottom substrate composition and texture; (viii) Size of the fish; (ix) Species of the fish; (x) Presence of swim bladder; (xi) Physical condition of the fish and (xii) Effectiveness of sound/pressure attenuation technology used to minimize the impacts.

ii) Dredging

The development of Phase III facilities consists of dredging of harbour basin including turning circle and approach channel. The total capital dredging is estimated

as $33 \times 10^6 \text{ m}^3$. The dredging activity would cause increase in turbidity level of the seawater at the dredging site, entrainment and removal of marine living organisms, organic matter enrichment and fish injury associated with exposure to suspended sediments and decreased dissolved oxygen and fish behavioral effects due to the effects of noise.

Turbidity: Increased turbidity can affect the filter feeding organisms, such as shellfish, through clogging and damaging feeding and breathing equipment (gills). Similarly, young fish can be damaged if suspended sediments become trapped in their gills and increased fatalities of young fish have been observed in heavily turbid water. Adult fish are likely to move away from or avoid areas of high suspended solids, such as dredging sites, unless food supplies are increased as a result of increases in organic material. Increases in turbidity results in a decrease in the depth that light is able to penetrate the water column which may affect submerged seaweeds, sea grasses and phytoplankton, the major primary producer in the coastal waters.

The degree of suspension of sediments and turbidity from dredging, either capital or maintenance, depends on four main variables:

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

Removal of Benthic animals: During all dredging operations, the removal of material from the seabed also removes the animals living on and in the sediments (benthic animals). With exception of some deep burrowing animals or mobile surface animals

that may survive a dredging event through avoidance, dredging may initially result in the complete removal of animals from the excavation site.

Where the channel or berth or turning circle has been subjected to continual maintenance dredging over many years, it is unlikely that well developed benthic communities will occur in or around the area. It is therefore unlikely that their loss as a result of regular maintenance dredging will significantly affect the marine ecology of the area. The recovery of disturbed habitats following dredging ultimately depends upon the nature of the new sediment at the dredge site, sources and types of recolonizing animals and the extent of disturbance. In soft sediment environment recovery of animal communities generally occurs relatively quickly and a more rapid recovery of communities has been observed in areas exposed to periodic disturbances, such as maintained channels.

A cursory examination of the literature indicates that the rates of recovery of benthic communities following dredging in various habitats varied greatly (from few weeks to several years). Recovery rates are generally more rapid in highly disturbed sediments that are dominated by opportunistic species compared to stable sand habitats that are dominated by long-lived components with complex biological interactions controlling community structure. In general, the studies conducted elsewhere indicate that the dredging impacts are relatively short term in areas of high sediment mobility.

Organic matter and nutrients: The release of organic rich sediments during dredging can result in the localized removal of oxygen from the surrounding water. Depending on the location and timing of the dredge this may lead to the suffocation of marine animals and plants within the localized area or may deter migratory fish or mammals from passing through. However it is important to stress that the removal of oxygen from water is only temporary, as tidal exchange would quickly replenish the

oxygen supply. Therefore, in most cases where dredging is taking place in open coastal waters this localized removal of oxygen has little, if any, effect on marine life.

The resuspension of sediments during dredging may also result in an increase in the levels of organic matter and nutrients available to marine organisms. This can result in two main effects:

- In certain cases, such as environments adapted to low nutrient conditions or sensitive to the effects of eutrophication which can simply be described as nutrient enrichment leading to the formation of algal blooms. These blooms can reduce the surrounding water quality by causing the removal of oxygen as the blooms break down or occasionally by the release of toxins which may disturb marine life.
- In other cases, increased organic material, nutrients and algal growth may provide food for zooplankton and higher organisms, thereby increasing the productivity of the marine ecosystem.

Entrainment: Entrainment occurs when organisms are trapped during uptake of sediments and water by dredging machinery. Benthic infauna are particularly vulnerable to being entrained by dredging uptake, but mobile epibenthic and demersal organisms such as burrowing shrimp, crabs and fish may also be susceptible to entrainment under some conditions.

Fish injury: Although juvenile fishes of many species thrive in the rivers and estuaries with naturally high concentration of suspended sediments, studies have shown that the size and shape of suspended sediment and the duration of exposure can be important factors in assessing risks posed.

Noise: It has been documented that underwater noise can influence fish behaviour. This is likely linked to the importance of sound to fish when they hunt for prey, avoid predators and engage in social interaction.

Changes to hydrodynamic regime: The dredging of the harbour basin will change the hydrodynamic regime and enable to modify the existing equilibrium due to waves, currents and tides. The change in the hydrodynamic parameters would disturb the stability of existing morphology within the port. The magnitude and type of effect will be related to the extent of dredging. Most reported adverse effects of dredging are associated with capital dredging operations.

iii) Disposal of dredge spoil

The physical and chemical nature of the material dredged determines the method of disposal. In general, the disposal methods include: (i) confined disposal, (ii) open-water disposal and (iii) beneficial use. It is observed that the proposed area for dredging is free from any chemical contamination or sewage pollution. When the dredged material, are disposed of at sea they will have a blanketing and smothering effect on the benthic organisms in the immediate disposal site. This blanketing or smothering of benthic animals and plants may cause stress, reduced rates of growth or reproduction and in the worst case the effects may be fatal. The sensitivity of marine animals and plants to siltation varies greatly.

- Animals with delicate feeding or breathing apparatus, such as shellfish can be intolerant to increased siltation, resulting in reduced growth or mortality.
- Some seaweed such as calcified species are reported to be sensitive to smothering due to siltation.
- In important spawning or nursery areas for fish and other animals, disposal of dredged material can result in smothering eggs and larvae.

The continued disposal of maintenance dredging at disposal sites may prevent the development of stable benthic communities and the partial or complete loss of benthic production is an adverse effect which has to be accepted within regularly used disposal sites.

With the exception of the initial smothering of benthic communities at the disposal site which is inevitable, the potential for other effects to possibly occur as a result from disposal operations will be site specific, depending on the characteristics of the dredged material and the hydrodynamic conditions at the disposal site. The finer the material, the greater the energy at the disposal site and greater is the possibility of increased suspended sediments and of far-field effects. However, these far-field effects of turbidity smothering are generally only of high concern in areas of low background levels of suspended solids. Adverse effects may occur if these dredged materials settle over communities adapted to and dependent upon clear conditions, such as sponges, corals etc.

iv) Impacts on shoreline

The shoreline in this region is subjected to moderate gross littoral drift, but relatively low annual net drift. Also the proposed phase III development is within the existing breakwater in the Port basin. This will not cause any interruption for the movement of littoral drift is explained in Chapter 8. Hence there will not be any impact on shoreline due to the proposed development.

v) Oil spill

The detailed oil spill contingency plan has already been in operation at Kamarajar Port. A separate report on *Oil spill contingency plan* is available with KPL.

During towing and berthing of the ships, owing to natural calamity or piloting errors, there can be remote possibility of mishap of one to one ship collision or ship hitting against the berth or ship getting grounded. During such events, the ship may sink/break and lead to oil spill inside the port basin or in the vicinity.

It is difficult to assess the effect of oil in the marine environment because of the large variation in sources, quantities and nature of the oil, also the physical, chemical and biological conditions of the environments involved. The majority of research relating to the effects of the oil on the marine environment relates to major oil spill events, usually from shipping accidents and groundings, the environmental effects of which are well known by all, particularly the associations with oiled birds and mammals. However, very little literature describes the effects of chronic discharges from run off or numerous small discharges of oil which are common in port and harbour areas.

Some of the potential effects of oil pollution are as follows:

- Marine animals and plants tend to be tolerant of low level concentrations of oil in sediments from chronic or small discharges, however this is not always the case.
- Prolonged exposure to major or minor oil spills can lead to mass mortality of benthic communities, fish, mammals and birds.
- Contamination of sediments with oil may modify chemical, physical and biological processes. Contaminants can be trapped in the sediments and later released as a result of disturbance such as erosion or dredging.
- In sediments, as it is organic, oil will be broken down relatively quickly by microorganisms which may result in the localized removal of oxygen from the sediments and surrounding water with possible effects on marine life.
- The persistent toxic constituents of oil, such as heavy metals, can become stored in the sediments, and taken up into the food chain. Therefore following large oil spills, even where animals recover in diversity and density, they may continue to suffer physiological and behavioural disorders which can result in reduction in growth and reproduction and in the worst cases, death.
- The breakdown of oil tends to be slowest in intertidal areas, which leads to the highest concentration and longest residence times.

vi) Storms and Tsunami

Storm: The occurrence of depression and cyclones are common over the project region and it keeps the wave climate relatively higher. The coastal currents are greatly influenced by wind followed by tides and show northerly during southwest monsoon/ fair weather and southerly during northeast monsoon. They will also affect the port installations structure and subsequently damage the marine living organism. The tracks of cyclones which have crossed the coast near Chennai (within 150 km on either side) during 1877 to 1990 shows that totally 58 storms had occurred within 300 km off the project region. The occurrence of storms in this region are more frequent in November (23) and in October (19). Among them about 37 times storms had crossed the coast within 300 km distance during 1877 to 1990.

Tsunami: Occurrence of Tsunami is an extremely rare phenomenon along the Indian coast. The past history shows that the periodicity of occurrence may range from 300 to 500 years. The Tsunami occurred on 26.12.04 had a dreadful devastation effect along the port region. In case of the port, the breakwaters are expected to protect the harbour basin from the impact of run up. However, the rise in sea level may over topple on the berths and wash away the shore installations. More details on storm and Tsunami are presented in Chapter 10.

vii) Kosasthalaiyar River

The river joins the sea at a distance of 2.6 km from the port. There will not be any dumping or reclamation in and the vicinity of Kamarajar Port. Therefore the proposed activity will not have any impact on the Kosasthalaiyar River. However KPL is suggested to deepen the existing Kosasthalaiyar River upto 2.0 m CD as requested by local fishermen in order to maintain the enhanced tidal flow between Pulicat Lake and Ennore creek.

viii) Ground water

The proposed berths of 10 Nos. are planned as a waterfront structure. After the development, the entire structure will come in CRZ IV area i.e. close to LTL getting into the sea. The details are given in the CRZ map prepared by Anna University. It is being in the coastal front and part of sea environment there will not be any infiltration into the ground water

ix) Ecologically Sensitive Area (ESA) and Critically Polluted Area (CPA)

In reference to the land use map prepared by Anna University, Chennai, it is only the expansion of existing port activity and all developments are confined to existing port premises. There is no Ecologically Sensitive Areas (ESA) fall within this region. The port is being maintained as clean and healthy environment which will be maintained with same spirit after the completion of the proposed expansion of the port. Many mitigation measures are proposed under Chapter 11 in order to combat the temporary pollution in land, air and water environment. There will not be any Critically Polluted Area (CPA) due to development of phase III.

Impacts on environment

Based on the baseline data collected and modelling studies it has been observed that the development will not have any impact on Kosasthalaiyar River, Ennore Estuary, Buckingham canal and also in the open sea. It will not have any destructive impact on the inter tidal benthic organisms. There are no coral communities. There will not be any impacts on sea grass due to proposed phase III development. There are no sea weeds inside the port region. Also study shows that there will not be any significant impacts on subtidal habitats, since the expansion is within the already existing port basin.

There will not be any impact on fisheries/ marine aquatic life. No mangroves are observed in the phase III development area. There will not be any significant impact on the flora and fauna including benthos and planktons. The stretch of the coastline does not attract turtle nesting and hence there will not be any impacts on the turtle. The project will not hamper any migratory birds passing through the project region.

This Phase III development is only the expansion of existing operating port. All activities are restricted within Port area and hence will not have any significant impact on terrestrial and marine environment.

11.3.2. MITIGATION

i) Construction of berths

During the construction of berths, the benthic organisms will get temporarily disturbed, but they are expected to colonize again once the construction is completed. In order to limit the damage at initial stage, the bed should not be disturbed much. Explosives should not be used. The construction materials should be placed one above another by using proper hoisting machineries and should not be dropped on the seafloor.

The change in current pattern due to the construction of wharf will be significant only for the initial period and the seabed will adjust itself for the new flow regime. There should not be any sudden increase in flow velocity across the navigational channel between the breakwater tips. Beacon lights are to be fixed along the wharf alignment, so that the safety for the navigation is assured. No fishing zone in the areas of approach channel and harbour basin should be marked with beacon buoys.

ii) Dredging and disposal of dredge spoil into sea

Dredging: In order to minimize destruction on sub-tidal benthic community while dredging, the controlled method of dredging may be carried out confined to only port area. The lowering of buckets can be done slowly in order to avoid accidental impact on the fishes. The turbidity induced during the dredging can be minimized using controlled dredging techniques using appropriate bucket/cutter suction dredgers. The net enclosures (silt screens) with booms should be placed around the dredging area in order to control the spread of the turbid plume. Regular monitoring of the turbidity and sediment concentration may be carried by water sampling and OCM satellite imageries.

Regular monitoring on the heavy metals in the water column has to be carried out during dredging in order to watch any unusual rise in concentration due to dredging. Another effective method is to reduce the excess dredging. The amount of material dredged can be reduced considerably by using latest techniques for greater dredging accuracy and increased surveying of dredged channels. Improved dredging technology and position fixing equipment allows more precision which has resulted in real reductions in the amounts of materials dredged and deposited.

In most cases, sediment resuspension is only likely to present a potential problem if it is moved out of the immediate dredging location by tidal processes. Therefore when dredging in enclosed areas, such as within locks or dock basins, there is little likelihood that material will be transported to the wider environment and affect the marine features. In general, the effects of suspended sediments and turbidity are generally short term (<1 week after activity) and near-field (<1 km from activity).

Disposal: The disposal at offshore can be carried out as per the suggestion given in Chapter 8. The disposal can be carried out at 16 nodal points covering an area of 5400 m x 5400 m as shown in Fig.8.14.

If disposal has carried out according to the proposed configuration then the morphology of the seabed will not have any impact and also the benthic organisms will not get affected.

iii) Shoreline changes

Since, there is no impact on shoreline due to the proposed development mitigation measures are not required.

iv) Oil spill

Oil spill contingency plan should be evaluated to handle accidental spill. Kamarajar Port has already evaluated and implemented an effective oil spill contingent plan. The plan can be followed after the development of phase III facilities. The list of Oil Spill Pollution Response Trained personnel in Kamarajar Port Limited and the offshore oil spill response equipment available with KPL are presented in chapter 10.

The following authorities have to be kept informed in case of any oil spill incident without delay:

- i) Indian Coast Guard at Chennai giving the details of the quantity and type of oil, exact location with coordinates,
- ii) MoEF&CC Regional Office, Bangalore,
- iii) L&T ship building yard, Kattupalli,
- iv) Tamil Nadu Pollution Control Board.

v) Storms, Tsunami and other man made hazards

Cyclonic shelter may be constructed within the port and in the nearby villages. Cyclone and Tsunami warning systems may be established in coordination with

Indian National Centre for Ocean Information Services (INCOIS), Hyderabad and Department of Disaster Management.

The ships berthed on the berth have to be taken offshore immediately on receiving the Tsunami warning. The port has to establish appropriate warning system in co-ordination with INCOIS and Department of Disaster Management. Online monitoring system with appropriate prediction system in the control room should be established.

For manmade emergencies, Port has already implemented a Disaster management plan which includes Emergency Response Action Plan to tackle any type of manmade contingencies such as Grounding of Vessels, Breaking up of mooring ropes and collision of vessels, fire incidents etc. where in procedures and action plan has been elaborated.

More details on Disaster Management Plan are described in Risk Assessment Chapter.

vi) Fisheries

No fishing activity exists inside the port and hence requires no special mitigation measures.

12. ENVIRONMENTAL MANAGEMENT FOR TERRESTRIAL AND MARINE ENVIRONMENT

The development of Phase III facilities involves: construction of berths, dredging of approach channel/ harbour basin and disposal of dredge waste for reclamation and at offshore. The proposed activities will have the impacts on the environment and hence a proper Environmental Management Plan is necessary.

This Environmental Management Plan has been prepared with the guidelines on appropriate design, protection of shoreline, preservation of nearshore ecology and protection of social life to identify potential impacts and outline environmental management measures developed for construction and operations phase at the port to ensure environmental safeguards are in place to minimize the risk of impacts to the natural environment..

12.1. Summary of proposed impacts and Mitigation measures

The details of the impacts due to the proposed project activities during construction and operation and its respective mitigation measures are explained in detail in chapter 10. Based on these mitigation measures Environmental Management Plan (EMP) has been prepared. The environmental mitigation measures for construction and operation phases are briefly listed in below Table.

Table 12.1. Impacts and mitigation measures of the proposed projects

Sl. No	Impacts		Mitigation Measures
	Parameter	Cause	
Construction phase			
1	Air	Fugitive dust emission and dust generation from concrete mixing, cement handling, welding and operations of construction machinery.	Methods for controlling dust emission are water sprinkling in the construction site, use of proper transport methods such as a conveyor belt, for excavated material.
		Generation of dust from handling and transportation of fine & coarse gravel in uncovered trucks.	Trucks hauling dirt, rock or other granular or particulate material to construction site should have their loads limited, trimmed, or wetted and covered to prevent material from being spilled / scattered or wind blown over public streets.
		Dust emission due to transportation of construction materials in unpaved roads.	Fugitive dust emissions will be controlled by application of water sprinkling on unpaved roads.
		Emission of air pollutants like CO, SO2, NOx from vehicles, heavy machineries and DG sets.	Engines and exhaust systems of all vehicle and equipment will be maintained so that exhaust emissions do not reach statutory limits.
2	Land	Disposal of contaminated dredged material, construction debris and other wastes from construction activities.	All waste generated at the construction site and at the labour camp will be collected and disposed off in an appropriate manner in a dump site or recycled or reused wherever possible.
		Soil contamination may take place due to movement of vehicles and solid waste generated from the labour camp setup during pre-construction phase stage.	Vehicle movement on the track will be limited to daylight hours between 06h00 and 16h00. Waste rock from the quarry operations will be used as surface cover for areas where erosion occurs. Maintenance of the track will be ongoing process.
3	Water	Construction work in water would cause re-suspension of sediment and turbid water. Re-suspension of sediments in water leads to an increase in the level of	Effective sediment control measures will be adopted before starting work to prevent the entry or re-suspension of

SI. No	Impacts		Mitigation Measures
	Parameter	Cause	
		suspended solid.	sediment in the water body.
		Disposal of dredged material on land/sea may possibly cause leakage of harmful substances.	The characteristics of dredged material shall be analyzed before dumping and proper methods will be followed based on the characteristics of dredged.
		Exploitation of water resources for domestic usage.	No ground water will be extracted during the construction phase.
		Disposal of untreated waste water.	Appropriate sanitation facilities to be provided at the construction site for the proper collection and disposal of sewage.
4	Marine Water	construction of berths	Use of latest construction equipments for installation of the piles and construction of the berth to minimize the spread of suspended particles, silt screens may be deployed.
		Dredging (Minimum destruction on sub tidal benthic community especially filter feeders)	Use of appropriate dredging equipments consistent with soil conditions and quantity to be deployed. Controlled dredging confined to the area identified; Use of net enclosures with booms to prevent movement of turbid plume; Monitoring of the turbidity in the water column for a few days after dredging is completed. Use the dredge spoil as back fill.
5	Noise	The major noise generating sources will be DG sets, crusher excavators, crane, blasting, concrete mixer / dredgers etc	Regular servicing and maintenance of construction machineries, equipments and vehicles to control noise.

SI. No	Impacts		Mitigation Measures
	Parameter	Cause	
		Noise generated from construction activities will be predominantly confined within port site and it will impact construction workers at site.	Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. especially construction personnel involved in pile driving operations. Rotation of personnel will also be adopted.
6	Socio-Economic	Change in land use and land cover.	<p>No rehabilitation and resettlement.</p> <p>No staff colony will be established, and hence there will be no change in land use and land cover.</p> <p>Preference will be given to local labours while selecting labours during construction phase which will have a positive impact.</p>
7	Occupational Health and Safety	<p>Generation of dust during construction and dredging activity might lead to respiratory ailments in labours/ workers.</p> <p>Noise generated during the construction activities, operation of DG sets might lead to auditory ailments.</p>	Workers will be strictly enforced to wear personal protective equipments like dust mask, ear muffs or ear plugs, whenever and wherever necessary/ required.
8	Biological Environment (Coastal and Marine Ecology)	Construction activities may cause displacement of fishery resources and other mobile bottom biota.	Controlled method of dredging using appropriate bucket/cutter suction dredgers may be carried out confined to only port area in order to minimize destruction on sub-tidal benthic community.
		Dredging causes migration of bottom biota and dumping of dredged material covers bottom habitat, both of which may reduce fishery resources.	The net enclosures (silt screens) with booms will be placed around the dredging area in order to control the spread of the turbid plume. Regular monitoring of the turbidity and sediment concentration may be carried by water

Sl. No	Impacts		Mitigation Measures
	Parameter	Cause	
			sampling.
		During site clearance, the existing trees and shrubs will be removed.	Green belt development can be carried out to compensate the loss of vegetation during site clearance.
Operation Phase			
9	Air	The number of heavy duty trucks carrying cargoes will increase which in turn will lead to increase in emission of air pollutants like CO, SO2, NOx.	Only the vehicles that conform to emission norms (air/noise) of CPCB and have valid Pollution under Control (PUC) certificates will be used.
		Loading, unloading and transportation of cargoes will result in dust generation.	Bulk material will be transported in closed trucks or through closed conveyor belt to avoid wind entrainment.
		Increase in emission of PM10 and PM2.5 due to storage and handling of cargoes.	To mitigate adverse impacts due to fugitive emissions, about one third of the total area of storage terminals will be developed with plantation.
10	Land	Additional domestic waste and ship waste will be generated from the proposed facilities which can have impact on the land environment.	Ship generated waste and other wastes such as metal scrap can be re-cycled and sold to authorized agencies.
		Compaction of soil due to movement of vehicles.	Movement of vehicles to be restricted to paved road only. In order to increase the soil stability Bio-shield can be developed.
11	Water	Discharges from ships such as bilge water, ballast water, oily wastes, sewage, garbage and other residues in a ship.	Bilge water from the vessel will not be directly released into the surrounding environment. Instead, a holding tank will be installed to retain any bilge water on board unit. It will be pumped into a waste barge and which will be

SI. No	Impacts		Mitigation Measures
	Parameter	Cause	
			periodically cleaned.
		Spill of oils, lubricants and fuel	Regular water monitoring will be undertaken as part of the regular water quality and biodiversity monitoring programs.
		Water requirements for the labours	Water supply from Chennai metro water supply and sewage board (CMWSSB) for the increasing demand.
12	Marine Water	Maintenance Dredging (Minimum destruction on sub tidal benthic community especially filter feeders)	Use of appropriate dredging equipments consistent with soil conditions and quantity to be deployed. Use of net enclosures with booms to prevent movement of turbid plume; Monitoring of the turbidity in the water column for a few days after dredging is completed. Use the dredge spoil as back fill.
		Accidental oil spill	Proper contingency plan; Readily available oil handling equipment like booms, skimmer and chemicals for dispersion; Establish coordination with National Oil Spill Committee (Indian Coast Guard).
13	Marine Environment	Storms & Tsunami	Construction of Cyclone shelter and easy road access. Planting of Casuarinas in open beach. Planting of Mangroves in tidal flats.
14	Noise	The cumulative noise levels due to the combined operation of loading/unloading of bulk cargoes, transportation of automobiles, operation of heavy machineries and generators will result in generation of noise.	For the high noise generating equipment/zones, proper acoustic barriers/ enclosures/ shelters shall be provided. Latest equipments will be used or loading/unloading of bulk cargoes and

SI. No	Impacts		Mitigation Measures
	Parameter	Cause	
			<p>will be maintained periodically.</p> <p>Diesel generator set will be kept in acoustic enclosure to contain noise. Diesel generator will be used only during power failure.</p> <p>Employees working in noisy environment will be made to wear ear muffs/ear plugs to avoid any adverse impact of noise on them.</p>
15	Socio-Economic	Employment opportunity.	Direct or Indirect employment opportunity.
16	Occupational Health and Safety	Generation of dust during handling and storage of cargoes like coal will lead to respiratory ailments. Fire hazard due to cargoes handling and storage.	<p>Workers will be strictly enforced to wear personal protective equipment like dust mask and safety goggle.</p> <p>Safety training will be given to all workers exposed to fire hazards and mock drills will be conducted regularly.</p>
17	Biological Environment (Coastal and Marine Ecology)	Water pollution and bottom contamination	Periodic monitoring of marine water quality
		Storage of cargoes in stock yard might result in dust generation, which will increase the particulate matter concentration in the nearby areas, which might affect the flora and fauna in the area adjacent to port.	Green belt development will be carried out in the port area to contain dust generation and to enhance the aesthetics of the area.
		Similar to capital dredging, maintenance dredging might also lead to migration of marine faunal species to other areas. As the proposed project site is within the breakwater sheltered area, significant major impact on the aquatic organism is not envisaged.	Silt curtains will be used during maintenance dredging in marine area to contain the spread sediments, which might cause disturbance to marine faunal species.

12.2. TERRESTRIAL ENVIRONMENTAL MANAGEMENT PLAN

12.2.1. Labour Management Plan

The total number of workers to be employed during construction phase will be around 250 nos. and at the maximum not more than 500 will be employed since the project will be carried out in a phased manner. Almost all the labours will be recruited from nearby villages and hence temporary labour camp/ residential colony has not been proposed for this project. The basic facilities required for the labours at the work place as per the Contract Labour (Regulation & Abolition) Act, 1970 will be made available.

Potable Water Requirement

The proposed projects will be done in phased manner and hence not more than 500 labours will be employed at a time during the construction period which will be met from the Chennai Metro Water.

Canteen Facility

If the work regarding the employment of contract labour is likely to continue for many months and since the number of labours exceeds 400, an adequate canteen shall be provided by the contractor for the use of such contract labour within 60 days of the commencement of the employment of contract labour.

Sanitation Facility

There will be one latrine for every 25 males or females, as the case may be, up to the first 100, and one for every 50 thereafter.

Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings. "For Men only" and "For Women only" must be displayed in the local language in the door of the latrines. The notice shall also bear the figure of a man or of a woman, as the case may be.

The sewage will be collected in septic tanks and the same must be emptied through external agencies by the contractor. The budget estimation for the sanitation facility is given in Table 12.2.

Table 12.2. Estimated Budget for Sanitation Facilities

Unit	No.	Unit cost (Rs.)	Total cost (Rs.)
Toilets	10	50,000	5,00,000
Septic tanks	4	5,00,000	20,00,000
Total Cost			25,00,000

First Aid Box

First aid posts will be provided at the construction site to attend the workers on immediate basis in case of an injury or accident. This first-aid post will have the following facilities:

1. First aid box with essential medicines including ORS packets.
2. First aid appliances-splints and dressing materials.
3. Stretcher, wheel chair, etc.

The first aid box must contain the following:

- 15 small sterilized dressings,
- 8 medium size sterilized dressings.
- 8 large size sterilized dressings,
- 8 large size sterilized burn dressings,
- 8 (15 gms.) packets sterilized cotton wool.

- 2 (60 ml.) bottle containing a two per cent alcohol solution of iodine,
- 2 (60 ml.) bottle containing sal volatile having the dose and mode of administration indicated on the label,
- 2 roll of adhesive plaster, A snake-bite lancet.
- 2 (30 gms.) bottle of potassium permanganate crystals,
- 2 pair scissors,
- 2 copy of the first-aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India,
- 2-3 bottles containing 100 tablets (each of 5 grains) of aspirin,
- Ointment for burns.
- 2-3 bottles of a suitable surgical anti-septic solution

A person in charge of the First-Aid Box shall be a person trained in First-Aid treatment, in establishment where the number of contract labour employed is 150 or more. The first aid post will be housed in temporarily erected structure and managed by one Health Assistant and one attendant. The first aid post will have adequate communication facility to link with the nearest health centre/hospital in case of an emergency. One doctor from the Hospital may visit the medical post once in a week. The capital cost for development of first-aid posts is about INR 17 lakh.

12.2.2. Sewage Management

About 250 persons are likely to be deployed during construction phase. The availability of infrastructure could be a problem during the initial construction phase. As a part of Environmental Management Plan, following facilities shall be developed for the construction staff/ technical staff likely to be deployed during project construction phase:

- Potable water supply
- Community toilets and sewage treatment
- Solid waste collection and disposal facilities.

12.2.3. Solid Waste Management

Construction waste consisting of bricks, stones, pipelines etc. will be generated during the construction phase. The waste will be sold to recyclers/vendors. The ship related solid wastes are sold to authorized recyclers/ vendors.

12.2.4. Water Balance and Sewage Management Plan

The water balance will comprise of the following components:

- Volume of water required during construction and Operation phase – 1000 kl/day
- Source of water during construction – Outsourcing
- Source of water during operation – Chennai Metro Water
- Workers during construction and operation phase – 350 (Floating)
- Source of solid waste:

Ship: cartons, tins, plastic bottles, cans, drums, etc.
Port: Paper, plastic bottles
- Volume of solid waste generated:

Present: 230 -240 m³ per month
Future: 380 m³ per month
- Type of solid waste:

95% non hazardous
5% hazardous – will be sent to TSDF
- Treatment or disposal plan – Segregation and disposal

12.2.5. Air Pollution Management

Bulk cargoes which will create air pollution will be transported through elevated closed conveyor belt and dust suppression devices will be installed. The air pollution control measures for the proposed project will be similar to that of the existing system. The general air pollution management measures, which will be adopted to reduce/ contain air pollution for the proposed project:

Transportation and heavy machineries

- All vehicles used will have a valid Pollution Under Control Certificate.
- Regular servicing and maintenance of machineries as well as vehicles to control unwanted air pollutant emission.

Diesel Generator

- Low sulphur content (<0.5%) diesel must be used.
- The stack height of the DG set must be minimum 30 m.
- Monitoring of DG set emission must be carried out regularly as specified in the Environment Monitoring Plan.
- DG set must be serviced regularly.
- DG set must be used only during power cut.

Fugitive Coal Dust Control

Dry Fog Dust Control System: One of the widely used and effective dust control system is the dry fog dust control system. The basic principle is the formation of dry fog with the help of air atomizing nozzle to agglomerate and remove airborne dust particles from various material handling and processing operations. Compressed air and water is used in this system to produce droplets of 1 – 10 micron, which is equivalent to fog. Only the dust in the air gets attached with the ultra-fine water droplets and fall onto the surface due to increase in size, whereas the material does not get wet in this process. Since, no chemical suppressants are used, this method is

safer to use. Dry fog dust control system must be installed in coal unloading/loading areas, to control fugitive emission.

Closed Conveyor System: During transportation of coal from one place to another through conveyor belt, coal dust might get generated due to the movement and wind. Hence, it is essential to transport coal by closed conveyor system, to avoid coal dust generation.

Water Sprinkler System: Due to the large area of the coal stock pile to be stored in the coal storage yard, water sprinkler system is proposed to control coal dust emanation from the stockpile. Care must be taken not to over wet the coal stockpiles, leading to runoff of coal contaminated water.

12.2.6. Rainwater Harvesting System

The Port has Rainwater Harvesting System in its Administrative Building, Car Parking Yard and Control Tower Building. The details about the same are given below:

Administrative Building

Consists of Open well, created by submerging RCC ring of dia 3' - 0" into a pit of 3 m depth.

Consists of filter chamber of size 0.6 x 0.6 x 0.9 m in brickwork CM 1:5.

The filter chamber has the following filter media:

- River sand to a depth of 0.15 m
- Pebbles to a depth of 0.15 m
- Nylon mesh between river sand and Pebble stone.

PVC pipes of 110 mm dia connecting terrace, well and filter chamber have been laid.

The well is covered with RCC precast slab with a provision of covered manhole.

Car Parking Yard and Control Tower Building:

- I. Consists of percolation/ recharge well, created by submerging RCC ring of dia 2' - 0" into a pit of 3 m depth.
- II. The percolation/ recharge well consists of the following filter media:
 - ◆ River sand to a depth of 0.15m
 - ◆ Pebbles to a depth of 0.15m
 - ◆ Nylon mesh between river sand and Pebble stone.
- III. PVC pipes of 110 m dia, connecting the terrace and the recharge well has been laid.
- IV. The well is covered with RCC precast slab with a provision of covered manhole.

12.2.7. Storm Water Drainage System

The rain water on the concrete deck of the berth is drained to the sea by providing slope on the deck surface.

12.2.8. Green Belt Development

A green belt will be developed around the proposed project area, along the road side, around the stack yard and office area to contain dust emission and to improve the aesthetics of the area. Area around the proposed project site has been allocated for green belt development.

12.3. Marine Environmental Management Plan

a) Activity: Construction and operation

Mitigation: During the construction work, the subtidal benthos will get temporarily disturbed. In order to limit the damage to benthos at initial stage, the bed should not

be disturbed much. Explosives should not be used. The construction materials should be placed above one another by using proper hoisting machineries and should not be dropped on the seafloor. There should not be any sudden increase in flow velocity within the port basin.

Compensation: The activities are related directly to the port and there are no stakeholders and hence no compensation is considered necessary.

b) Shoreline erosion

Mitigation: The Port authorities have to make necessary beach nourishment scheme for stabilizing the downdrift coastline. Regular monitoring of the shoreline is essential in order to design a suitable shore protection method if needed.

Compensation: The activities are related directly on the shore and beach users/coastal dwellers/coastal property owners are involved in the impact caused by this activity. The affected persons may be engaged for any marine related works.

c) Activity: Accidental collusion of ships and oil spill

Mitigation: Oil spill contingency plan should be evaluated to handle any accidental spill. Oil spill contingency equipments like boom, skimmer and dispersant chemicals should be stored. Oil Contingency Team established at Port may be strengthened. They should coordinate with National Oil spill Committee headed by Indian Navy.

Compensation: The activities are related directly in the sea at offshore and no shareholders are involved in any impact caused by this activity.

d) Activity: Port installations

Mitigation: All port installations on the shore in connection with handling, stacking, offices and other facilities may be developed beyond the CRZ line.

Compensation: The activities are related directly in the sea at offshore and no shareholders are involved in any impact caused by this activity.

12.4. EMP BUDGET

The total cost for the EMP implementation is INR 59 lakh. The detailed split up of the same is given in Table 12.3.

Table 12.3. Environmental Budget

S.No	Construction Phase	Cost (in INR Lakh)	Operation Phase	Cost (in INR Lakh)
1	Solid waste Management	3.0	Sanitation facility and sewage collection system	4.0
2	Greenbelt Development	2.0	Maintenance of green Area	2.0
3	Environmental Monitoring Plan	6.0	Environmental Monitoring Plan	12.0
4	Air Pollution Control Equipments	6.0	Maintenance of Air pollution Control System	
5	Labour Management	24.0		
	Total	41.0	Total	18.0

Administrative and Technical Setup

An Environment Management Cell (EMC) will be formed, which will be responsible for implementation of the aforesaid post project monitoring/management plan. The composition of the Environment Management Cell and responsibilities of its various members are given in Table 12.4.

Table 12.4. Environment Management Cell

S. No	Designation	Proposed Responsibility
1.	General Manager	Policy decisions and overall responsibility with respect to implementation of EMP
2.	Manager(Environment)	Responsible for Management and Implementation of EMP
3.	Site Engineer / Environmentalist	Day to day monitoring of the implementation of EMP

13. POST PROJECT MONITORING

The post project monitoring is an important aspect in Environmental Management Plan. The Kamarajar Port is already having a well-established and documented post monitoring programme. The same system can be continued for the proposed expansion

This is summarized as under:

- i) Monitoring Air, water, Noise and sediment quality:
- ii) Habitat and ecosystem integrity
- iii) Coastal processes

Prepare and implement a monitoring programme to determine the effects of the present expansion at the project site.

- i) Siltation
- ii) Shoreline erosion
- iii) Flora and Fauna
- iv) Non-indigenous marine species (NIMS)
- v) Research

Table 13.1. Details of Monitoring, Review and Reporting

Purpose	Parameter	Frequency
Air		
To monitor impacts on Air	PM ₁₀ , PM _{2.5} , SO _x , NO _x , CO	Monthly (except during monsoon months)
Noise		
To monitor impacts on Noise	Leq day time and night time	Monthly
Water		
To monitor impacts on Surface and Ground Water	Measurements of levels of turbidity, nutrients and heavy metals in water and sediment samples collected from sites at risk of pollution	Monthly

Purpose	Parameter	Frequency
Soil		
To monitor impacts on Soil	Measurements of levels of turbidity, nutrients and heavy metals in water and sediment samples collected from sites at risk of pollution	Yearly
Soil Quality	Measurement of soil EC, pH, ESP(exchangeable sodium percentage),organic carbon & available P from greenbelt site	Yearly
Seawater & Sediment quality		
To monitor impacts on seawater and sediment quality	Measurements of levels of turbidity, nutrients and heavy metals in water and sediment samples collected from sites at risk of pollution	Quarterly 3 seasons (SW Monsoon, NE Monsoon and Fair weather)
Habitat and Ecosystem integrity		
To determine whether the community structure, habitat has been altered	Measurements of various parameters: phytoplankton, zooplankton, benthic population, primary production, bacteria of health significance, nutrients and heavy metals. Subjecting them to statistical analyses to assess the change (if any) in species diversity, richness, evenness etc.	Quarterly 3 seasons (SW Monsoon, NE Monsoon and Fair weather)
Coastal Processes		
To determine if the project changes the quality and quantity of water entering the ecosystem	Sediment transport and nutrient flows into offshore areas	Quarterly 3 seasons (SW Monsoon, NE Monsoon and Fair weather)
To determine any shoreline change on either side of the port	Shoreline monitoring for 1 km on either side of the port	Quarterly for the entire operational period of the port. 3 seasons (SW Monsoon, NE Monsoon and Fair weather)
	Satellite imagery – comparison of photos used to establish any trends or	Annually

Purpose	Parameter	Frequency
	changes in the morphology of shore in the vicinity	
Marine Benthic Fauna		
To determine the composition and distribution of major groups of fauna	Benthic faunal composition in the water and sediment of the port basin and channel.	Quarterly 3 seasons (SW Monsoon, NE Monsoon and Fair weather)
Non-Indigenous Marine Species (NIMS)		
To determine if they, especially fouling organisms, have been introduced.	Temporal and spatial changes in species composition in port basin and anchoring areas.	Annually

The results of monitoring will be reported to the relevant authority annually or as required which could include:

- Ministry of Environment and Forests, Zonal office, Bangalore
- State Department of Environment
- State Pollution Control Board
- National Biodiversity Authority for NIMS

Monitoring program has to be done during the construction and operational phases of the project. It should be repeated at periodic intervals after the commencement of the project, when the project is fully operational. The monitoring has to be organized with qualified and experienced environmental team. Standard procedure shall be followed in sample collection and analysis.

Post project monitoring can be carried out in the same locations where the existing monitoring is being carried out.

- a) **Air quality:** Sampling can be carried out at 7 locations. The parameters which are to be analyzed are: PM₁₀, PM_{2.5}, SO_x, NO_x, CO.
- b) **Ground Water quality:** Sampling can be carried out atleast at 3 locations in areas mentioned above. The parameters which are to be analyzed are: Color, pH, Salinity, Dissolved oxygen, BOD, Total Hardness, Chloride, Total Dissolved Solids, Sodium, Potassium, Calcium, Magnesium, Sulfates, Fluoride, Nitrate, Nitrite, Manganese, Iron, Chromium, Copper, Cadmium, Arsenic, Mercury, Lead, Zinc.
- c) **Drinking Water quality:** Water Samples shall be collected from canteen and it has to be analyzed for the following parameters Color, pH, Odor, Turbidity, Taste, Total Alkalinity, Free Residual Chlorine, Total Hardness, Chloride, Total Dissolved Solids, Calcium, Magnesium, Sulfates, Fluoride, Nitrate, Iron, Chromium, Copper, Cadmium, Arsenic, Mercury, Lead, Zinc, Boron, Total Coliform, Fecal Coliform, E. Coli.
- d) **Marine Water quality:** Sampling can be carried out at 5 locations. The parameters which are to be analyzed are: Color, pH, Turbidity, Odour, Salinity, Dissolved oxygen, BOD, Total Dissolved Solids, Total suspended solids, Sulfates, , Nitrate, Nitrite, Ammonical nitrogen, Iron, Chromium, Copper, Cadmium, Arsenic, Mercury, Lead, Zinc, Oil & grease, Petroleum Hydrocarbons Total Coliform and Feacal Coliform.
- e) **Seabed sediment quality:** Sampling can be carried out at 5 locations. The parameters which are to be analyzed are: texture, Total organic carbon, Total nitrogen, Total Phosphorus, Calcium Carbonate, Cadmium, Mercury, Lead, Chromium, Phenols and Total Petroleum Hydrocarbons.
- f) **Biological parameters:** Phytoplankton population, zooplankton population, benthic fauna, and the nature of fisheries in the area (by experimental trawling once in three months).
- g) **Shoreline:** The shoreline for 1 km on either side of the Port has to be monitored.
- h) **Bathymetry** in the vicinity covering 1 km on either side of the breakwater and 1 km into the sea.

The monitoring location of the project region is shown in Fig. 13.1.

SUMMARY

The above discussions on EMP, DMP and PMP reveal that the Port is fully equipped to meet any emergency and disastrous situation due to handling all types of cargo including liquid bulk, LNG etc. besides other drybulk, general cargo and containers. A perfect time-tested system is in place right from the commencement of port operation in 2001 and further augmented from time to time to meet the demand arising out of new cargo such as LNG terminal being developed now under Phase II. The existing system will take care of the additional volume of cargo such as containers, drybulk, multipurpose/automobile export etc. and in fact there is no hazardous cargo proposed in Phase III. This will however be reviewed again in the context of Phase III development to confirm the adequacy of existing system and study further the need for improvement and improvisation.

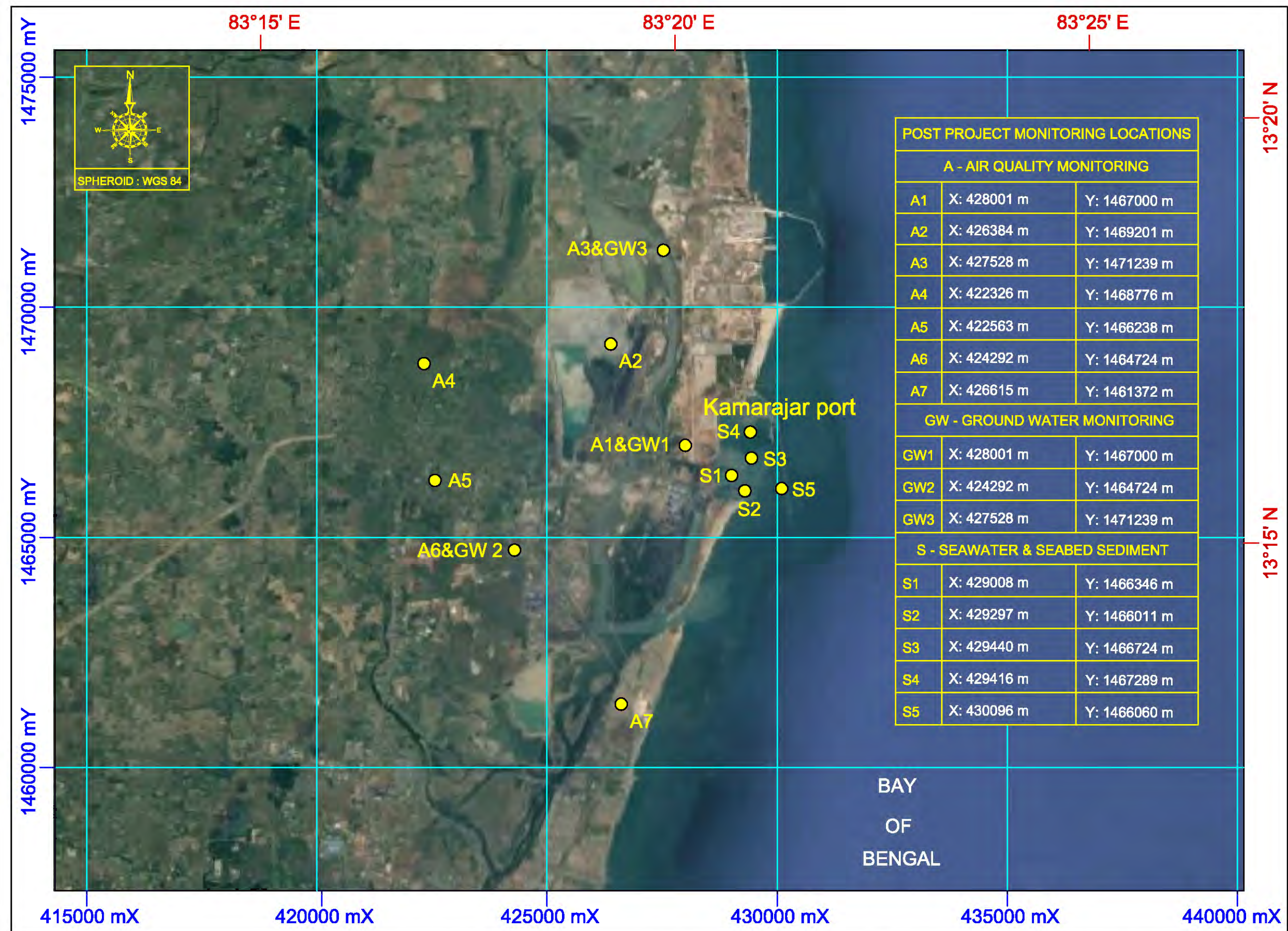


FIG. 13.1. POST PROJECT MONITORING LOCATIONS FOR TERRESTRIAL AND MARINE ENVIRONMENT



Annexure I Public Hearing

The public hearing was held on 5th August 2016 at Port site near Ennore, Chennai. The district collector, sub collector and G. Vasudevan, District Environmental Engineer, TNPCB, organized the public hearing. The extracts of the public hearing are given below,

S.No	Name	Village	Suggestions	Reply from KPL
1	Mr.Haridas	Mugathuvarakuppam	During the second phase development, Port has promised to provide proper sanitation and job opportunities. But till date port has not provided the above facilities to Ennore area. Now the port has planned to expand its Phase III activities, and added they have already approached the Chairman, port trust to provide job opportunity and hence requested to provide job opportunity to all educated/ uneducated (both skilled and unskilled) persons belonging to six villages in their area.	Kamarajar port will facilitate job opportunities through BOT operators.
			In addition, for the past 10 years they have been requesting the port to de-silt the Buckingham canal dumped with dredged material from the port and by the deposition of fly ash due to the erosion/ corrosion/ breakage in the pipeline. The port has de-silted only a portion, leading to loss of their livelihood i.e. their fishing activity. Hence requested to deepen the river to the original state to solve the said issue.	The referred pipeline/fly ash belongs to adjacent power plant. The issue raised can be informed to them for necessary action. At the meeting with Commissioner KPL has agreed for de-siltation of dredged material if any left.

S.No	Name	Village	Suggestions	Reply from KPL
2	M. D. J. Kathirvel	Athipattu	The proposed project will be only benefiting the port not the local public. During the development of the port, nearly 150 women belonging to women self-help Group of Athipattu village were involved in converting the unused land as port during the period 2002-2004. Subsequently job was given to persons belonging to Kattupalli village stating that it will be under rotational basis. Mostly job opportunities were given only to the north Indians on contract basis.	Kamarajar port will facilitate job opportunities through BOT operators
			From the year 2011 port has not implemented their CSR activities in their village and added every year fund was allocated under CSR activity but not implemented.	KPL informed District collector that all CSR activities under the purview of KPL are being channeled through Revenue department, District Collector's office.
3	Mr. Gajendran	Minjur	The CSR activities of the port have to be extended to all fifty five villages of Minjur Panchayat union. Further stated that, the port has allocated a fund of rupees 7 crores in the year 2015-2016 under CSR activities to the 11 village Panchayats but till now nothing implemented.	Neighbouring coastal villages also will be taken into consideration for future CSR scheme under the direction of District Collector.

S.No	Name	Village	Suggestions	Reply from KPL
4	Mr. Srinivasan	Ennore Kattukuppam	Public in this area has come to know about the Corporate Social Responsibility (CSR) activities of the port recently only during last month.	CSR activities are being carried out since 2008
			Due to the dredging activities of the port from the year 2008, fishery resources were gone down in turn affected the fishermen livelihood. The port has not taken any initiatives to solve the issue.	There will not be any dredging in the fishing ground. More details on the impact on fisheries are presented in Chapter 11 of the EIA report.
			The port, Chettinad Coal Terminal, Revenue authorities along with fishermen made an agreement regarding preference in giving job opportunities to the local fishermen, but till now it was not done.	Port will facilitate job opportunities through BOT operators.
			The port has dumped the dredged materials in the river and only because of their initiative further dumping was stopped through TNPCB, hence the port was now taking action to get Coastal Regulation Zone (CRZ) clearances for the same directly to the Ministry of Environment Forest & Climate Change (MoEF&CC).	No dredge material was dumped in Kosathalaiyar River. The dredged material for phase III development will be disposed at offshore at the designated site determined through model studies (Chapter 8 of EIA report). The phase III development is confined

S.No	Name	Village	Suggestions	Reply from KPL
				to port premises and there will not be any dumping of material into the creek.
			He questioned whether any study was conducted in their fishing area & in the area where dredging was being carried and whether the same was informed the fishermen.	Study has been covered for 10 km radius including the dredging areas and fishing villages and the details are presented in EIA report Chapters 4 & 5.
			He further requested to explain whether their fishing area will be reduced due to the shipping activity in the port in the larger extent and stated that fishery resources have gone down due to the dumping of the dredged material by the port in the salt pan area to an extent of 532 acres purchased by them from the Government. Furthermore there is no mention in the EIA report by the port regarding impact of their activity in the adjacent river.	Incoming ships will be channelized only through the existing navigational channel and KPL will ensure that it will not disturb any fishing area. Reduction of fishing area does not arise since the developments are confined within the existing port basin and channel.

S.No	Name	Village	Suggestions	Reply from KPL
5	Mr. Dassappan	Ennorekuppam	Earlier while developing Ennore port it was promised to give job opportunities & basic amenities to the fishermen community of Ennore, However there was no change in their livelihood but even affected badly by the growth of port activity.	Port will facilitate job opportunities through BOT operators. Sanitary facilities will also be considered under CSR scheme planned for phase III development.
			Earlier fishing was done at 2 km in the sea and now beyond 20 km in the sea for fishing. Further the fishing activity was badly affected due to large scale ship movement.	Even now fishing vessels with outboard engines do fishing within 2 km radius and consequently the socio economic status fishing community has increased. Big boats are going for voyage. The Fish landing statics is presented in EIA report (Chapter 7) which shows the increasing trend.
			In addition, the port has provided barriers by placing the boulders to avoid sea erosion it in turn affects the nearby villages. Around 100 houses were likely to be affected and around 10-20 houses were already drowned in the sea.	KPL has not placed any boulders to avoid sea erosion. It has only taken up shore protection created by sand banks on northern side in order to protect the shoreline.
			Till date they did not know about the CSR scheme of the company. Finally requested to give job opportunities and to provide basic amenities to the people	All CSR activities being carried out through District Collector. Port will facilitate job opportunities through BOT operators particularly for youth and women.

S.No	Name	Village	Suggestions	Reply from KPL
			nearby villages.	
6	Mrs. Prema	Kattupalli	No job opportunity was given to the village people even after the establishment of so many companies in their area, the port has not given permanent employment, salary hike and basic amenities to the ladies working in the port for the past 12 years. Requested to give preferences in job opportunities to their village people.	District collector has agreed to look into this. Port will facilitate job opportunities through BOT operators particularly for youth and women.
7	Mr. Babu	Thazhankuppam	Livelihood was badly affected due to the sea erosion caused by the port development activities.	The developments of port do not cause sea erosion which is evidenced by shoreline study carried out for 2009 to 2019 which is presented in Chapter 8 in EIA report.
			Further, the port has given false statement that the people were given proper training but really it didn't do so. Finally requested the port to provide the job opportunity to the both educated and uneducated people of their six villages.	Port will facilitate job opportunities through BOT operators even for uneducated people to the extent possible.

S.No	Name	Village	Suggestions	Reply from KPL
8	Mr. Dharmaprakash	Athipattu	Ladies were given training only but not given job opportunities. The CSR scheme should be reached to Ennore, Kattupalli, Athipattu and Vallur villages. Salary hike and sanitary facilities shall be proved to the ladies working in the port. No job opportunities given to the people and also requested to make arrangements for job opportunity to both educated and uneducated villagers. Thanked Chettinad company for giving job opportunity to them.	All CSR activities being carried out through District Collector. Port will facilitate job opportunities through BOT operators.
9	Mr. Durairaj	Thazhankuppam	Most of their villagers were uneducated and had much hope of getting more employment due to the port establishment. But till date the port has not given any job opportunity to the fishermen and requested to take necessary action to provide job opportunity.	Port will facilitate job opportunities through BOT operators.
10	Mrs. Vennila	Athipattu Pudhunagar	About 150 families were working inside the port since the year 2012 and it was promised to give jobs on rotational basis. But till date no jobs were given to them. Requested jobs to all of them since livelihood is badly affected due to poor	Jobs are being provided on the rotational basis; however as requested the position will be reviewed.

S.No	Name	Village	Suggestions	Reply from KPL
			income.	
11	Mr. Sethuraman	Kattupalli	Regretted for the participation in the public hearing and supported, which was conducted 2 years ago. No preference was given in the job opportunity. Even though 100 ladies and one man were working for the past 14 years, they were being treated as bonded labours without providing any basic amenities. Job opportunities were given only to the people those who got the recommendation letter from the politicians by bribing them. But port has refused to give jobs to the people those who were recommended through Councilor & village president but they were filling a case against us for creating problems to them. Further he questioned how they will be benefited by the construction of additional berths.	Employment opportunities will be taken up through BOT operators. The development of the port will increase the living standard of local people which are explained in EIA report Chapter 4.

S.No	Name	Village	Suggestions	Reply from KPL
			Ennore and Palaverkadu village areas were getting sea erosion due to the dredging activity carried out by the port.	The developments of port do not cause sea erosion which is evidenced by shoreline study carried out for 2009 to 2019 which is presented in Chapter 8 in EIA report.
12	Mr. Ranjithkumar	Katupalli Kuppam	During the year 2009, L&T constructed their company in their village. The L&T and the former District collector has given promise to provide employment for 140 people, accordingly they were given jobs. But till date they were treated as bonded labours and promised to provide permanent employment within 2 years but till date it was not done. After that they have assured to provide the same after completion of construction activities, again assured to provide after one and half years in view of the occurrence of natural disaster. Till date they have not been given permanent employment. They have been given monthly salary of only Rs. 7500/- even though daily wagers were getting wages of Rs.300-400/-. If a MLA participates in a strike, 40 No' s of port persons were attending the grievance but none of	Not applicable.

S.No	Name	Village	Suggestions	Reply from KPL
			them listening when they do so. An agreement which was signed during 2014 expires by 04.08.2016. However, no action has been taken by the company. The company had not called for any discussion, they have taken their decision to meet the new District Collector to sort out the said issue.	
13	Mr. Saravanan	Oorkuppam	Due to the cutting of land for the development of the port activity, there is a possibility of sea water intrusion and may affect the ground water and get polluted.	It is shorefront activity in CRZ IB permitted under CRZ and intrusion of water affecting ground water will not arise. Also for 1 km distance there are no dwelling area exists close to the port area. In fact there are sea water carrying Buckingham canal and Korataliyar river are present at 1 km west of the port.
			One third of the dredged sand will be utilized inside the port which is reflected in EIA report but the remaining was not evidenced in EIA report and added that they are dumping dredged material generated during the construction of CB3 & CB4 of Phase II activity in the river, salt pan, mangrove forest & CRZ area even though it was prohibited activity. Further	The major dredged material will be disposed at offshore at the designated site determined through model studies (Chapter 8 of EIA report). It will not cause any impacts. KPL will continue the de siltation process to clean up the siltation in the river. The phase III development is confined to port premises and there will not be any

S.No	Name	Village	Suggestions	Reply from KPL
			stated that the District environmental Engineer has inspected the site as directed by the Chairmen of State Coastal Zone Management Authority and confirmed the violation made by the Kamarajar port based on their complaint made by the 6 villagers from Nettukuppam, Thalankuppam, Ennorekuppam, Mugathukuppam, Kattukuppam & Athukuppam villages against the dumping of the dredged material in the river.	dumping of material into the creek.
			The land use plan shows that coal yard, liquid terminal, office complex are proposed to be constructed on the river, mangroves and salt pans. The impacts due to the above said activity on the river were not mentioned in the EIA report.	All the planned facilities such as coal stockyard, terminals etc. are well within the port area where there are no mangroves or salt pans.
			The EIA report was not mentioned with the impacts on fishermen livelihood due to dumping of dredged material in the river.	As stated above, there will be no impact on the livelihood of fishermen due to dumping of dredged material- which be done in offshore area.

S.No	Name	Village	Suggestions	Reply from KPL
			There will be a danger of flood due to the above said activity.	The flooding and drainage into the sea is explained in Chapters 9 and 13. There will not be any flooding into the village. Since the development with port premises.
			Mode of disposal of the dredged material was not mentioned in the EIA report. Fishing activity badly affected due to the above said activity.	Mode of disposal of dredge waste will be carried out in a grid wise pattern covering 5.4 km x 5.4 km area and the details are given in Chapter 8 of the EIA report.
			If the project is to be implemented nearby salt pan area, creek then CRZ clearance to be obtained but on 13.10.2015 port has applied for EIA & CRZ clearance directly for its activity and added cumulative impact assessment study was not carried out. As per CRZ notification, initial recommendation to be obtained from the District level Coastal Zone Management Authority and from State Level coastal Zone Management Authority and then apply for clearance to Central Government instead they have applied straight away to the Central Government for obtaining clearance. As they have hid the same, conducting	KPL is aware and committed to follow the procedure laid down by MOEF&CC in respect of obtaining clearances and the same is followed.

S.No	Name	Village	Suggestions	Reply from KPL
			public hearing for the project was not valid and requested not to grant Environmental Clearances to the said project.	
14	Mr. Sasikumar	Kadalora Makkal Tharkappu	This was not the proper meeting. He said that based only on his earlier representation to the former District Collector for conducting public hearing in the seashore area and the same has been conducted now here.	Public hearing is conducted in most comfortable place at the convenience of all villages and it was decided by TNPCB.
			Due to the port activities, rivers were polluted and fishing and fishing activity has been affected.	Due to present port development there will not be any impact on river and other fishing activities.
			The CRZ areas belong to fishermen and due to construction of permitted activity like port have affected the livelihood of their fishermen. The fishermen who generate foreign exchange crores of rupees were given low wages. Requested to give job opportunities to them to uplift their life.	Port will facilitate job opportunities through BOT operators particularly for youth and women.
15	Mr.Paneerselvam	Ponneri	Public hearing was not properly advertised.	As per procedure TNPCB has given necessary paper advertisement 30 days in advance. In addition banners

S.No	Name	Village	Suggestions	Reply from KPL
				were kept at various locations.
			Due to the growth of the port, the very old salt water lake at Pulicat will disappear within 4 years.	Pulicat Lake lies 18 km away from the northern side of the port. The present development will not have any impact on Pulicat Lake morphology.
			Requested the District collector to inform regarding the measures taken to drain out rain water in Athipattu & Ennore areas.	The flooding and drainage into the sea is explained in Chapters 9 and 13. There will not be any flooding into the village. Since the development with port premises.
			The public were facing health problems due to spillages of coal dust on the roads during coal transportation by lorries from the Chettinad Coal handling terminal at the port to outside areas en-route through their villages. Lorries were not covered properly by tarpaulin covers during coal transportation and thereby creating adverse impacts on the environment.	The coal trucks will be covered to avoid air pollution.
			There was an increase in the company's growth not the people and hence the company should provide proper job	Port will facilitate job opportunities through BOT operators.

S.No	Name	Village	Suggestions	Reply from KPL
			opportunities to fishermen community.	
			Kamarajar Port had stated that they will construct Industrial training Institute & Hospitals for the upliftment of people and yet to be constructed. In such a situation he questioned how to trust the CSR activities formulated for this third phase activity and hence was opposing the project. Further requested the District Collector to intervene in this matter and do good to the people.	CSR activities being carried out through District Collector.
16	Mr. Ravimaran	Thazhankuppam	The port authorities were not providing job opportunities to the fishing community people and were only giving job for people from northern states.	Port will facilitate job opportunities through BOT operators.
			Due to the dumping of dredged sand from the sea in the river and Buckingham canal, badly affected the livelihood of fisherman, also stated that a case was filed in the court, and obtained the stay in this regard.	KPL will not dump any dredged material in Korataliyar River and Buckingham canal.

S.No	Name	Village	Suggestions	Reply from KPL
			Further the port officials have proposed to give industrial training now to villagers, which have not been provided in the past 8 years and they were not worried about the livelihood of fishermen. Requested the District Collector to take special care to provide jobs and to improve the livelihood of fishermen community.	Based on the baseline survey conducted for CSR initiatives of KPL by NABARD consultant, the skill training for 19 fishermen villages and 2 local villages were planned and the same is being executed through Ms. MSME Hyderabad (Government of India institution). Further, the fisheries department has been requested to give a suitable CSR initiative, accordingly the skill training is being prepared by the Jt. Director Fisheries Department, Government of Tamil Nadu.
17	Mr. Bharathi	South Indian Fishermen society	The two major aspects as stipulated in the CRZ Notification 2011 such as long time plans for improving the livelihood of fishermen and to include the fishermen as a member in the committee were not implemented so far. Due to the growth of Chennai & Ennore port, Fishermen activity and the livelihood of the nearby villages viz., Thathankuppam, Neduvangadu kuppam, Ennore etc., were badly affected.	Betterment of livelihood of fishermen will be implemented through CSR activities.

S.No	Name	Village	Suggestions	Reply from KPL
			During the presentation on the project by Dr. Chandramohan he has not informed anything regarding the adverse impacts on the fishermen community, moreover requested not to destroy any mangrove forest & salt pans. There was no mention about the people living in the coastal area. He also stated that due to the growth of the port, the nearby villages would be affected. Requested to provide an area for long time betterment of livelihood of fishermen community and to develop the housing area for fishermen, till then no project must be given CRZ clearance.	Due to the Phase III development there will not be any impact on mangrove forests which are explained in detail in Chapter 11. Fishermen details are included in the EIA report in Chapters 4 and 7.
18	Ms. Pooja	Coastal Resource Group	Emphasis was made on 3 points. During the presentation it was stated that there was no impact to the fishermen community but there is no information about fishing villages in the EIA report, in that case how can they state that there was no adverse impacts to fishermen, in case if it was mentioned in the EIA report, wished to know in which page of the report they have mentioned about the same.	The information of fishing villages is given in Chapters 4 and 7. Since it is only expansion project, there will not be any impact on fishermen.

S.No	Name	Village	Suggestions	Reply from KPL
			Submitting Master Plan, they were obtaining environmental Clearance after that using integrated land use plan they were implementing the project, the above mentioned two project plans do not match each other. Especially coal and marine liquids were handled in the port but their storage yards were housed in the river. Moreover there is no information regarding the impact of the same in the EIA report	The details of the development under each phase have been provided in detail (Chapter 5). The stockyard will be developed outside of CRZ area on the backup land. They are given in Chapters 1 and 5. The impacts of the development are provided in Chapter 11.
			Furthermore there was no information about the Ennore creek and Buckingham canal in the report.	The details of Korataliyar River, Buckingham canal and Ennore Creek are explained in Chapter 9.
			In form 1 it was stated that there is no eco-sensitive area & Critically polluted area within 10 km radius whereas Manali Industrial area and Eco sensitive areas were present.	Manali industrial area is located out of 10 km radius of the port.

S.No	Name	Village	Suggestions	Reply from KPL
			Bypassing the process of obtaining CRZ clearance, they have directly approached Central Government for obtaining clearance. Further they have written thrice to MoEF stressing that public hearing should not be conducted for the project since, it has been confirmed that Kamarajar Port dumped dredged sand illegally in the CRZ area, hence they have directly approached Central Government without obtaining permission from District & State Level Coastal Zone Management Authorities.	The clearance procedure being followed as per state and central standards stipulated by MoEF&CC.
			During the expansion of port, cutting of land and carrying out work must be considered as last resort, but the proposal of cutting of land to the tune of $2.5 \times 10^6 \text{ m}^3$ land by them will lead to sea water intrusion making the ground water in the fishermen villages brackish.	The removal of material will be partly used for landfilling and major part will be disposed in offshore location (Chapter 8). There will not be any seawater intrusion which is explained in Chapter 9.

S.No	Name	Village	Suggestions	Reply from KPL
			Furthermore it was stated that in the EIA report that the dredged material will be disposed offshore but there is no description about the same in the EIA report. Also, there is no information whether there is any fishing activity or not in that region. Henceforth the public hearing must be declared invalid & EIA report must be re-prepared. Finally concluded that till an EIA report fulfilling all TOR points issued by MoEF&CC has been prepared no environmental clearance or CRZ clearance shall be given to the project.	All details such as demography of fishing villages, details of Ecologically Sensitive Area (ESA), importance of Phase III development, impacts due to dredging etc. are provided in the revised EIA report in Chapters 4 & 11.
19	Mr. Praveen	Athipattu	When approached the port seeking employment, was not allowed by CISF personnel's inside the port. Questioned why he was allowed today.	Everyone was allowed today to attend the Public Hearing.
			Complained that drinking water sea water desalination plant has not been provided to nearby villages. Also added that it was not an issue if they were not given job but requested to provide loan without bond & interest. Finally requested to provide jobs to educated	Drinking water arrangement will be taken up with District Administration.

S.No	Name	Village	Suggestions	Reply from KPL
			and uneducated people.	
20	Ms. Archana	Chennai Solidarity Group	There has been no answer to the adverse effects that have occurred during the Phase 1 & Phase 2 growth of the port activity during the past 25 years. Due to complete loss of habitat, fishermen were not able to catch fishes. If they enter the river there is only slush till knee level.	There is no adverse impact reported during phase I and phase II. Living status of the fishermen has increased over the past years. The fishermen population is provided in Chapter 4. It is common that the creek morphology will have soft silty clay at the creek bed .
			The ambient air quality result of the area indicates the presence of high levels of selenium & heavy metals due to which livelihood of the people have affected and there is no protection for life, in such a case she stated that she has no concurrence for this 3 rd phase activity.	The ambient air quality study carried out shows that the environment is clean and the selenium level is very low in non-detectable range in the port area which is explained in Chapter 6.
			She further stated that they are ready to discuss about the 3 rd phase activity only after assurance given to the people of the locality about the protection to their livelihood & life.	During the phase III development necessary precautions will be taken to protect the surrounding environment, people and livelihood. The details are presented in Chapter 11.

S.No	Name	Village	Suggestions	Reply from KPL
21	Ms. Vandhana	General Public	During the last rainy season this area was worst affected, measures proposed to protect this area in the future from similar issues have not been mentioned. Rainwater drains via Kosasthalaiyar river & mixes with the sea through creek, this is known even to a common citizen like her, but astonished how the port consultant didn't know about the same.	More details on the rain water drain on the Korataliyar River, Buckingham canal and Ennore Creek are presented in EIA report. Hence there will be appropriate drainage system through the water bodies during rain.
			Further added that how come an environment consultant of the project was collecting data from them and discussing about the corporate social responsibility of the port.	Data were collected from all available sources in order to make it more environmental friendly. More details on the CSR activities are explained in Socio economic chapter (Chapter 4).

GALLERY





Annexure II

Water Sample Collection

The water samples were collected at seven locations in open sea from two different depth viz. surface and bottom. A water sampler should be used for sampling sea water from 50 meters or more depth. The sampler comprises of a bottle/sampler which is open at both ends. The bottle/sampler is lowered to the desired depth in open position and then closed by dropping a dead weight or a messenger which slides down the supporting cord and strikes the head of the sampler to close from both sides. Water samples are collected in river or open sea, at surface, mid depth and bottom. Van Dorn water samplers are normally used for water sample collection.

Method of analysis protocol

Sl. No	Parameters	Protocol
Water quality		
1	Temperature	IS 3025 (part 9) – 1984 (RA 2012)
		2550-B APHA 22 nd edition, 2012
2	pH	IS 3025 (part 11) – 1983 (RA 2012)
		4500-H+ B, APHA 22 nd edition, 2012
3	Salinity	4500-N org (B) APHA 22 nd edition, 2012
		2520 – B APHA 22 nd edition, 2012
4	Dissolved Oxygen	IS 3025 (part 38) – 1989 (RA 2014)
		4500-O (G) APHA 22 nd edition, 2012
5	Biological Oxygen Demand	IS 3025 (part 44) – 1993 (RA 2014)
		5210 – B APHA 22 nd edition, 2012
6	Turbidity	IS 3025 (part 10) – 1984 (RA 2012)
		2130 – B APHA 22 nd edition, 2012
8	Nitrite	IS 3025 (part 34) – 1988 (RA 2009)
9	Nitrate	4500 – NO ₂ (B) APHA 22 nd edition, 2012
		IS 3025 (part 34) – 1988 (RA 2009)
10	Inorganic phosphate	IS 3025 (part 31) – 1988 (RA 2014)
		4500 – P (E) APHA 22 nd edition, 2012
11	Total Nitrogen	IS 3025 (part 34) – 1988 (RA 2009)
		4500-N org (B) APHA 22 nd edition, 2012

12	Total Phosphorous	IS 3025 (part 31) – 1988 (RA 2014)
		4500 – P (J) APHA 22 nd edition, 2012
13	Total Suspended Solids	IS 3025 (part 17) – 1984 (RA 2012)
		2540 – D APHA 22 nd edition, 2012
14	Colour	IS 3025 (part 4) – 1983 (RA 2012)
		2120-B APHA 22 nd edition, 2012
15	Odour	IS 3025 (part 5) – 1983 (RA 2012)
		2150-B APHA 22 nd edition, 2012
16	Total Dissolved Solids	IS 3025 (part 17) – 1984 (RA 2012)
		2540 – D APHA 22 nd edition, 2012
17	Cadmium	IS 3025 (part 41) – 1992 (RA 2014)
		3120 – B APHA 22 nd edition, 2012
18	Lead	IS 3025 (part 47) – 1994 (RA 2014)
		3120 – B APHA 22 nd edition, 2012
19	Chromium	IS 3025 (part 52) – 2003 (RA 2014)
		3120 – B APHA 22 nd edition, 2012
20	Mercury	IS 3025 (part 48) – 1994 (RA 2014)
		3120 – B APHA 22 nd edition, 2012
21	Zinc	IS 3025 (part 49) – 1994 (RA 2009)
		3120 – B APHA 22 nd edition, 2012
22	Iron	IS 3025 (part 2) – 2004 (RA 2014)
		3120 – B APHA 22 nd edition, 2012
23	Arsenic	IS 3025 (part 2) – 2004 (RA 2014)
		IS 3025 (part 37) – 1988 (RA 2014)
		3120 – B APHA 22 nd edition, 2012
24	Copper	IS 3025 (part 2) – 2004 (RA 2014)
		3120 – B APHA 22 nd edition, 2012
25	Oil and grease	5520 B APHA 22 nd edition 2012
26	Total Petroleum Hydrocarbons	TNRCC method 1055

Sediment Sample Collection

The seabed sediment samples were collected at seven locations in open sea. Sediments are collected using van Veen grab, whereas shore sediments are collected using hand shovel. After collection, the collected/ scooped sample is transferred to polythene bags, labeled and stored under refrigerated conditions. On reaching the laboratory, the sediment samples are air dried and sieved. For macro benthos studies, the collected seabed sediments are preserved by adding formaldehyde mixed with Rose Bengal solution.

Method of analysis protocol

Sl. No	Parameters	Protocol
Sediment quality		
1	Organic matter,	IS 2720 (part XXII) – 1972 (RA 2010)
2	Total Nitrogen	IS 14684 -1999 (RA 2014)
3	Total Phosphorous	IS 10158 – 1982 (RA 2014)
4	Calcium carbonate	IS 2720 (part XXIII) – 1976 (RA 2010)
5	Cadmium	USEPA 3050 B
6	Lead	USEPA 3050 B
7	Total Chromium	USEPA 3050 B
8	Mercury	USEPA 3050 B
9	Phenolic compounds	USEPA 8041& 3545 A
10	Total Petroleum Hydrocarbons	TNRCC method 1055

RISK ASSESSMENT STUDY FOR THE DEVELOPMENT OF THE FACILITIES ENVISAGED IN THE PORT MASTER PLAN - PHASE III FACILITIES

FINAL REPORT



**KAMARAJAR PORT LIMITED
CHENNAI**

Project Code: 533081516

SEPTEMBER 2017

ENVIRONMENTAL CONSULTANT




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Client	Kamarajar Port Limited, Chennai.				
Project Title	Risk assessment study for the Development of the facilities envisaged in the Port Master Plan - Phase III facilities.				
Project Code	533081516				
Abstract	<p>Kamarajar Port Limited is operating, at present, with six berths for handling coal, export/import of automobiles, Marine Liquid Terminal (MLT) etc. As Phase II development, six more berths for handling containers (two berths), LNG (one berth), coal (two berths) and multipurpose cargo (one berth) are under construction.</p> <p>In view of imminent growth potential as exemplified by the demand during the last few years, KPL has proposed to take up another set of following projects as Phase III development comprising of 10 berths, viz. i) Automobile import/export terminals - 2 Nos, ii) Container berths in 1000 m wharf (3 berths) - 1 No, iii) Marine Liquid Terminal - 2 No. iv) Dry bulk terminals - 2 Nos, v) Multi Cargo berth - 1 No.</p> <p>The comprehensive EIA and EMP studies has been conducted by Indomer Coastal Hydraulics (P) Ltd., Chennai, which is an ISO 9001:2015 organization, accreditation for preparation of DPR – Marine sector by Consultancy Development Centre, DSIR, Ministry of Science and Technology vide., CDC/ACC/2015/046, and NABET - QCI accredited organization vide NABET/ EIA/ 1417/ SA 009 for the sectors 27 and 33.</p> <p>The Public Hearing was conducted by the District Collector and TNPCB on 05.08.16. This report presents the details of the Risk Assessment and Disaster Management Plan for the Development of the facilities envisaged in the Port Master Plan - Phase III facilities.</p>				
Foreword	The materials presented in the report carry the copy right of Kamarajar Port Limited, Chennai and Indomer Coastal Hydraulics (P) Ltd. and should not be altered or distorted or copied or presented in different manner by other organizations without the written consent from Kamarajar Port Limited and Indomer Coastal Hydraulics (P) Ltd.				
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1. RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

1.1. Introduction

Risk Assessment (RA) is a method that has proven its value as an all-round tool for improving the safety standards prevalent in every hazardous industry. With advancements in in-built and inherent safety systems, accidents rates have come down, but still persist at unacceptable levels for newer technology and new plants. RA is a structured safety assessment tools designed for high hazard activities such as handling of chemical, petrochemical, storage and transportation of cargoes etc., supplementing other safety systems tools such as HAZOP, regular incident analysis and to identify the potential for incidents (near-misses, unsafe conditions) and to evaluate the necessary control measures.

Objectives

- Assessing risk levels due to the operations of the facility
- Identification of the risk mitigation measures to bring the potential risk within acceptable range.
- To suggest general safety improvement measures.
- To help generate accident free hours
- To identify emergency scenarios and suggest mitigation measures.

Disaster management Plan has been prepared in view of user-friendly for quick reference to the action plan. Main functions of DMP are to manage an emergency and not to use DMP just as reference material for training and shall be made applicable (i) to prevent casualties - both on-site and off-site; to reduce damage to property, machinery, public and environment; to develop a state of readiness for a prompt and orderly response to an emergency.

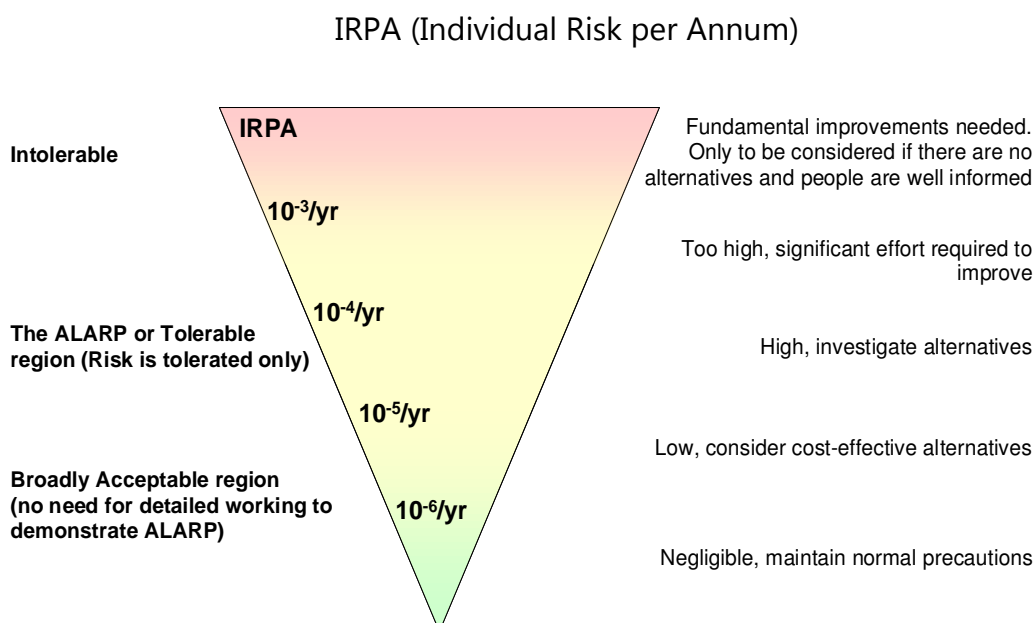
1.2. Present Status

Over a period of time since the commencement of port facilities in 2001 a perfect Risk Assessment and Disaster Management Plan has been put in place at different stages to meet the additional risk due to increased volume of coal, MLT, general cargo, containers being handled. Proposed Phase III involves development of additional facilities for the same type of cargo. The existing DMP which is mainly designed for these types of cargoes presently being handled would be adequate and probably augmented to meet the demand arising out of increase in volume of cargo at appropriate stage.

1.3. Marine liquid terminal

It is proposed to construct additional two numbers of liquid terminals each of 5 MTPA capacity. The liquid cargo expected to be handled at these berths are HSD, MS, CBFS, Lub/Base oil, POL, Chemicals, SKO, LPG etc. The risks normally associated with handling these liquid cargoes are given below.

1.3.1. Risk Assessment



Note: A risk of 10 per million per year, or $10^{-5}/\text{Year}$, effectively means that any person standing at a point of this level of risk would have a 1 in 100 000 chance of being fatally injured per year.

1.3.2. Risk Analysis – effect of fire

Thermal radiation due to pool fire may cause various degrees of burns on human bodies. Moreover their effects on inanimate objects like piping equipment or vegetation also need to be evaluated to assess their impact. The following tables show the damage effects due to thermal radiation intensities.

Table 1.1. Damage due to Incident Radiation Intensity

Incident Radiation Intensity (kw/m ²)	Type of Damage
62.0	Spontaneous ignition of wood
37.5	Sufficient to cause damage to process equipment
25.0	Minimum energy required to ignite wood at infinitely long exposure (non – piloted)
12.5	Minimum energy required for piloted ignition of wood, melting of plastic etc.
4.5	Sufficient to cause pain to personnel if unable to reach cover within 20 sec., however blistering of skin (1 st degree burn) is likely.
1.6	Cause no discomfort on long exposure
0.7	Equipment to solar radiation

Source: DMP report, Environmental Technical Services Pvt. Ltd, 2014

Table 1.2. Heat Radiation and Escape Time

Radiation Intensity (Btu/hr/ft ²)	Time to pain Threshold (Seconds)
440	60
550 (1.6 kw/m ²)	40
740	30
920	16
1500 (4.7 kw/m ²)	9
2200	6
3000 (9.5 kw/m ²)	5
3700	4
6300	2

Source: DMP report, Environmental Technical Services Pvt. Ltd, 2014

For continuous presence of persons, the following thermal radiation intensity levels are usually adopted:

- 1.6 kw/m² for population outside
- 4.5 kw/m² for terminal operators

The effect of incident radiation intensity and exposure time on lethality is given in the following table.

Table 1.3. Radiation Exposure and Lethality

<i>Radiation Intensity (kw/m²)</i>	<i>Exposure Time (Seconds)</i>	<i>Probability of Lethality In (%)</i>	<i>Degree of Burns</i>
4.5	20	0	-
4.5	50	0	1 st
8.0	20	0	1 st
8.0	50	Less than 1	3 rd
12.0	20	Less than 1	2 nd
12.0	50	2	-
8.0	60	1	-

Source: DMP report, Environmental Technical Services Pvt. Ltd, 2014

The scenarios considered were tank fire and bund fire, it was appropriately assumed that peak level of radiation intensity will not occur suddenly. It was estimated that 20-30 minutes time will be required before a tank fire grows to full size. It may be mentioned that tanks under consideration are of fixed roof, cone roof type; the roof has to sink or be blown off before the full diameter fire can develop. For radiation calculation, full tank fire was considered.

1.3.3. Pipe leakage and pipe rupture

In case of small leaks the pressure will be built up slowly and will often be able to be evacuated in time. Pipe rupture will lead to the leakage if the working pressure in the pipes is much higher than the design pressure of the pipe and pressure is developed due to thermal expansion of the liquid. If the pipe is protected by TSV (Thermal safety valves the chances of pipe rupture are less. This frequency can be estimated based on the length of the pipes. An internal DNV gives a failure frequency of $7.87 \times 10^{-5}/\text{m} \cdot \text{year}$ for small pipe leaks and $1.77 \times 10^{-5}/\text{m} \cdot \text{year}$ for large pipe leaks. Based on these data the total failure frequency for pipe leaks is estimated at $9.64 \times 10^{-5}/\text{m} \cdot \text{year}$. From the pipe leakage distribution it is clear that approximately 5 % of failure is pipe ruptures.

1.3.4. Total Breakdown of the pipeline

The pipeline system is designed to transport petroleum products from port to Tank Terminal. The flow rate of 390 KL/hr through the pipeline is considered for the calculations of any extreme possibility of total loss of petroleum products due to severe and complete break-down of the pipeline. Worst case scenario was assumed in the event of the expelled petroleum product catching fire to work out the consequent harmful radiation from the disaster for which only MS is considered. The quantity of the released product for the computations was derived by assuming that the breakdown is detected and checked/stopped after certain time. Consequently, the possible scenario assuming that the complete control of the total break-down is checked after one hour (Quantity of Motor Spirit 390 KL) is shown in Fig. 1.1.

Table 1.4. Hazardous radiation distance from fire due to the total breakdown of the pipeline

Product	Quantity (KL)	Diameter (m)	Duration of burning(sec)	Distance from the center (m)			
				37.5 Kw/m ²	12.5 Kw/m ²	4.5 Kw/m ²	1.6 Kw/m ²
MS (petrol)	390	258	43	291	505	841	1146

Source: DMP report, Environmental Technical Services Pvt. Ltd, 2014

1.3.5. Vapor Cloud Explosions (VCE):

The most dangerous and destructive explosions in the chemical process industries are vapor cloud explosions (VCE). These explosions occur by a sequence of steps:

- 1) Sudden release of a large quantity of flammable vapor. Typically this occurs when a vessel, containing a superheated and/or pressurized liquid, ruptures.
- 2) Dispersion of the vapor throughout the plant site while mixing with air
- 3) Spontaneous Ignition of the resulting vapor cloud resulting in explosion

From a safety standpoint, the best approach is to prevent the release of material. A large cloud of combustible material is very dangerous and almost impossible to control, despite any safety systems installed to prevent ignition. In the event of VCE incident, the distribution of vapor and the associated radiation is determined by the prevailing wind speed and direction. Particularly the wind direction has an immense bearing, as the flame is skewed in the downwind direction. Consequently, the hazardous radiation is towards west and northwest, as shown in evening VCE and morning VCE (Fig. 1.2).

1.3.6. Loading arm failure

The total (100%) failure of loading/unloading arm results in spilling of 600 Liters of **MS** in one minute (10Li/s) from 3 inch diameter hose/pipe. The hazardous radiation in the event of the product catching fire (*before the failure is checkered*) was evaluated in a possible scenario when the disaster is stopped in 60s (10 X 60 = 600 litres) is shown in Fig. 1.3.

Table 1.5. Hazardous Radiation Distance from Fire due Loading arm failure

				Distance from the center (m)			
Product	Quantity (KL)	Diameter (m)	Duration of burning(sec)	37.5 Kw/m ²	12.5 Kw/m ²	4.5 Kw/m ²	1.6 Kw/m ²
MS	0.6	36	6	29	51	85	132

Source: DMP report, Environmental Technical Services Pvt. Ltd, 2014

The same study was also done for spilling of 1200 Liters of **MS** in one minute (10Li/s) from 3 inch diameter hose/pipe.

1.3.7. Road Tanker Failure (MS)

As the tank trucks comes under storage tanks category, its failure frequency is very low, i.e. 1×10^{-6} per year. In the event of heat received by the tank trucks e.g. by flame impingement or from fire in the vicinity, the liquid inside the tanker shall start boiling and the pressure inside the tank shall start building up. If the safety valve provided in the tanker does not work properly or if it has not been designed properly, the phenomenon of BLEVE may occur. The tanks shall rupture and the immediate ignition of the expanding fuel/air mixture leads to intense combustion, resulting in the fire balls. The scenario of pool fire in road tanker is presented in Fig 1.4.

Table 1.6. Hazard Distances to Thermal Radiation due to BLEVE in Road Tankers
(Capacity 12 & 20 KL, MS)

Capacity (MS)	Fire –Dia meters	Burning time (Sec.)	37.5 KW/M ²	12.5 KW/M ²	4.5 KW/M ²	1.6 KW/M ²
20 KL	98	20	102	198	330	493

Source: DMP report, Environmental Technical Services Pvt. Ltd, 2014

1.3.8. LPG Pipeline

LPG is transported through 18" Dia above ground pipeline from jetty to IOCL LPG Plant at Attipathu. The pipeline rupture scenario is shown in Fig. 1.5.

1.3.9. Fire fighting inventories

It is evident that ETTPL has taken every precautionary measure to handle any untoward incident inside the tank farm and at Jetty. The fire fighting systems listed below supports the above fact.

Jetty is connected with fire hydrant line running throughout jetty connected to following:

Fire water pumps	: 1 Nos with capacity of 720 m ³ /hr 3 Nos with capacity of 376 m ³ /hr.
Jockey Pump	: 2 Nos with capacity of 25 m ³ /hr
Foam Pump	: 2 Nos with capacity of 18 m ³ /hr
Foam storage tank	: 30 KL
Double Hydrants	: 4 Nos
Tower Monitors (Water & Fog)	: 2 Nos with capacity of 360 m ³ /hr.
Tower Monitors	: 4 Nos with capacity of 180 m ³ /hr.
Medium Weigh globe boom	: 30 meters length 20 Nos
Oil skimmer	: 1 No with recovery rate of 2 ton per hour

Along with the above facilities terminal is also provide with fire suits, DCP, CO₂ and foam type extinguishers at appropriate places.

1.3.10. Mitigation Measures, Conclusion and recommendations

Mitigation measures

- i. Proper design, inspection and testing of the codes and practices applicable to various components and fabrication jobs are strictly followed to guarantee integrity, reliability and safety of the systems.
- ii. Various operations involved in loading of Tank trucks, connections of loading/unloading Arms, pumping etc. should be well integrated and the operations should be carried out according to a pre-set protocol. Loading arms, joints, coupling, valves etc. should be periodically pressure tested to ascertain their integrity. Accurate records of all inspections, unusual findings, action taken etc. must be scrupulously maintained as a part of the overall record system.
- iii. Operational protocols and safety procedures should be printed and made freely available to the concerned staff. These employees should be adequately trained to inculcate high level of competence not only in day to day operations but also in emergency situation. Periodic refresher courses should also be held to maintain the level of their competence.

Conclusions and recommendations

- The hazard distances due to catastrophic failure of tanks will go beyond the Terminal boundary. However, they are non – credible scenarios with a low frequency of occurrence i.e. $1/10^6$ years. Hence the risk level is low .
- The hazard distances due to road tanker catastrophic failure and loading arm failure will not go beyond the Terminal boundary.
- The study is based on assumption that the storage tanks are designed, constructed and operated in accordance with the safe engineering practices and standards. It is recommended that strict adherence to the standards and accepted practices are followed throughout the life of the Terminal. Regular thickness monitoring & corrosion monitoring of the tanks will be done as per the accepted international norms.
- Proper inspection and testing of the codes and practices applicable to various components and fabrication jobs are strictly followed to guarantee integrity, reliability and safety of the system.
- Various operations involved in storage, pumping, filling and loading etc. should be well integrated and the operations should be carried out according to preset protocols. Arms, hoses, joints, coupling, valves etc. should be periodically pressure tested to ascertain their integrity. Accurate record of all inspections, unusual findings, action taken etc. must be scrupulously maintained as a part of the overall record system.
- Operational protocols and safety procedures should be printed and made freely available to the concerned staff. These employees should be adequately trained to inculcate high level of competence not only in day to day operations but also in emergency situation. Periodic refresher courses should also be held to maintain the level of their competence. Periodic mockdrills will also be done to test the system efficiency.
- Maintenance plays a vital role in proper upkeep of the Terminal. One important function is monitoring of health of equipment, pipeline and machines. Adoptions of the systems like thickness survey including supports, maintenance of history cards, preventive maintenance practices will improve Terminal performance and safety. It should be pointed out that the failure rates of equipment and pipes are influenced by the maintenance practices followed.

- The individual risk level of 1×10^{-6} / yr is limited to a distance of about 200 meters on either side of the pipeline corridor.
- Line patrolling - This is a visual inspection of the pipeline along its entire route. The inspection may be done by means of ground patrolling.

1.4. Coal Stack Yard

1.4.1. Operational Objectives

- Discharge the coal from ship using shore based un-loaders without air and sea water pollution at shore lines.
- Conveying the cargo from the berth to designated stock pile and forming discrete stock piles for separate cargo/grades.
- Re-claiming material, store in the stock yard and convey it to wagon and truck loading points through closed conveyor system.
- Loading wagons and truck with measured quantities.
- Provision of direct dispatch by conveyor by-passing the stack yard.

1.4.2. Stack Yard

The stack yard is constructed using graded gravel of 250 mm with quarry dust 25 mm thickness as top layer. Area of stack yard: 1700m x 40m x 2 nos. =13600 m²

The stack yard comprises the following.

- a) Water sprinkling system at stock yard
- b) Wind shield at stock yard
- c) Green belt and compound wall at stock yard
- d) Catch pits and settling pond
- e) Stacker cum re-claimer

- f) Automatic wagon loading system
- g) Automatic truck loading system
- h) Centralized control room
- i) Fire fighting system at stock yard

1.4.3. Coal Handling

- Coal dust will be generated generally at the conveyor transfer point, coal unloading area and coal stock pile area. Hence, coal transfer points and coal stock yard can be provided with dust suppression/dust extraction facilities.
- Dust collection system can be provided in bunkers to evacuate dust and hazardous gases like Methane from the coal stacks.
- Internal roads will be concreted / asphalted to reduce fugitive emission.

Spatial distribution of radiation from fire of Coal stock yard and Coal dust fugitive emission is shown in Fig. 1.6.

1.4.4. Fire fighting inventories

a. Fire Hydrant

- 1) Number of Fire Hydrant around the stock yard: 168 Nos.
- 2) Number of fire Hydrant point at coal Berth area: 6 Nos.

Stock yard is fully equipped with 168 nos of fire hydrant stock pile. Separate pump house is provided. During the power failure period diesel operated pump is available at stock yard and berth.

b. Fire Extinguisher

CO₂ Type Extinguisher - 55 Nos; Dry Powder Type - 14 Nos; M/F Type - 10 Nos; Totally - 79 Nos.; Fire Extinguishers location data are enclosed.

c. Sand Bucket

Total sand bucket – 60 Nos. (Kept at various locations at coal stack yard and berth)

d. Fire Fighting Hose

Fire Fighting Hose kept in ship Un-loader 1&2; Hose with box – 10 nos. and Hoses are available in Pump House

e. Water Capacity

Capacity of the water sump at Pump House – 9 lac. Liters if required water from the sea can be used for fire fighting.

1.5. Iron Ore Stackyard

Iron ore stock yard yet to be started. Fine iron ore dust fly into the atmosphere due to high wind velocity and may cause health hazard. Fig 1.7 shows iron ore fugitive emission from iron ore stockyard.

Recommendations

- (i) Transportation of iron ore from Jetty to stock yard should be by closed conveyer system.
- (ii) Dust suppression system should be perfect to avoid spreading of dust into the atmosphere due to high wind velocity and the large area may become reddish brown and may create health hazard.

1.6. Car Stack Yard

The car stock yard area is cemented and has 3 feet high boundary wall all around. In this area 5000 to 6000 cars can be parked. The maximum detention time of cars may be around 10 days and within that period cars will be loaded on board for export. In

case if any disaster due to fire in car parking yard, then the spatial distribution of radiation of fire is shown in Fig. 1.8.

Recommendations

- i. There should not be any greenery near the car park area (Inside and outside of the boundary wall).
- ii. At the entrance gate there should be "stop sign" to avoid any type of accident.
- iii. LPG pipeline has to be routed 200 m away from parking yard (or) buried 1.5 m below ground level to avoid accident.

1.7. Hazop Study

The technique of HAZID study is systematically applied to assess the safety and operability of the plant. It is made through a structured set of questions using "guidewords" which focus on the process or operating deviations outside the established parameters. The guide words are used to ensure that the questions which are posed to test the integrity of each part of the design will explore all conceivable ways in which they could deviate from the design intentions. Each deviation is then considered to decide how it could be caused and what would be consequences. The team looks for causes of each deviation and if there is a consequence of concern, they evaluate the safeguards in place to determine if they are sufficient given the risk posed. If the team feels additional safeguards may be warranted they make recommendations. The technique is then repeated until every Processing section and piece of equipment of concern has been reviewed.

The important terms used in HAZID/ hazop study are:

- | | | |
|-------------|---|---|
| Intention | : | The intention defines how the part is expected to operate. |
| Guide words | : | These are simple words which are used to qualify or quantify the intentions in order to guide and stimulate |

brain storming process and so discover deviations.

- Parameter : An aspect of process that describes it physically chemically or in terms of what is happening viz. flow, Pressure, Temperature, Level Composition etc,
- Deviation : These are departure from the intension, which are, discovered by systematically applying the guide words.
- Causes : These are the reasons why deviations might occur.
- Consequences : These are the results of the deviations, would they occur.
- Safeguards : These are the protection provided in the system.
- Recommendation : These are hardware and software changes required for protecting and smooth operating of the system.

Table 1.7. List of guide words

Guide Words	Meanings	Comments
None	Complete negation of the intention	No part of the intention is achieved e.g. no flow or reverse flow.
More of	Quantitative increase	More of any relevant physical properties than there should be e.g. higher flow (rate or total quantity) higher temperature, higher pressure higher viscosity, more heat, more reaction etc.
Less of	Quantitative decrease	Less of any relevant physical property than there should be, e.g. Lower flow (rate or total quantity), lower temperature, lower pressure, less heat, less reaction etc.
Part of	Quantitative decrease	Composition of system different from what it should be e.g. Change in ration of components, component missing etc.
More than	Qualitative increase	More components present in the system that there should be e.g. extra phase present (Vapor, solid), impurities (air, water, acids, corrosion products etc.)
Other than	Substitution	What else can happen apart from normal operation e.g. Start up, shutdown, high/low rate running, alternative operation mode, failure of plant services, maintenance, catalyst change etc.

Source: DMP report, Environmental Technical Services Pvt. Ltd, 2014

Guidewords are applied to the design intention. The design intention informs us what the equipment is expected to do.

Table 1.8. Study Work for Hazard Identification-PLT receipts

Event	Cause/Comments	Possible Consequences	Prevention/ Protection
SECTION OF FACILITY: PETROLEUM PRODUCTS			
1. Mechanical impact on the pipeline causes leak of petroleum products from the pipeline.	3 rd party involvement e.g. digging or trenching, or other earth work. 1 st party involvement. Non through wall damage, i.e. part wall or delayed failure damage.	Massive release of petroleum products. If ignition, then possibility of flash or jet fire. Physical explosion from the pressure of the pipeline creates projectiles (earth, sand, stones). Injury and property damage.	<ul style="list-style-type: none"> - Rural zoning. Mainly large farming developments with some smaller lots. - Pumping stations will be clearly marked and surrounded by security fencing. All pipes and valves are of robust design and construction. - Automatic shut down through automatic line break detection and valve closure if large hole in pipe. Manual shut down by Network Controller in Control Centre in if pressure drop. - MS disperses readily upwards, minimizing chances of ignition. Explosion not credible in unconfined situation.
2. Corrosion leads to leak of Petroleum Products from the petroleum products pipeline.	Damage of pipeline coating due to excavation inspection damage leads to corrosion. Construction damage or coating flaw or faulty materials	Release of petroleum products. If ignition, a jet fire is possible. Injury and property damage.	<ul style="list-style-type: none"> - Cathodic protection for external corrosion. Internal corrosion virtually absent with clean hydrocarbon. - Coating on external surfaces of pipelines. - Routine inspection of pipeline (including regular patrol and pigging). Visual and sound indications if leak. - Pipeline to be constructed to facilitate internal (pigging) inspection (minimize dips). - MS disperses readily upwards, minimizing chances of ignition. - MS is odorized, allowing for detection and subsequent response in case of a small leak before it can develop

			into a larger leak.
3. Nearby explosion at neighboring petroleum products pipeline or tie-offs.	Incident (wear and tear, mechanical impact, lightning strike etc. etc.) at the parallel petroleum products pipeline.	Possible damage to petroleum products pipeline with release of MS, HSD, FO. If ignition, then possibility of flash or jet fire. Injury and property damage.	<ul style="list-style-type: none"> - Internal risk management procedures / systems by petroleum products pipeline operator. - Pipeline integrity plan (incl. protection, pigging etc. to monitor integrity of pipeline and coating inspection). - 24 hour monitoring of petroleum products pipelines. - MS disperses readily upwards, minimizing chances of ignition. Explosion not credible in unconfined situation. - Thickness and grade of pipelines.
4. Pressure excursion leads to failure of the pipeline.	Operational error upstream or Downstream facility.	Over pressuring the petroleum products MS, HSD, FO pipeline causing failures, leaks and release of MS HSD FO. If ignition, then possibility of fire. Injury and property damage.	<ul style="list-style-type: none"> - Pipelines constructed and hydro tested as per requirements. - Continuous observation of pressure of pipeline from Control Centre. Lack of control for several hours required before pressure could exceed critical levels. - High-pressure trip and automatic line-break protection isolating flow of petroleum products. - Mechanical over pressure protection & controls at compressor stations.
5. Spontaneous loss of integrity of pipe	Construction defect or operational error (repeated).	Massive release of MS gas. If ignition, then possibility of flash or jet fire. Injury and property damage.	<ul style="list-style-type: none"> - X-raying of welds as required. - Cathodic protection. - Design for pipelines to limit crack propagation to about two pipe lengths. - Pipeline has integrity management plan. - Pipeline subject to CP monitoring at regular intervals.
6. Erosion results in damage to piping	Flooding	Potential for flood waters to	<ul style="list-style-type: none"> - Control of erosion through regular and periodic patrols

and equipment.		wash away soil cover. May cause pipeline to be exposed. Possibility of damage to coating and subsequent corrosion issues. If not corrected may eventually lead to failure of pipeline.	and inspections (aerial patrols, ground patrols after heavy rain/flooding, landowner liaison). - Repair to soil cover if erosion.
7. Land subsidence results in pipeline damage.	Mining activities in area or earthquake creates.	Failure of pipeline resulting in potential for rupture or massive leak. Release of petroleum products. If ignition, then possibility of flash or jet fire. Injury and property damage.	- Site is not affected by mine subsidence. - Pipe to be designed to in terms of strength of material and design.
8. Aircraft, train or heavy vehicle crash result in damage to pipeline resulting in hazardous releases.	Aircraft crash. Heavy vehicle crash.	Potential damage to pipeline resulting in hazardous releases, fire / explosion.	- Pumping stations are located safely away from potential road or train crash locations. - Pumping stations are surrounded by security fencing which will assist in containing a vehicle. - Automatic line break isolation valves minimizes amount of petroleum products released if pipe line is damaged. Possibility of remote activation of isolation valves by Controller. - Aviation safety standards to apply.
9. Damage to pipeline through terrorism / vandalism.	Malicious damage.	Massive release of MS. If ignition, then possibility of flash or jet fire.	- MLVs surrounded by security fence. - Any building doors will be fitted with intruder alarms.

10. Neighboring fire.	Bush / brush fire.	Possible heat radiation at pipeline. If damage to pipe and equipment then possibility of release of hazardous material and fire risk.	<ul style="list-style-type: none"> - Control of vegetation in easement. Pipeline is unlikely to be affected by heat radiation. - Above ground valves are fire safe.
<i>Source: DMP report, Environmental Technical Services Pvt. Ltd, 2014</i>			

Table 1.9. Study Work for Hazard Identification-Pump station

Event ID No.	Hazardous Event	Causes	Possible Consequences	Proposed Prevention and Mitigation Control Measures
11	Major mechanical failure of tanks	<ul style="list-style-type: none"> • Metal fatigue • Faulty fabrication • Corrosion of tank base / weld • Tank explosion due to lightning strike / breach of hazardous area ignition source controls • Adjacent tank on fire • Blocked vent 	<ul style="list-style-type: none"> • Large spillage of combustible materials in bund. Fire if ignited • For historical tank explosions, some tanks have rocketed away from the foundations • Impact to people (radiant heat and/or exposure to products), property and the environment (products of combustion) 	<ul style="list-style-type: none"> • Tanks designed to API 650 • Regular maintenance and inspection procedures • Tank and site fire protection facilities available • Explosions only occur when ullage vapour is between LEL and UEL. For combustible liquids, the vapour concentration is expected to be below the LEL.
12	Tank roof failure	<ul style="list-style-type: none"> • Ignition, e.g. by lightning, of atmosphere within the roof space • Vents blocked during filling procedure • High speed filling 	<ul style="list-style-type: none"> • Rim seal fire (floating roof tank) • Tank top fire • Initial explosion possible leading to a tank top fire • Potential for spill into the bund with a fire if ignition occurs • Boil over possible if water layer exists • Impact to people (radiant heat and/or exposure to products), property and the environment (products of combustion) 	<ul style="list-style-type: none"> • Internal floating roof with mechanical seal • Foam injection system • Fire fighting system • Regular maintenance and inspection procedures • Level alarms, controlled tank filling • Explosions prevention as per Item 1

13	Pipe failure (i.e. new piping within the terminal)	<ul style="list-style-type: none"> Corrosion Impact Maintenance work Pressure surge 	<ul style="list-style-type: none"> Spillage of combustible material. Fire if ignited. Impact to people (radiant heat and/or exposure to products), property and the environment (products of combustion) 	<ul style="list-style-type: none"> Regular maintenance and inspection procedures Emergency isolation valves on the tanks Fire fighting system (including foam)
14	Pipeline failure external to the terminal – note that this is existing piping	<ul style="list-style-type: none"> As per 3 above plus vandalism 	<ul style="list-style-type: none"> As per 3 above 	<ul style="list-style-type: none"> Regular maintenance and inspection procedures Emergency isolation valves Fire fighting system (including foam) Pipelines surge study Routine inspections during transfers
15	Spillage of combustible material to the existing or approved or proposed bunds	<ul style="list-style-type: none"> Tank overfilled during transfer Tank drain valve left open or tank sampling valve left open, e.g. human error 	<ul style="list-style-type: none"> Spill into bund Bund fire if ignited Possible tank fire and boil over Impact to people (radiant heat and/or exposure to products), property and the environment (products of combustion) 	<ul style="list-style-type: none"> Fire fighting as above Two independent level devices installed Emergency shutdown system Operating procedures Sampling and inspection procedures prior to disposing of waste bund water
16	Leak during filling of existing road tanker	<ul style="list-style-type: none"> Failure of loading arm Leak from valves or fittings Road tanker overfill 	<ul style="list-style-type: none"> Leak of petroleum product in loading area Fire if ignited Impact to people (radiant heat and/or exposure to products), property and the environment (products of combustion) 	<ul style="list-style-type: none"> High level of surveillance and use of leak detection & shutdown systems Drivers are well trained so as to minimise chance of operator error & ensure quick response to leaks Road tanker bay to be fitted with automatic foam deluge system

				(if filling flammable product) <ul style="list-style-type: none"> • Ignition sources controlled • Scully truck overfill shutdown system and vent knock out pot level shutdown system
17	Road tanker drive-away incident (i.e. driver does not disconnect the hose and drives away from the loading bay)	<ul style="list-style-type: none"> • Failure of procedures and hardware interlocks 	<ul style="list-style-type: none"> • Leak of petroleum product in loading area • Fire if ignited • Impact to people (radiant heat and/or exposure to products), property and the environment (products of combustion) • Ignition source present (road tanker engine), hence fire more likely 	<ul style="list-style-type: none"> • Driver training • Driver not in cab during filling • Brakes interlocked prior to connection and until disconnection • Road tanker bays to be fitted with automatic foam deluge system • "Dry-break" hose couplings
18	Leak at product pumps	<ul style="list-style-type: none"> • Pump seal, shaft or casing failures 	<ul style="list-style-type: none"> • Leak of petroleum product in loading area • Fire if ignited • Impact to people (radiant heat and/or exposure to products), property and the environment (products of combustion) 	<ul style="list-style-type: none"> • Double mechanical seal with seal failure trip interlock (if filling flammable product) • Condition monitoring and preventative maintenance of pumps • Fire fighting as above • Pumps in contained area
19	Leak at vapour recovery unit	<ul style="list-style-type: none"> • Failure of vessel due to corrosion or other cause 	<ul style="list-style-type: none"> • Potential for fires and environmental impact 	<ul style="list-style-type: none"> • Regular maintenance and inspection procedures • Gas detection system and alarm • Stoppage of road tanker filling • Fixed firewater monitors for fighting fires

20	Road accident (off-site)	<ul style="list-style-type: none"> • Bad road or traffic conditions 	<ul style="list-style-type: none"> • Most likely outcome is no loss of load • Leak may occur, leading to fire • Impact to people (radiant heat and/or exposure to products), property and the environment (products of combustion) 	<ul style="list-style-type: none"> • Design of road tankers to survive accident without a loss of containment - pipes and running gear designed to shear off without product loss • Driver training and choice of routes to reduce accident potential
21	Aircraft crash	<ul style="list-style-type: none"> • Pilot error • Bad weather • Plane fault 	<ul style="list-style-type: none"> • Propagation to tank / bund fires • Impact to people (radiant heat and/or exposure to products), property and the environment (products of combustion) 	<ul style="list-style-type: none"> • As per aviation standards
22	Strong winds, earthquakes	<ul style="list-style-type: none"> • Strong winds cause equipment damage etc 	<ul style="list-style-type: none"> • Loss of containment leading to a fire if ignited (as above) 	<ul style="list-style-type: none"> • The tanks are designed API 650 / AS 1692 / • AS 1170 to resist the combined effects on internal pressure due to contents, weight of platforms, ladders, live loads, wind loads, earthquake forces and hydrostatic test loads • Operations stopped in adverse weather conditions
23	Breach of Security / Sabotage	<ul style="list-style-type: none"> • Disgruntled employee or intruder 	<ul style="list-style-type: none"> • Possible release of product with consequences as per above 	<ul style="list-style-type: none"> • Security measures include fencing, CCTV, security patrols, operator / driver vigilance • Pressure tests prior to commissioning transfer • Pipe inspections prior to commissioning transfer; regularly during ship discharge

				and otherwise on a periodic basis
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Table 1.10. Study Work for Hazard Identification-Pipelines

24	Loss of containment in the Pipeline Corridor	<ul style="list-style-type: none"> Pipe failures, e.g. due to corrosion, thermal overpressure or third party activity / malicious act 	<ul style="list-style-type: none"> Most likely outcome is a spill onto the ground. Few sources of ignition exist in the Pipeline Corridor. 	<ul style="list-style-type: none"> Regular maintenance and inspection procedures. Emergency isolation valves. Fire fighting system. Pipelines surge study. Routine inspections during transfers
25	Insulation fires	<ul style="list-style-type: none"> Loss of containment of products into the piping, tank or vessel insulation 	<ul style="list-style-type: none"> Potential for fires, i.e. from burning of the product and/or flammable vapours, and hence propagation to the adjoining system 	<ul style="list-style-type: none"> Flammable vapours are limited and H₂S is readily noticeable at low odour levels of 0.005 ppm well before LEL. Combustible product. Fire fighting systems
26		<ul style="list-style-type: none"> Hose failure, pipe failure, valve left open 	<ul style="list-style-type: none"> Potential for people to be exposed to corrosive liquids. Potential for environmental impact if the spilt liquids are released via the storm water system 	
27	Leak during filling of road tanker	<ul style="list-style-type: none"> Failure of loading arm. Leak from valves or fittings. Road tanker overfill 	<ul style="list-style-type: none"> Leak of product in loading area. Fire if ignited. Impact to people (radiant heat and/or exposure to products), property and the environment 	<ul style="list-style-type: none"> High level of surveillance and immediate access button to shutdown systems. Drivers are well trained so as to minimise chance of operator

			(products of combustion)	<p>error and ensure quick response to leaks.</p> <ul style="list-style-type: none"> • Ignition sources controlled at top of road tanker. • Road tanker overfill shutdown system and vent knock out pot level shutdown system • Fire fighting systems
28	Road tanker drive-away incident (i.e. driver does not disconnect the hose and drives away from the loading bay)	<ul style="list-style-type: none"> • Failure of procedures and hardware interlocks 	<ul style="list-style-type: none"> • Leak of product in loading area. • Fire if ignited. • Impact to people (radiant heat and/or exposure to products), property and the environment (products of combustion) 	<ul style="list-style-type: none"> • Driver training. • Driver not in cab during filling but monitoring at same elevation as loading arm. • Automatic loading system instructs driver on actions required. • Ignition sources controlled at top of road tanker. • Fire fighting systems

Source: DMP report, Environmental Technical Services Pvt. Ltd, 2014

Node: Transfer of Petroleum Products by Pipeline to Storage Tanks

SI.No.	Guideword	Deviation	Possible Cause	Consequence	Action Required
29	No/Less	No Flow / Less Flow	No flow of petroleum products in pipeline	Operational delay	Ensure supply of petroleum products in pipeline.
			Petroleum products going back in the pipeline	Operational delay	Non returning valve (NRV) is provided to avoid the possibility of back flow in the line
			Some valves are erratically closed,	Operational delay	Proper maintenance an inspection of valves is required.
30	More	More Flow	Leakage in the transfer line / pipeline	Oil spillage and it may cause fire & explosion	Proper fire-fighting facilities are provided as per rules and standards. Proper inspection and maintenance of transfer line and pipeline.
			Not possible as flow is controlled in pipeline from Tap-off point	None	None
31	High	High Pressure	High pressure in pipeline line	Possibility of leakage of petroleum product from flange, fittings and joints in the transfer line.	Thermal relief valve (TRV) followed by non – returning valve is provided to release the pressure in transfer line.
32	Reverse	Reverse Flow	Not possible due to Non Returning Valve (NRV) has already been provided in the line.	None	None
33	As well as	Flow of Foreign Materials	Not possible	None	None
34	Low	Low Level	No level measuring device.	Over flow of petroleum product in dyke area	Hi-Hi level alarm switch is provided on the tank as interlock to avoid over flow from tanks.

SI.No.	Guideword	Deviation	Possible Cause	Consequence	Action Required
			No alarm system on the tanks.	Pool fire in dyke area	
35	No/Low	No/Low Flow	No/less flow in transfer/pipeline	Operational delay	Radar Tank Gauge (RTG) is provided
36	High	High Temperature	High Ambient Temperature	More emissions of hydrocarbon vapours	Breathing vent is provided on the tank
37	No/Less	No/Less Flow	No pumping from storage tank to filling gantry.	Operation Delay	Pump rectification, use stand by pump,
			Stop pumping due to power failure	Operational delay	Arrangement of power back-up
			One of the valve closed erratically/partially block	Excess pressure in line	There should be excess pressure tripping
Node : Transfer of Petroleum Products from Storage Tank to Loading Bays					
38	More	More Flow	Line failure and leakage in line or pump	Spillage of petroleum products Fire, if, ignition source is available	Ensure mechanical integrity of line. Provision of adequate fire fighting facilities. Inspection and maintenance schedules should be prepared and followed as per operating procedures.
39	High	High Pressure	More pressure in line due to pumping	Non as thermal relief valve (TRV) provided	None
40	As well as	Other products	Pumping of other petroleum products	None hazardous. Contamination of petroleum products	Density meter is provided
41	Reverse	Reverse Flow	Reverse rotation of pump	None hazardous	Non returning valve (NRV) is provided to avoid the possibility of back flow in the each line
Node: Unloading and Transfer of Ethanol to Semi Buried Storage Tanks					

SI.No.	Guideword	Deviation	Possible Cause	Consequence	Action Required
42	No/ Less	No Flow	Tanker unloading pump not working	Operational Delay	Check motor faults, impeller, mechanical seal failure, in other words good maintenance of pump and motor is desired. Operate stand by pump.
43	More	More Flow	Leakage from pump	Spillage of petroleum products and possibility of fire.	Provision of adequate fire fighting facilities.
			More supply of Ethanol from the tank truck to underground tank.	Overflow of Ethanol from the underground tank	Level switch needs is provided to control the quantity/supply in the underground tank.
44	Reverse	Reverse flow	Reverse rotation of pump or suction	Non hazardous Possibility of back flow	Non return valve (NRV) is provided
Node : Filling of Petroleum Products in Tank Truck through Loading Bays					
45	No/ Less	No flow in loading arm	No pumping from Storage tank	Operational delay None hazardous	None
46	More	More flow	More supply of petroleum product in the truck tank.	Overflow of petroleum product from the tanker.	Digital Control Valve is provided to control the quantity/supply for the tanker.
			Position of man hole of truck tank and filling arm is not correct.	Over spill of petroleum products on the floor and possibility of fire, if, source of ignition is available	Provision should be kept for over spill sensors to prevent the overflow
				Spillage of petroleum product on the floor and fire, if, source of ignition is available.	Provision of adequate fire fighting facilities.

Source: DMP report, Environmental Technical Services Pvt. Ltd, 2014

1.8. Tsunami, Flood and Storm surge

This section describes the possibility of occurrence of Cyclone and the related high wind speed, the expected storm surge along the coastal region due to the passage of Cyclone and also the impact in case of occurrence of Tsunami. The possible intensity of occurrence, impact on the coastal form and people, the risk assessment and the Disaster management plan are enumerated.

Storm surge

Occurrence of storm is a common phenomenon in Bay of Bengal during Northeast monsoon particularly in October and November. The region selected for the development is prone to cyclone and storm surges. Based on the data published by IMD in, 'The tracks of Storms and Depressions in the Bay of Bengal and the Arabian Sea-1877 to 2013', ninety nine storms had occurred in the vicinity. The occurrence of cyclones is more frequent in the month of November followed by October. If a cyclone with an intensity of 180 kmph develops near the project region it will be followed by heavy wind and continuous rain, in such case the storm surge will be around 1.5 m. The rise in water level combined with high tide period and flood discharge due to heavy rain fall will flood the areas having elevation < 3 m MSL.

Storm surge and the associated effect during the storm

If a cyclone approaches the project region, it will be followed by heavy wind, incessant rain, coinciding with the high tide time, flooding from catchments and the storm surge causing the rise in water level on low lying areas and draining basins.

In addition, during the event of storm, high waves approach the coast and break. The heavy rainfall causing huge flood in the river as well as the opening of inland dams/reservoirs will cause stagnation of flow and inundation leading to killing

people and damaging the coastal properties. For e.g., during the disastrous Cyclones like Andhra Pradesh Cyclone (November, 1977), Odisha Cyclone (November, 1999) and Rameswaram Cyclone (December, 1964), thousands of people were killed and there was a huge damage to the coastal properties.

The characteristics of tropical disturbances and the maximum surge heights recorded along the east coast of India are given below:

Table 1.11. Characteristics of Tropical disturbances

Tropical disturbances	Wind Speed	
	knots	kmph
Low pressure	< 17	< 31
Depression	17 – 27	32 – 50
Deep depression	28 – 33	51 – 60
Cyclonic storm	34 – 47	61 – 89
Severe cyclonic storm	48 – 63	90 – 119
Severe cyclonic storm with a core of hurricane winds	64 – 119	120 – 221
Super cyclones	≥ 120	≥ 222

Source: IMD, Pune.

Tsunami

Tsunami is a series of wave train generated in the ocean by a hydraulic impulsive force that vertically displaces the water column. Earthquakes, landslides, volcanic eruptions, explosions and even the impact of cosmic bodies taking place in the ocean can generate Tsunami waves with long periods (≈ 30 min), long wave length (≈ 100 km) with a high velocity of propagation (≈ 700 km/hr).

Tsunamis are shallow water waves which propagate with phase velocity equal to the square root of the product of the acceleration due to gravity and the water depth. For example, in the Pacific Ocean, where the typical water depth is about 4000 m, the Tsunami wave travels at about 700 km/hr. Because the rate at which the wave loses its energy is inversely related to its wave length, Tsunami not only propagates at high speed, but it can also travel great transoceanic distances with limited energy losses and reach different continents in shorter time i.e., the energy propagating with a Tsunami waves remain nearly constant.

Among the various factors causing the occurrence of Tsunami, the large vertical movements of the earth's crust is more predominant and it can occur at tectonic plate boundaries. The plates that interact along these boundaries are called faults. Around the margins of the faults, the denser oceanic plates slip under the continental plates in a process known as subduction. Such subduction earthquakes are particularly very effective in generating the devastating Tsunamis.

The energy flux due to Tsunami is proportional to its velocity of propagation and height and it remains nearly constant till it reaches the coast. Consequently, the velocity of propagation gets retarded when it enters shallower water and its height gets amplified. Because of this shoaling effect, the Tsunami that is imperceptible at deep ocean close to centimeter height may rise up to several meters near the coast called run up.

When Tsunami finally reaches the coast, the crest of the wave appears as rapidly risen water mass gushing into the coastline as a bore with a crashing velocity of 50 km/hr for more than 10 - 30 min. The trough of the wave will appear as the withdrawal of water mass with same speed back into the ocean swallowing everything on the land and dragging back into the ocean.

Possible intensity of Tsunami: In worst case, if a Tsunami occurs due to the movement of Andaman and Indonesian plate then there will be surging of Tsunami waves with a speed of > 60 kmph into the shore and the run-up will be > 4 m. The gushing of water will sweep and flood the areas having elevation < 3 m MSL.

The occurrence of a Tsunami along the Indian coast is an extremely rare event with a very low frequency of less than once in 500 years. No reliable historical records of occurrence of Tsunami events and their impact along the Indian coast are available because of its exceedingly rare nature.

One worst tsunami event was witnessed on 26th December 2004 along the Tamil Nadu coast, and the water level rise due to this Tsunami along the coast near the project region was around 2.5 m. The backshore in the project region was low and flat and hence the runup of Tsunami has intruded to a longer distance till the East Coast Road.

From the records of tide gauge data during the 2004 tsunami event, the number of high tsunami waves at different places along the coast was observed to vary between 3 to 5 waves with an average period of nearly 2 hours. Eye witness accounts say that each high tsunami wave that approached the coast was like a solitary surging / tidal bore wave, and the rise in water level near the coast due to such surging wave existed only for a short duration of nearly 30 minutes.

Flood

The project region is located in more dry area. Rainfall statistics shows that most of the time Chennai remain dry with marginal deficit of rain. Chennai city has experienced drought during the period of 2000- 2005 and drinking water were brought through train due to deficit of fresh water supply from several places. The storm water drains remain dry for the major part of the year. However the statistics

shows that once in ten years Chennai received heavy rainfall which resulted in flooding through all draining rivers like Kosathalaiyar River, Cooum river, Adyar river, Palar river etc. It is observed that during such situation a peak rainfall of 10 – 15 cm/day occurred for a period of 2 – 3 days amounting to 30 cm rainfall spread over to 3 days. The existing river/ drainage system within the city is capable of transporting flood water into the sea without much stagnation/flooding on the land.

In the year 2015, which people call as 1 in 500 year cycle, there was a heavy downpour amounting to 40 cm rainfall in 8 hrs spread over 60 km radius of the city. In total it was reported about 540 mm of rainfall for five days which was called a natural disaster. During those period, the entire Chennai and its adjacent areas were totally flooded irrespective of the type of facilities, plans, residential areas, roads, bridges, etc. All reservoirs got filled up and got breached. The drainage/ rivers were discharging 4 times their capacity into the sea. It was found that hydrologically it was not sufficient to drain the flood water. Under such drastic circumstances, Kosathalaiyar River, Buckingham canal and the adjoining low lying areas got filled up and became the most affected areas like any other areas in Chennai. It took 15 days for the situation to come to normal. On the otherhand these places remain dry with insufficient tidal incursion in Kosathalaiyar River and Buckingham canal near the project region for many years.

It has been suggested under mitigation, KPL has to deepen the Kosathalaiyar River and the Buckingham canal cross section and maintain its functionality so that during any such repetition of natural calamity, the existing rivers can discharge maximum possible flood water into the sea.

Disaster Management Plan

Cyclone, Tsunami and Storm surge are the most destructive forces among the natural devastations. It causes instant disaster and burial of lives and destruction to entire coastal properties. The damage and loss can be minimized if appropriate preparedness plan is formulated. The following statutory guidelines are recommended by National Disaster Management Authority (NDMA) to minimize the impact due to Cyclone, Tsunami and storm.

- Developing sand dunes along the coast with shrubs or Casuarina trees for stabilization of the sand dunes (Tsunami Mound).
- Raising the ground level (above the design water level) with natural beach sand so as to rehabilitate the coastal region.
- Development of coastal forest (green belt) by planting casuarinas and coconut trees along the coastline to cover minimum of about 500 m width of the beach.
- Adopting natural beach nourishment to create steep beach face.
- Creation of sandy ramps at close intervals along the coast.

In addition to the guidelines by NDMA, it is also necessary to adopt various preventive actions in the coastal region of the project site.

Preparedness Plan

The preparedness plan shall contain details about: i) warning that should be given ii) Protective measures to contain the effect of surging water level and iii) Other precautionary measures to be taken. The following measures are the key aspects in the preparedness plan.

- i) Coordination with International and National Agencies
- ii) Vigilant online monitoring
- iii) Emergency Evacuation

Coordination with International and National Agencies

International: Following a series of Tsunamis that hit Japan and North America, an international Tsunami warning network was put in place in 1960s in regions around the Pacific Ocean. This network is administered by National Oceanic and Atmospheric Administration (NOAA), USA. NOAA comprises of hundreds of seismic stations worldwide, which can detect earthquakes that are precursors to Tsunami. This network also includes coastal tide gauges that detect local changes in sea level and sophisticated **DART Buoys** (Deep Sea Assessment and Reporting of Tsunamis buoys) in the Pacific basin, capable of detecting even a centimetre change in water depths in ocean. DART was introduced in 2003. This system consists of a pressure sensor anchored to the sea floor and a surface transmitter. When potentially dangerous seismic activity is detected, the network of DART buoys will detect the small change in the sea level.

Tsunami waves do not induce high surface elevation in Deep Ocean and hence their presence is not felt in Deep Ocean until they reach the shallow water close to coast. If any small yet potentially significant sea level change is noted following a seismic activity, the data are transmitted acoustically to the surface buoys and relayed by satellites to the warning stations. Computer modelling converts the data into a prediction of potential damages for the use of the members of the network.

National: After the 2004 Tsunami affected the Indian sub continent, the following organizations are involved on watch and cautioning the government and public in the event of possibility of occurrence of Tsunami. As a part of Tsunami hazard

mitigation, warning systems have been established in India by the coordination of the following organizations.

- I. Indian National Centre for Ocean Information Services (INCOIS), Hyderabad.
- II. National Disaster Management Authority (NDMA), New Delhi.
- III. Indian Meteorological Department (IMD), New Delhi.
- IV. National Institute of Ocean Technology (NIOT), Chennai.

Table 1.12. Contact details of International and National agencies

Organization	Address	Website	Contact Number
INCOIS	Ocean Valley, Pragathi Nagar (BO), Nizampet (SO), Hyderabad - 500090	www.incois.gov.in	+91 - 40 - 23895002
NDMA	NDMA Bhavan, A-1 Satdarjang Enclave, New Delhi, DL 110029.	www.ndma.gov.in	+91 - 11 - 26701700
IMD	Mausam Bhavan, Lodi road, New Delhi, DL 110033.	www.imd.gov.in	+91- 11 - 24699216
NIOT	Velachery – Thambaram main Road, Narayanapuram, Pallikaranai, Chennai 600100.	www.niot.res.in	+91 - 44 - 66783300
NOAA	1401, Constitution Avenue, NW. Room 5128, Washington, USA. DC 20230	www.noaa.gov	-

INCOIS in collaboration with NIOT has deployed DART buoys at 3 locations in the deep ocean along the fault plane of Andaman plate and Indonesian plate. The data transmission system has been effectively linked through satellite with 24 hours online monitoring at NIOT, Chennai.

The online monitoring is capable of raising alarm in case of instantaneous change in surface elevation exceeding centimeter which can be caused by the generation of Tsunami. IMD interacts with the above institutions and takes the responsibility of broadcasting the disaster through various Medias. In case of a Tsunami, the warning is usually broadcast based on the earthquake occurred in the nearby ocean. Irrespective of *definite occurrence* of Tsunami, the *possibility to occur* is also considered as equally vulnerable and accordingly the warning news is instantly flashed through Radios and TVs. The notification is followed by orders from the local Government Authorities on reinforcing evacuation, prohibition to enter the demarcated risky zone and mobilizing facilities for easier evacuation and augmenting medical facilities.

There are a variety of evacuation notification systems in case of Cyclone, Tsunami and Storm surge. They include sirens, weather radio, Emergency Alert System, Telephones, and Emergency Weather Information Network etc. In each system, it should be noted that the application and message is consistent as well as continuous with repetition of messages with periodicity at short time interval. It should be ensured that the warning reaches immediately to all people prone to the devastation.

Vigilant online monitoring

The time at which the cyclone, storm surge or Tsunami may reach the coast can be predicted with sufficient lead time. The destruction can be minimized if the coastal populations are warned and evacuated to elevated place and inland in time. Therefore keeping vigil on the warning is the very important aspect in protecting the lives.

Kamarajar Port should have an agreement with NIOT/INCOIS/IMD by enrolling themselves as the potential users. Live contact should be kept with the organizations indicated above to transmit the instant warning on occurrence of cyclone, Tsunami

and storm surge. A vigilant team must be created and they should be deputed to the above organizations to attend the training programs and to understand the method of monitoring and the kind of emergency preparedness. The vigilant team must monitor the warning systems around the clock.

The vigilant team should have proper knowledge about the warning systems and should have attended the training programs conducted by the Tsunami warning centres. The training should be given periodically to update the system and methods of warning. The team should take the responsibility of giving immediate warning to the people in and around the port in case of Tsunami and they have to undertake the Emergency Preparedness Action. Safety drills should be conducted periodically.

Operational and emergency preparedness procedures should be planned meticulously in order to act on the warning and to disseminate it rapidly and effectively to the public.

Emergency Evacuation

Evacuation of people from risk areas is the first priority when early warning is received or the natural warning sign indicates the immediate arrival of cyclone, Tsunami wave or rise of storm surge.

Evacuation plan describes the time span available before and during the Tsunami or storm surge event. When facing local threat, evacuation procedures most possibly will have the character of a 'runaway effort' and people should not expect to receive much institutional support. The primary objective should be bringing as many people as possible out of the reach of the wave's impact to safe or 'relatively safe' areas. Therefore necessary steps have to be taken in advance to enable and support the community at risk to protect themselves at any time.

Mitigation measures against Tsunami and storm

Although the impact of Tsunami and storm is disastrous, the impact can be minimized by adopting the key components of mitigation measures. It was noticed during December 2004 Tsunami that the places located behind the highly elevated dunes, forest department planted Casuarina trees, dense plantations, Mangrove forests, offshore coral reefs, long salt pan heaps etc., were considerably protected. These areas experienced very low damage without causing death of the people. The kinematic energy of the Tsunami waves riding into the land gets dissipated due to these natural barriers. Thus the nature gives the scientific understanding of preparing the energy dissipating obstruction on the shore that can greatly protect the people and property against Tsunami.

The mitigation measures to be taken normally vary according to the local site conditions. Accordingly, in general case, the following mitigation measures are seen to be effective for the proposed project:

- i) Bio Shield
- ii) Construction of Tsunami/Cyclone Shelter

I. Bio Shield

It is a general belief that natural formations such as coral reefs, grass beds, coastal vegetations such as mangroves, estuaries and deltas of river mouths and flood plains play an important role in dissipating the forces of Tsunami waves.

A bio-shield formed by planting a vegetation belt along coastlines would protect the region against coastal storms, cyclones and Tsunamis. The plantations could absorb the force of severe storms and Tsunamis, and it could act as a



'carbon sink' by absorbing emissions of the greenhouse gas (carbon dioxide). The coastal front comprises beaches, sand dunes, head lands, creeks/river, rocky cliffs. The coastal vegetation also has a very important role in stabilizing and trapping marine sediments and forming a protective buffer between the land and the sea.

Mangroves: Mangroves are often recognized as the best defenses against wind, waves and erosion by deflecting and absorbing much of the energy of winds hence, Forest department encourages afforestation of Mangroves. Because of planting suitable species of mangroves along the coastline, during 2004 Tsunami, the fishing hamlets located on the leeward side of the Pitchavaram were totally safe without any traces of Tsunami. Therefore, Kamarajar Port may explore the suitability of their location to plant mangroves in consultation with Forest department.

Planting of Casuarinas: *Casuarina equisetifolia* is the most popular farm forestry tree in the coastal lands of Mainland India. The Casuarinas planted along the east-coast protected the region from Cyclone in November, 1999. Planting Casuarinas along the coastal front would provide substantial protection to the project region from the impacts of storm surges and Tsunami. Hence the water level rise during a Tsunami or storm will not have any major impact in this region.

Transplanting vegetation will not prevent the natural process of erosion, but it will accelerate natural recovery after damage. Additional works are often necessary to increase the potential for success. Thatching and beach recycling will assist in the accretion of sand, and will provide minor protection from Tsunami waves and will reduce damage due to trampling. Once grasses are well established they may well become self-sustaining, although any storm erosion damage will need to be rapidly made good.

II. Tsunami/Cyclone shelter

The warning and disaster evacuation system is the most important element in ensuring the public's safety. Suitable shelter must be constructed in order to evacuate the people in case of emergency.

The time of arrival provides only a limited time for people to move safely to the shelter. Two Cyclone shelters per cluster must be provided along the region of port. After the warning/siren is given, the government authorities will start the evacuation and the people living in the interior area will have to be moved to the Cyclone shelter built along the coastal stretch.

The location of the shelter must be chosen such that it is easily accessible for workers in the port and for the public living in the vicinity. Maintenance of these shelters and the access roads and keeping them in good condition throughout the year to its functional requirements is very important.

The shelter should be equipped with water supply, toilets, first aid centre, Generators, ration storing rooms and minimum cooking facility. The shelters should be designed to bear the workers in the port and the people living in the vicinity. The stairway should be wide enough (>3 m) for the rushing people to climb the top without confusion and struggle. It should have an elevated handrail with proper light and ventilation. There should not be any windows on the seaward side to avoid the entry of water due to rising Tsunami wave. But enough windows and other ventilation measures must be provided on the leeward side of shelters.

Escape routes: The availability of safety zones that can be used as evacuation sites within walking distance must be inspected. People can be evacuated to hills over ten metres in elevation or the deep inland (>1 km) out of coastal inundation. Good

elevated roads should be laid along the escape route to safe places which can be waded even during flooding.

Emergency alarm from Government Institutions

Kamarajar Port should jointly make understanding with NIOT/INCOIS/NDMA and a communication link should be established through satellite or GPRS. In case of emergency if warning is given at the above mentioned institutions, they can instantly activate the alarm at the industries & ports through satellite/GPRS and give caution to the vigilant team so that they can immediately start the rescue operation.

1.9. Oil Spill Contingency Plan

The contingency plans are the over-arching document that embodies the Government response policy and national/local level response organization for responding to various types of disasters that may affect the local populace and also the flora and fauna. Certain types of pollution can cause irreparable damage to the eco system which sustains large life forms.

The coast of Tamil Nadu now face increased threat from oil spill from the passing ships, port activities, petro chemical exploration and exploitation activities, etc. The contingency plan is provided to assist the Port authority in dealing with an accidental discharge of oil. Its primary purpose is to set in motion the necessary actions to stop or minimize the discharge and to mitigate its effects. Effective planning ensures that the necessary actions are taken in a structured, logical and timely manner. This plan predicts the mutual assistance and movement of equipment and personnel to respond to the oil spill in neighbor terminal / area.

1.9.1. Responsibilities

Oil spill up to Tier I will be the responsibility of the agencies as mentioned below

- i. Port - Area in and around port up to port limits including anchorage.
- ii. Oil Handling Agencies - With in the area of operation
- iii. State Government- Shoreline clean up including inland waters

Table 1.13 Participants of Organization at various levels

Level	Organization	Joint Participation by Organizations
TIER I	Port Authority	Ship + Port Authority + Mutual Aid Agencies
TIER II	State Government of Tamil Nadu + Indian Coast Guard	Ship + Port Authority + State Government of Tamil Nadu + Indian Coast Guard
TIER III	Central Government (Indian Coast Guard)	Ship + Port Authority + State Government of Tamil Nadu+ Central Government (Indian Coast Guard)

Source: DMP report, Environmental Technical Services Pvt. Ltd, 2014

The Tiruvallur District administration will be lead agency for coordinating shoreline response with other agencies and polluter within the district.

1.9.2. Scope of Oil Spill Contingency Plan

An oil spill contingency plan may appear complicated because it provides many details about the numerous steps required to prepare for and respond to spills. It also covers many different spill scenarios and addresses many different situations that may arise during or after a spill. Despite its complexity, a well-designed plan is easy to follow. The Contingency plans always have four major aspects in common,

- Hazard identification
- Vulnerability analysis
- Risk assessment
- Response actions

Planners use hazard identification and vulnerability analysis for developing risk assessment and then it is used as a basis for planning specific response action.

Notification

- Spill of any nature shall be notified to the port through signal station. The responsibility of raising the alarm shall be with the Master of the Ship while the vessel in port limits.
- Preliminary Oil spill Notification report shall be given to the signal station.

Signal Station

- On receiving and recording the alarm, will communicate the same to the General Manager (MS)/Chief Manager (MS).
- Make an announcement on VHF Ch 16/74 about the situation.
- Inform the Agents of the vessel.
- Inform harbour crafts to be ready and should report to response team for further instructions.
- Activate response team.
- Update Port main office all the reports received from response team.
- As per instructions from main office center inform all other parties.
- Initial crisis notification/ Oil spill notification sheet to be filled up and faxed to main office.
- Maintain record of events and communication log.
- Make an announcement on VHF Ch 16/74 about the latest situation.

1.14. Description of Oil Spill

Code	Description Appearance	Layer Thickness Interval (μm)	Liters /Sq. KM	Description of Appearance
1	Sheen (Silvery / Grey)	0.04 – 0.30	40 - 300	Light reflecting from very thin oil films
2	Rainbow	0.30 – 5.0	300 – 5000	Range of colours
3	Metallic	5.0 – 50	5000 – 50000	Homogeneous colour i.e. brown, blue or purple
4	Discontinuous True oil colour	50 – 200	50000 – 200000	Broken nature of colour
5	Continuous True oil colour	200 to more than 200	More than 200000	Diffuse in overcast condition

1.15. Oil Spill Crisis Management Team

S. No.	Oil Spill Crisis Management Team
1	Director
2	General Manager (Marine)
3	Chief Manager (Marine)
4	Chief Manager (Finance)
4	Safety Officer
5	Head Environment
6	Occupational Health Centre (PRO)

The Kamarajar Port Oil Spill Response Team (OSRT) undertakes responses to all Tier 1 oil spills at Kamarajar Port limits.

Kamarajar Port is facilitated with Oil Spill Response Equipments like

- Skimmers
- Booms
- Dispersants

Mobilizing Immediate Response

- Dispatch the oil spill equipment and activate the response
- Dispatch a vessel to collect a reel of boom, power pack, towing bridles, etc., a skimming unit and to take a slop barge alongside. Assisted by one of the line boats, the vessel will maintain 'J' configuration or take instruction from SCO.
- Once in position with the boom deployed, the vessel will deploy the recovery unit into the oil and commence recovery into flexi barge.
- In high sea states or currents a second vessel may need to assist.
- If oil traveled past the fixed boom, the vessels should proceed to the leading edge of the slick, deploy the boom, retaining one end, and passing the other end to other available vessel. The vessel should then take up station such that the boat forms 'J' configurations. The vessel on the short leg of the boom with the slop barge alongside will deploy the skimmer unit and recover oil into the slop barge.
- In the event of a large or continuing spillage a second boom should be deployed with two vessels, one of which will have storage capacity and a recovery unit onboard. This second containment system will take up station astern of the first boom array. Any oil escaping from the first system will then be contained by the second boom.

Use of Dispersants

- If oil is not contained, or is unlikely to be contained, SCO recommend who will seek approval from ICG for use of dispersants.
- While permission is being sought one or two vessels proceed to the leading edge of slick, deploying dispersant spraying equipment during transit.
- Once on station after firm instruction of on receipt of permission, vessel shall commence applying dispersant.

Post Cleaning Operations

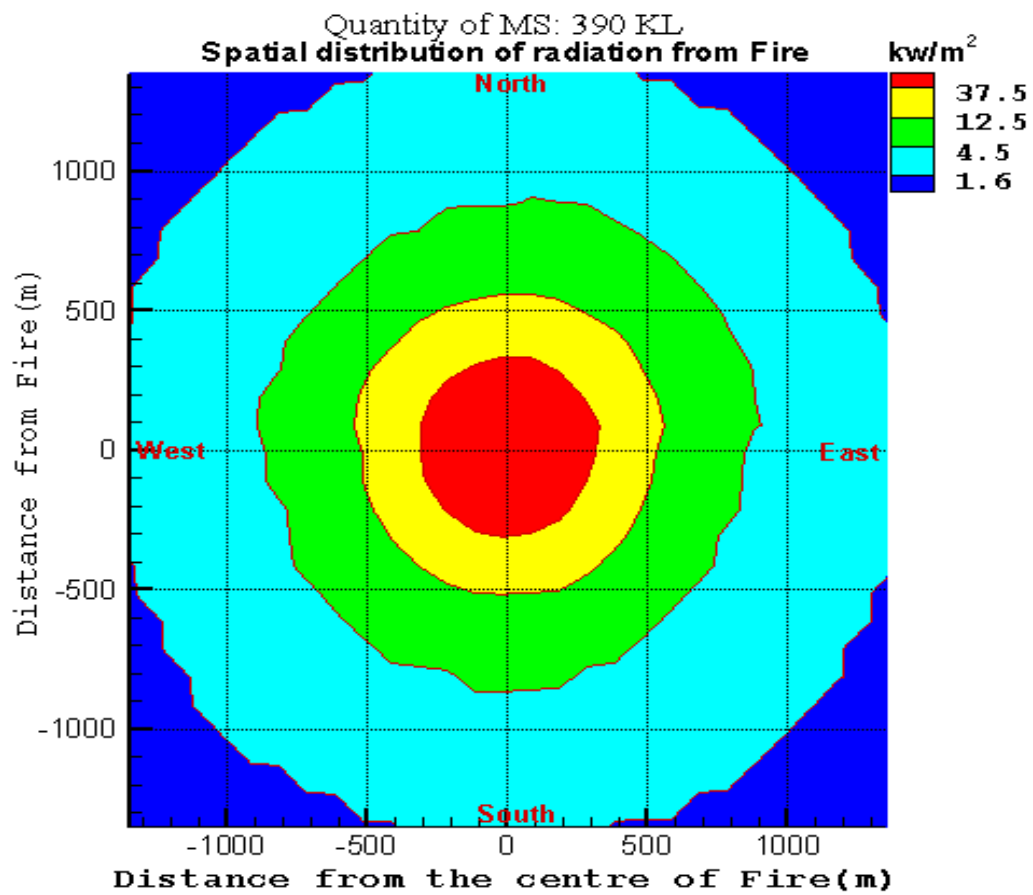
- The collected oil samples will be sent to the Laboratory for analysis.
- The waste materials will be brought ashore and disposed through CPCB approved recyclers.

1.9.3. Integration of DMP with National Disaster Management Authority

National Disaster Management Plan

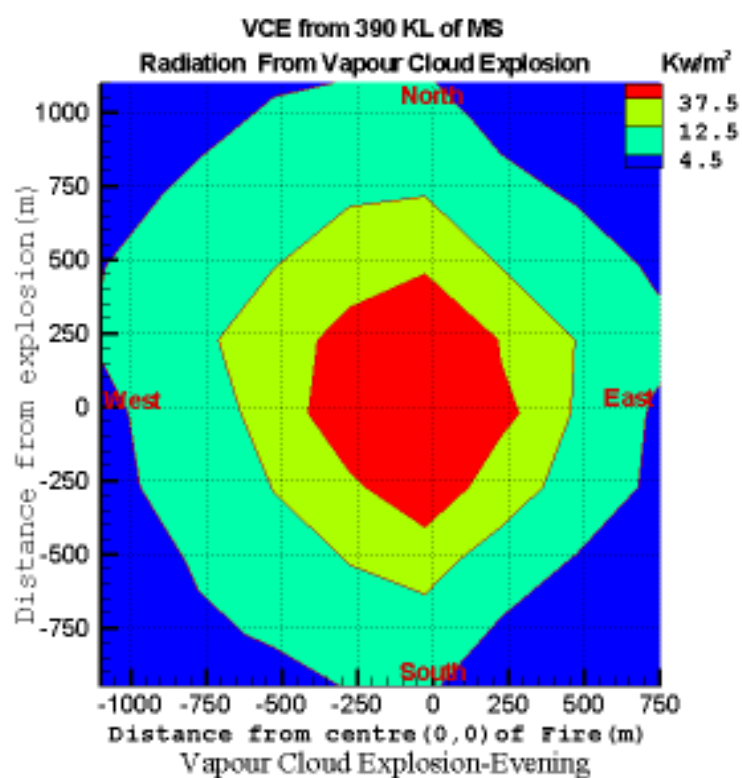
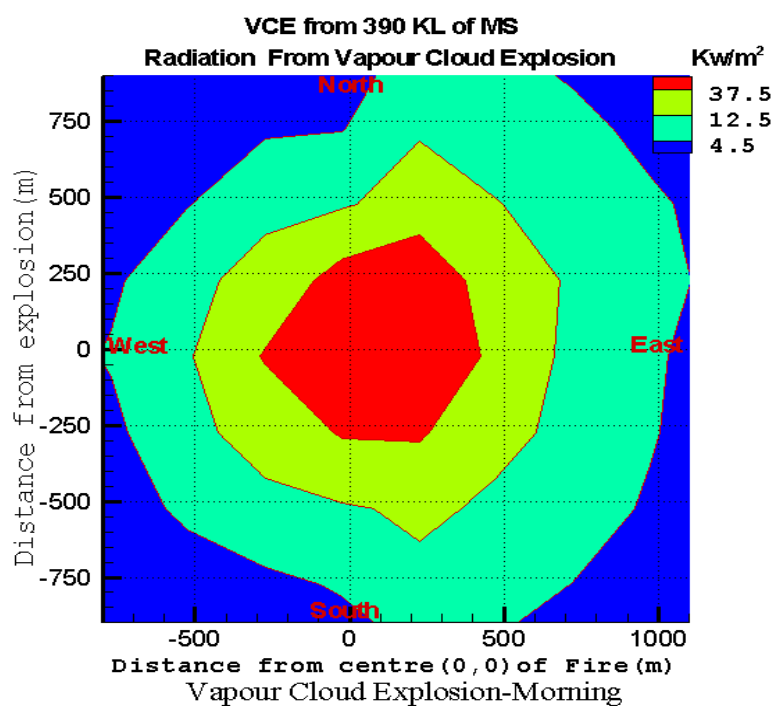
- On 23 December 2005, the Government of India took a defining step towards NDMP by enacting the NDMP ACT, 2005. The NDMP Act, 2005 is a Paradigm Shift from a response and relief-centric approach to a proactive, and comprehensive mindset towards NDMP covering all aspects from prevention, mitigation, preparedness to rehabilitation, reconstruction and recovery.
- Similar to National Authority at the Centre, the State Government is to establish a State Disaster Management Authority for the State. The State Authority is to be headed by the Chief Minister of the State as the Chairperson. Every State Government, in turn, is to establish a District Disaster Management Authority for every district in the State with the District Collector as the Chairperson.
- The Central Government is empowered to take further measures as it deems fit for the purpose of disaster management like deployment of naval, military and air forces, other armed forces of the Union or any other civilian personnel as may be required for the purposes of this Act. Government of India is empowered to establish institutions for research, training, and developmental programmes in the field of disaster management as per this act.

The national vision is to build a safer and disaster resilient India by developing a holistic, proactive, multi-disaster and technology driven strategy for NDMP. This will be achieved through a culture of prevention, mitigation and preparedness to reduce the impact of disasters on people. The entire process will centre stage the community and will be provided momentum and sustenance through the collective efforts of all government agencies supported by Non-Governmental Organizations (NGOs).



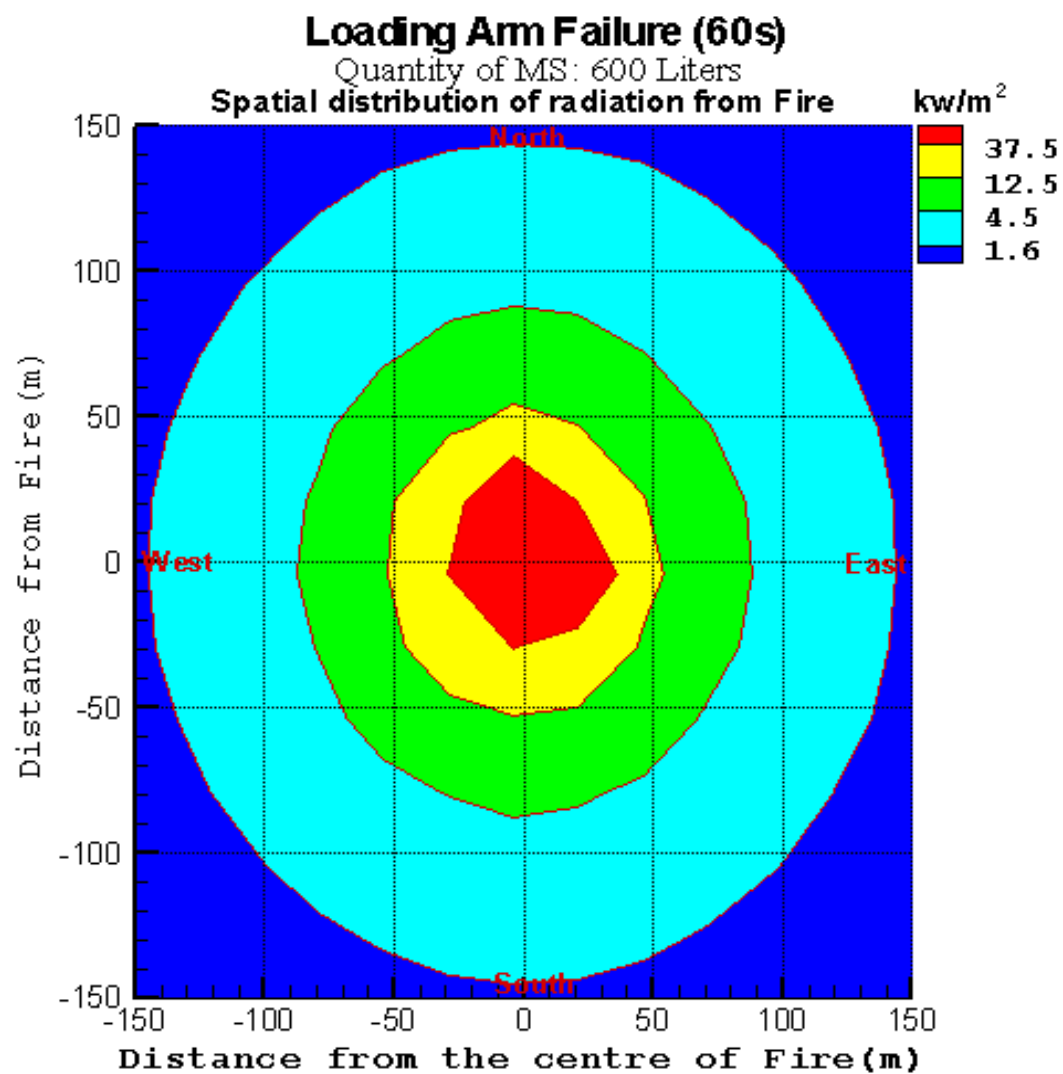
Source: DMP report, Environmental technical services Pvt. Ltd., 2014

Fig. 1.1. Hazardous Radiation due to total failure of the Pipeline for 90 minutes



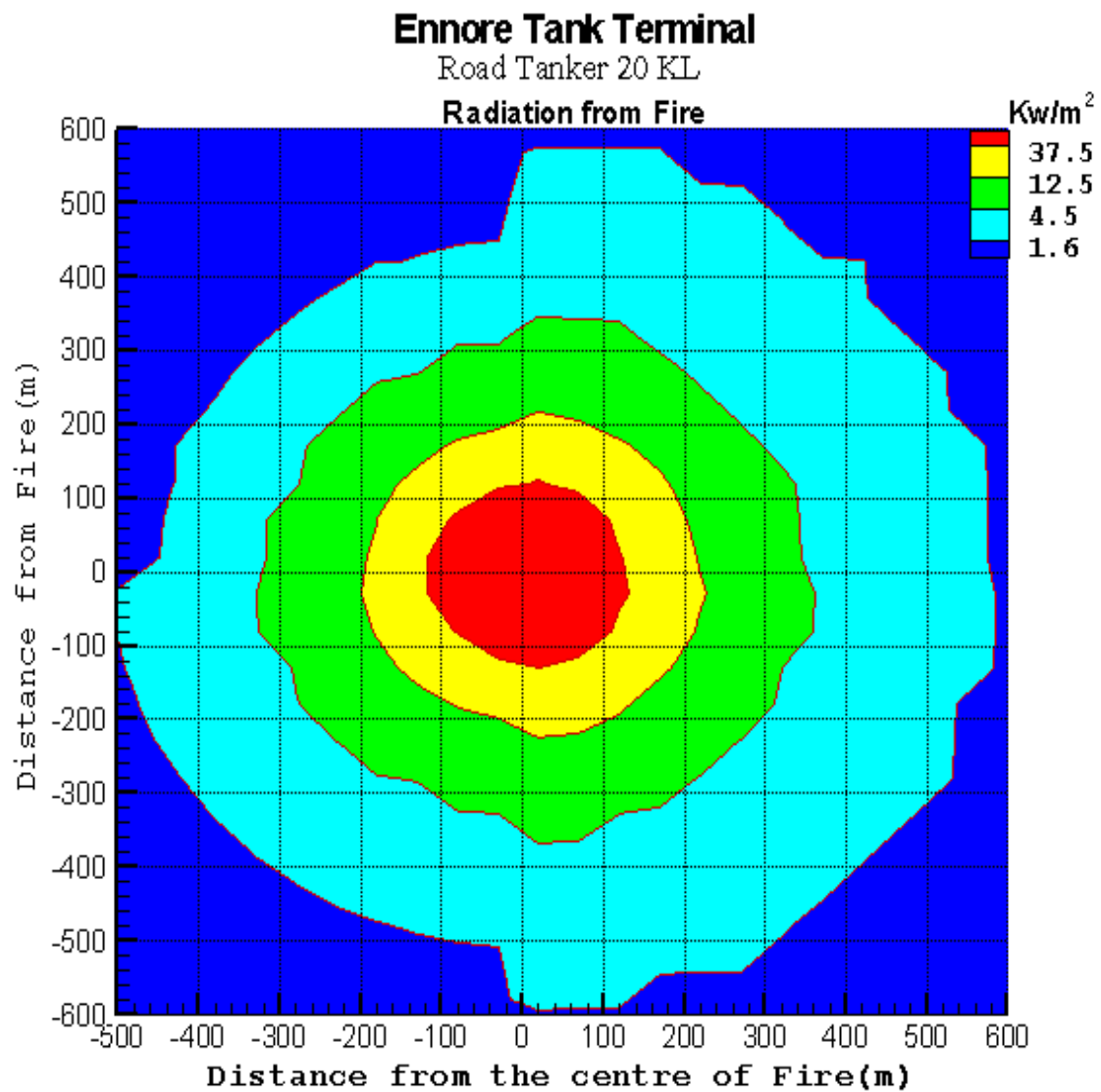
Source: DMP report, Environmental technical services Pvt. Ltd., 2014

Fig. 1.2. Hazardous Radiation due to VCE from total failure of the Pipeline for one Hour (Morning & Evening)



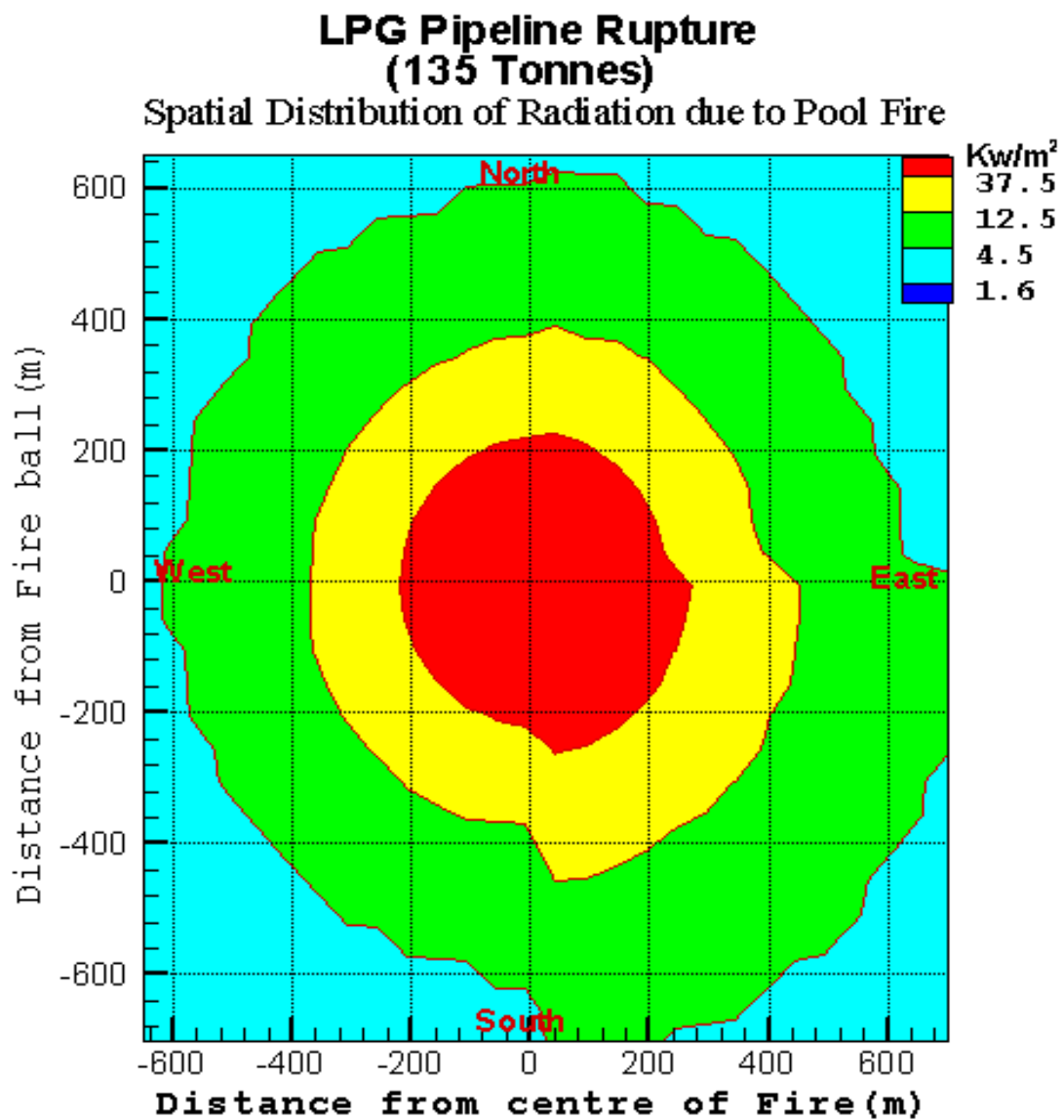
Source: DMP report, Environmental technical services Pvt. Ltd., 2014

Fig. 1.3. Total failure of loading/unloading arm of 600 liters of MS in one minute



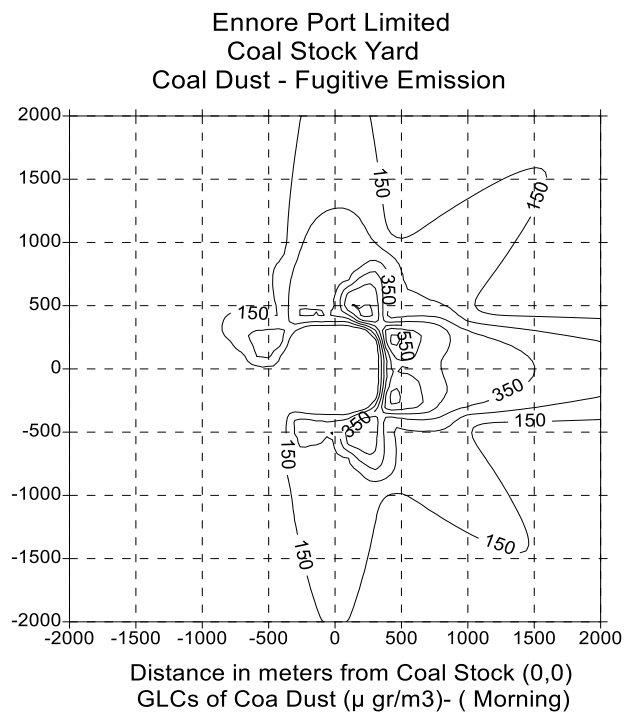
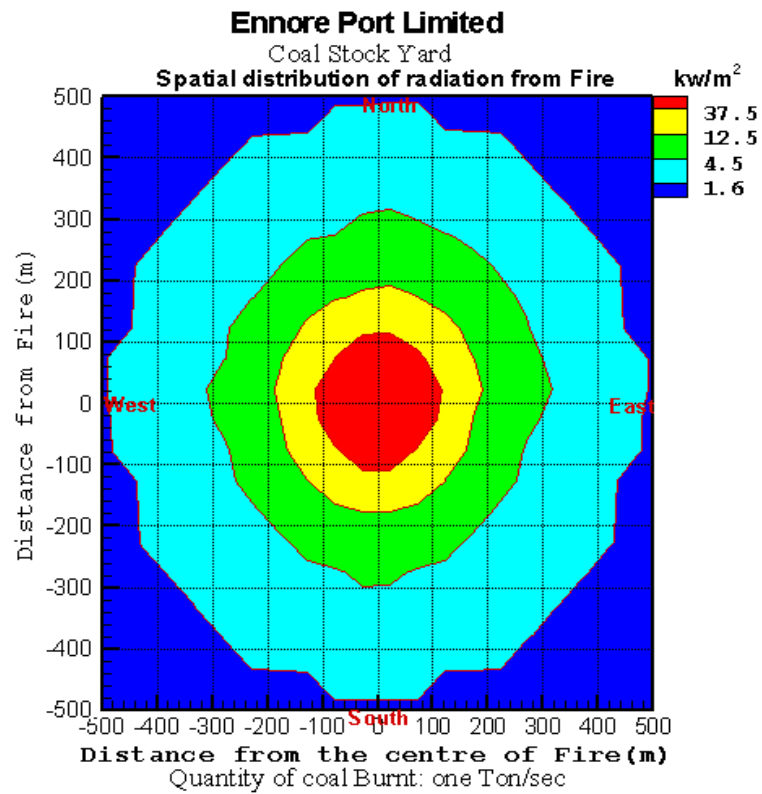
Source: DMP report, Environmental technical services Pvt. Ltd., 2014

Fig. 1.4. Hazard distances to thermal radiation due to BLEVE in Road Tankers (capacity 20 KL, MS)



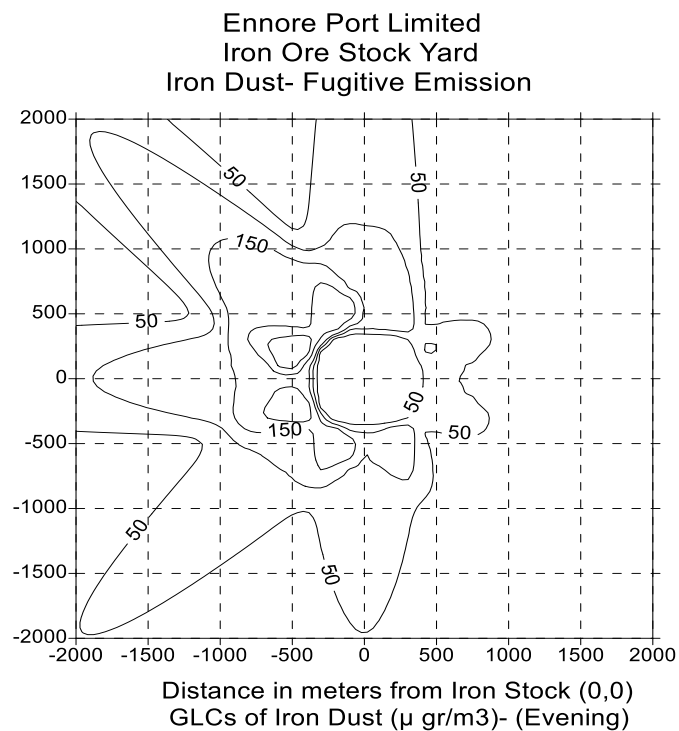
Source: DMP report, Environmental technical services Pvt. Ltd., 2014

Fig. 1.5. Spatial distribution of radiation from LPG pipeline rupture due to pool fire



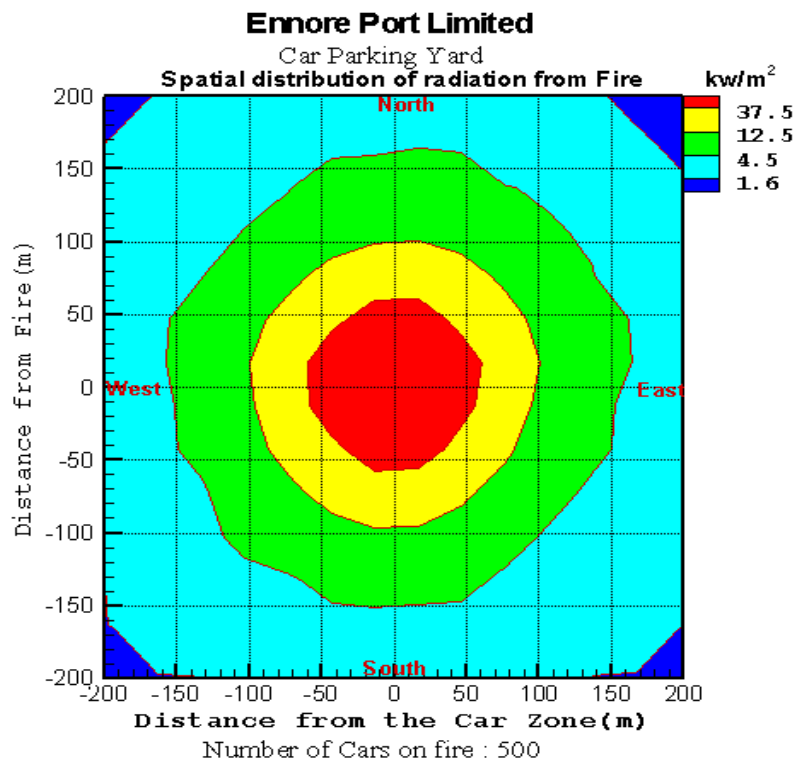
Source: DMP report, Environmental technical services Pvt. Ltd., 2014

Fig. 1.6. Spatial distribution of radiation from fire of Coal stock yard and Coal dust fugitive emission



Source: DMP report, Environmental technical services Pvt. Ltd., 2014

Fig. 1.7. Iron fugitive emission



Source: DMP report, Environmental technical services Pvt. Ltd., 2014

Fig. 1.8. Spatial distribution of radiation from fire in Car parking yard

