

BEFORE THE NATIONAL GREEN TRIBUNAL
SOUTHERN ZONE, CHENNAI
Original Application No. 224 of 2024 (SZ)

In the matter of:

K.Saravanan

... Applicant(s)

Versus

The Commissioner,
Fisheries and Fishermen Welfare Department,
Government of TamilNadu

...Respondent(s)

Annexures to the Report in Original Application No. 224 of 2024(SZ)

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Through

Dr. D. Shanmuganathan

Standing Counsel of Tamil Nadu

National Green Tribunal

Southern Zone, Chennai

DATE: 28.09.2024



மாநில மீன்பிடிப்புத் துறை
மாநில மீன்பிடிப்புத் துறை

காரிகாட்டுக்குப்பம் மீனவர் பஞ்சாயத்து சபை

சிறுநீர், 15, முட்டுக்காடு, திருப்போரூர் வட்டம் - 603112

பஞ்சாயத்தாரிகள்:

N.செல்வா	S.M.பக்கிரி	P.குப்பன்	R.வேலாயுதம்	T.பழனி	N.கிருஷ்ணன்
9710016769	6381539527	9677175398	7358539484	9840328405	9841101568
G.V.முருகன்	K.குணாலன்	D.உதயகுமார்	V.விசு	D.தினேஷ்	D.ஹரிநாள்
9884313889	9677220871	9940304334	8248175476	9840791056	9962429185

பெயர்:

3/10/18
மீனவர் பஞ்சாயத்து சபை
மீனவர் பஞ்சாயத்து சபை

12
1867

தேதி: 16.09.2018
1452

மீனவர்களுக்கு மீனவளத்துறை அமைச்சர் அவர்கள்
தயவுசெய்து அரசு
தலைமைச் செயலகம், சென்னை-600 009.

பொருள்: எங்கள் ஊர் ஆற்றுக்கும், கடலுக்கும் தூண்டில் வளைவு
அமைப்பது தொடர்பாக.

வணக்கம்.

பெருங்கனம் பொருந்திய ஐயா அவர்களுக்கு, மேற்படி மீனவ கிராம
பஞ்சாயத்தாரிகள். ஊர் பொதுமக்கள் அனைவரும் சேர்ந்து எழுதி தெரிவிப்பது
ஆகவே, மேற்படி மீனவ கிராமத்தில் சுமார் 400 குடும்பங்கள் வாழ்ந்து வருகிறோம்.
நாங்கள் அனைவரும் மீன்பிடி தொழிலையே வாழ்வாதாரமாகக் கொண்டு வாழ்ந்து
வருகிறோம். கனாமிக்கு பின் எங்கள் ஊர் கடற்கரையில் கடல் கீற்றம் ஏற்பட்டு
கடற்கரையில் நிறுத்தி வைக்கப்பட்ட படகுகள், வலைகள், கட்டுமரங்கள், மீன்பிடி
உபகரணங்கள் அனைத்தும் சேதமடைந்து வந்த நிலையில் தற்போது படகுகள்
நிறுத்தி வைக்க கடற்கரையே இல்லாத நிலை ஏற்பட்டுள்ளது. இதனால் நாங்கள்
சுமார் 20 நாட்களாக மீன்பிடி தொழில் செய்ய முடியாமல் தவித்து வருகிறோம்.
இதலிருந்து மீள வேண்டுமென்றால், எங்கள் ஊருக்கும், கடலுக்கும் நடுவே சுமார்
நூறு ஏக்கர் சுற்றளவுள்ள உப்பளங்கள் ஆறு இருப்பதால், இந்த ஆற்றுக்கும்,
கடலுக்கும் தூண்டில் வளைவு அமைத்து கொடுத்தால் எங்கள் மீன்பிடி தொழில்
சிரமமின்றி நடைபெறும் என்பதை இதன் மூலம் தெரிவித்துக் கொள்கிறோம்.
மேலும், தூண்டில் வளைவு அமைத்தால் இயற்கை பேரிடர் காலங்களில் நாங்கள்
தப்பித்துக் கொள்ள ஏதுவாக இருக்கும். மேலும் அருகிலுள்ள 10 மீனவ
கிராமங்களுக்கு இது ஒரு மீன் இறங்கும் மற்றும் மீன் விற்பனை துறைமுகமாக
உருவெடுக்கும் என்பதை ஐயா அவர்களின் கவனத்திற்கு கொண்டு வருகிறோம்.

ஆகவே, மாண்புமிகு ஐயா அவர்கள் இது வெறும் எழுத்தாக கருதாமல்,
இது எங்கள் ஊர் கடல்வாழ் மக்களின் உயிராக கருதி மேற்படி தூண்டில் வளைவு
அமைப்பதற்கு ஆவணம் செய்யுமாறு மிகவும் தாழ்மையுடன் கேட்டுக்கொள்கிறேன்.
நன்றி.

இப்படிக்கு,

V. தினேஷ்
D. HARISH
N. BOOBATH
M. PALLICIVY
M. HARISH
K. GURURAJAN

G.V.M
P. குப்பன்
V. VISU
R.வேலாயுதம்
T. பழனி
N. கிருஷ்ணன்

ஸ்ரீ ஜாலவயம்பத் துணை
ஸ்ரீ சங்கராதிவயம்பத் துணை

கரிகாட்டுக்குப்பம்

மீனவர் பஞ்சாயத்து சபை

நெ.10, முட்டுக்காடு, திருப்போரூர் வட்டம்-600 112.

பஞ்சாயத்தார்களே!

சென்னை	கோயம்புத்தூர்	கரிகாட்டுக்குப்பம்	கரையேரி	கரையேரி	கரையேரி
கரையேரி	கரையேரி	கரையேரி	கரையேரி	கரையேரி	கரையேரி

12/10/2020
1536/13/10/2020
தேதி: 13-10-2020

உயிர்திரு. உதவி இயக்குநர் அவர்கள்
மீனவளத்துறை - துறைமுகம்
காஞ்சிபுரம் மாவட்டம்.

பொருள்: எங்கள் மீனவ கிராமத்தின் வாழ்வாதாரம் நிலைத்திட வங்ககடலுக்கும் எங்கள் ஊர் ஏரிக்கும் தூண்டில் வளைவு அமைத்திடவும் எங்கள் ஊர் ஏரியை தூர் வாருதல் சம்மந்தமாக....

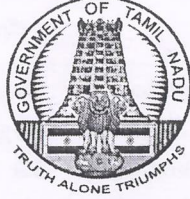
ஐயா, வணக்கம்,
செங்கல்பட்டு மாவட்டம், திருப்போரூர் வட்டம், முட்டுக்காடு ஊராட்சிக்குட்பட்ட கரிகாட்டுக்குப்பம் மீனவ பொதுமக்கள் எழுதி கோருவது யாதெனில்,
எங்கள் மீனவ கிராமத்தில் சுமார் 500 குடும்பங்கள் பாரம்பரிய மீனவர்களாக தொழில் செய்து வசித்து வருகிறோம். பலஆண்டுகாலமாக எங்கள் கிராமத்தின் கடற்கரையில் பல இன்னல்களை சந்தித்து வருகிறோம். கோடை நாட்கள் வந்துவிட்டால் கடலுக்கு சென்று தொழில் செய்ய முடியாத நிலை ஏற்பட்டு வருகிறது. தற்போது உள்ள நிலையில் படகுகளை நிறுத்திவைப்பதற்கு கூட கடற்கரையில்லாமல் போய்விட்டது. இதிலிருந்து மீள வேண்டும், எங்கள் மீனவ கிராமத்தின் நிலைத்த வாழ்வாதாரம் நிலைக்க வேண்டுமென்றால் எங்கள் ஊர் ஏரிக்கம் கடலுக்கும் தூண்டில் வளைவு அமைத்து கொடுத்தால் எங்கள் வாழ்வாதாரம் நிலைத்து நிற்கும் என்பதை தங்களின் மேலான கவனத்திற்கு கொண்டு வருகிறோம். எங்கள் கிராமம் பல வருடங்களாக எங்களுக்கு தூண்டில் வளைவு வேண்டும் என்பதை கோரி வந்துள்ளோம் என்பதையும் தங்களின் மேலான கவனத்திற்கு கொண்டுவருகிறோம்.
ஆகவே, தயவு கூர்ந்து மேற்படி தூண்டில் வளைவு ஏரியில் தூர் வாருதல் பணியினை பாரகால அடிப்படையில் ஆய்வு நடத்தி எங்கள் மீனவ கிராமத்தை காக்குமாறு ஆயிரம் கரம் கூப்பி வணங்கி கேட்டுக் கொள்கிறோம்.

இப்படிக்கு
கரிகாட்டுக்குப்பம் கிராம பஞ்சாயத்தார்கள்
மற்றும் ஊர்பொதுமக்கள்

G.v.m
V.V.S
N.Krishna
C. Jeyaraj

K. Rajaraman

M. S. S. S. S.
D. Paul P. Ramana
R. Vel
M. S. S. S. S.
D. R. S.



த. பொ.	13/12/21
நே. உ.	
த. வ.	
க. கா.	

ABSTRACT

Fisheries and Fishermen Welfare - Announcements 2021-22 - Construction of Fish Landing Centres and Development / improvements to Fish Landing Centres at various fishing villages in 7 Districts of Tamil Nadu with the financial assistance from National Bank for Agriculture and Rural Development under RIDF-XXVII - Administrative Approval - Orders - Issued.

Animal Husbandry, Dairying, Fisheries and Fishermen Welfare
(FS-1) Department

G.O.(D).No.318

Dated 13.12.2021

பிலவ வருடம், கார்த்திகை - 27

திருவள்ளூர் ஆண்டு - 2052

Read:

1. Announcements made by the Hon'ble Minister (Fisheries-Fishermen Welfare and Animal Husbandry) dated 28.08.2021.
2. From the Commissioner of Fisheries letter Rc. No.17588/C3/2019, dated 06.07.2021.
3. Government letter No.30854/Fin(Res.II)/2021-1, Finance Department, dated 29.07.2021.
4. From the Deputy General Manager, National Bank for Agriculture and Rural Development, Chennai, Letter No.NB.TN.SPD/572/RIDF-6/RIDF-XXVII/2021-22, dated 02.11.2021.

ORDER:

While moving the Demand for Fisheries and Fishermen Welfare and Animal Husbandry Department held during the Budget Session 2021-2022 on 28.08.2021 in the Tamil Nadu Legislative Assembly, the Hon'ble Minister for Fisheries-Fishermen Welfare and Animal Husbandry has made the following Announcements:-

வ. எண்.	அறிவிப்பு எண்.	அறிவிப்பு
1.	(7)	செங்கல்பட்டு மாவட்டம் கொக்கிலமேடு, கடலூர் பெரியகுப்பம், கடலூர் சின்னக்குப்பம் மற்றும் கடலூர் ஆளிக் குப்பம் ஆகிய இடங்களில் மொத்தம் 39 கோடி ரூபாய் செலவில் மீன் இறங்குதளங்கள் அமைக்கப்படும்.
2.	(8)	தூத்துக்குடி மாவட்டம் மணப்பாடு கிராமத்தில் 45 கோடி ரூபாய் மதிப்பீட்டில் முகத்துவாரத்தினை நிலைப்படுத்தி மீன் இறங்குதளம் அமைக்கப்படும்.
3.	(9)	தஞ்சாவூர் மாவட்டம், சேதுபாவாசத்திரத்தில் உள்ள மீன் இறங்குதளம் 10 கோடி ரூபாய் மதிப்பீட்டில் மேம்படுத்தப்படும்.
4.	(10)	விழுப்புரம் மாவட்டம் எக்கியார்ப்பம் மீன் இறங்குதளம் மேம்பாட்டு பணிகள் மற்றும் அனுமந்தை கிராமத்தில் புதிய மீன் இறங்குதளம் அமைக்கும் பணிகள் 10 கோடி ரூபாய் மதிப்பீட்டில் மேற்கொள்ளப்படும்.
5.	(11)	தூத்துக்குடி மாவட்டம் அமலி நகர், ஜீவா நகர், ஆலந்தலை, மீனவர் காலனி மற்றும் குலசேகரபட்டினம் ஆகிய கடலோர கிராமங்களில் மொத்தம் 12 கோடி ரூபாய் மதிப்பீட்டில் புதிய மீன் இறங்குதளங்கள் அமைக்கப்படும்.
6.	(12)	செங்கல்பட்டு மாவட்டம், பழைய நடுக்குப்பம், புது நடுக்குப்பம், அங்காளம்மன்குப்பம், செம்மஞ்சேரிக்குப்பம் மற்றும் கரிகாட்டுக்குப்பம் ஆகிய மீனவ கிராமங்களில் மொத்தம் 57 கோடி ரூபாய் செலவில் மீன் இறங்கு தளங்கள் அமைக்கப்படும்.
7.	(13)	கன்னியாகுமரி மாவட்டம், கேசவன்புத்தன்துறை, கீழமணக்குடி மற்றும் மேலமணக்குடி ஆகிய கடலோர கிராமங்களில் 79 கோடி ரூபாய் மதிப்பீட்டில் நேர்கல் சுவர்களுடன் கூடிய மீன் இறங்குதளங்கள் அமைக்கப்படும்.
8.	(14)	மயிலாடுதுறை மாவட்டம், திருமுல்லைவாசல் மற்றும் புதுகுப்பம் மீனவ கிராமத்தில் மீன் இறங்கு தளம் மேம்படுத்துதல் மற்றும் நேர்கல் சுவர் அமைக்கும் பணிகள் 27 கோடி ரூபாய் செலவில் மேற்கொள்ளப்படும்.
9.	(15)	தூத்துக்குடி மாவட்டம் பெரியதாழை மற்றும் வீரபாண்டியபட்டினம் ஆகிய கடலோர கிராமங்களில் 14 கோடி ரூபாய் மதிப்பீட்டில் மீன் இறங்குதளங்கள் அமைக்கப்படும்.
10.	(16)	கடலூர் மாவட்டத்தில் வெள்ளார் முகத்துவாரம் நிலைப்படுத்தும் பணி 30 கோடி ரூபாய் மதிப்பீட்டில் மேற்கொள்ளப்படும்.
11.	(17)	கடலூர் மாவட்டம், பெரியகுப்பம், புதுக்குப்பம் மற்றும் சி.புதுப்பேட்டை ஆகிய கடலோர கிராமங்களில் கடல் அரிப்பு தடுப்பு சுவர்களுடன் கூடிய புதிய மீன் இறங்குதளங்கள் 25 கோடி ரூபாய் மதிப்பீட்டில் அமைக்கப்படும்.

12.	(18)	தூத்துக்குடி மாவட்டம், திரேஸ்புரம், சிப்பிகுளம் மற்றும் கீழவைப்பார் ஆகிய கிராமங்களில் உள்ள மீன் இறங்குதளங்கள் 38 கோடி ரூபாய் மதிப்பீட்டில் மேம்படுத்தப்படும்.
13.	(19)	செங்கல்பட்டு மாவட்டம், கோவளம் கிராமத்தில் கிழக்கு பகுதியில் 3 கோடி ரூபாய் மதிப்பீட்டில் மீன் இறங்குதளம் அமைக்கப்படும்.
14.	(20)	கன்னியாகுமரி மாவட்டம், புத்தன்துறை கிராமத்தில் கடல் அரிப்பு தடுப்பு பணிக்காக கூடுதல் நேர்கல் சுவர் 22 கோடி ரூபாய் மதிப்பீட்டில் அமைக்கப்படும்.

2. In order to execute the Announcements made by the Hon'ble Minister for Fisheries-Fishermen Welfare and Animal Husbandry, in the letter second read above, the Commissioner of Fisheries has furnished proposals for 33 works towards construction of Fish Landing Centres and Development / improvements to Fish Landing Centres at various fishing villages in 7 Districts of Tamil Nadu along with the Detailed Project Reports and has requested the Government to accord Administrative sanction at an estimated cost of Rs.411.00 crore under National Bank for Agriculture and Rural Development RIDF-XXVII loan assistance for the year 2021-22.

3. In the letter third read above, the proposals of the 33 works in respect of construction of Fish Landing Centres and Development / improvements to Fish Landing Centres at various fishing villages in 7 Districts of Tamil Nadu at an estimated cost of Rs.411.00 crore have been forwarded to National Bank for Agriculture and Rural Development, for obtaining loan assistance under RIDF-XXVII for the year 2021-22.

4. In the letter fourth read above, the Deputy General Manager, National Bank for Agriculture and Rural Development, Chennai has stated that Project Sanctioning Committee of National Bank for Agriculture and Rural Development in its 195th meeting held on 26.10.2021, had sanctioned an amount of Rs.39045.00 lakh (95% of the total project cost) for the 33 works in respect of construction of Fish Landing Centres and Development / improvements to Fish Landing Centres at various fishing villages in 7 Districts of Tamil Nadu as RIDF loan to Government of Tamil Nadu with the total financial outlay of Rs.41100.00 lakh under RIDF-XXVII for the year 2021-22.

5. The Government, after careful examination, hereby accord Administrative Sanction for Rs.411,00,00,000/- (Rupees four hundred and eleven crore only) (Rs.390.45 crore [95%] NABARD loan + Rs.20.55 crore [5%] State Fund) for 33 works towards construction of Fish Landing Centres and Development / improvements to Fish Landing Centres at

various fishing villages in 7 Districts of Tamil Nadu as annexed to this order under National Bank for Agriculture and Rural Development RIDF-XXVII during the year 2021-22.

6. This order issues with concurrence of the Finance Department vide its U.O.No.233/JS(GKT)/Finance(AHDF&FW)/2021, dated 13.12.2021.

(By Order of the Governor)

T.S. Jawahar
Additional Chief Secretary to Government

To

The Commissioner of Fisheries, Chennai-35.

✓The Chief Engineer, Fishing Harbour Project Circle, Chennai-35.

The Deputy General Manager,

National Bank for Agriculture and Rural Development, Chennai-34.

The Principal Accountant General (E&RSA), Chennai-18 / By Name.

The Pay and Accounts Officer (South), Chennai-35.

The Resident Audit Officer,

Office of the Principal Accountant General (Audit-I), Chennai-9.

Copy to:

The Finance (AHDF&FW/Res-II) Department, Chennai-9.

The Office of the Hon'ble Chief Minister, Chennai-9.


The Special Personal Assistant to Hon'ble Minister (Finance and Human Resources Management), Chennai-9.

The Special Personal Assistant to Hon'ble Minister (Fisheries-Fishermen Welfare and Animal Husbandry), Chennai-9.

The Private Secretary to the Additional Chief Secretary to Government, Animal Husbandry, Dairying, Fisheries and Fishermen Welfare Department, Chennai-9.

Stock file/spare copies.

//Forwarded By Order//


Section Officer
13/12/21

**ANNEXURE TO G.O.(D).No.318, Animal Husbandry,
Dairying, Fisheries and Fishermen Welfare (FS-1) Department,
Dated 13.12.2021**

Sl. No.	Announcement No.	Name Of the work	Estimate Cost (Rs. in Crore)
1.	(7)	Construction of Fish Landing Centre and Shore Protection Works at Kokilamedu in Chengalpattu District.	10.00
2.		Providing Shore Protection Works and Improvements to Fish Landing Centre at Kadalore Periyakuppam in Chengalpattu District.	9.00
3.		Construction of Fish Landing Centre and Shore Protection Works at Kadalore ChinnaKuppam in Chengalpattu District.	10.00
4.		Construction of Fish Landing Centre and Shore Protection Works at Alikuppam in Chengalpattu District.	10.00
5.	(8)	Providing Permanent Stability of Bar Mouth and Development of Fish Landing Centre at Manapad in Thoothukudi District.	45.00 ✓
6.	(9)	Development of Existing Fish Landing Centre at Sethubavachatram in Thanjavur District.	10.00
7.	(10)	Construction of Fish Landing Centre at Ekkiyarkuppam and Anumanthai in Villupuram District	10.00
8.	(11)	Construction of Fish Landing Centre at Jeeva Nagar (Tiruchendur) in Thoothukudi District.	3.00
9.		Construction of Fish Landing Centre at Amali Nagar in Thoothukudi District.	3.00
10.		Construction of Fish Landing Centre at Alanthalai in Thoothukudi District.	2.00 ✓
11.		Construction of Fish Landing Centre at Fishermen Colony (Near Thermal - II) in Thoothukudi District.	2.00 ✓
12.		Construction of Fish Landing Centre at Kulasekaranpattinam in Thoothukudi District.	2.00 ✓

Sl. No.	Announcement No.	Name Of the work	Estimate Cost (Rs. in Crore)
13.	(12)	Providing Shore Protection Works and Construction of Fish Landing Centre at PazhayaNadukuppam in Chengalpattu District.	11.00
14.		Providing Shore Protection Works and Construction of Fish Landing Centre at PudhuNadukuppam in Chengalpattu District.	11.00
15.		Construction of Fish Landing Centre and Shore Protection Works at Angalamankuppam in Chengalpattu District.	9.00
16.		Construction of Fish Landing Centre and Shore Protection Works at Chemmencherry kuppam in Chengalpattu District.	10.00
17.		Construction of Fish Landing Centre and Shore Protection Works including boat berthing facilities at Karikattukuppam in Chengalpattu District.	16.00
18.	(13)	Construction of Additional Groynes for Shore protection at Kesavanpenthurai village in Kanniyakumari District.	20.00
19.		Construction of Fish Landing Centre at Keelamanakudy village in Kanniyakumari District.	29.50
20.		Construction of Fish Landing Centre at Melamanakudy village in Kanniyakumari District.	29.50
21.	(14)	Upgradation of Existing Fish Landing Centre at Thirumullaivasal in Mayiladuthurai District.	18.00
22.		Construction of Short Groynes in Northern side of Poompuhar Fishing Harbour at Puthukuppam village in Mayiladthurai District.	9.00

Sl. No.	Announcement No.	Name Of the work	Estimate Cost (Rs. in Crore)
23.	(15)	Providing Infrastructure Facilities at Periyathalai Fish Landing Centre in Thoothukudi District.	9.00
24.		Construction of Fish Landing Centre at Veerapandyanpattinam in Thoothukudi District.	5.00
25.	(16)	Providing Permanent Stability of Vellar Barmouth in Cuddalore District.	30.00
26.	(17)	Construction of Fish Landing Centre and Shore Protection Works at Periyakuppam in Cuddalore District.	12.00
27.		Construction of Fish Landing Centre and Dredging of Approach Channel in Pudhukuppam in Cuddalore District	8.00
28.		Construction of Fish Landing Centre at C.Pudhupettai in Cuddalore District	5.00
29.	(18)	Development of Fish Landing Centre at Sippikulam in Thoothukudi District.	7.00
30.		Development of Fish Landing Centre at Threspuram in Thoothukudi District.	21.00
31.		Development of Fish Landing Centre at Keelavaipar in Thoothukudi District.	10.00
32.	(19)	Improvements to Fish Landing Centre at Kovalam Muslim Village in Chengalpattu District.	3.00
33.	(20)	Construction of Additional Groynes for Shore protection at Puthenthurai village in Kanniyakumari District.	22.00
TOTAL			411.00

T.S. Jawahar
Additional Chief Secretary to Government

//True Copy//



Section Officer (13/12/21)
13/12/21

(A)

FORWARDING SLIP TO ACCOMPANY THE AGREEMENT NO. CE/2022-23

1.	Name of Work	:	Construction of Fish Landing Centre and Shore Protection Works including boat berthing facilities at Karikattukuppam in Chengalpattu District
2.	Estimate amount sanction in original/ Revised estimate No. work slip approved for Rs.	:	Rs.1600.00 Lakhs CR No. 14 CE/ 2021-22
3.	Name of Contractor and address	:	M/s.Sri Raja Engineering Contractors, No,770, Madurai Road, Theni-625531.
4.	Original or supplemental	:	Original
5.	If supplemental original Agreement/ Written Understanding No.	:	--
6.	Approximate value of work to be done under this Agreement written understanding	:	Rs.14,04,23,797/-and GST Rs.1,68,50,856 /- totaling to Rs. 15,72,74,653 /- (Rupees Fifteen Crore seventy two lakhs seventy four thousand six hundred and fifty three only)
7.	If this is supplemental approximate value of work to be done under original agreement / written Understanding	:	--
8.	If tenders have been called for is the lowest tender is accepted	:	Yes, the lowest tender approved by the Tender Award Committee 174 th meeting held on 01.04.2022
9.	Has the contractor signed the Divisional or Sub-Divisional copy of MDSS and its addenda volume brought up to date	:	Yes
10.	If data furnished for all items of work noted in the schedule	:	Yes
11.	Are the rates in agreement / written understanding within the estimate rates whichever is less and are the lumpsum provision sufficient or likely to be exceeded.	:	--

12. <u>Additional Information :</u>		(By separate sheet attached)
A. <u>Original Agreement :</u>		
1.	Original Agreement – Amount of tender excess and percentage over the estimate rate	(+) Rs.60,49,169/- Or (+) 4.00%
2.	If concessional rates of EMD/ SD have been allowed reference to sanction thereof	-Nil-
B. <u>Supplemental Agreement :</u>		
a.	Whether the approval of the CF or EE as the case may be has been obtained for entrusting additional items of work fairly contingent as the main work required in G.O. Ms. No.811/ P.W., dated 13.03.1959	--
b.	Whether the rate for additional items of work contingent on the main work have been approved by the competent authority as required in G.O. Ms. No.811 / P.W., dated 13.03.1959.	--
c.	If entrusted without tenders whether Government sanction is necessary with reference to total value of work covered by the supplemental agreemental so far accepted.	--


 Chief Engineer,
 Fisheries and Fishermen
 Welfare Department,
 Chennai-35
 05/5/22
 05/5/22

FORM I
PROJECT INFORMATION DETAILS & EMP REPORT

CRZ CLEARANCE

for

**PROPOSED CONSTRUCTION OF FISH LANDING
CENTRE AND SHORE PROTECTION WORKS WITH
BERTHING FACILITIES AT KARIKATTUKUPPAM
VILLAGE, THIRUPORUR TALUK, CHENGALPATTU
DISTRICT, TAMIL NADU**

Project Proponent



GOVERNMENT OF TAMIL NADU

**DEPARTMENT OF FISHERIES AND
FISHERMEN WELFARE DEPARTMENT**

SEPTEMBER 2022

Prepared By

ABC Techno Labs India Private Limited
An ISO : 9001:2008, ISO:14001:2004 & OHSAS:18001:2007 Certified Company
(Accrediated by NABL, NABET, MoEF)

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Form - I



FORM I- FOR SEEKING CLEARANCE FOR PROJECT ATTRACTING CRZ NOTIFICATION

(I) BASIC INFORMATION

(a) Name of the Project: Proposed Construction of Fish Landing Centre and Shore Protection works along with Boat Berthing facilities at Karikattukuppam Village, Thiruporur Taluk of Chengalpattu District, Tamil Nadu.

Location or Site alternatives under consideration:

Structure	Latitude	Longitude
G1	12°49'20.67"N	80°14'52.67"E
G2	12°49'23.89"N	80°14'52.65"E
Northern Breakwater	12°49'15.77"N	80°14'52.44"E
Southern Breakwater	12°49'10.89"N	80°14'52.78"E
Diaphragm Wall	12°49'14.15"N	80°14'51.35"E

No alternatives are considered

(b) Size of the Project (In terms of total area):

Total Land CRZ Area : 21716.64 m²

Total Built Up Area : 17075.77 m²

(c) CRZ Classification of the area: CRZ I (B) Intertidal Zone, CRZ III and CRZ IV (A)

(d) Expected cost of the project : Rs.1600.00 Lakhs

(e) Contact Details:

Assistant Director of Fisheries
Fisheries and Fishermen welfare Department,
Neelangari, Kancheepuram District,
Chennai- 600 115

E.mail ID: ee.fisheries@gmail.com & adjkpm@gmail.com

Telephone No: 044-24492719, 044-29510401



(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	No Change in coastal morphology and wave regime. Enhancement of land use as the proposed project will prevent erosion.
1.2	Details of CRZ classification as per the approved Coastal Zone Management Plan?	Yes	The project site comes under CRZ I (B) Intertidal Zone, CRZ Zone III and CRZ IV (A) Sea bed area between the Low Tide Line up to twelve nautical miles on the seaward side area as per CRZ Notification.
1.3	Whether located in CRZ-I area?	Yes	Not Applicable
1.4	The distance from the CRZ-I areas.	Yes	Not Applicable
1.5	Whether located within the hazard zone as mapped by Ministry of Environment and Forests/National Disaster Management Authority?	No	Not Applicable
1.6	Whether the area is prone to cyclone, tsunami, tidal surge, subduction, earthquake etc.?	Yes	Cyclones, tsunami and tidal surge are prone to the project site.
1.7	Whether the area is prone for saltwater ingress?	No	Not Applicable
1.8	Clearance of existing land, vegetation and buildings?	No	Not Applicable
1.9	Creation of new land uses?	No	Not Applicable
1.10	Pre-construction investigations e.g. borehole, soil testing?	No	Not Applicable
1.11	Construction works?	Yes	Construction of Groynes Northern Breakwater, Southern Breakwater, Diaphragm Wall.
1.12	Demolition works?	No	No demolition works will be carried out as the land is vacant.
1.13	Temporary sites used for construction works or housing of construction workers?	Yes	Temporary sites will be constructed for construction workers.
1.14	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations	Yes	Excavation works will be carried out for foundation of the structures. Later on, the site will be leveled.



S.No	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.15	Underground works including mining or tunneling?	No	No underground works will be required as the proposed project is the construction of Shoreline Protection Structures
1.16	Reclamation works?	No	Not Applicable.
1.17	Dredging/reclamation/Land filling/disposal of dredged material etc.?	No	Not Applicable.
1.18	Offshore structures?	No	Not Applicable.
1.19	Production and manufacturing processes?	No	Not applicable as the project is development of shoreline protection structures.
1.20	Facilities for storage of goods or materials?	Yes	Temporary sheds will be constructed for the storage of cement and other materials during developmental phase.
1.21	Facilities for treatment or disposal of solid waste or liquid effluents?	Yes	Solid waste generated would be collected by the Local Panchayat
1.22	Facilities for long term housing of operational workers?	No	Not Applicable
1.23	New road, rail or sea traffic during construction or operation?	No	Not Applicable
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	There will not be any alteration in the hydrology of the watercourses or aquifers due to the proposed project.
1.28	Stream and river crossings?	No	Not Applicable
1.29	Abstraction or transfers of water from 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	Transportation of personnel & construction materials during development phase will be through existing roads only.



S.No	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
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?	Yes	During construction period few workers will be stationed temporarily and others will be deployed locally.
1.35	Introduction of alien species?	No	Not Applicable
1.36	Loss of native species or genetic diversity?	No	Not Applicable
1.37	Any other actions?	No	Not Applicable

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	Not applicable
2.2	Water (expected source & competing users) unit: KLD	Yes	Fresh water Requirement - 1 KLD Source: Town Panchayat/Local bodies
2.3	Minerals (MT)	No	No usage of mineral is envisaged
2.4	Construction material – stone, aggregates, sand/soil (expected source – MT)	Yes	The construction material like gravel, soling stone, coarse aggregate, etc. will be used for the developmental activities.
2.5	Forests and timber (source – MT)	No	Forests and timbers will not be used in this project.
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)	Yes	As the proposed project is Shoreline Protection Structures (Groynes Field for Erosion Prevention & Control) by The Department of Fisheries, Government of Tamil Nadu. The source of Power Supply will be from TANGEDCO.
2.7	Any other natural resources (use appropriate standard units)	No	There is no need for other natural resources.



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)	No	No hazardous material will be utilized during the development phase
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	No	There will not be any occurrence of diseases as activities are confined to construction.
3.3	Affect the welfare of people e.g. by changing living conditions?	No	Not envisaged.
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,	No	Not applicable
3.5	Any other causes, that would affect local communities, fisher folk, their livelihood, dwelling units of traditional local communities etc.	No	The project is to be executed for the welfare of local fishing Community by providing FLC & thereby improving their livelihood.

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	No	There will not be any spoil, overburden or mine waste.
4.2	Municipal waste (domestic and or commercial wastes)	Yes	Marginal amount of solid waste (fish cutting waste) will be generated from the proposed project site and will be disposed through municipal corporation
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)	No	Not Applicable
4.4	Other industrial process wastes	No	Not Applicable
4.5	Surplus product	No	Not applicable since this is a development of Shoreline Protection Structures.
4.6	Sewage sludge or other sludge from effluent treatment	No	Not Applicable



4.7	Construction or demolition wastes	No	The project is only development of Shoreline Protection Structures and there will not be any major construction activity.
4.8	Redundant machinery or equipment	No	Not Applicable
4.9	Contaminated soils or other materials	No	There is no source for contamination of soils or other materials.
4.10	Agricultural wastes	No	Does not arise
4.11	Other solid wastes	No	No other waste generation expected.

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	No	Temporary gaseous emissions are expected from transport of construction material vehicles during development activity. This will be minimized by controlling the speed of vehicles, hiring well maintained vehicles, planting trees and spraying water periodically etc.
5.2	Emissions from production processes	No	Does not arise since the proposed project is a development of Shoreline Protection Structures.
5.3	Emissions from materials handling including storage or transport	No	No storage involved in this project site.
5.4	Emissions from construction activities including plant and equipment	Yes	Marginal quantity of emission is expected from construction activities which will be controlled by suitable control measures like water spraying.
5.5	Dust or odours from handling of materials including construction materials, sewage and waste	Yes	Transportation of construction materials may generate dust, so emissions will be arrested by water spraying
5.6	Emissions from incineration of waste	No	Not Applicable
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	No	Not Applicable
5.8	Emissions from any other sources	No	No emissions from any other sources.

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	No	Not Applicable
6.2	From industrial or similar processes	No	Not Applicable
6.3	From construction or demolition	No	Minor construction activity will be there for the development of Shoreline Protection Structures. Noise levels in the range of 75-85 dB (A) will be generated occasionally during the construction activities. Workers in the noisy areas will be provided with earmuffs and earplugs
6.4	From blasting or piling	No	Not applicable
6.5	From construction or operational traffic	No	Minor construction activity will be there for the development of Shoreline Protection Structures.
6.6	From lighting or cooling systems	No	Not Applicable
6.7	From any other sources	No	Not Applicable

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	Not Applicable
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)	No	Not Applicable
7.3	By deposition of pollutants emitted to air into the land or into water	No	Not Applicable
7.4	From any other sources	No	Not Applicable
7.5	Is there a risk of long term buildup of pollutants in the environment from these sources?	No	Not Applicable



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	Not Applicable
8.2	From any other causes	No	Not Applicable
8.3	Could the project be affected by natural disasters causing environmental damage (e.g., floods, earthquakes, landslides, cloudburst etc)?	No	The area under study falls in Zone-III according to the Indian Standard Seismic Zoning Map. The structure was designed to be earthquake resistant. The proposed project will not be affected by natural disasters causing environmental damage.

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 utilities, 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 Housing development Extractive industry Supply industry	No No No No	Proposed infrastructure will not create any impact on the environment. Nil No Extraction Nil
9.2	Lead to after-use of the site, which could have an impact on the environment	No	Not Applicable
9.3	Set a precedent for later developments	No	Not Applicable
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects	No	Not applicable



(III) ENVIRONMENTAL SENSITIVITY

S. No	Areas	Name/ Identity	Aerial distance (Within 15 km.)
1	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value.	Nil	No such areas within 15 Km radius
2	Areas which are important for or sensitive Ecological reasons - Wetlands, water sources or other water bodies, coastal zone, biospheres, mountains, forests	Bay of Bengal	Nearest to the project site
3	Area used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	Nil	Not Applicable
4	Inland, coastal, marine or underground waters	No	Not Applicable
5	State, National boundaries	No	Not Applicable
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	No	Not Applicable
7	Defense installations	No	Not Applicable
8	Densely populated or built-up area	Kelambakkam	4.56 km Southwest of project site.
9	Area occupied by sensitive man-made land uses Hospitals, schools, places of worship, community facilities)	Yes	Hospital • Annai hospital - 12.58 km Northwest. Schools • Christwood School – 9.36 km Northwest. Place of Worship • Selva Vinayagar Temple – 12.10 km North.
10	Areas containing important, high quality or scarce resources (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)	No	Not Applicable



11	Areas already subjected to pollution environmental damage. (those where existing legal environmental standards are exceeded)	No	Not Applicable
12	Areas susceptible to natural hazard which could cause the project to present environmental problems (earthquakes, subsidence, landslides, flooding erosion, or extreme or adverse climatic conditions)	No	The area under study falls in Zone-III, according to the Indian Standard Seismic Zoning Map

“I hereby given undertaking that data and information given in the application and enclosures are true to the best of the knowledge and belief and I am aware that if any part of the data and information submitted is found to be false or misleading at any stage, the project will be rejected and clearance given, if any to the project will be revoked at our risk and cost.”

Date:

Place: Chennai

SIGNATURE OF THE APPLICANT

Name :
Designation : Assistant Director of Fisheries
Address : Fisheries and Fishermen welfare
Department,
Neelangari, Kancheepuram District,
Chennai- 600 115

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EIA Report



1 INTRODUCTION

1.1 Preamble

The proposed Fish Landing Centre is located in Karikattukuppam which is an active fishing village located in between Kovalam and Muthukadu of Thiruporur Taluk, Chengalpattu District (erst while Kancheepuram District), Tamil Nadu State. The geographic locations are 12° 49' 14.60" N (Latitude) and 80° 14' 51.34" E (Longitude). Fish Landing Centre and fishing activities are predominantly carried out in and around this village.

1.2 Need for the Project

Fishing is being carried out using Mechanised Fishing Boats (MFB) & Fibre Reinforced Plastic Boats (FRP) that are available at Karikattukuppam Fishing Village.

Chengalpattu district has a coastal length of 57.0 Km, the district is bounded in the east by the Bay of Bengal. Chengalpattu features a tropical wet and dry climate. As Tamil Nadu government is keen to expand the fishing harbours and fish landing centres to give a new dimension to the livelihood of the fishing community.

In view of the above, Fisheries Department, Government of Tamil Nadu has proposed to construct the fish landing center with various facilities.

1.3 Location of the Project

The proposed Fish Landing Centre is located in Karikattukuppam which is an active fishing village located in between Kovalam and Muthukadu of Thiruporur Taluk, Chengalpattu District (erst while Kancheepuram District), Tamil Nadu State. The geographic locations are 12° 49' 14.60" N (Latitude) and 80° 14' 51.34" E (Longitude) and the location of the map showing general location, specific location is shown in **Figure. 1.1**



Environmental Impact Assessment for the Proposed Construction of Fish Landing Centre and Shore Protection Works along with Boat Berthing facilities at Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District, Tamil Nadu.



Table 1-1 Location of Project Site



1.4 Study Approach

In order to assure that development projects are planned, designed and implemented in an environmentally sustainable manner, it is important that Environmental Management Plan is undertaken during the project planning stage. In this regard, **Fisheries Department, Government of Tamil Nadu** has appointed **ABC Techno Labs India Private Limited**, Chennai as Environmental Consultants who are accredited by National Accreditation Board for Education and Training (NABET)-Quality Council of India (QCI), New Delhi.

The report has been prepared in line with the Coastal Zone Regulation (CRZ) Notification, 2011, Government of India, Ministry of Environment and Forests and Climate Change (MoEF&CC) and internationally accepted practices so as to ensure necessary safeguards to protect against.

1.5 Objective of the Study

The main objective of the study is to obtain Coastal Regulation Zone (CRZ) Clearance under CRZ Notification, 2011 notified by MoEF&CC, Government of India. The proposed fish landing center with various facilities falls under CRZ Zone-IB, III & IVA area and CRZ clearance need to be obtained under CRZ Notification, 2011. In order to obtain CRZ clearance, Form I & EMP Report shall be undertaken for the activities that are proposed which are permissible under CRZ area.

1.6 Need for CRZ Clearance

As per CRZ Notification 2011, the proposed project site is near coastal zone which is influenced by sea water during high tide. The Institute of Remote Sensing, Anna University has carried our field survey and the proposed project site is falls under CRZ- IB, III & IVA area as per the approved CZMP as per CRZ Notification, 2011.

1.7 Regulatory Context

The environmental laws and regulations of India relevant to the proposed project at are listed and commented upon below.

1.7.1 Legislation and Regulations

Environmental protection and improvement were explicitly incorporated into the Constitution of India by the 42 Amendment Act (1976) which added Article 48 A to the directive principles of State policy and declares that “the State shall endeavor to protect and



improve the environment and to safeguard the forests and wild life for the country". Article 51 A (g) on "Fundamental Duties" imposed a similar responsibility on every citizen to protect and improve natural environment. The Directive Principles of State Policy, an integral and significant element of India's democratic set-up, also contains a specific provision enunciating the State's commitment for protecting the environment. Article 253 of the Constitution empowers Parliament to make laws implementing international obligations of the country. The constitutional provisions have provided for local management of resources and are implemented through environmental protection laws of the Country.

The Ministry of Environment and Forests & Climate Change (MoEF&CC) constituted in 1985 is the nodal agency at the Central level of planning, promoting and coordinating the environmental programmes, apart from policy formulation. A number of enforcement agencies assist the MoEF in executing the assigned responsibilities. The responsibilities for industrial pollution prevention and control are primarily executed by the Central Pollution Control Board (CPCB) at the Central level, which is a statutory authority, attached to the MoEF&CC. The State Departments of Environment and State Pollution Control Boards (SPCBs) are the designated agencies to perform these functions at the State level.

The constitutional provisions are backed by a number of laws – acts, rules, and notifications. The legislative framework is broadly contained in the umbrella Environment Protection Act, 1986; the Water (Prevention and Control of Pollution) Act, 1974; the Water Cess Act, 1977; and the Air (Prevention and Control of Pollution) Act, 1981. The law in respect of management of forests and biodiversity is contained in the Indian Forest Act, 1927; the Forest (Conservation) Act, 1980; the Wild Life (Protection) Act, 1972; and the Biodiversity Act, 2002. There are several other enactments, which complement the provisions of these basic enactments.

1.7.2 Environmental (Protection) Act, 1986

The Environment (Protection) Act, 1986 was introduced as an umbrella legislation that provides a holistic framework for the protection and improvement to the environment. In terms of responsibilities, the Act and the associated Rules requires for obtaining environmental clearances for specific types of new / expansion projects (addressed under Environmental Impact Assessment Notification, 1994) and for submission of an environmental statement to the State Pollution Control Board annually.



Environmental Impact Assessment is undertaken for this residential plots project as a standard management procedure as laid down in The Environment (Protection) Act, 1986 and also ambient air quality, water quality, soil and noise levels are tested for permissible standards as prescribed by national laws and international regulations.

1.7.3 Coastal Regulation Zone (CRZ) Notification, 2011

In exercise of powers also conferred by clause (d) and sub rule (3) of rule 5 of Environment(Protection) Act, 1986 and in supersession of the notification of the Government of India in the Ministry of Environment and Forests, number S.O.114(E), dated the 19thFebruary, 1991 except as respects things done or omitted to be done before such supersession, the Central Government here by declares the following areas as CRZ and imposes with effect from the date of the notification the following restrictions on the setting up and expansion of industries, operations or processes and the like in the CRZ,-

- i The land area from High Tide Line (hereinafter referred to as the HTL) to 500 meters on the landward side along the sea front.
- ii CRZ shall apply to the land area between HTL to 100 mts or width of the creek whichever is less on the landward side along the tidal influenced water bodies that are connected to the sea and the distance upto which development along such tidal influenced water bodies is to be regulated shall be governed by the distance upto which the tidal effects are experienced which shall be determined based on salinity concentration of 5 parts per thousand (ppt) measured during the driest period of the year and distance upto which tidal effects are experienced shall be clearly identified and demarcated accordingly in the Coastal Zone Management Plans (hereinafter referred to as the CZMPs).

Classification of the CRZ – For the purpose of conserving and protecting the coastal areas and marine waters, the CRZ area shall be classified as follows, namely

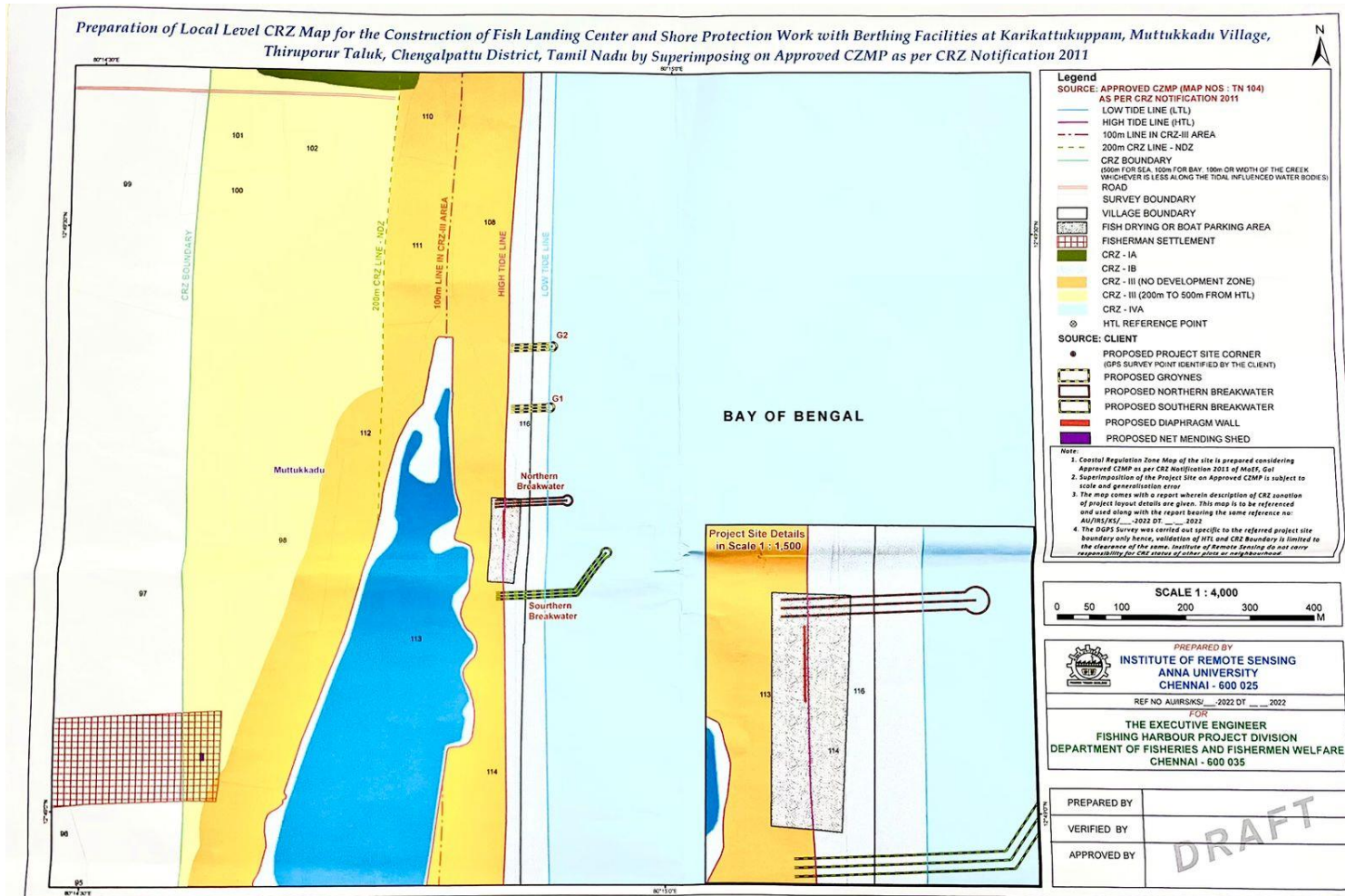
- A. CRZ-I– The areas that are ecologically sensitive and the geomorphological features which play role in the maintaining the integrity of the coast
- B. The area between Low Tide Line and High Tide Line:
CRZ-II- The areas that have been developed up to or close to the shoreline.
Explanation.- For the purposes of the expression “developed area” is referred to as that area within the existing municipal limits or in other existing legally designated



urban areas which are substantially built-up and has been provided with drainage and approach roads and other infrastructural facilities, such as water supply and sewerage mains;



Environmental Impact Assessment for the Proposed Construction of Fish Landing Centre and Shore Protection Works along with Boat Berthing facilities at Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District, Tamil Nadu.



DRAFT CRZ MAP



1.8 Structure of EIA Report

The structure of the EIA report is given below:

Chapter 1 This chapter gives an overview of the need for the project, objectives and need for the EIA study etc.

Chapter 2 This chapter gives a brief description of the proposed project

Chapter 3 This chapter describes the baseline environmental conditions for various physico-chemical, biological and socio-economic aspects.

Chapter 4 This chapter describes the anticipated positive and negative impacts due to the construction of the proposed fish landing centre.

Chapter 5 This chapter describes the Environmental Management Plans associated with the construction and operation of the fish landing centre.

Chapter 6 This chapter describes the Associated Risks for the proposed study.

Chapter 7 This chapter describes the Environmental Monitoring programme for construction of the proposed fish landing centre.

Chapter 8 This chapter gives the conclusions of the proposed study.



2 PROJECT DESCRIPTION

2.1 Project Location

Fisheries Department, Government of Tamil Nadu has proposed to construct the fish landing center with various facilities at in Karikattukuppam which is an active fishing village located in between Mahabalipuram and Sadras (Sathurangapattinam) of Muttukadu Taluk, Chengalpattu District (erst while Kancheepuram District), Tamil Nadu State. The geographic locations are $12^{\circ} 43' 52.37''$ N (Latitude) and $80^{\circ} 14' 14.01''$ E (Longitude). The Layout showing the project site is given in **Figure 2.1**. Map showing Topo map of the proposed project site is given in **Figure 2.2 & 2.3**.

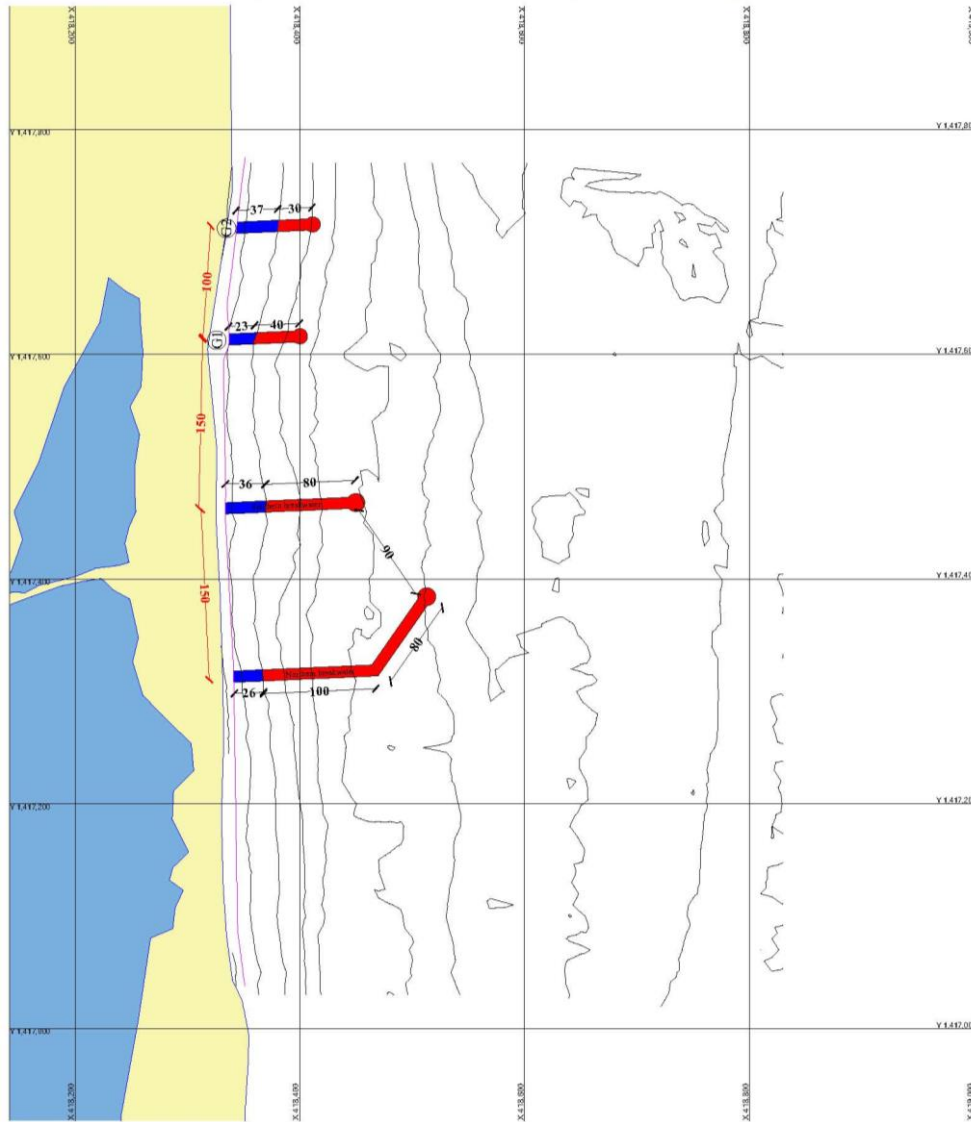


Figure 2-1 Layout of the Project Site



Environmental Impact Assessment for the Proposed Construction of Fish Landing Centre and Shore Protection Works along with Boat Berthing facilities at Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District, Tamil Nadu.

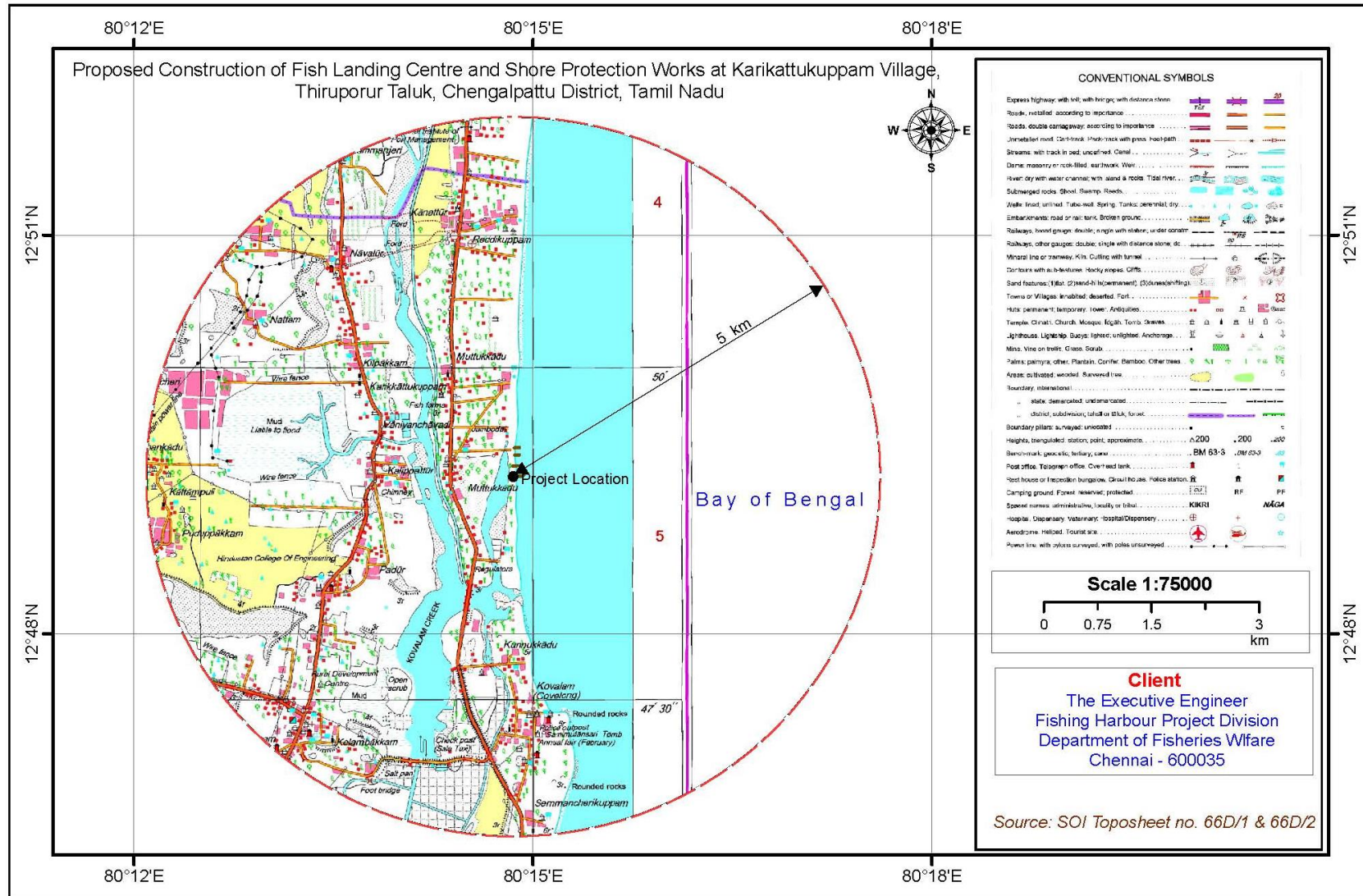


Figure 2-2 Topo map covering 5km radius of the Project Site



Environmental Impact Assessment for the Proposed Construction of Fish Landing Centre and Shore Protection Works along with Boat Berthing facilities at Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District, Tamil Nadu.

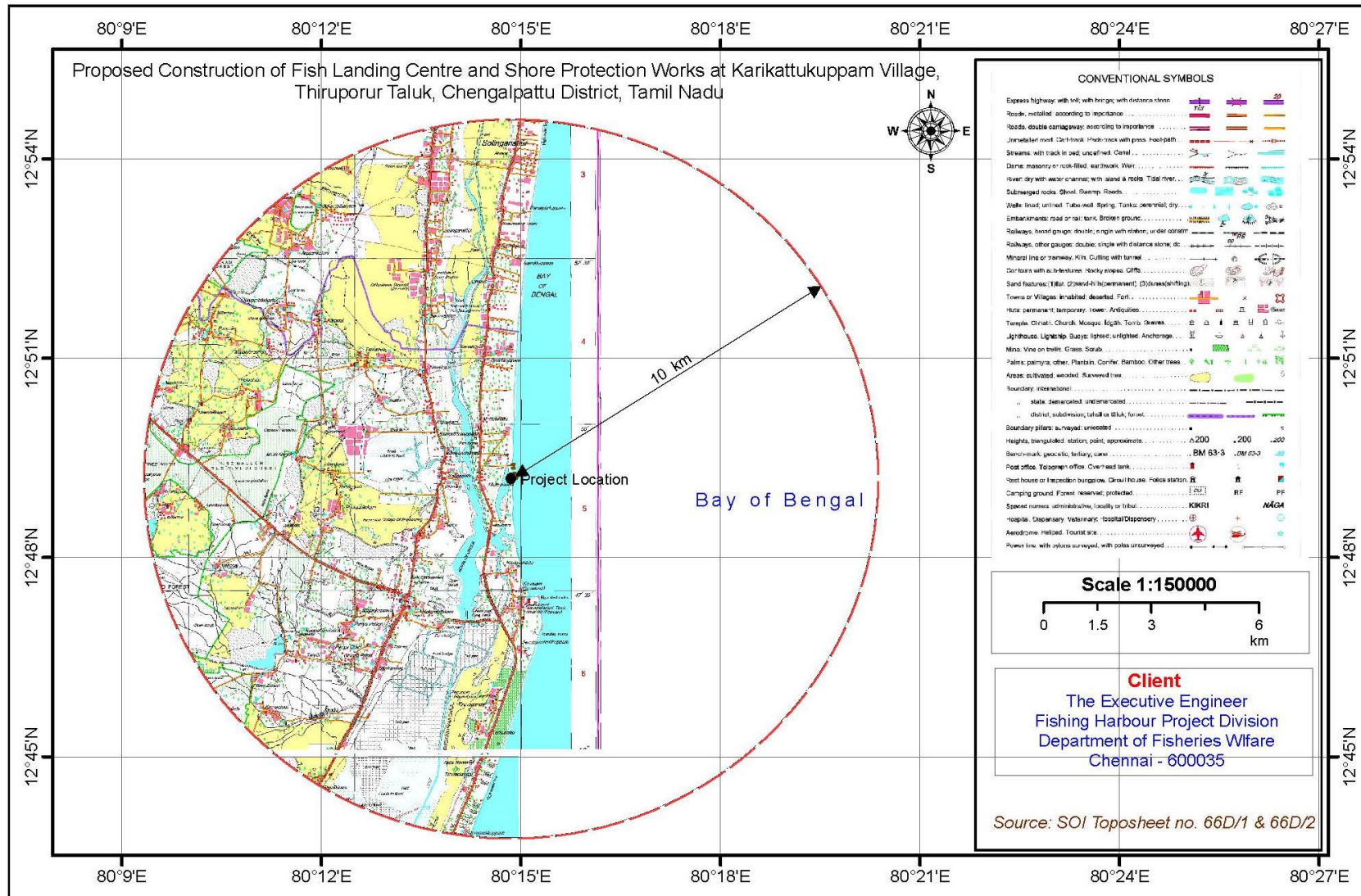


Figure 2-3 Topo map covering 10km radius of the Project Site



Table 2-1 Environmental Setting of the Project

S.No	Particulars	Details
1	Site latitude & Longitude	12°49'14.60"N & 80°14'51.34"E
2	Site average level	0 m at Sea level
3	Nearest bus stand	<ul style="list-style-type: none">• Karikattukuppam Bus stop – 0.81 km (WSW)• Muttukadu Bus Stop – 1.03 km (NW)
4	Nearest railway station	<ul style="list-style-type: none">• Kotturpuram railway station – 21.34km (N)
5	Nearest airport	<ul style="list-style-type: none">• Chennai International Airport – 20.62 km (NNW)
6	Nearest Highway	<ul style="list-style-type: none">• SH – 49 – 0.8 km (W) East Coast Road (Thiruvanmiyur - Mahabalipuram - Marakkanam - Pondicherry Road)• Rajiv Gandhi Salai – 1.86 km (W)• SH – 121 – 4.48 km (WSW) (Vandalur - Mambakkam - Kelambakkam Road)
7	National park /Wild life sanctuaries	<ul style="list-style-type: none">• The Madras Crocodile Bank Trust & Centre for Herpetology – 8.66 km (S)
8	Reservoir/Lake /River/Canal	<ul style="list-style-type: none">• Arachi Lake – 2.22 km (WSW)• Thalambur Lake – 4.45 km (NW)• Thaiyur Lake – 7.98 km (SW)• Ottiyambakkam lake – 6.68 km (NNW)
9	Reserved/Protected forest	5.8 km (W)
10	Seismic zone	Zone III
11	Defense installation	Nil within 10 km radius
12	Nearest port	Chennai Port – 29.21 km (N)
13	Ecological Sensitive / Historical Areas	Sandunes – 900m (N)



Table 2-2 Details of the proposed structure and its corresponding structure

S. No	Name of contents	Location of the proposed structure	Land area (acres)	Land classification	CRZ Classification Zones
1.	Net Mending Shed – 1 nos		12m x 6m	Land belongings to Fisheries and Fishermen welfare Department	CRZ – III-B.
2.	2 nos of Groynes		G 1 – 67m G 2 – 63m		CRZ – IB & CRZ – IVA.
3.	Northern Breakwater		116m		CRZ – IB & CRZ – IVA.
4.	Southern Breakwater		206m		CRZ – IB, CRZ – III-A & CRZ – IVA.
5.	Diaphragm Wall		44m		CRZ – III-A.

2.2 Site Connectivity

Chengalpattu district is situated on the north east coast of Tamil Nadu with a total geographical area of 2945 Sq.Kms. The district is bounded on the north by the Chennai district, West by the Kancheepuram district and Thiruvannamalai districts, South by the Villupuram district and East by the Bay of Bengal with a coastal length of 57 Kms. Chengalpattu features a tropical wet and dry climate.

2.3 Description of the Project

Department of Fisheries has been proposed to develop a fish landing Centre to cater the increasing needs of the fisher folk of Karikattukuppam in Chengalpattu district, Tamil Nadu.

The infrastructure facilities envisaged are as follows:

- Groynes – 2 Nos
- Net Mending Shed – 1 Nos
- Northern Breakwater
- Southern Breakwater
- Diaphragm Wall

2.3.1 Groynes

The design of Groynes section is mainly being carried out for the stability of armour units and the overall

Hydraulic stability of the section formed by rubble stones. The length of the groynes are as follows

- Groyne 1 – 67m
- Groyne 2 – 63m

2.3.2 Net Mending Shed

- This facility is designed to consist of a space, where fishnets are repaired and mended and another, where they are dried.
- Net Mending Shed of 12m lengths x 6m wide fishnet mending sheds are proposed.

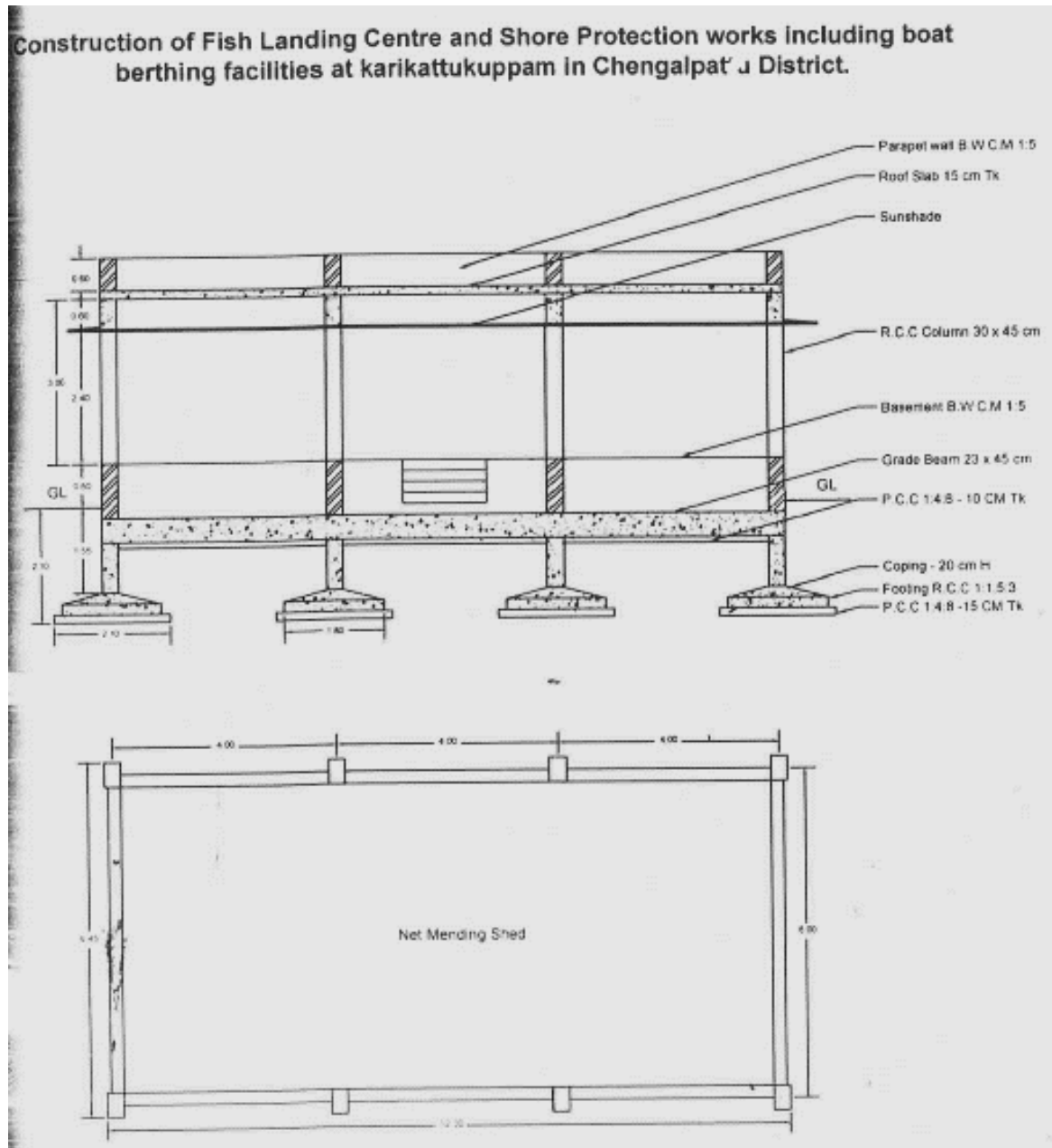


Figure 2-4 Net mending Shed

2.3.3 Northern Breakwater

- The proposed Northern Breakwater is of length 116m.



2.3.4 Southern Breakwater

- The proposed Southern Breakwater consists of a total of length 206m.

2.3.5 Diaphragm Wall

- A 44m length anchored diaphragm wall structure is proposed for the proposed fish landing centre in Karilattukuppam.

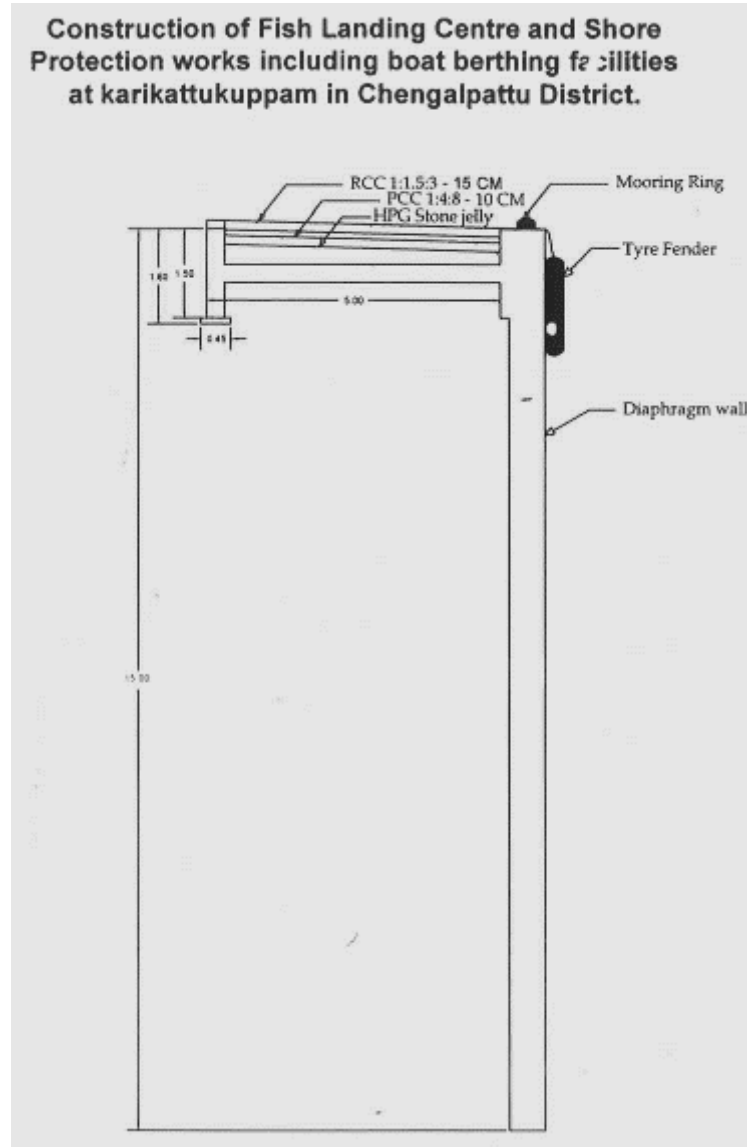


Figure 2-5 Anchored Diaphragm Wall

2.4 Project Cost

The expected project cost is estimated to be around **Rs.1600.00 Lakhs (Rs. 16.00 Cr.)**



3 DESCRIPTION OF ENVIRONMENT

3.1 Introduction

Baseline Environmental Studies have been conducted to determine the existing status of various Environmental attributes viz., Climatic and Atmospheric conditions, Air, Water, Noise, Soil, Marine Water Quality and Sediment Quality, Marine Ecology and Socio-Economical environment, prior to setting up of the proposed project. This study would help to undertake corrective mitigation measures for protection of the environment on account of any change deviation of attributes due to activities of the proposed project.

3.2 Scope of Baseline Study

The proposed project sites for considered as the study area for the baseline studies. As part of Environmental and Social Impact Assessment, this study was undertaken for a period of May 2022.

During survey, sediment and biological samples (plankton, benthos, microbiological and other ecologically important flora and fauna) were collected from 5 different stations from the proposed sites. Primary data on Water, Air, & Socio-Economic data were collected by a team of Engineers and Scientists of **ABC Techno Labs India Pvt Ltd**, Chennai. Secondary data was collected from various Departments of State/Central Government Organizations, Semi-Government and Public Sector Organizations. **Table 3.1** gives various environmental attributes considered for formulating environmental baseline and **Table 3.2** gives the frequency and monitoring methodology for various environmental attributes.

Table 3-1 Environmental Attributes

S.No.	Attribute	Parameter	Source of Data
1.	Climatology & Meteorology	Wind speed, Wind direction, Dry bulb temperature, Wet bulb temperature, Relative humidity, Rainfall, Solar radiation, Cloud cover and Environmental Lapse	Indian Meteorological Department and Site-specific Data
2.	Marine Water Quality	Physical and Chemical parameters, Marine Water biological parameter- Primary productivity, Chlorophyll a, Phaeophytin, Phytoplanktons, Abundance, Density, Total Biomass, Zooplanktons- Abundance, Number and name of groups, present and Density	Monitored Data (8 locations)



S.No.	Attribute	Parameter	Source of Data
3.	Sediment Quality	Samples analyzed for physical and chemical parameters, Benthic Organisms Meiobenthos and Macros-benthos-Abundance, Number and name of each group, present, Total number and name of species of each group present, Density (Total numbers of individuals of each species/m ²)	Monitored Data (8 locations)
4.	Marine Ecology	Marine Ecology- The water bodies shall be characterized for primary productivity, density and diversity of phytoplankton, zooplanktons, benthic macro invertebrates/fauna, Marine flora (sea grasses), Marine fauna (marine mammals, marine reptiles, fishes and macrophytes), Corals. Existing terrestrial flora and fauna within the study area	Field survey and Secondary sources
5.	Socioeconomic Aspects	Socioeconomic characteristics of the affected area	Based on field survey and data collected from secondary sources

Table 3-2 Baseline Environmental Components, Frequency & Monitoring Methodology

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
Meteorological Data				
Wind speed, Wind direction, Dry bulb temperature, Wet bulb temperature, Relative humidity, Rainfall, Solar radiation, Cloud cover and Environmental Lapse	Requisite locations in the project influence area.	-	Weather Station with the database	IS 5182 Part 1-20 Site-specific Primary data is essential Secondary data from IMD-Regional Meteorological Centre, Chennai.
Land Environment				
Soil quality, Particle size distribution, Texture, pH, Electrical conductivity, Cation exchange capacity, Alkali metals, Sodium Absorption Ratio (SAR), Permeability, Porosity	Requisite soil samples be collected as per BIS specification within project influence area	Once	Collected and analyzed as per soil analysis reference book, M.L. Jackson	
Marine Water				



Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
<p>Parameters for Marine waterquality: Temperature, pH, Electrical Conductivity, Turbidity, Salinity, density at various depths, Turbidity, Chlorides, Sulphates, Calcium, all nutrient values, Magnesium, Sodium, Potassium, TDS, TSS, Total Kjeldahl Nitrogen, Dissolved Oxygen, BOD, Nitrates, Ammonical Nitrogen, Phosphates, Total Nitrogen, Zinc, Cadmium, Lead, Mercury, Copper, TPH and Oil & Grease. Nitrite, Cr, Fe, As, Al, Mn, Ni, Silica, Vandium.</p> <p>Marine Water biological parameter: Primary productivity, Chlorophyll a, Phaeophytin Phytoplanktons, Abundance, Density Total Biomass</p> <p>Zooplanktons Abundance, Number and name of groups, present and Density</p> <p>Avifauna Rare and endangered species Sanctuaries/National park/Biosphere reserve</p>	Set of grab samples at the requisite locations for Marine water samples	Once during the study period	Samples for water quality collected and analyzed as per IS : 3025 Part 10-1987 methods for sampling and testing of Marine Water Standard methods for the examination of Marine water and Sediment analysis published by American Public Health Association.	IS : 3025 Part 10-1987 & APHA 23rd EDITION
Socio-Economic				
Demographic structure Infrastructure resource base Economic resource base Health status: Morbidity pattern Cultural and aesthetic attributes	Socio-economic survey is based on proportionate, stratified and random sampling method		Survey is based on personal interviews and questionnaire. Secondary data from census records, statistical hard books, health records and relevant official records available with Govt. agencies	



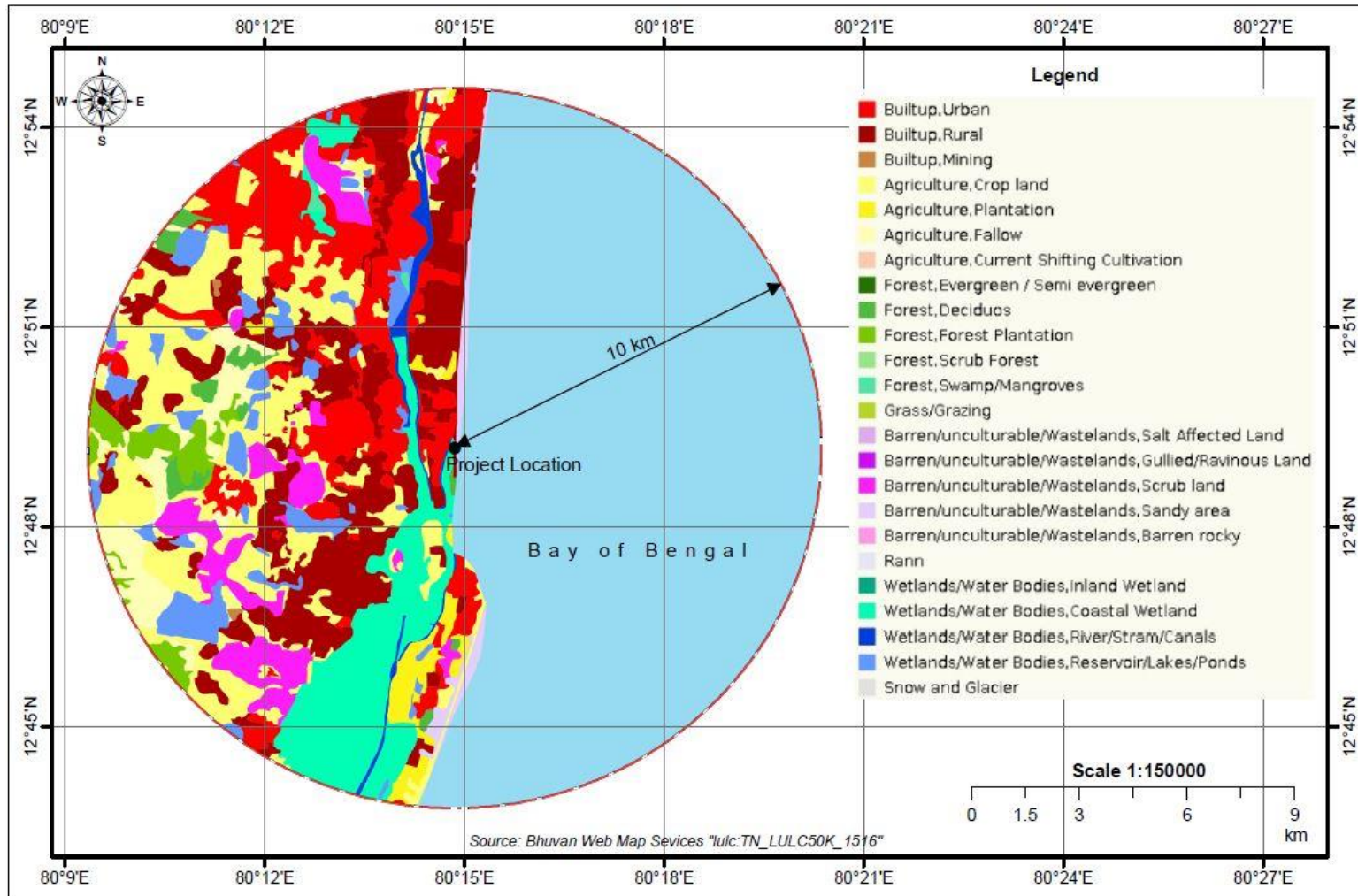
3.3 Land Environment

3.3.1 Physiography of the Study Area

The elevation of the area ranges from 0 m AMSL in the west to a sea level in the east. The coastal plain displays a fairly low level or gently rolling surface and only lightly elevated above the local water surfaces on rivers (Palar River). The river Palar is one of the major rivers in the state of Tamil Nadu traversing through Chengalpattu district for a length of 54 Kms. The river Palar enters the district at Palur village and confluxes with Bay of Bengal between Vayalur and Kadalur village. Moreover, the district is bounded by the river Adayar in the North and the Ongur river in the South. Besides the aforesaid rivers, Neenjal Maduvu, Pukkadurai Odai, and Kiliyar are other minor rivers flowing through Chengalpattu district. The district is home to 528 major irrigation tanks having ayacut of more than 100 Acres (or) 40 Hectares each.



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LU/LC MAP



3.3.2 Drainage of the Study area

- The project is partially onshore and offshore of Bay of Bengal, and the nearby land area is mainly drained by Palar River in the bottom of the area and flows west to east direction (**Fig. 3.1**). Chengalpattu district is classified into coastal areas and other plain lands with small intermittent hills. Few residual hills such as St.Thomas Mount, Thirukkalukundram hills and Vandalur hills are found in the district. The general elevation of the district ranges from 0.5m to 230m above MSL. River Palar is a major river course, which drains this district originates from Western Ghats in Karnataka State. Cheyyar and Kiliyar are the small tributaries of Palar river.



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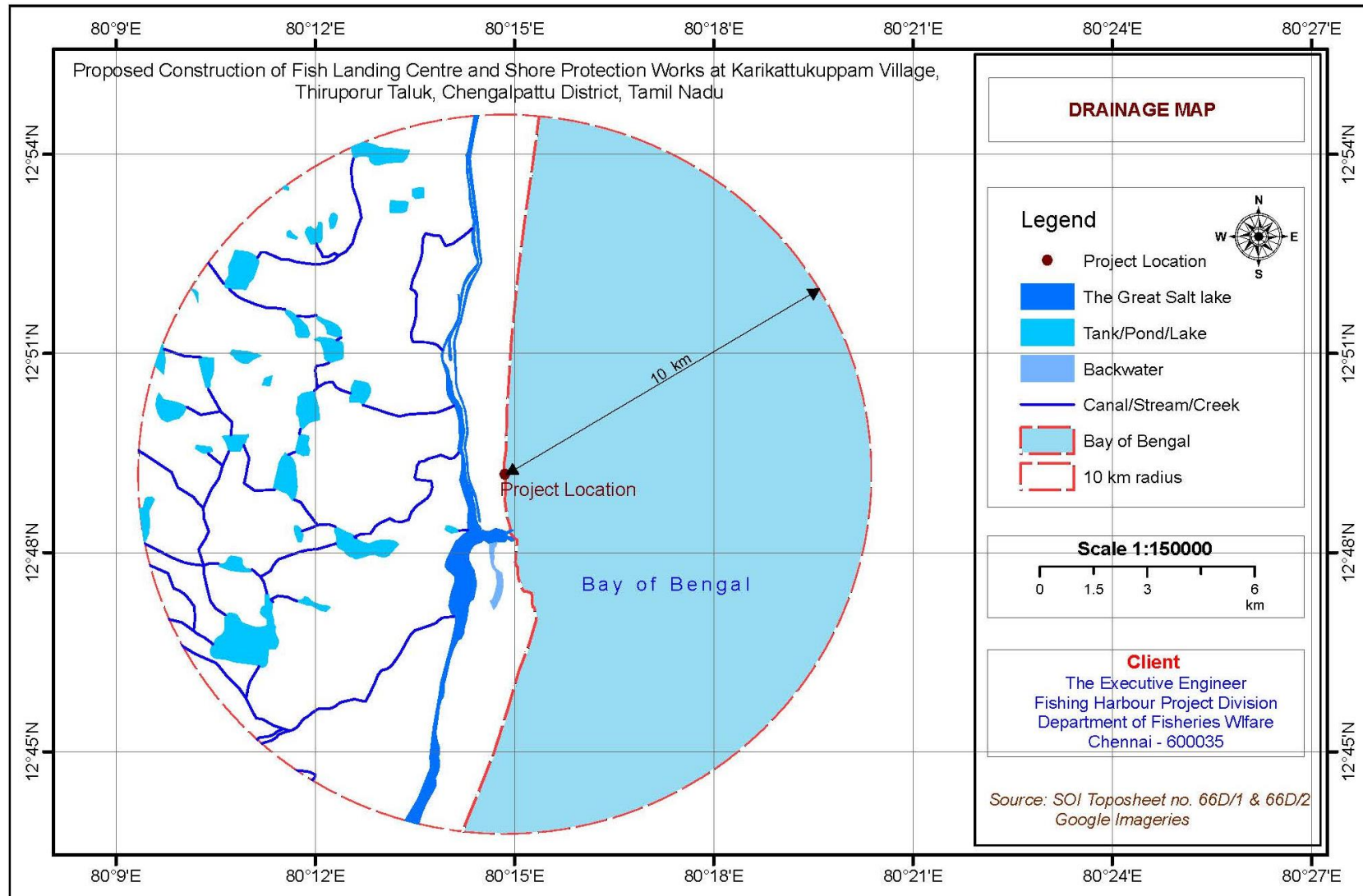


Figure 3-1 Drainage/Water Bodies of the Project Site



3.3.3 Geology of the Study Area

Alluvial soils are found on the banks of Palar River. The river alluvium is transported and is seen in coastal area of this district. Sandy coastal alluvial (arenaceous soil) occurs along the seacoast as a narrow belt. Soils have been classified into 1) clayey soil, 2) red sandy or red loamy soil 3) Red sandy brown clayey soil and 4) Alluvial soil. Hence, the study area can be classified as paleo-tidal flat. Evidences of tidal action comes from the occurrence of remains of gastropods and lamellibranches shells that are characteristic of marine and marginal marine environment. Hard Rock 80%, Sedimentary 20% having Granite, Gneiss, Chronockite, Sandstone, Sandy clay, Laterite, Alluvium and Marine deposits.

3.3.4 Geomorphology of the Study Area

The study area falls in the coastal landform as per the geomorphological map of the Chengalpattu District. Coasts are also the unique assemblage of erosional and depositional processes. The various landforms of coastal area are almost exclusively the result of the action of ocean waves.

3.4 Meteorology and Climate

3.4.1 Climatic condition

Chengalpattu features a tropical wet and dry climate. The fact that the district is close to the thermal equator and is also coastal prevents extreme variations in the seasonal temperature. The district gets most of its annual seasonal rainfall from the north-east monsoon winds during the months of October and November.

3.4.2 Regional Meteorology

3.4.3 Chennai (Meenambakkam) IMD station

Climatological Table of 30 years (of 1971 to 2000) of IMD for Chennai Station was referred to assess long term meteorological conditions prevailing in the region.

A. Temperature

The monthly mean maximum temperature varied from 28.6°C in December to 38.0°C in May while monthly mean minimum varied from 20.5°C in January to 27.7°C in May indicating January as the coldest while May as hottest month.



B. Relative Humidity

During the month of September to January the relative humidity was highest (83%). The annual average Relative humidity is 74% (at 0830 Hours) and 65% (at 1730 Hours). Generally, the weather during other seasons was observed to be dry.

C. Rainfall

The rainfall occurred maximum in November (1071.4 mm) followed by August (395.3 mm). The total rainfall received in the year is about 1071.0 mm. Total rainy days observed about 60.5 days.

D. Wind Speed/ Direction

The maximum wind speed observed during the month of June is 11.6 Kmph and minimum wind speed observed during the month of January is 5.5 Kmph. The annual average wind speed calculated is 8.2 Kmph.

Table 3-3 Historical Meteorological Data at IMD Chennai (1971-2000)

Month	Daily mean Temp. (°C)		Relative Humidity (%)		Rainfall (mm)		Cloud cover (in Oktas)		Station Level Pressure (hPa)		Mean Wind Speed (KMPH)
	Max	Min	08:30	17:30	Monthly Total	No. of Rainy	08:30	17:30	08:30	17:30	
January	29.0	20.5	83	64	28.2	1.4	3.6	3.5	1013.6	1010.3	5.5
February	31.0	21.7	80	63	4.0	0.4	3.0	2.7	1012.2	1008.9	6.8
March	33.4	23.5	76	63	3.3	0.2	3.0	2.2	1010.7	1007.0	8.2
April	35.7	26.1	71	66	11.2	0.7	4.3	3.4	1008.1	1004.1	10.4
May	38.0	27.7	63	62	46.6	1.7	4.5	4.6	1004.9	1001.3	11.1
June	37.4	27.3	59	56	74.7	4.9	5.5	6.1	1003.6	1000.0	11.6
July	35.4	26.2	67	60	130.5	7.7	6.1	6.4	1004.2	1000.7	9.9
August	34.5	25.6	71	63	145.8	8.4	5.9	6.3	1005.0	1001.4	9.4
September	34.2	25.3	74	68	169.2	8.5	5.3	5.7	1006.5	1002.9	7.9
October	32.0	24.4	81	74	293.9	10.0	5.4	5.7	1005.5	1008.7	5.8
November	29.7	22.9	83	74	361.6	10.4	5.2	5.5	1010.8	1008.0	5.7
December	28.6	21.5	82	69	173.0	6.2	4.7	4.9	1013.2	1010.2	5.9
Annual or Mean	32.8	24.4	74	65	1441.9	60.5	4.7	4.8	1008.5	1005.0	8.2

Source: IMD Station, Chennai



MAY

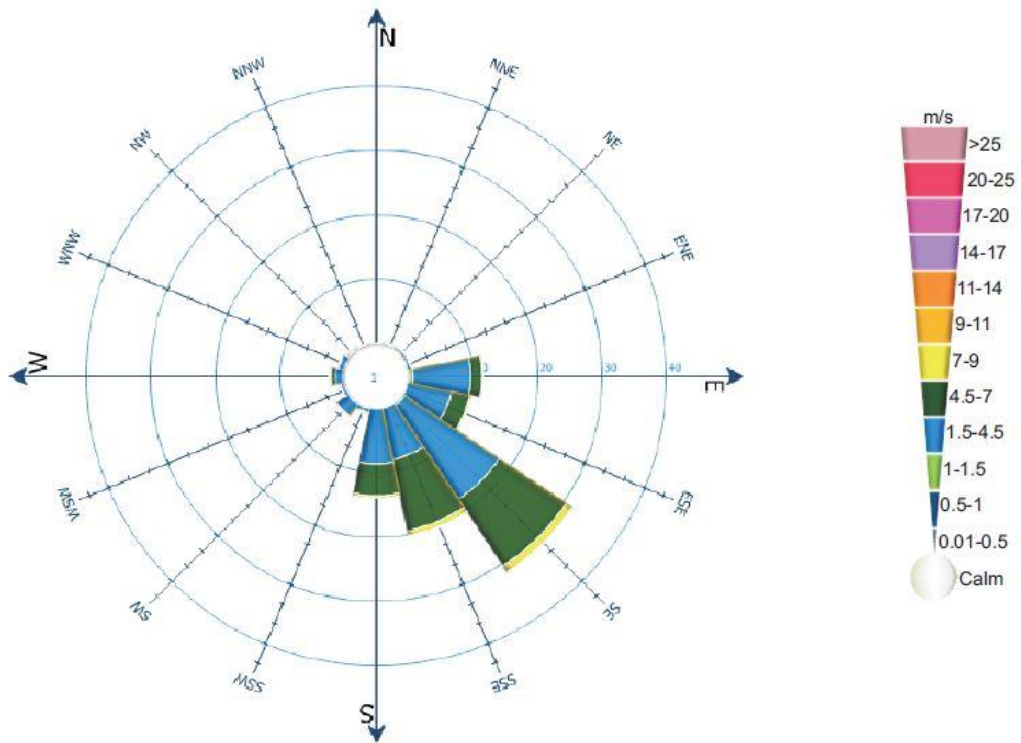


Figure 3-2 Windrose Diagrams for the Month of May – IMD, Chennai

3.4.4 Site Specific Meteorology

The continuous weather monitoring station was installed at Chengalpattu (Karikattukuppam). On site monitoring was undertaken for various meteorological parameters in order to generate the site-specific data. The Central Monitoring Station (CMS), equipped with continuous monitoring system to record wind speed, wind direction, temperature, humidity and rain fall was set up at the top of the building at a height of ~5.0 m above the ground level. The methodology adopted for monitoring surface observations was as per the Standard norms laid down by the Bureau of Indian Standards (IS: 8829:1978) and IMD.



Table 3-4 Site specific Weather Report for the Study period

S.No.	Parameters	Observations (Chengalpattu)
1	Dry Bulb Temperature (°C)	
	Maximum	30
	Minimum	23
	Average	27
2	Relative Humidity (%)	
	Maximum	72
	Minimum	4
	Average	79
3	Wind Speed (m/s)	
	Maximum	11
	Minimum	6
	Average	8.2
	Predominant Wind Direction (From)	ENE
4	Rainfall (in mm)	
	Total (mm)	86.1 mm

1. Temperature

The average temperature during study period in the site locations varied from 23°C to 30°C

2. Relative Humidity

The average relative humidity during study period in the site locations Chengalpattu district varied from 4% to 72%

3. Rainfall

Average rainfall was observed during the study period.

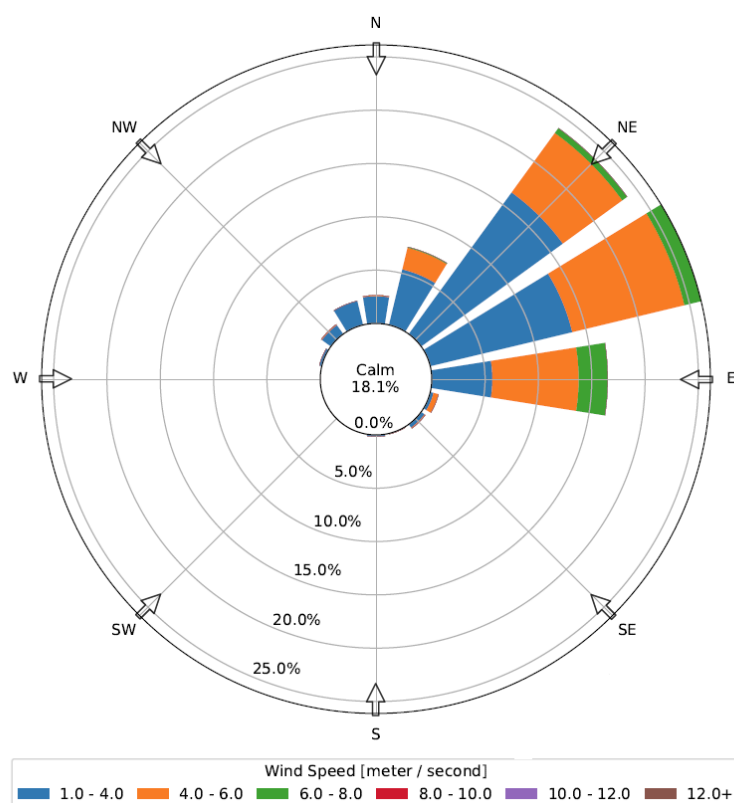
4. Wind

The monthly wind speed in the site locations at Chengalpattu varied from 6 KMPH to 11 KMPH occurring study period respectively.

It can be observed that during study period wind blows mostly from WSW to ENE. The wind rose for the study period in the district of Chengalpattu is given in **Figure 3.3**.



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Source: mesonet.agron.iastate.edu

Figure 3-3 Windrose of Study Area (Chengalpattu)

3.4.5 Weather Phenomena of Bay of Bengal

The weather phenomena like thunderstorms, fog and dust storms is observed for a very limited period. Incidences of fog were observed mainly in the months of January and March. Incidences of dust storms were observed for short periods of 2.4 hrs to 4.8 hrs in the months of April, May and June. Thunders occur more predominantly during the monsoon months. The reported occurrence of hail and squall is practically nil in the region. Occurrence of storms and depressions in the Bay of Bengal is relatively higher compared to Arabian Sea. Andhra Pradesh coast is the most vulnerable to the cyclone activity. Most of the cyclones occur in the post monsoon (i.e. Northeast monsoon) months of October and November with few in the months of May and September. As per Climatological Profile of India (Met Monograph No. Environment Meteorology-01/2010), post-monsoon season of October to December is the principal cyclonic season over the North Indian Ocean, followed by the pre-monsoon season of March to May.



Table 3-5 Cyclones observed over Bay of Bengal over 110 years (1900 to 2009)

Intensity Level of Cyclones	Cyclones Frequency												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
D+CS+SCS	17	5	7	29	81	100	133	168	142	170	152	77	1081
CS+SCS	7	2	5	22	55	32	36	24	31	78	111	46	449
SCS	2	1	2	13	38	3	7	3	13	36	63	21	202

Source: Extracted from Table 12 page 65 of IMD's Climatological Profile of India (Met Monograph No. Environment Meteorology-01/2010); Note: D = Depression (52-61kmph); CS = Cyclonic Storm (62-87 kmph); SCS = Severe Cyclonic Storm (88-117 kmph).

3.5 Oceanography

3.5.1 Tides

Tide is an important parameter determining the maximum reach of seawater along the sea coast and on the banks of rivers, creeks and backwater. The tidal range has an important role in deciding the HTL. It is also important in determining the landward extent of the reach of seawater into the land along rivers and backwaters. The influx of sea water determines the salinity in the river or backwater. The maximum tidal range is about 1m.

3.5.2 Wave Heights

The class interval that has been adopted for the calculations is 0.5m. It is observed from the results that, the most frequently occurring wave height is about 1.0m, with percentage of occurrences of 20 to 35% for the months February, March, April, May, October and December. It can also be observed that the most frequently occurring wave height is 1.5m, with percentage of occurrences of 20 to 30% during the months of January and November. The most frequently occurring wave height is 2m with percentage of occurrences between 20 to 25% for the months June to September.

3.5.3 Wave Periods

The monthly distribution of wave periods in terms of the percentage of occurrence derived from the wave atlas. The class interval that has been adopted for the presentation is 1sec. the maximum percentage of occurrence is the waves associated with periods ranging between 5 and 6 seconds.



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3.5.4 Ocean Current

Due to the wind driven currents results small tidal ranges, appreciable tidal currents occur in the Tamil Nadu region. The predominant current is SE from May to end of September with highest average velocity of about 0.5 Knots (0.26m/s) from December to January, the average predominant current is W to WSW with an average speed of 0.33 Knots (0.17m/s).

3.6 Natural Hazard Vulnerability

3.6.1 Seismicity

There are 4 major seismic zones (zones II, III, IV and V) in India, based on the seismo tectonic parameters, history of seismicity and certain geophysical parameters. The Study Area is categorized in the seismic zone II which is classified as having a fairly high probability of earthquake shocks measuring 5 or 6 on the Richter scale.

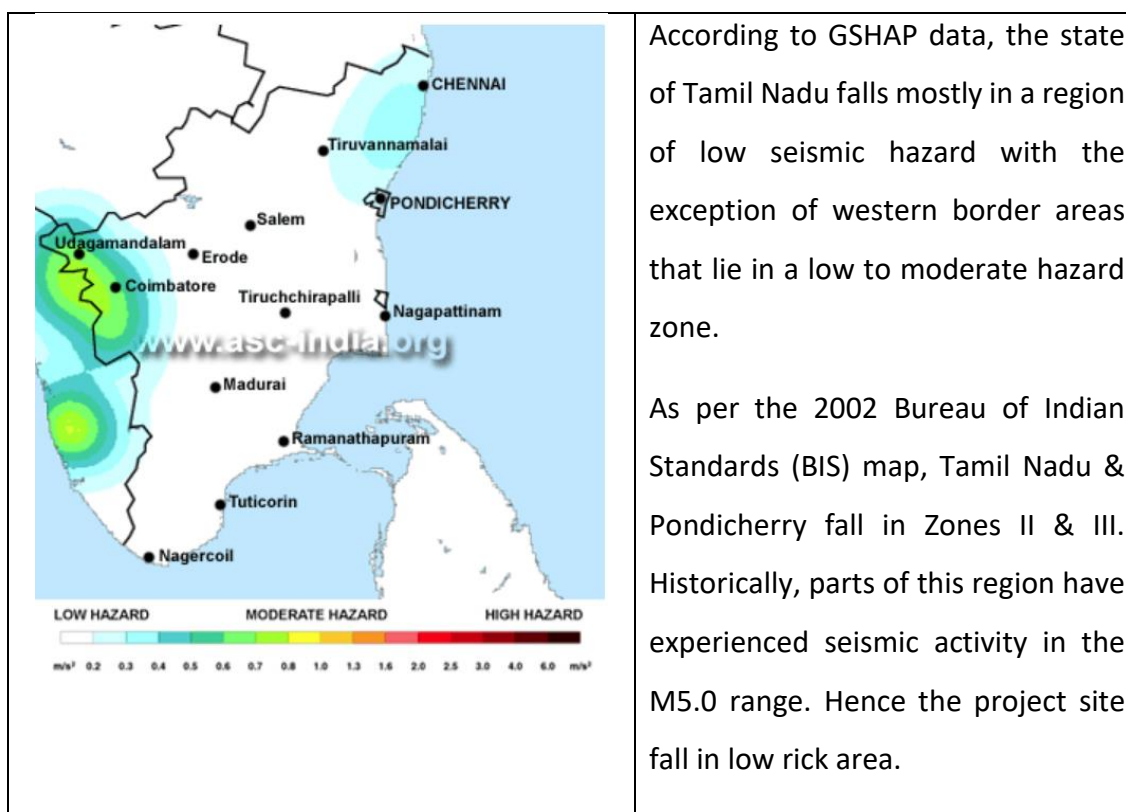


Figure 3-4 GSHAP Hazard Maps (Tamil Nadu & Pondicherry)

3.6.2 Cyclones

Cyclones may occur in the period June/September or October/December. The last severe cyclonic storm was experienced from 1891 to 2012. IMD has broadly classified these tracks as depression,



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cyclonic storm and severe cyclonic storm. Out of total 98 tracks, 44 are depressions, 25 are cyclonic storms and 29 are severe cyclonic storms.

There are 34 depressions, 24 cyclonic storms and 23 severe cyclonic storms which made a landfall in northern Tamil Nadu coast, but only 10 depressions, a cyclonic storm and six severe cyclonic storms crossed the southern Tamil Nadu coast.

Cyclone Nada in 2016 and cyclone Ockhi in 2017 were very severe which have crossed the Mayiladuthurai coast resulting heavy damages.

Table 3-6 Frequency of Cyclones (1891-2012)

	Cyclonic Disturbances (32 to 59 Km/hr)	Cyclones (60 to 90 Km/hr)	Severe Cyclones (>90 Km/hr)
Bay of Bengal	1173	499	221

Source: IMD, Chennai

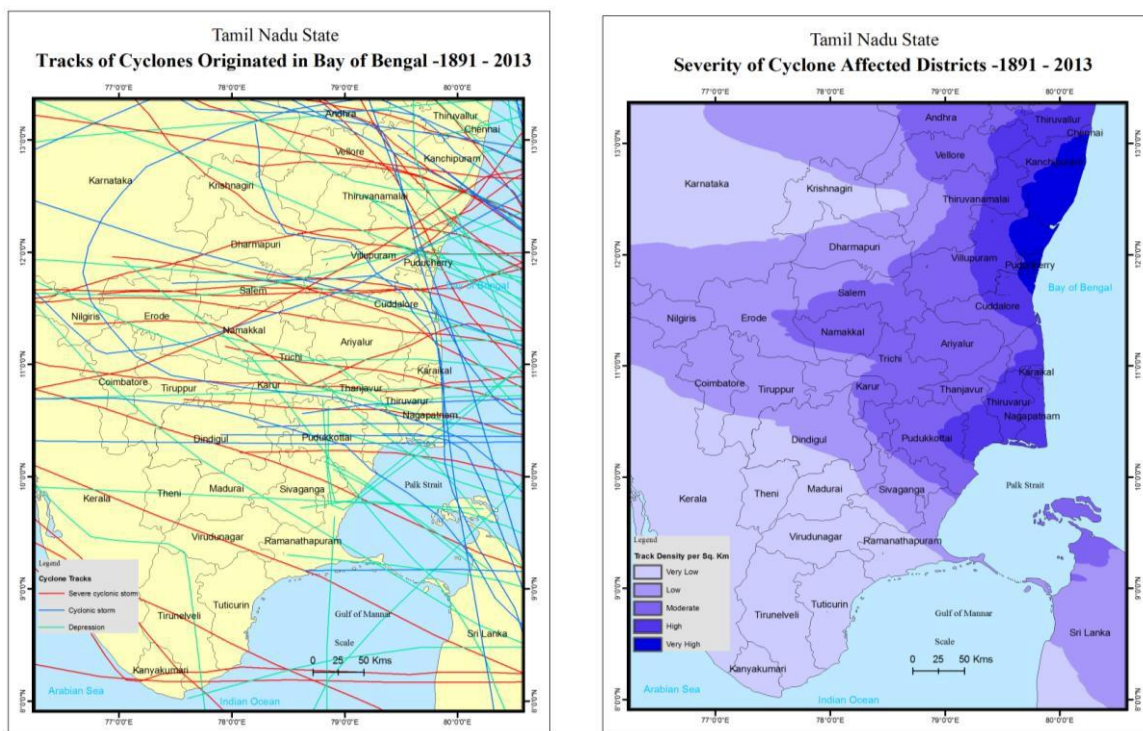


Figure 3-5 Tracks & Severity of Cyclone Maps



3.7 Terrestrial Ecology

3.7.1 Introduction

An ecosystem is composed of plant and animal populations, and it differs from natural community designation in that it involves the total nutrient and energy economics of the system as well as the organisms involved. Ecosystems are self maintained and self contained. Natural ecosystems are invariably richer in species and more stable than those of artificially developed, due to their many inter-dependencies and inter-relationships.

Ecosystem shows complex inter-relationships between biotic and abiotic components leading to dependence, competition and mutualism. Biotic components comprise both plant and animal communities, interacting not only within and between themselves but also with the abiotic components of the environment. Generally, biological communities are good indicators of climatic and edaphic factors because of their strong relationships with them. The studies on the biological aspects of the ecosystem are important in Environment Impact Assessment studies for the suitability of natural flora and fauna. Information on the impact of environment stress on the community structure serves as an inexpensive and efficient early warning system to check the damage on a particular ecosystem. A change in the composition of biotic communities under stress is reflected through a change in the distribution pattern, density, diversity, frequency, dominance and abundance of natural species of fauna and flora existing in the ecosystem. These changes over a span of times can be quantified and related to the existing environment.

The Fisheries and Fishermen Welfare Department, Fishing Harbour Project Division of Chennai have intended to construct a fish landing centre and shore protection works at Karikattukuppam Villages located in Thiruporur Taluk of Chengalpattu District, Tamil Nadu.

3.7.2 Objectives

The objectives of ecological study during the study period of EIA study period may be outlined as follows:

- To characterize the environmental components like land, water, flora and fauna;
- To understand their present status;



Environmental Impact Assessment for the Proposed Construction of Fish Landing Centre and Shore Protection Works along with Boat Berthing facilities at Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District, Tamil Nadu.

- To understand carrying capacity of the ecosystem;
- To assess present bio-diversity; and
- To identify susceptible and sensitive areas.

3.7.3 Regional Biodiversity

Tamil Nadu has a total land area of 1,30,060 km² which constitute of about 3.96% of the total geographical area of the country. Physiographically, the State can be divided into four major regions viz Coastal Plains, Eastern Ghats, Central Plateau and Western Ghats. The main rivers of the State are Cauvery, Bhavani, Palar, Vaigai etc. which drain into the Bay of Bengal. Tamil Nadu has a Humid Tropical Climate.

Forest Biodiversity in the State is mainly confined to Western Ghats and Eastern Ghats. Forest Cover of the State is 21,570 km² which is 16.55% of the State's geographical area (GA). In terms of forest canopy density classes, the State has 3,593 km² (2.76% of GA) very dense forest, 11,034 km² (8.48% of GA) moderately dense forest and 11,729 km² (9.07 % of GA) open forest respectively (Source: FSI, 2021; www.forests.tn.gov.in).

The mangrove cover in the State is 44.83 km², which is 0.035% of the State total geographical area. The Very Dense mangrove comprises 1.04 km² of the mangrove cover, Moderately Dense mangrove is 27.24 km² while open mangroves constitute an area of 16.55 km².

Recorded Forest Area (RFA) in the State is 22,877 km² which constitute of about 17.59% and 2.99% of the total geographical area of the State and Country respectively, of which 20,293 km² is Reserved Forest, 1,782 km² is Protected Forest and 802 km² is Unclassed Forests. The RFA covers 17.59% of geographical area of the State. The reserved, protected and unclassified forests are 88.70%, 7.79% and 3.51% of the recorded forest area in the State respectively.

Tropical dry Deciduous Forest covers an area of 12.23 lakh ha constituting 54.30%, Tropical Thorn Forest covers an area of 5 lakh ha constituting 22.10%, Tropical Moist Deciduous Forest covers an area of 2.60 lakh ha constituting a percentage of 11.10%. The Biodiversity rich forest types are the Tropical Wet Evergreen Forest covering an area of 0.60 lakh ha constituting 2.67%, Tropical Semi Evergreen Forest covering an area of 0.23 lakh ha constituting 1.01%, Subtropical Broad



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leaved Hill Forest covers an area of 1.14 lakh ha constituting 5.04%, the Tropical Dry Evergreen Forest which is a unique type of Tamil Nadu covers an area of 0.26 lakh ha constituting 1.16%, the mangrove forest covers an area of approximately 0.23 lakh ha constituting 1.01%.

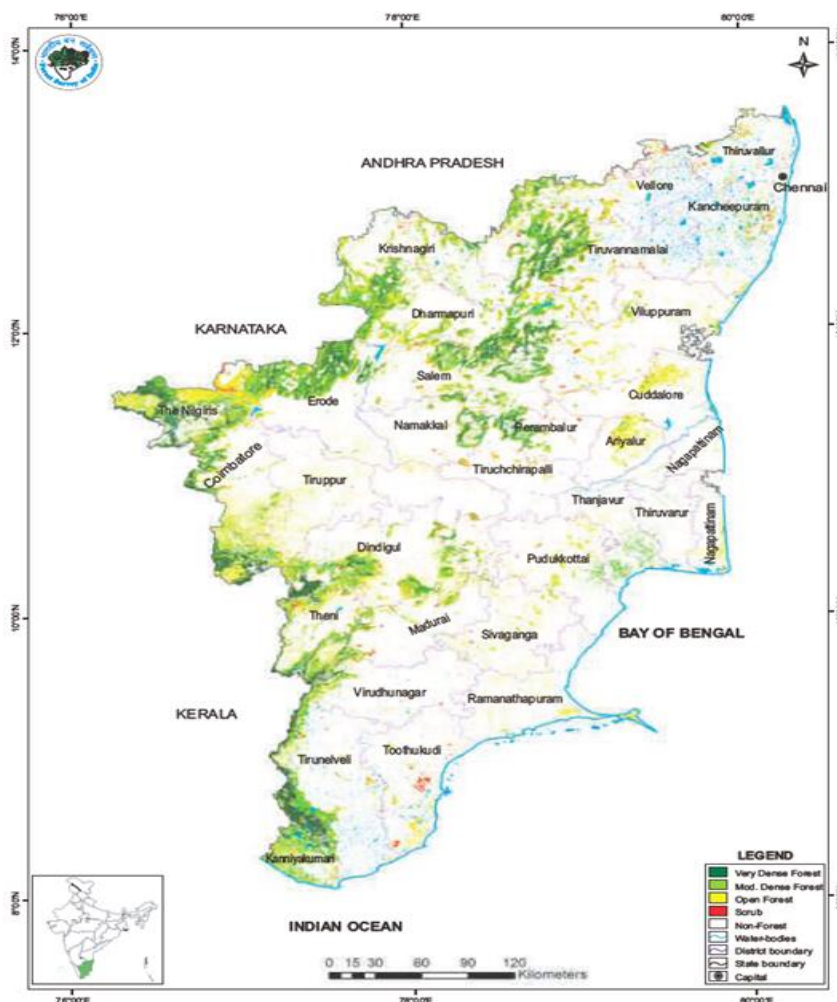


Figure 3-6 Forest Map of Tamil Nadu (Source: Forest Survey of India, 2021)

Habitat fragmentation is the process by which habitats which were once continuous become divided into separate fragments. This mainly happens due to human activities such as agriculture, rural development and urbanization. As cities and civilization grow in size, the fragmentation of habitats causes extinction of many plant and animal species and is the largest threat to biodiversity on earth. Designing with nature can improve the quality of cities for people, plants and animals. In doing so, ecosystem services can be enhanced.



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The state's rich biodiversity and the natural resources are facing a serious threat from the growing human encroachments, cattle grazing, collection of fire wood, man-animal conflict, poaching, illicit felling, mass tourism and pilgrimage etc. and also from various developmental activities. Biodiversity Conservation has been structured covering the Ecosystem Diversity, Species Diversity and Genetic Diversity. Species Diversity has been structured separately for plants and animals. Wild plant diversity has been structured on the lines of Red-listed plants, Endemic plants, Medicinal plants, Wild relatives of cultivated plants, allied species of cultivated species and others.

Wild Animal diversity has been structured on the lines of Red listed animals, Endemic animals, Flagship species, Keystone species, Pollinators and others. Domesticated species diversity has been structured on the lines of Cultivated Plants and Domesticated animals.

Chengalpattu District

Chengalpattu District has a geographical area of 2945 km². The district is situated on the north east coast of Tamilnadu and bounded on the north by the Chennai district, West by the Kancheepuram district and Thiruvanamalai districts and on the south by the Vilupuram district. With a coastal length of 57 Kms, the district is bounded in the east by the Bay of Bengal.

The river Palar is one of the major rivers in the state of Tamil Nadu traversing through Chengalpattu district for a length of 54 Kms. The river Palar enters the district at Palur village and conflues with Bay of Bengal between Vayalur and Kadalur village. Moreover, the district is bounded by the river Adayar in the north and the Ongur river in the south. Besides the aforesaid rivers, Neenjal Maduvu, Pukkadurai Odai, and Kiliyar are other minor rivers flowing through Chengalpattu district. The district is home to 528 major irrigation tanks having ayacut of more than 40 Hectares each.

Most of the agricultural activity is dominated by Paddy, Pulses, oil seeds, Tapiaco, Greengram, fruit crops and vegetables. Watermelons are cultivated in Kodur, Cheyyur and its surrounding areas during summer. The major cash crops are Coconut, Groundnut and Banana are also cultivated in considerable area.



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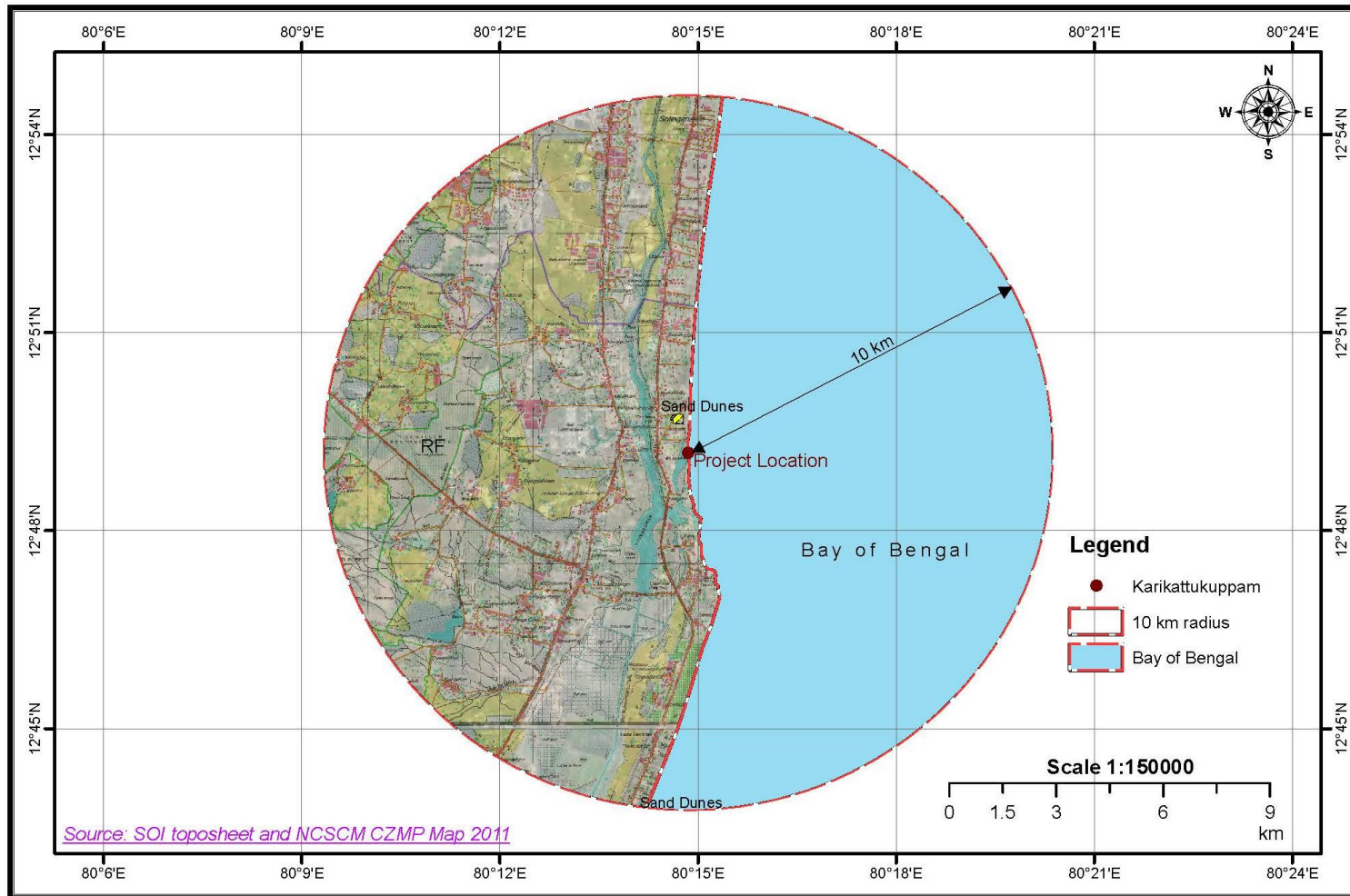


Figure 3-7 Ecologically Sensitive Area Map





3.7.4 Biogeographic zone, province and Forest type

This study has been carried out during the May 2022 of study period for the purpose of providing an independent and comprehensive baseline assessment of the flora, terrestrial vertebrate, aquatic fauna and associated habitat values of the site and within 20 km radius area around the project sites at Karikattukuppam Villages located in Thiruporur Taluk of Chengalpattu District, Tamil Nadu and a subsequent assessment of potential ecological impacts.

The study area falls under semi-arid category as far as the Indian Biogeographical Zones (*Rodger, Panwar, and Mathur 2000*) are concerned. Under the biogeographical provinces, the study area falls under the category of **6E-Deccan Peninsula-Deccan South**.

The field investigation and satellite imagery data show that the study area is a mixture of coastal region, agricultural and get irrigated by tanks and bore wells. The dry tropical vegetation is observed within the study area. The experimental finding of the pre-monsoon season shows the dominance of grasses like *Cynodon dactylon*, *Cyperus rotundus*. From the primary observations, the tree species recorded in the study area were *Cocos nucifera*, *Azadirachta indica*, *Borassus flabellifer*, *Acacia auriculiformis*, *Acacia nilotica*, *Phoenix sylvestris*, *Mangifera indica*, *Aegle marmelos* etc. Some of the common shrub species are *Calotropis procera*, *Datura metel*, *Hibiscus rosa-sinensis*, *Lantana camara*, *Nerium oleander*, *Sida cordifolia* etc. and *Acanthospermum hispidum*, *Amaranthus spinosus*, *Boerhavia diffusa*, *Achyranthes aspera*, *Commelina benghalensis*, *Euphorbia hirta*, *Cassia tora*, *Hyptis suaveolens*, *Sida acuta*, *Tridax procumbens* etc. among herbaceous species.



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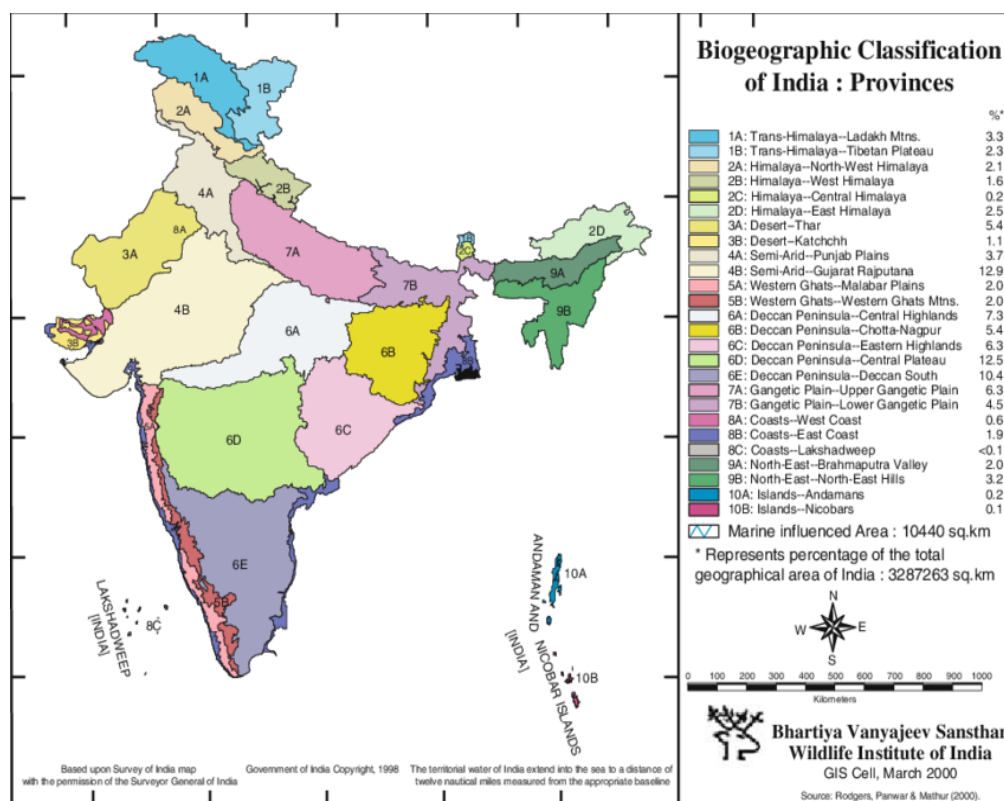


Figure 3-8 Map showing the Bio-geographic Provinces of India

The detailed ecological assessment of the study area has been carried out with the following objectives:

- To establish the present status of ecological conditions surrounding the project location;
- To study the existing anthropogenic stresses on the prevailing ecosystem.
- To identify and predict the likely impacts on the local ecosystem from the proposed activities;
- To list out floral species, terrestrial vertebrate and aquatic flora and fauna present within the study area, and significance status under The Wildlife (Protection) Act, 1972;
- To define ecological/conservation status of each species as per IUCN categories (Red Data List).
- To formulate migratory measures and a sustainable Environmental Management Plan (EMP) basing upon the likely impacts.

During survey, following aspects were considered for ecological studies:

- Assessment of present status of flora and fauna;



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- Identification of rare and endangered species of plants and animals (if any);
- Identification of ecologically sensitive areas within the study area;
- Assessment of migratory route of wildlife (if any); and
- Assessment of Aquatic Ecology with specific reference to aquatic birds and fishery resources.

3.7.5 Methodology

A desktop review (published documents etc.) was conducted to determine the forest area through Satellite imagery, vegetation type (*Champion and Seth, 1962*), floral and faunal assemblage in the study area. Terrestrial investigations for flora and fauna records were collected by random field survey and a checklist was prepared. During field survey, discussions with the local people were carried-out to collect information related to local biodiversity in and around the villages. The ecological status of the study area has been assessed based on the following methodology:

- Primary field surveys to establish primary baseline of the study area;
- Compilation of secondary information available in published literatures/ forest working plans etc.
- Site Verification and finalization in consultation with Project proponent, local inhabitants.

A. Floral Study

The assessment of the flora of the study area is done by an extensive field survey of the study area.

- Plants species were identified based on their specific diagnostics characters of family, genus and species using available floral, other related literature.
- Besides the identification of plant species, information was collected on the vernacular names and uses of plants made by local inhabitants.
- Qualitative analysis of vegetation is made by two different methods such as floristic (by simple studying various genera and species of various plant groups i.e. herbs, shrubs, trees etc).



B. Faunal Study

Ground surveys are carried out by trekking the study area for identification of important animal groups such as birds, mammals and reptiles for sampling of animals through the following methods.

- For sampling birds/ avifauna 'point sampling' along the fixed transects (foot trails) were done to record all the species of birds with the help of binoculars; field guides and photography for more than 1 hour on each transect (n=4).
- For sampling mammals, 'direct count on open width (20 m) transect' were used on the same transects. Besides, information on recent sightings/records of mammals by the locals are also collected from the study areas.
- 'Reptiles' mainly lizards were sampled by 'direct count on open width transects'.
- Secondary information collected from local villagers, published government data etc.

□ List of the endangered and endemic species as per the schedule of The Wildlife Protection Act, 1972

Emphasis is given to identify avifauna and mammals to determine the presence and absence of Schedule-1 species, listed in The Wildlife Protection Act 1972, as well as in Red List of IUCN. Various methods used for study animals are as follows:

- A. **Point Survey Method:** Observations were made at each site for 15-20 min duration.
- B. **Road Side Counts:** The observer travelled by motor vehicles from site to site and all sightings were recorded.

3.7.6 Floristic composition within the study area

The ecology and diversity survey was conducted in the study area. It is observed that human settlements present within the study area and many of areas have moderate ranges of plantations. Most of the vegetations are natural vegetation observed within the study area. During site assessment several floral species encountered within the study area.

The plants grown are mostly of economic importance. Among the fruit trees which are common are Coconut, Mango, lime, Banana, Papaya, Custard apple, etc. Among the non-fruit trees the



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common ones are Neem, Curry tree etc. Coconut and Betel nut palm is mostly planted in plantations. During site assessment several floral species encountered within the study area.

The study area doesnot have any forest land and permanent natural vegetation. From the primary observation, the tree species recorded in the study area in the plantation area were *Cocos nucifera*, *Azadirachta indica*, *Borassus flabellifer*, *Acacia auriculiformis*, *Acacia nilotica*, *Phoenix sylvestris*, *Mangifera indica*, *Aegle marmelos* etc. The survey was conducted in the study area and its surroundings.

The study area reveals the presence of Madras Crocodile Bank Trust & Centre for Herpetology which is located about 1.28 km towards North. There are no reserved / protected forests within the study area of 15 km radius. However, the vegetation within the study area is moderate density, with the existence of some weeds as per the survey conducted within the study area. The results of survey exhibited sparsy vegetation with the existence of 136 terrestrial flora. Since the project area is not a forest area and water scarcity is always a problem most of the area is covered with the invasive plant. However, coconut, Neem, Acacia trees are widely distributed away from the study area.

The following species were encountered from the study area during the field visits as given in Table 3.7.

Table 3-7 Floristic Diversity in the Study Area

S. No.	Scientific Name	Common Name	Family	IUCN Conservation Status	Status
Tree					
1	<i>Albizia lebbek</i>	Siridam	Fabaceae	Not assessed	Common
2	<i>Cassia siamea</i>	Manjal konrai	Caesalpiaceae	Not assessed	Common
3	<i>Acacia auriculiformis</i>	Katthisavukku	Mimosaceae	Not assessed	Common
4	<i>Buchanania lanzan</i>	Charam	Anacardiaceae	Not assessed	Common
5	<i>Albizia saman</i>	Thoongumoonji maram	Fabaceae	Secure	Common



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S. No.	Scientific Name	Common Name	Family	IUCN Conservation Status	Status
6	<i>Eucalyptus leptophylla</i>	Neelagiri thailam	Myrtaceae	Not assessed	Planted
7	<i>Cassia fistula</i>	Appai	Caesalpiniaceae	Least Concern	Very Common
8	<i>Bauhinia racemosa</i>	Atti	Fabaceae	Not assessed	Common
9	<i>Borassus flabellifer</i>	Nonkuppanai	Arecaceae	Endangered	Common
10	<i>Carica papaya</i>	Pappali	Caricaceae	Not assessed	Common
11	<i>Bridelia retusa</i>	Mullu-Vengai	Phyllanthaceae	Not assessed	Common
12	<i>Acacia nilotica</i>	Karuv Elai	Mimosaceae	Not assessed	Common
13	<i>Bambusa arundinacea</i>	Kulay-munkil	Poaceae	Not assessed	Common
14	<i>Diospyros melanoxylon</i>	Karundumbi	Ebenaceae	Not assessed	Planted
15	<i>Gardenia gummifera</i>	Sirukkambil	Rubiaceae	Least Concern	Planted
16	<i>Madhuca longifolia</i>	Illupei	Sapotaceae	Not assessed	Common
17	<i>Ficus racemosa</i>	Atthi	Moraceae	Least Concern	Common
18	<i>Gmelina arborea</i>	Kumalaamaram	Lamiaceae	Least Concern	Common
19	<i>Melia azedarach</i>	Kattu vembhu	Meliaceae	Not assessed	Common
20	<i>Ailanthus excelsa</i>	MahaNeem	Simaroubaceae	Not assessed	Common
21	<i>Manilkara zapota</i>	Sapota	Sapotaceae	Not assessed	Common
22	<i>Neolamarckia cadamba</i>	Vellaikkatampu	Rubiaceae	Not assessed	Common
23	<i>Phoenix acaulis</i>	Kaattu echam	Arecaceae	Not assessed	Very Common
24	<i>Phyllanthus emblica</i>	Nelli	Euphorbiaceae	Least Concern	Common
25	<i>Murraya koenigii</i>	Karivepillai	Rutaceae	Not assessed	Very Common
26	<i>Alstonia scholaris</i>	Elilaipalai	Apocynaceae	Least Concern	Common
27	<i>Butea monosperma</i>	Parasa	Fabaceae	Not assessed	Common



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S. No.	Scientific Name	Common Name	Family	IUCN Conservation Status	Status
28	<i>Aegle marmelos</i>	Vilvam	Rutaceae	Not assessed	Very Common
29	<i>Casuarina equisetifolia</i>	Savukku	Fabaceae	Not assessed	Very Common
30	<i>Albizia amara</i>	Wunja	Mimosaceae	Not assessed	Common
31	<i>Cocos nucifera</i>	Tennai	Arecaceae	Not assessed	Very Common
32	<i>Artocarpus heterophyllus</i>	Palaa	Moraceae	Not assessed	Common
33	<i>Bombax ceiba</i>	Sittan	Bombacaceae	Not assessed	Very Common
34	<i>Terminalia arjuna</i>	Marutham	Combritaceae	Not assessed	Common
35	<i>Terminalia bellirica</i>	Thandri	Combritaceae	Not assessed	Common
36	<i>Wrightia tinctoria</i>	Paalai	Apocynaceae	Not assessed	Common
37	<i>Azadirachta indica</i>	Veppai	Meliaceae	Not assessed	Very Common
38	<i>Delonix regia</i>	Cemmayir-konrai	Fabaceae	Least Concern	Common
39	<i>Delonix elata</i>	Perungondrai	Fabaceae	Least Concern	Rare
40	<i>Dalbergia sissoo</i>	Shisham	Fabaceae	Not assessed	Common
41	<i>Ficus benghalensis</i>	Alai	Moraceae	Not assessed	Common
42	<i>Annona squamosa</i>	Sitapalam	Annonaceae	Not assessed	Planted
43	<i>Citrullus colocynthis</i>	Kumatti	Cucurbitaceae	Not assessed	Common
44	<i>Ficus religiosa</i>	Araca-maram	Moraceae	Not assessed	Common
45	<i>Polyalthia longifolia</i>	Nettilinkam	Annonaceae	Not assessed	Common
46	<i>Musa paradise</i>	Vaazha	Musaceae	Not assessed	Common
47	<i>Prosopis juliflora</i>	Vaelikaruvai	Fabaceae	Not assessed	Common
48	<i>Mangifera indica</i>	Mamaram	Anacardiaceae	Data Deficient	Common
49	<i>Terminalia catappa</i>	Nattuvadumai	Combretaceae	Not assessed	Rare
50	<i>Morinda citrifolia</i>	Nuna	Rubiaceae	Not assessed	Common
51	<i>Phoenix sylvestris</i>	Thangtup	Arecaceae	Not assessed	Common



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S. No.	Scientific Name	Common Name	Family	IUCN Conservation Status	Status
52	<i>Tectona grandis</i>	Tekku	Verbenaceae	Not assessed	Common
53	<i>Tamarindus indica</i>	Puli	Caesalpiniaceae	Not assessed	Very Common
54	<i>Syzygium cumini</i>	Naval	Myrtaceae	Not assessed	Common
55	<i>Psidium guajava</i>	Segapu	Myrtaceae	Not assessed	Common
56	<i>Ziziphus mauritiana</i>	Elandhai	Rhamnaceae	Not assessed	Common
57	<i>Citrus medica</i>	Elumiccai	Rutaceae	Not assessed	Common
Shrubs					
1	<i>Jasminum sessiliflorum</i>	Kuruvilaangkodi	Oleaceae	Not assessed	Common
2	<i>Agave tomentosa</i>	Malai-k-koyya	Agavaceae	Not assessed	Common
3	<i>Lantana camara</i>	Unnichi	Verbenaceae	Not assessed	Very Common
4	<i>Balanites aegyptiaca</i>	Nanchundan	Zygophyllaceae	Not assessed	Common
5	<i>Bougainvillea spectabilis</i>	Bougainvillea	Nyctaginaceae	Not assessed	Planted
6	<i>Calotropis procera</i>	Vellai Erukku	Asclepiadaceae	Not assessed	Common
7	<i>Sida cordifolia</i>	Arivalmukku	Malvaceae	Not assessed	Common
8	<i>Tecoma stans</i>	Manjarali	Bignoniaceae	Not assessed	Common
9	<i>Nerium oleander</i>	Arali	Apocynaceae	Not assessed	Common
10	<i>Jatropha curcas</i>	Kattukkottai	Euphorbiaceae	Not assessed	Rare
11	<i>Calotropis gigantea</i>	Erukku	Asclepiadaceae	Not assessed	Common
12	<i>Datura metel</i>	Dhutura	Solanaceae	Not assessed	Common
13	<i>Euphorbia tirucalli</i>	Cakkalavi	Euphorbiaceae	Least Concern	Common
14	<i>Hibiscus rosa sinensis</i>	Ampurukam	Malvaceae	Not assessed	Common
15	<i>Tarena asiatica</i>	Tharani	Rubiaceae	Not assessed	Common
16	<i>Oxalis corniculata</i>	Paliakiri	Oxalidaceae	Not assessed	Rare
17	<i>Euphorbia geniculata</i>	Amman-paccarici	Euphorbiaceae	Not assessed	Common
18	<i>Vitex negundo</i>	Nochi	Verbenaceae	Not assessed	Common
19	<i>Ziziphus nummularia</i>	Narielandai	Rhamnaceae	Not assessed	Common



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S. No.	Scientific Name	Common Name	Family	IUCN Conservation Status	Status
20	<i>Xanthium strumarium</i>	Marul-umattai	Asteraceae	Not assessed	Common
21	<i>Dodonaea viscosa</i>	Virali	Sapindaceae	Not assessed	Common
22	<i>Woodfordia fruticosa</i>	Velakkai	Lythraceae	Least Concern	Common
23	<i>Morinda pubescens</i>	Mannanunai	Rubiaceae	Not assessed	Very Common
Herbs					
1	<i>Plumbago zeylanica</i>	Chittiramoolam	Plumbaginaceae	Not assessed	Common
2	<i>Abutilon indicum</i>	Akatam	Malvaceae	Not assessed	Common
3	<i>Achyranthes aspera</i>	Nayuruvi	Amaranthaceae	Not assessed	Very Common
4	<i>Cassia tora</i>	Taghrai	Caesalpinaceae	Not assessed	Very Common
5	<i>Aloe vera</i>	Katrazhai	Liliaceae	Not assessed	Planted
6	<i>Chloris barbata</i>	Chevvarakupul	Poaceae	Not assessed	Common
7	<i>Cyperus rotundus</i>	Panni-korai	Cyperaceae	Not assessed	Common
8	<i>Amaranthus spinosus</i>	Mullukkeerai	Amaranthaceae	Not assessed	Common
9	<i>Commelina benghalensis</i>	Kanang-karai	Comlinaceae	Not assessed	Common
10	<i>Boerhavia diffusa</i>	Mukaratte kirai	Nyctaginaceae	Not assessed	Common
11	<i>Argemone mexicana</i>	Eliyotti	Papaveraceae	Not assessed	Common
12	<i>Digera muricata</i>	Thoyya keerai	Amaranthaceae	Not assessed	Common
13	<i>Eclipta prostrata</i>	Karisalanganni	Asteraceae	Not assessed	Common
14	<i>Indigofera oblongifolia</i>	Avuri	Fabaceae	Not assessed	Rare
15	<i>Ocimum basilicum</i>	Sweet basil	Lamiaceae	Not assessed	Common
16	<i>Ocimum sanctum</i>	Thulasi	Lamiaceae	Not assessed	Planted
17	<i>Mimosa pudica</i>	Thottaccurungi	Fabaceae	Least Concern	Common
18	<i>Phyllanthus amarus</i>	Keelanelli	Phyllanthaceae	Not assessed	Common
19	<i>Sida acuta</i>	Karuncaranai	Malvaceae	Not assessed	Very Common
20	<i>Solanum nigrum</i>	Manathakkali	Solanaceae	Not assessed	Common



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S. No.	Scientific Name	Common Name	Family	IUCN Conservation Status	Status
21	<i>Phyla nodiflora</i>	Poduthalai	Verbenaceae	Least Concern	Rare
22	<i>Vernonia cinerea</i>	Puvamkuruntal	Asteraceae	Not assessed	Common
23	<i>Sida cordifolia</i>	Mayir-manikham	Malvaceae	Not assessed	Common
24	<i>Ipomoea dissecta</i>	Kakkattan	Convolvulaceae	Not assessed	Common
25	<i>Helicteres isora</i>	Valampuri	Sterculiaceae	Not assessed	Common
26	<i>Cynodon dactylon</i>	Arugu	Poaceae	Not assessed	Very Common
27	<i>Dinebra retroflexa</i>	Viper grass	Poaceae	Not assessed	Very Common
28	<i>Aerva lanata</i>	ciru-pulai	Amaranthaceae	Not assessed	Common
29	<i>Cymbopogon citratus</i>	Karppurappul	Poaceae	Not assessed	Common
30	<i>Euphorbia hirta</i>	Ammam Paccharisi	Euphorbiaceae	Not assessed	Common
31	<i>Tridax procumbens</i>	Vettukkaaya-thalai	Asteraceae	Not assessed	Common
Climbers					
1	<i>Abrus precatorius</i>	Kundumani	Fabaceae	Not assessed	Common
2	<i>Aristolochia bracteolata</i>	Aduthinnarppalai	Aristolochiaceae	Not assessed	Common
3	<i>Basella rubra</i>	Pasalakkirai	Basellaceae	Not assessed	Common
4	<i>Bougainvillea spectabilis</i>	Kakitha poo	Nyctaginaceae	Not assessed	Common
5	<i>Cissus quadrangularis</i>	Perandai	Vitaceae	Not assessed	Common
6	<i>Citrullus colocynthis</i>	Kumatti	Cucurbitaceae	Not assessed	Common
7	<i>Clitoria ternatea</i>	Sangu Poo	Fabaceae	Not assessed	Common
8	<i>Coccinia grandis</i>	Kovaikkaai	Cucurbitaceae	Not assessed	Common
9	<i>Cyclea peltata</i>	Pon-mucuttai	Menispermaceae	Not assessed	Common
10	<i>Gloriosa superba</i>	Sengandhal	Liliaceae	Not assessed	Common
11	<i>Hemidesmus indicus</i>	Nannari	Apocynaceae	Not assessed	Common
12	<i>Ichnocarpus frutescens</i>	Utar-koti	Apocynaceae	Not assessed	Common



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S. No.	Scientific Name	Common Name	Family	IUCN Conservation Status	Status
13	<i>Ipomoea dissecta</i>	Kakkattan	Convolvulaceae	Not assessed	Common
14	<i>Ipomoea nil</i>	Kotikkakkattan	Convolvulaceae	Not assessed	Common
15	<i>Ipomoea obscura</i>	Siruthalai	Convolvulaceae	Not assessed	Common
16	<i>Ipomoea pes-caprae</i>	Attukkal	Convolvulaceae	Not assessed	Rare
17	<i>Ipomoea reptans</i>	Vallaikkirai	Convolvulaceae	Not assessed	Common
18	<i>Luffa cylindrica</i>	Peerkankai	Cucurbitaceae	Not assessed	Common
19	<i>Pergularia daemia</i>	Velipparuthi	Apocynaceae	Not assessed	Common
20	<i>Pueraria tuberosa</i>	Nilapoosani	Fabaceae	Not assessed	Common
21	<i>Solena amplexicaulis</i>	Pulivanci	Curcubitaceae	Not assessed	Common
22	<i>Tragia involucrata</i>	Kanchori	Euphorbiaceae	Not assessed	Common
23	<i>Trichosanthes cucumerina</i>	Pudalankaai	Curcubitaceae	Not assessed	Common
24	<i>Tylophora asthmatica</i>	Kalutai-p-palai	Asclepidaceae	Not assessed	Common
25	<i>Tylophora indica</i>	Nachchuruppam	Asclipedaceae	Not assessed	Common

The detailed study revealed dominance of *Cocos nucifera*, *Azadirachta indica*, *Borassus flabellifer*, *Acacia auriculiformis*, *Acacia nilotica*, *Phoenix sylvestris*, *Mangifera indica*, *Aegle marmelos* among tree species. Totally 57 species of trees found in the study area along with 23 shrub species, 31 herb species and 25 climber species. *Lantana camara*, *Datura metel*, *Calotropis procera*, *Jasminum sessiliflorum*, *Sida cordifolia* are found to be the predominant species among shrub. Among the herbaceous species *Mimosa pudica*, *Achyranthes aspera*, *Amaranthus spinosus*, *Abutilon indicum*, *Euphorbia hirta*, *Tridax procumbens*, *Cynodon dactylon*, etc. found to be abundant.

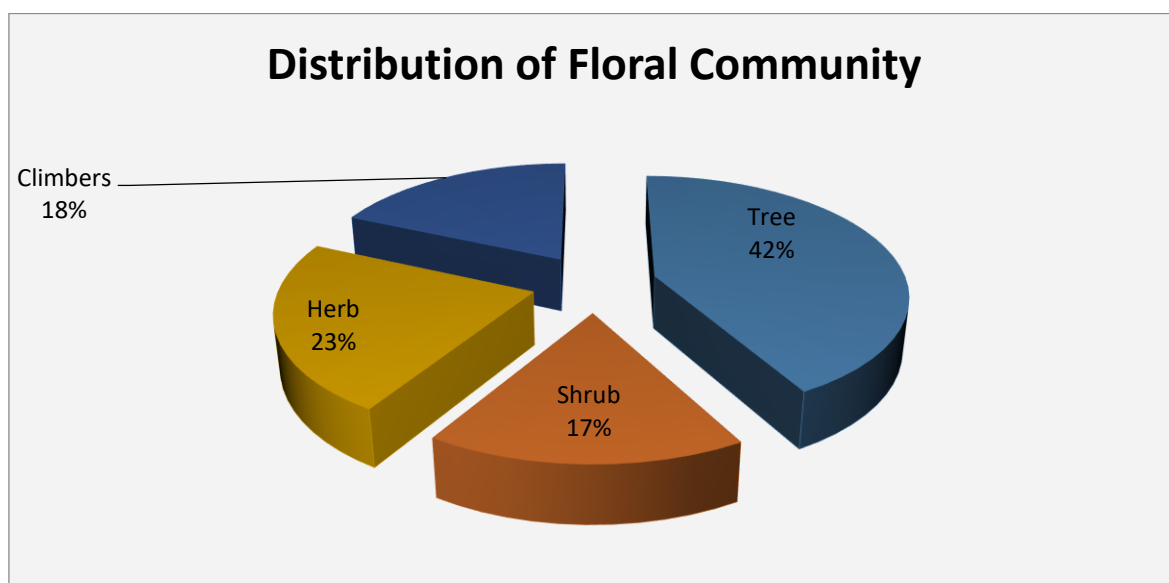


Figure 3-9 Distribution of Floral Community

3.7.7 Economically Important Flora of the Study Area

Agricultural crops: The major crops grown in study area are Paddy, groundnuts, sugarcane, cereals, millet and pulses. In canal fed areas paddy occupies the largest area of cultivation followed by green gram and black gram. Other crops grown in the region are cashew and coconut. Different fruits like banana, papaya, mangoes, sapota, guava and vegetables like brinjal, tomato, lady's finger, drumsticks, coriander and chilies also grown by the local people.

Medicinal plant species: The nearby area is also endowed with the several medicinal plants which are commonly available in the shrub forest and waste lands. The common medicinal plants of the region is *Azadirachta indica* (Neem).

Fuel wood plant species: Local villagers use to collect dry leaves, stems and log to fulfill their daily need for fuel wood requirement. *Azadirachta indica* (Neem), *Mangifera indica* etc. are the species used for fuel wood collection from the surrounding forest area.

Rare and endangered floral species: As per IUCN red list *Borassus flabellifer* (Nonkuppenai) categorized as endangered species. During the vegetation survey in the study area did not encounter any such species which are endangered or threatened under IUCN (International Union for Conservation of Nature and Natural resources) guidelines.



3.7.8 Faunal Communities

Both direct (sighting) and indirect (evidences) observation methods were used to survey the faunal species around the study area. Additionally, reference of relevant literatures (published/unpublished) and conversations with local villagers were also carried out to consolidate the presence of faunal distribution in the area (*Smith 1933-43, Ali and Ripley 1983, Daniel 1983, Prater 1993, Murthy and Chandrasekhar 1988*).

Mammals: No wild mammalian species was directly sighted during the field survey. Conversation with local villagers around the study area also could not confirm presence of any wild animal in that area. Palm-Squirrel, Jungle Cat, Little Indian field mouse, Rat, Short nosed fruit bat, Black rat, Indian mole rat, Three stripped Palm Squirrel, Common mongoose, Common Mouse, Indian Hare etc. were observed during primary survey.

Avifauna: Since birds are considered to be the indicators for monitoring and understanding human impacts on ecological systems (*Lawton, 1996*) attempt was made to gather quantitative data on the avifauna by walk through survey within the entire study area and surrounding areas. From the primary survey, a total of 54 species of avifauna were identified and recorded in the study area. The diversity of avifauna from this region was found to be quite high and encouraging. The list of avifauna species found in the study area is mentioned in Table 3.8.

The Indian Chameleon, tree lizard, common garden lizards and common toads are also seen. Variety of butterflies (like Plain Tiger, Common Pierrot, Great Eggfly, Common bushbrown, Common sailor, Lime butterfly, Common Mormon, Indian Skipper, Southern birdwing, Common lime, Common crow, Common tiger, Small Grass Yellow) is spotted in abundance in the study zone.



Table 3-8 Fauna Recorded from the Primary Survey in the Study Area and their Conservation Status

S. No.	Scientific Name	English Name	Schedule of Wildlife Protection Act	IUCN Conservation Status
Mammals				
1	<i>Funambulus pennanti</i>	Palm-Squirrel	IV	Not assessed
2	<i>Felis chaus</i>	Jungle Cat	II (Part I)	Least Concern
3	<i>Mus booduga</i>	Little Indian field mouse	IV	Least Concern
4	<i>Bandicota indica</i>	Rat	IV	Least Concern
5	<i>Cynopterus sphinx</i>	Short nosed fruit bat	IV	Least Concern
6	<i>Rattus rattus</i>	Black rat	IV	Not assessed
7	<i>Bandicota bengalensis</i>	Indian mole rat	IV	Least Concern
8	<i>Funambulus palmarum</i>	Three stripped Palm Squirrel	IV	Least Concern
9	<i>Herpestes edwardsii</i>	Common mongoose	IV	Least Concern
10	<i>Mus musculus</i>	Common Mouse	IV	Not assessed
11	<i>Lepus nigricollis</i>	Indian Hare	IV	Least Concern
12	<i>Felis catus</i>	Cat	--	Not assessed
Birds				
1	<i>Milvus migrans</i>	Black kite	IV	Least Concern
2	<i>Vanellus indicus</i>	Red-wattled lapwing	IV	Least Concern
3	<i>Acridotheres tristis</i>	Common myna	IV	Least Concern



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S. No.	Scientific Name	English Name	Schedule of Wildlife Protection Act	IUCN Conservation Status
4	<i>Accipiter badius</i>	Shikra	IV	Least Concern
5	<i>Egretta intermedia</i>	Intermediate egret	IV	Least Concern
6	<i>Ceryle rudis</i>	Pied Kingfisher	IV	Least Concern
7	<i>Alcedo atthis</i>	Small blue kingfisher	IV	Least Concern
8	<i>Coracias benghalensis</i>	South Indian roller	IV	Least Concern
9	<i>Anastomus oscitans</i>	Asian open billed stork	IV	Least Concern
10	<i>Corvus macrorhynchos</i>	Indian jungle crow	V	Least Concern
11	<i>Apus apus</i>	Common swift	IV	Least Concern
12	<i>Ardea alba</i>	Large egret	IV	Least Concern
13	<i>Charadrius leschenaultii</i>	Large sand plover	IV	Least Concern
14	<i>Athene brama</i>	Southern Spotted owlet	IV	Least Concern
15	<i>Dicrurus adsimilis</i>	Fork-tailed drongo	IV	Least Concern
16	<i>Dendrocitta leucogastra</i>	Southern tree pie	IV	Least Concern
17	<i>Gallinula chloropus</i>	Common Moorhen	IV	Least Concern
18	<i>Halcyon smyrnensis</i>	White-breasted kingfisher	IV	Least Concern
19	<i>Haliastur indus</i>	Brahminy kite	IV	Least Concern



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S. No.	Scientific Name	English Name	Schedule of Wildlife Protection Act	IUCN Conservation Status
20	<i>Hydrophasianus chirurgus</i>	Pheasant-tailed Jacana	IV	Least Concern
21	<i>Nectarinia asiatica</i>	Purple sunbird	IV	Least Concern
22	<i>Lanius schach</i>	Long-tailed Shrike	IV	Least Concern
23	<i>Oriolus oriolus</i>	Golden oriole	IV	Least Concern
24	<i>Nectarinia minima</i>	Small sunbird	IV	Least Concern
25	<i>Turdoides caudatus</i>	Common babbler	IV	Least Concern
26	<i>Tringa hypoleucos</i>	Common sandpiper	IV	Least Concern
27	<i>Nycticorax nycticorax</i>	Night heron	IV	Least Concern
28	<i>Pitta brachyura</i>	Indian pitta	IV	Least Concern
29	<i>Ploceus philippinus</i>	Baya weaver bird	IV	Least Concern
30	<i>Turdoides striatus</i>	Jungle Babbler	IV	Least Concern
31	<i>Saxicoloides fulicatus</i>	Indian Robin	IV	Least Concern
32	<i>Pycnonotus cafer</i>	Red vented Bulbul	IV	Least Concern
33	<i>Phragamaticola aedon</i>	Thick billed Warbler	IV	Least Concern
34	<i>Pericrocotus cinnamomeus</i>	Small Minivet	IV	Least Concern
35	<i>Pseudibis papillosa</i>	Black Ibis	IV	Least Concern



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S. No.	Scientific Name	English Name	Schedule of Wildlife Protection Act	IUCN Conservation Status
36	<i>Eudynamys scolopaceus</i>	Koel	IV	Least Concern
37	<i>Egretta garzetta</i>	Little Egret	IV	Least Concern
38	<i>Psittacula krameri</i>	Rose ringed parakeet	IV	Least Concern
39	<i>Bubulcus ibis</i>	Cattle Egret	IV	Least Concern
40	<i>Dicrurus macrocercus</i>	Black drongo	IV	Least Concern
41	<i>Streptopelia chinensis</i>	Spotted dove	IV	Not assessed
42	<i>Columba livia</i>	Rock pigeon	IV	Least Concern
43	<i>Corvus splendens</i>	House crow	V	Least Concern
44	<i>Cypsiurus balasiensis</i>	Asian palm swift	IV	Least Concern
45	<i>Ardeola grayii</i>	Pond Heron	IV	Least Concern
46	<i>Elanus caeruleus</i>	Black-winged Kite	IV	Least Concern
47	<i>Alcedo atthis</i>	Small Blue Kingfisher	IV	Least Concern
48	<i>Cuculus canorus</i>	Common cuckoo	IV	Least Concern
49	<i>Centropus sinensis</i>	Greater coucal	IV	Least Concern
50	<i>Phalacrocorax niger</i>	Little cormorant	IV	Least Concern
51	<i>Perdica asiatica</i>	Bush Quail	IV	Least Concern



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S. No.	Scientific Name	English Name	Schedule of Wildlife Protection Act	IUCN Conservation Status
52	<i>Alauda gulgula</i>	Oriental Skylark	IV	Least Concern
53	<i>Passer domesticus</i>	House sparrow	IV	Least Concern
54	<i>Merops orientalis</i>	Green bee eater	IV	Least Concern
Reptiles & Amphibians				
1	<i>Chameleon zeylanicum</i>	Chameleon	IV	Not assessed
2	<i>Ahaetulla nasuta</i>	Green whip snake	II (Part II)	Least Concern
3	<i>Cnemaspis littoralis</i>	Coastal day gecko	--	Data Deficient
4	<i>Daboia russelii</i>	Russeles viper	II (Part II)	Not assessed
5	<i>Euphlyctis cyanophlyctis</i>	Skipper frog	IV	Least Concern
6	<i>Polypedates maculatus</i>	Tree frog	IV	Least Concern
7	<i>Naja naja</i>	Common cobra	II (Part II)	Not assessed
8	<i>Calotes versicolor</i>	Common Garden Lizard	II	Not assessed
9	<i>Bungarus caeruleus</i>	Common Krait	IV	Not assessed
10	<i>Ophisops leschenaultii</i>	Snake-eyed lizard	--	Not assessed
11	<i>Duttaphrynus melanostictus</i>	Common toads	IV	Least Concern
12	<i>Ptyas mucosa</i>	Rat snakes	IV	Least Concern
13	<i>Hemidactylus frenatus</i>	Common house gecko	--	Least Concern
Butterflies				
1	<i>Danaus chrysippus</i>	Plain Tiger	--	Not assessed
2	<i>Castalius rosimon</i>	Common Pierrot	--	Not assessed



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S. No.	Scientific Name	English Name	Schedule of Wildlife Protection Act	IUCN Conservation Status
3	<i>Hypolimnna bolina</i>	Great Eggfly	--	Not assessed
4	<i>Mycalesis perseus</i>	Common bushbrown	--	Not assessed
5	<i>Neptis hylas</i>	Common sailor	--	Not assessed
6	<i>Papilio demoleus</i>	Lime butterfly	--	Not assessed
7	<i>Papilio polytes</i>	Common mormon	--	Not assessed
8	<i>Spialia galba</i>	Indian Skipper	--	Not assessed
9	<i>Troides minos</i>	Southern birdwing	--	Least Concern
10	<i>Papilio demoleus</i>	Common lime	--	Not assessed
11	<i>Euploea core</i>	Common crow	--	Least Concern
12	<i>Danaus genutia</i>	Common tiger	--	Not assessed
13	<i>Eurema brigitta</i>	Small Grass Yellow	--	Least Concern

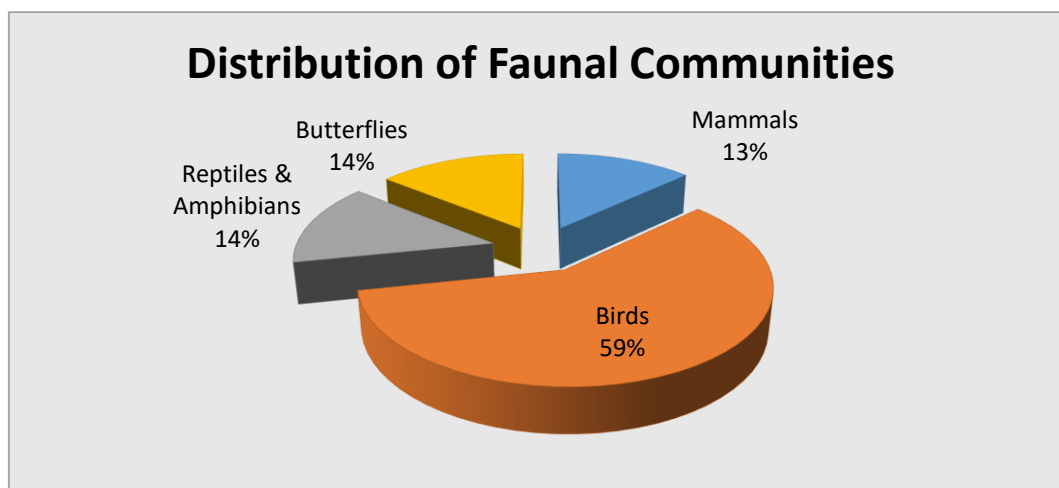


Figure 3-10 Distribution of Faunal Communities

Livestock like cattle, buffalo, goat, poultry, duck and pig are reared for dairy products, meat, egg and for agriculture purpose. Majority of cattle and buffalo are of local variety. Backyard poultry



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farms are mostly common in this area; however, some commercial poultry farms are also recorded in the study area.

The study area is marked with moderate population of flora and fauna. With reference to the Wildlife Protection Act 1972 total number of wildlife tabulated in this study can be characterized as given in the Table 3.9.

Table 3-9 Characterization of Fauna In The Study Area (As Per W.P Act, 1972)

S. No.	Schedule of Wildlife Protection Act 1972	No. of species	Remark
1	Schedule I	0	-
2	Schedule II	4	-
3	Schedule III	0	-
4	Schedule IV	69	-
5	Schedule V	2	-
6	Schedule VI	0	-

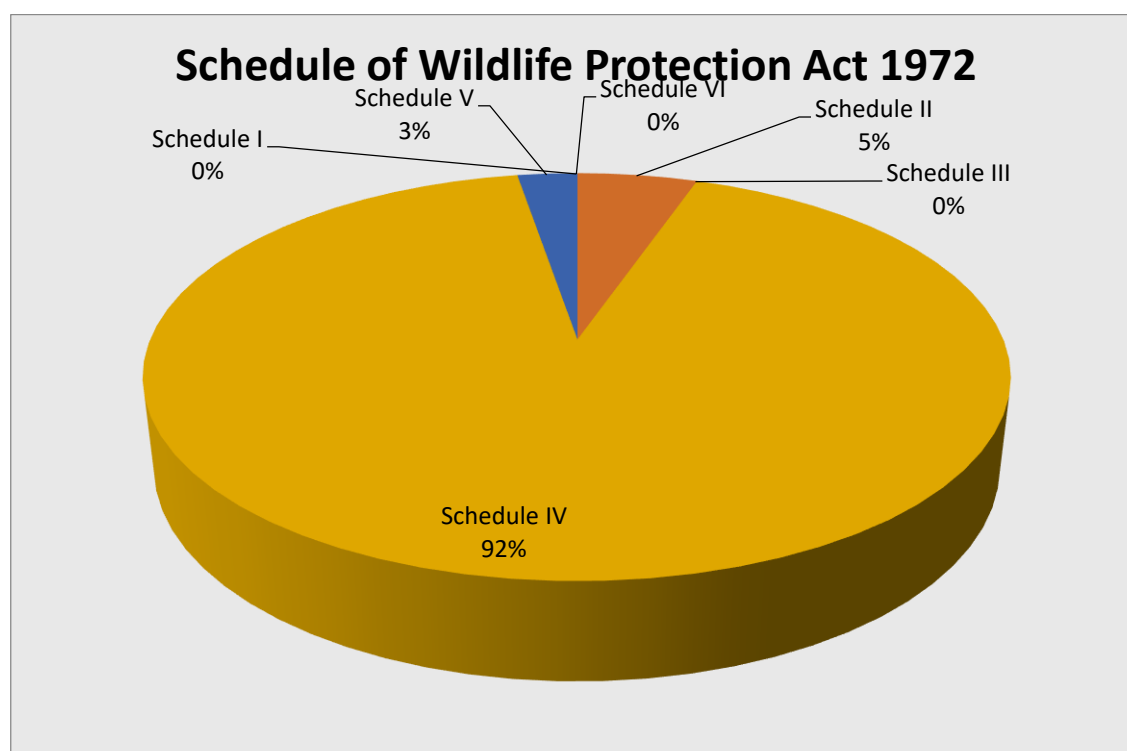


Figure 3-11 Schedule as per Wildlife Protection Act 1972

The detailed interpretation of flora and fauna identified within the study area are tabulated in Table 3.10.



Table 3-10 Description of Flora and Fauna

S. No.	Type of Species	Scientific Name	Common Name
Flora			
1	Endangered species	<i>Borassus flabellifer</i>	Nonkuppantai
2	Threatened species	None	None
3	Near Threatened species	None	None
4	Vulnerable species	None	None
Fauna			
1	Endangered species	None	None
2	Threatened species	None	None
3	Near Threatened species	None	None
4	Vulnerable species	None	None
5	Migratory Corridors & Flight Paths	No corridors & flight paths	-
6	Breeding & Spawning grounds	None	-

A comprehensive Central Legislation namely Wild Life (Protection) Act was enforced in 1972 to provide protection to wild animals. Schedule-I of this act contains the list of rare and endangered species, which are completely protected throughout the country. The list of wild animals and their conservation status as per Wild Life Act (1972) are presented in Table 3.9 species recorded/reported from study area, out of which 4 species belongs to schedule-II, 2 species belongs to schedule-V and rest of the species belongs to schedule-IV of Wildlife protection Act, 1972.

3.8 Marine Ecology and Biodiversity

Evaluation of the biological impulses on potential coastal development site is an integral part of an environmental impact assessment as the consequences of perturbations in the environment ultimately may affect the habitat. Development zones should be selected avoiding areas of intense breeding/nursery grounds of economically important living resources. Though organisms have evolved to withstand the change within certain limits, they may not be well



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adapted to manmade stresses. Thus, the monitoring programme should sufficiently target the entire potential at risk. Critical biological variables covering productivity at different trophic levels should be identified. Biological productivity has to be evaluated on the basis of phytoplankton pigments/cell counts as a measure of renewable primary resources; zooplankton standing stock in terms of biomass and population density and community structure; benthic population, biomass and group diversity at intertidal and sub tidal zones to evaluate benthic productivity associated with the sediment; information on larval stages of fish to evaluate probable occurrence of breeding grounds of economically important fish species and microbial examination to investigate the extent of contamination by pathogens as a measure of human influence.

While considering assessment of aquatic pollution and its implications, it must be realized that, despite many changes in the physico-chemical properties of the water body and seabed sediment, the ultimate consequences of pollutants may be reflected inevitably on the biological system. Hence, the investigations of an ecosystem and particularly of its communities constitute an integral part of any ecological assessment. This can be achieved by selecting a few reliable parameters from a complex community structure. The parameters considered have phytoplankton (cell count, and generic diversity), zooplankton (standing stock i.e., faunal groups), macro benthos (population and faunal groups) and status of fishery and mammals as well as birds. The first two reflect the productivity of a water column at the primary and secondary levels, respectively. Benthic organisms being sedentary animals associated with the seabed, provide information regarding the integrated effects of stress, if any, and hence serve as good indicators of early warnings of potential damages. Ultimate commercial interest being fisheries, the status of the exploitable fishery resources was assessed. Information on larval stages of fishes and decapods was used to evaluate probable occurrence of spawning and breeding grounds of economically important species.

To assess the planktonic profile of Phytoplankton and Zooplankton, 5 water samples from estuary region, intertidal zone and coastal water were collected at sub surface level. The marine



ecological study was conducted in different water bodies of the study area and the flora and fauna was recorded.

The biological parameters considered in the present study are chlorophyll, primary production, abundance of phytoplankton, abundance of zooplankton and macro and meiobenthic population. Phytoplankton and zooplankton reflect the productivity of a water column at primary and secondary levels. Benthic organisms being associated with the seabed, provide information regarding the integrated effects of stress due to disturbances, if any, and hence are good indicators of early warning of potential damage.

3.8.1 Primary Productivity

Marine primary production plays an important role in food web dynamics, in biogeochemical cycles and in marine fisheries. Primarily, phytoplankton depends on carbon dioxide, sunlight and nutrients for growth, but some other factors such as water depth, water temperature, wind and grazers also play a significant role. Primary productivity varies from freshwater to estuarine and from estuarine to marine water bodies. Its major components are net and gross primary production.

3.8.2 Chlorophyll

Chlorophyll, in various forms, is bound within the living cells of algae and other phytoplankton found in surface water. Chlorophyll-containing organisms are the first step of production in the most food chains, and the health and abundance of these primary producers affect the integrity of the other trophic levels. It is a key biochemical component in the molecular apparatus that is responsible for photosynthesis, the critical process in which the energy from sunlight is used to produce life-sustaining oxygen. In the photosynthetic reaction below, carbon dioxide is reduced by water, and chlorophyll assists this transfer. The results indicate that the area is moderately productive, and the values of Chlorophyll-a varied from 2.21 to 3.12 mg/m³, Chlorophyll-b varied from 1.0 to 1.51 mg/m³ and Chlorophyll-c varied from 1.95 to 2.12 mg/m³.



Table 3-11 Chlorophyll Concentration

S. No.	Chlorophyll (mg/m ³)	Sample Location Code				
		PP 1	PP 2	PP 3	PP 4	PP 5
1	Chl-a	2.54	2.21	2.57	3.12	2.98
2	Chl-b	1.51	1.26	1.12	1.0	1.12
3	Chl-c	1.95	2.12	1.56	1.16	1.56
	Total Chlorophyll	6.0	5.59	5.25	5.28	5.66

Source: ABC Techno Labs India Pvt. Ltd.

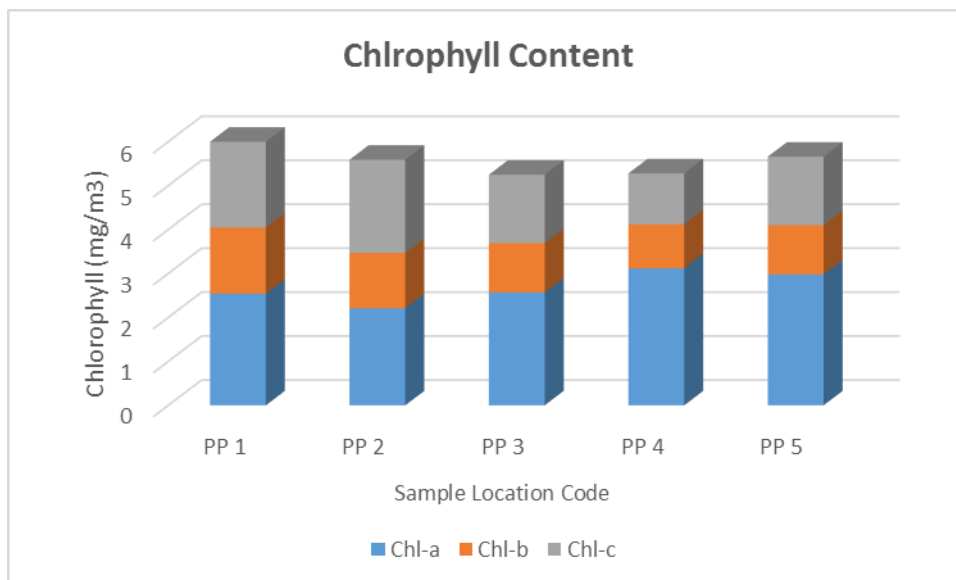


Figure 3-12 Chlorophyll Content

3.8.3 Plankton

Planktons can be broadly grouped into two categories those with plant origin are called 'Phytoplankton' and those with animal origin are called 'Zooplankton'.

A. Phytoplankton

Phytoplankton is the major primary producers of organic matter in the aquatic ecosystem and especially oceans whose 90% productivity is from the planktons. Phytoplankton samples were collected without filtering the water. To preserve, 0.3 mL lugol's solution was added to 100 ml sample. Subsequently, phytoplankton were concentrated by centrifugation and analysed



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microscopically in laboratory. Identification of phytoplankton was done using standard taxonomic keys.

The Lackey Drop (microtransect) method (Lackey 1938) is a simple method for obtaining counts of considerable accuracy (APHA 2017).

Chemicals/reagents used: Lugol's iodine

Equipments used: Centrifuge tubes of 15ml capacity, cover slips, glass slides, dropper, plastic bottles (100 ml capacity)

Instruments used: Centrifuge and Microscope.

- ***Shannon Wiener Diversity index***

The most commonly accepted index in past few decades has been Shannon and Wiener equation which is based on both the number of taxon present and the relative abundance of each taxon. The Shannon Wiener diversity index is usually used to calculate species diversity but comparisons are also made using the different taxonomic levels (Hellawell 1978). This index (H) is a useful measure of community diversity.

$$H = \text{Sum} [(Pi) \times \ln (Pi)]$$

Sum: Summation

Pi: proportion of total samples represented by species- i

In: Log of Pi.



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Table 3-12 Analysis Result of Phytoplankton

S. No.	Species	Phyto Plankton Count (No.*10 ³ /L)				
		PP 1	PP 2	PP 3	PP 4	PP 5
Class: Bacillariophyceae						
1	<i>Bacteriastrum varians</i>	2.3	2.4	2	1.3	0.92
2	<i>Bellerochea malleus</i>	2.2	2.5	2.2	1.5	1
3	<i>Chaetoceros affinis</i>	1.5	1.3	1.3	1.3	1.3
4	<i>Chaetoceroslorenzianus</i>	0.2	0.2	0.1	0.2	0.2
5	<i>Coscinodiscus wailesii</i>	0.21	0.1	0.1	0.2	0.16
6	<i>Coscinodiscus centralis</i>	0.4	0.2	0.2	0.21	0.17
7	<i>Corethron</i> sp.	0.3	0.2	0.2	0.3	0.2
8	<i>Ditylum brightwellii</i>	1.1	0.9	0.7	0.28	0.24
9	<i>Eucampia zoodiacus</i>	0.4	0.5	0.4	0.2	0.2
10	<i>Lithodesmium undulatum</i>	0.3	0.2	0.2	0.3	0.2
11	<i>Odontella mobiliensis</i>	0.9	0.21	0.31	0.22	0.21
12	<i>Rhizosolenia alata</i>	0.1	0.11	0.1	0.22	0.2
13	<i>Schroederella delicatula</i>	1	0.7	0.2	0.1	0.3
14	<i>Skeletonema costatum</i>	1.5	1.2	1.1	1.3	1.5
15	<i>Stephanopyxis palmeriana</i>	0.1	0.1	0.21	0.16	0.6
16	<i>Thalassiosira subtilis</i>	0.1	0.2	0.1	0.11	0.21
17	<i>Triceratium rediculatum</i>	0.1	0.21	0.1	0.2	0.27
18	<i>Entomonis</i> sp.	0.3	0.1	0.2	0.1	0.3
19	<i>Gyrosigma</i> sp.	0.21	0.1	0.2	0.3	0.35
20	<i>Navicula</i> sp.	0.24	0.1	0.16	0.2	0.34
21	<i>Nitzschia</i> sp.	0.34	0.1	0.2	0.9	0.22
22	<i>Pleurosigma directum</i>	0.2	0.1	0.1	0.3	0.21
23	<i>Thalassionema nitzschioides</i>	0.1	0.2	0.2	0.2	0.26
24	<i>Thalassiothrix longissima</i>	0.1	0.12	0.21	0.2	0.8
Class: Dinophyceae						
25	<i>Ceratium furca</i>	0.1	0.2	0.3	0.1	0.29
26	<i>Dinophysis caudate</i>	1.2	1.3	1.2	1.4	1.8
27	<i>Prorocentrum micans</i>	1.3	1.4	1.4	1.5	1.3



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S. No.	Species	Phyto Plankton Count (No.*10 ³ /L)				
		PP 1	PP 2	PP 3	PP 4	PP 5
28	<i>Peridinium depressum</i>	0.3	0.2	0.2	0.3	0.2
29	<i>Protoperidinium divergens</i>	0.1	0.1	0.2	0.11	0.17
Class: Cyanophyceaea						
30	<i>Anabaena sp.</i>	0.1	0.1	0.2	0.21	0.9
31	<i>Anacystis sp.</i>	0.25	0.1	0.1	0.2	0.2
32	<i>Oscillatoria sp.</i>	0.4	0.1	0.24	0.22	0.1
33	<i>Spirulina sp.</i>	0.3	0.1	0.2	0.24	0.31
34	<i>Trichodesmium erythraeum</i>	0.1	0.2	0.5	0.32	0.41
35	<i>Ankistrodesmus sp.</i>	1.2	1.3	1.7	1.6	1.2
36	<i>Chlamydomonas sp.</i>	0.2	0.3	0.2	0.3	0.2
TOTAL		19.75	17.45	17.23	16.8	17.44

Source: ABC Techno Labs India Pvt. Ltd.



B. Zooplankton

The significance of zooplanktons is found in their role in transferring biological production from phytoplankton to larger organisms in the food web. Sample collection was carried out in the similar method as that of phytoplankton. The result of the zooplankton analysis is tabulated in Table 3.13.

Table 3-13 Analysis Result of Zooplankton

S. No.	Species	Zoo Plankton Count (No.*10 ³ /L)				
		ZP1	ZP2	ZP3	ZP4	ZP5
	Foraminifera	0.3	0.32	0.24	0.36	0.35
1	<i>Globigerina rubescence</i>	0.43	0.38	0.31	0.44	0.48
2	<i>G.bulloides</i>	1.3	1.24	1.3	1.45	1.35
3	<i>G.opima</i>	0.9	0.67	0.9	0.94	0.95
4	<i>Tintinnopsis bermudensis</i>	0.4	1	1.05	0.86	0.45
5	<i>T.buttschlii</i>	0.43	0.6	0.72	0.68	0.48
6	<i>T.cylindrica</i>	0.35	0.32	0.3	0.2	0.4
7	<i>T.rubulosa</i>	1.2	1.22	1.5	1.5	1.25
8	<i>T.mortensenii</i>	0.6	0.7	0.4	0.32	0.65
9	<i>Eutintinnus tenuis</i>	0.75	0.55	0.52	0.44	0.8
	Hydroida	0.22	0.2	0.16	0.15	0.27
1	<i>Obelia sp</i>	0.32	0.2	0.1	0.11	0.37
	Rotatoria	0.24	0.1	0.1	0.1	0.29
1	<i>Brachionus plicatilis</i>	0.26	0.1	0.3	0.1	0.31
	Calanoida	0.3	0.1	0.2	0.1	0.35
1	<i>Rhincalanus sp</i>	0.45	0.6	0.1	0.2	0.5
2	<i>Metacalanus sp</i>	0.32	0.1	0.5	0.5	0.37
3	<i>Eucalanus sp</i>	0.26	0.2	0.2	0.4	0.31
4	<i>Acartia danae</i>	1.06	0.7	0.7	0.6	1.11
5	<i>Acartia sp</i>	1.2	1.7	1.4	1.22	1.25
	Cyclopoida	1.7	1.3	1.04	1.2	1.75
1	<i>Oithona rigida</i>	0.88	0.5	0.31	0.2	0.93
2	<i>Euterpina acutifrons</i>	0.7	0.32	0.2	0.22	0.75



S. No.	Species	Zoo Plankton Count (No.*10 ³ /L)				
		ZP1	ZP2	ZP3	ZP4	ZP5
3	<i>Microsetella</i> sp	0.22	0.2	0.25	0.24	0.27
TOTAL		14.79	13.32	12.8	12.53	14.84

Source: ABC Techno Labs India Pvt. Ltd.



The plankton diversity has been calculated as follows:

Table 3-14 Plankton Biodiversity Indices results

Community	Biodiversity indices		
	Shannon-Wiener Index (H)	Simpson Diversity Index (1/D)	Species Evenness
Phytoplankton	3.050	0.997	0.827
Zooplankton	2.859	0.993	0.900

Source: ABC Techno Labs India Pvt. Ltd.

Conclusion

In the present study, Planktonic sampling and analysis have been carried out at 5 locations. In total, 36 genera of phytoplankton were identified comprised of four major groups, viz. Chlorophyceae, Bacillariophyceae, Dinophyceae, Cyanophyceae. The group Bacillariophyceae was found to be dominated at all locations.

In general, it may be mentioned that the values of the Index <1.0, 1.0-2.0 and > 2.0 indicate maximum impact of pollution, medium impact of pollution and lowest impact of pollution respectively.

Eight major groups of zooplankton, namely, Oligotrichea, Eurotatoria, Branchiopoda, Globothalamea, Hydrozoa, Copepoda were found to inhabit the water bodies. The group Copepoda was found to be dominated at all locations.

The Shannon Wiener Index was found to be 3.05 for phytoplankton and 2.85 for Zooplankton. The diversity of phytoplankton indicates about lowest impact of pollution level in all the sampling locations and as a result zooplankton diversity also found to be high. The diversity value of the water is an illustration of the level of pollution of water which is measured by the content of nutrients and pollutants. Increasing nutrient content to the estuary area of the river can lead to phytoplankton blooms which result in increased water turbidity. However, sufficient nutrient content will increase phytoplankton productivity. Increasing phytoplankton productivity will support increased productivity of other organisms that have higher trophic levels. Each type of organism will occupy certain aquatic and its existence is determined by the water quality, namely the physical properties and chemical properties of the waters.



3.8.4 Benthos

The benthic organisms can be analyzed from a high index of biological diversity. These are represented by a large number of animalphyla, while dominated groups are represented by Polychaeta, Nematoda, Globothalamea, Malacostraca, Gastropoda, Bivalvia, Echinoidea. Macrobenthos in marine sediments play an important role in ecosystem processes such as mineralization, promoted and mixing of sediments, the flux of oxygen into sediments, nutrients cycling, dispersion and burial and secondary production. It is providing key linkage between primary producers and higher tropic levels.

Sediment samples were collected from the sampling and reference stations using a van Veen grab (0.1 m² area). The benthic samples were collected using a plastic core (10 cm length; 4.5 cm dia.) and sieved through 0.045 mm mesh sieve. The meiobenthic organisms were preserved in 5% Rose Bengal formalin solution. The benthic samples were sieved through a 0.5 mm mesh sieve and preserved in 5% Rose Bengal-formalin solution. Biomass (wet weight) of macrofauna was determined on an electronic balance and is expressed as g.m⁻². The taxonomic composition of benthic fauna were analysed in the laboratory under stereo-zoom microscope is expressed as No. (No./m²)⁻¹.

Table 3-15 Sub tidal and inter tidal benthic population

S. No.	Groups	Population Density (No./m ²)				
		MW1	MW2	MW3	MW4	MW5
Class: Polychaeta						
1	<i>Ancistrosyllis sp.</i>	2	1	2	7	4
2	<i>Armandia sp.</i>	3	1	1	2	2
3	<i>Capitella sp.</i>	1	0	0	2	4
4	<i>Cirratulus sp.</i>	2	0	1	1	1
5	<i>Cossura sp.</i>	2	0	1	2	1
6	<i>Eunice sp.</i>	1	1	3	5	2
7	<i>Glycera sp.</i>	1	1	1	1	2
8	<i>Goniada sp.</i>	1	2	1	0	1
9	<i>Nereis sp.</i>	2	0	1	0	1
10	<i>Notocirrus sp.</i>	2	0	2	0	0
12	<i>Perinereis sp.</i>	0	1	5	1	0



S. No.	Groups	Population Density (No./m ²)				
		MW1	MW2	MW3	MW4	MW5
13	<i>Pisoneindica sp</i>	0	0	2	2	1
14	<i>Prionospio sp.</i>	0	0	2	2	2
15	<i>Sabella sp.</i>	3	1	4	1	1
16	<i>Onuphis sp.</i>	2	2	2	1	2
17	<i>Hesione sp.</i>	2	1	2	0	2
18	<i>Nephtys sp.</i>	0	0	1	1	1
19	<i>Capitella sp.</i>	0	0	1	1	0
Class: Nematoida						
20	<i>Nematodes</i>	1	1	0	2	2
Class: Globothalamea						
21	<i>Bolivina abbreviate</i>	0	1	0	1	2
22	<i>Rotaliapulchella</i>	0	3	0	0	1
23	<i>Elphidiumsp.</i>	1	3	2	0	0
Class: Malacostraca						
24	<i>Amphipods</i>	1	2	2	3	3
25	<i>Albuneasp.</i>	0	2	2	4	4
26	<i>Cumacea</i>	1	1	1	4	1
27	<i>Emerita sp.</i>	4	8	5	2	2
28	<i>Isopod</i>	0	2	2	1	2
Class: Gastropoda						
29	<i>Nassarius sp.</i>	6	4	6	5	5
30	<i>Oliva olive</i>	12	9	11	11	8
Class: Bivalvia						
31	<i>Donax sp.</i>	4	11	6	5	4
32	<i>Pholasorientalis</i>	0	1	0	1	1
33	<i>Placuna placenta</i>	0	5	3	2	1
Class: Echinoidea						
34	<i>Sea urchin</i>	1	0	1	1	0
Total		55	64	73	71	63

Source: ABC Techno Labs India Pvt. Ltd.

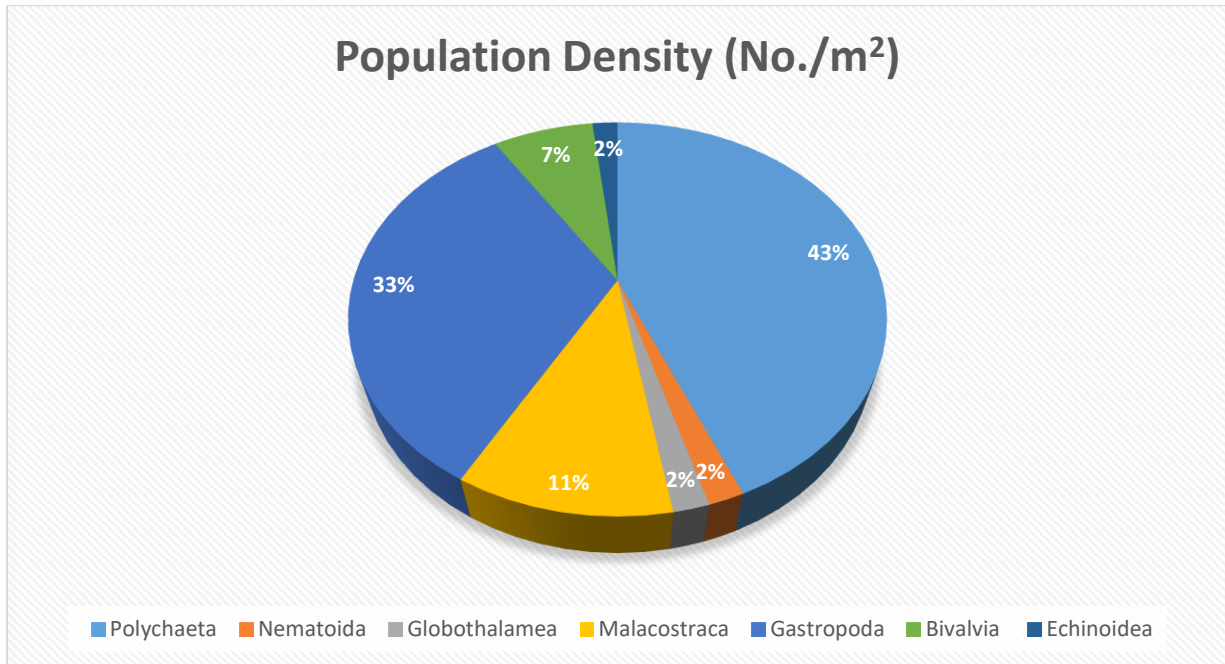


Figure 3-13 Population Density

3.8.5 Coastal Sand Dune Vegetation

Study area conducted in the Project region indicated the presence of coastal vegetation which includes *Ipomea pre-caprae*, *Casuarina sp*, *Optunia stricta*, *Spinifex sp* and *Cocus nucifera*.

However the proposed project will not have any major impacts on the coastal vegetation

3.8.6 Seaweeds and Sea grasses

The marine ecosystem provides a vast habitat for macro algal communities as they occupy the rock. Sea grass and seaweeds provide food, shelter for diverse organisms and act as a nursery ground for many fishes of commercial importance and play a vital role in the fisheries production of the region. Both are economically important marine living resources.

Sea grass and Sea weeds has not been reported along the coastal area of the project site.

3.8.7 Coral reefs

Corals and any associated reef were not reported along the coastal area of the project site during the site visit.

3.8.8 Flora

General coastal flora and agricultural crops were observed. The common species which were found in the study area were *Cocus nucifera*, *Casurina equisetifolia*, *Azadirachta indica*, *Acacia nilotica*.



3.8.9 Mangroves

Mangroves in India

In India, mangroves are found in the States of West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Andaman and Nicobar Islands, Kerala, Goa, Maharashtra, Karnataka and Gujarat. The Mangroves cover in Gujarat are second only to the Mangroves in the West Bengal on the East Coast in terms of area, occurring in about 1044 km² area in Gujarat [FSI-2011, GEC-BISAG-2009]. The Indian mangroves cover about 4827 Km², with about 57% of them along the east coast, 23% along the west coast and the remaining 20% in Andaman and Nicobar Islands. A total of 39 mangrove species are known from India. Mangroves forests in India are endowed with 125 plant species, accounting for 56% of the world's mangrove species of which 39 are true mangroves and 86 are mangrove associates. The total number of mangrove inhabiting faunal species in Indian mangroves is 3,111, which includes prawns, crabs and molluscs, fish, fish parasites, insets, reptiles, amphibian and mammals.

3.8.10 Marine Protected Area

As per the wildlife protection Act 1972, there are not critically endangered, threatened or rare species of wildlife in the study area. As per records of the Botanical Survey of India, Zoological Survey of India and available published literature pertaining to the study area, no threatened, endangered or rare plant or animal species occur in the study area.

No protected area near the site and within 20 km radius from the project site.

3.8.11 Marine Mammals

There are no reports in recent years about regular occurrence of marine mammals in the coastal waters off Tamil Nadu region.

3.8.12 Avifauna

Waterbirds are an important component of biotic community in wetland ecosystems and highly sensitive to changing habitat including climate and weather. They use the wetland habitats either throughout or during certain part of their life. Over 56 species of birds have been reported during the study period which is listed below.

Sl.no	Scientific Name	Common Name
1	<i>Tachybaptus ruficollis</i>	Little Grebe
2	<i>Pelecanus philippensis</i>	Spot-billed Pelican



3	<i>Phalacrocorax niger</i>	Little Cormorant
4	<i>Phalacrocorax fuscicollis</i>	Indian Shag
5	<i>Phalacrocorax carbo</i>	Great Cormorant
6	<i>Anhinga melanogaster</i>	Darter
7	<i>Egretta garzetta</i>	Little Egret
8	<i>Ardea cinerea</i>	Grey Heron
9	<i>Ardea purpurea</i>	Purple Heron
10	<i>Casmerodius albus</i>	Large Egret
11	<i>Mesophoyx intermedia</i>	Median Egret
12	<i>Bubulcus ibis</i>	Cattle Egret
13	<i>Ardeola grayii</i>	Indian Pond-Heron
14	<i>Butorides striatus</i>	Little Green Heron
15	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron
16	<i>Ixobrychus sinensis</i>	Yellow Bittern
17	<i>Dupetor flavicollis</i>	Black Bittern
18	<i>Mycteria leucocephala</i>	Painted Stork
19	<i>Anastomus oscitans</i>	Asian Openbill-Stork
20	<i>Plegadis falcinellus</i>	Glossy Ibis
21	<i>Threskiornis melanocephalus</i>	Oriental White Ibis
22	<i>Platalea leucorodia</i>	Eurasian Spoonbill
23	<i>Dendrocygna javanica</i>	Lesser Whistling-Duck
24	<i>Anas penelope</i>	Eurasian Wigeon
25	<i>Anas poecilorhyncha</i>	Spot-billed Duck
26	<i>Anas clypeata</i>	Northern Shoveller
27	<i>Anas acuta</i>	Northern Pintail
28	<i>Anas querquedula</i>	Garganey
29	<i>Anas crecca</i>	Common Teal
30	<i>Gallirallus striatus</i>	Blue-breasted Rail
31	<i>Amaurornis phoenicurus</i>	White-breasted Waterhen
32	<i>Porphyrio porphyrio</i>	Purple Moorhen
33	<i>Gallinula chloropus</i>	Common Moorhen
34	<i>Fulica atra</i>	Common Coot



35	<i>Hydrophasianus chirurgus</i>	Pheasant-tailed Jacana
36	<i>Rostratula benghalensis</i>	Greater Painted-Snipe
37	<i>Charadrius dubius</i>	Little Ringed Plover
38	<i>Vanellus malabaricus</i>	Yellow-wattle Lapwing
39	<i>Vanellus cinereus</i>	Grey-headed Lapwing
40	<i>Vanellus indicus</i>	Red-wattled Lapwing
41	<i>Gallinago gallinago</i>	Common Snipe
42	<i>Limosa limosa</i>	Black-tailed Godwit
43	<i>Numenius arquata</i>	Eurasian Curlew
44	<i>Tringa totanus</i>	Common Redshank
45	<i>Tringa stagnatilis</i>	Marsh Sandpiper
46	<i>Tringa ochropus</i>	Green Sandpiper
47	<i>Tringa glareola</i>	Wood Sandpiper
48	<i>Actitis hypoleucos</i>	Common Sandpiper
49	<i>Himantopus himantopus</i>	Black-winged Stilt
50	<i>Larus brunnicephalus</i>	Brown-headed Gull
51	<i>Gelochelidon nilotica</i>	Gull-billed Tern
52	<i>Alcedo atthis</i>	Small Blue Kingfisher
53	<i>Halcyon smyrnensis</i>	White-breasted Kingfisher
54	<i>Ceryle rudis</i>	Lesser Pied Kingfisher
55	<i>Motacilla maderaspatensis</i>	Large Pied Wagtail
56	<i>Motacilla flava</i>	Yellow Wagtail

There will be short term disturbance to the avian fauna during the construction period.

3.8.13 Fisheries

Along the Indian coast there are 3,477 marine fishing villages distributed in 9 coastal states, union territories of Puducherry, Daman & Diu, Lakshadweep and Andaman & Nicobar, the last two being island territories. Highest number of marine fishing villages are in Odisha, Tamil Nadu and Andhra Pradesh with 739 (21.3%), 575 (16.5%) and 533 (15.3%) villages respectively. The total population of marine fishermen in India is 37, 74,577 out of which 21.1% are in Tamil Nadu, 14.9% are in Kerala and 13.7% each are in Odisha and Andhra Pradesh. According to the Marine Fisheries Census 2016, there are 575 marine fishing villages



and 349 landing centers in Tamilnadu and in Puducherry there are 32 landing centers and 30 marine fishing villages.

3.8.14 Fish & Other Marine Community

The fish and other marine species reported from the study area are tabulated in Table 3.16.

Table 3-16 Fish and Marine Species reported

S.No.	Scientific Name	Common Name	Family
1	<i>Arius maculatus</i>	Spotted catfish	Ariidae
2	<i>Alectisindica</i>	Indian threadfish	Carangidae
3	<i>Alectisciliaris</i>	African pompano	Carangidae
4	<i>Alepes mate</i>	Smallmouth scad	Carangidae
5	<i>Crassostreamadrasensis</i>	Indian oyster	Ostreidae
6	<i>Cynoglossusmacrolepidotus</i>	Largescaledtonguesole	Cynoglossidae
7	<i>Ephippusorbis</i>	Orbfish	Ephippidae
8	<i>Holothuriaatra</i>	Lollyfish	Holothuriidae
9	<i>Leiognathusfasciatus</i>	Striped ponyfish	Leiognathidae
10	<i>Lepturacanthussavala</i>	Savalahairtail	Trichiuridae
11	<i>Liza seheli</i>	Bluespot mullet	Mugilidae
12	<i>Parapenaeopsisstylifera</i>	Kiddi shrimp	Penaeidae
13	<i>Scomberoidestol</i>	Needlescaledqueenfish	Carangidae
14	<i>Sardinellalongiceps</i>	Indian oil sardine	Clupeidae
15	<i>Sardinellagibbosa</i>	Goldstripesardinella	Clupeidae
16	<i>Sardinellaclupeoides</i>	Bleekersmoothbellysardinella	Clupeidae
17	<i>Sardinellaalbella</i>	White sardinella	Clupeidae
18	<i>Stolephorusindicus</i>	Indian anchovy	Engraulidae
19	<i>Stolephoruscommersonii</i>	Commerson's anchovy	Engraulidae
20	<i>Thryssamalabarica</i>	Malabar thryssa	Engraulidae
21	<i>Chanoschanos</i>	Milkfish	Chanidae
22	<i>Tylosurusstrongylurus</i>	Spottail needlefish	Belonidae
23	<i>Lutjanusfulviflamma</i>	Dory snapper	Lutjanidae
24	<i>Lutjanusrussellii</i>	Russell's snapper	Lutjanidae
25	<i>L. johnii</i>	John's snapper	Lutjanidae
26	<i>L. argentimaculatus</i>	Mangrove red snapper	Lutjanidae



S.No.	Scientific Name	Common Name	Family
27	<i>Johniusdussumieri</i>	Sin croaker	Sciaenidae
28	<i>Etroplussuratensis</i>	Pearlspot	Cichlidae
29	<i>Leiognathusequulus</i>	Common ponyfish	Leiognathidae
30	<i>Liza dussumieri</i>	Dussumier's mullet	Mugilidae
31	<i>Liza macrolepis</i>	Largescale mullet	Mugilidae
32	<i>Gerresfilamentosus</i>	Whipfin silver-biddy	Gerreidae
33	<i>Ambassisambassis</i>	Commerson's glassy	Ambassidae
34	<i>Ambassisgymnocephalus</i>	Bald glassy	Ambassidae
35	<i>Anguilla bengalensis</i>	Indian mottled eel	Anguillidae
36	<i>Anguilla bicolor</i>	Indonesian shortfin eel	Anguillidae
37	<i>Megalaspiscordyla</i>	Torpedo scad	Carangidae
38	<i>Oreochromismossambicus</i>	Mozambique tilapia	Cichlidae
39	<i>Mugilcephalus</i>	Flathead grey mullet	Mugilidae
40	<i>Liza parsia</i>	Goldspot mullet	Mugilidae
41	<i>Siganusjavus</i>	Streaked spinefoot	Siganidae
42	<i>Sillagosihama</i>	Silver sillago	Sillaginidae
43	<i>Johniuscoitor</i>	Coitor croaker	Sciaenidae
44	<i>Platycephalusindicus</i>	Bartail flathead	Platycephalidae
45	<i>Leiognathusdussumieri</i>	Dussumier'sponyfish	Leiognathidae
46	<i>Lates calcarifer</i>	Barramundi	Latidae

Source: ABC Techno Labs India Pvt. Ltd.

3.8.15 Turtle

Tamilnadu has a coastline of 1076 km (excluding the Union Territory of Puducherry), which is largely east-facing with a small stretch of west-facing coast (80 km). Five species of marine turtles — olive ridley, green, leatherback, hawksbill and loggerhead turtles have been reported to occur along the Tamil Nadu coast. Olive ridley turtles nest along the Coromandel Coast and are known to forage in southern Tamil Nadu waters. Hawksbill turtles are also found in the Gulf of Mannar and stray adults and juveniles are occasionally seen along the rest of the coast. Similarly, leatherbacks are occasionally seen along this coast. Loggerhead turtles are rare and there are few confirmed reports. Olive ridley turtles are categorized as



Vulnerable on the IUCN Red List (IUCN, 2010) and are included in Schedule I of the Indian Wildlife (Protection) Act, 1972.

None of the turtle nesting was observed along coastal stretches of the project region during the present assessment.



3.9 Marine Environmental Baseline Studies

3.9.1 Marine Water Quality

One time marine water monitoring was conducted by qualified Marine Expert of ABC Techno Labs India Pvt Ltd, Chennai. Samples of marine water for analysis were collected at five (5) selected locations using a 5L Van Dorn Water Sampler (PARTEX make) for analyzing major physico-chemical and biological parameters. Plankton net (WP net) was used for collecting plankton samples. A Van Veen grab was operated at all stations for collecting sediments and benthic fauna. Grab samples from three (3) different depths i.e. at surface, at 10 m middle and at 20 m and bottom were collected from each location. Details on the marine sampling locations is presented in **Table 3.17** and also shown in **Figure 3.14**. Details on the marine water quality during the study period is given in **Table 3.18**.

Table 3-17 Marine Water Sampling Locations

Monitoring location Code	Latitude	Longitude	Distance from the Shore (Km)
MW1	12°50'9.12"N	80°15'51.42"E	1.75
MW2	12°48'20.30"N	80°15'51.36"E	1.71
MW3	12°51'6.47"N	80°16'48.29"E	3.37
MW4	12°47'27.85"N	80°16'52.08"E	3.19
MW5	12°49'17.54"N	80°20'19.54"E	9.91

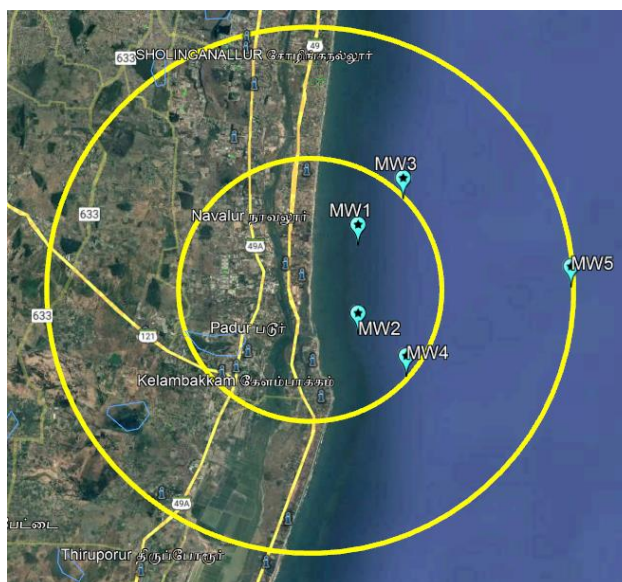


Figure 3-14 Marine Water Sampling Locations



Environmental Impact Assessment for the Proposed Construction of Fish Landing Centre and Shore Protection Works along with Boat Berthing facilities at Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District, Tamil Nadu.

Table 3-18 Marine Water Quality during the Study Period (Part-1)

S.No	Parameter	Unit	Test Method	MW1 Surface	MW1 Subsurface	MW1 Bottom	MW2 Surface	MW2 Subsurface	MW2 Bottom
1	Temperature	°C	APHA 23rd EDITION	29	27.3	26.8	29.4	27	26.6
2	pH at 25 °C	-	IS : 3025 Part 11- 1987 (Reaff: 2017)	8.13	8.71	8.58	8.64	8.68	8.59
3	Salinity	ppt	APHA 22 nd EDITION-2520B	34.4	34.6	34.7	35	35.2	35.1
4	Calcium as Ca	mg/l	IS : 3025 Part 40-1991 (Reaff:2003)	412.5	426.5	421.5	432.5	417.5	428.5
5	Magnesium as Mg	mg/l	APHA 22nd EDN-3500 Mg B	1294.5	1312.5	1285.5	1290.5	1315.5	1287.5
6	Potassium as K	mg/l	APHA 22nd EDN -4500-SO42- E	470.5	430.5	460.5	482.5	442.5	466.5
7	Nitrate as NO3	mg/l	APHA 23rd EDN -4500- NO3- B	2.6	3.3	2.9	2.3	2.8	2.9
8	Iron as Fe	mg/l	IS : 3025 Part 53-1987 (Reaff:2019)	BDL(<0.05)	BDL(<0.05)	0.06	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
9	Manganese as Mn	mg/l	APHA 23rd EDN -3500-Mn D	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
10	Sodium as Na	mg/l	IS : 3025 Part 45-1987 (Reaff:2019)	12300	12700	12600	13300	13500	12400
11	Phosphate as PO ₄	mg/l	IS:3025:Part-31:1988 (Reaff:2019)	0.05	0.1	0.08	0.07	0.1	0.12
12	Nickel as Ni	mg/l	APHA 23rd EDN -3111 B	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
13	Cadmium as Cd	mg/l	APHA 23rd EDN -3111 B	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
14	Lead as Pb	mg/l	IS:3025 Part 47-1987 (Reaff:2019)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
15	Copper as Cu	mg/l	APHA 23rd EDN -3111 B	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)
16	Zinc as Zn	mg/l	IS:3025 Part:49-1987 (Reaff:2019)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
17	Total Chromium as Cr	mg/l	APHA 23rd EDN -3111 B	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)
18	Mercury as Hg	mg/l	IS:3025 Part 48-1987 (Reaff:2019)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
19	Selenium as Se	mg/l	IS 3025 Part 34 (Reaff:2019)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
20	Total Arsenic as As	mg/l	IS 3025 Part 31 (Reaff:2019)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)



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21	Barium as Ba	mg/l	IS 3025 Part 44 (Reaff:2019)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
22	Dissolved oxygen as O ₂	mg/l	IS:3025:Part-38:1989(Reaff: 2019)	5.5	5.3	4.9	5.7	5.2	5
23	Cobalt as Co	mg/l	IS 3025 Part 39 : 1987 (Reaff 2019)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
24	Cyanide as CN	mg/l	IS : 3025 Part 17-1984	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
25	Nitrite as NO ₂	mg/l	APHA 22 nd EDN-4500- NO ₂ ⁻ B	0.04	0.06	0.07	0.03	0.05	0.04
26	Silica as SiO ₂	mg/l	APHA 22 nd EDN-4500- SiO ₂ - D	2.14	3.58	4.97	2.14	3.17	4.36
27	Total Petroleum Hydrocarbon	mg/l	ABCTL/INS/SOP/31	0.002	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)

Table 3-19 Marine Water Quality during the Study Period (Part-2)

S.No	Parameter	Unit	Test Method	MW3 Surface	MW3 Subsurface	MW3 Bottom	MW4 Surface	MW4 Subsurface	MW4 Bottom	MW5 Surface	MW5 Subsurface	MW5 Bottom
1	Temperature	°C	APHA 23 rd EDITION	29.4	26.4	25.9	28.8	26	25.8	29.7	27	26.2
2	pH at 25 °C	-	IS : 3025 Part 11-1987 (Reaff: 2017)	8.17	8.12	8.11	8.21	8.18	8.13	8.15	8.12	8.07
3	Salinity	ppt	APHA 22 nd EDITION-2520B	34.5	34.2	34.3	34.6	34.4	34.2	34.7	34.3	34.1
4	Calcium as Ca	mg/l	IS : 3025 Part 40-1991 (Reaff:2003)	430	427	419	435	412	422	424	423	436
5	Magnesium as Mg	mg/l	APHA 22 nd EDN-3500 Mg B	1295	1320	1326	1282	1325	1311	1294	1310	1298



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6	Nitrate as NO ₃	mg/l	APHA 23 rd EDN - 4500- NO ₃ - B	2.1	2.6	2.4	2.5	1.8	2.9	1.93	2.16	2.4
7	Iron as Fe	mg/l	IS : 3025 Part 53-1987 (Reaff:2019)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
8	Manganese as Mn	mg/l	APHA 23 rd EDN - 3500-Mn D	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
9	Sodium as Na	mg/l	IS : 3025 Part 45-1987 (Reaff:2019)	13600	13500	12600	13500	13300	12400	13300	13500	12400
10	Potassium as K	mg/l	IS : 3025 Part 45-1987 (Reaff:2019)	472	482	458	466	494	470	482	460	476
11	Nickel as Ni	mg/l	APHA 23 rd EDN - 3111 B	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)
12	Cadmium as Cd	mg/l	APHA 23 rd EDN - 3111 B	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
13	Lead as Pb	mg/l	IS:3025 Part 47-1987 (Reaff:2019)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
14	Copper as Cu	mg/l	APHA 23 rd EDN - 3111 B	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)
15	Zinc as Zn	mg/l	IS:3025 Part:49-1987 (Reaff:2019)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
16	Total Chromium as Cr	mg/l	APHA 23 rd EDN - 3111 B	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)
17	Arsenic as As	mg/l	IS:3025 Part:37-1987 (Reaff:2019)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)



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18	Mercury as Hg	mg/l	IS:3025 Part 48-1987 (Reaff:2019)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.001)	BDL(<0.1)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
19	Dissolved Oxygen as O ₂	mg/l	IS 3025 Part 38 (Reaff:2019)	5.6	5.1	4.9	5.7	5.3	5	5.6	5.1	4.9
20	Nitrite as NO ₂	mg/l	APHA 22 nd EDN-4500- NO ₂ ⁻ B	0.02	0.06	0.08	0.03	0.05	0.06	0.05	0.08	0.07
21	Silica as SiO ₂	mg/l	APHA 22 nd EDN-4500- SiO ₂ - D	1.89	2.68	3.71	1.17	2.88	4.01	1.82	2.63	4.15
22	Total Petroleum Hydrocarbon	mg/l	ABCTL/INS/SOP/31	0.002	BDL(<0.001)	BDL(<0.001)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.1)	BDL(<0.1)	BDL(<0.1)
23	Phosphate as PO ₄		IS:3025:Part-31:1988 (Reaff:2019)	0.04	0.08	0.13	0.05	0.12	0.15	0.08	0.1	0.09
24	Cyanide as CN		APHA 23 rd Edn - 4500-CN E	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
25	Selenium as Se	mg/l	APHA 23 rd Edn - 3113 B	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
26	Cobalt as Co		APHA 23 rd Edn - 3111 B	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
27	Barium as Ba		APHA 23 rd Edn - 3111 D	BDL(<0.1)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.1)	BDL(<0.1)	BDL(<0.1)

BDL: Below detection limit



3.9.1.1 Observations on Marine Water Quality

Following are the summary observations on marine water quality

Temperature

Water temperature generally regulates species distribution and their composition and activity of life associated with aquatic environment. Since most of the aquatic animals are cold blooded, water temperature regulates their metabolism and ability to survive and reproduce effectively. The variation in temperature in coastal and estuarine system may influence the physico-chemical characteristics and distribution and abundance of flora and fauna. Spatial temperature flux might be due to wind intensity and wave action (Reddy et al., 1993).

During the present study the temperature did not show much variation from surface to the depth of 20m, and it ranged from 25.8°C to 29.7°C. Temperature at depth of 20 m was observed to be in the range of 25.8°C to 26.3°C, however it ranged from 29.7°C to 28.5°C at surface and from 28.7°C to 29.5°C at depth of 10m.

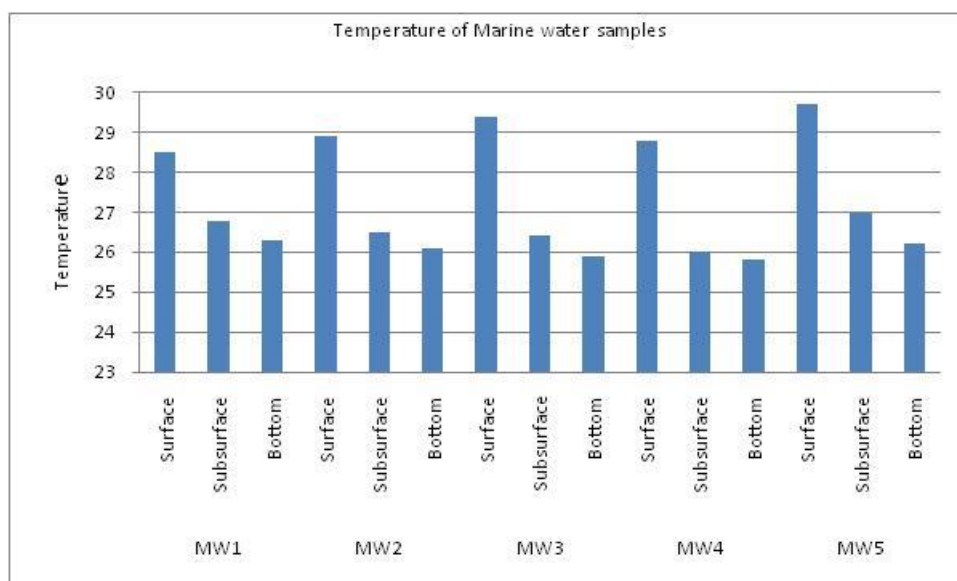


Figure 3-15 Temperature of the Marine Water Samples

pH

The principal systems that regulate pH of water are the carbonate system consisting of CO_2 , H_2CO_3 , HCO_3^- and CO_3^{2-} . Because of the buffering capacity of seawater, generally seawater pH has limited variability. During the present study the observed pH did not show much variation, it ranged from 8.07 to 8.21 at surface, 8.12 to 8.21 at the depth of 10 m and 8.07 to 8.13 at



depth of 20m. pH values at different levels for all the 5 locations are presented in **Figure 3.16** below.

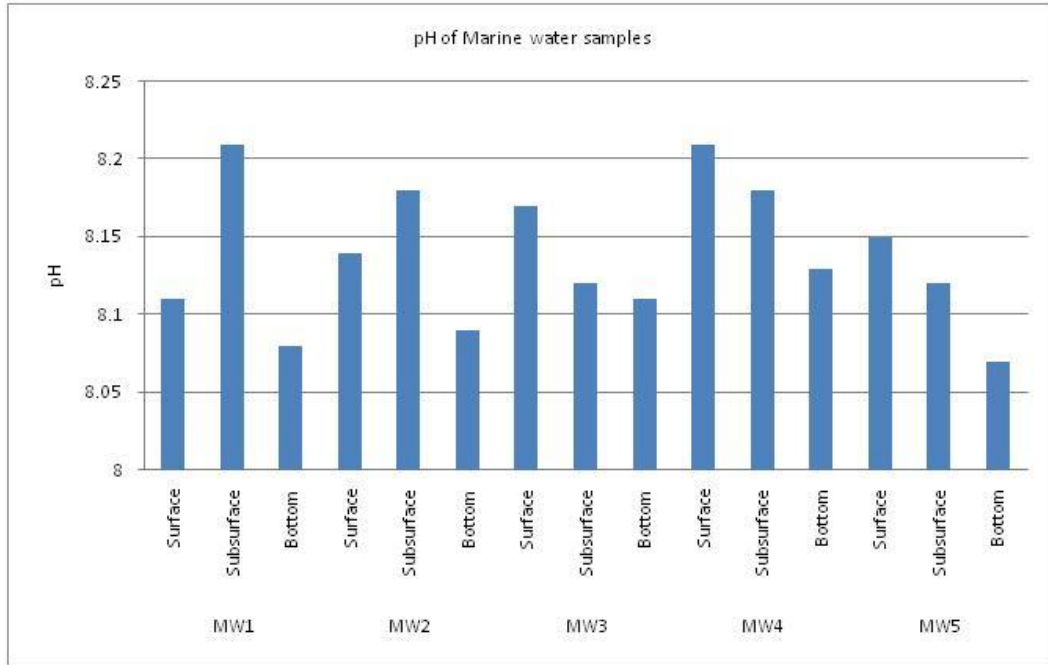


Figure 3-16 pH of the Surface Water Samples

Salinity

Salinity is an important factor in controlling all environment characteristics including coastal water and inhabitant flora and fauna. The salinity fluctuations in coastal environment mainly depends upon local precipitations and influx of surface runoff water. The observed concentration of salinity did not show much variation at different depths; it ranged from 33.9 ppt to 34.7 ppt at surface, 34.1 ppt to 34.7 ppt at the depth of 10m and 34.1ppt to 34.6 ppt at the depth of 20m. The graphical representation of the same is presented in **Figure 3.17** below.

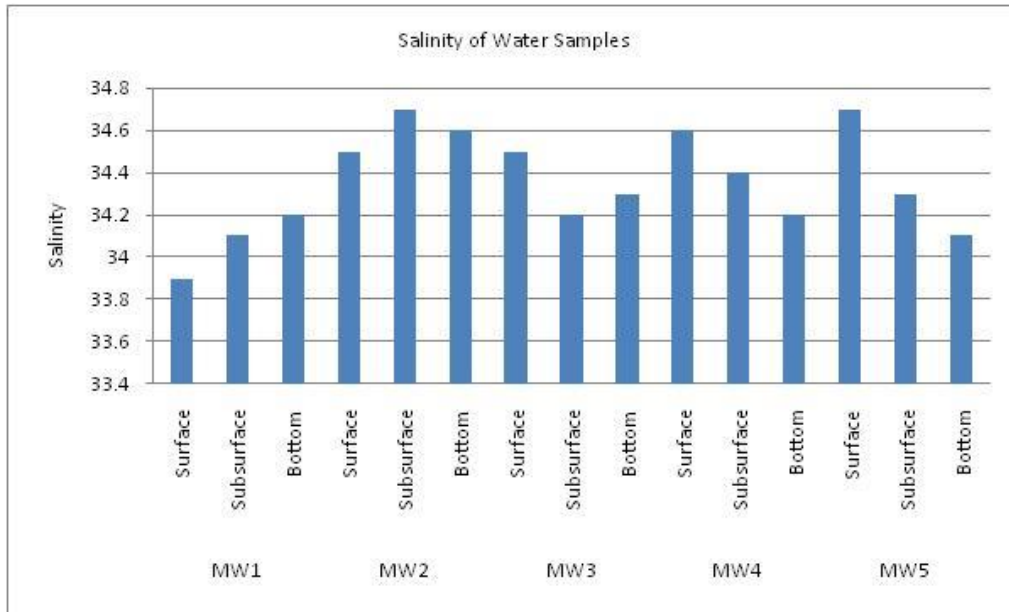


Figure 3-17 Salinity of the Surface Water Samples

Dissolved Oxygen (DO)- Dissolved Oxygen (DO) is of considerable interest in water quality investigations as its concentration in water is an indicator of the ability of a water body to support a well balanced aquatic life. During the present study the values of Dissolved Oxygen (DO) at surface, 10m depth and 20m depth ranged from 5.5 mg/l to 5.7 mg/l, 5.3 mg/l to 5.1 mg/l and 4.9 mg/l to 5.0 mg/l respectively. Higher DO values were recorded at the surface of sea water in all stations which shows the coastal water is well oxygenated. The graphical representation of DO at different depths is presented in **Figure 3.18** below.

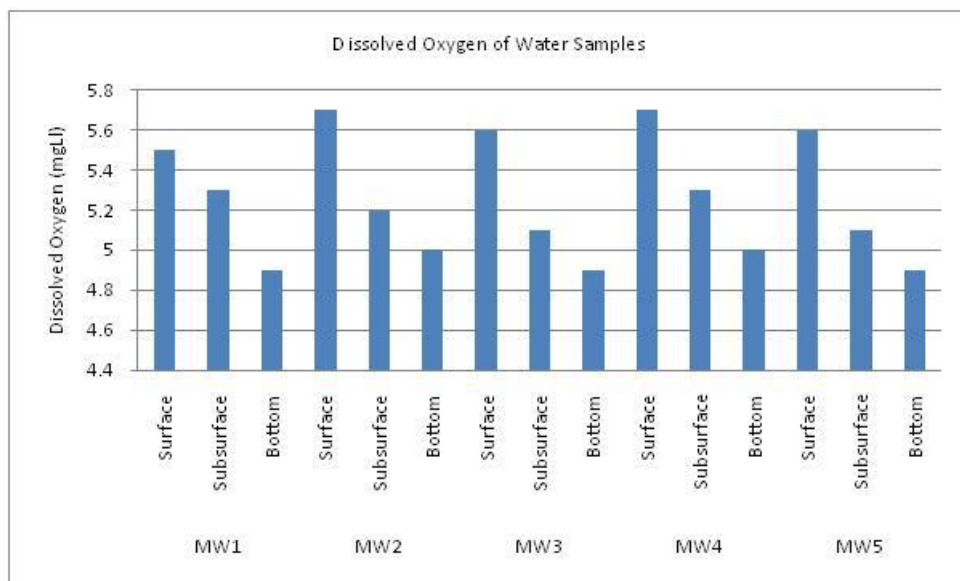


Figure 3-18 Dissolved Oxygen of the Surface Water Samples

Nitrate and Nitrite- It was observed that concentration of nitrate at the 20m depth ranged from 2.4 mg/l to 2.9 mg/l and at the surface ranged it from 1.8 mg/l to 2.5 mg/l and at 10 m it ranged 1.8 mg/l to 2.8 mg/l and whereas Nitrite fluctuated from 0.02 mg/l to 0.08 mg/l with an average of 0.05mg/l from all the five locations respectively. Not much variation was noticed in the study area.

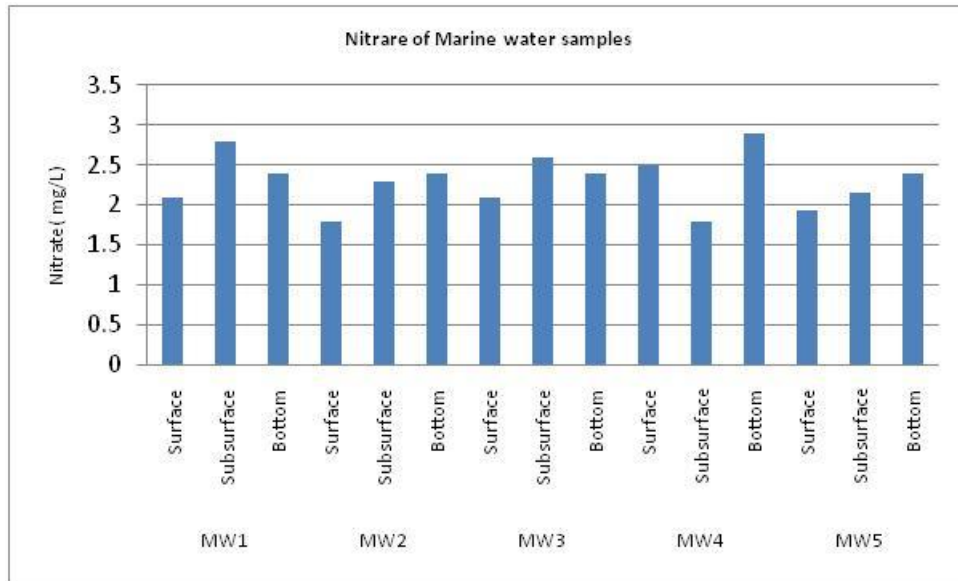


Figure 3-19 Nitrate of the Surface Water Samples

Phosphate and Silica

The main reservoir of phosphorus on land is rocks which gradually release phosphorus compounds into marine ecosystems. Most of this phosphorus is delivered via rivers and surface water ruff. In recent times, anthropogenic sources of phosphorus have become a large fraction of the phosphorus delivered to the marine environment, effectively doubling the pre-anthropogenic flux. An excess of phosphate causes uncontrolled growth of algae leading to eutrophication

The spatio temporal variation of silica in coastal waters largely depends on proportional mixing of sea water and freshwater and adsorption of reactive silicate into suspended sedimentary particles. Biological removal by phytoplankton, especially by diatom and silicoflagellates has been reported one of the important factors of silicate distribution

In the present study phosphate concentration ranged from 0.04 mg/l to 0.08 mg/l at surface and in 10 m depth it ranged from 0.1 mg/l to 0.12 mg/l and at 20 m depth it ranged from 0.09



mg/l to 0.15 mg/l and Silica at surface ranged from 1.17 mg/l to 2.14 mg/l and at 10 m it ranged from 2.63 mg/l to 3.58 mg/l and 20m depth it ranged from 3.71 mg/l to 4.97 mg/l.

Total Petroleum hydrocarbon

Petroleum hydrocarbons are organic chemicals composed of fused benzene rings formed during incomplete combustion of coal, oil, petrol and wood. Main sources of oil pollution are from oil fields, oil refineries and/or shipment activities. Oil is the major pollutant to the marine environment as the fate and effects of the PHc was of great concern for general wellbeing of the aquatic biota. During the present study the value of Total petroleum hydrocarbon was found below detectable limit in all locations except station MW1 surface which water which recorder 0.002 mg/l.

Major Cations

Concentration of Sodium ranged from 12300 mg/l to 13600 mg/l and Potassium ranged from 430 mg/l to 494 mg/l. Concentration of Calcium ranged from 412 mg/l to 436 mg/l and Magnesium ranged from 1283 mg/l to 1326 mg/l.

Metals

The concentration of metals such as Manganese, Nickel, Cadmium, Lead, Copper, Arsenic and Mercury was found to be below detectable limit (BDL) at all five (5) locations monitored at all levels.

3.9.1.2 Inference

The marine water samples collected from surface, mid depth and bottom of the samples did not show variation in terms of concentrations of physicochemical parameters. The water samples collected from different locations at different depth did not shows the presence of high concentration of metals and most of the samples reveal metal and Petroleum hydrocarbon contents below detectable limits.

3.9.2 Sediment Quality

Geochemical and texture analysis were carried out for understanding the characteristics of sediments. Metals such as Cadmium (Cd), Copper (Cu), Chromium (Cr), Iron (Fe), Manganese (Mn), Nickel (Ni), Zinc (Zn), Lead (Pb) were estimated from all the stations. Grain size analyses

were accomplished to determine the contribution of various sediment components such as sand, silt and clay. In addition samples of benthos from the sediments were also collected.

Marine sediment quality monitoring was carried out at 5 (five) locations in the study area to understand the physical and chemical characteristics of the sediments. Details of the sediment sampling locations are presented in **Table 3.20**.

Table 3-20 Marine Sediment Quality Sampling Locations

Monitoring location Code	Latitude	Longitude
S1	12°50'9.12"N	80°15'51.42"E
S2	12°48'20.30"N	80°15'51.36"E
S3	12°51'6.47"N	80°16'48.29"E
S4	12°47'27.85"N	80°16'52.08"E
S5	12°49'17.54"N	80°20'19.54"E

The observed marine sediment quality of the area is as per details given in **Table3.21**

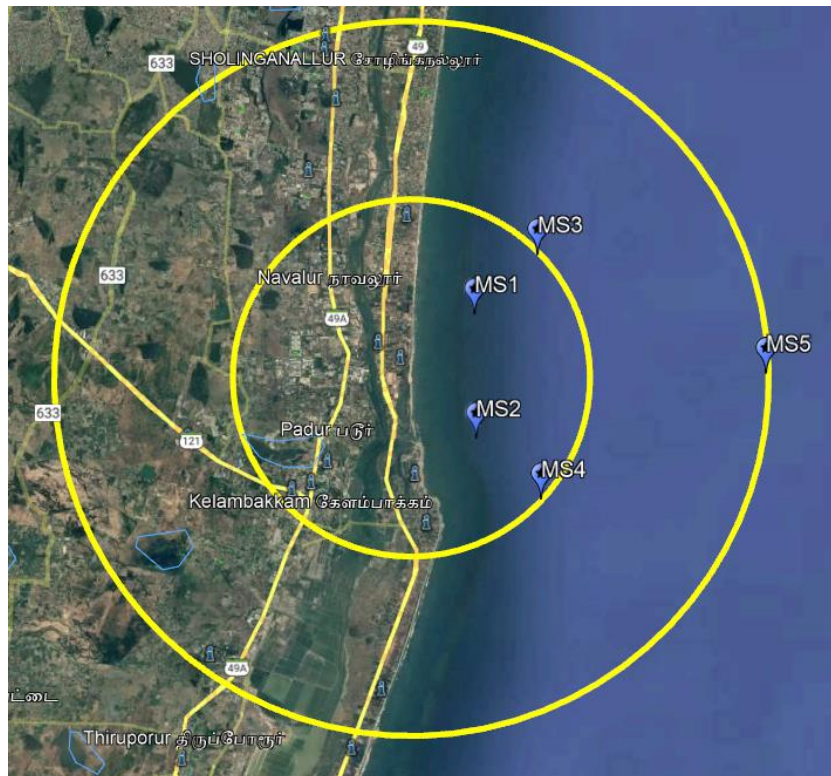


Figure 3-20 Marine Sediment Sampling Locations



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Table 3-21 Marine Sediment Quality

S.No	Parameter	Test Method	Unit	S1	S2	S3	S4	S5
1	pH	IS -2720(Part 26) 1987(RA 2016)	..	8.05	7.98	7.82	7.58	7.67
2	Calcium Carbonate as CaCO3	FAO Chapter 3	%	0.15	0.13	0.17	0.14	0.13
3	Total Organic Carbon as C	IS 2720 (Part 22):1972 (RA 2015)	%	4.78	5.97	5.13	6.03	4.71
4	Calcium	Soil Chemical Analysis By M. L. Jackson	%	2.54	1.96	2.81	2.81	2.39
5	Magnesium	IS -14684:1999, Reaff:2008	mg/kg	4128	3652	3288	3785	3482
6	Phosphorus	EPA 3050 B & Stannous Chloride Method	mg/kg	214	307	284	364	252
7	Sodium as Na	EPA3050 B & 7000 B	%	2900	3400	3100	3300	3900
8	Potassium as K	EPA3050 B & 7000 B	mg/kg	690	880	770	850	940
10	Zinc as Zn	EPA3050 B & 7000 B	mg/kg	46	78	63	64	88
11	Cadmium as Cd	EPA3050 B & 7000 B	mg/kg	BDL(<2)	BDL(<2)	BDL(<2)	BDL(<2)	BDL(<2)
12	Copper as Cu	EPA3050 B & 7000 B	mg/kg	16.7	15	22.1	21.1	26.4
13	Lead as Pb	EPA3050 B & 7000 B	mg/kg	4.6	7.1	6.4	5.9	6.3
14	Mercury as Hg	EPA3050 B & 7000 B	mg/kg	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)
15	Chromium as Cr	EPA3050 B & 7000 B	mg/kg	11.8	9.8	14.1	14.1	16.3



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16	Iron as Fe	EPA3050 B & 7000 B	mg/kg	2368	3061	1748	2879	2065
17	Arsenis as As	EPA3050 B & 7000 B	mg/kg	BDL(<2)	BDL(<2)	BDL(<2)	BDL (<2)	BDL (<2)
18	Manganese as Mn	EPA3050 B & 7000 B	mg/kg	124	212	104	174	252
19	Nickel as Ni	EPA3050 B & 7000 B	mg/kg	3.98	5.39	5.82	5.32	4.71
20	Selenium	EPA 3050B & USEPA 7000B	mg/kg	BDL(<2)	BDL(<2)	BDL(<2)	BDL (<2)	BDL (<2)
21	Cobalt as Co	USEPA 3050B & USEPA 7000B	mg/kg	BDL(<2)	BDL(<2)	BDL(<2)	BDL (<2)	BDL (<2)
22	Barium as Ba	USEPA 3050B & USEPA 7000B	mg/kg	3.3	5.6	4.7	6.1	4.8
23	Texture	Robinson Pipette Method		Silt	Silt Loam	Silt Loam	Silt Loam	Silt Loam
	Sand		%	14.2	28.8	22.6	28.7	24.6
	Clay		%	81.6	59.4	77.1	53.5	57.1
	Silt		%	4.2	11.8	0.3	17.8	18.3
24	Total Petroleum Hydrocarbon	ABCTL/INS/SOP/31	mg/kg	BDL (<0.05)	0.14	0.71	0.21	0.11

3.9.2.1 Observation of Marine Sediment

Sediment Texture

Sediment texture is defined as the relative proportion of sand, silt and clay. The ranges of diameters of these three components are 0.05 - 2.0 mm for sand, 0.002 - 0.05 mm for silt and <0.002 mm for clay. The textural classes are based on the relative proportions of these components. Percentage of sand in the sediment samples ranged from 0.3% to 81.6% while silt varied 0.3% to 18.3 %. Percentage of clay was found to range from 53.5% to 81.6% in all the five samples collected from the study area. The graphical representation of the texture of all the samples is presented in **Figure 3.21** below.

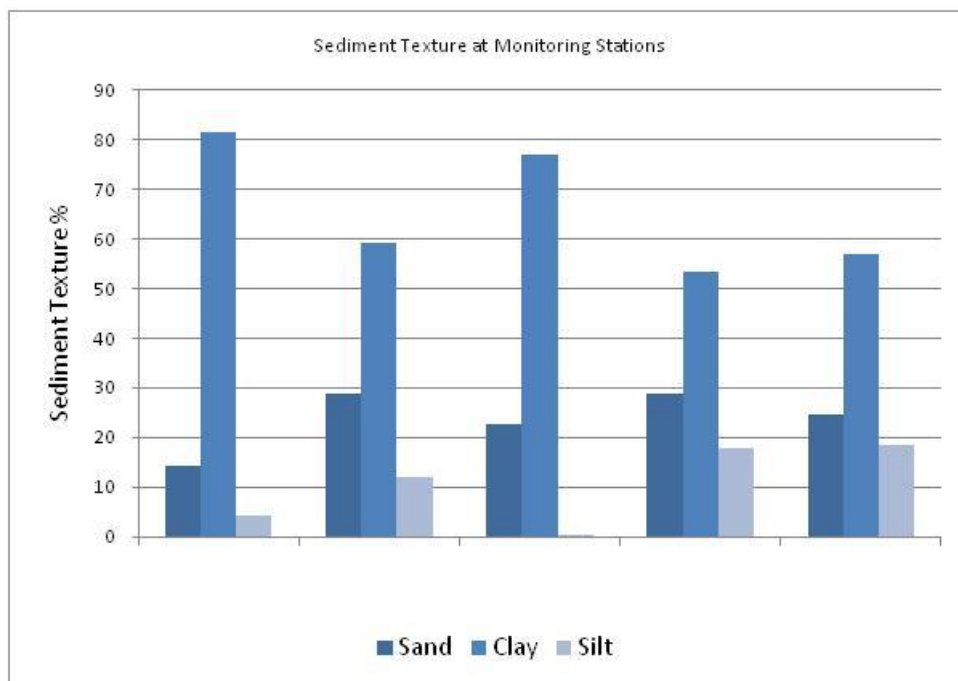


Figure 3-21 Sediment Texture at the Monitored Stations

Total Organic Carbon

The organic matter in sediments, expressed as total organic carbon (TOC), represents an important force for the global carbon cycle. It and plays an important part in the ocean chemistry (Lee, 1994). Nearly 80 % of the carbon is sequestered in the continental margins, therefore representing the largest carbon storehouse. During the study period the concentration of total organic carbon showed minimum of 0.71% at S5 and maximum of 6.03% at S4 followed by S2 and S3



Calcium Carbonate

Calcium (Ca^{2+}) is one of the major cations in seawater. The precipitation and dissolution of calcium carbonate is an important component of the oceanic carbon cycle. Recent estimates of both CaCO_3 production and export at a global ocean scale ($\sim 175 \times 10^{12}$ mol/year). During the present study Calcium carbonate ranged from minimum of 0.13 at S2 and S5 to maximum of 0.17 at S3 followed by S1.

Petroleum Hydrocarbon

Concentration of Total Petroleum Hydrocarbon (TPH) was found to be at in below detectable limits (BDL) in S1 and in station 2, 3, 4 and 5 it ranged from 0.11 to 0.71.

Major Cations

Concentration of Sodium and Potassium ranged from 2900 mg/kg to 3900 mg/kg and 690 mg/kg to 940 mg/kg and concentration of calcium and Magnesium ranged from 1.96 mg/kg to 2.81 mg/kg and 3288 mg/kg to 4128 mg/kg

Heavy Metals

Metal pollution in coastal areas is one of the focused environmental concerns. Sediment quality in coastal zone reflects the long-term environmental status. When the metal concentration in sediment exceeds certain threshold level, adverse biological effects frequently occur.

In present study Iron ranged from 1748 mg/kg to 3061 mg/kg with highest in S2 and Copper ranged from 15.0 mg/kg to 26.4 mg/kg with highest at S5. Concentration of Chromium, Lead and manganese varied from 4.6 mg/kg to 7.1 mg/kg, 2980 mg/kg to 104 mg/kg and 252 mg/kg to 312 mg/kg respectively. Cadmium, Mercury, Selenium and Total Arsenic was found to be below detectable limit (BDL) at all the five locations. Concentration of nickel, zinc and Barium ranged between 3.98 mg/kg to 5.82 mg/kg & 46 mg/kg and 88 mg/kg and 3.3 mg/kg to 6.1 mg/kg respectively in the study area. Concentration of lead in the study area ranged from 4.6 mg/kg to 7.1 mg/kg.

Microbial Population



Microorganism distribution in the marine and brackish environment plays an important role in the decomposition of organic matter and mineralization. Pathogenic bacteria invade into marine environment through human and animal excreta, river runoff, land runoff, sewage with organic and inorganic contents, agricultural waste and industrial waste. Hence, spatial and temporal distribution of the Total faecal coliforms as well as pathogenic bacteria in water and sediment is essential to assess the sanitary conditions.

Microbial count in seawater:

Bacterial counts in the surface water and seabed sediment were analysed and are given in **Tables 3.22**. In the water samples, Bacterial counts varied from 0.14 to 5.62 nos. $\times 10^3$ CFU/ml.

Table 3-22 Bacterial Population (nos $\times 10^3$ /ml)

Type of Bacteria	Stations				
	S1	S2	S3	S4	S5
TVC	4.25	5.21	5.18	5.62	3.98
TC	0.36	0.52	0.48	0.36	0.51
ECLO	0.48	0.32	0.36	0.24	0.48
SHLO	0.17	0.14	0.18	0.16	0.20
VLO	0.38	0.42	0.25	0.22	0.32

TVC -Total Viable Counts; TC- Total Coliforms; ECLO-*Escherichia coli* like organisms; SHLO-*Shigella* like organisms; SLO-*Salmonella* like organisms; VLO-*Vibrio* like organisms.

Microbial count in seabed sediment

Bacterial counts in the surface water and seabed sediment were analysed and are given in **Tables 3.23**. The sediment sample Bacterial counts varied from 0.18 to 5.63 nos. $\times 10^4$ CFU/g.

Table 3-23 Bacterial population in seabed sediments (nos $\times 10^4$ /g)

Type of Bacteria	Stations				
	S1	S2	S3	S4	S5
TVC	4.97	5.63	5.38	4.89	5.31
TC	0.41	0.34	0.89	0.64	0.43



ECLO	0.39	0.45	0.63	0.47	0.42
SHLO	0.18	0.25	0.22	0.26	0.20
VLO	0.38	0.29	0.34	0.42	0.29

TVC -Total Viable Counts; TC- Total Coliforms; ECLO-Escherichia coli like organisms; SHLO-Shigella like organisms; SLO-Salmonella like organisms; VLO-Vibrio like organisms

The bacterial colonies were identified up to generic level. Organisms isolated were normally expected in all coastal waters, under moderate human influence. The total count in the water sample at the surface closer to the coastal areas was found to be higher due to terrestrial run off and towards the open sea the count was found to be lesser. Shigella and Vibrio like organisms were found to be present in very low numbers. Other counts indicated lesser populations. This result implies that in this region there is no indication of any major microbiological pollution.

The pathogenic organism such as (TVC) Escherichia coli, Vibrio like organisms, Shigella, Vibrio cholera, Vibrio parahaemolyticus, Total coli forms have been recorded in the study area. The counts indicated lesser population which shows that the environment is fairly healthy and free from any major pollution. In general, the coastal waters are influenced by Escherichia coli, Salmonella sp., Klebsiela sp., Enterobacter sp., Bacillus sp., and Staphylococcus sp., and Vibrio like organisms. Estuaries and creeks are influenced by E. coli, Shigella sp., Vibrio cholera, Vibrio parahaemolyticus, Pseudomonas sp., and other pathogens like Total Coli forms and Total Viable Counts.



4 ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

4.1 General

The proposed Shoreline Protection Structures is envisaged for public cause to prevent coastal erosion along a coastal village to safeguard their life and property in the event of any coastal extreme events like Storm Surges, Tsunami, etc.

The proposed activity of establishing two numbers of Groynes along with a Northern & Southern Breakwater as Shoreline Protection Structures requires CRZ Clearance under CRZ Notification, 2011 which mandated EIA, EMP, RA and DMP.

The proposed Erosion prevention structure consists of two numbers of Groynes along with a Northern & Southern Breakwater along Karikattukuppam, coastal fishermen villages. The Groynes are planned to have a complimenting performance in trapping the sand and sustain the littoral drift in the project location. The Groynes will trap sand and prevent further erosion and proper nourishing with sand they will enable the project area to gain back the beaches that were lost to sea in the recent past due to erosion. While the breakwater facilitates easy movement of boat to the shore acting as a barrier and reducing the wave motion.

The project is responsive to changing natural challenges but not to have any reactive processes and hence there will not be any residues out or noise. The inert structural components will not have any emission or discharge and hence there will not be any impact on Marine and Water Environment.

The impacts due to Groynes & Breakwaters are net-positive with respect to human safety and may have some only temporal impacts to marine environment, during construction. However, studies were carried out to evaluate the proposed activity for any Impacts on environment, for their characteristics and assessed for their quantum and value.

The Groynes & breakwater will ensure shoreline stability along the project location to prevent erosion.

4.2 Analysis of Impacts (Groynes & Breakwaters)

The proposed Groynes & Breakwaters will ensure the direct access which will be denied in case of conventional RMS. The fishermen will now find it easy to have parking of their fishing boats and catamarans. The Groyne & Breakwaters will become sandy on stabilization and the by-passing of sand over the groynes was done over a time.



The Groynes will have lee side impact when they do not position properly for an angle and length. The Groyne & Breakwaters was planned and designed in such a way that the natural sand bypassing will avoid the lee side erosion, especially on the northern side of the field.

4.2.1 Air Pollution

- The proposed Groynes & Breakwaters has nothing to dispose or will have any residual to discharge.
- These structures are physical barriers constructed using highly inert, non-leaching stones/rock and rubbles. Hence, they have no emission to pollute the air shed.

4.2.2 Water Pollution

- No water is required for any purpose of the performance of the proposed Structures.
- The Groynes will, however, offer surface for attached-growth of fauna and flora which may have some marginal biological change in the water quality in the surf /quash zone in the coastline of the project location.
- This quality change will remain positive to the coastal water quality with enhanced cleanliness and dissolved oxygen.

4.2.3 Wastewater

- There will not be any waste streams from the proposed structures.

4.2.4 Solid waste

- There will not be any solid Waste from the proposed structures.
- Some occasional disturbances to Rubbles from Groynes & Breakwaters will not have any significant impact. If they get disturbed significantly under the influence of any extreme events, they always can be brought back to their respective place.

4.2.5 Noise

- There is no noise generating processes.

4.3 Impact Prediction Studies

The Groyne is envisaged to protect further erosion of the project line and it will also have sand by passing over the time and it is expected to gain the eroded beach in the long run. The design of Groyne & Breakwaters is based essentially on the changes in the wave pattern, alongshore sediment transport and littoral drift of the project location.



The Groyne & Breakwaters was strategically planned and designed to protect the eroding shoreline and also sustain the existing shoreline conditions and features in the project location.

4.3.1 Coastal Environment

The project location has been already surveyed by Department of Environment through IIT(M) and reported as eroding and requirement for SPS is justified. The eroding coastal conditions of the project location will look to have rocky obstructions, temporarily and brief time till the sand bypassing is completed between the groynes.

The lee side erosion on the northern side of the project location is prevented with proper planning and designing of the Groyne & Breakwaters. This negative impact, which is characteristically retrievable, can be justified with the importance of the proposed SPS to prevent erosion and protect shoreline, which will save large number of population and significant account of property.

4.3.2 Biological Environment

There is no discharge of effluent or any emission. Hence, no change in coastal biology is foreseen. The strata made out of Rubble/Stone Surfaces will host specific species of microorganisms which may lead some change in the amount of specific species like, green algae will profusely grow. In fact, the exposed surfaces of Groynes will offer a specific habitat for flora and fauna over a time. Any change in the account of microorganisms and benthic organisms will become acclimatized to the changed environment of physical strata. This will not in anyway spoil the biological attributes of the shoreline.

4.3.3 Socio Economics

The proposed project is essentially for public cause and need based to prevent further erosion of the eroding shoreline of the project location, Karikattukuppam. Peoples of this village also in the nearby areas have made several representations to Government of Tamil Nadu for the proposed Structures to protect the eroding shoreline. It is evident that some of the family lost their houses and most of them suffered serious damage to their properties, during Tsunami, 2004. Public amenities like roads, water supply systems, etc., were suffered severe damage in Tsunami 2004. Hence, the proposed project of Groynes is need based and highly demanding.



The proposed Groyne & Breakwaters will minimize the vulnerability of the project location for loss and damage due to high wind and strong waves. The fishing activities will improve and their life will prosper. The fear of damages to their vessels and safety of their vessels will improve the socio economic conditions of the project location. CEHS found the villagers demanding for the early completion of this project, during every visit during the environmental survey.

4.4 Evaluation of Impacts

The impacts due to the proposed construction activities are Net- positive and the project is essentially for public cause. The impacts are required to be evaluated for potential significances and value indexes. The environmental impacts are considered in four accounts as follows;

Impact I: Mitigated by EMP and systems

Impact II: Not yet fully and qualitatively assessed.

Impact III: Not yet fully and quantitatively assessed.

Impact IV: Positive impacts.

However, the elaborate methodology of constructing EIA Matrix is not required as the proposed project is not cause for any type of pollution and environmental impact on the project location.

4.5 Impact Quantification

To quantify the assessed impacts, they are assigned certain arbitrary weightage on the basis of standards and listed in **Table 4.1**. The values of the importance of the environmental parameters are related to the impacts of the proposed project activities of Department of Fisheries, Government of Tamil Nadu.

To sum up impact score, the coefficient of impacts for different environmental parameters is assumed. The values are ranging from 0 – 5 are used in Quantification of total impact value for the proposed project Department of Fisheries, Government of Tamil Nadu and listed in **Table 4.2**. The assumed coefficients of impact, which are devised based on the impact quality, are for quantifying the total impact values of the proposed project of Department of Fisheries, Government of Tamil Nadu.

The detailed impact calculation is tabulated in **Table 4.3**. The total impact value, as calculated in the Table is a net positive value of +1050, which favor the implementation of the proposed



project of Shoreline Protection Structures by Department of Fisheries, Government of Tamil Nadu. The total impact score is an assertive, positive score, which favors the implementation of the project.

Table 4-1 Arbitrary Weightage Values for Impact Assessment

S.No.	Parameters	Importance Value
1.	Air Quality	100
2.	Water Resources	100
3.	Land Use Pattern	100
4.	Solid waste disposal	100
5.	Noise Level	50
6.	Coastal /Marine Environment	200
7.	Human Settlement	250
8.	Public Health/Safety	100
TOTAL		1000

Table 4-2 Coefficient Values for Impact Assessment

S.No.	Coefficient Criteria	Coefficient of Impact
1.	No impact	0
2.	No appreciable impact	0
3.	Significant impact-short term	-1
4.	Major impact-long term reversible	-1
5.	Major impact-long term irreversible	-2
6.	Permanent impact	-2
7.	Positive impacts	+1, +2

Table 4-3 Impact Quantification

S.No.	Environmental parameters	Importance value	Proposed Project	
			Coefficient Criteria	Impact value
1.	Air Quality	100	0	0
2.	Water Resources	100	0	0
3.	Land Use Pattern	100	-1	-100
4.	Solid waste disposal	100	0	0
5.	Noise Level	50	0	0
6.	Coastal/Marine Environment	200	-2	-400
7.	Human Settlement	250	+5	+1250
8.	Public Health/ Safety/ Socio Economics	100	+3	+300
ToTal				+1050



5 ANALYSIS OF ALTERNATIVES

5.1 General

The proposed construction of Groyne & Breakwaters (2 numbers of each) is to prevent erosion and to protect shoreline of the project shoreline. The project was envisaged and proposed for implementation by Department of Fisheries, Government of Tamil Nadu as the specified project location of Karikattukuppam at Thiruporur Taluk has become an eroding shoreline.

Erosion of shoreline is evident in the last one decade of time and hence the proposed structures to prevent further loss of the shoreline so as to physically safeguard coastal settlements in the location, abetting the shoreline.

5.2 Alternative Sites

The proposed location was identified and recommended for the proposed Groyne & Breakwaters by IIT-M in a comprehensive study made for the entire coastline of Tamil Nadu.

The fisherman community Karikattukuppam has made several representations to the line departments of State Government including the District Collectorate for Erosion prevention structures.

The proposed Groynes are important as the coastline in this section is witnessing erosion heavily in the last few years. The proposed location was chosen on the basis of its physical status, being under severe erosion with loss of beach and threat of sea water into the villages.

The coastline also has no biological sensitivity other than the common coastal biology of flora and fauna.

5.3 Alternatives of Technologies

Groynes & Breakwaters are the recommended methods to prevent erosion by IIT-M, specifically for the project location. In situations like the present project location, where the coastline with waves already reached a close proximity to Human settlement, providing Groynes to prevent the waves into village limit, is important.

Department of Fisheries has now taken steps to collect required long term coastal data on the project site and conducted surveys like GPS, Bathymetry for primary data. The Groynes were now designed to sustain the coastal processes and so will perform continuously for their life time in preventing the erosion in the project site.



The entire project, Groynes & Breakwaters is based on Socio Economic policy constraints as newer alternatives require significantly higher investments and may not go well with fishing community.

The options for other alternative methodologies for Erosion prevention cannot be entertained at this time as the project was assigned National Bank for Agriculture and Rural Development for funding assistance under RIDF XXVI for the financial year 2021-22 and very little possibility is there to plan it for revised alternatives.

5.4 Groynes Field

The proposed construction of Erosion prevention structures for Groynes & Breakwaters. These structures are designed based on the location specific characteristics of prevailing physical processes like along shore sediment transport, littoral drift, etc.,

The Groynes will complement with each other in trapping the sand and responding to a long shore sediment transport and thus further erosion will be prevented. Measures like sand nourishment is being suggested to gain beaches that were lost to erosion.



6 ENVIRONMENTAL MONITORING PROGRAMME

6.1 General

In the post project scenario, the proposed structures does require to be monitored for integration of soft solutions in these structures for their sustained performance. The Monitoring program, in this case, will be a kind of augmentation programs, to support the coastal processes, which should be in natural course of time, build and proceed with erosion free shorelines.

The Groynes & Breakwaters will provide physical balance under the influence of possible extremes like cyclone, surges and even Tsunami. Hence, periodical monitoring and maintenance, on annual basis, is important.

The Groynes with trapping of sand will have down drift impacts on the lee side with erosion, in the absence of sediment transport. Hence, in-between areas of Groynes do require sand nourishment from off shore to sustain the preventive processes to erosion.

The monitoring mechanism will be having two different mode viz., Continuous and Periodical. The Environmental monitoring for Groynes & Breakwaters have been devised with an integrated approach which will eventually gain the shoreline which was lost to erosion.

6.2 Field of Groynes & Breakwaters

Groynes & Breakwaters should be monitored continuously for accretion on the foreshore and down drift erosion on the lee side. The sand nourishment of the areas between the Groynes should be periodically carried out which will not only stop or prevent erosion, will also enable to gain the shoreline.

6.3 Monitoring for Marine Environment

The marine flora and fauna prior to the project implementation has been already surveyed in the Due Diligence studies. The survey on the marine environment for the available species of marine flora and fauna is important in the pre project time.

Annual basis of sampling of specified biological attributes on the coastal and marine environment should be continued for studying the impacts, if any, out of its role of in providing surface for attached growth systems of micro biology.



7 ADDITIONAL STUDIES

7.1 General

Specific additional studies were carried out on Coastal processes like Wind Pattern and Socio Economic Status of the project Location. Also, conceptual studies were carried out for Risk Analysis and Management and Disaster Management Plans. The project is for the public cause, as this will physically safeguard shoreline abetting coastal villages, at Karikattukuppam village, Thiruporur Taluk, of Chengalpattu District.

The possible catastrophic coastal hazards, like Cyclone, Hurricane, Storm, Earth quake, etc., have been evaluated conceptually through a Disaster Management Plan (DMP). A Comprehensive Risk Analysis and Management Plan also were carried out by correlating the proposed structures, natural hazards, coastal processes and human security.

7.2 Risk Analysis & Management Plan

The construction may for a brief time deny the direct access to the sea which may cause some accidents. It may cause difficulty in the easy negotiations of fishing boat with areas for docking and repairs.

7.3 Disaster Management Plan

The project location is historically prone for storm surges and cyclone during the monsoon periods. The District is known for major coastal events which resulted in huge property loss in the coast.

It must be noted that the proposed activity will not have any cause and stand reason for any Disaster situation in the project location.

7.4 Shoreline Management Plan

7.4.1 Shoreline Demarcation

In the present report the entire coastal line of Tamil Nadu has been analyzed by dividing the entire coastline into number of stretches with a length of around 5km each. Most land areas are covered in satellite imagery with a resolution of about 15 m per pixel. This base imagery is 30 m multispectral Landsat which is pansharpened with the 15 m [panchromatic] Landsat imagery. However, Google is actively replacing this base imagery with 2.5 m SPOT Image imagery and several higher-resolution datasets. Some population centers are also covered by aircraft imagery (orthophotography) with several pixels per meter. Google Earth will typically



default to older images with higher resolution or clarity rather than newer low- resolution images. Because of the wide variety of data sources, Google Earth images come in a wide range of spatial resolutions. Most land areas are shown at 15-meter resolution, but the most detailed Google Earth images have resolutions as fine as 15 centimeters (6 inches). The advantage in using google earth is that the updated and latest image available and a variety of supplementary data can be easily viewed on a feature of interest. Thereby existing coastal protection structures are located site specifically and demarcated. The instant availability of a wide range of historic images helps to enhance the accuracy and linearity in predicting the shoreline changes over the years.

Key points on shoreline analysis and its limitations

- To predict patterns of shoreline behavior using the derivation of historical rate of change trends as an indicator of future trends assuming continuity in the physical, natural or anthropogenic forcing which have forced the historical change observed at the site.
- The main advantage and reason for using historical maps is that they are able to provide a historic record that is not available from other data sources. Many potential errors however are associated with historical coastal maps and charts. Such errors may be associated with scale, datum changes, distortions from uneven shrinkage, stretching, creases, tears and folds, different surveying standards, different publication standards, and projection errors (Boak & Turner, 2005).
- The severity of these errors depends on the accuracy standards met by each map and the physical changes that have occurred since the publication of the map (Anders & Byrnes 1991).
- Uncertainty ranges (error bars) are smaller and the confidence of erosion rate data is greater when using long-term data rather than short-or medium-term data.
- The use of long-term data produces alongshore erosion rate profiles that are spatially smoother than short- or medium-term data
- The use of longer temporal spans acts to filter out short-term fluctuations (noise) from the long-term trend (signal).



- Forecasting guidance signifies the desirability of using data spanning duration at least twice as long as the projection interval. This demonstrates the importance of long term data in defining construction setbacks. (Mark Crowell, Stephen P. Leatherman, Michael K. Buckley, 1993).

7.4.2 Shoreline Assessment

The Digital Shoreline Analysis System (DSAS) is computer software that computes rate-of-change statistics from multiple historic shoreline positions residing in a GIS. It is used worldwide as a method for assessing shoreline change. It is useful for computing rates of change for just about any other boundary change problem that incorporates a clearly-identified feature position at discrete times. The software uses a reference baseline method as the starting point for transects that cross through a time series of shoreline positions. Output data include a variety of rate metrics including end-point and several regression methods like ordinary least square, weighted least squares, and least median of squares. The shoreline change rate was calculated by dividing the distance of shoreline movement by the time difference between the oldest and the most recent shoreline. End point rate (EPR) is a simple and popular approach adapted to calculate the shoreline change rates. Two shoreline dates is the minimal requirement for rate computation. Following equation is used for EPR calculation.

RSC (m/yr) = Distance between shorelines/Time difference between oldest and youngest shoreline

7.4.2.1 Shoreline analysis

Demarcating and assessing the shoreline for a given study area before going into the field has advantages that includes

- Promoting effective hypothesis for locating the vulnerable sites
- Aiding the selection and evaluating of the critically vulnerable sites
- Providing a baseline data on historic changes on shorelines

Steps involved in the present shoreline stability analysis through satellite imagery

- Shoreline of Tamil Nadu is demarcated with the help of Google Earth based on the historical maps available which ranges over a period of 2004-2016.



- The coastal stretch is divided into 5 km so that the entire shoreline analysis is executed in around 1:5000 scale.
- Google earth have the updated and latest image available to the users and it is less time consuming.
- A variety of supplementary data can be easily viewed by clicking on a feature of interest in Google earth and the mapping or the demarcation presented in Google Earth instantly makes the data presentation look professional with relatively little effort.
- The demarcated shorelines for different years of each stretch is superimposed for computing shoreline change rate using DSAS.
- The software uses a reference baseline method as the starting point for transects that cross through a time series of shoreline positions.
- The user supplies sequential shoreline vectors and a reference baseline as inputs and DSAS generates orthogonal transects from the baseline that intersect the shorelines.
- These transect-shoreline intersections provide the measurement locations used to estimate rates of change for the time series data.
- Calculations are performed using an external module included in the DSAS distribution that provides users the option of developing their own calculation modules.
- In addition to statistical outputs, DSAS automatically generates metadata when transect locations are created when rate calculations are performed.
- DSAS captures user-input variables and processing steps within the transect metadata file, providing automated recordkeeping of calculation parameters and settings used when generating transects and performing rate of change calculations
- The software presently works as an extension within ESRI's Arc Map application but an open-source, web-based application is currently being considered.
- Based on the accretion and erosion rate a vulnerability scale is defined which effective in channelizing the field study.
- Predictions were rechecked and compared with The Shoreline Change Analysis Atlas of the Indian Coast prepared by Space Application Centre (ISRO) and also with National Assessment of shoreline change for Tamil Nadu coast prepared by National Centre for Sustainable Coastal Management (NCSCM)



8 PROJECT BENEFITS

8.1 General

The proposed Groynes & Breakwaters as erosion prevention structures will prevent further erosion and also will physically protect the eroding coastline along Karikattukuppam village, Thiruporur Taluk, of Chengalpattu District.

These structures will enable the natural self-adjusting and regulation processes under the influence of wave, current and tidal effect. The project location will regain the stability of the coastline with sand bypassing between the Groynes.

The proposed Groynes & Breakwaters will provide coastal security against any extreme events for the peoples and property.

8.2 Human Security

Groynes can provide the stabilized coastal conditions from the vulnerability of erosion and prevention of sea level rise and flow landwards. Groynes & Breakwaters also provides a sense of security among the peoples who are in the nearby villages.

A significant flow of pilgrims always engaged in the project location and hence shoreline management is important.

The properties of artesian community in the Karikattukuppam will be saved with secured conditions ensured even at the times of extreme conditions, with the proposed Groynes & Breakwaters in place.

8.3 Fishing Activities

The fishing activities will improve in the given location as the proposed Groynes & Breakwaters will enable the fishing vessels to move landwards where boats can be docked and repaired.

In the long run, if beach nourishment activities will be addressed for Groynes or alternatively it happens over a time by natural littoral drift in the location, the lost beaches can be retrieved. This will further enhance the fishing activities in the project location.



8.4 Marine Biology

The change in the physical characters, like stone rubbles in place of sand, will change the type and account of species of microorganisms, briefly. However, over a time the exposed stone surfaces will offer a specific habitat for flora and fauna.



9 ENVIRONMENTAL MANAGEMENT PLAN

9.1 General

Environmental Management Plan (EMP) is envisaged as framework action plan for the proposed construction to ensure the designated performance of these structures in the project location. The Plan is essentially like a continuous augmentation works, distinctly and exclusively for Groynes & Breakwaters to prevent further erosion and protect the shoreline with regained beach.

The EMP, however, devised for three different phases of the project implementation:

- Planning and Designing Phase
- Establishment and Construction Phase
- Operation and Maintenance Phase

Requisite EMP framework shall be in force, right from site earmarking and development. Perhaps, the course of activities shall continue for ensuring the sustainable performance of the proposed Groynes, Breakwaters and Net Mending Shed.

Environmental Management Systems (EMS) is the environmental Policies and programs for Department of Fisheries, being the project implementation agency of State Government. Coastal studies, environmental evaluation and monitoring, Site development, Technology alternatives for Groynes, evaluation of performance, Risk Management and Disaster Management are the Core of activities be defined for the development of EMS for EMP framework.

9.2 Planning and Designing Phase

The proposed Groynes & Breakwaters shall be planned for its ecological sensitivity, regulated and compatible coastal conditions, pollution control and monitoring systems, Risk Assessment and Disaster Management Systems.

The establishment activities of these structures shall be compatible to the ecologically sensitive shore conditions and people around. The village boundaries and human settlements are primary important in sizing the extent of project line for erecting the proposed Groynes & Breakwaters. EMS is framed to explicit environmental policy with environmental performance objectives for these structures in erosion prevention and shoreline protection.



9.2.1 Evaluation of Coastal Processes

The Coastal physical features like its zone classification as defined under CRZ Notification, 2011. The Wave and Wind data were collected as long term data from and modeled by IIT (M) for Wave Climate and Coastal processes like Sediment Transport.

9.2.2 Sitting

Department of Fisheries have identified the project location based on the recommendations of IIT (M) on erosion prone shorelines.

The location was evaluated for the following:

- Erosion status
- Community nearby
- Human security
- Value of property
- Land acquisition
- Sensitivity of Area Biological, social and economical
- Drainage pattern & Topography
- Physical infrastructure like approach roads
- Pollution index of the area
- Economics of Establishment

The project location abetting Karikattukuppam is evident for its vulnerability for erosion.

9.2.3 Consultative Process

The local bodies of the adjoining villages were taken into long and proactive consultations by Department of Fisheries, for evaluating the selection index of the proposed site for providing SPS.

9.2.4 Planning Guidelines

CRZ Notification and Shoreline Protection Standard Practices are the two important planning guidelines.



9.3 Establishment and Construction Phase

The SPS constructions involves very elaborated works at site viz.

- Site earmarking
- GPS Positioning, Leveling and land development

9.3.1 Site Cleaning

The existing coastal, social and profile should not be disturbed. Any disturbance made to it, should be compensated for more amount of the same biological profile, as per the recommendations of MoEF&CC.

9.3.2 GPS Positioning, Leveling and Land Development

The project location was surveyed for its project.

9.4 Operations and Maintenance Phase

Department of Fisheries will have very elaborate program of schedule and plan of actions for a detailed EMP, for the monitoring and augmentation phase, in consultation with the member Enterprises. The monitoring and maintenance of these structures will be on annual basis.

Department of Fisheries will have very elaborate program of schedule and plan of actions for a detailed EMP, for the monitoring and augmentation phase, in consultation with the member Enterprises. The monitoring and maintenance of these structures will be on annual basis.

The EMP for Department of Fisheries administration will, anyhow, largely for

- Collection of data on Wind/Wave
- Collection of data on Coastal processes like Cyclone, sea level rise, etc.,
- Augmentation of Structures and Repairs

9.4.1 Collection of data on Wind/Wave

The Data on Wind and Wave may continuously be documented by collection them from IMD.

9.4.2 Collection of data on Coastal Processes

Department of Fisheries can record data from IMD on coastal extremes like Cyclone, Storm surges, etc., in the project location on annual basis.

These data are required to develop the future augmentation of Groynes & Breakwaters. The continuous monitoring for flood level, tidal effect, etc., is important so as to extend them in the future as augmentation for better performance and response to coastal processes.



9.4.3 Repair & Augmentation of Structures

The Groynes & Breakwaters requires specific means of repair and augmentation, if they physically displaced under any extreme coastal processes like Cyclone and Tsunami.

Department of Fisheries shall develop an annual plan for this purpose of continual augmentation of these structures.

9.5 Environmental Cell

An exclusive set up of executives and a team of skilled peoples will be formed as core active group as Environmental Cell. The cell will have a head with approvals for financial allocation, and responsibility drawn. The cell will evaluate the EMP on annual basis and will envisage a budgetary allocation to implement from the Department of Fisheries administration. The Environmental Cell is presented in Figure.9.1.

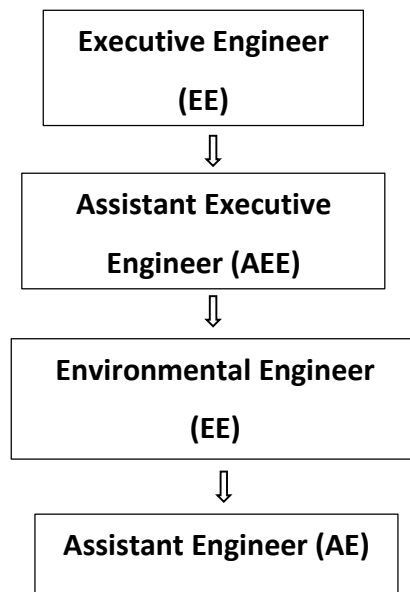


Figure 9-1 Environmental Cell



10 SUMMARY AND CONCLUSION

The East Coast of Tamil Nadu is characteristically known for sand dunes and bars and precisely for accretion shore conditions. However, the unprecedented disastrous events of Tsunami (2004) and Thane (2011) in the Coast of Tamil Nadu have become historical data for characterizing the coastal vulnerability to Natural Hazards. The loss of life and property has become one of the most disturbing remembrances to the coastal population. The eroding shoreline and its vulnerability to natural disasters have made the coastline of the proposed project location in the National Agenda.

The fisherman habitations and their activities on the shoreline have become major Environmental Concern due to Natural and Anthropogenic stresses of changes like sea inundation, beach erosion, wave characteristics, etc., Coastal erosion with rise in sea level and changes in the wave climate is one of the major global issues in the Coastal Environment. There are many global and national initiatives initiated to save our precious coastal resources and sustenance fishing community. The options for shoreline protection are classified broadly under two categories viz., soft and hard engineering structures.

The Soft options like beach nourishment are costlier and hard options like Sea Wall is learnt to be disturbing the fragile interface of human and sea coast. The Groynes, too do interfere the natural processes in the shoe line, apart from obscure the scenic beauty .However, they ensure the natural and direct access and functional negotiations of fishing community, unlike the RMS.

Department of Fisheries, Government of Tamil Nadu has proposed Groynes & Breakwaters as Shoreline Protection Structures (SPS) in the Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District. The Budgetary Estimate of the proposed fish landing centre is INR 9.70 Crores. The geographical location is 12° 43' 52.37" N & 80° 14' 14.01" E Longitude along the East Coast line in Bay of Bengal.

The proposed Shoreline Protection Structure is envisaged with a Groynes & Breakwaters to functionally complementing to safeguard the shoreline from erosion by interfering with along shore movement of sediment. The Groynes & Breakwaters is planned and designed strategically by IIT (M) to address the immediate requirement for erosion prevention and sea inundation, based on the model on coastal dynamics and sediment transport.



Although Groynes are not environmentally favored as they can obscure the nature and preventing direct and functional access to shore for fishing activities , it has become must and unavoidable in the project location to save a population of more than 4500 living in both Karikattukuppam village.

Improper design and execution of RMS and Groynes will cause down drift impacts and the problem of erosion and sea inundations cannot be negotiated in a sustainable way. Hence, Impact identification and management plan must be in place. Continuous monitoring on performance and structural stability of the coastal structures are very important as they are highly vulnerable for distortion and damage due to anthropogenic and natural hazards.

Environmental Management Plan was envisaged based on the comprehensive evaluation on

- Project Description
- Description of Environment
- Impact Evaluation and Assessment
- Analysis of Alternatives
- Environmental Monitoring Plan
- Additional Studies
- Project Benefits

The EMP outlined the required Strategies, Programs and Protocol of activities to ensue sustainable operation of Groynes in the project location in harmony with the Coastal environment and to the requirements and sustenance of fisherman community.

The Coastal environment and the human attribute in the project location will be ensured sustenance with the implementation of the proposed groynes field as Shoreline Protection Structures in the project location, Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District.



11 DISCLOSURE OF CONSULTANT ENGAGED

This chapter describes about the environmental consultant engaged in preparation of EIA report for Proposed Fish Landing Centre and Shore Protection Works along with Boat Berthing facilities at Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District, Tamil Nadu by Department of Fisheries.

11.1 Introduction

ABC Techno Labs India Private Limited (formerly ABC Environ Solutions Pvt. Ltd.) is an ISO 9001, ISO 14001 & OHSAS 18001 Certified Company & leading Environmental Engineering & Consultancy Company constantly striving towards newer heights since its inception in 2006. Our Company is dedicated to providing strategic services in the areas of Environment, Infrastructure, Energy, Engineering and Multilab.

It is the first firm to be accredited by NABET (National Accreditation Board for Education and Training), Quality Council of India, as an EIA Consultant, approved for carrying out EIA studies and obtaining environmental clearance for various sectors such as Thermal Power Plants, Infrastructure, Industrial Estates/Complexes/Areas, Mining, Township & area development and Building construction projects etc. ABC Techno Labs is equipped with in-house, spacious laboratory, accredited by NABL (National Accreditation Board for Testing & Calibration Laboratories), Department of Science & Technology, Government of India.

Since establishment ABC Techno Labs focus on sustainable development of Industry and Environment based on sound engineering practices, innovation, quality, R&D and most important is satisfying customers need. The company has successfully completed more than 100 projects of a variety of industries, in the field of pollution control and environmental management solutions. The company is also dealing in the projects of waste minimization and cleaner production technology.

The team of technocrats and scientist are well experienced to deal with the design, Manufacture, Fabrication, Installation, commissioning of Effluent/ Wastewater treatment plants, Sewage Treatment plants, and Combined Treatment plants. The company is having well-experienced team of Scientists & Engineers who are looking after environmental projects & well-equipped analytical laboratory with a facility including analysis of physical, chemical



and biological parameters as per the requirements of the State Pollution Control Board and our clients.

11.2 Services of ABC Techno Labs India Private Limited

Environmental Services

- Environmental Impact Assessment (EIA)
- Environmental Management Plan (EMP)
- Social Impact Assessment (SIA)
- Environmental Baseline data collection for Air, Meteorology, Noise, Water, Soil, Ecology, Socio-Economic and Demography etc;
- Environmental Monitoring
- Socio-Economic Studies
- Resettlement & Rehabilitation Plan
- Ecological & Human Health Risk Assessment Studies
- Ecological Impact Assessment
- Environmental Management Framework
- Solid Waste Management
- Hazardous Waste Management
- Internship & Training

Turnkey projects

- Water Treatment Plants
- Sewage Treatment Plant
- Recycling & Water Conservation Systems
- Zero Discharge System

Other services

- Operation & Maintenance of Water & Waste Water Plants
- Water & Waste Water Treatment Chemicals
- Pilot Plant studies
- Feasibility studies & preparation of budgetary estimates

Laboratory services

- Chemical Testing



- Environmental Testing
- Microbiological Testing
- Food Testing
- Metallurgical Testing

11.3 Sectors Accredited by NABET

S.No.	Sector No.	Name of sectors
1	1	Mining of Minerals including Opencast & Underground Mining
2	2	Offshore & Onshore Oil and gas exploration, development & productions
3	3	Irrigation Projects
4	4	Thermal Power Plant
5	7	Mineral Beneficiation including palletisation
6	8	Metallurgical Industries – (Ferrous only) Secondary
7	9	Cement Plants
8	10	Petroleum Refining Industry
9	15	Leather/Skin/hide processing industry
10	16	Chemical Fertilizers
11	17	Pesticides industry and pesticide specific intermediates
12	18	Petro-chemical Complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)
13	21	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediated excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)
14	22	Distilleries
15	25	Sugar Industry
16	27	Oil & gas transportation pipe line (crude and refinery/ petrochemical products), passing through national parks / sanctuaries / coral reefs / ecologically sensitive areas including LNG Terminal
17	28	Isolated storage & handling of hazardous chemicals (As per threshold planning quantity indicated in column 3 of schedule 2 & 3 of MSIHC Rules 1989 amended 2000)
18	29	Airports
19	31	Industrial estates/ parks/ complexes/ areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes
20	33	Ports, Harbours, Jetties, Marine terminals, break waters and dredging
21	34	Highways, Railways, Transport terminals, mass rapid transport system
22	36	Common Effluent Treatment Plants (CETPs)
23	37	Common Municipal Solid Waste Management Facility (CMSWMF)
24	38	Building and large Construction projects including shopping malls, multiplexes, commercial complexes, housing estates, hospitals, institutions
25	39	Townships and Area development projects



Source: ABC Techno Labs India Pvt. Ltd.

11.4 Study Team

ABC Techno Labs India Private Limited has carried out this Environmental Impact Assessment (EIA) study. The multidisciplinary team included expertise in Environmental Impact Assessment, Air & Water pollution & Control measures, Noise Control measures, Ecology & bio-diversity, Land use, Geology, Environmental Chemistry and Socio-Economic planner. The team members involved in EIA study area:

Sl. No.	Name	Role
1.	Mr.M.S.Bhaskar	FAE – Geology (GEO)
2.	Mrs.K.Vijayalakshmi	FAE – Air Quality Modelling & Prediction (AQ) FAE – Risk Assessment (RH) FAE – Noise and Vibration (NV)
3.	Mrs. S.Sathya	FAE – Solid and Hazardous Waste (SHW)
4.	Abhik Saha	FAE – Ecology and Biodiversity (EB)
5.	Mr. Sushil Meshram	FAE – Socio-Economic Expert (SE)
6.	Dr. R.K.Jayaseelan	FAE- Land use, Prevention & Control (LU)
7.	R.Rajendran	FAE- Soil Conservation (SE)
8.	Ms.Manika Hugar	FAE- FAE – Water Pollution (WP)
Team Members		
9.	Banu Priya. J	FAA
10.	M S Saravana	FAA
11.	Mr.Robson Chinnadurai	Senior Chemist
12.	S. Saravanakumar	FAA- Air Pollution, Water Pollution Prevention and Control
13.	Mr.Venkateshwaralu	Field Technician
14.	Mr. Thavanesan	Field Technician



NABET Certificate of ABC Techno Labs India Private Limited



Quality Council of India

National Accreditation Board for Education & Training



CERTIFICATE OF ACCREDITATION

ABC Techno Labs India Private Limited, Chennai
"ABC Tower", 400, 13th Street, SIDCO Industrial Estate North Phase, Ambattur, Chennai 600098

Accredited as Category - A organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA-EMP reports in the following Sectors:

Sl. No.	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals including open cast/ underground mining	1	1 (a) (i)	A
2	Offshore and onshore oil and gas exploration, development & production	2	1 (b)	A
3	River Valley projects	3	1 (c)	A
4	Thermal power plants	4	1 (d)	A
5	Mineral beneficiation including pelletisation	7	2 (b)	B
6	Metallurgical industries (ferrous & non-ferrous)	8	3 (a)	B
7	Cement plants	9	3 (b)	A
8	Petroleum refining industry	10	4 (a)	A
9	Asbestos milling and asbestos based products	12	4 (c)	A
10	Leather/skin/hide processing industry 4	15	4 (f)	A
11	Chemical Fertilizers	16	5 (a)	A
12	Petro-chemical complexes	18	5 (c)	A
13	Petrochemical based processing	20	5 (e)	A
14	Synthetic organic chemicals industry	21	5 (f)	A
15	Distilleries	22	5 (g)	A
16	Pulp & paper industry excluding manufacturing of paper from wastepaper and manufacture of paper from ready pulp without bleaching	24	5 (i)	A
17	Sugar Industry	25	5 (j)	B
18	Oil & gas transportation pipeline, passing through national parks/ sanctuaries/coral reefs / ecologically sensitive areas including LNG terminal	27	6 (a)	A
19	Isolated storage & handling of hazardous chemicals	28	-	B
20	Airports	29	7 (a)	A
21	Industrial estates/ parks/ complexes/ Areas, export processing zones(EPZs), Special economic zones (SEZs), Biotech parks, Leather complexes	31	7 (c)	A
22	Common hazardous waste treatment, storage and disposal facilities (TSDFs)	32	7 (d)	A
23	Ports, harbours, break waters and dredging	33	7 (e)	A
24	Highway	34	7 (f)	A
25	Common Effluent Treatment Plants (CETPs)	36	7 (h)	B
26	Common Municipal Solid Waste Management Facility (CMSWMF)	37	7 (i)	B
27	Building and construction projects	38	8 (a)	B
28	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated Jan 17, 2020 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/20/1257 dated March 02, 2020. The accreditation needs to be renewed before the expiry date by ABC Techno Labs India Private Limited, Chennai following due process of assessment.


Sr. Director, NABET
Dated: March 02, 2020

Certificate No.
NABET/ EIA/1922/ RA 0155

Valid till
May 24, 2022

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.



NABET Validity Extension Certificate of ABC Techno Labs India Private Limited



National Accreditation Board for Education and Training



QCI/NABET/ENV/ACO/22/2473

August 08, 2022

To
ABC Techno Labs India Private Limited,
"ABC Tower", 400, 13th Street,
SIDCO Industrial Estate North Phase, Ambattur
Chennai-600098, Tamil Nadu

Sub.: Extension of Validity of Accreditation till November 07, 2022– regarding
Ref.: Certificate no. NABET/EIA/1922/RA0155

Dear Sir/Madam,

This has reference to the accreditation of your organization under QCI-NABET EIA Scheme, the validity of ABC Techno Labs India Private Limited is hereby extended till November 07, 2022, or completion of assessment process, whichever is earlier.

The above extension is subject to the submitted documents/required information with respect to your application and timely submission and closure of NC/Obs during the process of assessment.

You are requested not to use this letter after expiry of the above stated date.

With best regards.

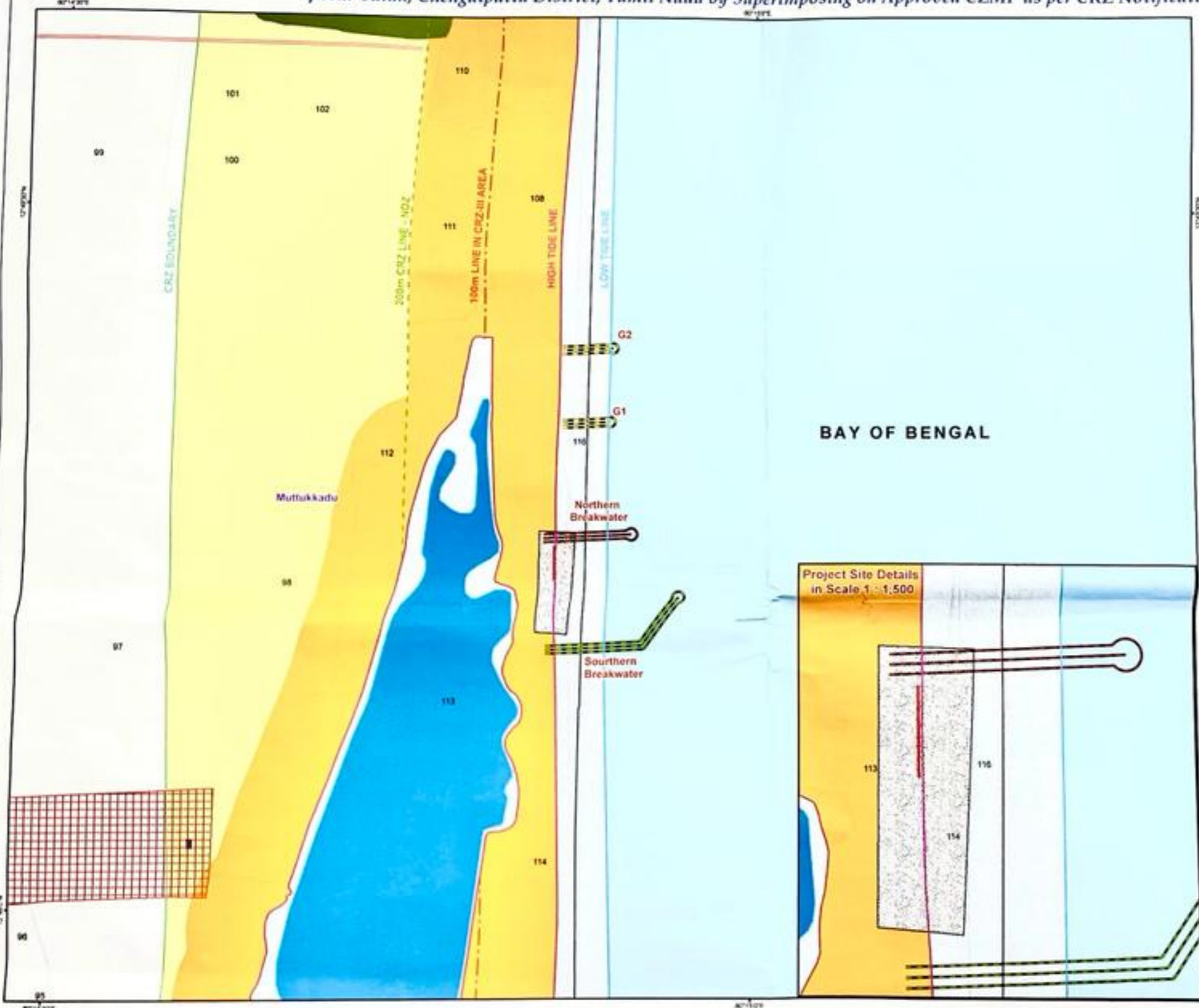
(A K Jha)
Sr. Director, NABET

Institute of Town Planners India, 6th Floor, 4-A, Ring Road, I.P Estate, New Delhi-110 002, India
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ANNEXURE-II

CRZ MAP

Preparation of Local Level CRZ Map for the Construction of Fish Landing Center and Shore Protection Work with Berthing Facilities at Karikattukuppam, Muttukkadu Village, Thiruporur Taluk, Chengalpattu District, Tamil Nadu by Superimposing on Approved CZMP as per CRZ Notification 2011



Legend

SOURCE: APPROVED CZMP (MAP NOS : TN 104) AS PER CRZ NOTIFICATION 2011

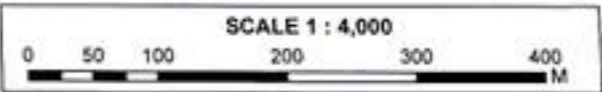
- LOW TIDE LINE (LTL)
- HIGH TIDE LINE (HTL)
- 100m LINE IN CRZ-III AREA
- 200m CRZ LINE - NDZ
- CRZ BOUNDARY (500m FOR SEA, 100m FOR BAY, 100m OR WIDTH OF THE CREEK WHICHEVER IS LESS ALONG THE TOTAL INFLUENCED WATER BODIES)
- ROAD
- SURVEY BOUNDARY
- VILLAGE BOUNDARY
- FISH DRYING OR BOAT PARKING AREA
- FISHERMAN SETTLEMENT
- CRZ - IA
- CRZ - IB
- CRZ - III (NO DEVELOPMENT ZONE)
- CRZ - III (200m TO 500m FROM HTL)
- CRZ - IVA
- HTL REFERENCE POINT

SOURCE: CLIENT

- PROPOSED PROJECT SITE CORNER (GPS SURVEY POINT IDENTIFIED BY THE CLIENT)
- PROPOSED GROYNES
- PROPOSED NORTHERN BREAKWATER
- PROPOSED SOUTHERN BREAKWATER
- PROPOSED DIAPHRAGM WALL
- PROPOSED NET MENDING SHED

Note:

- Coastal Regulation Zone Map of the site is prepared considering Approved CZMP as per CRZ Notification 2011 of MoEF, Govt.
- Superimposition of the Project Site on Approved CZMP is subject to scale and generalisation error.
- The map comes with a report wherein description of CRZ zonation of project layout details are given. This map is to be referenced and used along with the report bearing the same reference no: Au/RS/RS/...2022 DT. ...2022.
- The DGPS Survey was carried out specific to the referred project site boundary only hence, validation of HTL and CRZ Boundary is limited to the clearance of the same. Institute of Remote Sensing do not carry responsibility for CRZ status of other plots or neighbourhood.



PREPARED BY
**INSTITUTE OF REMOTE SENSING
 ANNA UNIVERSITY
 CHENNAI - 600 025**

REF NO. AJR/SKSI/...2022 DT. ...2022

FOR
**THE EXECUTIVE ENGINEER
 FISHING HARBOUR PROJECT DIVISION
 DEPARTMENT OF FISHERIES AND FISHERMEN WELFARE
 CHENNAI - 600 035**

PREPARED BY	
VERIFIED BY	
APPROVED BY	

DRAFT

**CONSTRUCTION OF FISH LANDING CENTRE AND SHORE
PROTECTION WORKS INCLUDING BOAT BERTHING
FACILITIES AT KARIKATTUKUPPAM IN CHENGALPATTU
DISTRICT**



Client

Fisheries Department, Tamilnadu

Consultants

Prof. S. A. Sannasiraj

Prof. V.Sundar



**Department of Ocean Engineering
Indian Institute of Technology Madras
Chennai 600 036, India
October 2022**



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1.0 INTRODUCTION

The Department of Fisheries, Tamilnadu has requested the Department of Ocean Engineering, Indian Institute of Technology Madras to suggest suitable coastal protection measures that could possibly limit the coastal erosion process in the site vicinity of Karikattukuppam. The coastal site of the Karikattukuppam is located at latitude $12^{\circ}49'15.67''N$ and longitude $80^{\circ}14'51.04''E$, in Chengalpattu district. Prior to the implementation of preventative measures, the Department of Fisheries, Tamilnadu conducted a bathymetry and topographical study of the area. The location of Karikattukuppam is shown in **Fig.1**.

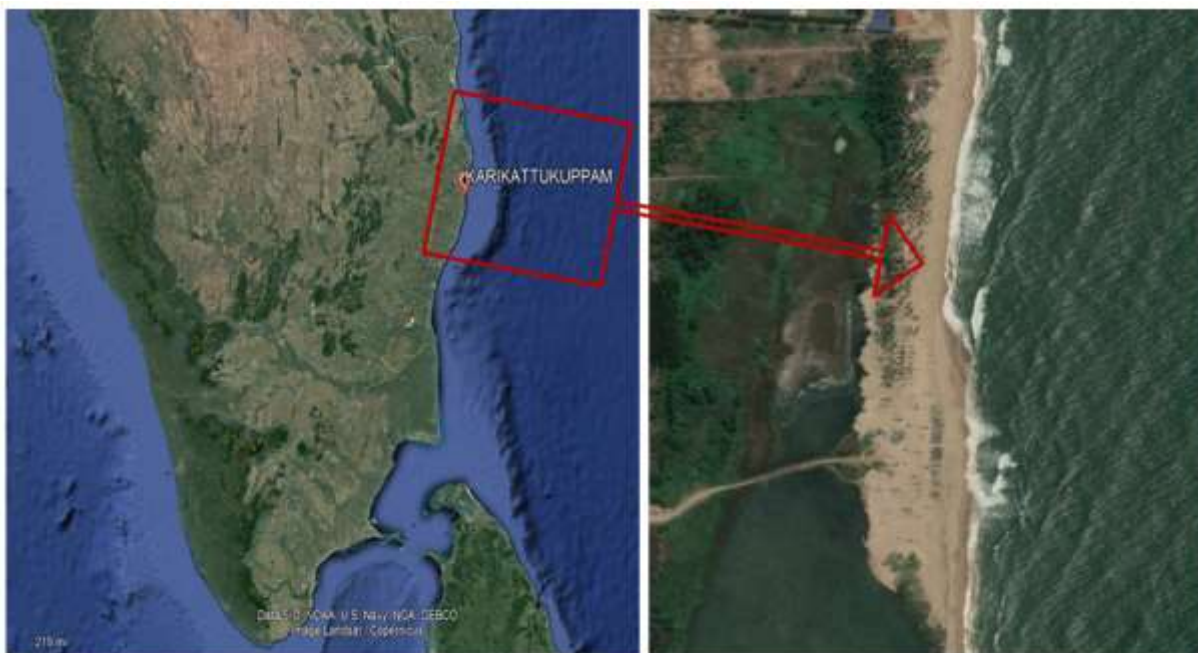


Fig.1 Location of Karikattukuppam site

2.0 OBJECTIVE & SCOPE OF WORK

The objectives of the present study include,

1. Offshore annual wave climate shall be established using the best available data sources.
2. Layout of groynes field suitable for Karikattukuppam coast.
3. Wave tranquility to identify the wave characteristics in the proposed location.
4. The shoreline changes due to the proposed structure i.e., accretion or erosion shall be established.
5. Design of groynes, cross sections and bill of quantity.

3.0 BATHYMETRY

A bathymetry survey for a stretch of about 750 m off the coast of Karikattukuppam has been provided by the Department of Fisheries, Tamilnadu on 9th May 2022 (Surveyed on 15th March 2022) which is shown in **Fig.2** and **Plate (IITM - KKK - BG – 001)**.

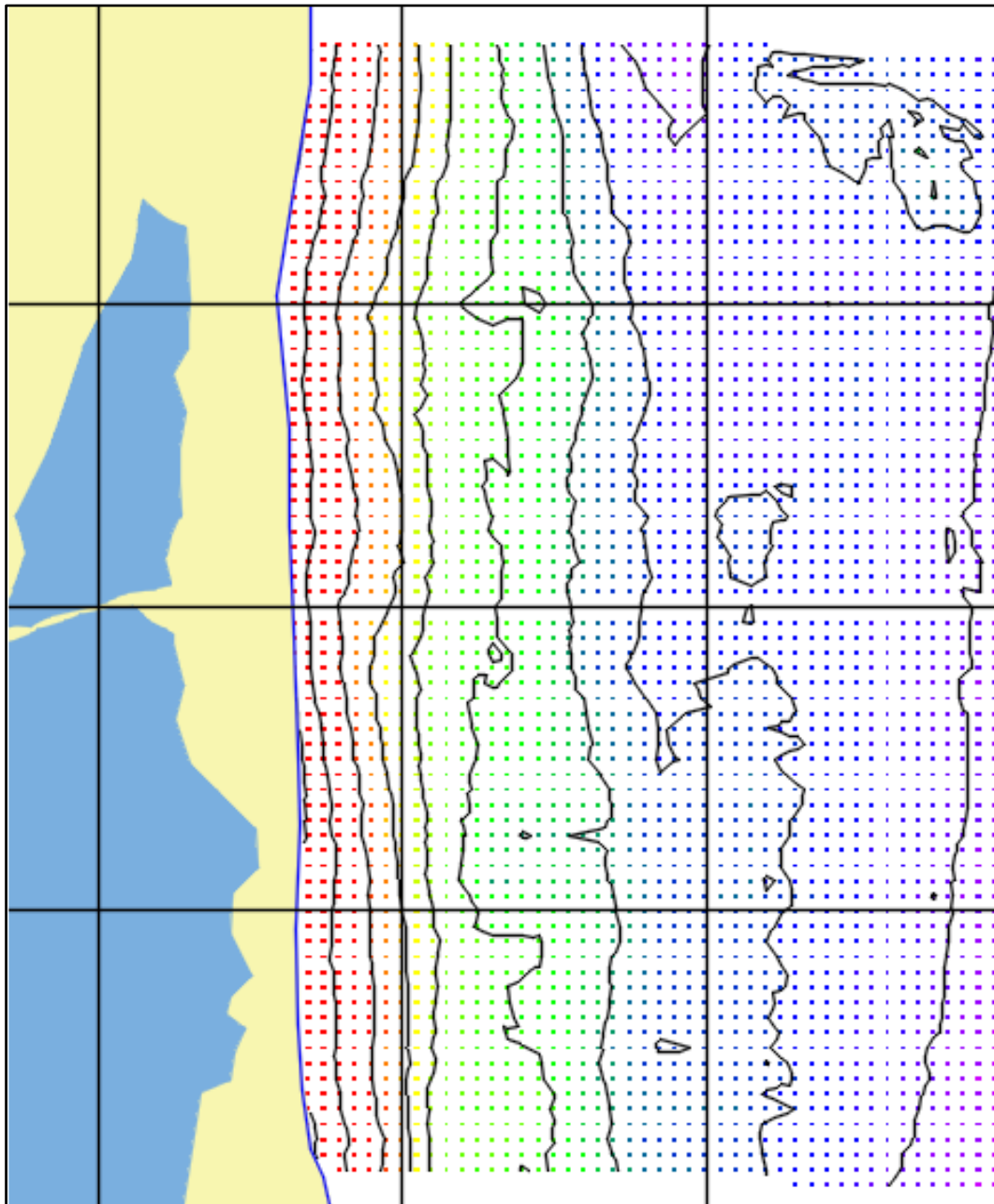


Fig.2 Bathymetry off Karikattukuppam stretch provided by the Department of Fisheries, Tamilnadu



4.0 OFFSHORE WAVE CHARACTERISTICS

The wave characteristics such as significant wave height, mean wave period and mean wave direction at a deep-water location (12°75'00.00"N, 80°05'0.00"E) off Chengalpattu have been extracted at every 6 hours interval from the European Centre for Medium-Range Weather Forecasts (ECMWF). Basically, the wave field follows the wind pattern. It is noted that the spatial variability is closely related, the maximum H_s are associated with maximum wind speeds. The annual percentage of occurrence of significant wave height is presented in **Fig.3**. It is observed that the offshore wave climate of Chengalpattu is predominantly from east and south east.

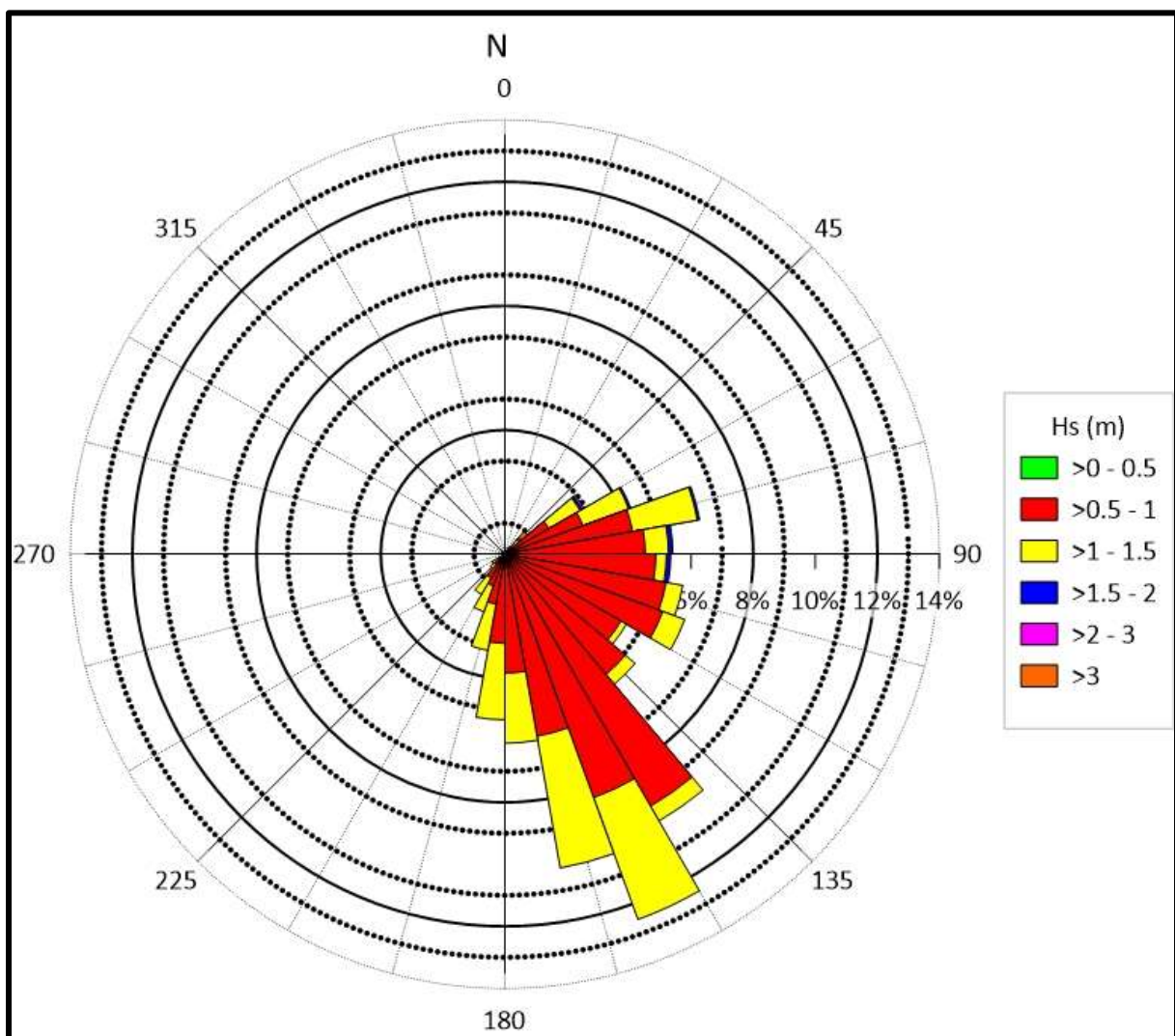


Fig.3 Wave Rose diagram representing the significant wave height (m) along the direction for an annual year



5.0 LITTORAL DRIFT ESTIMATE

5.1 Distribution of Sediment Transport

The wave characteristics such as significant wave height, mean wave period and mean wave direction at a deep-water location (12°75'00.00"N, 80°05'0.00"E), Chengalpattu have been extracted at every 6 hours interval from the European Centre for Medium-Range Weather Forecasts (ECMWF). **Table 1** shows the Wave characteristics for the present study. These are offshore wave climate and are transformed to the near shore location of Karikattukuppam coast using Snell's law. The average breaking wave characteristics were derived from the available wave data. The monthly distribution of mean breaker wave height for the study area is shown in **Fig. 4**. The results indicate that the mean breaker height varies from about 0.80 m to 1.40 m. The breaker height is observed to be a maximum during the month of September. The monthly distribution of the mean breaker wave angle with respect to shore normal is shown in **Fig. 5**. From the results, it is seen that for the study area, the breaker angle with respect to shore normal and longshore current velocity are directed towards North during the months, March to November, and towards the South in January, February and December. The average surf width within which the long shore drift is predominant is further estimated from the breaker wave height for the given bathymetry and is projected in **Fig.6** for the different months. It shows that the maximum surf width of about 90 m during the month of September.

Further, the derived wave characteristics were used to calculate the long shore sediment transport. Three different methods CERC (1984), Komar (1976a), and by integrating the distribution across the surf zone (Komar, 1976b) have been adopted to calculate the alongshore sediment transport rate. The average sediment transport rate for the different months is shown in **Fig.7**. All the three methods have yielded similar order sediment transport rate. The net drift is found to be about 111600 m³ per annum and directed towards the north.



Table 1 Wave characteristics for the present study

	Month	Deep water wave direction w.r.t North	Wave height, $H_s(m)$	Wave period, $T(sec)$
1	January	67	0.9	5.3
2	February	102	0.7	5.3
3	March	138	0.8	5.8
4	April	145	0.9	5.5
5	May	148	1.0	5.5
6	June	183	1.1	5.4
7	July	164	0.9	5.8
8	August	184	1.0	5.5
9	September	160	1.1	7.3
10	October	140	0.9	5.8
11	November	113	1.0	6.2
12	December	83	0.9	5.8

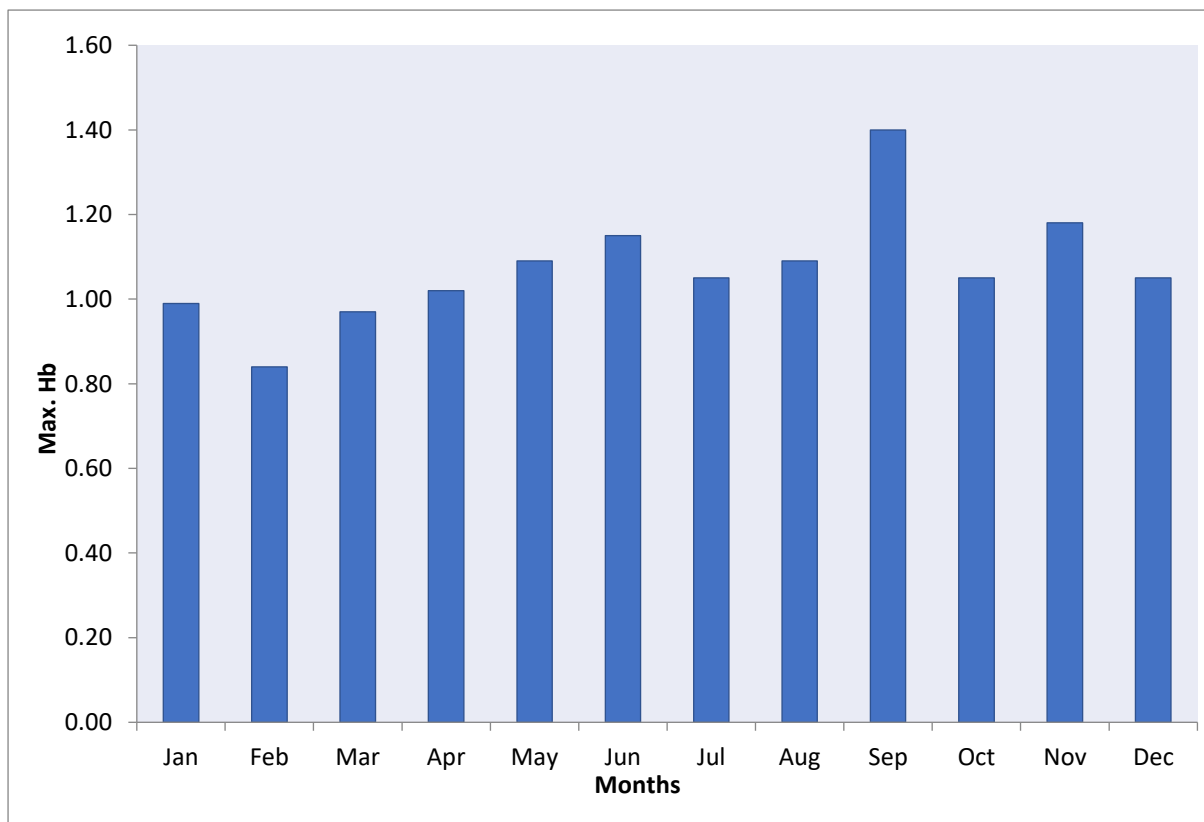


Fig.4 Breaker wave heights in meter

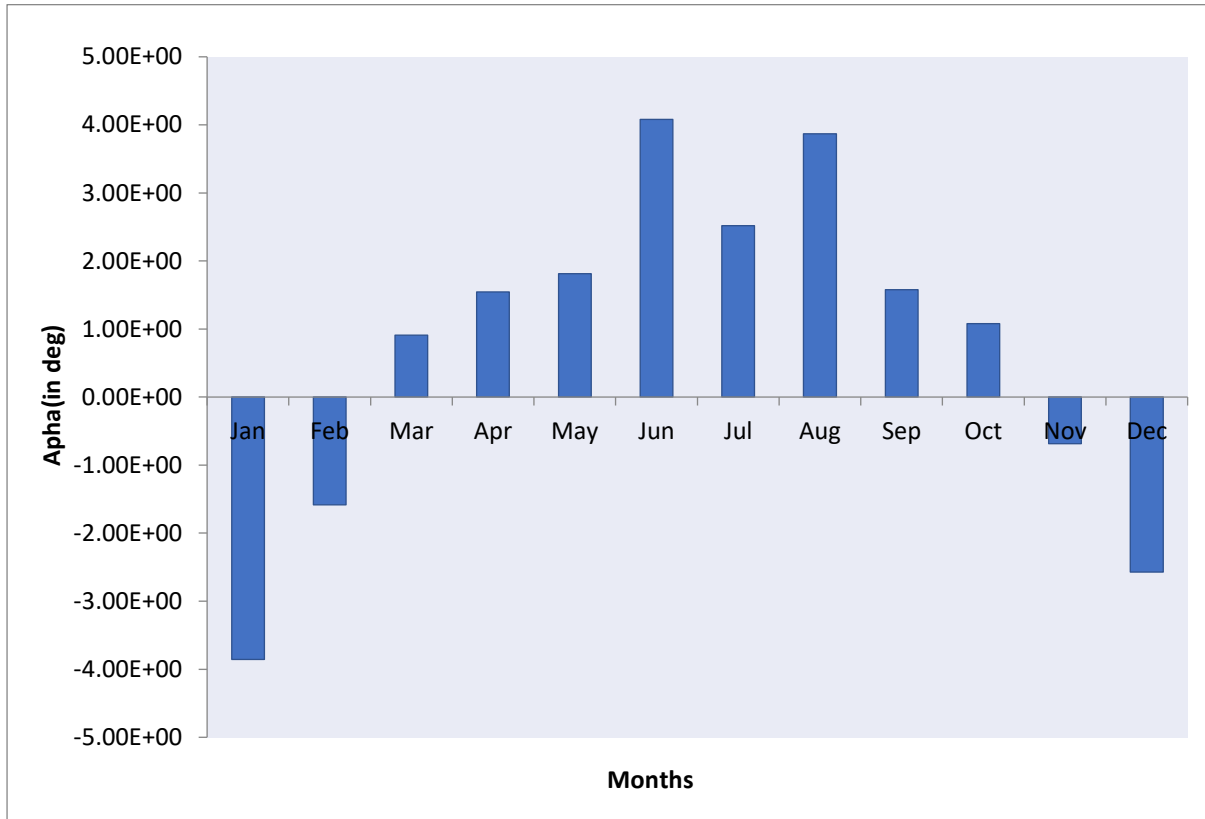


Fig.5 Wave breaker angle

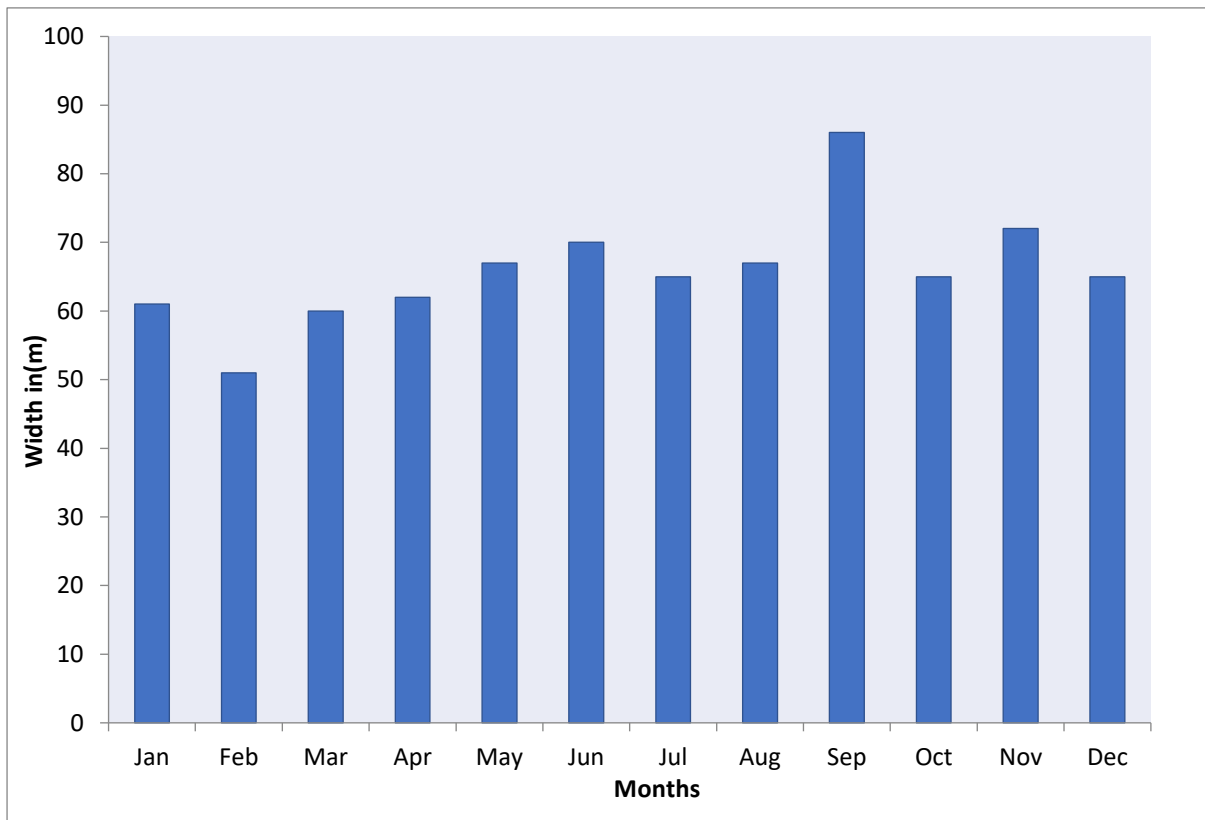


Fig.6 Surf zone width



Table.2 Sediment transport rate (Net Northerly)

Methods	Rate (m ³ /year)
Komar	101000
CERC	114500
Distribution	110110

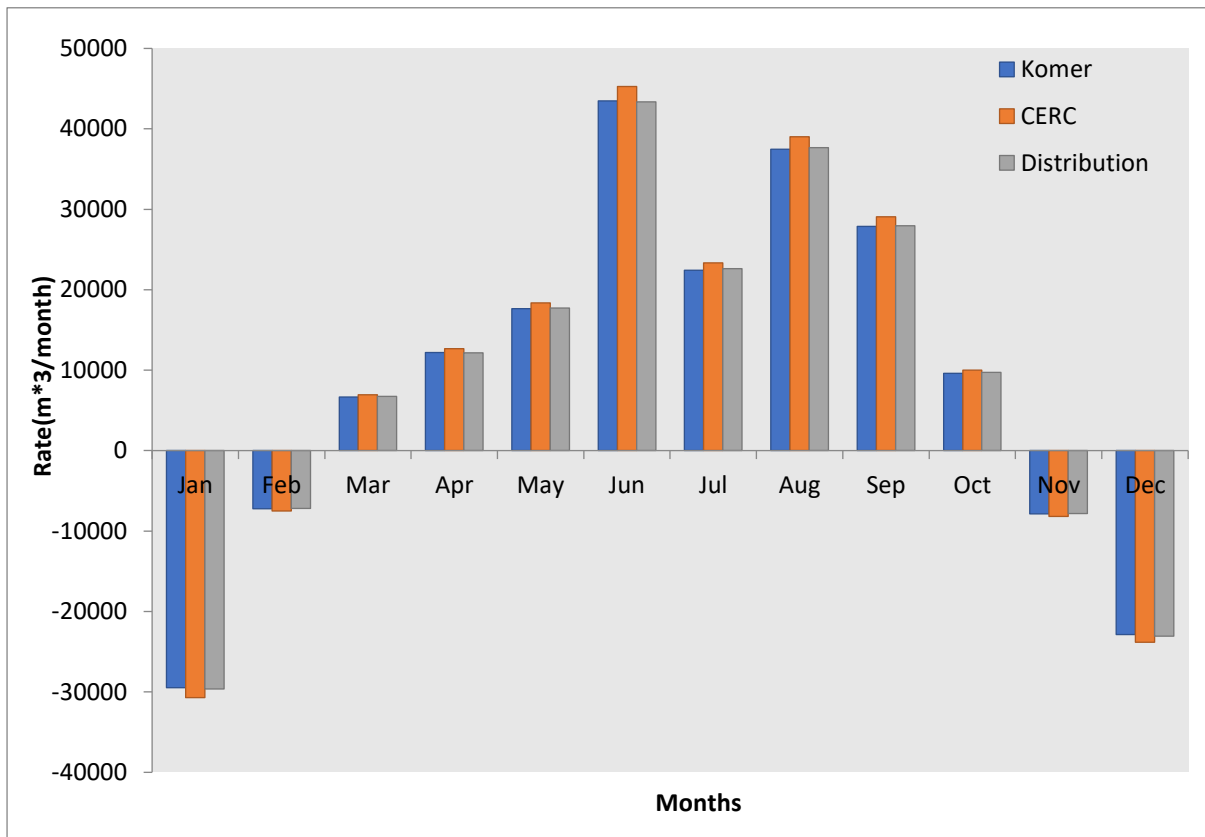


Fig.7 Longshore Sediment transport rate



6.0 PROPOSED LAYOUT OF GROYNES

A pair of breakwater and a pair of groynes have been proposed to protect the coastal stretch (400m) of Karikattukuppam. **Fig.8** depicts an overview of the proposed breakwater and groynes superposed over bathymetry provided by the Tamilnadu fisheries department on 09/05/22. The details of which are projected in **Plate (IITM - KKK - BG - 101 – 01)**. The Southern breakwater and northern breakwater, each of which measuring 160 m and 80 m in length, would reach a maximum water depth of about (-) 4.0 m and (-) 3.0 m respectively. Each of the groynes, G1 and G2 should measure 40 metres and 20 metres in length and extend to about (-) 1.5 m and (-) 1.0 m of water depth respectively.

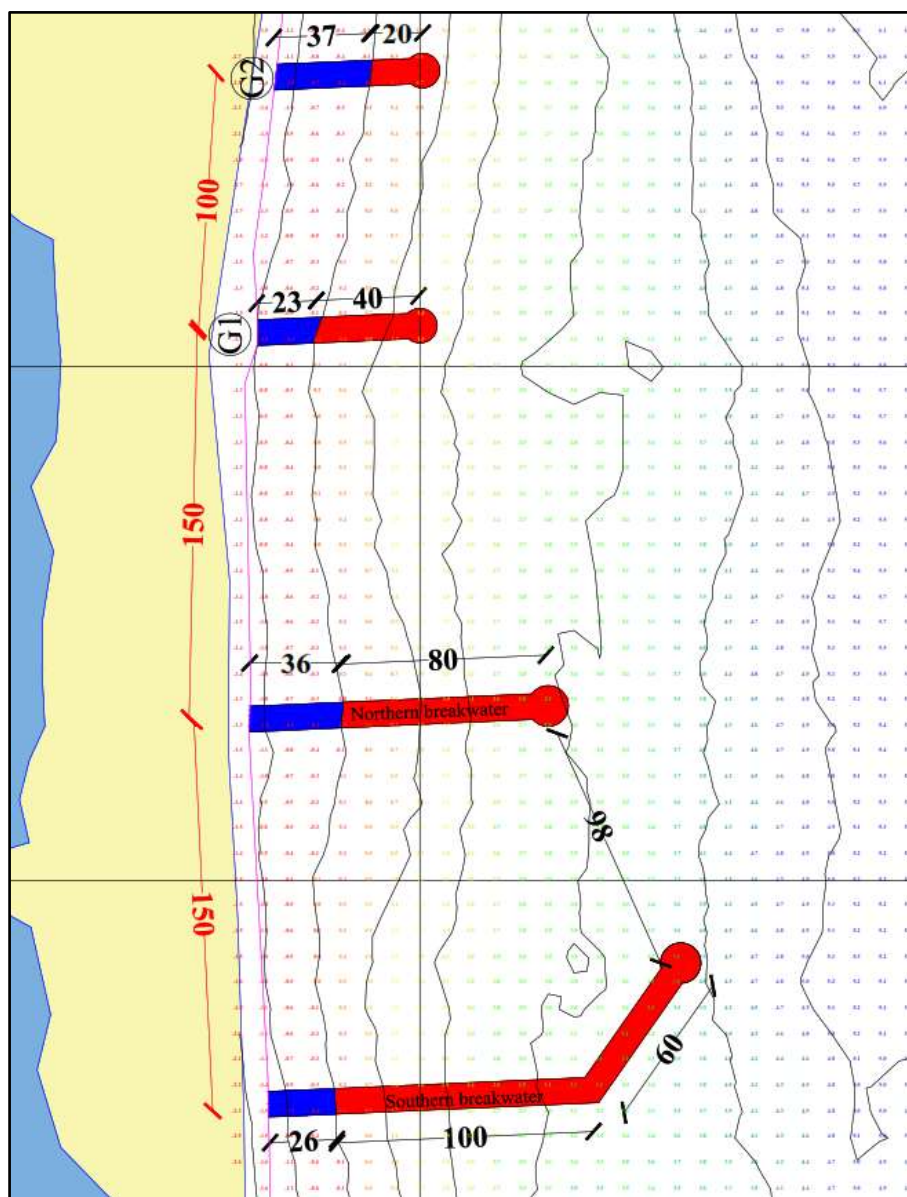


Fig.8 Layout of groynes field



7.0 NUMERICAL MODELLING FOR SHORELINE EVOLUTION

Structures in the near shore environment are built for different purposes, which may be for the formation of artificial harbors, shore protection measures, seawater intake systems, disposal of effluent, etc. There are several configurations of such structures with respect to the shoreline, among which, structures normal to the shore is most common. The construction of a shore-connected structure often leads to changes in the shoreline. This warrants a study on the shoreline due to presence of the shore-connected structures. Such a study is very much essential in planning stage; so as to assess the impact of shore connected structures on the adjacent shoreline.

Numerical models offer the capability to study the effect of the wave characteristics, structure dimensions and other associated parameters in providing reasonable estimates of the shoreline response. As the ocean waves approaches the near shore it undergoes transformations like shoaling, refraction, diffraction and breaking. The phenomena of wave breaking throw sediments to the surface due to the turbulence generated. The sediments in suspension are then driven by the wave-induced currents. Since the direction of waves in the near shore is oblique, the currents induced by them have two components. One along the shore called longshore current mainly responsible for the long shore sediment transport, which plays an important role in the shoreline changes especially due to the shore connected structures. The other component is in the direction normal to the shore, in which case, the mode of sediment transport is called onshore-offshore sediment transport. When a structure normal to the shoreline is constructed, it will intercept the free passage of longshore sediment transport, which results an imbalance in the quantity of sediment in the near shore especially near the structure. This leads to accretion on the up-drift side and erosion on the down drift side of the structure.

Methodology

Kraus and Harikai (1983) proposed a numerical scheme to solve the one line model using Crank Nicholson implicit finite difference method. The non-dimensional equation of shoreline

$$y_{n,t^*+1}^* = B \{ Q_{n,t^*+1}^* - Q_{n+1,t^*+1}^* \} + C_n$$

$$\text{where } B = \frac{\delta t^*}{2 \times \delta x^*} \text{ and } C_n = B \{ Q_{n,t^*}^* - Q_{n+1,t^*}^* + 2\delta x^* q_{n,t^*}^* \} + y_{n,t^*}^*$$



The non-dimensional shoreline is divided into ‘n’ grid points at equal non-dimensional interval, δx^* . Then shoreline changes over a non-dimensional time, δt^* is calculated using Crank-Nicholson finite difference scheme. The schematic diagram for finite difference scheme is shown in **Fig. 9**

In this method, Q^* at the time interval $(t^* + 1)$ is expressed in terms of the shoreline co-ordinate of y^* , first isolating the term involving α_{sp} (angle of shoreline normal to x-axis) using trigonometric identities. One of the terms involving α_{sp} is then expressed as first order quantities in y^* at time step (t^*+1) .

$$Q^* = K_D^2 \cos(\alpha_o) \sin(\alpha_b)$$

Where, $\alpha_o = \alpha - \alpha_{sp}$ and α is wave direction with respect to x-axis. The definition sketch showing the angles is shown in **Fig. 10**.

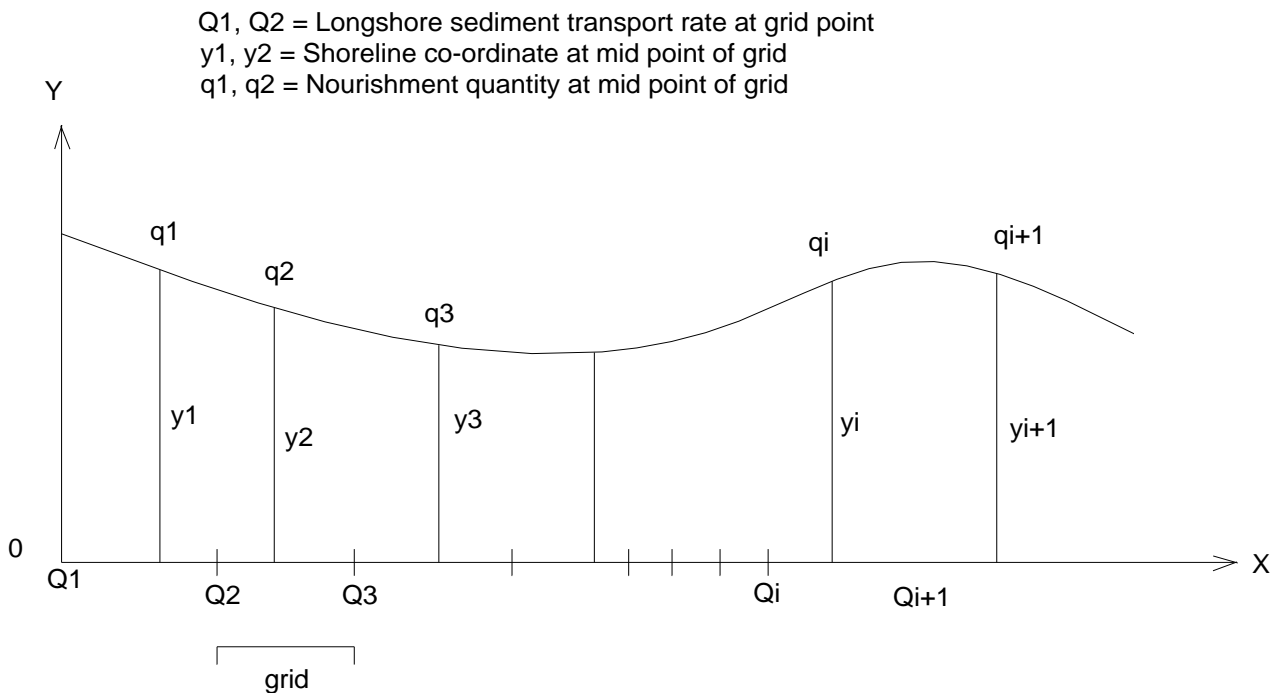


Fig 9. Schematic diagram for finite difference scheme

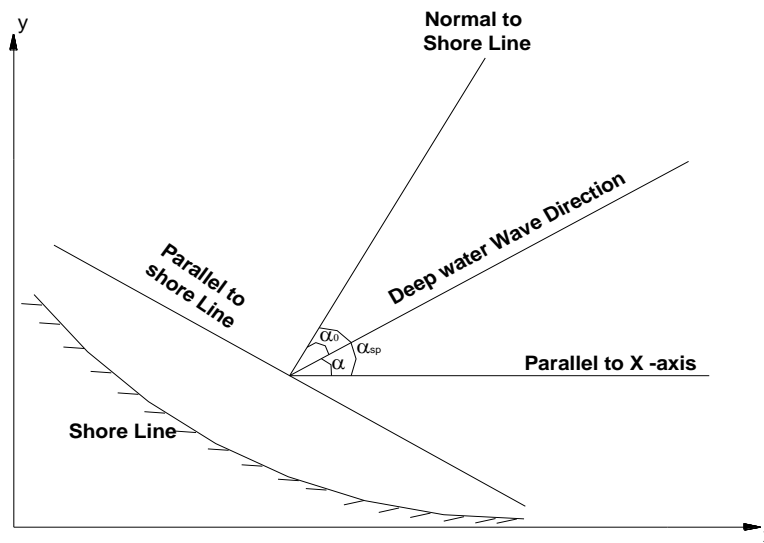


Fig 10. Definition sketch of angles considered

The elliptical form of mild slope equation, which deals with combined refraction-diffraction,

$$Q^* = K_D^2 \cos(\alpha - \alpha_{sp}) \sin(\alpha_b) \quad (1)$$

$$Q^* = K_D^2 \sin(\alpha_b) \left\{ \cos(\alpha) \sin(\alpha_{sp}) \cot(\alpha_{sp}) + \sin(\alpha) \sin(\alpha_{sp}) \right\} \quad (2)$$

$$Q^* = E_n \left\{ y_{n-1,t^*+1} - y_{n,t^*+1} \right\} + F_n \quad (3)$$

Where $E_n = K_D^2 \left\{ \cos(\alpha) \sin(\alpha_{sp,t^*}) \sin(\alpha_{b,t^*}) \right\} / \delta x^*$ and $F_n = K_D^2 \left\{ \sin(\alpha_{sp,t^*}) \sin(\alpha_{b,t^*}) \right\}$

By substituting above equations, give the final equation as given below

$$BE_n Q_{n-1,t^*+1}^* - (1 + 2BE_n) Q_{n,t^*+1}^* + BE_n Q_{n+1,t^*+1}^* = E_n [C_n - C_{n-1}] - F_n$$

The above equations represent a set of (N-1) linear equation for (N-1) unknowns. The end values are specified as boundary conditions, that is, $Q_1^* = 0$ and $Q_{N+1}^* = Q_N^*$. The above equation results into a tri diagonal form which is solved for Q^* . This process is repeated for the entire duration and non-dimensional quantity is converted into real quantities using the corresponding scale factors. The program has been validated with published results.



7.1 Input and Output

The numerical model to predict the shoreline evolution due to the shore-connected structures has been used to predict the shoreline changes due to the proposed groynes over the bathymetry the Department of Fisheries, Tamilnadu the on 9th May 2022. The wave characteristics given as the input to the numerical model is as per given **Table 1**. The length of the groynes, water depth at the end of the groynes and the present status of the shore are to be given as the input to the numerical model.

The numerical model was executed for the most frequently occurring wave characteristics for the different months as stated earlier. The result on the predicted shoreline variations over years are projected in **Fig. 11**. The shoreline prediction has been made at the end of 1 year, 5years, 10years, 15 years, 20 years and 25 years after the construction of the groynes and has been presented by superimposing the shoreline patterns.

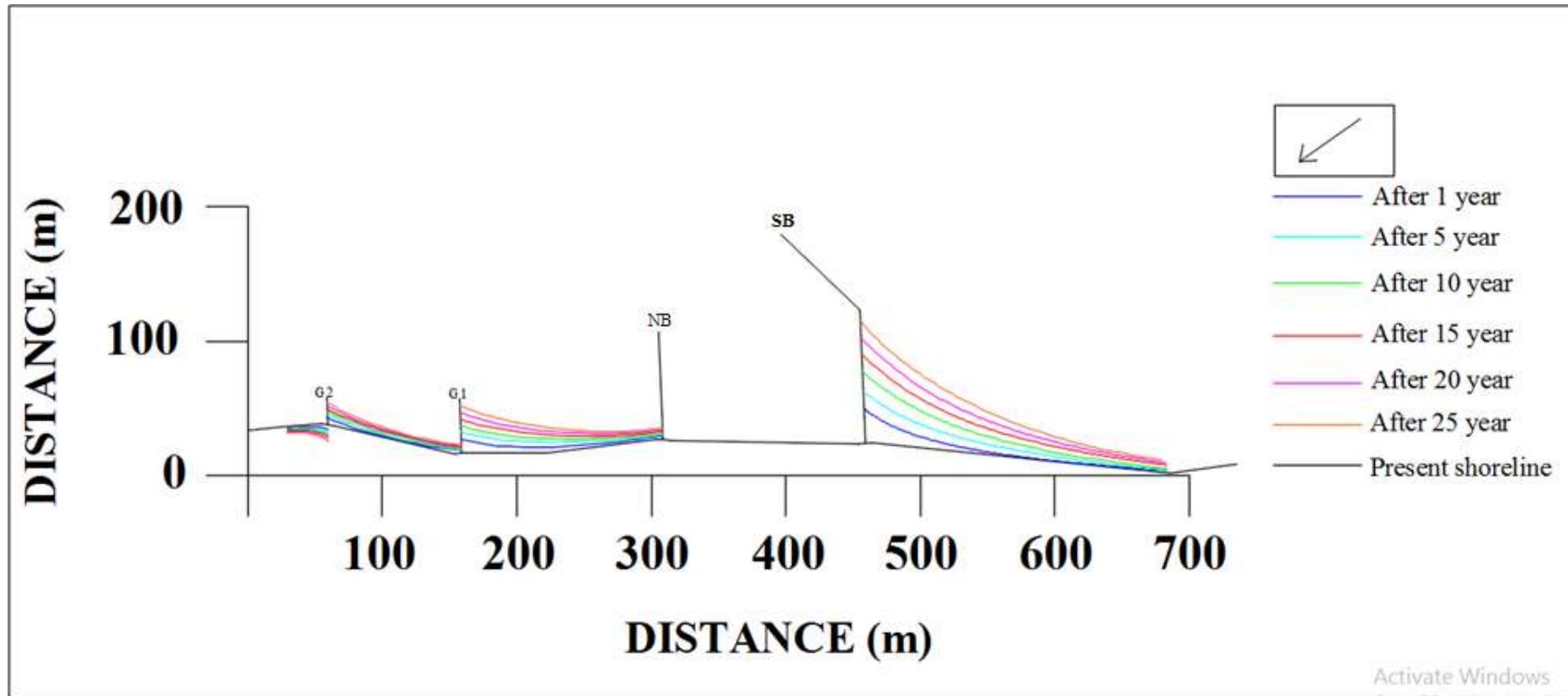


Fig.11 Shoreline evolution



8.0 WAVE MODELLING

8.1 General

The study aims at providing an in-depth analysis on the wave characteristics along the series of groynes at Karikattukuppam. A suitable numerical model is required in order to carry out this task. For the present simulation, the well-known CGWAVE model has been used.

The nonlinear wave propagation associated with most of the observed phenomenon in offshore region (e.g., wave reflection, refraction and diffraction) is generally represented by the shallow water mild slope equation.

$$\nabla \cdot (C_p C_g \nabla \eta) + k^2 C_p C_g \eta = 0 \quad (4)$$

Where,

C_p and C_g are the wave celerity and group celerity respectively.

η is the water surface elevation.

k is the wave number.

For the computation of near shore wave field, this model (Eqn. (4)) is subjected to the proper boundary conditions. This is provided by the bathymetry and the shore line.

8.2 Computational domain

The computational domain roughly approximates a semi-circle of radius 1km. **Fig.12** shows the domain where the computations are actually performed. The direction of the incident monochromatic wave is defined with respect to the geometric northern direction.

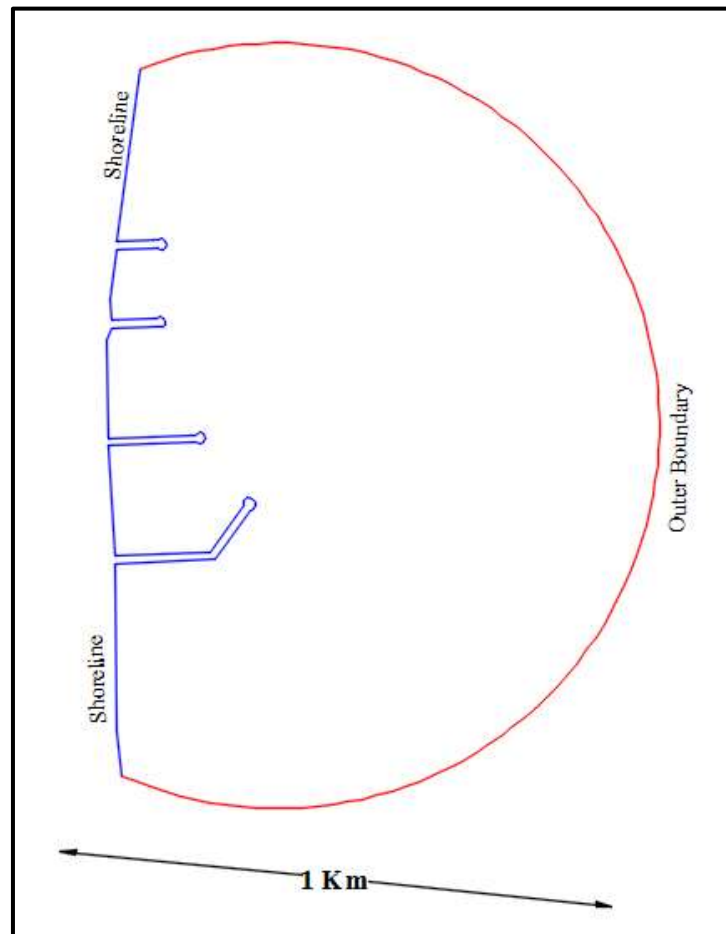


Fig. 12 Computational domain

A numerical method is required to solve the above Eqn. (4) for wave elevation. In this study, Finite Element Method (herein after abbreviated as FEM) is employed. This requires creating a mesh structure in the given computational domain. Upon creation of such a mesh, the domain is represented by nodal points which are connected with each other through the created mesh. The numerical solution of Eqn. (4) is sought in those nodes. This mesh has been generated using the commercial package GAMBIT. The procedure for generation of grid in GAMBIT as follows:

- Based on the region of the sea whose analysis is required add a path in Google earth software.
- Taking the two end nodes of the path draw a semicircle which would represent the domain for which the wave analysis is required.
- Choose the type of elements (tri/quad) and the sizing of mesh.
- Mesh will be generated from which we would be able to know significant wave height and phase at each node.

8.3 Detail of the mesh structure

The CGWAVE model utilizes triangular mesh units in the computational domain. Due to the complexity in the shoreline geometry, an unstructured mesh is desired. Hence a triangular unstructured mesh is generated in GAMBIT, mesh generation software. In such a mesh the nodal spacing is optimized so as to adapt to the nearby portion of the shoreline boundary. The outer semicircular periphery is modeled by 382 nodes with a spacing of 5 m and the inner shoreline is modeled by nodes with a spacing of 5 m. Then an unstructured mesh is created with an average spacing of 5 m inside the domain. This leads to a total number of 26531 nodes with 52308 numbers of triangular elements. The mesh is shown in **Fig. 13**.

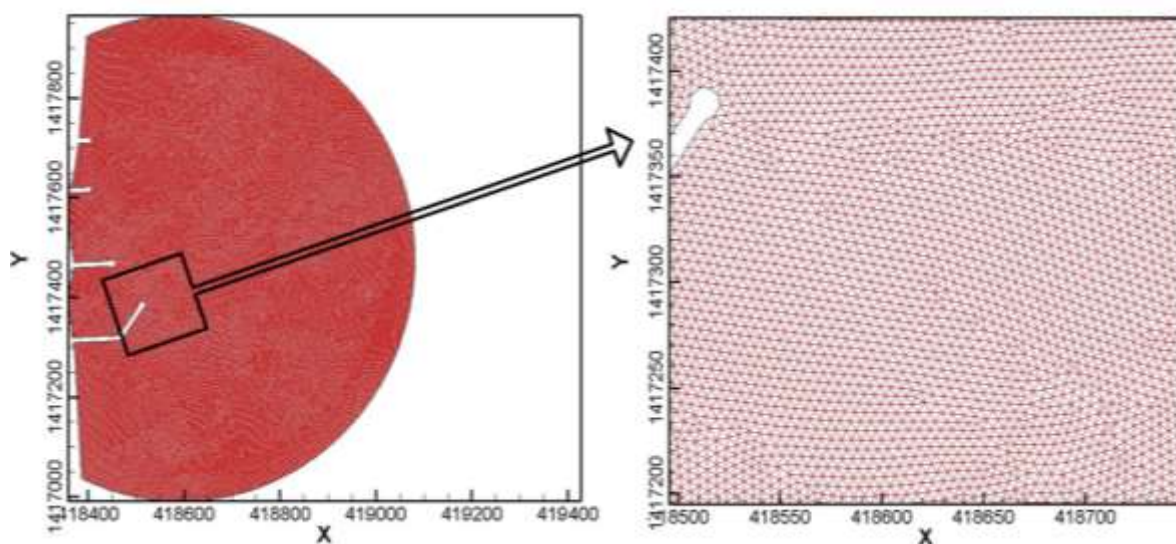


Fig.13 Mesh Structure adopted for the wave propagation modeling

8.4 Results and discussion

A total number of five wave directions have been simulated in order to investigate the wave tranquility inside the proposed port region. The wave directions are chosen such that these represent an annual year. The wave period of the computations is given as 6s-12s to observe the wave climate. The incident wave angle is varied to simulate different wave directional scenarios. The wave climates representing typical wave directions are presented. **Fig.14** to **Fig.18** reports the wave phase diagram and the wave height distribution for different wave approach angles of 45° , 90° , 135° , 155° and 180° respectively.

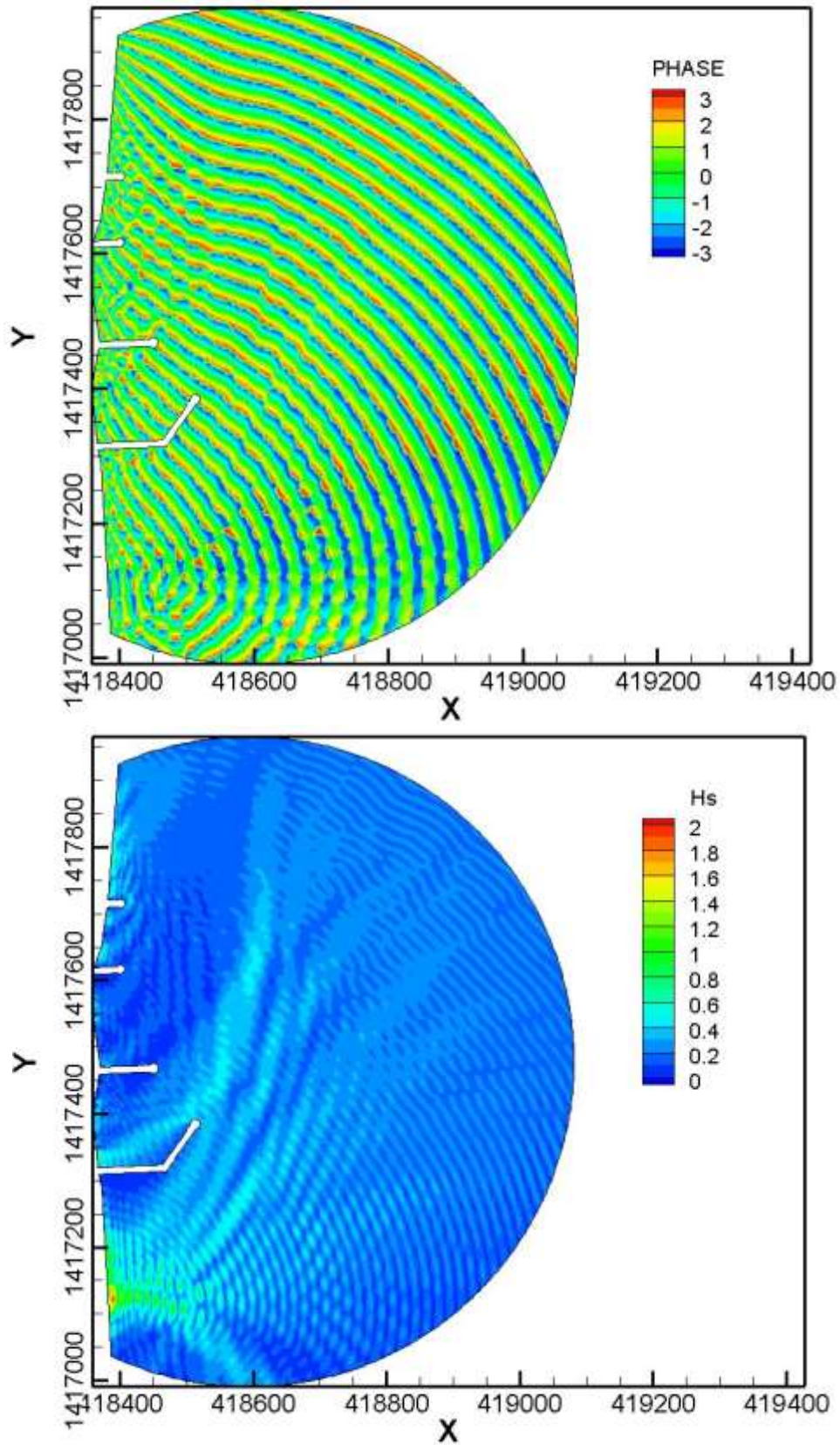


Fig.14 Phase distributions and Wave height distribution for the wave approach angle from 45°

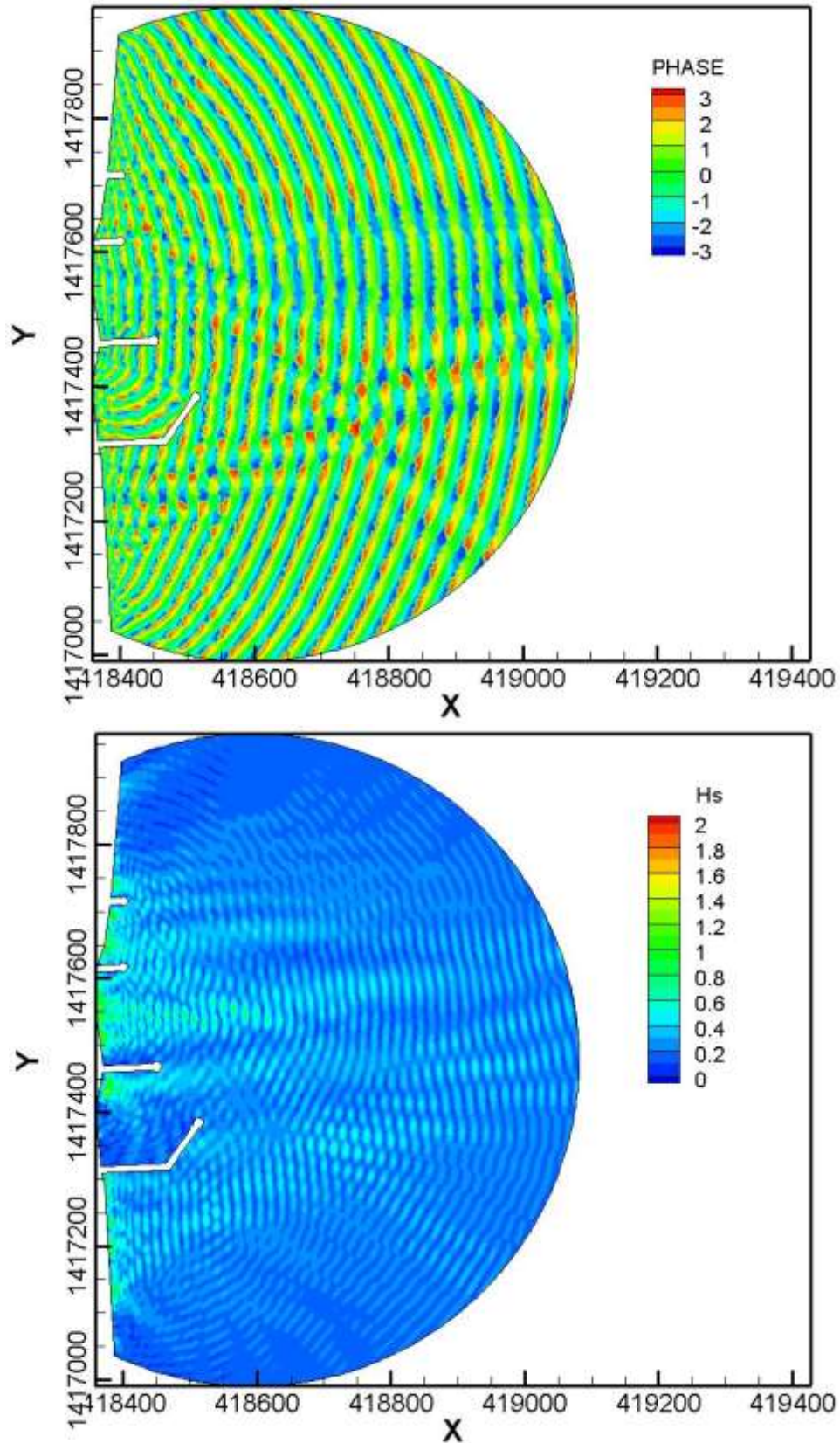


Fig.15 Phase distributions and Wave height distribution for the wave approach angle from 90°

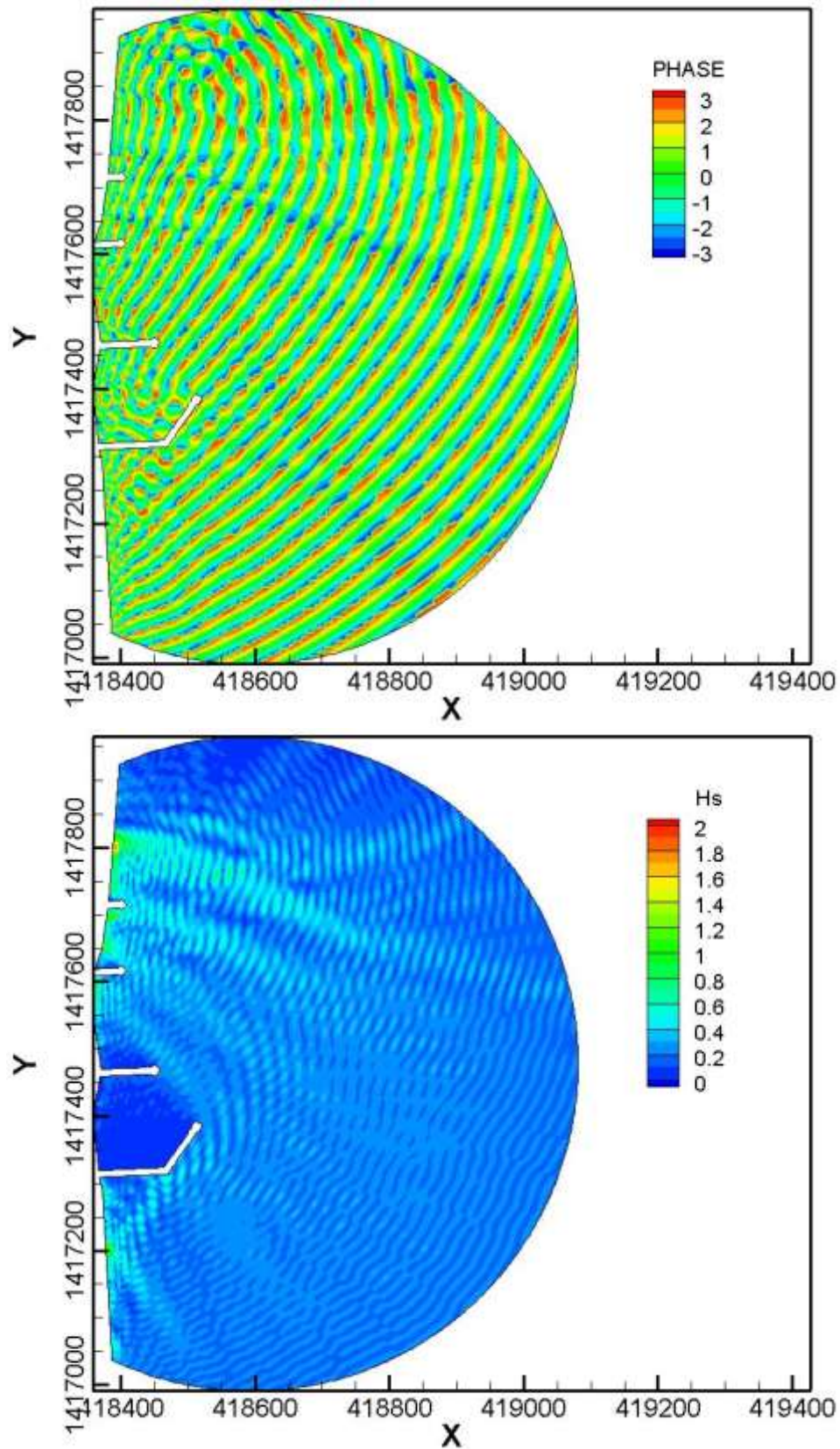


Fig.16 Phase distributions and Wave height distribution for the wave approach angle from 135°

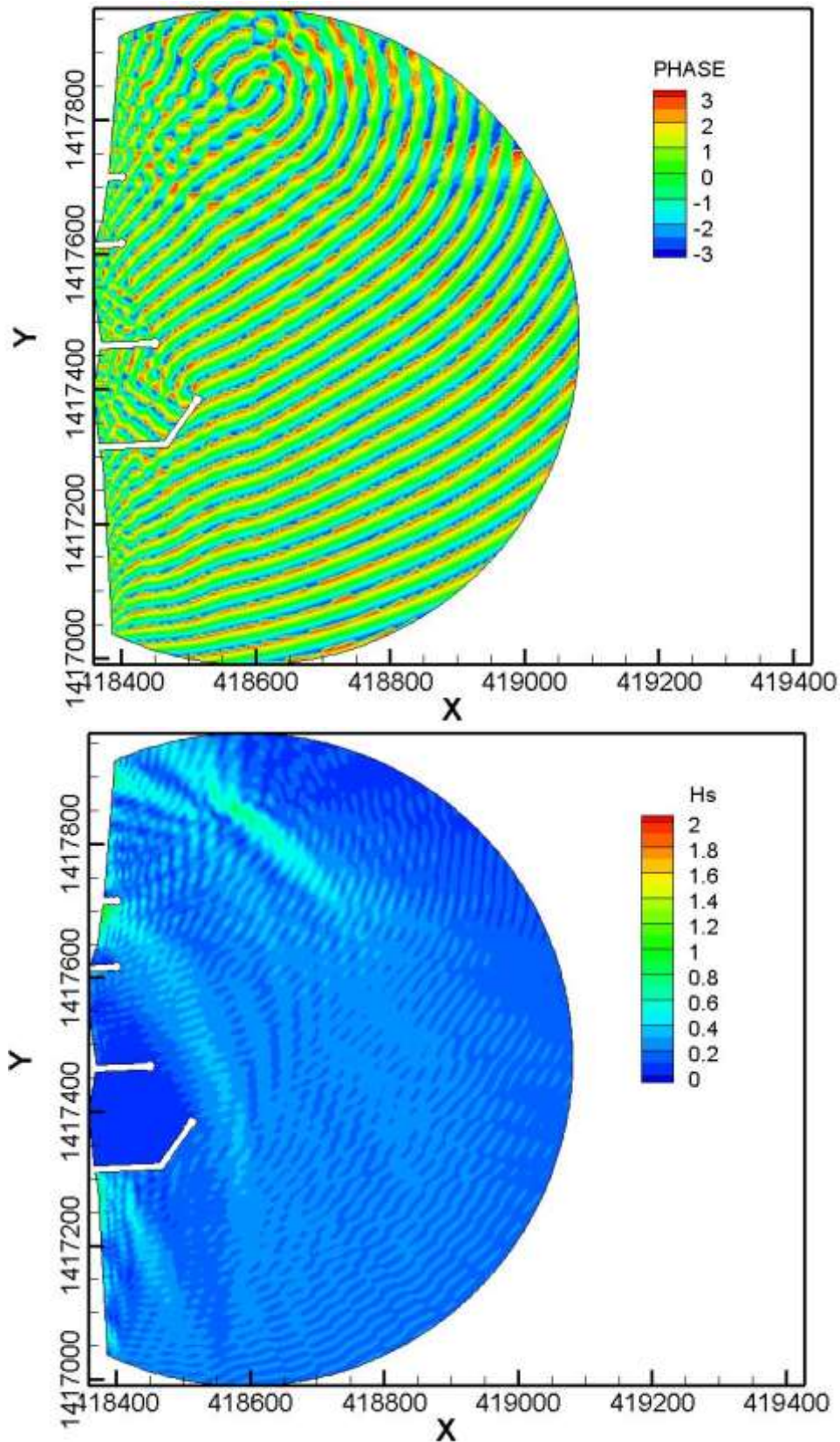


Fig.17 Phase distributions and Wave height distribution for the wave approach angle from 155°

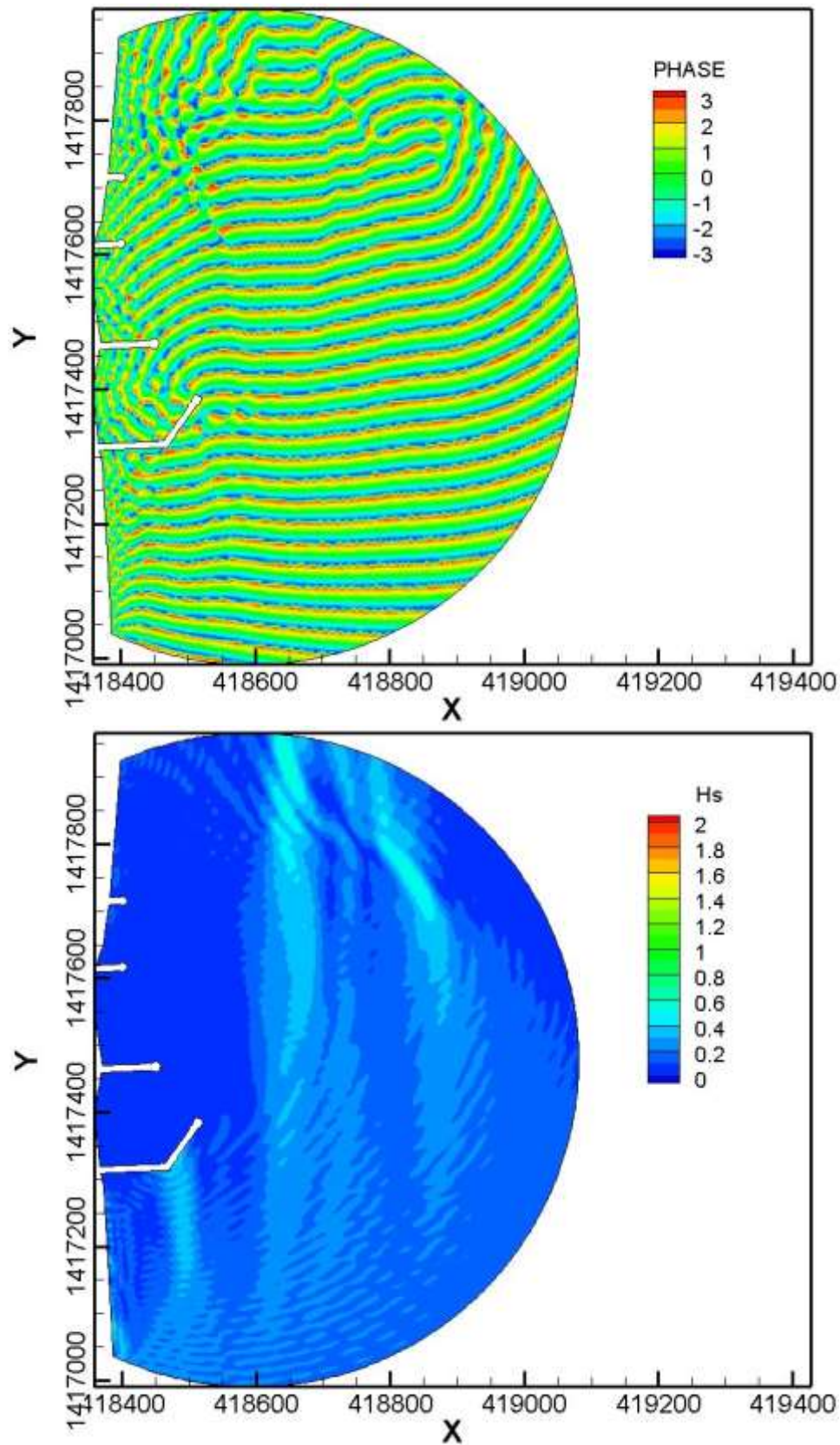


Fig.18 Phase distributions and Wave height distribution for the wave approach angle from 180°



9.0 DESIGN OF BREAKWATER

9.1 Design water level

Following design data has been adopted for the design of tetrapod's section. The Mean high-water level was +1.2 m CD. For the design of the section, MHWL is adopted as maximum water level.

The design water level for the breakwater can thus be set as the sum of MHWS and the design water depth is,

$$d = 4.0 + 1.2 + 0.8 = 6.0 \text{ m}$$

$$H_{\max} = 0.78 \times 6.0$$

$$= 4.68 \text{ m}$$

$$\text{Significant wave Height} = H_{\max} / 1.6 = 2.92 \text{ m}$$

Take Design wave height as 2.92 m.

9.2 Design of layers

The following describes a typical breakwater design.

Armour Layer

The size of the armour stones for the breakwater section is calculated by using the Hudson formula, which is recommended by CERC (1984). Stones are used as armour unit.

$$W = \frac{W_r H_D^3}{K_D (S_r - 1)^3 \cot \theta}$$

Where,

W=Weight of an individual armour unit in the primary cover layer.

W_r =Unit weight of tetrapod's, 2.40 T/m³.

H_D =Design wave height at the structure site in meters,

S_r =Specific weight of armour unit relating to water at the structure

$$S_r = (W_r / W_w)$$

W_w =Unit weight of seawater = 1025 kg/m³



θ =Angle of structure slope measured with the horizontal in degrees =1:1.5 (Chosen) for trunk section and 1:2 for head section.

K_D =for rough quarry stones in breaking condition, the stability coefficient is 7, and it is 4.5 for the head and trunk, respectively.

From Hudson's formula, the weight of tetrapod's is worked out to be 4 T in two layers to withstand the design wave height of 2.92 m at the maximum water depth (-) 4.0 m water depth.

The thickness of the armour layer is calculated by following,

$$t = nK_{\delta} \left[\frac{W}{W_r} \right]^{\frac{1}{3}} = 2.50 \text{ m}$$

2.50 m thickness was adopted for armour layer.

Core layer

The size of stone in core layer is 100 kg to 300 kg rough angular quarry stones are suggested for core layer for which $W_r = 2650 \text{ kg} / \text{m}^3$.

Toe Mound

The size of stone in toe mound is taken as $W/10$ to $W/15$ (as per CERC, 1984).

Rough angular quarry stones of weight 500 Kg to 800 Kg are suggested for toe layer for which $W_r = 2650 \text{ kg} / \text{m}^3$ with 1.25 m thickness for the trunk and head portion.

Crest width

Crest width, r is arrived from the formula

$$r = nK_{\delta} \left[\frac{W}{W_r} \right]^{\frac{1}{3}}$$

Where,

n= number of tetrapod's or stones on the crest

K_{δ} =Layer coefficient

Hence, Crest Width = 4 m



Crest elevation

The crest elevation of the breakwater is given by,

Crest elevation = MHWS + Design Water Level + free board

Free board may be adopted in calculating the design elevation to give free height for exceptional cases of storms and cyclone waves that hit the toe of the structure to avoid dangers. For breakwater and groynes, (+) 4.5 m crest elevation is maintained for breakwater and for groynes up to +1.2 m cross sections.

Filter layer

The size of stone in filter layer is taken as 1 kg to 10 kg Rough angular quarry stones are for which $W_r = 2650 \text{ kg} / \text{m}^3$. The thickness of filter layer is 0.3 m.

The detailed plan, longitudinal sections, and cross sections of the breakwater and groynes are given in **Plates (IITM - KKK - BG - 101 – 02 to IITM - KKK - BG - 101 – 10)**.



10.0 BILL OF QUANTITIES

Karikattkuppam - Southern Breakwater (160m)_ Armour Layer							
Water depth(m)	Length (m)	Start chainage Area(m ²)	End chainage Area(m ²)	Armour layer Average(m ²)	Volume (m ³)	Volume including porosity (m ³)	Quantity in Tonnes
(-) 3.5 m to (-) 4.0 m	15.00	70.40	61.40	65.90	988.50	494.25	1186.20
(-) 3.0 m to (-) 3.5 m	30.00	61.40	56.80	59.10	1773.00	886.50	2127.60
at (-) 3.0 m	30.00	56.80	56.80	56.80	1704.00	852.00	2044.80
					Total	Tetrapod	5358.60
(-) 2.5 m to (-) 3.0 m	22.00	42.48	38.90	40.69	895.18	626.63	1660.56
(-) 2.0 m to (-) 2.5 m	14.00	38.90	35.30	37.10	519.40	363.58	963.49
(-) 1.5 m to (-) 2.0 m	11.00	35.30	29.50	32.40	356.40	249.48	661.12
(-) 1.0 m to (-) 1.5 m	13.00	29.50	26.20	27.85	362.05	253.44	671.60
(-) 0.5 m to (-) 1.0 m	13.00	26.20	21.40	23.80	309.40	216.58	573.94
0.0 m to (-) 0.5 m	6.00	21.40	18.40	19.90	119.40	83.58	221.49
at 0.0 m	6.00	18.40	25.90	22.15	132.90	93.03	246.53
0 to (+) 0.5 m	15.00	25.90	25.90	25.90	388.50	271.95	720.67
(+) 0.5 m to (+) 1.2	11.00	25.90	25.90	25.90	284.90	199.43	528.49
shore anchore	20.50	27.00		27.00	553.50	387.45	1026.74
					Total	Stones	7274.62
					Total	Armour layer	12633.22

Karikattkuppam - Southern breakwater (160m) _ core layer							
Water depth(m)	Length (m)	Start chainage Area(m ²)	End chainage Area(m ²)	Core layer Average(m ²)	Volume (m ³)	Volume including porosity (m ³)	Quantity in Tonnes
(-) 3.5 m to (-) 4.0 m	15.00	45.31	30.23	37.77	566.55	396.59	1050.95
(-) 3.0 m to (-) 3.5 m	30.00	30.23	23.81	27.02	810.60	567.42	1503.66
at (-) 3.0 m	30.00	23.81	23.81	23.81	714.30	500.01	1325.03
(-) 2.5 m to (-) 3.0 m	22.00	55.00	46.24	50.62	1113.64	779.55	2065.80
(-) 1.5 m to (-) 2.0 m	14.00	46.24	30.90	38.57	539.98	377.99	1001.66
(-) 1.0 m to (-) 1.5 m	11.00	30.90	26.93	28.92	318.07	222.65	590.01
(-) 0.5 m to (-) 1.0 m	13.00	26.93	20.80	23.87	310.25	217.17	575.50
0.0 m to (-) 0.5 m	13.00	20.80	15.40	18.10	235.30	164.71	436.48
at 0.0 m	6.00	15.40	15.40	15.40	92.40	64.68	171.40
0 to (+) 0.5 m	6.00	15.40	13.40	14.40	86.40	60.48	160.27
(+) 0.5 m to (+) 1.2	11.00	13.40	13.40	13.40	147.40	103.18	273.43



shore anchore	20.50	13.50	13.50	276.75	193.73	513.37
					Total	9667.57

Karikattkuppam - Northern breakwater (160m)_ Under layer							
Water depth(m)	Length (m)	Start chainage Area(m ²)	End chainage Area(m ²)	Armour layer Average(m ²)	Volume (m ³)	Volume including porosity (m ³)	Quantity in Tonnes
(-) 3.5 m to (-) 4.0 m	15.00	22.00	17.62	19.81	297.15	208.01	551.21
(-) 3.0 m to (-) 3.5 m	30.00	17.62	15.36	16.49	494.70	346.29	917.67
(-) 2.5 m to (-) 3.0 m	30.00	15.36	15.36	15.36	460.80	322.56	854.78
						Total	2323.67

Karikattkuppam - Southern breakwater (160m)_ toe layer							
Water depth(m)	Length (m)	Start chainage Area(m ²)	End chainage Area(m ²)	Toe mound layer Average(m ²)	Volume (m ³)	Volume including porosity (m ³)	Quantity in Tonnes
(-) 3.5 m to (-) 4.0 m	15.00	22.90	22.90	22.90	343.50	240.45	637.19
(-) 3.0 m to (-) 3.5 m	30.00	22.90	22.90	22.90	687.00	480.90	1274.39
at 3.0 m	30.00	22.90	22.90	22.90	687.00	480.90	1274.39
(-) 2.5 m to (-) 3.0 m	22.00	16.51	16.51	16.51	363.22	254.25	673.77
(-) 2.0 m to (-) 2.5 m	14.00	22.90	16.51	19.71	275.87	193.11	511.74
(-) 1.5 m to (-) 2.0 m	11.00	16.51	16.51	16.51	181.61	127.13	336.89
(-) 1.0 m to (-) 1.5 m	13.00	16.51	15.70	16.11	209.37	146.56	388.37
(-) 0.5 m to (-) 1.0 m	13.00	15.70	15.70	15.70	204.10	142.87	378.61
0.0 m to (-) 0.5 m	6.00	15.70	15.70	15.70	94.20	65.94	174.74
at 0.0 m	6.00	15.70	15.70	15.70	94.20	65.94	174.74
						Total	5824.82

Karikattkuppam - Southern breakwater (160m)_ filter layer							
Water depth(m)	Length (m)	Start chainage Area(m ²)	End chainage Area(m ²)	Filter layer Average(m ²)	Volume (m ³)	Volume including porosity (m ³)	Quantity in Tonnes
(-) 3.5 m to (-) 4.0 m	15.00	11.50	10.60	11.05	165.75	116.03	307.47
(-) 3.0 m to (-) 3.5 m	30.00	10.60	10.15	10.38	311.25	217.88	577.37
at (-) 3.0 m	30.00	10.15	10.15	10.15	304.50	213.15	564.85
(-) 2.5 m to (-) 3.0 m	22.00	10.21	10.06	10.14	222.97	156.08	413.61
(-) 2.0 m to (-) 2.5 m	14.00	10.06	9.61	9.84	137.69	96.38	255.41



(-) 1.5 m to (-) 2.0 m	11.00	9.61	9.16	9.39	103.24	72.26	191.50
(-) 1.0 m to (-) 1.5 m	13.00	9.16	8.71	8.94	116.16	81.31	215.47
(-) 0.5 m to (-) 1.0 m	13.00	8.71	8.26	8.49	110.31	77.21	204.62
0.0 m to (-) 0.5 m	6.00	8.26	7.81	8.04	48.21	33.75	89.43
at 0.0 m	6.00	7.81	6.01	6.91	41.46	29.02	76.91
0 to (+) 0.5 m	6.00	6.01	6.01	6.01	36.06	25.24	66.89
(+) 0.5 m to (+) 1.2	11.00	6.01	6.01	6.01	66.11	46.28	122.63
shore anchore	20.50	8.00		8.00	164.00	114.80	304.22
						Total	3390.37

Head Portion (-4.0 M Water Depth)						
SPEIFICATIONS	h (m)	R (m)	r (m)	VOLUME(m³)	VOLUME INCLUDIG POROSITY (m³)	QUANTITY IN (TONNES)
Armour Layer						
Armour Layer	4.5	12.9	3	1008.46		
Armour Layer	2	7.31	2.41	160.90		
Armour Layer	2.5	8.74	3.74	322.01		
				Total Armour layer	614.03	1473.67
Toe mound layer						
Toe mound	1.25	21.55	19.05	1619.50		
Toe mound	1.25	12.02	9.54	458.13		
				Total Toe mound layer	609.72	1615.75
under layer	4.96	14.97	2.41	1380.86		
under layer	3.71	9.55	2.12	450.22		
				Total under layer	488.59	1294.75
Core Material	4.95	12.02	2.12	903.86	474.53	1257.50
Filter Layer	0.3	23.65	23.05	513.63	269.65	714.58

GROYNE	QUANTITY IN TONNES					
	ARMOUR LAYER 4 T TETRAPOD	ARMOUR LAYER (STONES)	CORE LAYER	UNDER LAYER	TOE MOUND LAYER	FILTER LAYER
SOUTHERN BREAKWATER _ 160M	6832.27	7275	10925	3618	7441	4104.96



Karikattukuppam - Northern Breakwater _ 80m Armour Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Armour layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 2.5 m to (-) 3.0 m	15.00	56.80	52.30	54.55	818.25	409.13	981.90
					Total	tetrapod	981.90
(-) 2.0 m to (-) 2.5 m	13.00	38.90	35.30	37.10	482.30	337.61	894.67
(-) 1.5 m to (-) 2.0 m	9.00	35.30	31.66	33.48	301.32	210.92	558.95
(-) 1.0 m to (-) 1.5 m	10.00	31.66	26.20	28.93	289.30	202.51	536.65
(-) 0.5 m to (-) 1.0 m	14.00	26.20	22.94	24.57	343.98	240.79	638.08
0.0 m to (-) 0.5 m	10.00	22.94	19.60	21.27	212.70	148.89	394.56
at 0.0 m	9.00	19.60	26.50	23.05	207.45	145.22	384.82
0 to (+) 0.5 m	17.00	26.50	26.50	26.50	450.50	315.35	835.68
(+) 0.5 m to (+) 1.2	18.00	26.50	26.50	26.50	477.00	333.90	884.84
shore anchore	20.50	27.00		27.00	553.50	387.45	1026.74
					Total	Stones	6154.98
					Total	Armour layer	7136.88

Karikattukuppam - Northern Breakwater _ 80m Core Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Core layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 2.5 m to (-) 3.0 m	15.00	23.81	27.70	25.76	386.33	270.43	716.63
(-) 2.0 m to (-) 2.5 m	13.00	46.24	38.20	42.22	548.86	384.20	1018.14
(-) 1.5 m to (-) 2.0 m	9.00	38.20	30.90	34.55	310.95	217.67	576.81
(-) 1.0 m to (-) 1.5 m	10.00	30.90	26.93	28.92	289.15	202.41	536.37
(-) 0.5 m to (-) 1.0 m	14.00	26.93	20.80	23.87	334.11	233.88	619.77
0.0 m to (-) 0.5 m	10.00	20.80	15.40	18.10	181.00	126.70	335.76
at 0.0 m	9.00	15.40	15.40	15.40	138.60	97.02	257.10
0 to (+) 0.5 m	17.00	13.40	13.40	13.40	227.80	159.46	422.57
(+) 0.5 m to (+) 1.2	18.00	13.40	13.40	13.40	241.20	168.84	447.43
shore anchore	20.50	13.50		13.50	276.75	193.73	513.37
					Total	Total	5443.95



Karikattkuppam - Northern breakwater (180m)_ Under layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Armour layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 2.5 m to (-) 3.0 m	15.00	15.36	15.36	15.36	230.40	161.28	427.39
						Total	427.39

Karikattkuppam - Northern Breakwater _ 80m Toe Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Toe mound layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 2.5 m to (-) 3.0 m	15.00	22.90	16.51	19.71	295.58	206.90	548.29
(-) 2.0 m to (-) 2.5 m	13.00	16.51	16.51	16.51	214.63	150.24	398.14
(-) 1.5 m to (-) 2.0 m	9.00	16.51	16.51	16.51	148.59	104.01	275.63
(-) 1.0 m to (-) 1.5 m	10.00	16.51	15.70	16.11	161.05	112.74	298.75
(-) 0.5 m to (-) 1.0 m	14.00	15.70	15.70	15.70	219.80	153.86	407.73
0.0 m to (-) 0.5 m	10.00	15.70	15.70	15.70	157.00	109.90	291.24
at 0.0 m	9.00	15.70	15.70	15.70	141.30	98.91	262.11
						Total	2481.89

Karikattkuppam - Northern Breakwater _ 80m Filter Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Filter layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 2.5 m to (-) 3.0 m	15.00	10.15	10.06	10.11	151.58	106.10	281.17
(-) 2.0 m to (-) 2.5 m	13.00	10.06	9.61	9.84	127.86	89.50	237.17
(-) 1.5 m to (-) 2.0 m	9.00	9.61	9.16	9.39	84.47	59.13	156.68
(-) 1.0 m to (-) 1.5 m	10.00	9.16	8.71	8.94	89.35	62.55	165.74
(-) 0.5 m to (-) 1.0 m	14.00	8.71	8.26	8.49	118.79	83.15	220.36
0.0 m to (-) 0.5 m	10.00	8.26	7.81	8.04	80.35	56.25	149.05
at 0.0 m	9.00	7.81	6.01	6.91	62.19	43.53	115.36
0 to (+) 0.5 m	17.00	6.01	6.01	6.01	102.17	71.52	189.53
(+) 0.5 m to (+) 1.2	18.00	6.01	6.01	6.01	108.18	75.73	200.67
shore anchore	20.50	8.00		8.00	164.00	114.80	304.22
						Total	2019.96



Head portion (-3.0 m water depth)						
SPEIFICATIONS	h (m)	R (m)	r (m)	VOLUME(m³)	VOLUME INCLUDIG POROSITY (m³)	QUANTITY IN (TONNES)
<u>Armour Layer</u>						
Armour Layer	3.45	9.99	3.00	501.10		
Armour Layer	0.95	4.31	2.41	34.57		
Armour Layer	2.50	8.74	3.74	322.01		
Total Armour Layer				295.70		709.69
<u>Toe Mound Layer</u>						
Toe Mound	1.25	18.55	16.05	1176.76		
Toe Mound	1.25	9.05	6.51	239.68		
Total Toe Mound Layer				491.96		1303.70
Under Layer	3.45	9.31	2.41	414.98		
Under Layer	2.20	6.51	2.11	139.47		
Total Under Layer				636.61		1687.01
Core Material	3.45	9.01	2.11	377.87	198.38	525.71
Filter Layer	0.30	20.65	20.12	391.47	205.52	544.63

GROYNE	QUANTITY IN TONNES					
	ARMOUR LAYER 4 T TETRAPOD	ARMOUR LAYER (STONES)	CORE LAYER	UNDER LAYER	TOE MOUND LAYER	FILTER LAYER
Northern breakwater _ 80m	1691.59	6155	5970	2114	3786	2564.59



Karikattukuppam - G1 (40m) Armour Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Armour layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 1.0 m to (-) 1.5 m	13.00	31.66	26.20	28.93	376.09	263.26	697.65
(-) 0.5 m to (-) 1.0 m	12.00	26.20	22.94	24.57	294.84	206.39	546.93
0.0 m to (-) 0.5 m	8.00	22.94	19.60	21.27	170.16	119.11	315.65
at 0.0 m	7.00	19.60	26.50	23.05	161.35	112.95	299.30
0 to (+) 0.5 m	12.00	26.50	26.50	26.50	318.00	222.60	589.89
(+) 0.5 m to (+) 1.2	11.00	26.50	26.50	26.50	291.50	204.05	540.73
shore anchore	20.50	27.00		27.00	553.50	387.45	1026.74
Total						Stones	4016.89

Karikattukuppam - G1 (40m) Core Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Core layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 1.0 m to (-) 1.5 m	13.00	30.90	26.93	28.92	375.90	263.13	697.29
(-) 0.5 m to (-) 1.0 m	12.00	26.93	20.80	23.87	286.38	200.47	531.23
0.0 m to (-) 0.5 m	8.00	20.80	15.40	18.10	144.80	101.36	268.60
at 0.0 m	7.00	15.40	15.40	15.40	107.80	75.46	199.97
0 to (+) 0.5 m	12.00	13.40	13.40	13.40	160.80	112.56	298.28
(+) 0.5 m to (+) 1.2	11.00	13.40	13.40	13.40	147.40	103.18	273.43
shore anchore	20.50	13.50		13.50	276.75	193.73	513.37
Total						Total	2782.18

Karikattukuppam - G1 (40m) Toe Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Toe mound layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 1.0 m to (-) 1.5 m	13.00	16.51	15.70	16.11	209.37	146.56	388.37
(-) 0.5 m to (-) 1.0 m	12.00	15.70	15.70	15.70	188.40	131.88	349.48
0.0 m to (-) 0.5 m	8.00	15.70	15.70	15.70	125.60	87.92	232.99
at 0.0 m	7.00	15.70	15.70	15.70	109.90	76.93	203.86
Total						Total	1174.71



Karikattkuppam - G1 (40m) Filter Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Filter layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 1.0 m to (-) 1.5 m	13.00	9.16	8.71	8.94	116.16	81.31	215.47
(-) 0.5 m to (-) 1.0 m	12.00	8.71	8.26	8.49	101.82	71.27	188.88
0.0 m to (-) 0.5 m	8.00	8.26	7.81	8.04	64.28	45.00	119.24
at 0.0 m	7.00	7.81	6.01	6.91	48.37	33.86	89.73
0 to (+) 0.5 m	12.00	6.01	6.01	6.01	72.12	50.48	133.78
(+) 0.5 m to (+) 1.2	11.00	6.01	6.01	6.01	66.11	46.28	122.63
shore anchore	20.50	8.00		8.00	164.00	114.80	304.22
						Total	1173.95

Head Portion (-1.5 M Water Depth)						
SPEIFICATIONS	h (m)	R (m)	r (m)	VOLUME(m³)	VOLUME INCLUDIG POROSITY (m³)	QUANTITY IN (TONNES)
<u>Armour Layer</u>						
Armour Layer	4.45	11.61	3.00	831.96		
Armour Layer	2.63	7.65	2.56	233.05		
Total Armour layer					314.43	833.24
<u>Toe mound layer</u>						
Toe mound	1.25	17.03	14.61	984.23		
Toe mound	1.25	7.65	10.06	309.66		
Total Toe mound layer					354.15	938.50
Core Material	3.88	10.06	2.56	542.20	284.65	754.33
Filter Layer	0.30	19.11	18.53	333.68	175.18	464.23

GROYNE	QUANTITY IN TONNES			
	ARMOUR LAYER (Stones)	CORE LAYER	TOE MOUND LAYER	FILTER LAYER
G1_40m	4850.13	3537	2113	1638



Karikattukuppam - G2 (20m) Armour Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Armour layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 0.5 m to (-) 1.0 m	10.00	26.20	22.94	24.57	245.70	171.99	455.77
0.0 m to (-) 0.5 m	5.00	22.94	19.60	21.27	106.35	74.45	197.28
at 0.0 m	5.00	19.60	26.50	23.05	115.25	80.68	213.79
0 to (+) 0.5 m	18.00	26.50	26.50	26.50	477.00	333.90	884.84
(+) 0.5 m to (+) 1.2	18.00	26.50	26.50	26.50	477.00	333.90	884.84
shore anchore	20.50	27.00		27.00	553.50	387.45	1026.74
Total						Stones	3663.25

Karikattukuppam - G2 (20m) Core Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Core layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 0.5 m to (-) 1.0 m	10.00	26.93	20.80	23.87	238.65	167.06	442.70
0.0 m to (-) 0.5 m	5.00	20.80	15.40	18.10	90.50	63.35	167.88
at 0.0 m	5.00	15.40	15.40	15.40	77.00	53.90	142.84
0 to (+) 0.5 m	18.00	13.40	13.40	13.40	241.20	168.84	447.43
(+) 0.5 m to (+) 1.2	18.00	13.40	13.40	13.40	241.20	168.84	447.43
shore anchore	20.50	13.50		13.50	276.75	193.73	513.37
Total						2161.63	

Karikattukuppam - G2 (20m) Toe Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Toe mound layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 0.5 m to (-) 1.0 m	10.00	15.70	15.70	15.70	157.00	109.90	291.24
0.0 m to (-) 0.5 m	5.00	15.70	15.70	15.70	78.50	54.95	145.62
at 0.0 m	5.00	15.70	15.70	15.70	78.50	54.95	145.62
Total						582.47	



Karikattkuppam - G2 (20m) Filter Layer							
Water depth(m)	Length (m)	Start chainage Area(m²)	End chainage Area(m²)	Filter layer Average(m²)	Volume (m³)	Volume including porosity (m³)	Quantity in Tonnes
(-) 0.5 m to (-) 1.0 m	10.00	8.71	8.26	8.49	84.85	59.40	157.40
0.0 m to (-) 0.5 m	5.00	8.26	7.81	8.04	40.18	28.12	74.52
at 0.0 m	5.00	7.81	6.01	6.91	34.55	24.19	64.09
0 to (+) 0.5 m	18.00	6.01	6.01	6.01	108.18	75.73	200.67
(+) 0.5 m to (+) 1.2	18.00	6.01	6.01	6.01	108.18	75.73	200.67
shore anchore	20.50	8.00		8.00	164.00	114.80	304.22
						Total	1001.58

Head portion (-1.0 m water depth)						
SPEIFICATIONS	h (m)	R (m)	r (m)	VOLUME(m³)	VOLUME INCLUDIG POROSITY (m³)	QUANTITY IN (TONNES)
<u>Armour Layer</u>						
Armour Layer	4.45	11.61	3.00	831.96		
Armour Layer	2.45	7.25	2.51	197.61		
Total Armour layer					333.04	882.55
<u>Toe mound layer</u>						
Toe mound	1.30	17.03	14.61	1023.60		
Toe mound	1.30	9.67	7.25	294.15		
Total Toe mound layer					382.96	1014.86
Core Material	3.70	9.67	2.51	480.52	252.27	668.53
Filter Layer	0.30	19.11	18.53	333.68	175.18	464.23

GROYNE	QUANTITY IN TONNES			
	ARMOUR LAYER (Stones)	CORE LAYER	TOE MOUND LAYER	FILTER LAYER
G2_20m	4545.80	2830	1597	1466



Calculation of Number of Tetrapod's

Southern breakwater _ 180m					
Water depth(m)	Length (m)	Start chainage length(m)	End chainage length(m)	Armour layer length (Tetrapods) Average(m)	Surface Area (m²)
(-) 3.5 m to (-) 4.0 m	15.00	28.12	24.44	26.28	394
(-) 3.0 m to (-) 3.5 m	30.00	24.44	22.68	23.56	707
(-) 2.5 m to (-) 3.0 m	30.00	22.68	22.68	22.68	680
4T-Tetrapods - Surface area					1781
Head Portion (-)4.0 m - 4T - Tetrapods - Surface area					722
					2503

Northern breakwater _ 80m					
Water depth(m)	Length (m)	Start chainage length(m)	End chainage length(m)	Armour layer length (Tetrapods) Average(m)	Surface Area (m²)
(-) 2.5 m to (-) 3.0 m	15.00	22.68	21.70	22.19	333
4T-Tetrapods - Surface area					333
Head Portion (-)3.0m - 4T - Tetrapods - Surface area					452
					785

Total	3273
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<u>Calculation of Number of Tetrapods</u>			
N=Na/A	(1/m²)		
N=nkt(1-nv)/(Dn50)^2			
N	=	0.740	/m2
Na - No of 4T - Tetrapods	=	2433	Nos



10.2 Total Quantity of Groynes

KARIKATTKUPPAM	
NORTHERN BREAKWATER _ 80M , SOUTHERN BREAKWATER _ 160M , GROYNES G1 AND G2	QUANTITY IN TONNES
ARMOUR LAYER 4 T - Tetrapod	8524
ARMOUR LAYER (Stones)	22826
CORE LAYER	23261
TOE MOUND LAYER	14937
UNDER LAYER	5733
FILTER LAYER	9774
<i>TOTAL</i>	<i>85055.00</i>

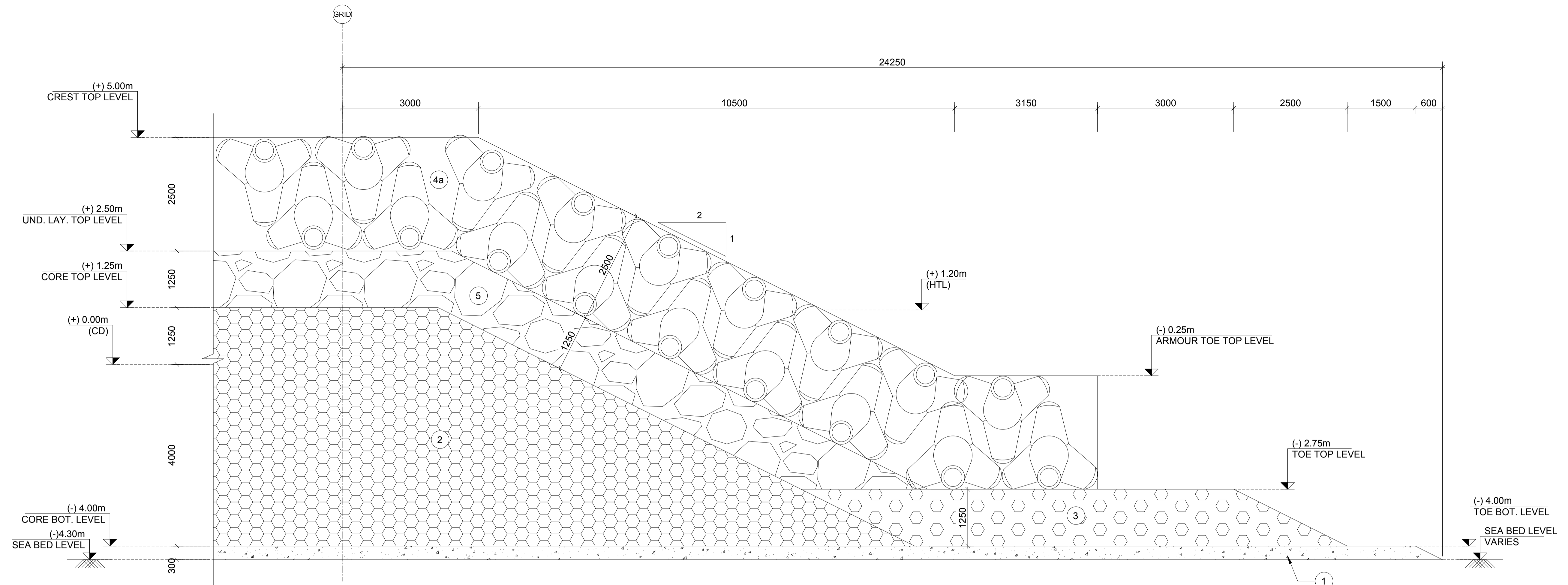


11.0 RECOMMENDATION

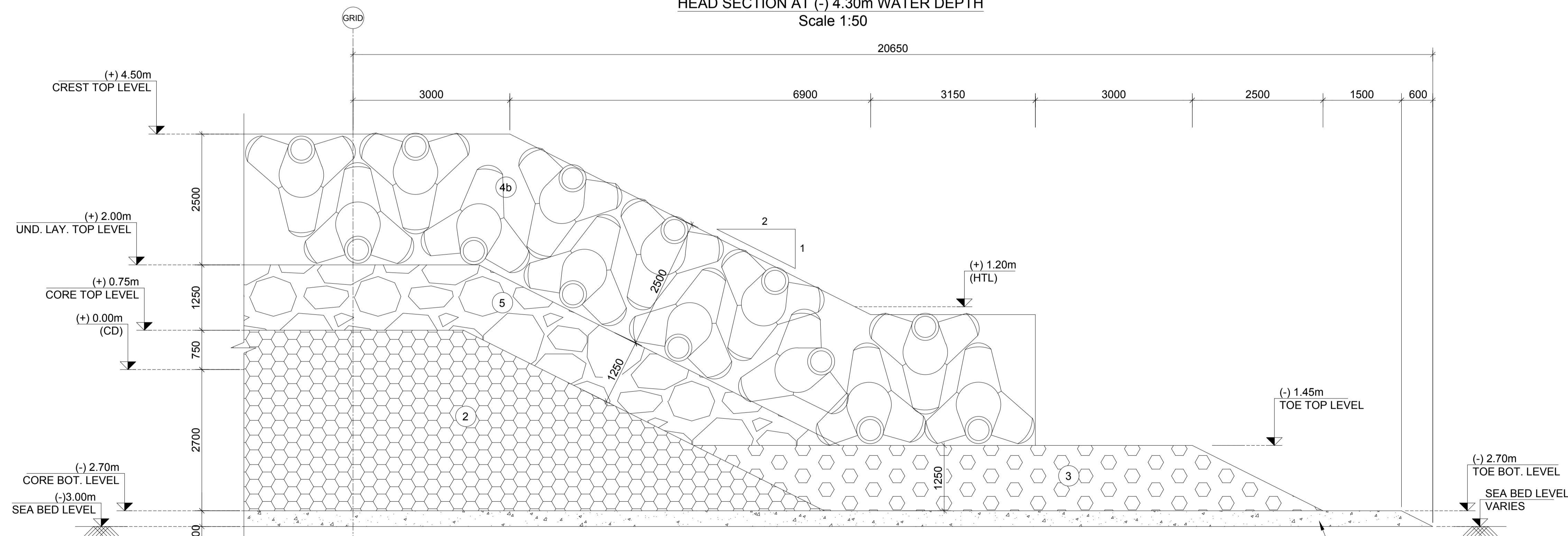
A comprehensive study was carried out on arriving at the coastal protection measure for a stretch of 400 m along the coast of Karikattukuppam (latitude $12^{\circ}49'15.67''N$ and longitude $80^{\circ}14'51.04''E$) as per the request of the Department of Fisheries, Tamilnadu. After deriving the offshore wave climate from the wind climate, the driving forces, breaker wave characteristics were obtained, which were then adopted to estimate the longshore sediment characteristics, both its magnitude and direction. The net sediment transport of the study area is estimated to be about 1.5 Lakhs per annum directed towards the North. For the welfare of the fisherman community and combat erosion, a pair of groynes and pair of breakwater field has been proposed which was subjected as fish landing center for small fishing boats.

Prior to the commencement of the work as proposed, borehole investigation needs to be performed to ascertain the soil conditions and the one-line bathymetry along the proposed alignment of the groynes as there could be a possibility of the changes in the bathymetry. IIT Madras should be informed prior to the commencement of the construction.

Prof. S.A.Sannasiraj



HEAD SECTION AT (-) 4.30m WATER DEPTH
Scale 1:50



HEAD SECTION AT (-) 3.00m WATER DEPTH
Scale 1:50

NOTES :-
 1. ALL DIMENSIONS ARE IN MILLIMETERS.
 2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO CHART DATUM (CD).
 3. ALL CO-ORDINATES ARE GIVEN IN METER REFERRED TO UNIVERSAL TRANSVERSE MERCATOR (UTM).

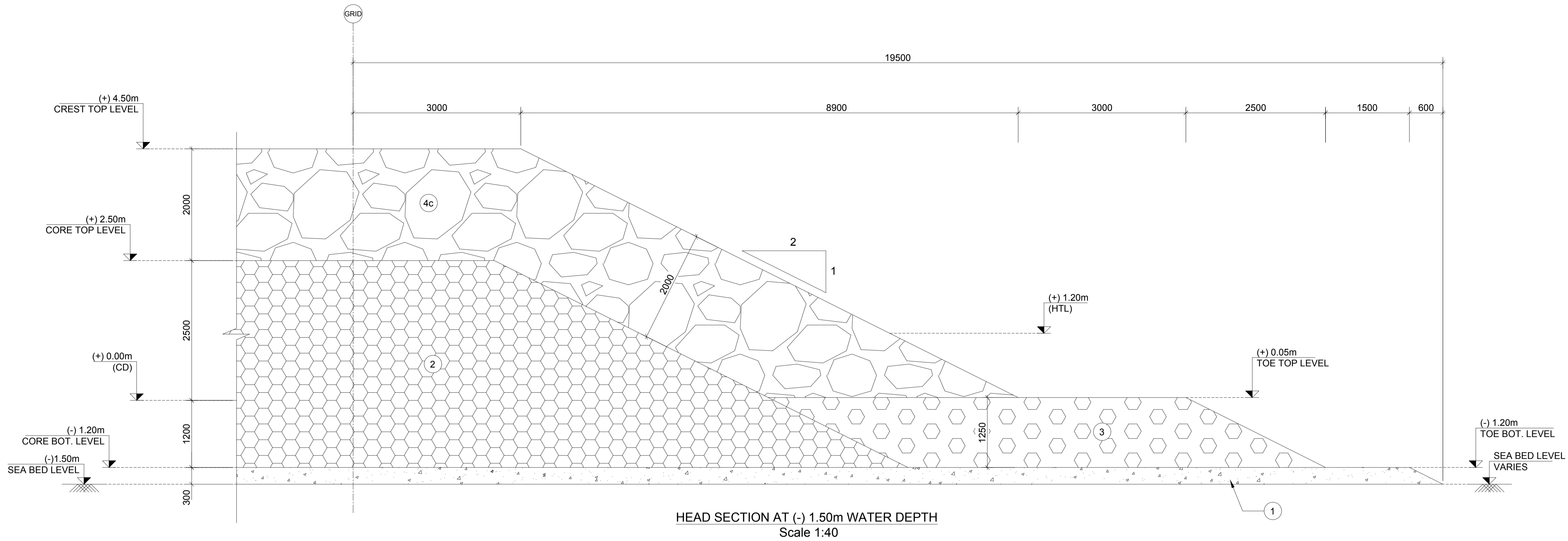
LEGEND:-
 ① - FILTER LAYER 1kg TO 10kg
 ② - CORE 100kg TO 300kg
 ③ - TOE MOUND 500kg TO 800kg 1.25m Thick
 ④a - ARMOUR LAYER, 4.0 Ton Tetrapods 2 layer at 2.50m Thick
 ④b - ARMOUR LAYER, 4.0 Ton Tetrapods 2 layer at 2.50m Thick

LEGEND:-
 ④c - ARMOUR LAYER, 2.5T- 3.5 T Stones 2 layer at 2.00m Thick
 ④d - ARMOUR LAYER, 1.5 T- 2.5 T Stones 2 layer at 1.82m Thick
 ⑤ - UNDER LAYER, 500kg - 800kg Stones 1.25m Thick
 ⑥ - DREDGE AREA

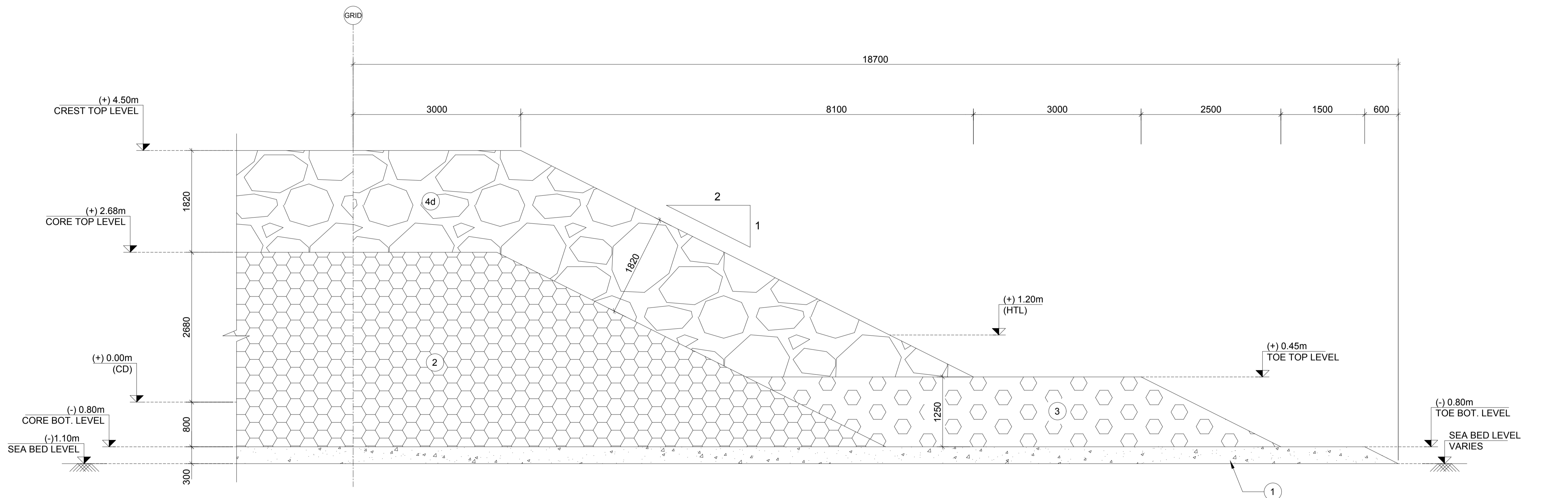
REFERENCE DRAWINGS :-
 1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH LATEST DRAWING NO :
 a) IITM-KKK-BG-101-01
 b) IITM-KKK-BG-101-02
 c) IITM-KKK-BG-101-03
 d) IITM-KKK-BG-101-04
 2. SEABED LEVEL REFER BATHYMETRY DRAWING NO:
 a) IITM-KKK-BG-001

REV.	DATE	DESCRIPTION	DESIGN	DRAWN
0	09.02.2023	ISSUED FOR CONSTRUCTION	CS	STR

ORIGINAL SIZE: A1	CLIENT:	DEPARTMENT OF FISHERIES AND FISHERMEN WELFARE, GOVT OF TAMILNADU.	DATE:	09.02.2023
	PROJECT:	CONSTRUCTION OF FISH LANDING CENTRE AND SHORE PROTECTION WORKS INCLUDING BERTHING FACILITIES AT KARIKATTUKUPPAM IN CHENGALPATTU DISTRICT.		
	DRAWING TITLE:	KARIKATTUKUPPAM BREAKWATER AND GROUYNE GENERAL ARRANGMENT SHEET (5 OF 10)		
	DRAWING NO:	IITM - KKK - BG - 101 - 05	Scale as shown	REV 0
ENGINEERING FIRM:	DEPARTMENT OF OCEAN ENGINEERING IIT MADRAS CHENNAI - 600036			



HEAD SECTION AT (-) 1.50m WATER DEPTH
Scale 1:40



HEAD SECTION AT (-) 1.10m WATER DEPTH
Scale 1:40

NOTES :-
 1. ALL DIMENSIONS ARE IN MILLIMETERS.
 2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO CHART DATUM (CD).
 3. ALL CO-ORDINATES ARE GIVEN IN METER REFERRED TO UNIVERSAL TRANSVERSE MERCATOR (UTM).

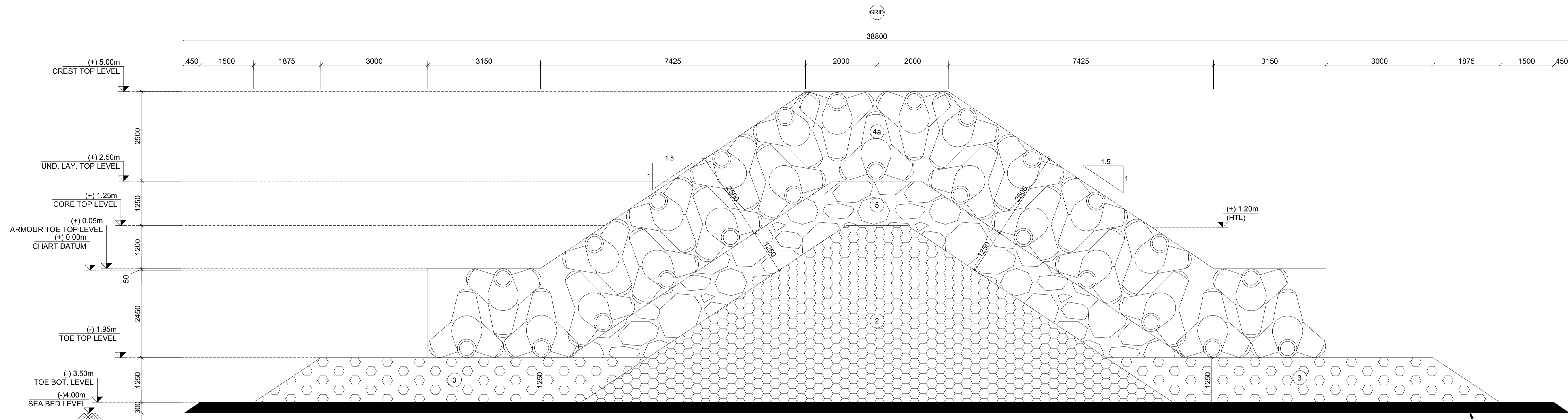
LEGEND:-
 ① - FILTER LAYER 1kg TO 10kg
 ② - CORE 100kg TO 300kg
 ③ - TOE MOUND 500kg TO 800kg 1.25m Thick

LEGEND:-
 ④c - ARMOUR LAYER, 2.5T- 3.5 T Stones 2 layer at 2.00m Thick
 ④d - ARMOUR LAYER, 1.5 T- 2.5 T Stones 2 layer at 1.82m Thick
 ⑤ - UNDER LAYER, 500kg - 800kg Stones 1.25m Thick
 ⑥ - DREDGE AREA

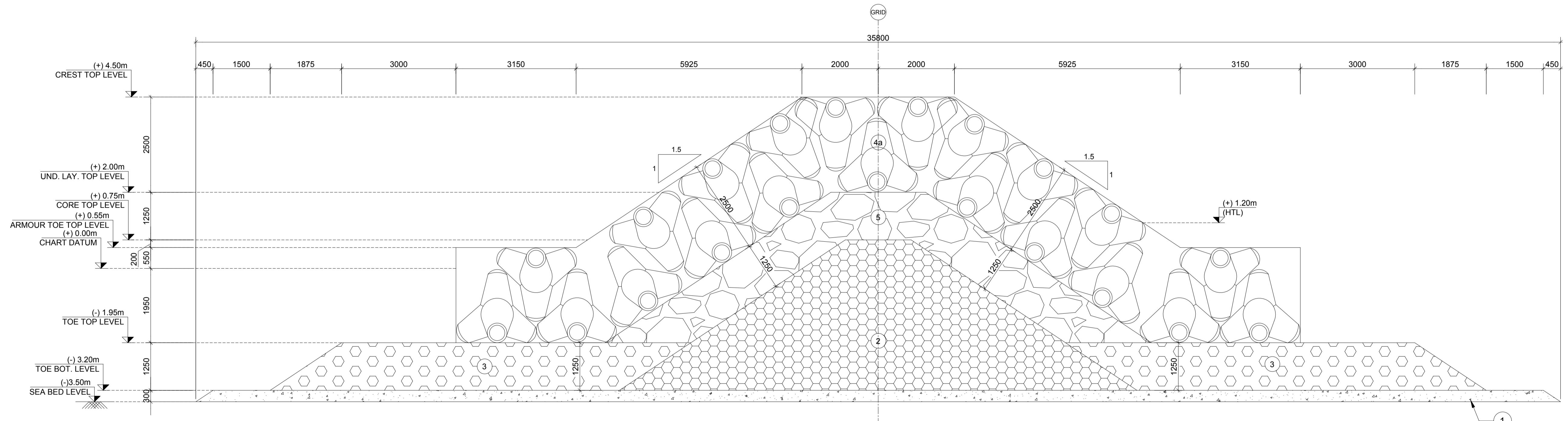
REFERENCE DRAWINGS :-
 1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH LATEST DRAWING NO :
 a) IITM-KKK-BG-101-01 e) IITM-KKK-BG-101-05
 b) IITM-KKK-BG-101-02
 c) IITM-KKK-BG-101-03
 d) IITM-KKK-BG-101-04
 2. SEABED LEVEL REFER BATHYMETRY DRAWING NO:
 a) IITM-KKK-BG-001

REV.	DATE	DESCRIPTION	DESIGN	DRAWN
0	09.02.2023	ISSUED FOR CONSTRUCTION	CS	AKE

ORIGINAL SIZE: A1	CLIENT:	DEPARTMENT OF FISHERIES AND FISHERMEN WELFARE, GOVT OF TAMILNADU.	DATE:	09.02.2023
	PROJECT:	CONSTRUCTION OF FISH LANDING CENTRE AND SHORE PROTECTION WORKS INCLUDING BERTHING FACILITIES AT KARIKATTUKUPPAM IN CHENGALPATTU DISTRICT.		
	DRAWING TITLE:	KARIKATTUKUPPAM BREAKWATER AND GROUYNE GENERAL ARRANGMENT SHEET (6 OF 10)		
	DRAWING NO:	IITM - KKK - BG - 101 - 06	Scale as shown	REV 0
ENGINEERING FIRM:	DEPARTMENT OF OCEAN ENGINEERING IIT MADRAS CHENNAI - 600036			



TRUNK SECTION AT (-) 3.5m TO (-) 4.0m WATER DEPTH
Scale 1:50



TRUNK SECTION AT (-) 3.0m TO (-) 3.5m WATER DEPTH
Scale 1:50

NOTES :-
 1. ALL DIMENSIONS ARE IN MILLIMETERS.
 2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO CHART DATUM (CD).
 3. ALL CO-ORDINATES ARE GIVEN IN METER REFERRED TO UNIVERSAL TRANSVERSE MERCATOR (UTM).

LEGEND:-

	① - FILTER LAYER 1kg TO 10kg
	② - CORE 100kg TO 300kg
	③ - TOE MOUND 500kg TO 800kg 1.25m Thick
	④a - ARMOUR LAYER, 4.0 Ton Tetrapods 2 layer at 2.50m Thick
	④b - ARMOUR LAYER, 4.0 Ton Tetrapods 2 layer at 2.50m Thick

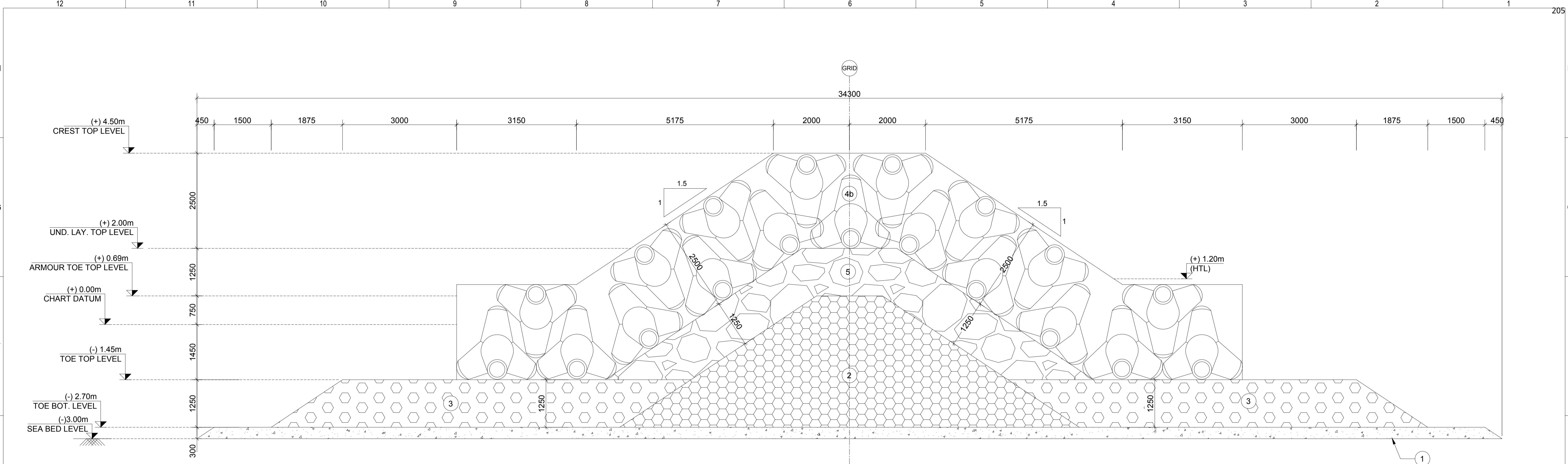
LEGEND:-

	④c - ARMOUR LAYER, 2.5T- 3.5 T Stones 2 layer at 2.00m Thick
	④d - ARMOUR LAYER, 1.5 T- 2.5 T Stones 2 layer at 1.82m Thick
	⑤ - UNDER LAYER, 500kg - 800kg Stones 1.25m Thick
	⑥ - DREDGE AREA

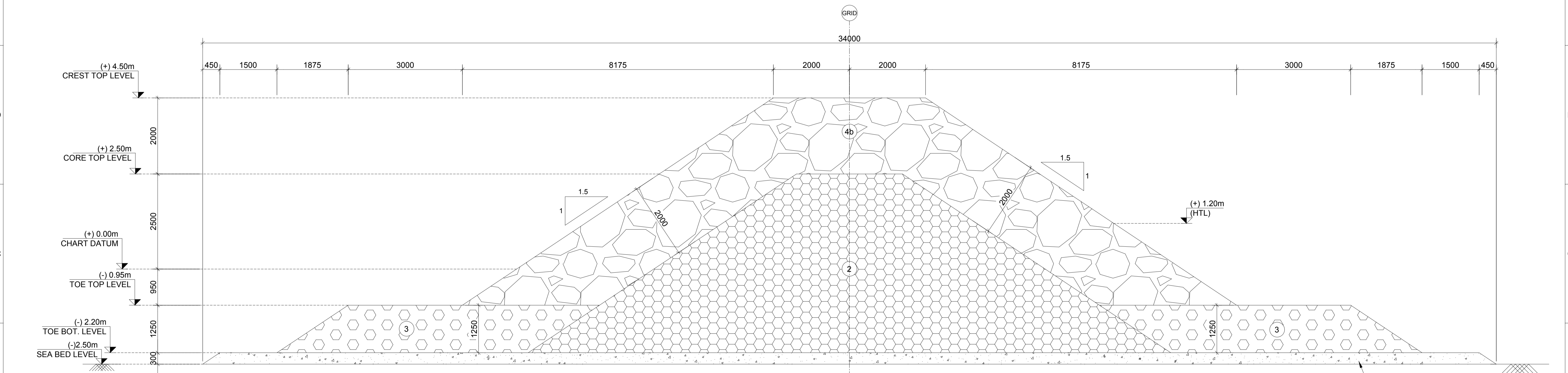
REFERENCE DRAWINGS :-
 1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH LATEST DRAWING NO :
 a) IITM-KKK-BG-101-01 e) IITM-KKK-BG-101-05
 b) IITM-KKK-BG-101-02 f) IITM-KKK-BG-101-06
 c) IITM-KKK-BG-101-03
 d) IITM-KKK-BG-101-04
 2. SEABED LEVEL REFER BATHYMETRY DRAWING NO:
 a) IITM-KKK-BG-001

REV.	DATE	DESCRIPTION	DESIGN	DRAWN
0	09.02.2023	ISSUED FOR CONSTRUCTION	CS	STR

ORIGINAL SIZE: A1	CLIENT:	DEPARTMENT OF FISHERIES AND FISHERMEN WELFARE, GOVT OF TAMILNADU.	DATE:	09.02.2023
	PROJECT:	CONSTRUCTION OF FISH LANDING CENTRE AND SHORE PROTECTION WORKS INCLUDING BERTHING FACILITIES AT KARIKATTUKUPPAM IN CHENGALPATTU DISTRICT.	Scale as shown	REV 0
	DRAWING TITLE:	KARIKATTUKUPPAM BREAKWATER AND GROUYNE GENERAL ARRANGMENT SHEET (7 OF 10)		
	DRAWING NO:	IITM - KKK - BG - 101 - 07		
ENGINEERING FIRM:	DEPARTMENT OF OCEAN ENGINEERING IIT MADRAS CHENNAI - 600036			



TRUNK SECTION AT (-) 2.5m TO (-) 3.0m WATER DEPTH
Scale 1:50



TRUNK SECTION AT (-) 2.0m TO (-) 2.5m WATER DEPTH
Scale 1:50

NOTES :-
 1. ALL DIMENSIONS ARE IN MILLIMETERS.
 2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO CHART DATUM (CD).
 3. ALL CO-ORDINATES ARE GIVEN IN METER REFERRED TO UNIVERSAL TRANSVERSE MERCATOR (UTM).

LEGEND:-

	① - FILTER LAYER 1kg TO 10kg
	② - CORE 100kg TO 300kg
	③ - TOE MOUND 500kg TO 800kg 1.25m Thick
	④a - ARMOUR LAYER, 4.0 Ton Tetrapods 2 layer at 2.50m Thick
	④b - ARMOUR LAYER, 4.0 Ton Tetrapods 2 layer at 2.50m Thick

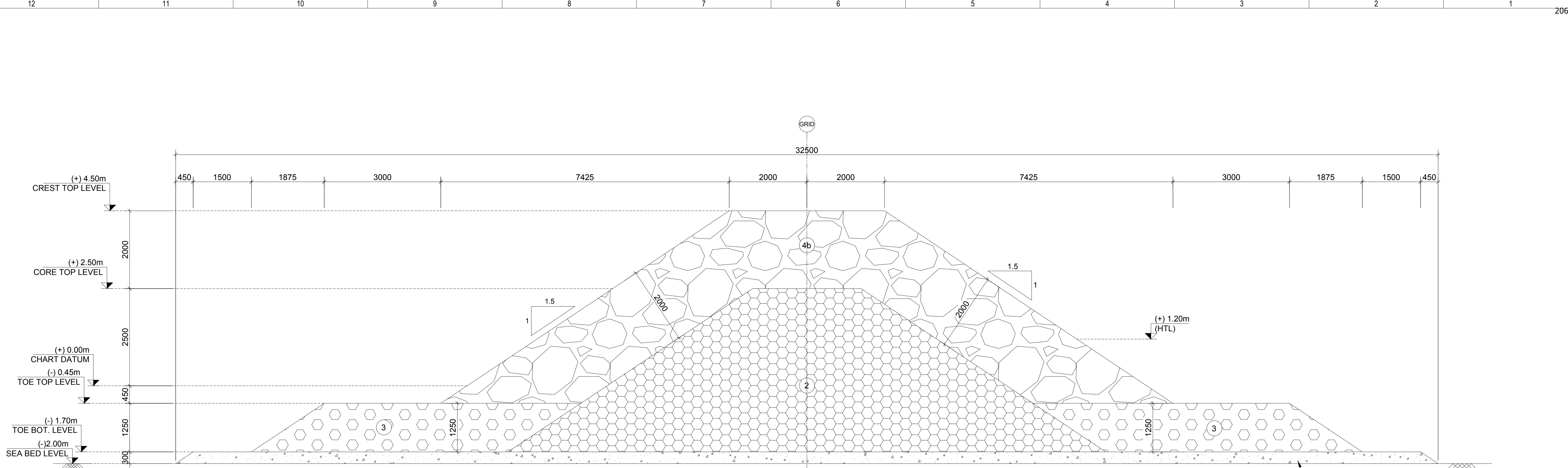
LEGEND:-

	④c - ARMOUR LAYER, 2.5T- 3.5 T Stones 2 layer at 2.00m Thick
	④d - ARMOUR LAYER, 1.5 T- 2.5 T Stones 2 layer at 1.82m Thick
	⑤ - UNDER LAYER, 500kg - 800kg Stones 1.25m Thick
	⑥ - DREDGE AREA

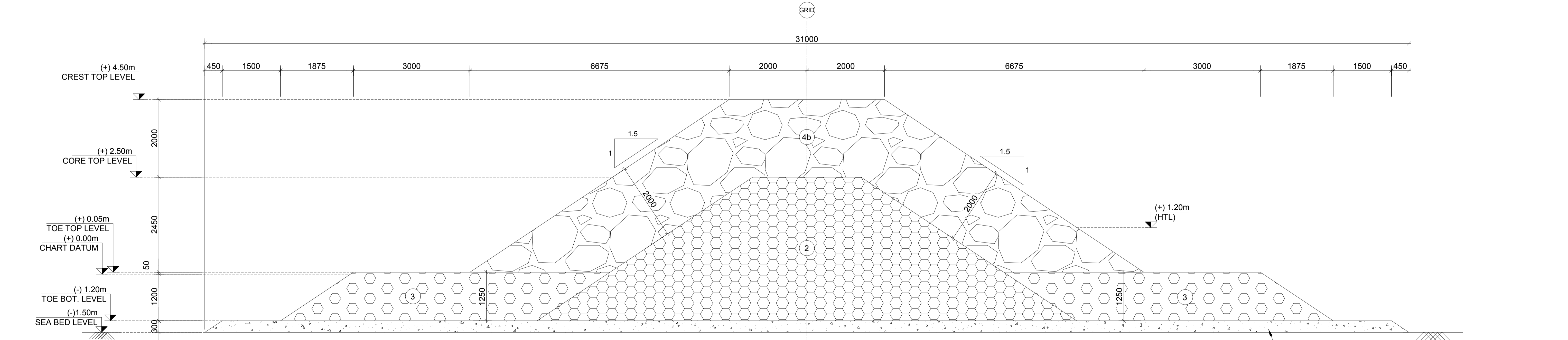
REFERENCE DRAWINGS :-
 1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH LATEST DRAWING NO :
 a) IITM-KKK-BG-101-01 e) IITM-KKK-BG-101-05
 b) IITM-KKK-BG-101-02 f) IITM-KKK-BG-101-06
 c) IITM-KKK-BG-101-03 g) IITM-KKK-BG-101-07
 d) IITM-KKK-BG-101-04
 2. SEABED LEVEL REFER BATHYMETRY DRAWING NO:
 a) IITM-KKK-BG-001

REV.	DATE	DESCRIPTION	DESIGN	DRAWN
0	09.02.2023	ISSUED FOR CONSTRUCTION	CS	STR

ORIGINAL SIZE: A1	CLIENT:	DEPARTMENT OF FISHERIES AND FISHERMEN WELFARE, GOVT OF TAMILNADU.	DATE:	09.02.2023
	PROJECT:	CONSTRUCTION OF FISH LANDING CENTRE AND SHORE PROTECTION WORKS INCLUDING BERTHING FACILITIES AT KARIKATTUKUPPAM IN CHENGALPATTU DISTRICT.	Scale as shown	REV 0
	DRAWING TITLE:	KARIKATTUKUPPAM BREAKWATER AND GROUYNE GENERAL ARRANGMENT SHEET (8 OF 10)		
	DRAWING NO:	IITM - KKK - BG - 101 - 08		
ENGINEERING FIRM:	DEPARTMENT OF OCEAN ENGINEERING IIT MADRAS CHENNAI - 600036			



TRUNK SECTION AT (-) 1.5m TO (-)2.0m WATER DEPTH
Scale 1:50



TRUNK SECTION AT (-) 1.0m TO (-)1.5m WATER DEPTH
Scale 1:50

NOTES :-
 1. ALL DIMENSIONS ARE IN MILLIMETERS.
 2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO CHART DATUM (CD).
 3. ALL CO-ORDINATES ARE GIVEN IN METER REFERRED TO UNIVERSAL TRANSVERSE MERCATOR (UTM).

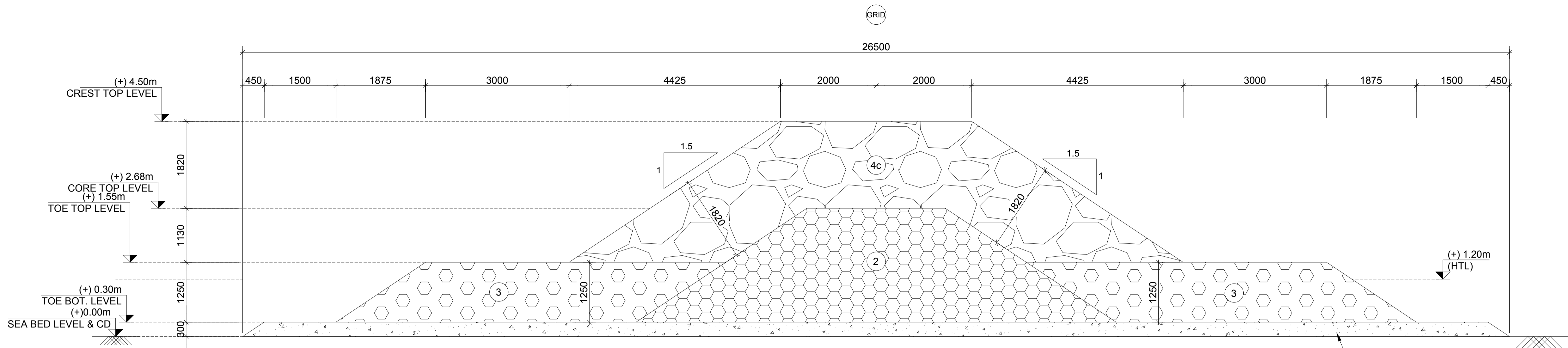
LEGEND:-
 ① - FILTER LAYER 1kg TO 10kg
 ② - CORE 100kg TO 300kg
 ③ - TOE MOUND 500kg TO 800kg 1.25m Thick

LEGEND:-
 ④c - ARMOUR LAYER, 2.5T- 3.5 T Stones 2 layer at 2.00m Thick
 ④d - ARMOUR LAYER, 1.5 T- 2.5 T Stones 2 layer at 1.82m Thick
 ⑤ - UNDER LAYER, 500kg - 800kg Stones 1.25m Thick
 ⑥ - DREDGE AREA

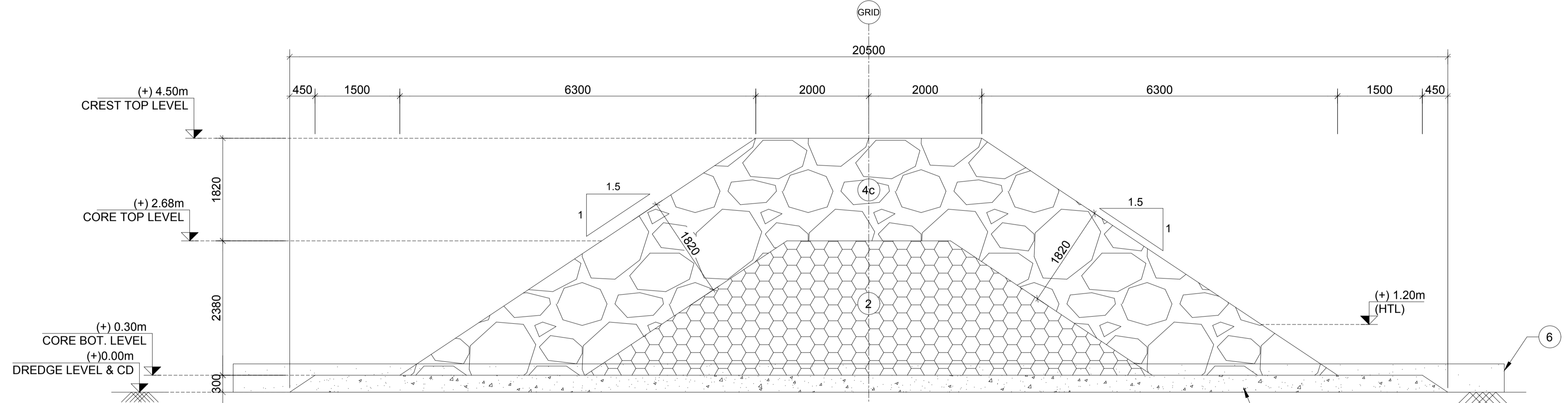
REFERENCE DRAWINGS :-
 1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH LATEST DRAWING NO :
 a) IITM-KKK-BG-101-01 e) IITM-KKK-BG-101-05
 b) IITM-KKK-BG-101-02 f) IITM-KKK-BG-101-06
 c) IITM-KKK-BG-101-03 g) IITM-KKK-BG-101-07
 d) IITM-KKK-BG-101-04 h) IITM-KKK-BG-101-08
 2. SEABED LEVEL REFER BATHYMETRY DRAWING NO:
 a) IITM-KKK-BG-001

REV.	DATE	DESCRIPTION	DESIGN	DRAWN
0	09.02.2023	ISSUED FOR CONSTRUCTION	CS	STR

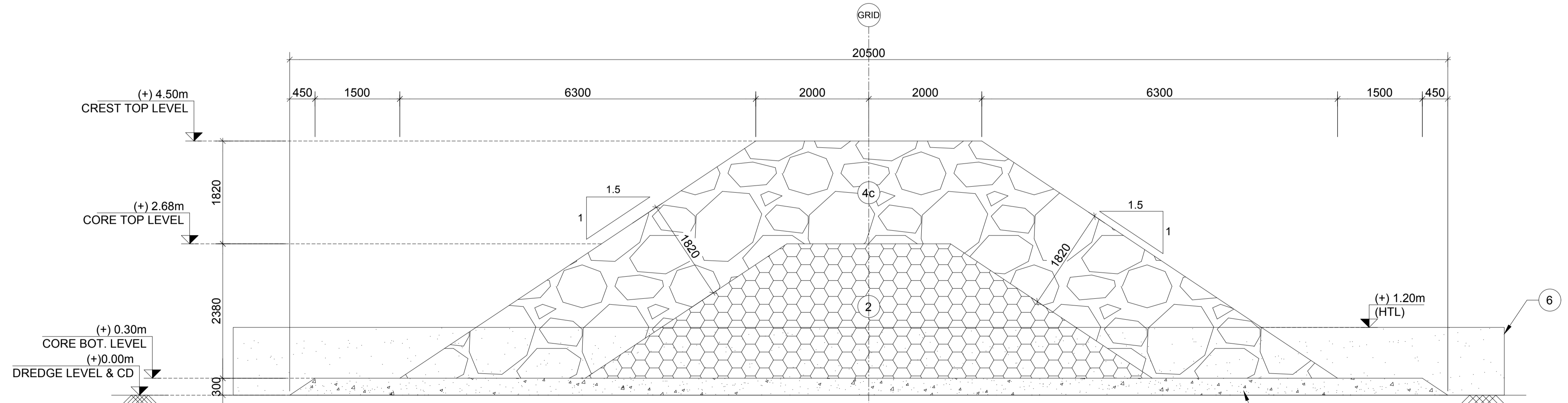
ORIGINAL SIZE: A1	CLIENT:	DEPARTMENT OF FISHERIES AND FISHERMEN WELFARE, GOVT OF TAMILNADU.	DATE:	09.02.2023
	PROJECT:	CONSTRUCTION OF FISH LANDING CENTRE AND SHORE PROTECTION WORKS INCLUDING BERTHING FACILITIES AT KARIKATTUKUPPAM IN CHENGALPATTU DISTRICT.		
	DRAWING TITLE:	KARIKATTUKUPPAM BREAKWATER AND GROUYNE GENERAL ARRANGMENT SHEET (9 OF 10)		
	DRAWING NO:	IITM - KKK - BG - 101 - 09	Scale as shown	REV 0
ENGINEERING FIRM:	DEPARTMENT OF OCEAN ENGINEERING IIT MADRAS CHENNAI - 600036			



TRUNK SECTION AT (+)0.5m TO 0.0m WATER DEPTH
Scale 1:50



TRUNK SECTION AT (+)0.5m
Scale 1:50



TRUNK SECTION AT (+)1.2m
Scale 1:50

NOTES :-
 1. ALL DIMENSIONS ARE IN MILLIMETERS.
 2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO CHART DATUM (CD).
 3. ALL CO-ORDINATES ARE GIVEN IN METER REFERRED TO UNIVERSAL TRANSVERSE MERCATOR (UTM).

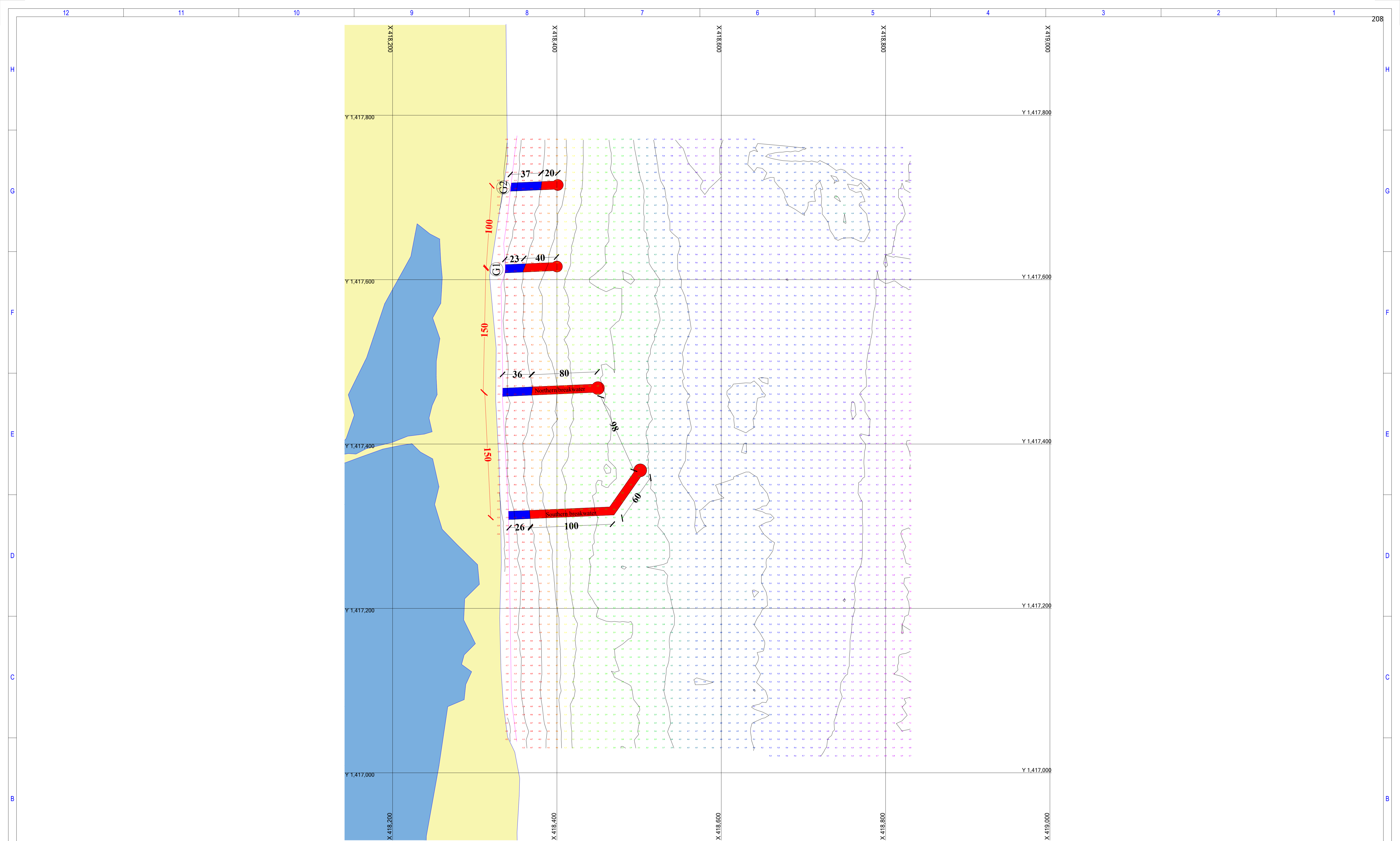
LEGEND:-
 ① - FILTER LAYER 1kg TO 10kg
 ② - CORE 100kg TO 300kg
 ③ - TOE MOUND 500kg TO 800kg 1.25m Thick

LEGEND:-
 ④c - ARMOUR LAYER, 2.5T- 3.5 T Stones 2 layer at 2.00m Thick
 ④d - ARMOUR LAYER, 1.5 T- 2.5 T Stones 2 layer at 1.82m Thick
 ⑤ - UNDER LAYER, 500kg - 800kg Stones 1.25m Thick
 ⑥ - DREDGE AREA

REFERENCE DRAWINGS :-
 1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH LATEST DRAWING NO :
 a) IITM-KKK-BG-101-01 e) IITM-KKK-BG-101-05 i) IITM-KKK-BG-101-09
 b) IITM-KKK-BG-101-02 f) IITM-KKK-BG-101-06
 c) IITM-KKK-BG-101-03 g) IITM-KKK-BG-101-07
 d) IITM-KKK-BG-101-04 h) IITM-KKK-BG-101-08
 2. SEABED LEVEL REFER BATHYMETRY DRAWING NO:
 a) IITM-KKK-BG-001

REV.	DATE	DESCRIPTION	DESIGN	DRAWN
0	09.02.2023	ISSUED FOR CONSTRUCTION	CS	AKE

ORIGINAL SIZE: A1	CLIENT:	DEPARTMENT OF FISHERIES AND FISHERMEN WELFARE, GOVT OF TAMILNADU.	DATE:	09.02.2023
	PROJECT:	CONSTRUCTION OF FISH LANDING CENTRE AND SHORE PROTECTION WORKS INCLUDING BERTHING FACILITIES AT KARIKATTUKUPPAM IN CHENGALPATTU DISTRICT.		
	DRAWING TITLE:	KARIKATTUKUPPAM BREAKWATER AND GROUYNE GENERAL ARRANGMENT SHEET (10 OF 10)		
	DRAWING NO:	IITM - KKK - BG - 101 - 10	Scale as shown	REV 0
ENGINEERING FIRM:	DEPARTMENT OF OCEAN ENGINEERING IIT MADRAS CHENNAI - 600036			




NOTES :

BATHYMETRY CHART BY:

LEGEND :

REV.	DATE	DESCRIPTION	DESIGN	DRAWN
0	09.07.2022	ISSUED FOR CONSTRUCTION	XXX	XXX

ORIGINAL SIZE:A1	CLIENT:	FISHING HARBOUR PROJECT DIVISION, TAMILNADU	DATE:	03.07.2022
	PROJECT:	CONSTRUCTION OF FISHING LANDING CENTRE AND SHORE PROTECTION WORKS INCLUDING BOAT BERTHING FACILITIES AT KARIKATTUKUPPAM IN CHENGALPATTU DISTRICT	Scale as shown REV 0	
	DRAWING TITLE:	BREAKWATER LAYOUT FOR KARIKATTUKUPPAM		
	DRAWING NO:	1		
	ENGINEERING FIRM:	 Prof.S.A.SANNASIRAJ Prof.V.SUNDAR DEPARTMENT OF OCEAN ENGINEERING,IIT MADRAS, CHENNAI - 36		

From

To

Dr. R. Umaiyakunjaram, M.Tech., Ph.D.,
District Environmental Engineer ,
Tamil Nadu Pollution Control Board,
Maraimalai Adigalar Street,
Maraimalai Nagar,
Chengalpattu District – 603 209.

1.The Regional Director of Municipal
Administration
Tambaram,
Chengalpattu District

✓ 2. The Assistant Director of Fisheries,
Fisheries and Fishermen Welfare Department,
Neelankarai,
Chengalpattu District

3. The General Manager,
District Industries Centre,
Kancheepuram

4. The Assistant Director of Town Panchayats,
Chengalpattu,
Collectorate of Kancheepuram,
Kancheepuram District.

5.The Deputy Director of Town and Country
Planing,
Chengalpattu Region
No. 124, GST Road,
Periyar Shopping Complex,
Chengalpattu - 603 001

Lr.No.DEE/TNPCB/MMN/DCZMA /CRZ/ 2022 Dated: 01.12.2022

Sir,

Sub: District Coastal Zone Management Authority meeting held on 24.11.2022 under CRZ Notification, 2011 for the proposed construction of Fish Landing Centres and Shore Protection work at Karikattukuppam Village, Chemmancherrykuppam Village, Pudhukalpakkam Village in Thiruporur Taluk, Kokilamedu Village in Tirukazhukundram Taluk and Angalammankuppam Village in Cheyyur Taluk, Chengalapattu District by Fisheries Department, Government of Tamilnadu – Minutes of the meeting – Communicated - Regarding.

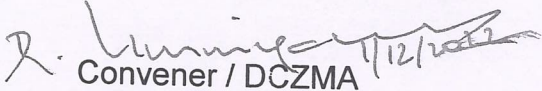
Ref: District Coastal Zone Management Authority Meeting held on 24.11.2022

I submit to state that the Fisheries Department, Government of Tamilnadu has applied for the clearance under the CRZ Notification, 2011 for the proposed construction of Fish Landing Centres and Shore Protection work at Karikattukuppam Village, Chemmancherrykuppam Village, Pudhukalpakkam Village in Thiruporur Taluk, Kokilamedu Village in Tirukazhukundram Taluk and Angalammankuppam Village in Cheyyur Taluk, Chengalapattu District.

The said proposal was placed before the District Coastal Zone Management Authority meeting held on 24.11.2022

The minutes of the said District Coastal Zone Management Authority meeting on 24.11.2022 regarding the above said proposals is enclosed herewith for kind attention please.

Minutes of the District Coastal Zone Management Authority meeting held on 24.11.2022.


Convener / DCZMA
District Environmental Engineer,
Tamil Nadu Pollution Control Board,
Maraimalainagar, Chengalpattu District

submitted to

District Collector,
Chengalpattu District - for favour of kind information please.

Minutes of the District Coastal Zone Management Authority, Chengalpattu District, Chengalpattu

Date: 24/11/2022

Subject : Issue of CRZ Clearance Under CRZ Notification 2011 for the proposed construction of Fish Landing Centre and Shore Protection Work at Karikattukuppam Village, Chemmancherrykuppam Village, Pudhukalpakkam Village in Thiruporur Taluk, Kokilamedu Village in Tirukazhukundram Taluk and Angalamkuppam Village in Cheyyur Taluk of Chengalpattu District in the CRZ 1(B) Intertidal Zone, CRZ III (No Development Zone) and CRZ IV (A) Sea bed area between the low tide line up to twelve nautical miles on the seaward side area as per CRZ Notification.

The District Coastal Zone Management Authority agenda was circulated on 23.11.2022 by the District Collector/Chairman of the District Coastal Zone Management Authority, Chengalpattu District.

The following members were circulated:

1.	The District Collector, Chengalpattu District	Chairman
2.	The District Environmental Engineer Tamilnadu Pollution Control Board, Maraimalainagar	Convener
3.	The Regional Directorate Of Municipal Administration, Chengalpattu Region	Member
4.	The Joint Director of Town and Country Planning, Chengalpattu.	Member
5.	The Assistant Director of Town Panchayat, Kancheepuram.	Member
6.	The Assistant Director of Fisheries (Marine), Neelankarai.	Member
7.	The General Manager, District Industries Centre, Chengalpattu.	Member

AGENDA NO.1

The Fisheries Department, Government of Tamil Nadu has proposed to construct Fish Landing Centre and Shore Protection Work at Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District in the CRZ 1(B) Intertidal Zone,

CRZ III (No Development Zone) and CRZ IV (A) Sea bed area between the low tide line up to twelve nautical miles on the seaward side area as per CRZ Notification.

The Project proponent has proposed to develop a fish landing centre to cater the increasing needs of the fisher folk of Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District, Tamilnadu. The infrastructure facilities include 2 Nos. of short and long Groynes (G1 & G2), net mending shed, diapharm wall, approach road.

The Project proponent has submitted the administrative approval issued by the Government vide G.O.(D).No.318 dated 13.12.2021. The Project proponent has submitted EIA report prepared by Environmental Consultants M/s. ABC Techno Labs India Private Limited, Chennai.

The Project proponent has furnished the report obtained from the Director, Institute of Remote Sensing, Anna University, Chennai superimposing the proposed project site on the approved Coastal Zone Management Plan – Map as per CRZ Notification, 2011 and stated that the above said proposed project falls in CRZ IB, CRZ III (No Development Zone) and CRZ IVA as per CRZ Notification, 2011. The project proponent has requested to accord CRZ Clearance as per the condition notified in the CRZ Notification, 2011.

As per the existing CZMP (as per CRZ Notifications, 2011) the said project alignment falls under CRZ-IB, CRZ-III & CRZ-IV-A.

- (a) As per CRZ Notification, 2011, Construction and operation for ports and harbours, jetties, wharves, quays, slipways, ship construction yards, breakwaters, groynes, erosion control measures is permissible activity under Para 4.(i).(f).
- (b) As per CRZ Notification, 2011, Construction of dispensaries, schools, public rain shelter, community toilets, bridges, roads, provisions of facilities for water supply, drainage, sewerage, crematoria, cemeteries and electric sub-station which are required for the local inhabitants may be permitted on a case to case basis by CZMA under Para 8 (III) (iii) (j).

(c) As per CRZ Notification, 2011, facilities required for local fishing communities such as fish drying yards, auction halls, net mending yards, traditional boat building yards, ice plant, ice crushing units, fish curving facilities and the like; is permissible under Para 8 (III) (iii) (I).

Therefore, the proposed construction of Fish Landing Centre and Shore Protection Work at Karikattukuppam Village, Thiruporur Taluk, Chengalpattu District is a permissible activity in the above said provisions under CRZ Notification, 2011.

Hence the above proposal was circulated among the said members of District Coastal Zone Management Authority for the detailed evaluation of the project and to take suitable decision on recommending the project to the State Level Coastal Zone Management Authority as required under Coastal Regulation Zone Notification 2011.

DECISION:

Further the committee has decided to recommend the project to the State Level Coastal Zone Management Authority for clearance under Coastal Regulation Zone Notification 2011 subject to the following conditions.

1. The project proponent shall segregate the municipal solid waste generated as Bio Degradable and Non Bio Degradable (Recyclable) and dispose the same scientifically as per the provisions of the Solid Waste Management Rules, 2016.
2. A continuous and comprehensive post – project marine quality monitoring program shall be taken up. This shall include monitoring of water quality, sediment quality and biological characteristics. Baseline data shall be collected prior to commencement of the project.
3. It shall be ensured that due to the project, there is no adverse impact on the drainage of the area and recharge of groundwater. No ground water shall be tapped in the project area.
4. The project activity shall not affect the coastal eco system including the marine flora and fauna.
5. The project proponent shall comply with the provision of the CRZ Notification 2011.

AGENDA NO.2

The Fisheries Department, Government of Tamil Nadu has proposed to construct Fish Landing Centre and Shore Protection Work at Kokilamedu Village, Tirukazhukundram Taluk, Chengalpattu District in the CRZ 1(B) Intertidal Zone, CRZ III (No Development Zone) and CRZ IV (A) Sea bed area between the low tide line up to twelve nautical miles on the seaward side area as per CRZ Notification.

The Project proponent has proposed to develop a fish landing centre to cater the increasing needs of the fisher folk of Kokilamedu Village, Tirukazhukundram Taluk, Chengalpattu District. The infrastructure facilities include 6 Nos. of short and long Groynes (G1 to G6) ranging from 20m to 80m, net mending shed and approach road.

The Project proponent has submitted the administrative approval issued by the Government vide G.O.(D).No.318 dated 13.12.2021. The Project proponent has submitted EIA report prepared by Environmental Consultants M/s. ABC Techno Labs India Private Limited, Chennai.

The Project proponent has furnished the report obtained from the Director, Institute of Remote Sensing, Anna University, Chennai superimposing the proposed project site on the approved Coastal Zone Management Plan - Map as per CRZ Notification, 2011 and stated that the above said proposed project falls in CRZ IB, CRZ III (No Development Zone) and CRZ IVA as per CRZ Notification, 2011. The project proponent has requested to accord CRZ Clearance as per the condition notified in the CRZ Notification, 2011.

As per the existing CZMP (as per CRZ Notifications, 2011) the said project alignment falls under CRZ-IB, CRZ-III & CRZ-IV-A.

- (a) As per CRZ Notification, 2011, Construction and operation for ports and harbours, jetties, wharves, quays, slipways, ship construction yards, breakwaters, groynes, erosion control measures is permissible activity under Para 4.(i).(f).

(b)As per CRZ Notification, 2011, Construction of dispensaries, schools, public rain shelter, community toilets, bridges, roads, provisions of facilities for water supply, drainage, sewerage, crematoria, cemeteries and electric sub-station which are required for the local inhabitants may be permitted on a case to case basis by CZMA under Para 8 (III) (iii) (j).

(c)As per CRZ Notification, 2011, facilities required for local fishing communities such as fish drying yards, auction halls, net mending yards, traditional boat building yards, ice plant, ice crushing units, fish curving facilities and the like; is permissible under Para 8 (III) (iii) (l).

Therefore, the proposed construction of Fish Landing Centre and Shore Protection Work at Kokilamedu Village, Tirukazhukundram Taluk, Chengalpattu District is a permissible activity in the above said provisions under CRZ Notification, 2011.

Hence the above proposal was circulated among the said members of District Coastal Zone Management Authority for the detailed evaluation of the project and to take suitable decision on recommending the project to the State Level Coastal Zone Management Authority as required under Coastal Regulation Zone Notification 2011.

DECISION:

Further the committee has decided to recommend the project to the State Level Coastal Zone Management Authority for clearance under Coastal Regulation Zone Notification 2011 subject to the following conditions.

1. The project proponent shall segregate the municipal solid waste generated as Bio Degradable and Non Bio Degradable (Recyclable) and dispose the same scientifically as per the provisions of the Solid Waste Management Rules, 2016.
2. A continuous and comprehensive post – project marine quality monitoring program shall be taken up. This shall include monitoring of water quality, sediment quality and biological characteristics. Baseline data shall be collected prior to commencement of the project.
3. It shall be ensured that due to the project, there is no adverse impact on the drainage of the area and recharge of groundwater. No ground water shall be tapped in the project area.

4. The project activity shall not affect the coastal eco system including the marine flora and fauna.
5. The project proponent shall comply with the provision of the CRZ Notification 2011.

AGENDA NO.3

The Fisheries Department, Government of Tamil Nadu has proposed to construct Fish Landing Centre and Shore Protection Work at Chemmancherrykuppam Village, Thiruporur Taluk, Chengalpattu District in the CRZ 1(B) Intertidal Zone, CRZ III (No Development Zone) and CRZ IV (A) Sea bed area between the low tide line up to twelve nautical miles on the seaward side area as per CRZ Notification.

The Project proponent has proposed to develop a fish landing centre to cater the increasing needs of the fisher folk of Chemmancherrykuppam Village, Thiruporur Taluk, Chengalpattu District. The infrastructure facilities include 6 Nos. of short and long Groynes (G1 to G6) ranging from 20m to 80m, net mending shed, fish drying platform, toilet facilities, internal road and approach road.

The Project proponent has submitted the administrative approval issued by the Government vide G.O.(D).No.318 dated 13.12.2021. The Project proponent has submitted EIA report prepared by Environmental Consultants M/s. ABC Techno Labs India Private Limited, Chennai.

The Project proponent has furnished the report obtained from the Director, Institute of Remote Sensing, Anna University, Chennai superimposing the proposed project site on the approved Coastal Zone Management Plan – Map as per CRZ Notification, 2011 and stated that the above said proposed project falls in CRZ IB, CRZ III (No Development Zone) and CRZ IVA as per CRZ Notification, 2011. The project proponent has requested to accord CRZ Clearance as per the condition notified in the CRZ Notification, 2011.

As per the existing CZMP (as per CRZ Notifications, 2011) the said project alignment falls under CRZ-IB, CRZ-III & CRZ-IV-A.

- (a) As per CRZ Notification, 2011, Construction and operation for ports and harbours, jetties, wharves, quays, slipways, ship construction yards,

breakwaters, groynes, erosion control measures is permissible activity under Para 4.(i).(f).

(b)As per CRZ Notification, 2011, Construction of dispensaries, schools, public rain shelter, community toilets, bridges, roads, provisions of facilities for water supply, drainage, sewerage, crematoria, cemeteries and electric sub-station which are required for the local inhabitants may be permitted on a case to case basis by CZMA under Para 8 (III) (iii) (j).

(c)As per CRZ Notification, 2011, facilities required for local fishing communities such as fish drying yards, auction halls, net mending yards, traditional boat building yards, ice plant, ice crushing units, fish curving facilities and the like; is permissible under Para 8 (III) (iii) (l).

Therefore, the proposed construction of Fish Landing Centre and Shore Protection Work at Chemmancherrykuppam Village, Thiruporur Taluk, Chengalpattu District is a permissible activity in the above said provisions under CRZ Notification, 2011.

Hence the above proposal was circulated among the said members of District Coastal Zone Management Authority for the detailed evaluation of the project and to take suitable decision on recommending the project to the State Level Coastal Zone Management Authority as required under Coastal Regulation Zone Notification 2011.

DECISION:

Further the committee has decided to recommend the project to the State Level Coastal Zone Management Authority for clearance under Coastal Regulation Zone Notification 2011 subject to the following conditions.

1. The project proponent shall segregate the municipal solid waste generated as Bio Degradable and Non Bio Degradable (Recyclable) and dispose the same scientifically as per the provisions of the Solid Waste Management Rules, 2016.
2. A continuous and comprehensive post - project marine quality monitoring program shall be taken up. This shall include monitoring of water quality, sediment quality and biological characteristics. Baseline data shall be collected prior to commencement of the project.

3. It shall be ensured that due to the project, there is no adverse impact on the drainage of the area and recharge of groundwater. No ground water shall be tapped in the project area.
4. The project activity shall not affect the coastal eco system including the marine flora and fauna.
5. The project proponent shall comply with the provision of the CRZ Notification 2011.

AGENDA NO.4

The Fisheries Department, Government of Tamil Nadu has proposed to construct Fish Landing Centre and Shore Protection Work at Pudhukalpakkam Village, Thiruporur Taluk, Chengalpattu District in the CRZ 1(B) Intertidal Zone, CRZ III (No Development Zone) and CRZ IV (A) Sea bed area between the low tide line up to twelve nautical miles on the seaward side area as per CRZ Notification.

The Project proponent has proposed to develop a fish landing centre to cater the increasing needs of the fisher folk of Pudhukalpakkam Village, Thiruporur Taluk, Chengalpattu District. The infrastructure facilities include 5 Nos. of short and long Groynes (G1 to G5) ranging from 20m to 80m, net mending shed and approach road.

The Project proponent has submitted the administrative approval issued by the Government vide G.O.(D).No.318 dated 13.12.2021. The Project proponent has submitted EIA report prepared by Environmental Consultants M/s. ABC Techno Labs India Private Limited, Chennai.

The Project proponent has furnished the report obtained from the Director, Institute of Remote Sensing, Anna University, Chennai superimposing the proposed project site on the approved Coastal Zone Management Plan - Map as per CRZ Notification, 2011 and stated that the above said proposed project falls in CRZ IB, CRZ III (No Development Zone) and CRZ IVA as per CRZ Notification, 2011. The project proponent has requested to accord CRZ Clearance as per the condition notified in the CRZ Notification, 2011.

As per the existing CZMP (as per CRZ Notifications, 2011) the said project alignment falls under CRZ-IB, CRZ-III & CRZ-IV-A.

(a)As per CRZ Notification, 2011, Construction and operation for ports and harbours, jetties, wharves, quays, slipways, ship construction yards, breakwaters, groynes, erosion control measures is permissible activity under Para 4.(i).(f).

(b)As per CRZ Notification, 2011, Construction of dispensaries, schools, public rain shelter, community toilets, bridges, roads, provisions of facilities for water supply, drainage, sewerage, crematoria, cemeteries and electric sub-station which are required for the local inhabitants may be permitted on a case to case basis by CZMA under Para 8 (III) (iii) (j).

(c)As per CRZ Notification, 2011, facilities required for local fishing communities such as fish drying yards, auction halls, net mending yards, traditional boat building yards, ice plant, ice crushing units, fish curving facilities and the like; is permissible under Para 8 (III) (iii) (l).

Therefore, the proposed construction of Fish Landing Centre and Shore Protection Work at Pudhukalpakkam Village, Thiruporur Taluk, Chengalpattu District is a permissible activity in the above said provisions under CRZ Notification, 2011.

Hence the above proposal was circulated among the said members of District Coastal Zone Management Authority for the detailed evaluation of the project and to take suitable decision on recommending the project to the State Level Coastal Zone Management Authority as required under Coastal Regulation Zone Notification 2011.

DECISION:

Further the committee has decided to recommend the project to the State Level Coastal Zone Management Authority for clearance under Coastal Regulation Zone Notification 2011 subject to the following conditions.

1. The project proponent shall segregate the municipal solid waste generated as Bio Degradable and Non Bio Degradable (Recyclable) and dispose the same scientifically as per the provisions of the Solid Waste Management Rules, 2016.
2. A continuous and comprehensive post – project marine quality monitoring program shall be taken up. This shall include monitoring of water quality,

- sediment quality and biological characteristics. Baseline data shall be collected prior to commencement of the project.
3. It shall be ensured that due to the project, there is no adverse impact on the drainage of the area and recharge of groundwater. No ground water shall be tapped in the project area.
 4. The project activity shall not affect the coastal eco system including the marine flora and fauna.
 5. The project proponent shall comply with the provision of the CRZ Notification 2011.

AGENDA NO.5

The Fisheries Department, Government of Tamil Nadu has proposed to construct Fish Landing Centre and Shore Protection Work at Angalamkuppam Village, Cheyyur Taluk, Chengalpattu District in the CRZ 1(B) Intertidal Zone, CRZ III (No Development Zone) and CRZ IV (A) Sea bed area between the low tide line up to twelve nautical miles on the seaward side area as per CRZ Notification.

The Project proponent has proposed to develop a fish landing centre to cater the increasing needs of the fisher folk of Angalamkuppam Village, Cheyyur Taluk, Chengalpattu District. The infrastructure facilities include 5 Nos. of short and long Groynes (G1 to G5) ranging from 20m to 80m, net mending shed and approach road.

The Project proponent has submitted the administrative approval issued by the Government vide G.O.(D).No.318 dated 13.12.2021. The Project proponent has submitted EIA report prepared by Environmental Consultants M/s. Indomer Coastal Hydraulics (P) Ltd., Chennai.

The Project proponent has furnished the report obtained from the Director, Institute of Remote Sensing, Anna University, Chennai superimposing the proposed project site on the approved Coastal Zone Management Plan – Map as per CRZ Notification, 2011 and stated that the above said proposed project falls in CRZ IB, CRZ III (No Development Zone) and CRZ IVA as per CRZ Notification, 2011. The project proponent has requested to accord CRZ Clearance as per the condition notified in the CRZ Notification, 2011.

As per the existing CZMP (as per CRZ Notifications, 2011) the said project alignment falls under CRZ-IB, CRZ-III & CRZ-IV-A.

- (a) As per CRZ Notification, 2011, Construction and operation for ports and harbours, jetties, wharves, quays, slipways, ship construction yards, breakwaters, groynes, erosion control measures is permissible activity under Para 4.(i).(f).
- (b) As per CRZ Notification, 2011, Construction of dispensaries, schools, public rain shelter, community toilets, bridges, roads, provisions of facilities for water supply, drainage, sewerage, crematoria, cemeteries and electric sub-station which are required for the local inhabitants may be permitted on a case to case basis by CZMA under Para 8 (III) (iii) (j).
- (c) As per CRZ Notification, 2011, facilities required for local fishing communities such as fish drying yards, auction halls, net mending yards, traditional boat building yards, ice plant, ice crushing units, fish curving facilities and the like; is permissible under Para 8 (III) (iii) (I).

Therefore, the proposed construction of Fish Landing Centre and Shore Protection Work at Angalamkuppam Village, Cheyyur Taluk, Chengalpattu District is a permissible activity in the above said provisions under CRZ Notification, 2011.

Hence the above proposal was circulated among the said members of District Coastal Zone Management Authority for the detailed evaluation of the project and to take suitable decision on recommending the project to the State Level Coastal Zone Management Authority as required under Coastal Regulation Zone Notification 2011.

DECISION:

Further the committee has decided to recommend the project to the State Level Coastal Zone Management Authority for clearance under Coastal Regulation Zone Notification 2011 subject to the following conditions.

1. The project proponent shall segregate the municipal solid waste generated as Bio Degradable and Non Bio Degradable (Recyclable) and dispose the

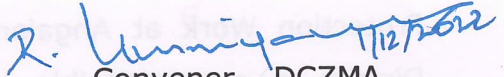
same scientifically as per the provisions of the Solid Waste Management Rules, 2016.

2. A continuous and comprehensive post – project marine quality monitoring program shall be taken up. This shall include monitoring of water quality, sediment quality and biological characteristics. Baseline data shall be collected prior to commencement of the project.
3. It shall be ensured that due to the project, there is no adverse impact on the drainage of the area and recharge of groundwater. No ground water shall be tapped in the project area.
4. The project activity shall not affect the coastal eco system including the marine flora and fauna.
5. The project proponent shall comply with the provision of the CRZ Notification 2011.

Sd./- A. R. Rahul Nadh, I.A.S.,
District Collector/
Chairman(DCZMA),
Chengalpattu.

To,
All the Members concerned
Copy to file

/Forwarded by Order/


Convener – DCZMA
District Environmental Engineer,
Tamilnadu Pollution Control Board,
Maraimalai Nagar

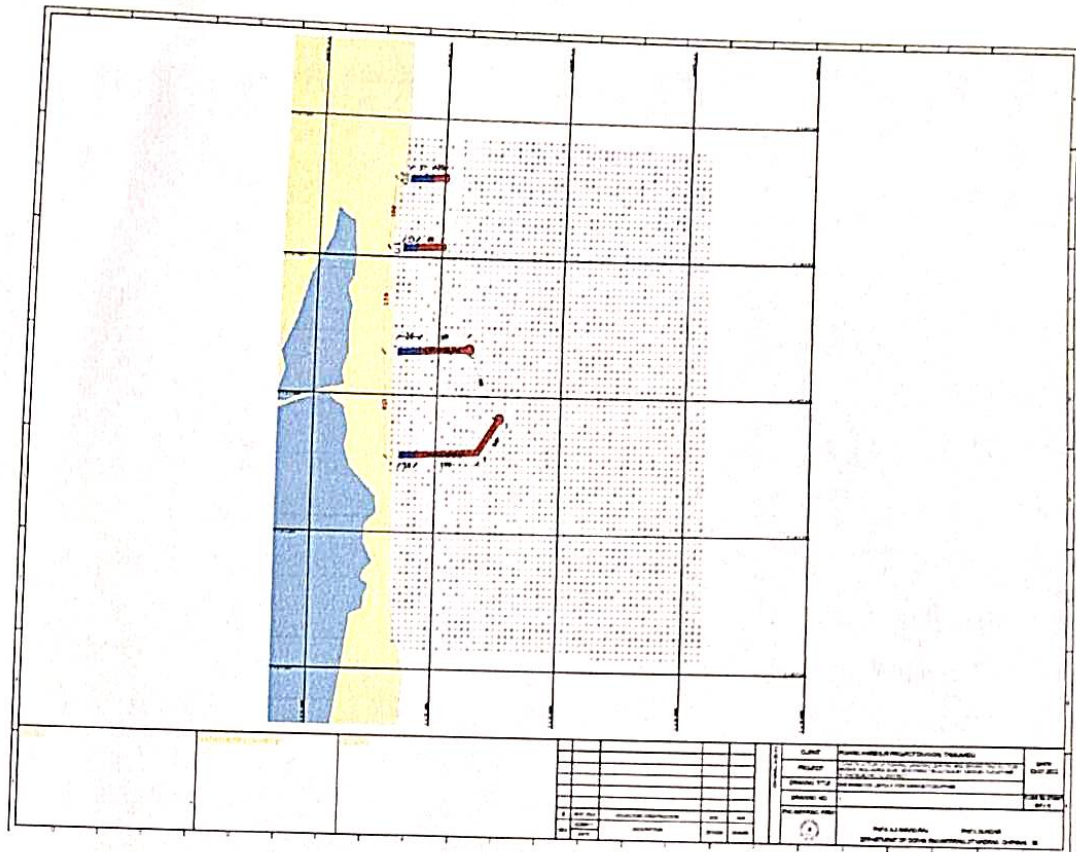
2/12
06/12/2022

Karikattukuppam FLC (Muttukadu)

The Karikattukuppam Fishing Village is situated on the South of Chennai in ECR road, lies at $12^{\circ}49'10.87''\text{N}$ $80^{\circ}14'52.24''\text{E}$. There are about 572 fisher folks and 43 FRP boats are actively involving in fishing activities. Due to sea erosion, that occurs very frequently along the coast causes damage to the assets of fisher folks. The fishermen from this village made frequent representation to protect the seashore, their residential settlements and to provide landside facilities.

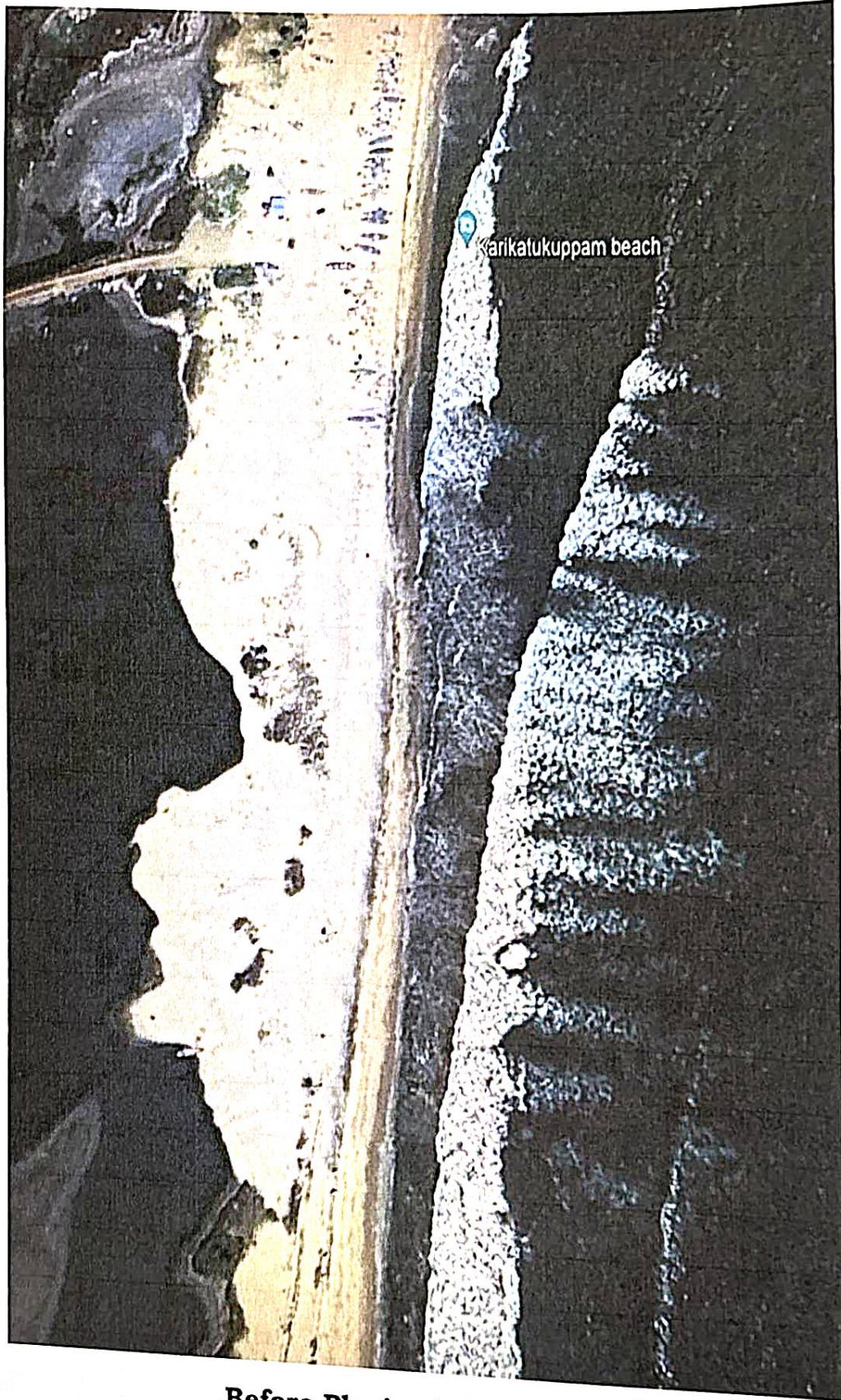


Beach formed for a length of 60m after placing groynes. The fishermen and their livelihood has been saved from severe sea erosion. At present, the fishermen berth their boats in the newly formed beach area.

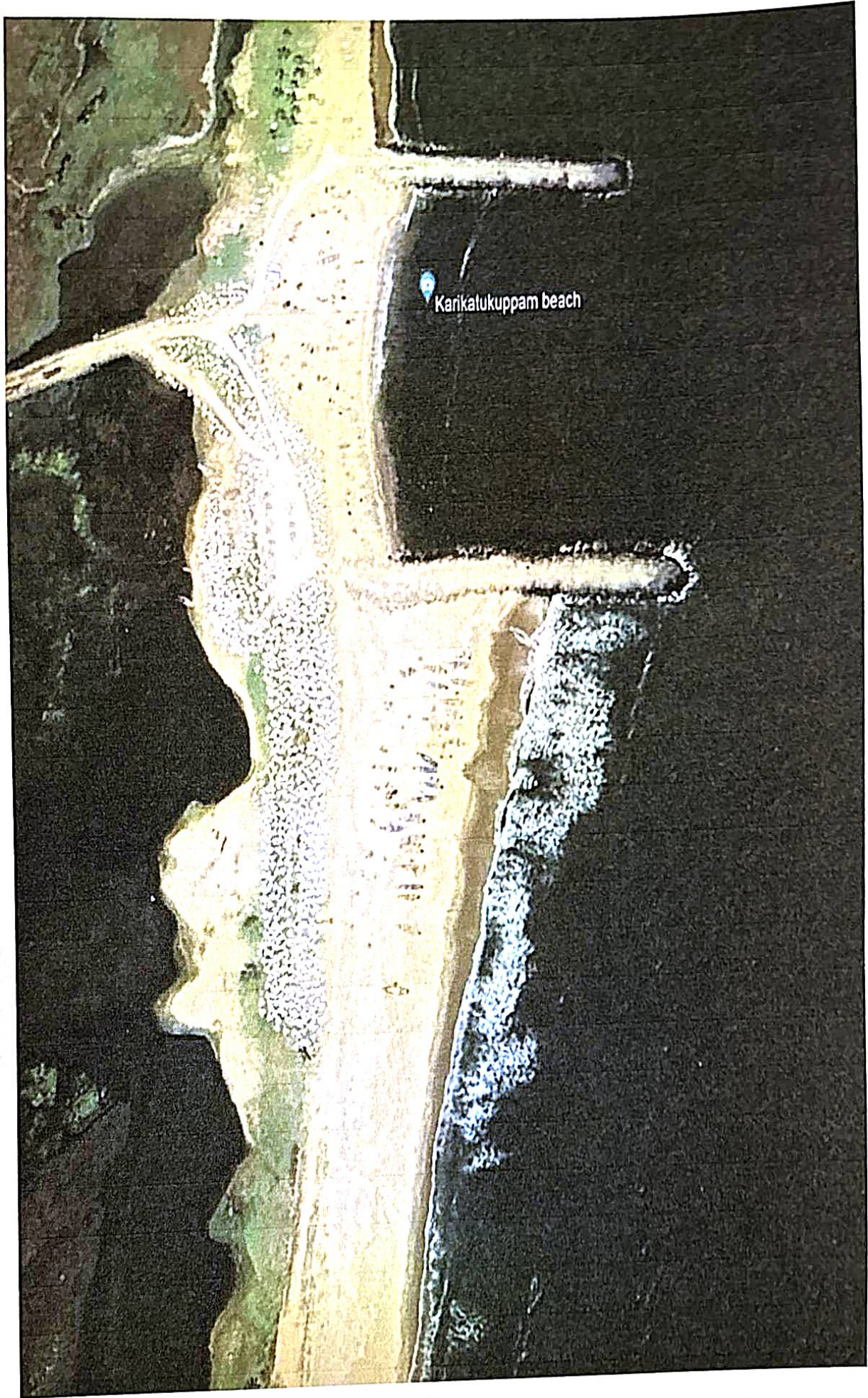


- 1). Southern Breakwater Length - 160.00 M
- 2) Northern Breakwater Length - 80.00 M
- 3) Groyne - 1 Length - 40.00 M
- 4) Groyne - 2 Length - 20.00 M

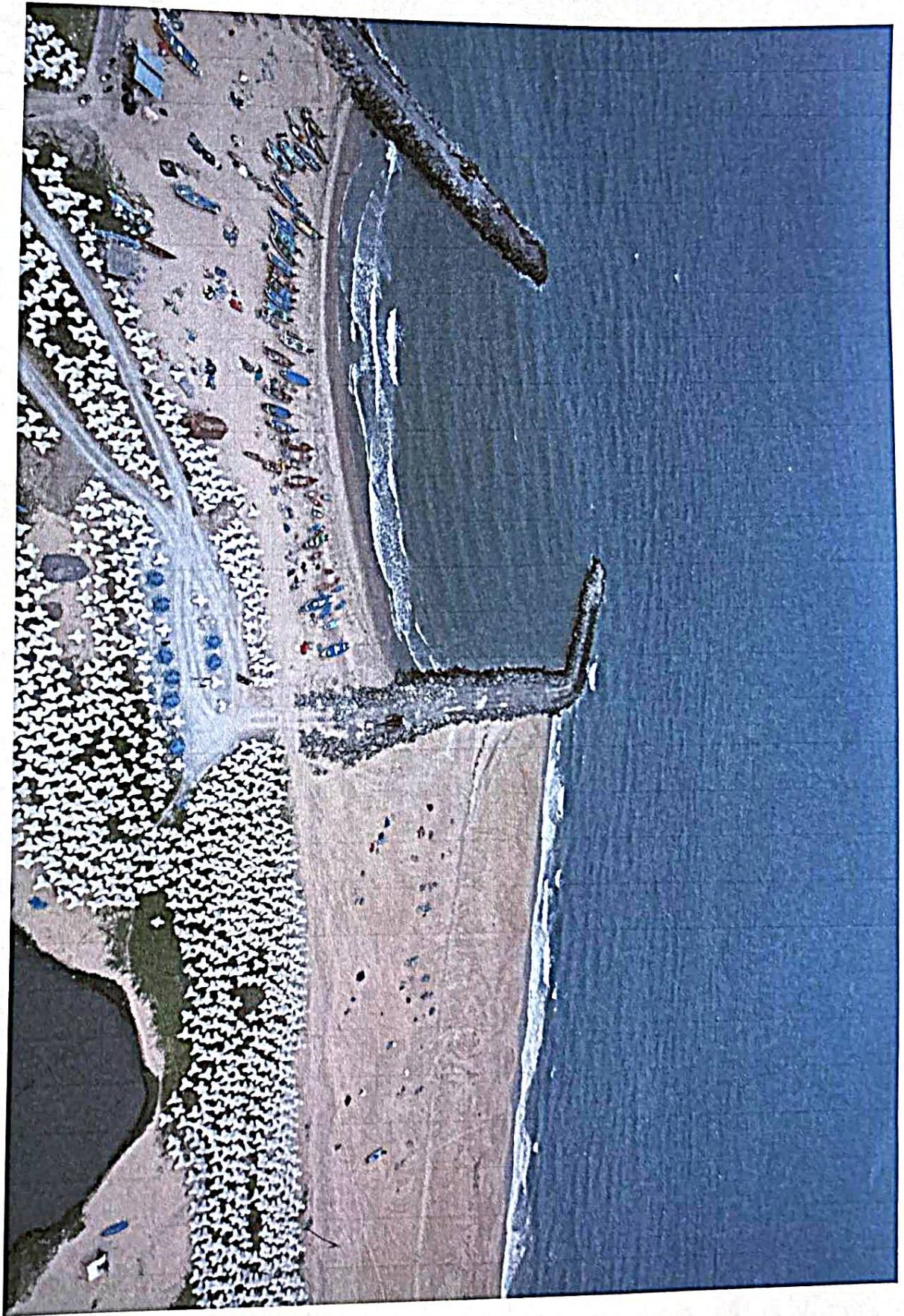
➤ Distance between Southern Breakwater to Groyne 2 = 400RM



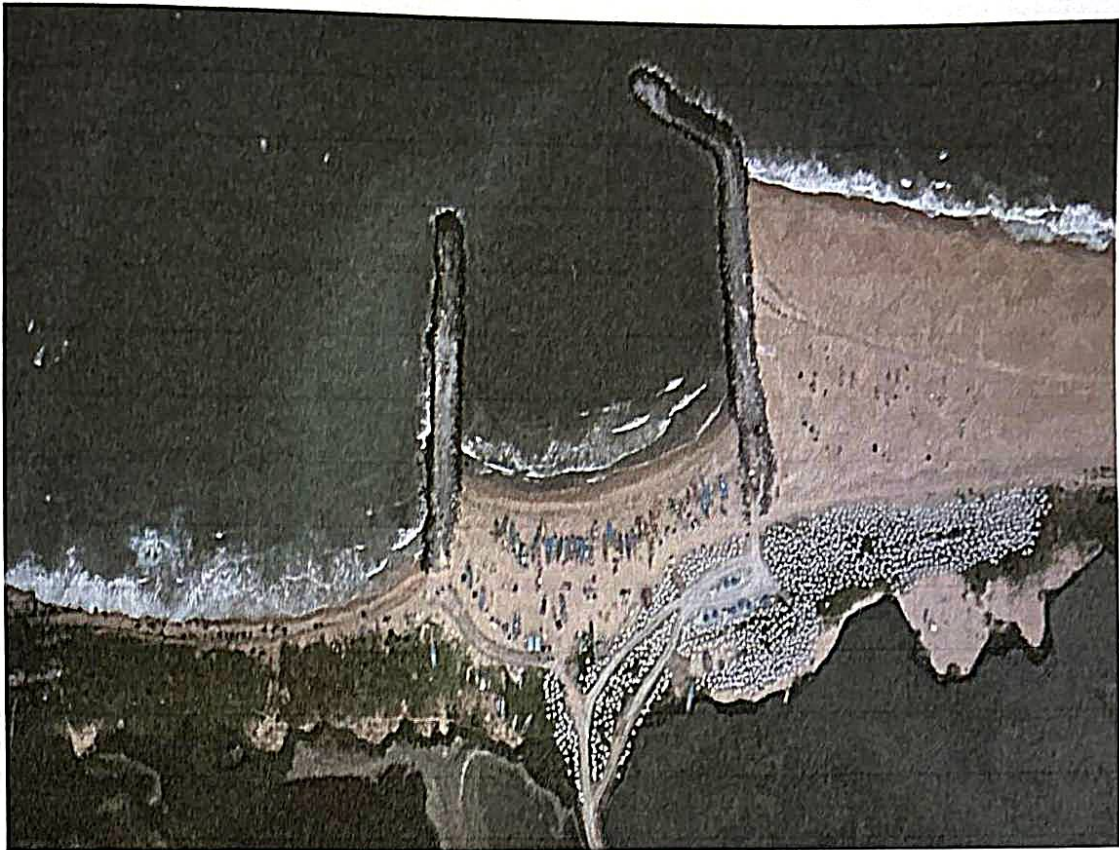
Before Placing Breakwaters



After Placing Breakwaters



After Placing Breakwaters



After Placing Breakwaters

