

**KARAIKAL PORT PRIVATE LIMITED  
KARAIKAL DISTRICT, PUDUCHERRY U.T**

**Amendment of Construction of Berth No.4 instead of  
Berth No.7 at Karaikal Port (Phase-II) at Puducherry by  
M/s. Karaikal Port Pvt Ltd**

**MoEF&CC Letter No. 10-42/2009-IA-III dated 20.05.2011**

**Compliance Report for the Period of  
APRIL TO SEPTEMBER 2023**

KPP/ENV/MoEF&CC/EC-CRZ /2023/05

Date: 18<sup>th</sup> October, 2023

**To**

**The Regional Officer, Integrated Regional Office (IRO),**

Ministry of Environment, Forest & Climate Change (MoEF&CC),

1st Floor, Additional Office Block for GPOA, Shastri Bhawan, Haddows Road,

Nungambakkam, Chennai - 600006

**Subject:** Submission of Compliance Report by end of 30<sup>th</sup> September, 2023 – Regarding

**Reference:**

Amendment of Construction of Berth No.4 instead of Berth No.7 at Karaikal Port (Phase-II) at Puducherry by M/s. Karaikal Port Pvt Ltd - MoEF&CC Letter No. 10-42/2009-IA-III dated 20.05.2011

Respected Sir,

As per the conditions stipulated in Environmental & CRZ Clearance letter (No.10 - 42/2009 - IA – III, dated 20.05.2011), from Government of India, Ministry of Environment, Forest and Climate Change IA.III Section (MOEF&CC, IA.III Section), herewith we are submitting the status of compliance reports for the period of April to September 2023.

Thanking you,

Yours faithfully,



**(Prabu Ananth B)**

Authorized Signatory

Cc:

➤ **The Regional Director**, CPCB Regional Directorate/Project Office, Second Floor, No.77-A, South Avenue Road, Ambattur Industrial Estate, Ambattur Taluk, Thiruvallur District, Chennai 600 058

➤ **The Member Secretary**, Puducherry Pollution Control Committee (PPCC) , Department of Science, Technology & Environment, 3rd Floor, PHB Building, Anna Nagar, Puducherry 605 005.

**KARAIKAL PORT PRIVATE LIMITED**

CIN: U4520PY2006PTC001945

Registered Office

Kheezhavanjoor Village, T.R. Pattinam, PB No. 33, Karaikal – 609 606. Tel. : +91 4365 256600 (5 Lines) Fax : +91 4365 256603

www.karaikalport.com

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| Sl.No | Particulars                                  | Remarks  |
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| 2     | Copy of Latest Compliance Report             | Attached |
| 3     | CTE/NOC from PPCC                            | Attached |
| 4     | Photographs of Environment Friendly measures | Attached |



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**KARAIKAL PORT PRIVATE LIMITED – Six Monthly Compliance Report**  
**For the period of APRIL TO SEPTEMBER 2023**

**DESCRIPTIVE REPORT ON STATUS OF COMPLIANCE TO THE CONDITIONS OF**  
**ENVIRONMENTAL CLEARANCE AND ENVIRONMENTAL MANAGEMENT**

**Subject:** Amendment of Construction of Berth No.4 instead of Berth No.7 at Karaikal Port (Phase-II) at Puducherry by M/s Karaikal Port Private Limited - Reg

**Reference:** MoEF&CC Letter No. 10-42/2009-IA-III dated 20.05.2011

**4. Specific Conditions:**

| <b>Sl.No</b> | <b>Conditions stipulated</b>  | <b>Compliance Status</b>  |
|--------------|---|---|
| (I)          | <p>The shore line map prepared by Institute for ocean management, Chennai with regard to the stretch at Karaikal port has be examined and it is observed that on the southern side of the port, the area is shown as medium accretion while, on the northern side the area is shown as medium erosion. This is because the net littoral drift is towards the northern side and due to the breakwater at the southern port there seems to be accretion at the southern breakwater and medium erosion on the northern side. This reveals that the existing measures for beach nourishment maintenance of shore line are insufficient. Those have to be rectified by adopting suitable measures viz. sand bypass system from south breakwater to the northern side of the north breakwater. The port shall submit the details of action taken to the ministry within 2 months.</p> | <p><b>Complied.</b></p> <p>Report on "<i>Shoreline Monitoring Study</i>" carried out by M/s Indomer Coastal Hydraulics Pvt. Ltd is attached as <b>Annexure 1.</b></p> <p>Recommendations are being complied with.</p> |
| (II)         | <p>The port shall adopt suitable measures viz. sand bypass system from south breakwater to the northern side of the north breakwater.</p>   | <p><b>Complied.</b> Recommendations on the shoreline monitoring study are being complied with.</p>  |

**KARAIKAL PORT PRIVATE LIMITED – Six Monthly Compliance Report**  
**For the period of APRIL TO SEPTEMBER 2023**

| Sl.No | Conditions stipulated   | Compliance Status  |
|-------|---|--|
|       | The port shall submit the details of action taken to the ministry within 2 Months.  |  |
| (III) | There shall be regular monitoring on the shoreline changes and report be submitted to the Ministry at Regional Office, Bangalore with six monthly monitoring report.  | <b>Complied.</b><br>Shoreline monitoring reports are being submitted to the Ministry at Regional office. Copy of latest compliance report is attached as <b>Annexure 2</b> & latest shoreline survey carried out in June 2023 is also attached as <b>Annexure 2A</b> .   |
| (IV)  | "Consent for Establishment" shall be obtained from Puducherry Pollution Control Committee under Air and Water Act and a copy shall be submitted to the Ministry before start of any construction work at the site.                        | <b>Complied.</b><br>No Objection Certificate from Pollution Angle was issued by Puducherry Pollution Control Committee.<br><br>Copy of the same is attached as <b>Annexure 3</b> .   |
| (V)   | Construction shall be carried out strictly as per the provisions of CRZ Notification, 1991. No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in coastal regulation zone area. | <b>Complied.</b> Construction was carried out strictly as per the provisions of CRZ Notification.  |
| (VI)  | There shall be no disposal of solid and liquid wastes in to the coastal areas.  | <b>Complied.</b> There is no disposal of solid & liquid wastes in to the coastal areas. Prevention of pollution of the marine environment by ships from operational or other accidental causes, MARPOL is strictly adhered. Necessary waste management plan is in place. |

**KARAIKAL PORT PRIVATE LIMITED – Six Monthly Compliance Report**  
**For the period of APRIL TO SEPTEMBER 2023**

| Sl.No | Conditions stipulated  | Compliance Status  |
|-------|--|--|
| (VII) | Dust control measures shall be installed wherever required in the coal handling areas. | <p><b>Complied.</b></p> <p>Port has Mechanized Coal Handling System which includes Ship Unloaders, Conveyors, Stacker cum Reclaimers, Wagon Loading &amp; Truck Loading Systems etc are in place and operational. This infrastructure helps in achieving efficient operations and in maintaining clean environment.</p> <p>Highly efficient water sprinkling/spraying system for dust suppression have been installed to address the coal dust emission.</p> <p>HDPE/Corrugated sheets of various heights of wind breaking wall have been put along the Coal Stock yards, boundary &amp; Railway sidings.</p> <p>State of the art Tyre wash system is in place where the effluent after treatment is reused in the same unit.</p> <p>Dedicated Tankers &amp; Tractors are engaged for wetting the coal yards, Roads etc.,</p> <p>Port has three tier Green Belt in all the boundaries.</p> |

**KARAIKAL PORT PRIVATE LIMITED – Six Monthly Compliance Report**  
**For the period of APRIL TO SEPTEMBER 2023**

| Sl.No  | Conditions stipulated   | Compliance Status  |
|--------|---|--|
|        |   | Photographs of the Environmental Friendly initiatives has been attached as <b>Annexure 4.</b>  |
| (VIII) | The leachate from the coal yard shall be properly collected and passed through settling tanks before reuse / recycling. | <b>Complied.</b><br>KPPL has installed a treatment plant to address the leachate from the Coal Yard. Photographs of Treatment Plants has been attached as above <b>Annexure 4.</b> |
| 5.     | All other conditions shall remain unchanged.  | Noted for Compliance.  |



**(Prabu Ananth B)**  
Authorized Signatory

# SHORELINE MONITORING STUDY FOR EROSION AND ACCRETION ASSESSMENT AT KARAİKAL PORT FOR THE YEAR 2022

PROJECT CODE: 784072223

STUDY CONDUCTED FOR



KARAİKAL PORT PRIVATE LIMITED  
KEEZHA VANJORE VILLAGE, T.R. PATTINAM  
KARAİKAL 609606, PUDUCHERRY U.T

REPORT PREPARED BY



**INDOMER COASTAL HYDRAULICS (P) LTD.**  
**(ISO 9001: 2015 CERTIFIED AND QCI-NABET&NABL ACCREDITED)**  
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**AUGUST 2022**





**INDOMER COASTAL HYDRAULICS (P) LTD.**  
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| Client        | Karaikal Port Private Limited (KPPL), Karaikal.   |                                |                  |                     |                 |
|---------------|---|--------------------------------|------------------|---------------------|-----------------|
| Project Title | Shoreline Monitoring Study for Erosion and Accretion Assessment at Karaikal Port for the Year 2022.   |                                |                  |                     |                 |
| Project Code  | 784072223   |                                |                  |                     |                 |
| Abstract      | <p>Karaikal Port is an all-weather Port developed under Public Private Partnership (PPP) with the Government of Puducherry. The port is in operation since the year 2009 and it handles multiple types of cargoes of which coal and fertilizer import constitute a major share.</p> <p>KPPL engaged Indomer Coastal Hydraulics (P) Ltd., Chennai to take up “Shoreline Monitoring Study for Erosion and Accretion Assessment” in order to understand the present status of the shoreline.</p> <p>This report also presents the shoreline status and the surveys carried out in October 2013, October 2016, July 2017, July 2022. All the earlier surveys and the present survey were carried out in July 2022 are compared with initial shoreline existed in June 2009.</p> |                                |                  |                     |                 |
| Foreword      | The materials presented in the report carry the copy right of KPPL and INDOMER and should not be altered or distorted or copied or presented in different manner by other organizations without the written consent from KPPL and INDOMER.  |                                |                  |                     |                 |
| Document      | Controlled  |                                |                  |                     |                 |
| References    | Work order No. LOI/PROJECT/SHORELINE STUDY dated 19.07.2022.  |                                |                  |                     |                 |
| Date          | Report Type   | Originator                     | Checked by       | Approved by         | Approver's Sign |
| 01.09.2022    | Final   | A. Baskaran                    | Mr. Guru Prasath | Dr. P. Chandramohan |                 |
|               | Project Code  | 784072223                      |                  | Text pages          | 29              |
|               | File Location   | E:/2022 Projects/July -22/KPPL |                  | Figures             | 18              |

**TEAM**

| Name                | Qualification & Designation   |
|---------------------|---|
| Dr. P. Chandramohan | Ph. D. (Ocean Engineering)<br>(Former Scientist, CSIR-NIO, Goa)<br>Managing Director  |
| Dr. J. Guru Prasath | B.E. (Marine Engineering),<br>M.S., <i>Ph. D.</i> (Ocean Engineering)<br>Director     |
| Dr. Terry Machado   | Ph.D. (Marine Geology)<br>(Former Scientist, NCESS, Trivandrum)<br>Associate Director |
| Mr. A. Baskaran     | B.Tech. (Civil Engineering)<br>Senior Project Officer                                 |
| Mr. R. C. Bragath   | M. Tech. (Coastal Engineering)<br>Senior Project Officer                              |
| Mr. S. Paramasivam  | M.Sc., M.Phil. (Geology)<br>Project Officer   |
| Mr. J. Vinoth Kumar | B.E. (Civil Engineering)<br>Project Officer   |
| Mr. C. Mahendran    | B.E. (Civil Engineering)<br>Project Officer   |
| Mr. M. Sharath      | B. E. (Electronics and Instrumentation<br>Engineering)<br>Project Officer             |

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## LIST OF ABBREVIATIONS

|       |  |
|-------|--|
| CD    | Chart Datum                                      |
| HTL   | High Tide Line                                   |
| LTL   | Low Tide Line                                    |
| cm    | Centimeter                                       |
| dB    | Decibel  |
| DGPS  | Differential Global Position System              |
| GGA   | Global Positioning System Fix Data               |
| GLL   | Geographic Lat /Long                             |
| GNSS  | Global Navigational Satellite System             |
| GPS   | Global Position System                           |
| GRS   | GPS Range Residuals                              |
| GSV   | Detailed Satellite data                          |
| GTS   | Great Trigonometrical Survey                     |
| Hz    | Hertz  |
| kHz   | Kilohertz  |
| km    | Kilometer  |
| kPa   | Kilo Pascal                                      |
| LAN   | Local area network                               |
| LED   | Light-Emitting Diode                             |
| m     | Meter  |
| mm    | Millimeters                                      |
| MSL   | Mean Sea Level                                   |
| NMEA  | National Marine Electronics Association          |
| ppm   | Parts Per Million                                |
| RMC   | Recommended Minimum Data for GPS                 |
| RTCM  | Radio Technical Commission for Maritime Services |
| RTK   | Real- time Kinematic                             |
| SBAS  | Satellite Based Augmentation Systems             |
| TTV   | Tow Vehicle                                      |
| TVG   | Time varying Gain                                |
| UTM   | Universal Transverse Mercator                    |
| V     | Volts  |
| VBS   | Virtual base station                             |
| VDC   | Direct Current Voltage                           |
| VHF   | Very High Frequency communication                |
| W     | Watts  |
| w.r.t | with respect to                                  |
| WAAS  | Wide Area Augmented System                       |
| WGS   | World Geodetic System                            |
| ZDA   | Date and Time                                    |

## 1. INTRODUCTION

Karaikal Port Private Limited (KPPL) is all weather port located at Karaikal region in the Union Territory of Pondicherry. It has been designed as a lagoon type all weather Deepwater port with south and north breakwaters, berthing wharfs, stacking yards, dredging of berthing areas/ harbour basin/ approach channel etc.

KPPL is located on the East Coast of India. It is located on the east coast of India in Karaikal within the Union Territory of Puducherry. The Port is in operation since the year 2009 and it has handled various types of cargoes of which the majority of the type consists of coal and fertilizer import. In addition, bagged cement and project cargo are handled including handling of offshore supply vessels (OSVs).

The breakwaters construction started in June 2008 and completed in February 2009. The port operation commenced in April 2009. In order to preserve the marine environment, KPPL has initiated the shoreline monitoring surveys since June 2009, along the northern and southern sides of the breakwaters.

The coastlines are generally subjected to quasi-steady state experiencing seasonal erosion during monsoon months and deposition in fair weather period. Over a period of one year cycle, it is expected to maintain its equilibrium without any net changes in its original form. Any changes in its annual equilibrium may be attributed due to natural causes like cyclones or manmade disturbances. However, the stability of the coastline phenomenon can be understood well only if long term data are collected, and a good monitoring program is evaluated.

Indomer Coastal Hydraulics (P) Ltd., Chennai, has been assigned with the task of monitoring of shoreline changes and identifying reasons for Erosion and Accretion in the vicinity of Karaikal Port. Indomer Coastal Hydraulics (P) Ltd., Chennai is an ISO 9001:2008 organization and QCI (NABET) accredited organization vide SI.No.81. for Sector 27: Oil & Gas Transportation pipeline (crude and refinery/petrochemical products), passing through national parks/sanctuaries/coral reefs/ecologically sensitive areas including LNG Terminal and Sector 33: Ports, harbours, jetties, marine terminals, breakwaters and dredging.

This report also presents the shoreline status and the surveys carried out in October 2013, October 2016, July 2017, July 2022. All the earlier surveys and the present survey were carried out in July 2022 are compared with initial shoreline existed in June 2009. The location map is shown in **Fig. 1**.

All calendar dates are referred in Indian style as dd.mm. yy (e.g., 20.08.22 for 20<sup>th</sup> August 2022) and the time is referred to Indian Standard Time in 24-hour clock, e.g., 3 P.M. is written as 1500 hrs. The WGS84 spheroid in Zone 44 is followed for surveys and for the presentation in this report. SI units are followed for fundamental and derived units.

## 2. SCOPE

- i) *Shoreline Monitoring Surveys at 1 km length from either side of Northern and Southern Breakwater of Karaikal Port till 3 m water depth and at 200 m interval,*
- ii) *Calculate sediment volume in comparison with baseline survey values carried out during 2009 and further monitoring values carried out during 2013 and 2016,*
- iii) *To assess the causes of erosion and accretion of Karaikal Port Shoreline Area,*
- iv) *To understand the Inferences drawn from the assessment and make Recommendations for mitigation of Shoreline change based on Survey, earlier survey Reports as well as present report,*
- v) *To submit the Shoreline Erosion and Accretion Assessment Report.*



### 3. VETTAR RIVER BREAKWATERS CONSTRUCTION – AN ADDITION IN THE VICINITY

The Department of Fisheries, Government Tamil Nadu has constructed fish landing centre at Nagore to a higher degree of functionality, a project of construction of breakwaters to prevent siltation of the bar mouth at Vettar River in Nagore Fishing harbour. Breakwaters of 330 m long was constructed on Southern Bank of River Vettar Mouth and breakwater work at Northern Bank of River Mouth is under construction.

The south breakwater construction commenced on Feb 2012 and completed in September 2012. And the construction of north breakwater was commenced in September 2021 and the construction work is in with under progress and the same was expected to complete by September 2022.

The construction of TN Fisheries breakwaters at Vettar river mouth, particularly its northern breakwater has the influence on the southern part of the shoreline of the Karaikal port. This southern part of coastline is 675 m long stretching between Karaikal port and Vettar river. This segment of 675 m long shoreline has become entrapped and expected to remain stable in future. The alignment of TN Fisheries breakwater in the vicinity of the Karaikal Port breakwater is shown in **Fig. 2**.

#### 4. EARLIER REPORTS SUBMITTED FOR KPPL

KPPL has initiated the shoreline monitoring surveys along the northern and southern sides of the breakwaters and the monitoring surveys were carried out by Indomer Coastal Hydraulics in 2008, 2009, 2010, 2013, 2014, 2016, 2017 and 2022. The chronological details of previous reports submitted to KPPL is given below:

| Sl. No | Month & Year                                | Report Title  |
|--------|---|---|
| 1      | <b>June 2008</b><br>(Prior to Construction) | Monitoring of Shoreline survey - <b>Phase I</b>   |
| 2      | <b>August 2008</b>                          | Monitoring of Shoreline survey - <b>Phase II</b>  |
| 3      | <b>October 2008</b>                         | Monitoring of Shoreline survey - <b>Phase III</b>   |
| 4      | <b>December 2008</b>                        | Monitoring of Shoreline survey - <b>Phase IV</b>  |
| 5      | <b>February 2009</b>                        | Monitoring of Shoreline survey - <b>Phase V</b>   |
| 6      | <b>April 2009</b>                           | Monitoring of Shoreline survey - <b>Phase VI</b>  |
| 7      | <b>June 2009</b><br>(Post Construction)     | Monitoring of Shoreline survey - <b>Phase VII</b>   |
| 9      | <b>September 2009 - April 2010</b>          | Monitoring of Shoreline survey (2009 -2010)   |
| 10     | <b>December 2010</b>                        | <b>Stability of Shoreline, Karaikal Port.</b>   |
| 11     | <b>October 2013</b>                         | Monitoring of Shoreline survey  |
| 12     | <b>November 2014</b>                        | Monitoring of Shoreline survey  |
| 13     | <b>October 2016</b>                         | <b>Siltation study Analysis survey</b>  |
|        | <b>March 2017</b>                           | <b>Siltation study in the Navigational Channel</b>  |
| 14     | <b>July 2017</b>                            | Siltation study in the Navigational Channel<br>1 <sup>st</sup> Season: October 2016<br>2 <sup>nd</sup> Season: February 2017<br>3 <sup>rd</sup> Season: August 2017 |
| 15     | <b>October 2017</b>                         | <b>Siltation study</b>  |
| 17     | <b>July 2022</b>                            | Shoreline Monitoring Study for Erosion and Accretion Assessment at Karaikal Port for the Year 2022.   |

## 5. METHODOLOGY

### 5.1. Reference spheroid

World Geodetic System (WGS84) spheroid – Zone 44N was followed for entire surveys and for the presentation in the report.

### 5.2. Horizontal control

**Reference station:** The DGPS Beacon Transmitter operated at Pondicherry by Department of Lighthouse and navigation is taken as reference station. The transmitting frequency of this reference Beacon transmitter is 315 kHz.

**Mobile station:** The horizontal positioning of the mobile unit was carried out using HemisphereR100 Series DGPS Beacon Receiver. It combines high-performance GPS reception with a DGPS-capable receiver in a lightweight, durable housing and comes with a separate antenna. It gives the horizontal position to an accuracy of close to 1 m.



The GPS receiver also contains technology enabling WAAS/EGNOS, Omni STAR or Beacon real time differential capabilities. When used with a Real-time Kinematic (RTK) Base station, the GPS receiver provides RTK positioning for high-accuracy, centimeter-level applications.

A standard GPS receiver provides the following features:

- 10 Hz (10 positions per second) output rate
- 12 GPS (C/A-code L1, C/A code L2 (for the Omni STAR XP/HP and RTK models)) tracking channels, code carrier channels
- Sub meter differential accuracy (RMS), assuming at least five satellites and a PDOP (Position Dilution of Precision) of less than four (when used with Satellite Based Augmentation Systems (SBAS) correction).

#### The system configuration is enabled with:

- LED display and keypad
- Outputs a 1 PPS (pulse per second) strong signal on both ports. This signal enables an external instrument to synchronize its internal time with a time derived from the very accurate GPS system time.
- SBAS such as WAAS (Wide Area Augmentation System) differential correction

- Beacon differential correction
- Omni STAR VBS capability
- Omni STAR XP/HP capability in the XP/HP and RTK models
- RTK positioning capability, In the RTK model only
- EVEREST™ multipath rejection technology
- Two connectors that support both CAN 2.0B and RS-232
- CAN: J1939 and NMEA 2000 messages
- NMEA-0183 output: GGA, GLL, GRS, GST, GSA, GSV, MSS, RMC, VTG, ZDA (the default NMEA messages are GGA, GSA, VTG, and RMC)

### 5.3. Vertical Control

**PBM:** The Naval Hydrographic Office, Dehradun has established a PBM in Berth No. 1 at Karaikal Port. The details of this PBM were provided by Karaikal Port. The bench mark is encrypted on a 6 x 6 inch square stainless steel plate of 2 mm thickness with a 1 mm dot engraved at center, embedded at the centre on top of a cemented platform with a dimension 0.34 m x 0.34 m x 0.16 m at the SE edge of Berth No.1 in 1.68 m and from first bollard at 5.64 m. ‘NATIONAL HYDROGRAPHIC SURVEY’, KARAİKAL PORT PVT LTD., BM, ‘INS DARSHAK’, is engraved and painted black on the station plate. The reference level is (+) 4.250 m w.r.t. CD.

The above mentioned PBM -2 established at Karaikal Port has been used as vertical reference level for the entire bathymetry and topographic surveys.

Details of Permanent Benchmark

| Description          | Geographical |              | UTM<br>(WGS 84 - Zone 44) |         | Reduced Level<br>w.r.t. CD<br>(m) |
|----------------------|--------------|--------------|---------------------------|---------|-----------------------------------|
|                      | Latitude, N  | Longitude, E | X (m)                     | Y (m)   |                                   |
| PBM<br>Karaikal Port | 10°49'54.38" | 79°50'56.28" | 0374178                   | 1197616 | (+) 4.250                         |

Source: Reference level of Benchmark given by Client (KPPL).

All levels reported in topography and bathymetry map are w.r.t Chart Datum (CD) Based on KPPL PBM.

## 6. TOPOGRAPHIC SURVEY

**Area of survey:** The topographical survey area is shown in **Fig. 3**. The topographical survey was carried out using RTK (Real Time Kinematic) GPS. The topography survey covers either side of the breakwaters 1000 m along the coast and 200 m into the land at 100 m grid interval.

**Instruments used:** Leica GS12 & GS14 GNSS RTK, Total Station and Sokkia Auto Level C320 were used for conducting the topographic survey. Leica GS09 & GS12 GNSS RTK: Leica RTK (Real Time Kinematic) satellite navigation is a technique used inland survey and in hydrographic survey based on the use of carrier phase measurements of the GPS, GLONASS and/or Galileo signals where a single reference station provides the real-time corrections, providing up to centimeter-level accuracy. When



referring to GPS in particular, the system is also commonly referred to as Carrier-Phase Enhancement, GPS. RTK systems use a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier that it measured, and the mobile units compare their own phase measurements with the ones received from the base station. There are several ways to transmit a correction signal from base station to mobile station. The most popular way to achieve real-time, low-cost signal transmission is to use a radio modem, typically in the UHF band. This allows the units to calculate their relative position to millimeters, although their absolute position is accurate only to the same accuracy as the position of the base station.

RTK systems are available in dual-frequency and single-frequency versions. Dual-frequency systems deliver greater precision, faster and over longer baselines than single-frequency systems. Leica GS09 & GS12 GNSS RTK that used for the survey contains dual frequency requires antenna and controller to suit any surveying task with a wide range of functionality. Leica GS09 & GS12 GNSS RTK Rover is extremely light-weight and cable free rover is comfortable to use and withstand even for rough use and topple over. It uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier that it measured, and the mobile units compare their own phase measurements with the ones received from the base station. So, that centimeter level accuracy can be achieved from latitude, longitude and altitude. RTK technique in terms of general navigation, it is perfectly suited to roles like surveying. In this case, the base station is located at a known surveyed location, often a benchmark, and the mobile units can then produce a highly accurate map by taking fixes relative to that point. RTK has also found uses in auto drive/autopilot systems, precision farming and similar roles.

**Technical Specifications:**

|                                |   |   |
|--------------------------------|---|---|
| <b>GNSS TECHNOLOGY</b>         | <b>MEASUREMENT ENGINE</b>                             |   |
|                                | Leica patented Smart Track+ technology                | <ul style="list-style-type: none"> <li>• Excellent low elevation tracking technology</li> <li>• Very low noise GNSS carrier phase measurements with &lt;0.5 mm precision</li> <li>• Minimum acquisition time</li> </ul> |
|                                | No. of channels                                       | • 120 channels  |
|                                | Reacquisition time                                    | • <1 sec  |
|                                | <b>GNSS Measurements</b>                              |   |
|                                | Satellite Reception                                   | • Dual frequency  |
|                                | Satellite signals tracking                            | <ul style="list-style-type: none"> <li>• GPS: L1, L2, L2C (C/A, P, C Code)</li> <li>• GLONASS: L1, L2 (C/A, P narrow Code)</li> </ul>   |
| <b>Measurement Performance</b> | <b>Accuracy</b>                                       |   |
|                                | DGPS/RTCM   | • Typically, 25 cm (rms)  |
|                                | RTK Rapid static (phase)                              | <ul style="list-style-type: none"> <li>• Horizontal: 5mm + 0.5ppm(rms)</li> <li>• Vertical: 10 mm +0.5ppm(rms)</li> </ul>   |
|                                | RTK Kinematic (phase)                                 | <ul style="list-style-type: none"> <li>• Horizontal: 10mm + 0.5ppm(rms)</li> <li>• Vertical: 20 mm +0.5ppm(rms)</li> </ul>  |
|                                | Post processing (phase) Static with long observations | <ul style="list-style-type: none"> <li>• Horizontal: 3mm + 0.5ppm(rms)</li> <li>• Vertical: 6 mm +0.5ppm(rms)</li> </ul>  |
|                                | Post processing (phase) Rapid static mode             | <ul style="list-style-type: none"> <li>• Horizontal: 5mm + 0.5ppm(rms)</li> <li>• Vertical: 10 mm +0.5ppm(rms)</li> </ul>   |
| <b>Hardware</b>                | <b>Physical</b>                                       |   |
|                                | Weight  | • 1.05kg including battery  |
|                                | Dimension (diameter x height)                         | • 186mm x 89 mm   |
|                                | <b>Power management</b>                               |   |
|                                | Supply Voltage  | • Nominal 12 V DC, Range 10.5-28 V DC   |
|                                | Power consumption                                     | • Typically: 1.8 W, 150mA   |
|                                | Internal Power supply                                 | • Removable & rechargeable Li-ion battery, GE211 2.2Ah / 7.4 V or GE212 2.6 Ah / 7.4 V  |

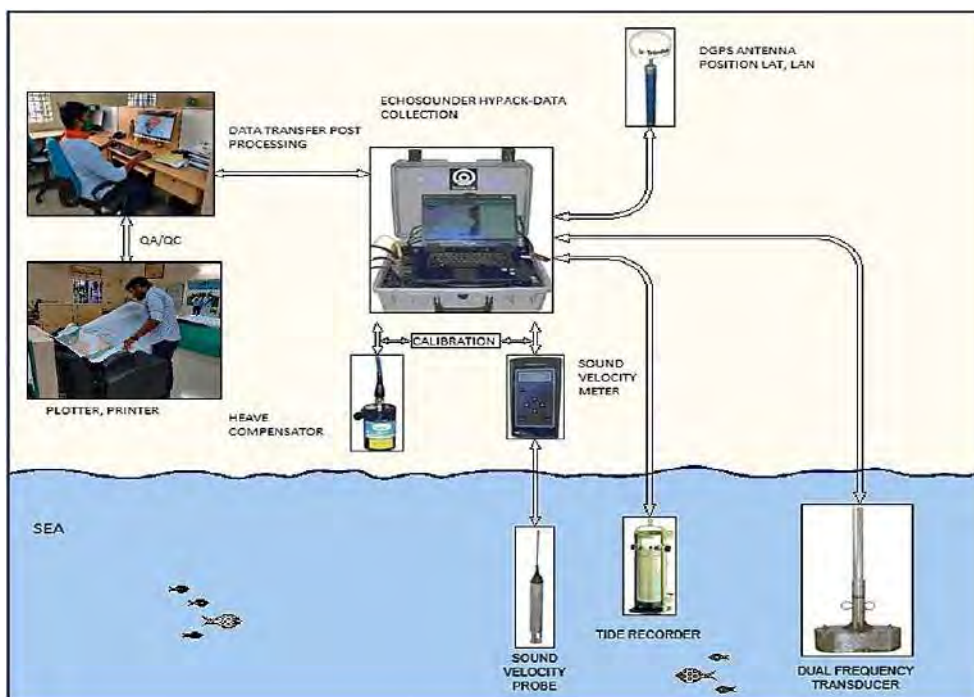
**Sokkia Auto Level C<sub>320</sub>:** Sokkia Auto Level C<sub>320</sub> is an improved leveling instrument manufactured by Sokkia, Japan. This instrument was used for measuring the elevation and transfer of reference levels from a given Benchmark to any required points. This instrument has telescoped length of 215 mm and a minimum focusing distance of 200 m. It has the leveling accuracy of ± 1.0 mm for 1 km double run levelling.



## 7. BATHYMETRY SURVEY

**Area of survey:** The bathymetry survey covers 3300 m distance between north and south breakwaters and 1000 m distance into the sea. The survey transects were planned perpendicular to coastline at 100 m grid spacing. The planned lines map for bathymetry survey is shown in **Fig. 4**.

**Instrument arrangement:** The configuration of various devices and arrangements for conducting the bathymetry survey is shown below:



The fiber boat **“FRB Raja”** was used for the survey. The Echosounder transducer was mounted on the port side of the vessel by positioning it at 1.0 m below the sea surface. The DGPS receiver antenna was mounted on the mast vertically in line with the transducer, so that it represents the exact coordinates of the location where the depth is simultaneously measured by the transducer. The Heave Sensor was attached close to transducer stem on the boat deck in order to measure the residual vertical displacement of the boat induced by external disturbances and to carry out the correction.

The DIGIBAR-PRO sound velocity meter was used to measure the sound velocity across the vertical and entered as input for calibrating the transmitting part of the instrument. The bar check was also carried out by lowering the rigid plate at different depths and comparing with the displayed depth. The necessary inputs were given in HYPACK data collection software before the commencement of

the survey. The planned track lines were displayed on the monitor at wheel for navigation. Watch guards were positioned at bow, transducer/antenna, and heave compensator at rear end. The data were continuously collected at onboard PC along each transect. After that day data collection was made, entire data were downloaded to external hard disc and stored. The recorded data included: date, time, latitude, longitude, X coordinate, Y coordinate and heave. The depth data was recorded at 0.2 sec interval.

**CEESCOPE ECHOSOUNDER:** This survey echosounder is manufactured by CEE Hydro systems, Australia. It is a Single frequency echosounder with standard transducer having the frequencies of 200 kHz. It measures the depth ranging between 0 - 200 m with the accuracy of 0.01 m and a resolution of 0.01 m. It has a built in 12 channel GPS receiver with an integrated Beacon receiver. It is a dual channel Beacon receiver for collection of reference station



data in both, automatic and manual mode. The system provides horizontal accuracy close to  $\pm 0.5$  m. It has the capability of giving position with WGS84 standard datum and 1 user defined datum. It has an antenna with 10 m long cable. The system works on 9 - 18 VDC or on 220 VAC. The unit has two RS232 ports and also Ethernet connection. It is equipped with internal data logger which can store 40 hours survey data and also External USB device for simultaneously log. It also has large LCD display in the front panel operating in touch screen. There is a provision for external DGPS input. It has NMEA output which can be connected to onboard PC and integrated with Hydrographic Software. The touch setting in the front panel enables to mark draught, tide input, time, date, scale shift, calibration gauge, alarm filter and fix interval.

**Technical specifications:**

|                           |   |
|---------------------------|---|
| <b>Physical</b>           |   |
| Dimensions                | 30.0 x 25.0 x 13.8 cm (L x W x D)         |
| Display                   | 420 x 272 touch screen colour LCD         |
| Weight                    | 3.65 kg (8.05 lbs.) *                     |
| Connectors                | LEMO 1K & 2K series, Industrial RJ45, TNC |
| <b>Environmental</b>      |   |
| Operating temperature     | 0°C – 50°C (32°F – 122°F)                 |
| Humidity                  | 95% non-condensing                        |
| Ingress protection rating | IP67                                      |



|                           |   |
|---------------------------|---|
| <b>Power</b>              |   |
| Power consumption         | 7.2 watts (approx. operating time 8 hours) - Eclipse L1 |
| Internal battery          | Rechargeable high-capacity NiMH battery 10Ah            |
| Antenna voltage output    | 5.0 VDC (nominal)                                       |
| External power supply     | Nominal 12.0 VDC @ 2A<br>(9-30 VDC range)               |
| <b>Connectivity</b>       |   |
| Network Ports             | 1, 2  |
| Bluetooth                 | 0 – 50 m range  |
| Wi-Fi                     | 0 – 1000 m range  |
| Internal UHF Rx modem     | 403 – 473 MHz (RTK only)                                |
| <b>Transducer Options</b> |   |
| Standard 200 kHz          | 9° beam width @-3dB                                     |
| <b>Echo Sounder</b>       |   |
| Mode                      | Auto Shallow, Auto or Manual                            |
| Depth range*              | 0.15 – 200 m (0.6 – 650 ft) @ 200 kHz                   |
| Ping rate                 | 1 – 20 Hertz, depth dependent                           |
| Pulse length              | HF (1 – 35), LF (1 – 30)                                |
| TVG                       | None, LOG 10, LOG 20                                    |
| Acoustic Velocity Range   | 1350 – 1750m (4,429 – 5,741 ft)                         |
| Draft                     | 0 – 10 m (1 cm increments)                              |
| Accuracy                  | 1 cm ± 0.1% of depth                                    |
| Resolution                | 1 cm  |
| GNSS input                | NMEA 0183   |
| RTCM                      | RS-232 UHF or Network                                   |
| Compass input             | NMEA 0183, HDG or HDT                                   |

**Hydrographic Survey Software: HYPACK 2021** survey software was used for data collection and processing. It is integrated, first generation hydrographic survey software developed by Coastal Oceanographical INC., USA. It works in MS Windows operating environment. The HYPACK's design program allows to import



background map in CAD's DFX or Microsoft's DGN format. It enables to quickly create planned survey lines, plotting sheets and bottom coverage grids in a graphical environment. It gives the flexibility to support multiple navigational systems (GPS, range/range, and range/azimuth), echo sounders (signal and dual frequency, multiple transducers and multibeam), magnetometers, ROV-tracking systems, telemetry tide systems and many other devices. It contains the post processing module to analyze and prepare the chart. The survey tracks were planned used this software for accurate maneuvering of the vessel and to keep the accuracy of the track. The post processing of the survey data and preparation of map were carried out using this software.

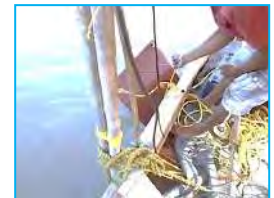
**Data recording:** The Echosounder, heave compensator and Beacon DGPS receiver were interfaced through HYPACK software with onboard PC. The entire system was supported by AC Power Generator installed onboard. The position and depth were recorded along the preplanned transect at 200 millisecond intervals continuously.



**Calibration for Sound Velocity:** ODOM DIGIPRO SVM has been used to measure the velocity of sound across the vertical and the mean value was fed in the Echosounder during calibration before the commencement of survey on each day. The bar check was carried out before the commencement of the survey and after the survey is completed using the bar mounted with a chain.



**Calibration by Bar Check:** Bar check was performed before starting and after completion of the survey on every day. It was done by lowering a bar plate at known depth below the transducer. The correction coefficients for known depth were noted and entered on the data collection software.



**Tidal corrections:** The collected data were processed in the laboratory by applying corrections for tides and immersion depth of the transducer.

## 8. REASONS FOR EROSION AND ACCRETION

The movement of sediments and impact on the shoreline siltation take place in the Karaikal port region due to various natural coastal processes.

Nearshore sediment movement beyond breaker zone: The pattern of nearshore sediment movement beyond the breaker is observed to move from south to north during March to September; and from north to south from October to February. The volume of sediments moving during southwest monsoon (June to September) is relatively higher compared to fair weather period (March to May) and northeast monsoon (November to February).

The nearshore region between the Vetter River northern breakwater and Karaikal port south breakwater forms a stagnant zone with a formation of a gyre in anti-clockwise direction during southwest monsoon/ fair weather period and in clockwise direction during northeast monsoon. This stagnation phenomenon causes a stable segment in recent days particularly after 2021.

Sediment characteristics: As the seabed on the southside of the port consists of finer materials like clay and silt, they are easily lifted and moved. The seabed on the northern side of the port consists relatively coarser fractions and hence their movement is slightly low.

Littoral Drift: The volume of littoral drift. i.e., annual gross volume of drift is very low. The annual net littoral drift near the project region is northerly but the volume is very low ( $0.03 \times 10^6 \text{ m}^3/\text{year}$  towards north). The littoral drift moving in surfzone from south to north during March to September takes diversion to offshore and try to bypass the Vettar groin and Port breakwaters. Such bypassing sediments which are part of the littoral drift cross the navigational channel. It is seen that about  $0.63 \times 10^6 \text{ m}^3/\text{year}$  is moving across the channel due the deflection of littoral drift. The littoral drift moving across the channel is high in June, July and August amounting to  $1,44,800 \text{ m}^3$  and it moves from south to north.

Vettar river: The sediments if any discharged from the Vettar River reach the nearshore region and get deposited on the southern side of the Karaikal port south breakwater. Other than the rainy days, the fresh water discharge from Vettar River is very low and in turn the sediment load brought by the river is very less. The influence of Vetter River appears to be not very significant for the shoreline process.

## 9. SHORELINE MONITORING PLAN

The neighboring coastline and the location of 10 reference stations at 200 m spacing covering on either side of the breakwaters are fixed originally in the year 2009 for monitoring the shoreline. The same reference stations are being adopted for comparison for each monitoring surveys thereafter. The monitoring stretch has been divided into two zones namely: i) South zone, 1000 m long, lying south of the southern breakwater and ii) North zone, 1000 m long, lying on the north of the northern breakwater. The reference points are spaced at 200 m interval and the details are given below:

| Zones      | Reference Points | UTM Coordinates (WGS84 - Zone 44N) |         |
|------------|------------------|------------------------------------|---------|
|            |                  | X (m)                              | Y (m)   |
| North Zone | NR1              | 374529                             | 1199189 |
|            | NR2              | 374529                             | 1199389 |
|            | NR3              | 374529                             | 1199589 |
|            | NR4              | 374529                             | 1199789 |
|            | NR5              | 374529                             | 1199989 |
| South Zone | SR1              | 374511                             | 1197737 |
|            | SR2              | 374511                             | 1197537 |
|            | SR3              | 374511                             | 1197337 |
|            | SR4              | 374511                             | 1197137 |
|            | SR5              | 374511                             | 1196937 |

**10. ESTIMATION OF EROSION / SILATION**

Based on the survey carried out in July 2022, the bathymetry charts are prepared in WGS84 spheroid with UTM coordinates supplemented by geographical coordinates indicating the latitude and longitude. The comprehensive chart covering the survey area is prepared in 1:2500 scale and presented in **Fig. 5**. The depths are represented in 12.5 m x 12.5 m grid with respect to Chart Datum. The X, Y, Z data are presented in CD separately.

To compute siltation/erosion and the volume of changes of sediments, the planar area covering 1000 m on either side of the breakwaters and 500 m distance into the sea has been considered.

The periodic shoreline changes indicating LTL (Low Tide Line) and HTL (High Tide Line) of the post project periods, i.e., October 2013, October 2016, July 2017, and July 2022 are compared with the coastline prevailed in June 2009 (period of project commencement) are shown in **Fig. 6**.

The change in sediment volume was estimated using HYPACK MAX TIN Model from the based on the bathymetry conducted in July 2009, October 2013, October 2016, July 2017 and July 2022. The changes in sediment volume with reference to the seabed level existed in June 2009 are given below in **Table 1**. The change in sediment volume over the reference area covering 1000 m on either side of the breakwater and 500 into sea is shown in **Fig. 7**. The extent of reference area used for comparison is shown in **Fig. 8**.

Table.1 Details of sediment volume changes

| Region | Change in sediment volume (m <sup>3</sup> ) |              |              |              |              |
|--------|---|--------------|--------------|--------------|--------------|
|        | June 2009                                   | October 2013 | October 2016 | July 2017    | July 2022    |
| North  | Reference                                   | (+) 2,75,985 | (+) 3,63,025 | (+) 4,92,135 | (+) 4,42,257 |
|        | Difference with previous survey             |              | (+) 87,040   | (+) 1,29,110 | (-) 49,875   |
|        | Percentage of siltation (%)                 |              | (+) 23       | (+) 26       | (-) 10       |
| South  | Reference                                   | (-) 1,30,865 | (-) 1,85,300 | (-) 1,84,320 | (-) 2,04,060 |
|        | Difference with previous survey             |              | (-) 54,435   | (+) 980      | (-) 19,740   |
|        | Percentage of siltation (%)                 |              | (-) 29%      | (+) 1%       | (-) 10%      |

(-) Erosion w.r.t. June 2009 seafloor; (+) Deposition w.r.t. June 2009 seafloor

**North zone:** The study shows that the northern side of the shoreline experienced mostly accretion compared to 2009. The accretion of sediment is (+) 87,040 m<sup>3</sup> (+23%) between October 2013 and October 2016. Similarly, the accretion was (+) 1,29,110 m<sup>3</sup> (+ 26%) between October 2016 and July 2017. The seafloor remained mostly stable between July 2009 and July 2022 showing a very marginal erosion of (-) 49,875 m<sup>3</sup> [(-) 10%]. In general, the northern stretch of the shoreline showed accretion trend since 2009 with mean net deposition of 15% till 2022.

**South zone:** The southern side of the shoreline showed net low erosion over the years compared with 2009 shoreline. The changes in sediment volume compared between October 2013 and October 2016 showed (-) 54,435 m<sup>3</sup> (- 29%) erosion. The sediment volume compared between October 2016 and July 2017 showed accretion of (+) 980 m<sup>3</sup>, i.e., 1% deposition. However, volume compared from July 2017 to July 2022 showed erosion amounting to (-) 19,740 m<sup>3</sup>, i.e. (-) 10% erosion. In general, the southern stretch of the shoreline data from July 2009 to July 2022 showed net erosion, but with very low magnitude with the mean value of 10% till 2022.

### Stability of shoreline

**North zone:** In comparison with the survey conducted in June 2009, the survey done in October 2013, October 2016, July 2017 and July 2022 indicates that the shoreline and seabed topography has undergone changes from reference points NR 1 to NR 5 as shown in **Fig. 9 to Fig. 13**. It is seen that there is a deposition of around 30% of sediment compared to the survey done in June 2009.

| Monitoring Station | Shoreline distance from monitoring stations (m) |     |              |     |              |     |           |     |           |     |
|--------------------|---|-----|--------------|-----|--------------|-----|-----------|-----|-----------|-----|
|                    | June 2009                                       |     | October 2013 |     | October 2016 |     | July 2017 |     | July 2022 |     |
|                    | HTL   | LTL | HTL          | LTL | HTL          | LTL | HTL       | LTL | HTL       | LTL |
| NR 1               | 34  | 47  | 75           | 90  | 90           | 110 | 86        | 120 | 134       | 190 |
| NR2                | 42  | 62  | 65           | 80  | 75           | 100 | 77        | 130 | 120       | 170 |
| NR3                | 30  | 45  | 45           | 65  | 65           | 85  | 70        | 105 | 80        | 130 |
| NR4                | 18  | 38  | 20           | 45  | 45           | 65  | 58        | 90  | 43        | 93  |
| NR5                | -4  | 15  | 10           | 40  | 35           | 60  | 45        | 70  | 35        | 75  |

Note: (-) distance towards land

**STN. NR 1:** The shoreline survey indicates that the HTL in June 2009, October 2013, October 2016, July 2017 and July 2022 remained at a distance of 34 m, 75 m, 90 m, 86 m and 134 m respectively. The Low Water Line (LTL) existed at a distance of 47 m, 90 m, 110 m, 120 m and 190 m respectively. The data indicated advancement of shoreline on the northern side.

**STN. NR 2:** The shoreline survey indicates that HTL in June 2009, October 2013, October 2016, July 2017 and July 2022 remained at a distance 42 m, 65 m, 75 m, 77 m and 120 m respectively. The Low Water Line (LTL) existed at a distance of 62 m, 80 m, 100 m, 130 m, and 170 m respectively. The data indicated advancement of shoreline on the northern side.

**STN. NR 3:** The shoreline survey indicates that HTL in June 2009, October 2013, October 2016, July 2017 and July 2022 remained at a distance 30 m, 45 m, 65 m, 70 m and 80 m respectively. The Low Water Line (LTL) existed at a distance of 45 m, 65 m, 85 m, 105 m, and 130 m respectively. The data indicated advancement of shoreline on the northern side.

**STN. NR 4:** The shoreline survey indicates that HTL in June 2009, October 2013, October 2016, July 2017 and July 2022 remained at a distance 18 m, 20 m, 45 m, 58 m and 43 m respectively. The Low Water Line (LTL) existed at a distance of 38 m, 45 m, 65 m, 90 m, and 93 m respectively. The data indicated advancement of shoreline on the northern side.

**STN. NR 5:** The shoreline survey indicates that HTL in June 2009, October 2013, October 2016, July 2017 and July 2022 remained at a distance (-) 4 m, 10 m, 35 m, 45 m and 35 m respectively. The Low Water Line (LTL) existed at a distance of 15 m, 40 m, 60 m, 70 m, and 75 m respectively. The data indicated advancement of shoreline on the northern side.

**South zone:** In comparison with the survey conducted in June 2009, the survey done in October 2013, October 2016, July 2017 and July 2022 indicates that the seabed topography has undergone changes from reference points (SR 1 to SR 5) are shown in **Fig. 14 to Fig. 18**. It is seen that there is an Erosion of around 10 % sediment compared to the survey done is June 2009.

| Monitoring Station | Shoreline distance from monitoring stations (m) |     |              |     |              |     |           |     |           |     |
|--------------------|---|-----|--------------|-----|--------------|-----|-----------|-----|-----------|-----|
|                    | June 2009                                       |     | October 2013 |     | October 2016 |     | July 2017 |     | July 2022 |     |
|                    | HTL   | LTL | HTL          | LTL | HTL          | LTL | HTL       | LTL | HTL       | LTL |
| SR 1               | 80  | 110 | 40           | 55  | 20           | 35  | -5        | 20  | 10        | 23  |
| SR2                | 43  | 92  | 15           | 30  | -10          | 10  | -24       | -5  | -25       | -5  |
| SR3                | -15   | 68  | -10          | 10  | -50          | -45 | -68       | -30 | -60       | 25  |
| SR4                | Vettar River mouth                              |     |              |     |              |     |           |     |           |     |
| SR5                | -40   | -04 | -75          | -50 | -40          | 0   | -95       | -73 | -94       | -67 |

Note: (-) distance towards land

**STN. SR 1:** The shoreline survey indicates that HTL in June 2009, October 2013, October 2016, July 2017 and July 2022 remained at a distance to 80 m, 40 m, 20 m, (-) 5 m and 10 m respectively. The Low Water Line (LTL) existed at a distance of 110 m, 55 m, 35 m, 20 m and 23 m respectively. The data indicated erosion of shoreline on the southern side.

**STN. SR 2:** The shoreline survey indicates that HTL in June 2009, October 2013, October 2016, July 2017 and July 2022 remained at a distance 43 m, 15 m, (-) 10 m, (-) 24 m and (-) 25 m respectively. The Low Water Line (LTL) existed at a distance of 92 m, 30 m, 10 m, (-) 5 m, and 10 m respectively. The data indicated erosion of shoreline on the southern side.

**STN. SR 3:** The shoreline survey indicates that HTL in June 2009, October 2013, October 2016, July 2017 and July 2022 remained at a distance (-) 15 m, (-) 10 m, (-) 50 m, (-) 68 m and (-) 60 m respectively. The Low Water Line (LTL) existed at a distance of 68 m, 10 m, (-) 45 m, (-) 30 m, and 25 m respectively. The data indicated erosion of shoreline on the southern side.

**STN. SR 4:** The STN. SR4 falls in Vettar river mouth.

**STN. SR 5:** The shoreline survey indicates that HTL in June 2009, October 2013, October 2016, July 2017 and July 2022 remained at a distance (-) 40 m, (-) 75 m, (-) 40 m, (-) 95 m and (-) 94 m respectively. The Low Water Line (LTL) existed at a distance of (-) 4 m, (-) 50 m, 0 m, (-) 73 m, and (-) 67 m respectively. The data indicated erosion of shoreline on the southern side.



## 11. INFERENCES & RECOMMENDATIONS

- The shoreline survey carried out during July 2022 indicates that the shoreline on the northern part of the northern breakwater is an accretion trend, and the seabed has become shallower compared to June 2009 (project commencement year).
- The shoreline on the southern part of the southern breakwater has experienced slight erosion and the seabed has become deeper compared to June 2009 survey.
- The construction of TN Fisheries breakwaters at Vettar river mouth, particularly the northern breakwater built by TN Fisheries in 2021, has the influence on the stability of the southern part of the shoreline of the Karaikal port.
- The southern part of coastline is 675 m long between Karaikal port southern breakwater and Vettar river northern breakwater. Due to the presence of Karaikal port southern breakwater and the Vettar river northern breakwater, this segment of 675 m long shoreline has become sheltered from 2021 and it is expected to remain stable in future due to reduction in littoral drift.
- As the shoreline on the northern side shows accretion trend and southern side becomes stable, Karaikal port need not to take any shoreline stabilization immediately.
- The trend of the shoreline can be monitored every year preferably in April being the fair weather period. Any shoreline management plan can be taken up if needed after conducting the annual shoreline survey.
- Karaikal port has obtained EC and CRZ clearance for LNG/LPG project which has been planned on the southern side of the coastline and this segment is expected to remain stable without erosion.
- Though the southern part of the coastline is expected to be stable, it is suggested to reclaim for 100 m width from High tide line into the sea along the 675 m stretch falling between the Karaikal southern breakwater and Vettar northern breakwater.

GALLERY



Discussion with KPPL Officials



Commencement of bathymetry survey



Installation of Transducer



RTK Base station



Shoreline survey South side

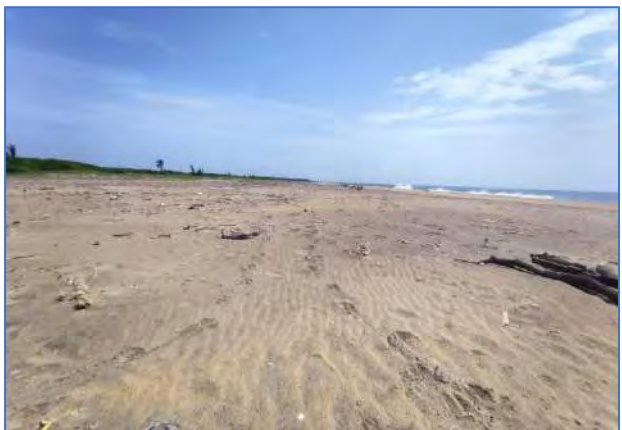




Erosion at south of south breakwater



Shoreline survey North side



Deposition at north of north breakwater



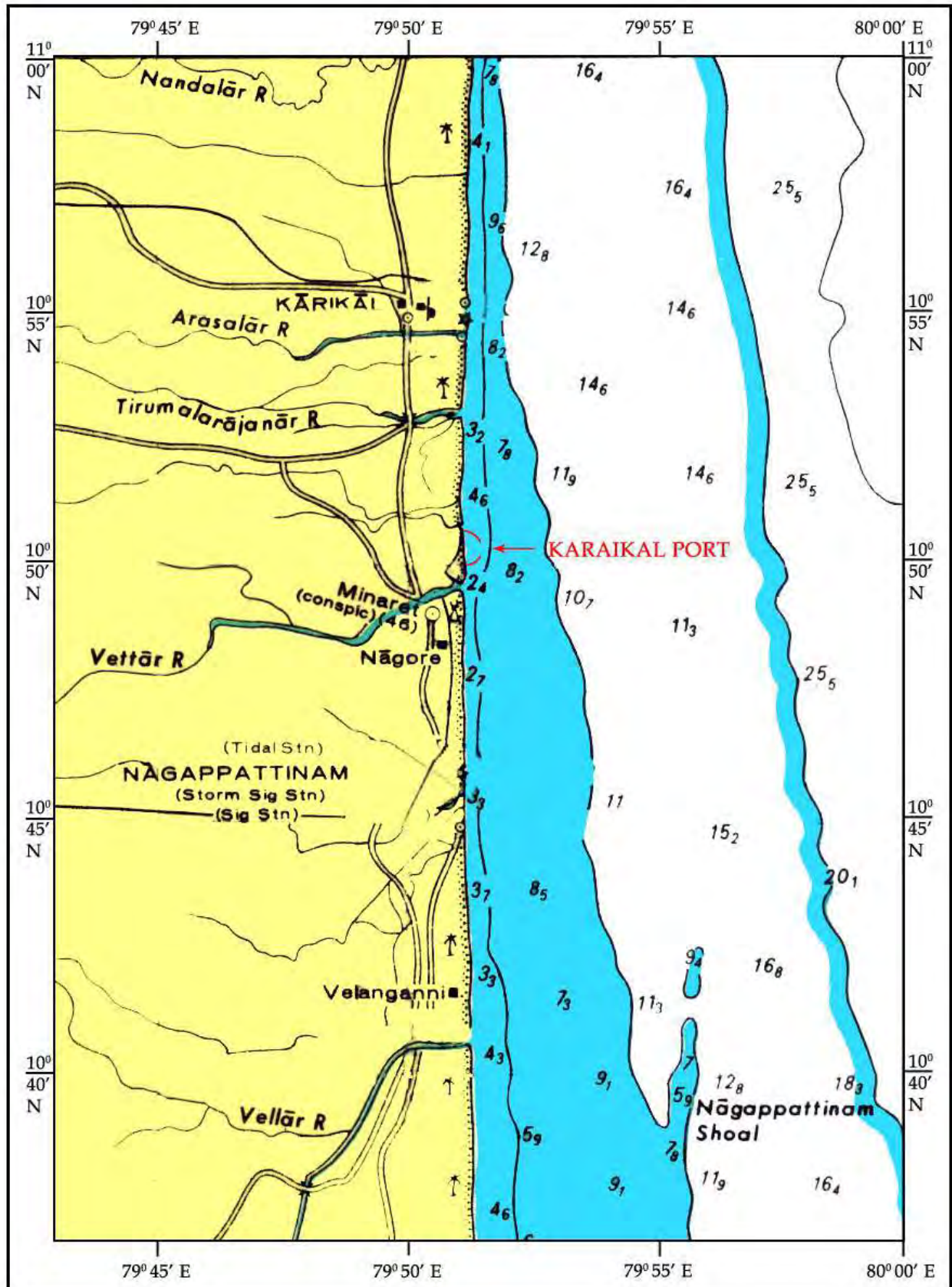


FIG. 1. LOCATION OF KARAIKAL PORT

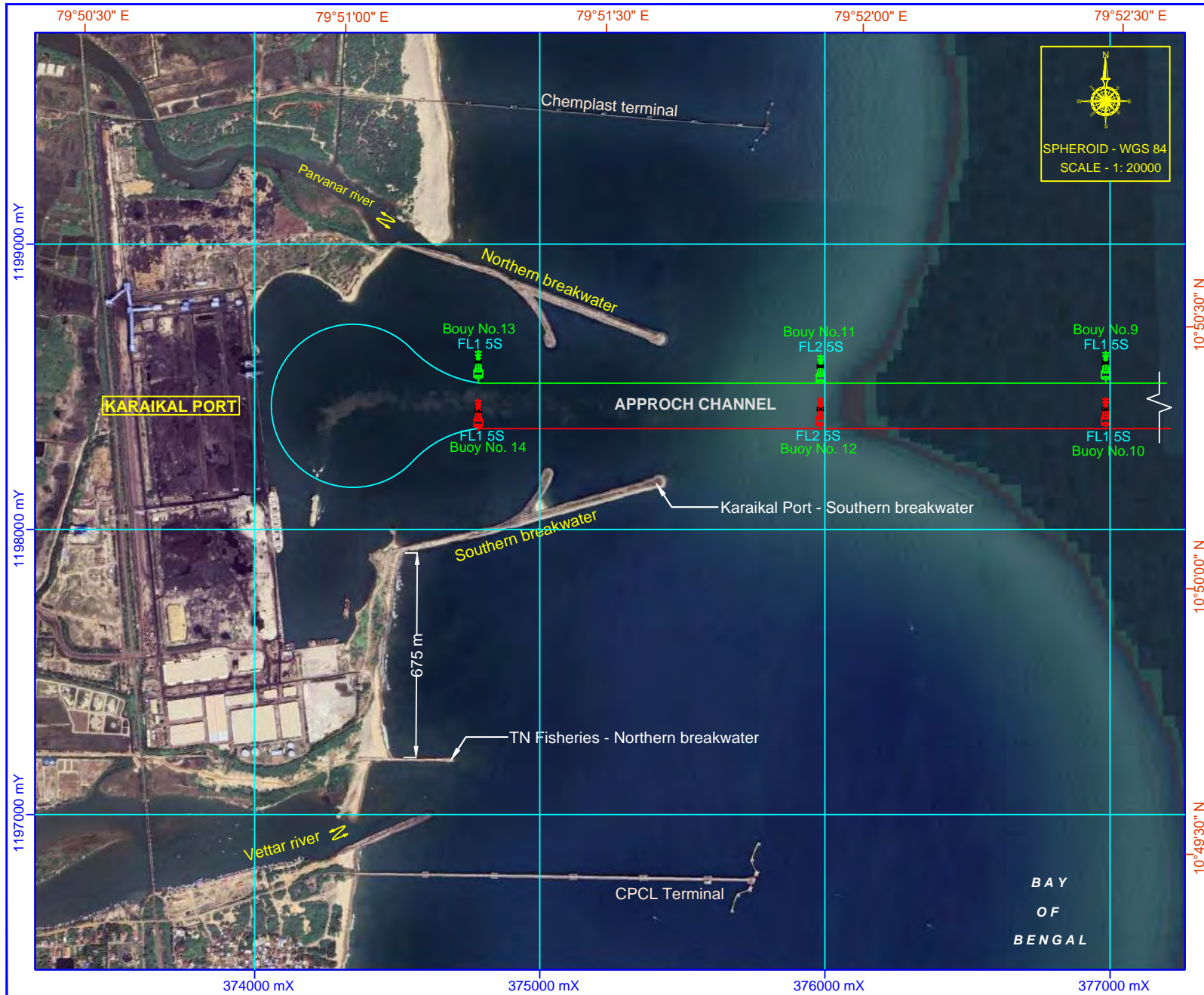


FIG. 2. ALIGNMENT OF TN FISHERIES BREAKWATER IN THE VICINITY OF THE KARAICAL PORT BREAKWATER



FIG. 3. TOPOGRAPHIC SURVEY AREA

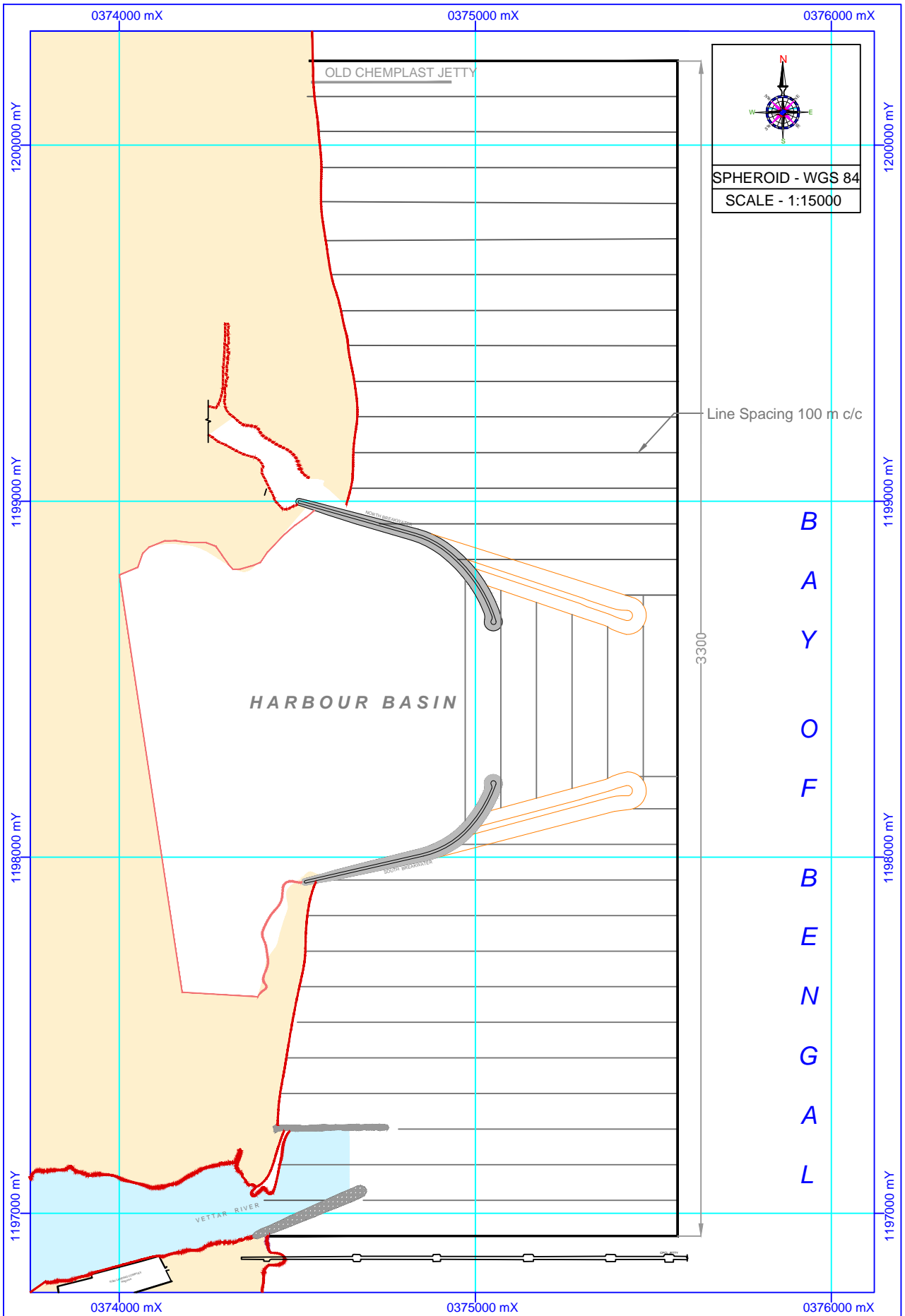


FIG. 4. PLANNED LINES MAP FOR BATHYMETRY SURVEY



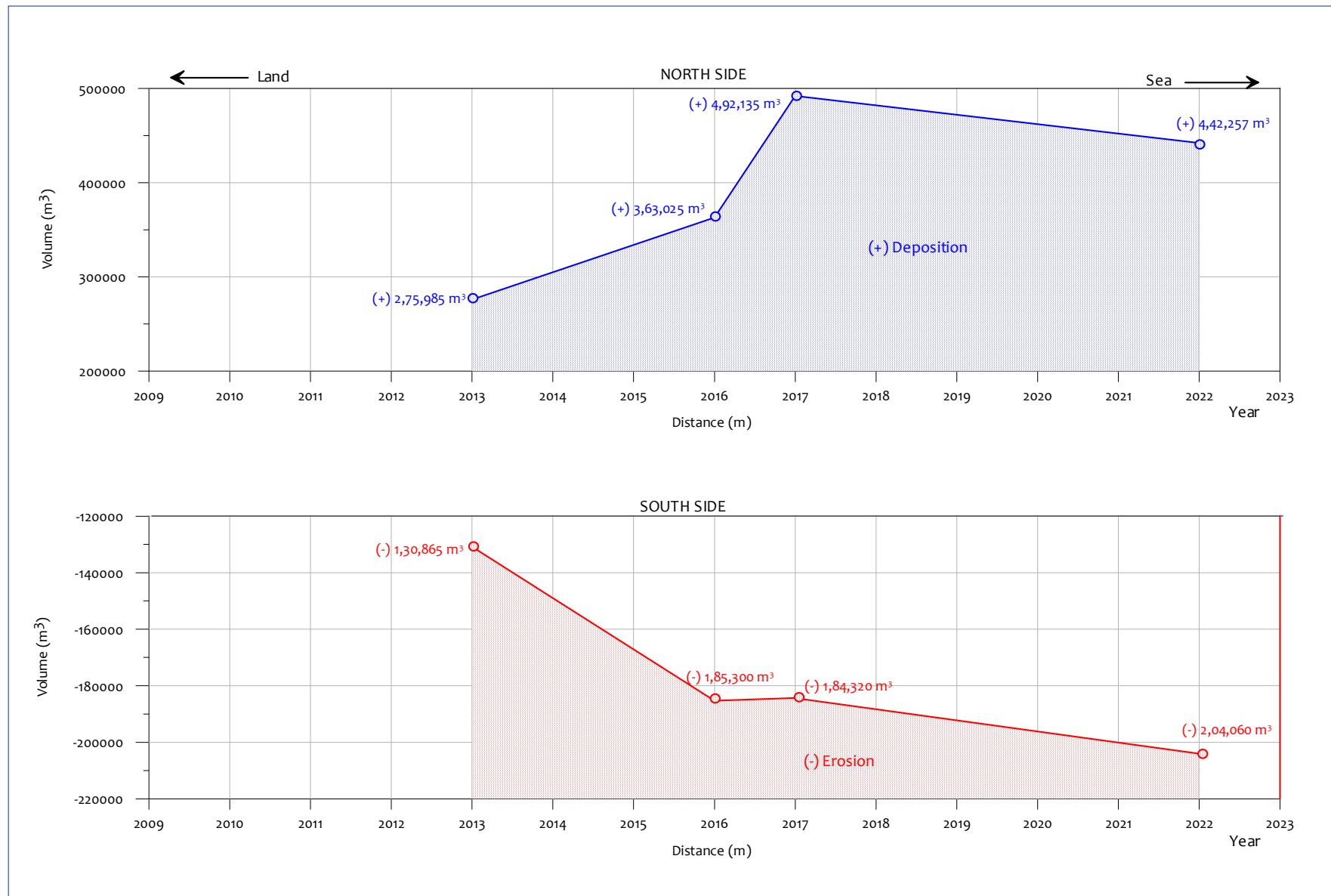


FIG. 7. CHANGES OF SEDIMENT VOLUME AT KPPL

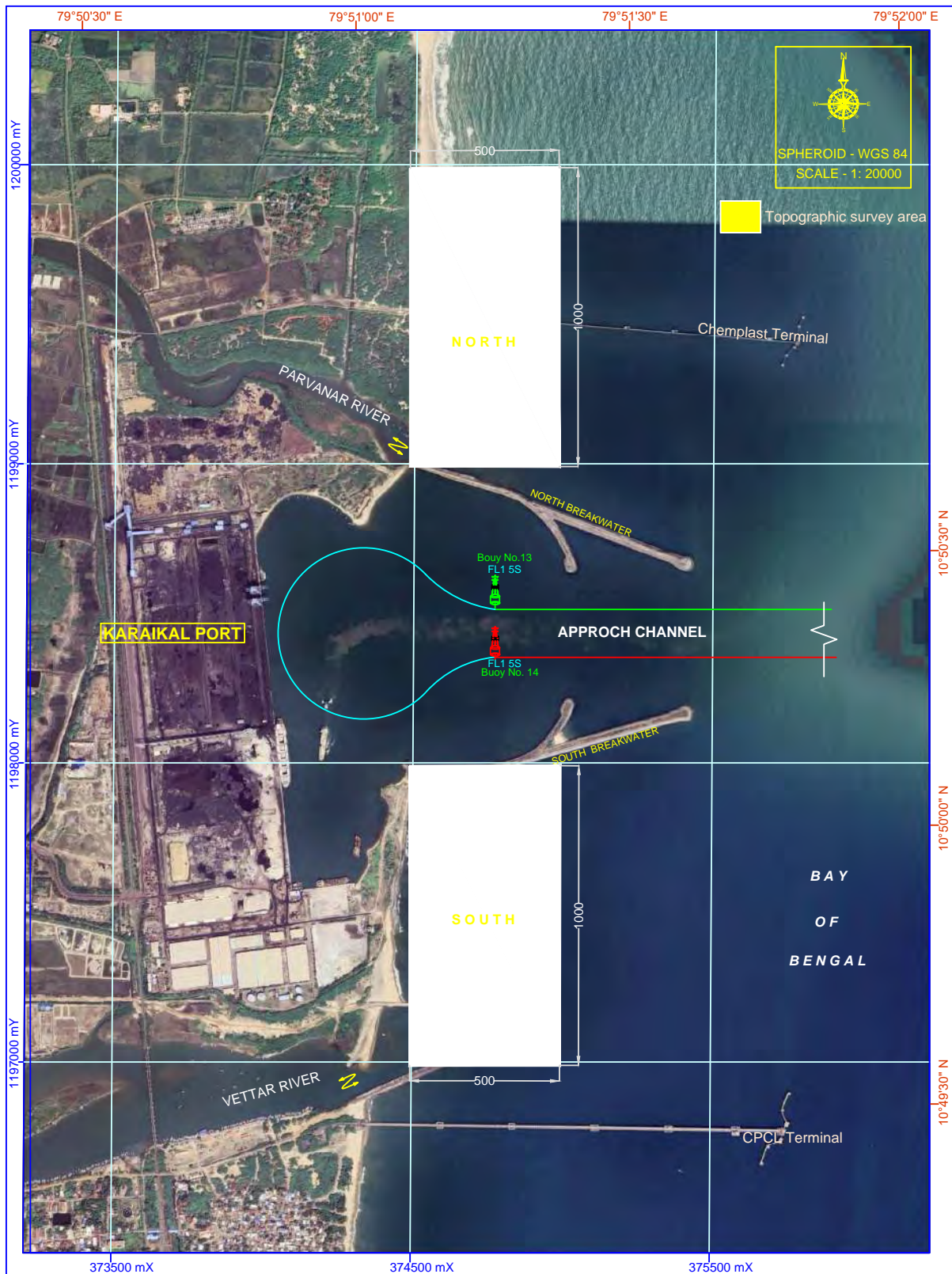


FIG. 8. AREA OF SEDIMENT VOLUME COMPARISON

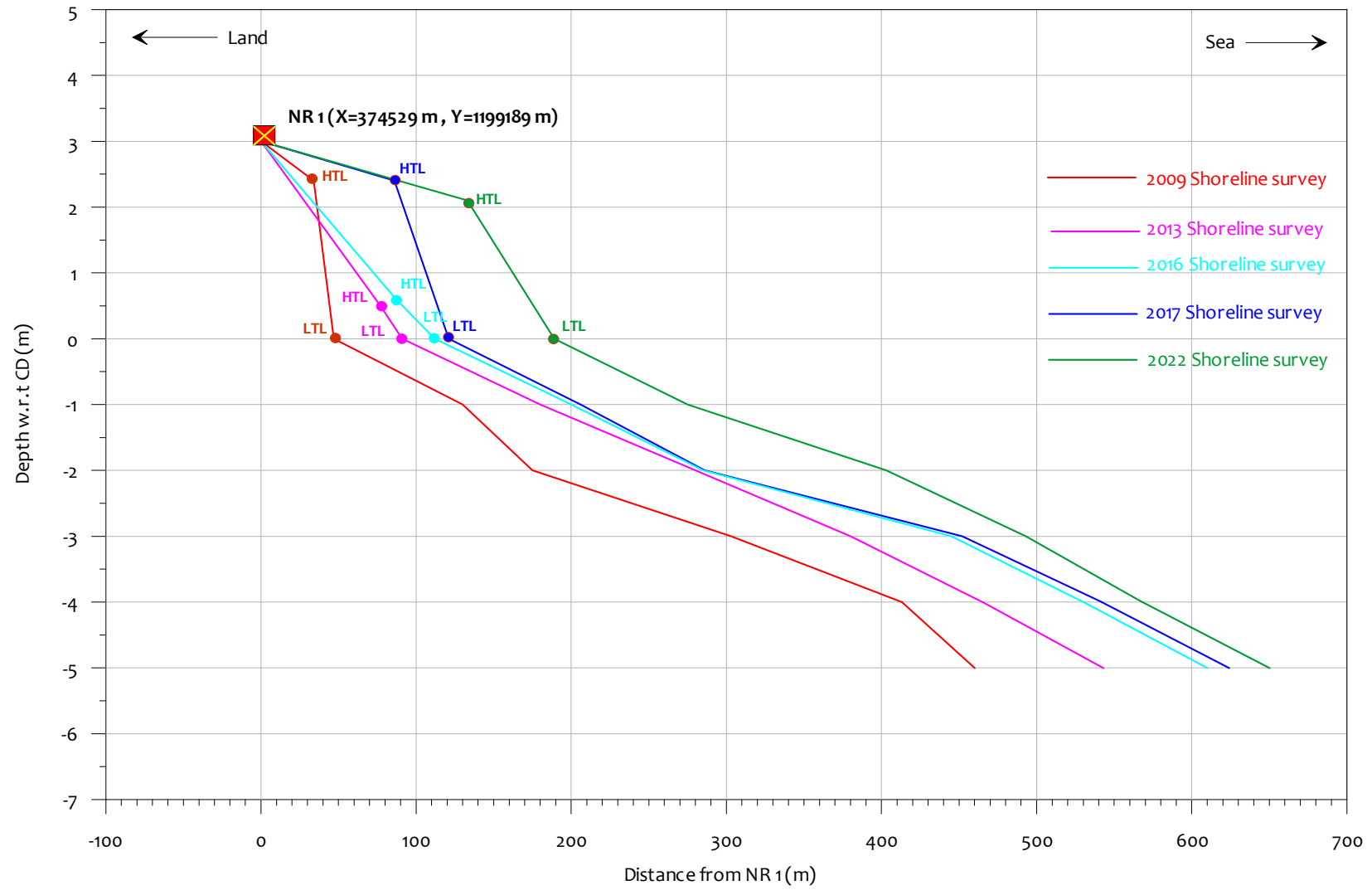


FIG. 9. CROSS SECTION PROFILE AT NR 1

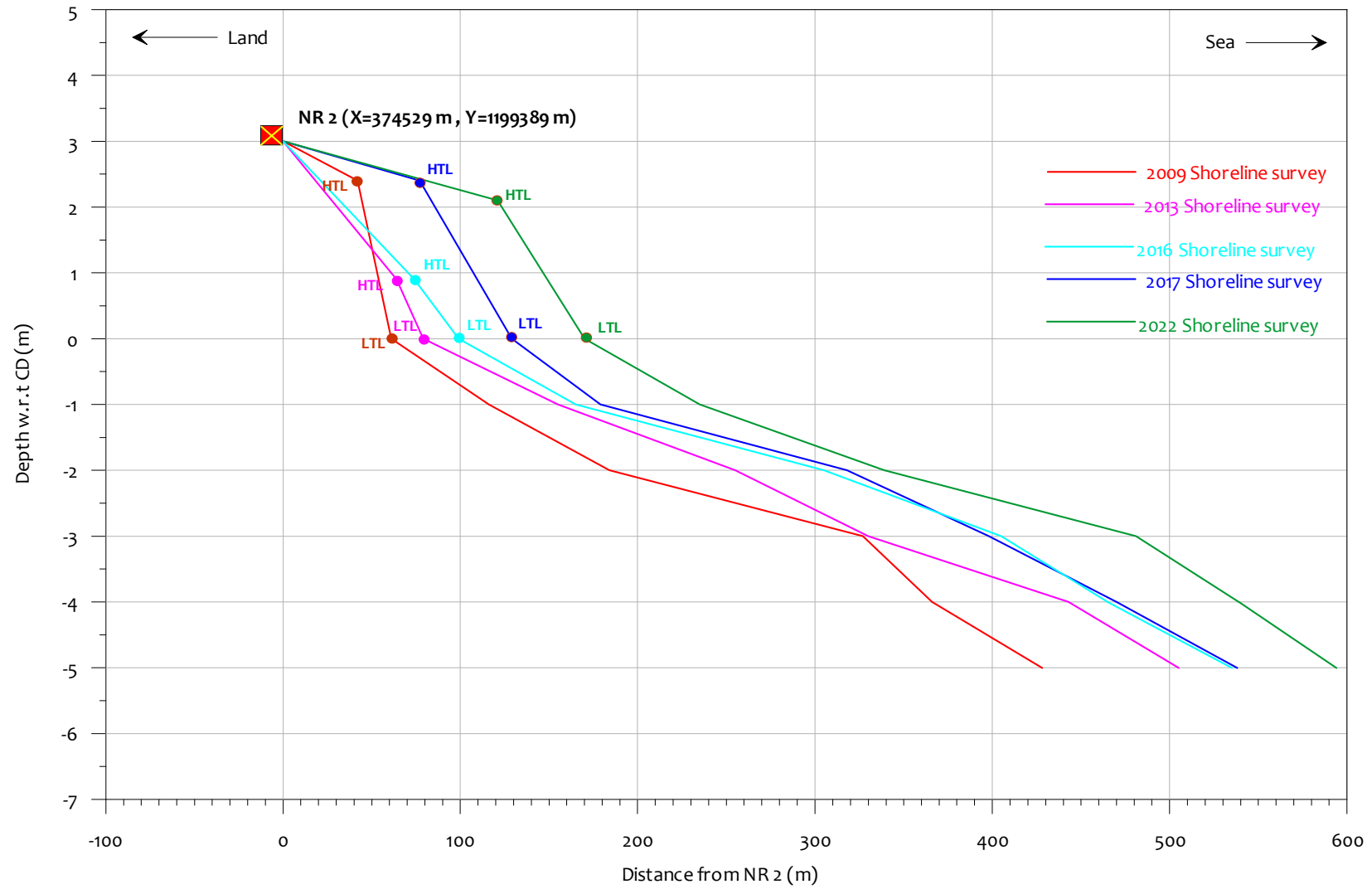


FIG. 10. CROSS SECTION PROFILE AT NR 2

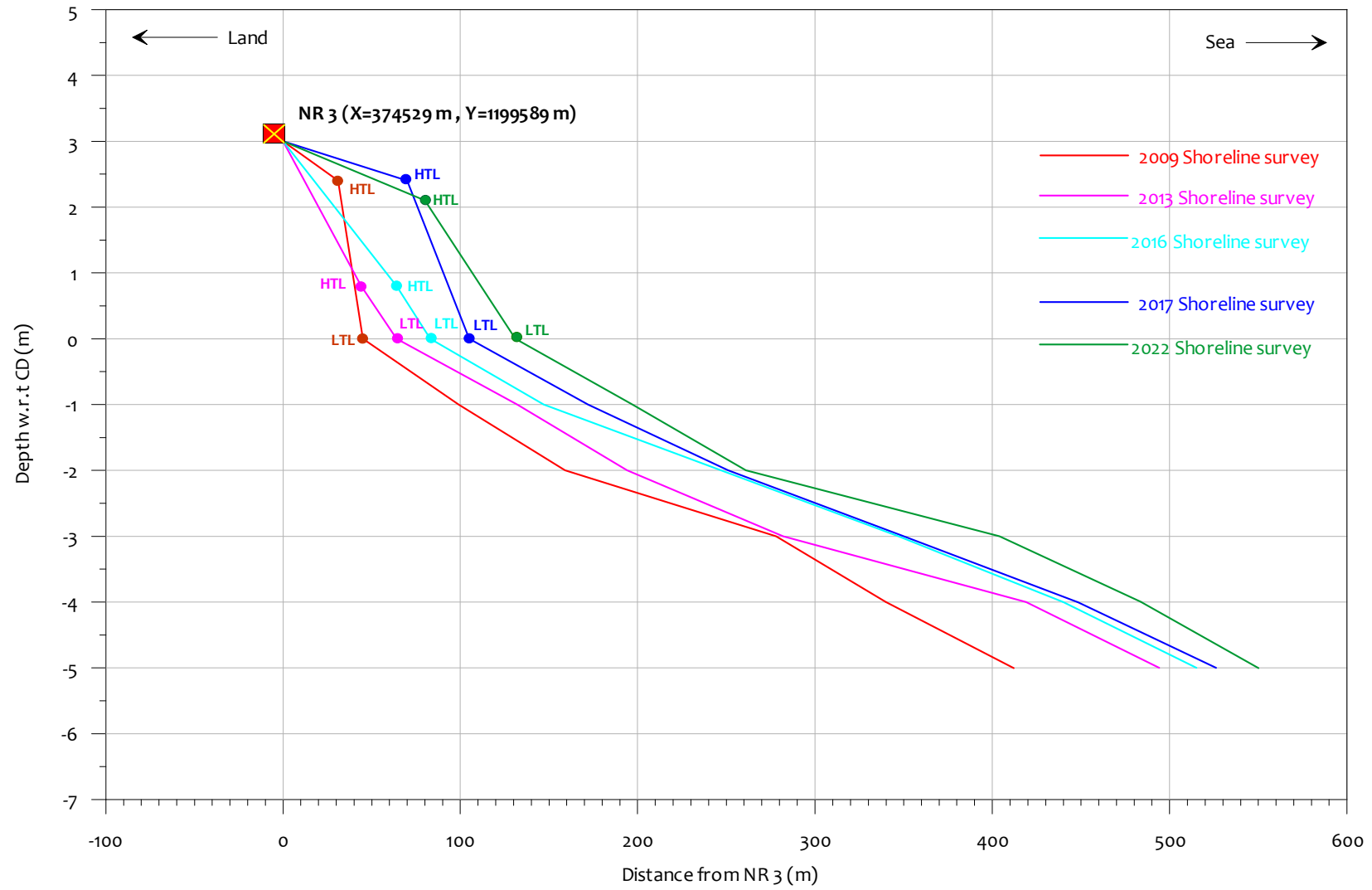


FIG. 11. CROSS SECTION PROFILE AT NR 3

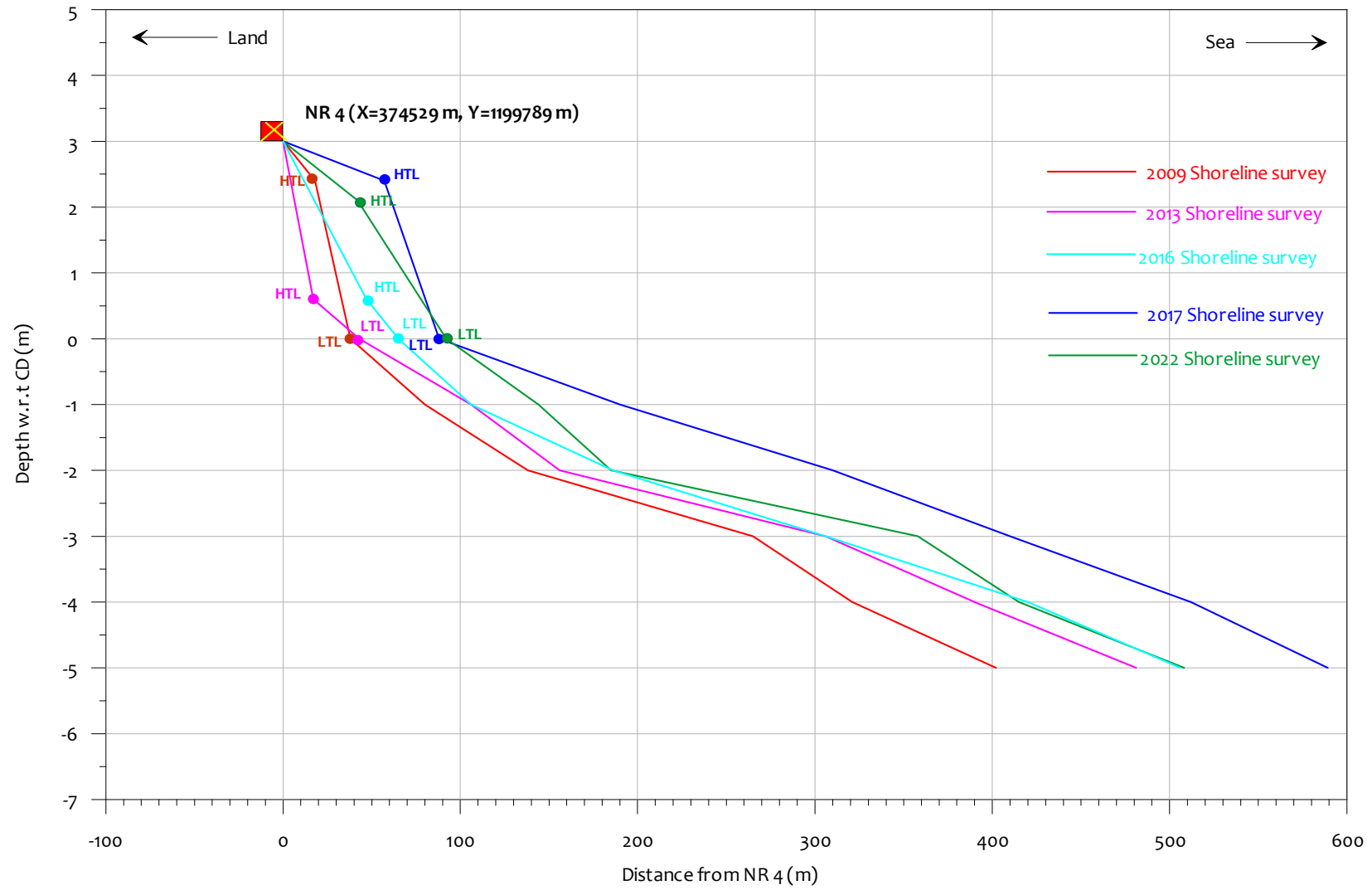


FIG. 12. CROSS SECTION PROFILE AT NR 4

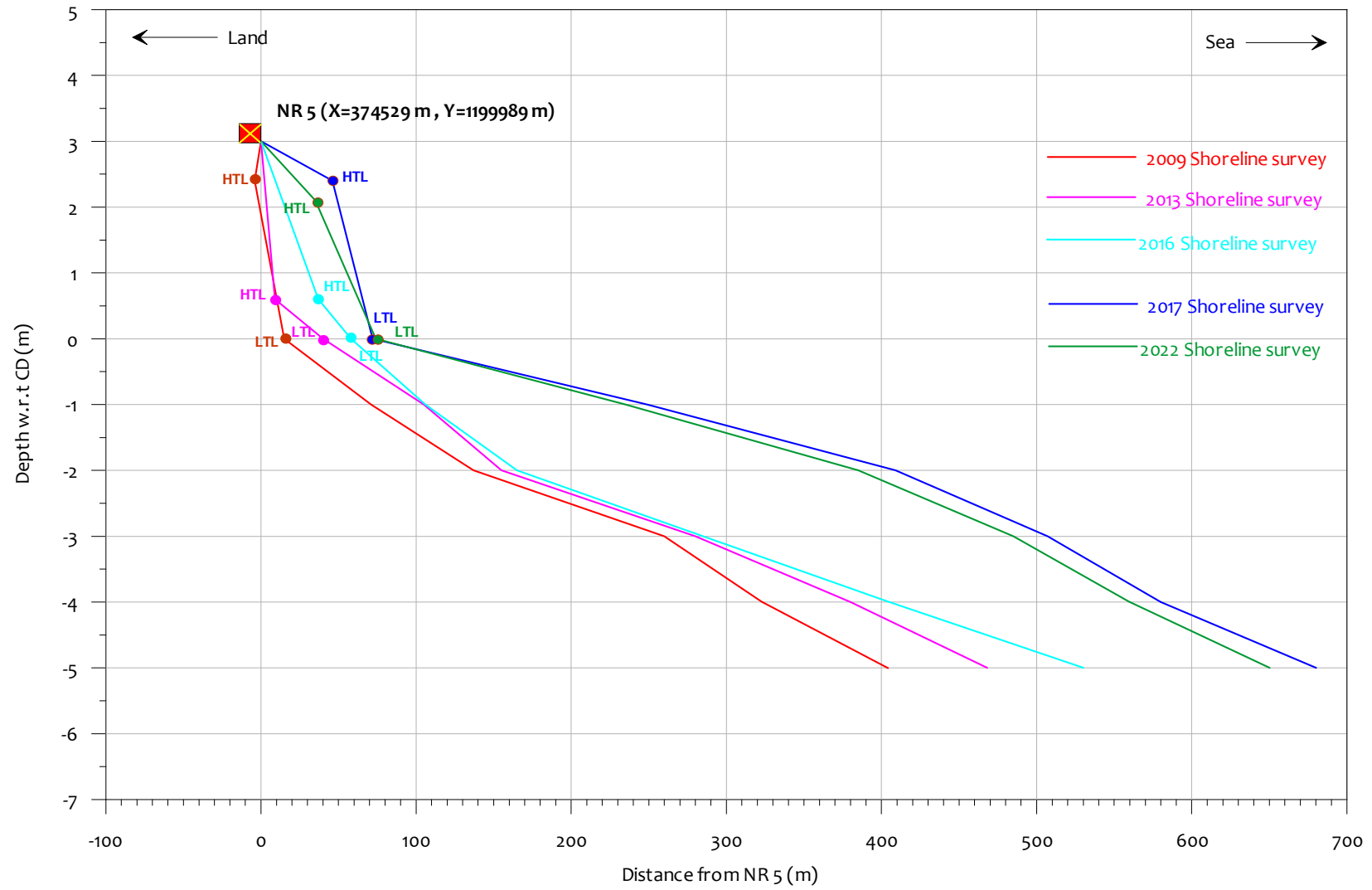


FIG. 13. CROSS SECTION PROFILE AT NR 5

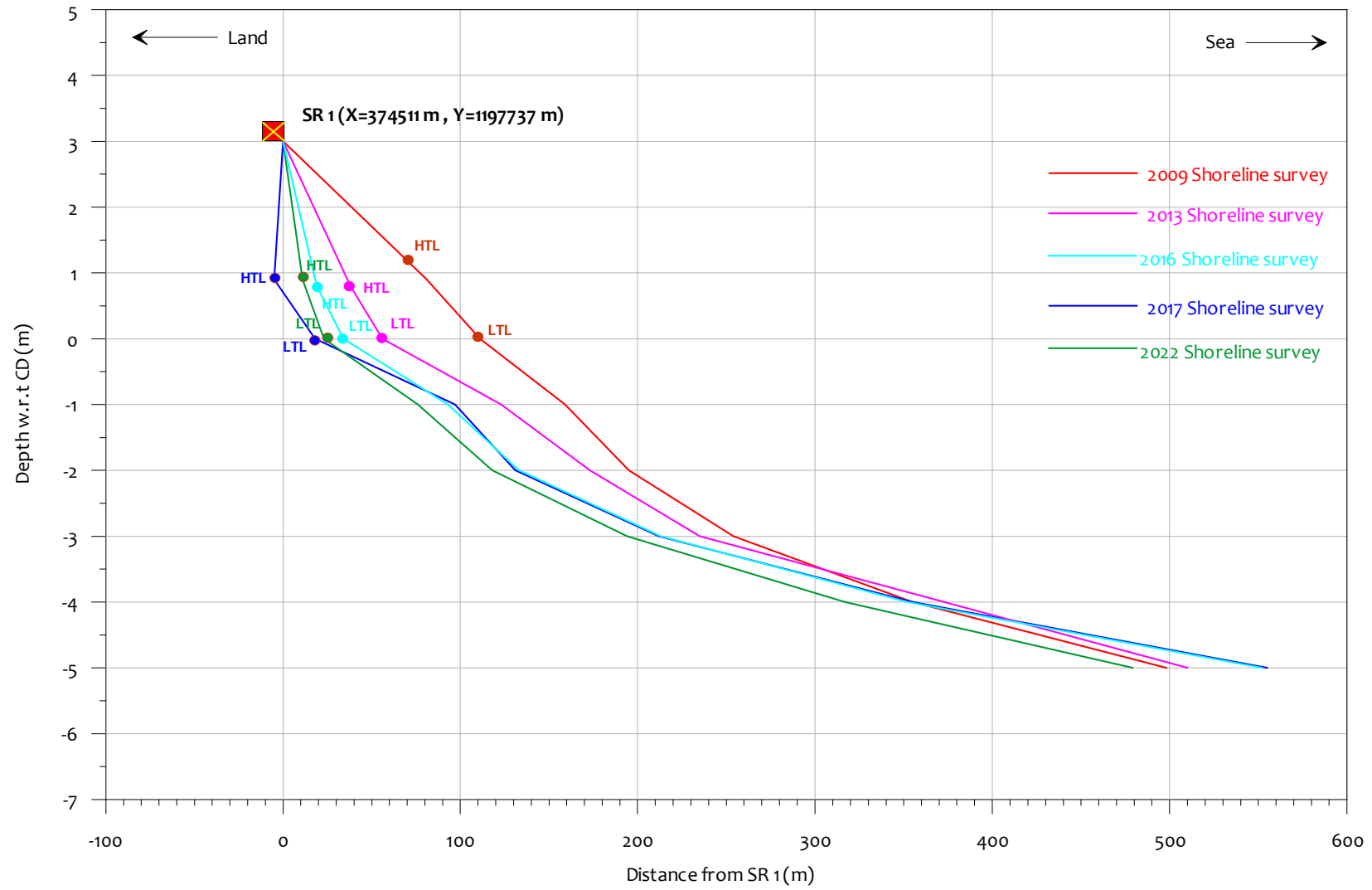


FIG. 14. CROSS SECTION PROFILE AT SR 1



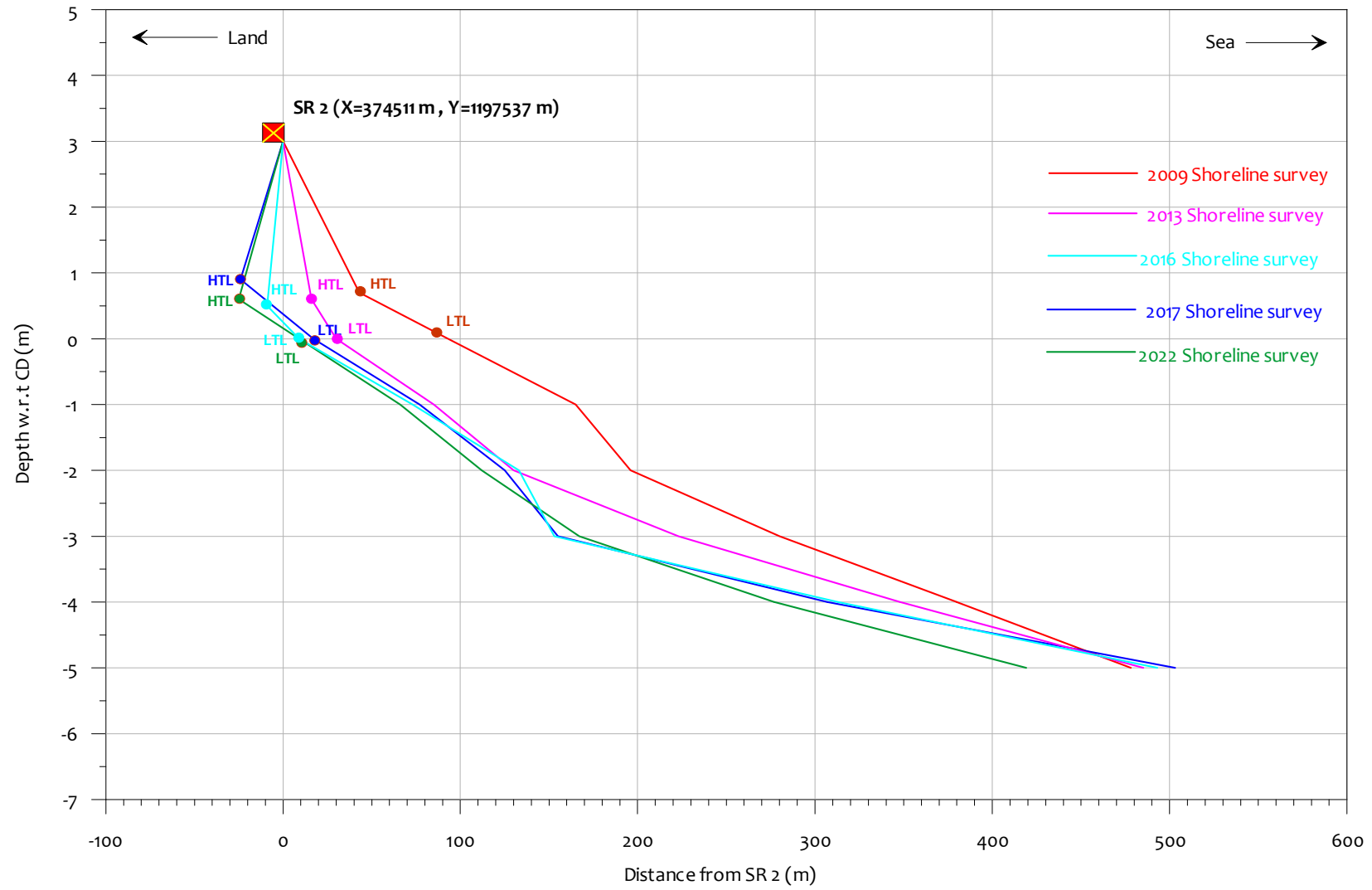


FIG. 15. CROSS SECTION PROFILE AT SR 2

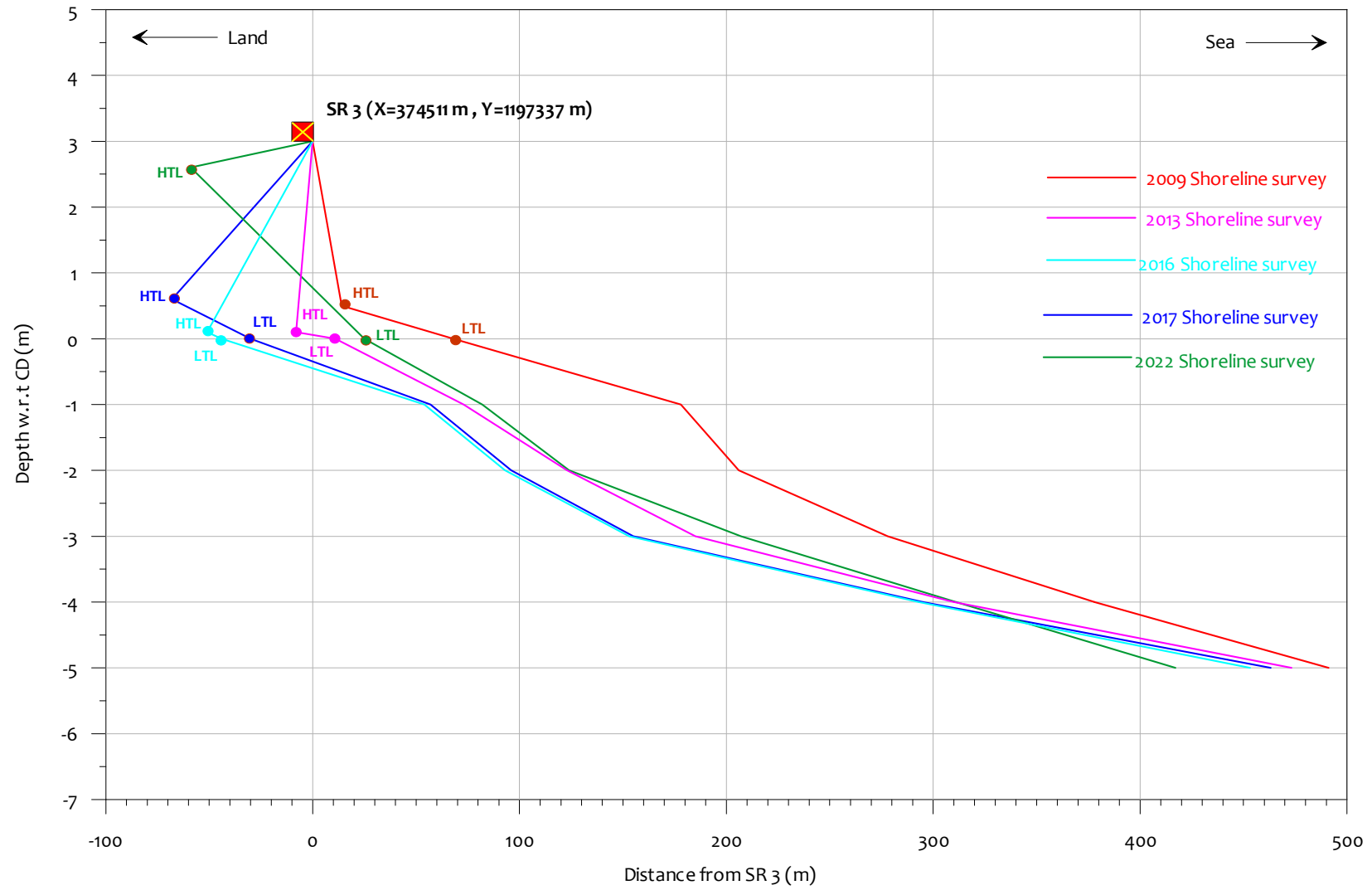


FIG. 16. CROSS SECTION PROFILE AT SR 3

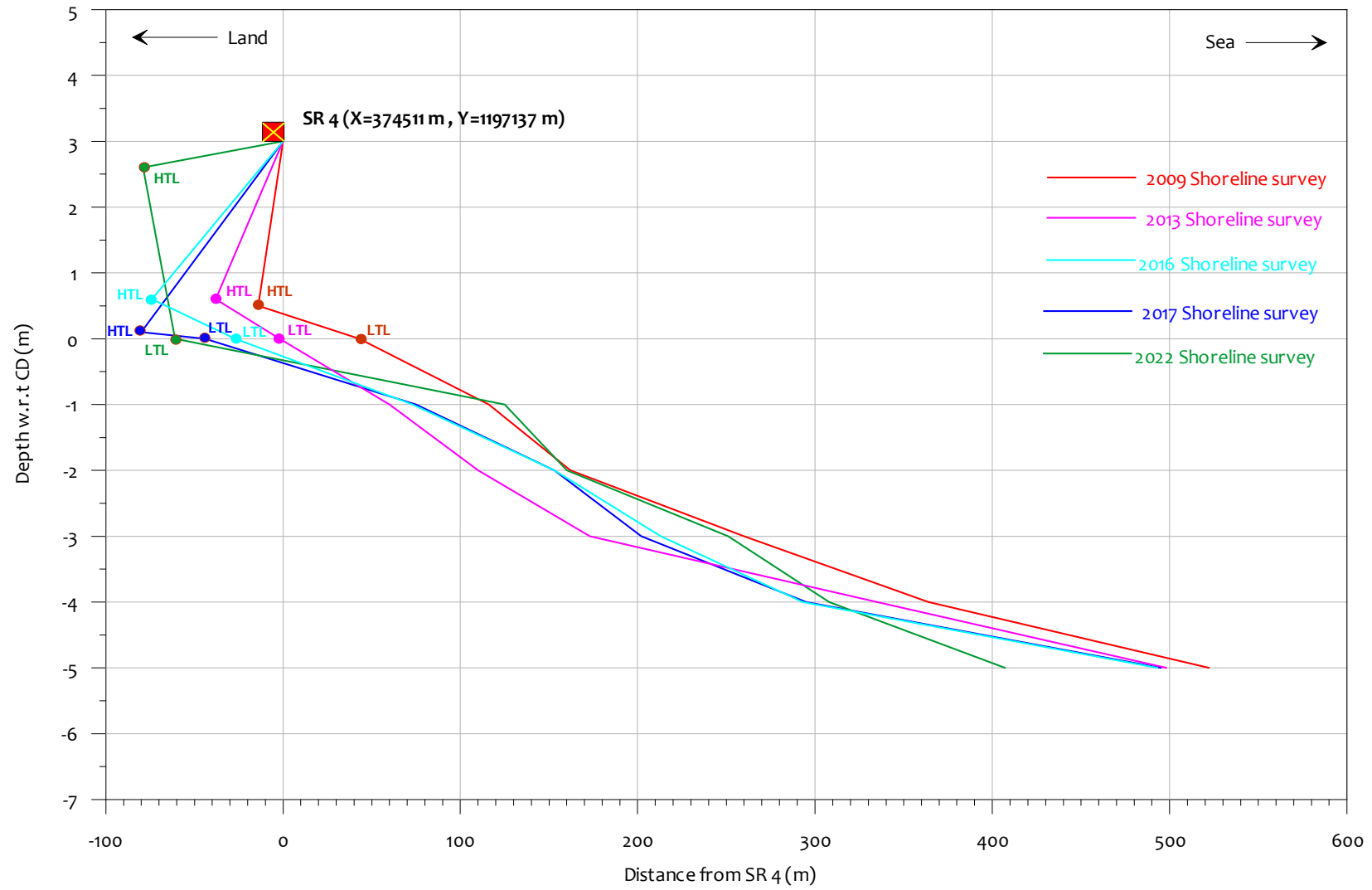


FIG. 17. CROSS SECTION PROFILE AT SR 4 (Vettar Mouth)

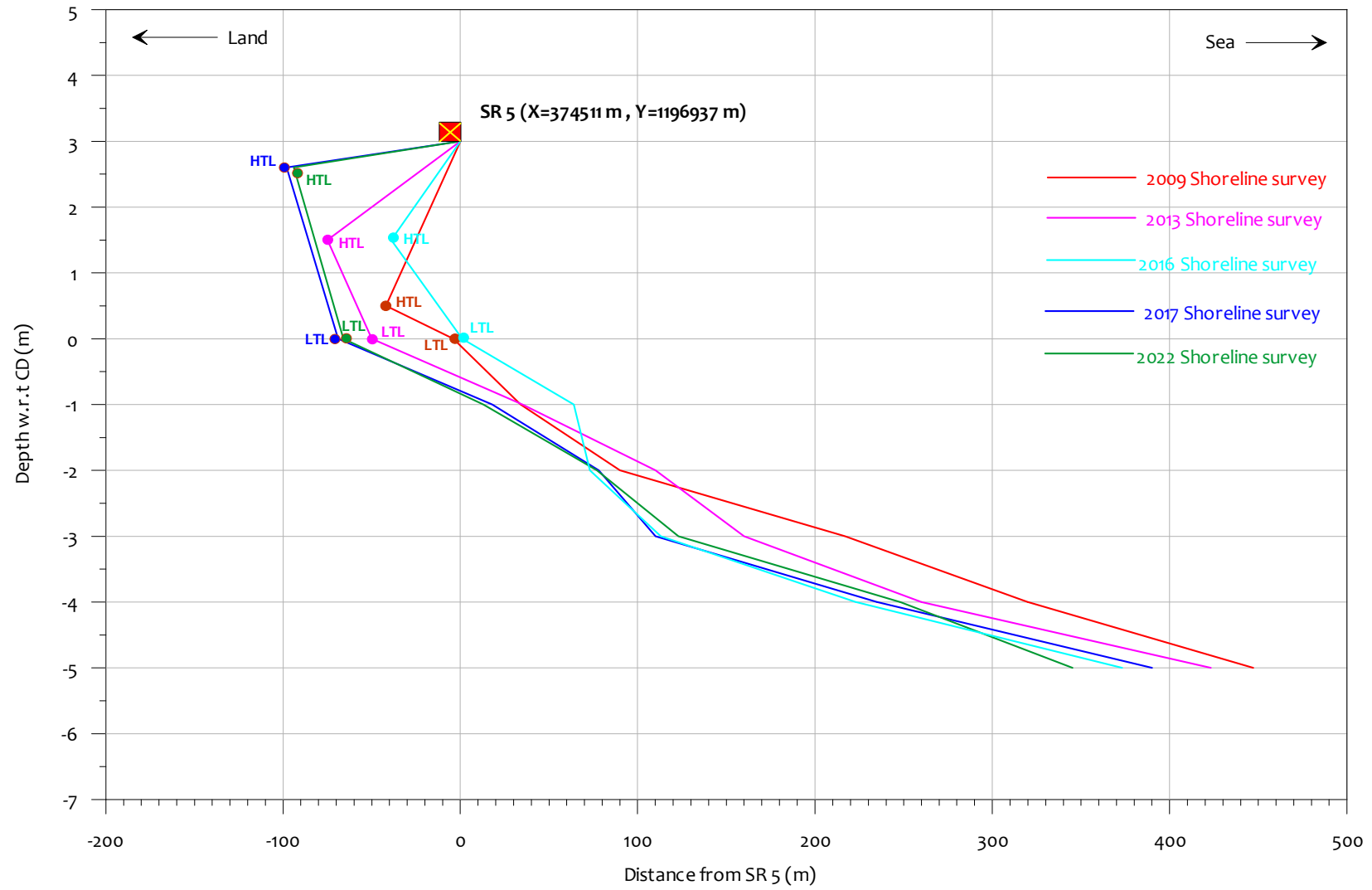


FIG. 18. CROSS SECTION PROFILE AT SR 5



KPP/ENV/MoEF&amp;CC/EC-CRZ /2023/01

Date: 27<sup>th</sup> April 2023**To****The Regional Officer, Integrated Regional Office (IRO),**

Ministry of Environment, Forest &amp; Climate Change (MoEF&amp;CC),

1st Floor, Additional Office Block for GPOA, Shastri Bhawan, Haddows Road,

Nungambakkam, Chennai - 600006

**Subject:**

1. Intimation regarding acquisition of Karaikal Port Private Limited (KPPL) by Adani Ports and Special Economic Zone Limited (APSEZ)
2. Submission of Compliance Report by end of 31<sup>st</sup> March, 2023 – Regarding

**Reference:**

Amendment of Construction of Berth No.4 instead of Berth No.7 at Karaikal Port (Phase-II) at Puducherry by M/s. Karaikal Port Pvt Ltd - MoEF&CC Letter No. 10-42/2009-IA-III dated 20.05.2011

Respected Sir,

This has reference to the above stated subject matter (1). In this connection, we would like to bring to your kind attention that Karaikal Port Private Limited (“KPPL”) has undergone corporate insolvency resolution process (“CIRP”) by virtue of the order dated April 29, 2022, passed by the Hon’ble National Company Law Tribunal, Chennai Bench (“NCLT”). In the matter of CIRP process pursuant, to order dated March 31, 2023, NCLT has approved the resolution plan of Adani Ports and Special Economic Zone Limited (“APSEZ”) which was filed by the committee of creditors (“CoC”).

Further, on March 31, 2023 (“Effective Date”), the resolution plan of APSEZ has been implemented and the operation creditors as well as the financial creditors have been paid in accordance with the terms and conditions of the resolution plan. The Company is now a wholly owned subsidiary of the APSEZ and you are requested kindly to take note of the same.

**KARAİKAL PORT PRIVATE LIMITED**


CIN: U45203PY2006PTC001945

**Registered Office**

Kheezhavanjoor Village, T.R. Pattinam, PB No. 33, Karaikal - 609 606. Tel. : +91 4365 256600 (5 Lines) Fax : +91 4365 256603

As per the conditions stipulated in Environmental & CRZ Clearance letter (No.10 - 42/2009 - IA - III, dated 20.05.2011), from Government of India, Ministry of Environment, Forest and Climate Change IA.III Section (MOEF&CC, IA.III Section), herewith we are submitting the status of compliance reports for the period of October 2022 to March 2023.

Thanking you,  
Yours faithfully,

  
(D.Ravi Shankar)  
General Manager, Environment

Cc:

- The Regional Director, CPCB Regional Directorate/Project Office, Second Floor, No.77-A, South Avenue Road, Ambattur Industrial Estate, Ambattur Taluk, Thiruvallur District, Chennai 600 058
- The Member Secretary, Puducherry Pollution Control Committee (PPCC), Department of Science, Technology & Environment, 3rd Floor, PHB Building, Anna Nagar, Puducherry 605 005.

**KARAIKAL PORT PRIVATE LIMITED**

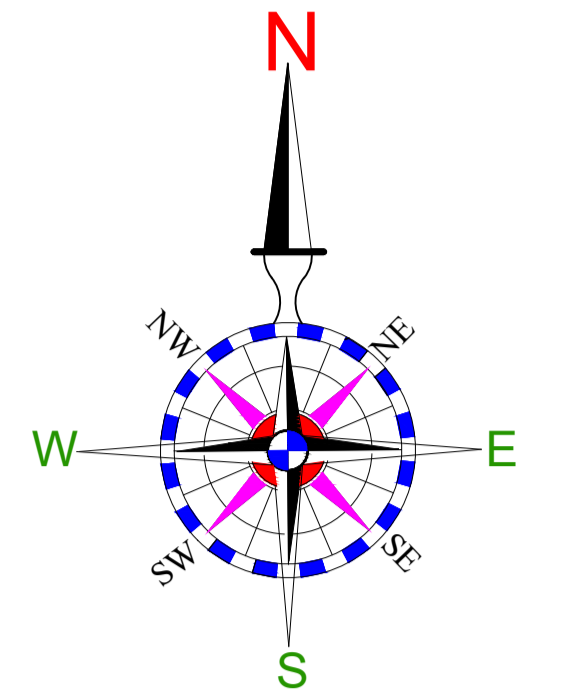
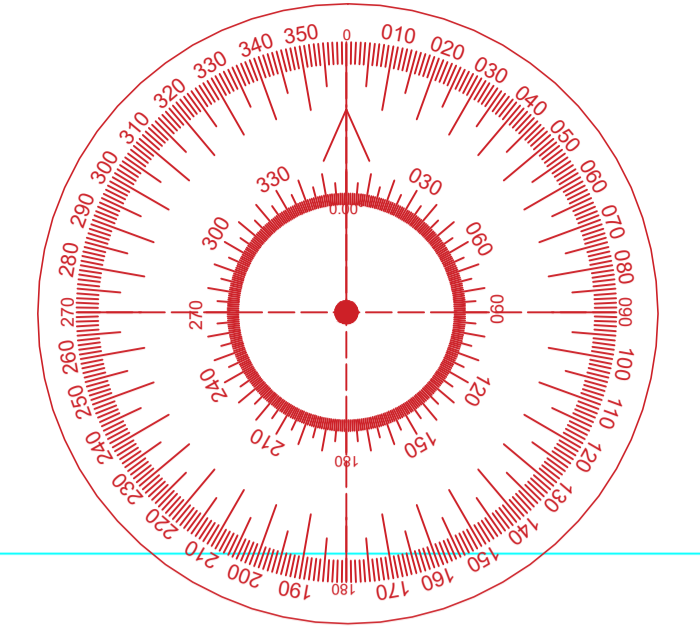
CIN: U45203PY2006PTC001945

Registered Office

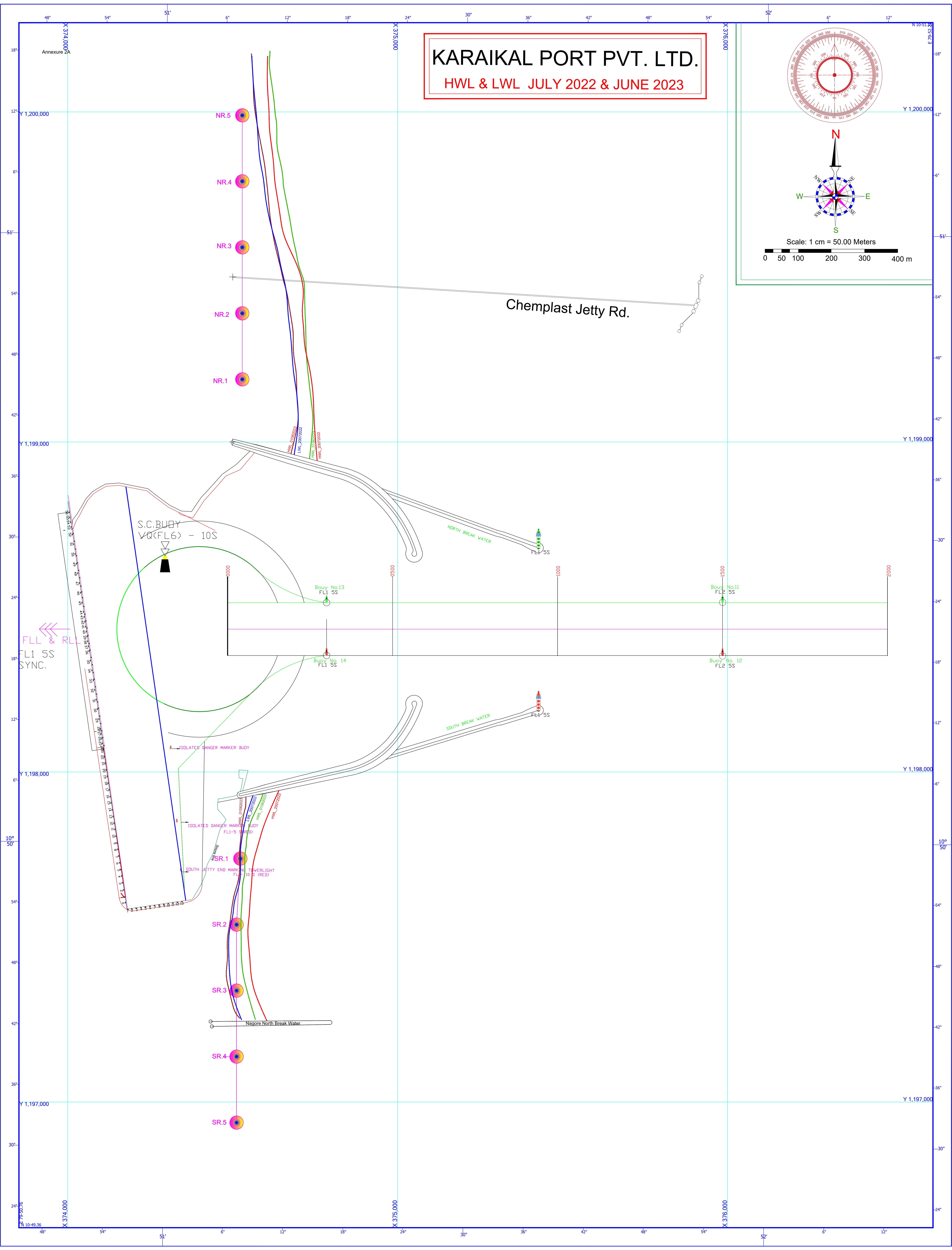
Kheezhavanjoor Village, T.R. Pattinam, PB No. 33, Karaikal - 609 606. Tel. : +91 4365 256600 (5 Lines) Fax : +91 4365 256603

# KARAIKAL PORT PVT. LTD.

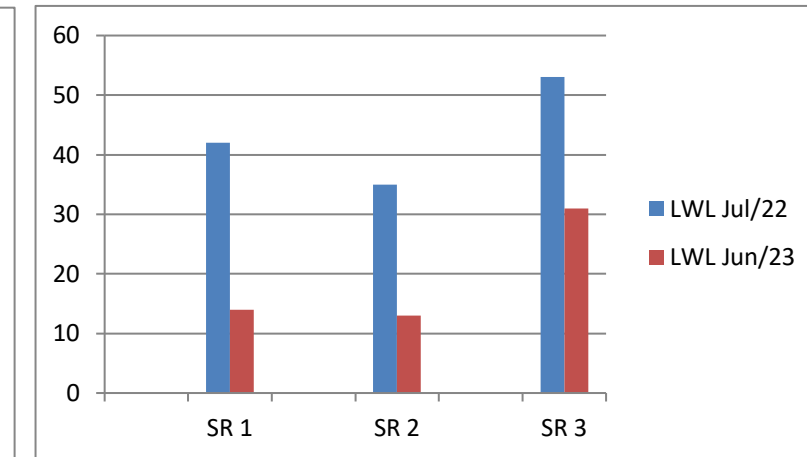
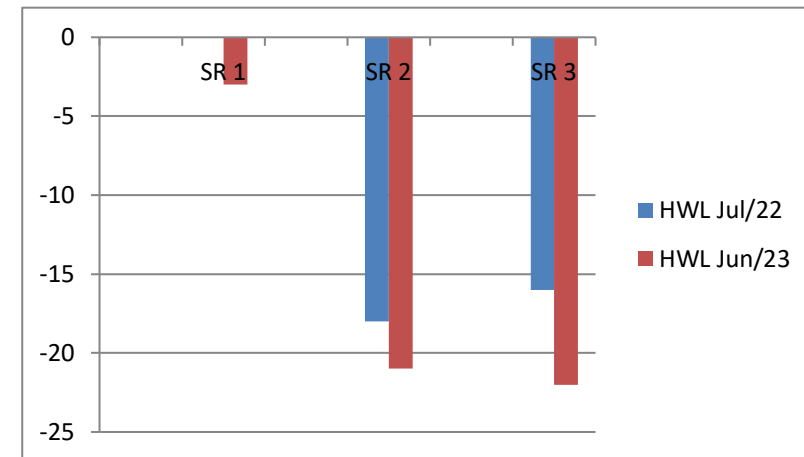
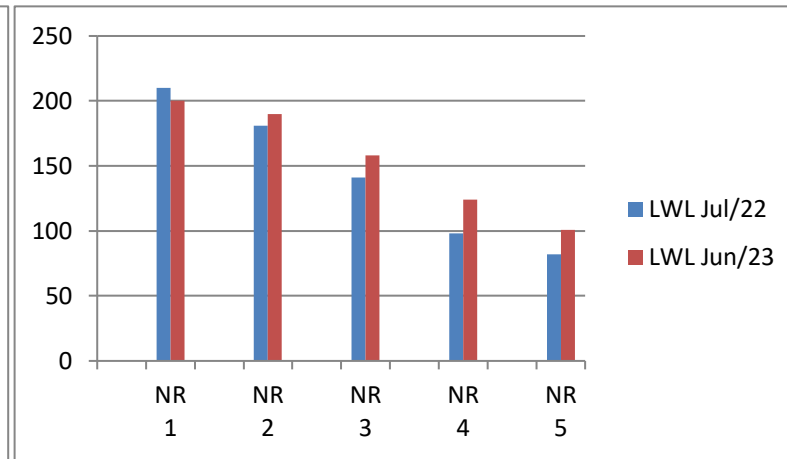
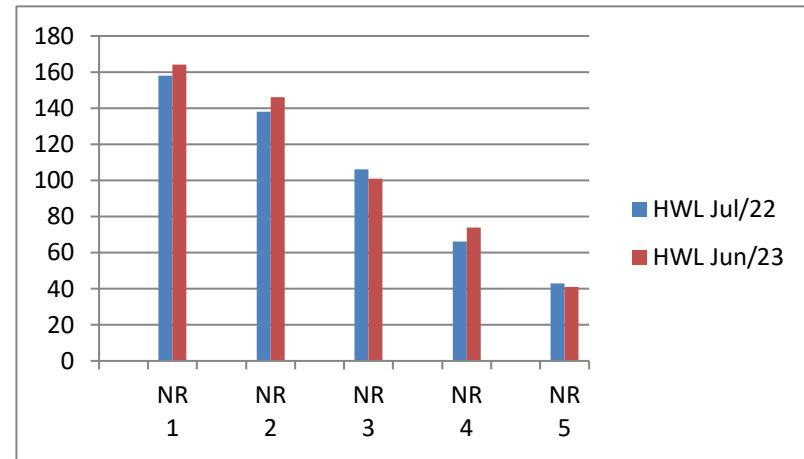
## HWL & LWL JULY 2022 & JUNE 2023



Scale: 1 cm = 50.00 Meters  
0 50 100 200 300 400 m



| Karaikal Port - Shoreline Monitoring |            |            |           |            |            |
|--------------------------------------|------------|------------|-----------|------------|------------|
| Comparison July 2022 & June 2023     |            |            |           |            |            |
| Ref. Pts.                            | HWL        |            | Ref. Pts. | LWL        |            |
|                                      | Jul/22     | Jun/23     |           | Jul/22     | Jun/23     |
| NR 1                                 | 158        | 164        | NR 1      | 210        | 200        |
| NR 2                                 | 138        | 146        | NR 2      | 181        | 190        |
| NR 3                                 | 106        | 101        | NR 3      | 141        | 158        |
| NR 4                                 | 66         | 74         | NR 4      | 98         | 124        |
| NR 5                                 | 43         | 41         | NR 5      | 82         | 101        |
| Ref. Pts.                            | HWL        |            | Ref. Pts. | LWL        |            |
|                                      | Jul/22     | Jun/23     |           | Jul/22     | Jun/23     |
| SR 1                                 | 0          | -3         | SR 1      | 42         | 14         |
| SR 2                                 | -18        | -21        | SR 2      | 35         | 13         |
| SR 3                                 | -16        | -22        | SR 3      | 53         | 31         |
| SR 4                                 | Sub merged | Sub merged | SR 4      | Sub merged | Sub merged |
| SR 5                                 | Sub merged | Sub merged | SR 5      | Sub merged | Sub merged |





Recd  
27.06.11  
YJH

GOVERNMENT OF PUDUCHERRY  
DEPARTMENT OF SCIENCE, TECHNOLOGY AND ENVIRONMENT  
PUDUCHERRY POLLUTION CONTROL COMMITTEE  
3<sup>rd</sup> Floor, PHB Building, Anna Nagar  
Puducherry – 605 005.  
\*\*\*

Phone : (0413) 2201256  
Telefax : (0413) 2203494

**NO OBJECTION CERTIFICATE FROM POLLUTION ANGLE**

No.PPCC/NOC/KKL/JLA/2011/73)

Puducherry, the

Sub : PPCC – Issue of NOC for amendment in construction of Berth No. 4 instead of Berth No. 7 – Issued – Reg.

123 JUN 2011

Ref : 116<sup>th</sup> Meeting of PPCC held on 16.06.2011.  
\*\*\*

With reference to the above, it is informed that the proposal for issue of No Objection Certificate from Pollution Angle (NOC) for amendment in construction of Berth No. 4 instead of Berth No. 7 was discussed in the 116<sup>th</sup> Meeting of Puducherry Pollution Control Committee held on 16.06.2011. The Puducherry Pollution Control Committee has no objection in according clearance to **Construct Berth No. 4 instead of Berth No. 7** subject to the **following conditions**:

1. All the conditions stipulated in the clearance issued by Ministry of Environment and Forests, Government of India vide F. No. 10-42/2009-IA.III dated 20.05.2011 shall be strictly adhered.
2. All the measures adopted in Environmental Impact Assessment (EIA) studies shall be strictly adhered.
3. The applicant shall not undertake any expansion, modernization, diversification, change of location etc., without the prior approval / clearance from this authority.
4. M/s. Karaikal Port (P) Ltd., shall take all possible measures to create pollution free surroundings during construction activities.
5. **The applicant shall apply to this Committee in prescribed form for Air and Water Consent Order (To Operate) thirty (30) days before the commencement of activities.**
6. This No Objection Certificate (NOC) from Pollution Angle shall be exhibited in the office room and must be made available to the inspecting officers of this Committee.

For & on behalf of PPCC

S. Sundaravivelu

(Dr. S. SUNDARAVIVELU)

1/2 MEMBER SECRETARY

PUDUCHERRY POLLUTION CONTROL COMMITTEE

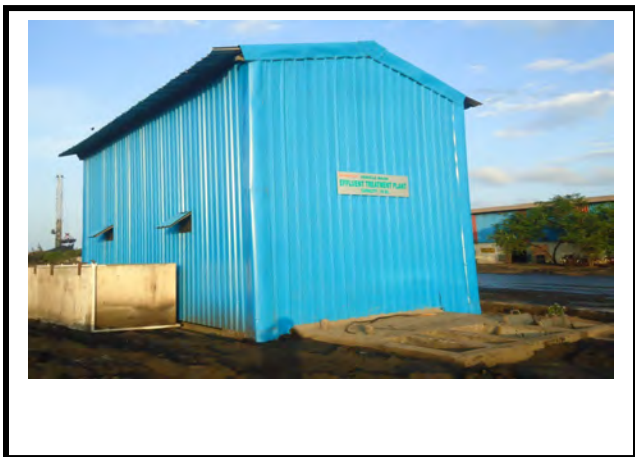
To

M/s. Karaikal Port Pvt. Ltd., Post Box No. 33, Karaikal – 609 602.

**ENVIRONMENTAL MITIGATION MEASURES AT KARAIKAL PORT PRIVATE LIMITED**



STP



ETP's



Road Cleaning Machine



Rain Water Harvesting Pond

# **ENVIRONMENTAL MITIGATION MEASURES AT KARAİKAL PORT PRIVATE LIMITED**



Tyre Wash System



Truck & Wagon Covered by Tarpaulin



CAAQM Station

## **ENVIRONMENTAL MITIGATION MEASURES AT KARAIKAL PORT PRIVATE LIMITED**



Sprinklers & Hose Wetting



Road Wetting Tanker & Tractor



Wind Screen @ Coal Yards & Railway Sidings

**ENVIRONMENTAL MITIGATION MEASURES AT KARAİKAL PORT PRIVATE LIMITED**



Green Belt Development



Green Belt Development

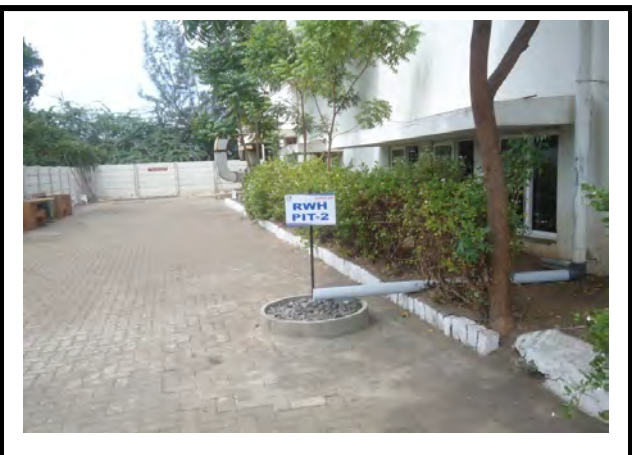


Green Belt Development

**ENVIRONMENTAL MITIGATION MEASURES AT KARAIKAL PORT PRIVATE LIMITED**

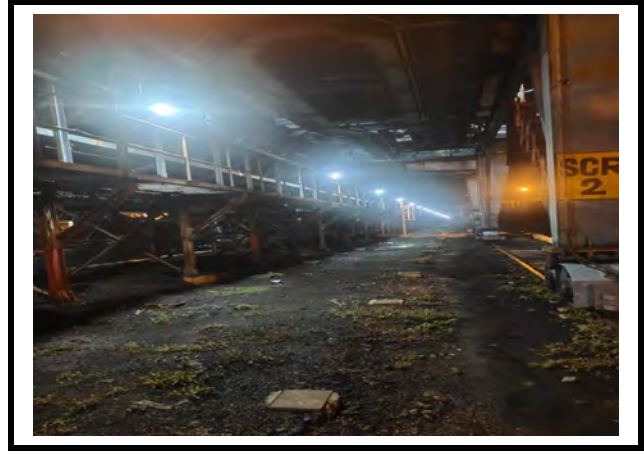


Rainwater harvesting Pits



Rainwater harvesting Ponds

**ENVIRONMENTAL MITIGATION MEASURES AT KARAİKAL PORT PRIVATE LIMITED**



Solar Initiatives



Green Belt Development



Green Belt Development

