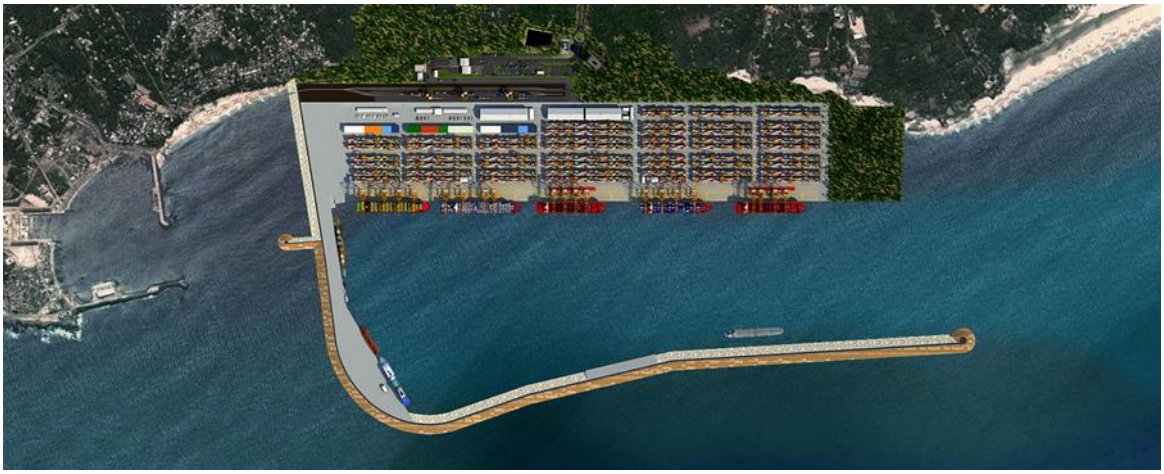
# ENVIRONMENT MONITORING REPORT
# AUGUST - 2026



## ADANI VIZHINJAM PORT PVT. LTD.
## VIZHINJAM, KERALA

**Report No.: SEAAL/EMR-AVPPL-2608**

**Report Date: 07th September, 2026**

This Report presents the discussion and the results of Environmental Monitoring at Adani Vizhinjam Port. The monitoring has been conducted and the report has been prepared & issued by Standards Environmental & Analytical Laboratories, Ernakulum-683110 to M/s Adani Vizhinjam Port Pvt Limited, Thiruvananthapuram-695 014

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| EMR-1 | Executive Summary |
|---|---|

**Background:**

As per the Environment Monitoring Plan prescribed in the EIA for Vizhinjam International Deepwater Multipurpose Seaport, continuous environment monitoring is being carried out by Standards Environmental & Analytical Laboratories (NABL Accredited testing laboratory vide certificate number TC12939, MoEF recognized Environmental Laboratory under the Environment (Protection) Act-1986) at specified frequency as mentioned in Service Order vide email dated 11.07.2022 awarded by Adani Vizhinjam Port Private Limited (AVPPL).

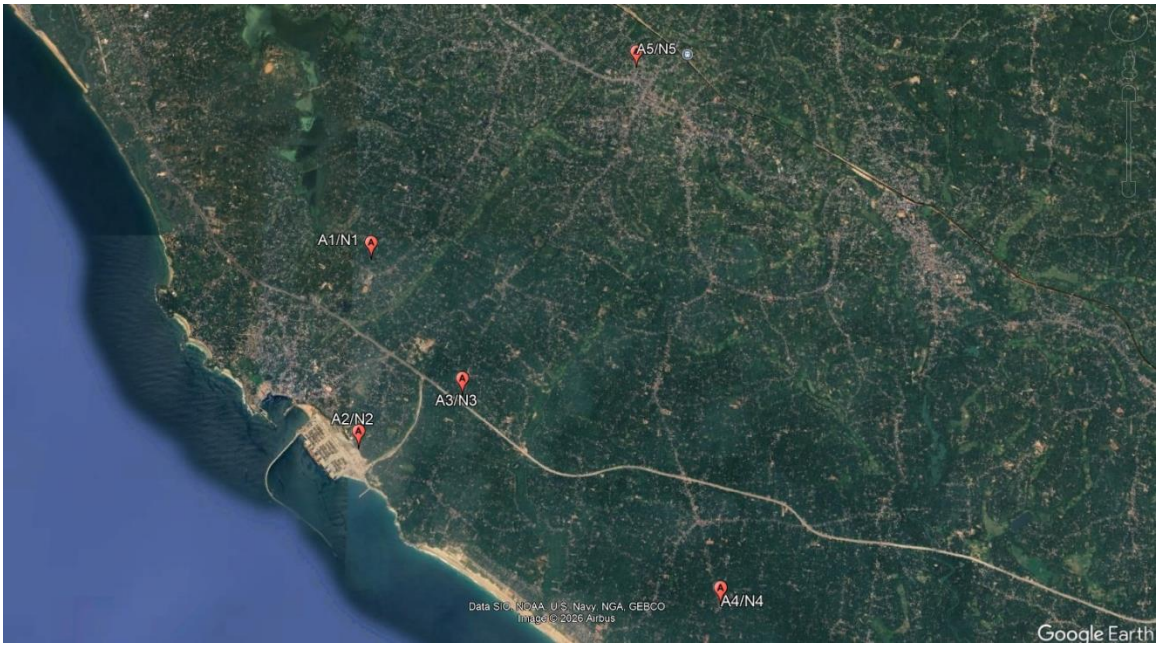
Environment Monitoring includes Ambient Air Quality, Ambient Noise, Marine Water (Physical, Chemical and Biological); Sediment (Physical, Chemical and Biological (Benthos), Ground Water (Physical, Chemical and Biological) and Surface Water (Physical, Chemical and Biological) was carried out at locations shown in following Google maps and co-ordinates as per the table below.

**Co-ordinates of the Sampling Locations:**

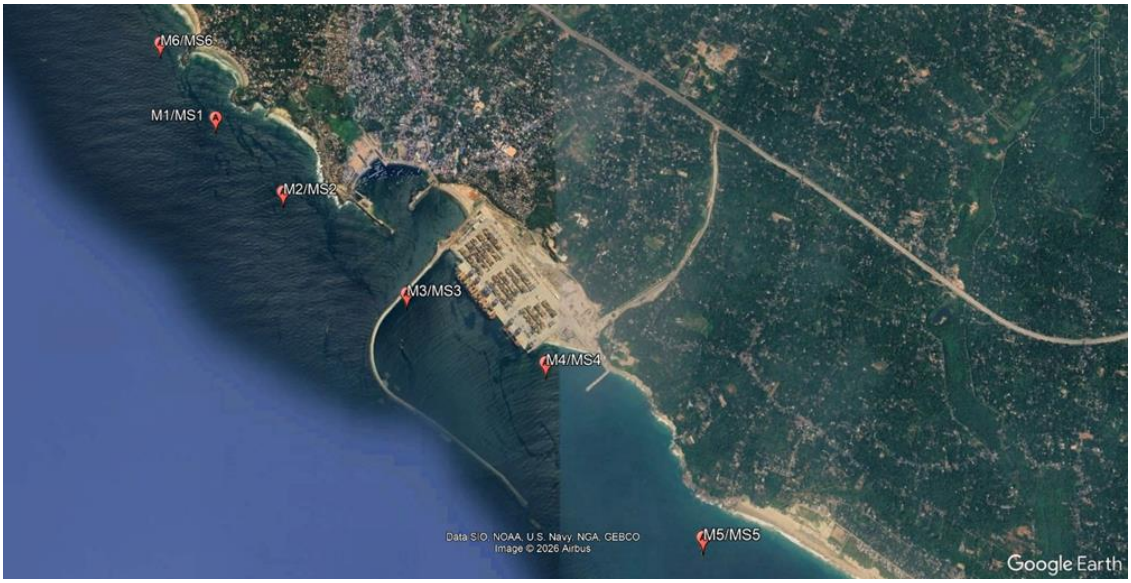
| Sl. No. | Matrix | Location Name | Legend | Latitude | Longitude |
|---|---|---|---|---|---|
| 1. | Ambient Air Quality | Venganoor | A1 | 8°23’55.10”N | 77°00’12.19”E |
| | | Port Site | A2 | 8°22’13.73”N | 77°00’08.39”E |
| | | Proposed Port Estate Area | A3 | 8°22’41.37”N | 77°01’03.17”E |
| | | Chani | A4 | 8°20’53.49”N | 77°03’18.76”E |
| | | Balarampuram | A5 | 8°25’43.85”N | 77°02’38.79”E |
| 2. | Ambient Noise | Venganoor | N1 | 8°23’55.10”N | 77°00’12.19”E |
| | | Port Site | N2 | 8°22’13.73”N | 77°00’08.39”E |
| | | Proposed Port Estate Area | N3 | 8°22’41.37”N | 77°01’03.17”E |
| | | Chani | N4 | 8°20’53.49”N | 77°03’18.76”E |
| | | Balarampuram | N5 | 8°25’43.85”N | 77°02’38.79”E |
| 3. | Marine Water | Near Kovalam Beach | M1 | 8°22’49.29”N | 76°58’40.77”E |
| | | Proposed Dredging Site | M2 | 8°22’31.11”N | 76°58’57.92”E |
| | | Port Basin | M3 | 8°22’06.96”N | 76°59’27.85”E |
| | | South of Breakwater | M4 | 8°21’51.07”N | 77°00’00.21”E |
| | | Inner Approach Channel | M5 | 8°21’12.68”N | 77°00’35.14”E |
| | | Kovalam Beach | M6 | 8°23’08.16”N | 76°58’26.09”E |
| 4. | Marine | Near Kovalam Beach | MS1 | 8°22’49.29”N | 76°58’40.77”E |

| Sl. No. | Matrix | Location Name | Legend | Latitude | Longitude |
|---|---|---|---|---|---|
| | Sediment | Proposed Dredging Site | MS2 | 8°22’31.11”N | 76°58’57.92”E |
| | | Port Basin | MS3 | 8°22’06.96”N | 76°59’27.85”E |
| | | South of Breakwater | MS4 | 8°21’51.07”N | 77°00’00.21”E |
| | | Inner Approach Channel | MS5 | 8°21’12.68”N | 77°00’35.14”E |
| | | Kovalam Beach | MS6 | 8°23’08.16”N | 76°58’26.09”E |
| 5. | Ground Water | Port Site | G1 | 8°22’03.72”N | 77°00’16.92”E |
| | | Proposed Port Estate Area | G2 | 8°22’24.96”N | 77°01’45.84”E |
| | | PAF Area | G3 | 8°22’17.60”N | 77°00’11.12”E |
| 6. | Surface Water | Poovar West Canal | S1 | 8°19’22.66”N | 77°04’31.70”E |
| | | Vizhinjam Branch Canal | S2 | 8°22’55.59”N | 76°59’36.29”E |
| | | Vellayani Lake | S3 | 8°25’31.91”N | 76°59’37.10”E |
| | | Poovar Estuary | S4 | 8°18’30.71”N | 77°04’36.95”E |

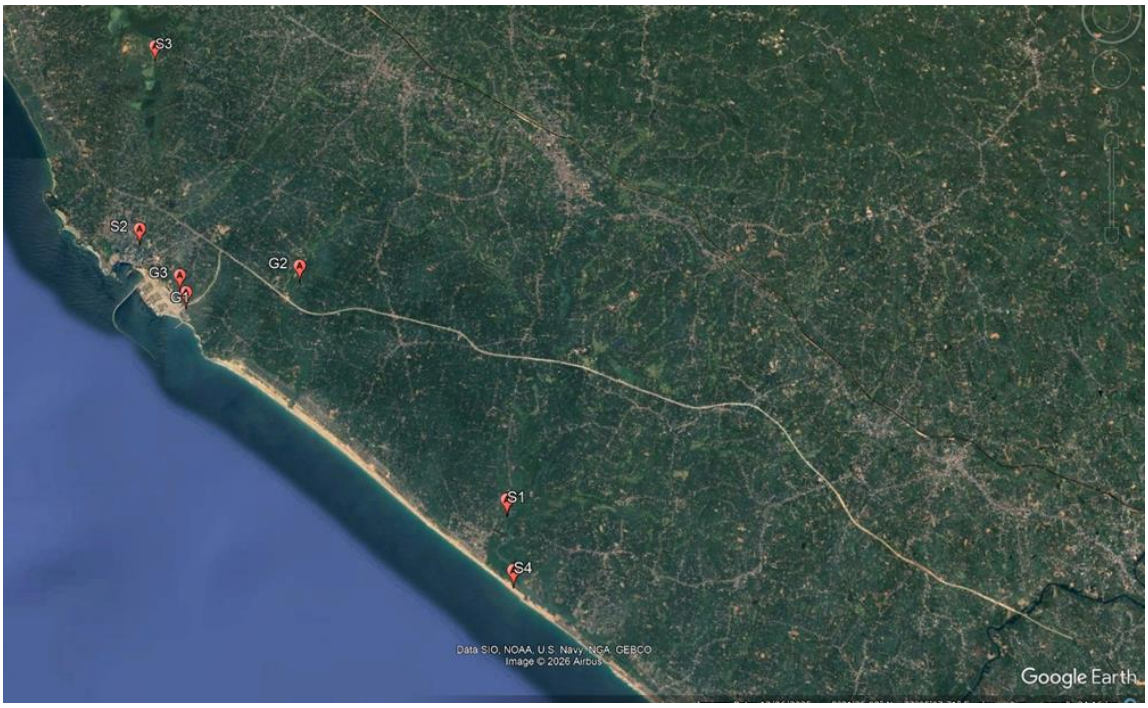
## Locations of Ambient Air Quality & Ambient Noise Monitoring



## Marine Water & Marine Sediment Sampling Locations




## Ground Water & Surface Water Sampling Locations



Ambient Air Quality Monitoring was carried out at 5 locations i.e., Venganoor, Port Site, Proposed Port Estate Area, Chani and Balarampuram. All 5 locations were monitored as per National Ambient Air Quality Standard (NAAQS), 2009 at a frequency of twice per week. The monitoring was conducted on the 3rd, 6th, 10th, 13th, 17th, 20th, 24th, 27th and 31st August 2026. Ambient air monitoring started at all 5 locations for 24 hours with the help of programmable timer. After analysis of samples, the obtained results are compared with NAAQS, 2009. All the parameters at all locations were within the NAAQS limits. The results are available under section EMR-2.

| | |
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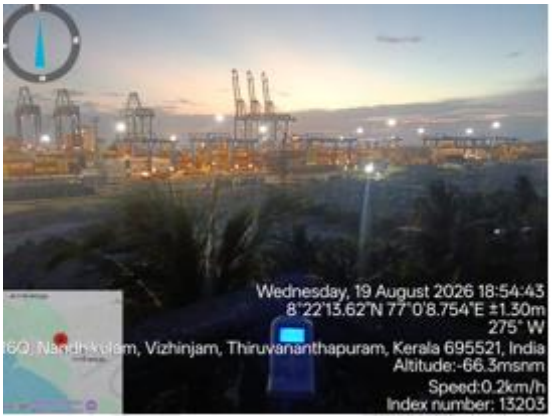
| | |
| **RDS & FPS Under Operation** | **Preparation for Gaseous Sampling** |

| | |
|---|---|
| | |
| **Installation for $PM_{2.5}$** | **Installation for $PM_{10}$** |

Ambient Noise Monitoring carried out at Venganoor, Port Site, Proposed Port Estate Area, Chani and Balarampuram. Classification of locations as per the Noise Pollution (Regulation & Control) Rules, 2000 (Rules 3 (1) and 4(1)) is given in the following table. The results obtained were compared with Noise Pollution (Regulation & Control) Rules, 2000 (Rule 3(1) and 4(1)). The Leq values in the locations were within the limits. *The noise readings are furnished under section EMR-3.

| Legend | Location | Area Type |
|---|---|---|
| N1 | Venganoor | Residential |
| N2 | Port Site | Industrial |
| N3 | Proposed Port Estate Area | Residential |
| N4 | Chani | Residential |
| N5 | Balarampuram | Commercial |

| | |
|---|---|
| |  |
| **Noise Monitoring @ Venganoor** | **Noise Monitoring @ Port Site** |
| | |
| **Noise Monitoring @ Proposed Port Estate Area** | **Noise Monitoring @ Chani** |

Marine water samples were collected from 6 locations - Kovalam Beach, Near Kovalam Beach, Proposed Dredging Site, South of Break Water, Port Basin, and Inner Approach Chanel. The samples were analysed as per IS/APHA Standard Test Procedures, and the results are provided in Section EMR-4.1.

| | |
|---|---|
| | |
| **Marine Water Sampling @ Near Kovalam Beach** | **Marine Water Sampling @ South of Break Water** |

| | |
|---|---|
| | |
| **Marine Water Sampling @ Inner Approach Channel** | **Marine Water Sampling @ Port Basin** |

Sediment samples were collected from 6 locations - Kovalam Beach, Near Kovalam Beach, Proposed Dredging Site, South of Break Water, Port Basin, and Inner Approach Channel. The samples were analysed as per IS/APHA Standard Test Procedures, and the results are provided in Section EMR-4.3.

| | |
|---|---|
| | |
| **Marine Sediment Sampling @ Proposed Dredging Site** | **Marine Sediment Sampling @ Kovalam Beach** |

Ground water samples were collected from 3 locations (open wells) - Port Site, Proposed Port Estate Area, and Port Annex Facility area (PAF). All the parameters at all locations were within the acceptable limits as per IS 10500:2012. However, the water from these locations is not used for drinking purposes. The results are provided in Section EMR-5.

| | |
|---|---|
| | |
| **Ground Water Sampling @ PAF Area** | **Ground Water Sampling @ Port Estate Area** |

| | |
|---|---|
| <br>**Ground Water Sampling @ Port Estate Area** | <br>**Ground Water Sampling @ Port Site** |

Surface water samples were collected from 4 locations - Poovar West Canal, Vizhinjam Branch Canal, Vellayani Lake and Poovar Estuary. The samples were analysed as per the standard procedures and the results are provided in Section EMR-6.

| | |
|---|---|
| | |
| **Surface Water Sampling @ Poovar West Canal** | **Surface Water Sampling @ Vellayani Lake** |

| | |
|---|---|
| | |
| **Surface Water Sampling @ Vizhinjam Branch Canal** | **Surface Water Sampling @ Poovar Estuary** |

The detailed results of Environmental monitoring carried out for the month of August 2026 are presented in subsequent sections.

| EMR-2 | Ambient Air Quality Monitoring Report |
|---|---|

| | |
|---|---|
| **Location, Legend** | **Venganoor, A1** |
| **Month, Year** | **August, 2026** |

| Date of Sampling | Results | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ µg/m³ | $PM_{2.5}$ µg/m³ | $SO_2$ µg/m³ | $NO_x$ µg/m³ | CO mg/m³ | HC ppm |
| 03-08-2026 | 24.6 | 12.3 | 4.19 | 4.81 | BDL | BDL |
| 06-08-2026 | 33.2 | 14.3 | 4.09 | 4.61 | BDL | BDL |
| 10-08-2026 | 30.8 | 13.8 | 4.04 | 4.60 | BDL | BDL |
| 13-08-2026 | 37.9 | 17.8 | 4.26 | 4.82 | BDL | BDL |
| 17-08-2026 | 36.6 | 16.9 | 4.11 | 4.70 | BDL | BDL |
| 20-08-2026 | 35.9 | 17.2 | 4.20 | 5.19 | BDL | BDL |
| 24-08-2026 | 37.8 | 18.2 | 4.26 | 5.03 | BDL | BDL |
| 27-08-2026 | 34.2 | 17.5 | 4.18 | 4.89 | BDL | BDL |
| 31-08-2026 | 35.1 | 16.3 | 4.08 | 4.68 | BDL | BDL |
| **NAAQS 2009 Limits** | **100** | **60** | **80** | **80** | **4** | - |

**Note:** National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area).
**BDL**: Below Detectable Limit

| | |
|---|---|
| **Location, Legend** | **Port Site, A2** |
| **Month, Year** | **August, 2026** |

| Date of Sampling | Results | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ µg/m³ | $PM_{2.5}$ µg/m³ | $SO_2$ µg/m³ | $NO_x$ µg/m³ | CO mg/m³ | HC ppm |
| 03-08-2026 | 74.6 | 38.3 | 4.36 | 4.93 | BDL | BDL |
| 06-08-2026 | 68.3 | 33.1 | 4.23 | 4.89 | BDL | BDL |
| 10-08-2026 | 71.2 | 34.6 | 4.23 | 4.77 | BDL | BDL |
| 13-08-2026 | 66.8 | 33.9 | 4.38 | 4.91 | BDL | BDL |
| 17-08-2026 | 73.6 | 36.8 | 4.22 | 4.78 | BDL | BDL |
| 20-08-2026 | 68.2 | 32.6 | 4.31 | 4.91 | BDL | BDL |
| 24-08-2026 | 64.5 | 31.9 | 4.19 | 4.82 | BDL | BDL |
| 27-08-2026 | 70.6 | 34.2 | 4.13 | 4.78 | BDL | BDL |
| 31-08-2026 | 62.7 | 32.5 | 4.30 | 4.84 | BDL | BDL |
| **NAAQS 2009 Limits** | **100** | **60** | **80** | **80** | **4** | - |

| Date of Sampling | Results | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ µg/m³ | $PM_{2.5}$ µg/m³ | $SO_2$ µg/m³ | $NO_x$ µg/m³ | CO mg/m³ | HC ppm |

**Note:** National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area).
**BDL**: Below Detectable Limit

| | |
|---|---|
| **Location, Legend** | **Proposed Port Estate Area, A3** |
| **Month, Year** | **August, 2026** |

| Date of Sampling | Results | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ µg/m³ | $PM_{2.5}$ µg/m³ | $SO_2$ µg/m³ | $NO_x$ µg/m³ | CO mg/m³ | HC ppm |
| 03-08-2026 | 36.9 | 17.9 | 4.17 | 4.80 | BDL | BDL |
| 06-08-2026 | 32.6 | 15.4 | 4.16 | 4.88 | BDL | BDL |
| 10-08-2026 | 42.5 | 21.3 | 4.26 | 4.89 | BDL | BDL |
| 13-08-2026 | 47.3 | 22.6 | 4.20 | 4.62 | BDL | BDL |
| 17-08-2026 | 43.1 | 20.8 | 4.31 | 4.82 | BDL | BDL |
| 20-08-2026 | 40.5 | 19.9 | 4.42 | 4.79 | BDL | BDL |
| 24-08-2026 | 37.8 | 18.3 | 4.19 | 4.85 | BDL | BDL |
| 27-08-2026 | 42.7 | 21.9 | 4.39 | 4.77 | BDL | BDL |
| 31-08-2026 | 39.2 | 17.7 | 4.31 | 4.76 | BDL | BDL |
| **NAAQS 2009 Limits** | **100** | **60** | **80** | **80** | **4** | - |

**Note:** National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area).
**BDL**: Below Detectable Limit

| | |
|---|---|
| **Location, Legend** | **Chani, A4** |
| **Month, Year** | **August, 2026** |

| Date of Sampling | Results | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ µg/m³ | $PM_{2.5}$ µg/m³ | $SO_2$ µg/m³ | $NO_x$ µg/m³ | CO mg/m³ | HC ppm |
| 03-08-2026 | 44.3 | 22.9 | 4.19 | 4.73 | BDL | BDL |
| 06-08-2026 | 43.5 | 19.3 | 4.21 | 5.24 | BDL | BDL |
| 10-08-2026 | 39.6 | 18.5 | 4.19 | 4.73 | BDL | BDL |
| 13-08-2026 | 42.9 | 19.6 | 4.32 | 4.92 | BDL | BDL |
| 17-08-2026 | 43.3 | 21.6 | 4.41 | 5.26 | BDL | BDL |
| 20-08-2026 | 44.6 | 23.7 | 4.38 | 5.01 | BDL | BDL |

| Date of Sampling | Results | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ µg/m³ | $PM_{2.5}$ µg/m³ | $SO_2$ µg/m³ | $NO_x$ µg/m³ | CO mg/m³ | HC ppm |
| 24-08-2026 | 42.7 | 19.9 | 4.28 | 4.87 | BDL | BDL |
| 27-08-2026 | 45.1 | 21.2 | 4.06 | 4.72 | BDL | BDL |
| 31-08-2026 | 41.8 | 20.2 | 4.17 | 4.93 | BDL | BDL |
| **NAAQS 2009 Limits** | **100** | **60** | **80** | **80** | **4** | - |

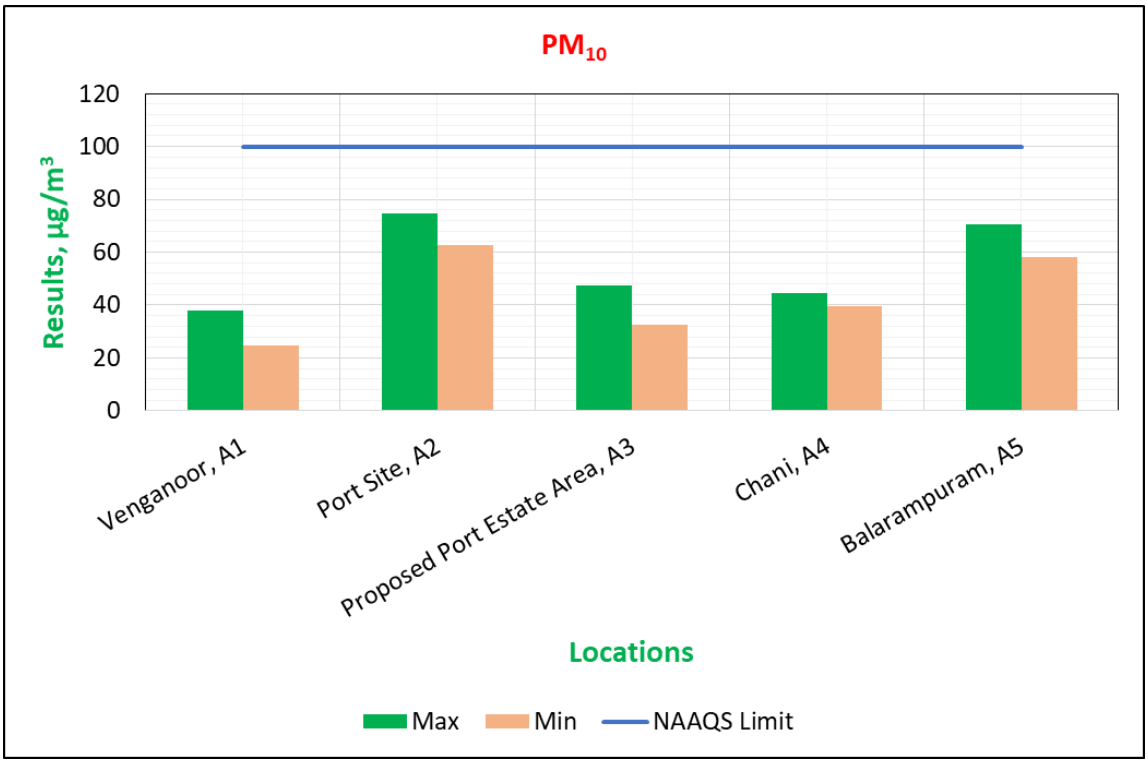
**Note:** National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area).
**BDL**: Below Detectable Limit

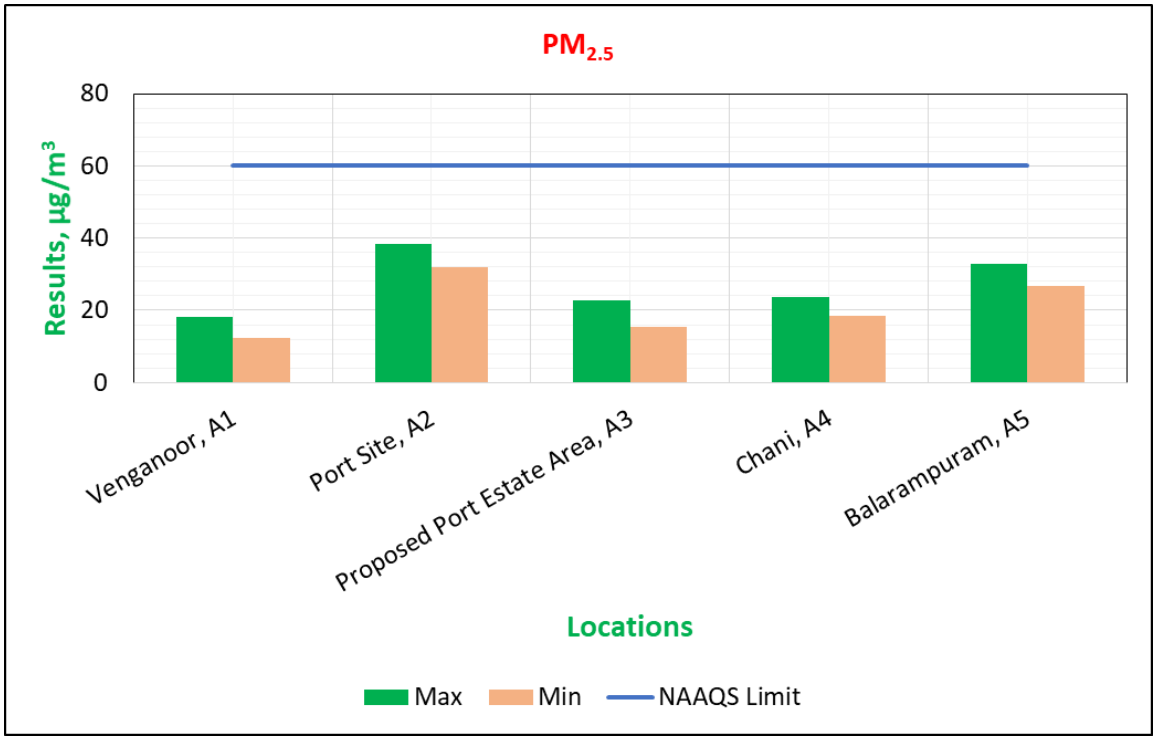
| | |
|---|---|
| **Location, Legend** | **Balarampuram, A5** |
| **Month, Year** | **August, 2026** |

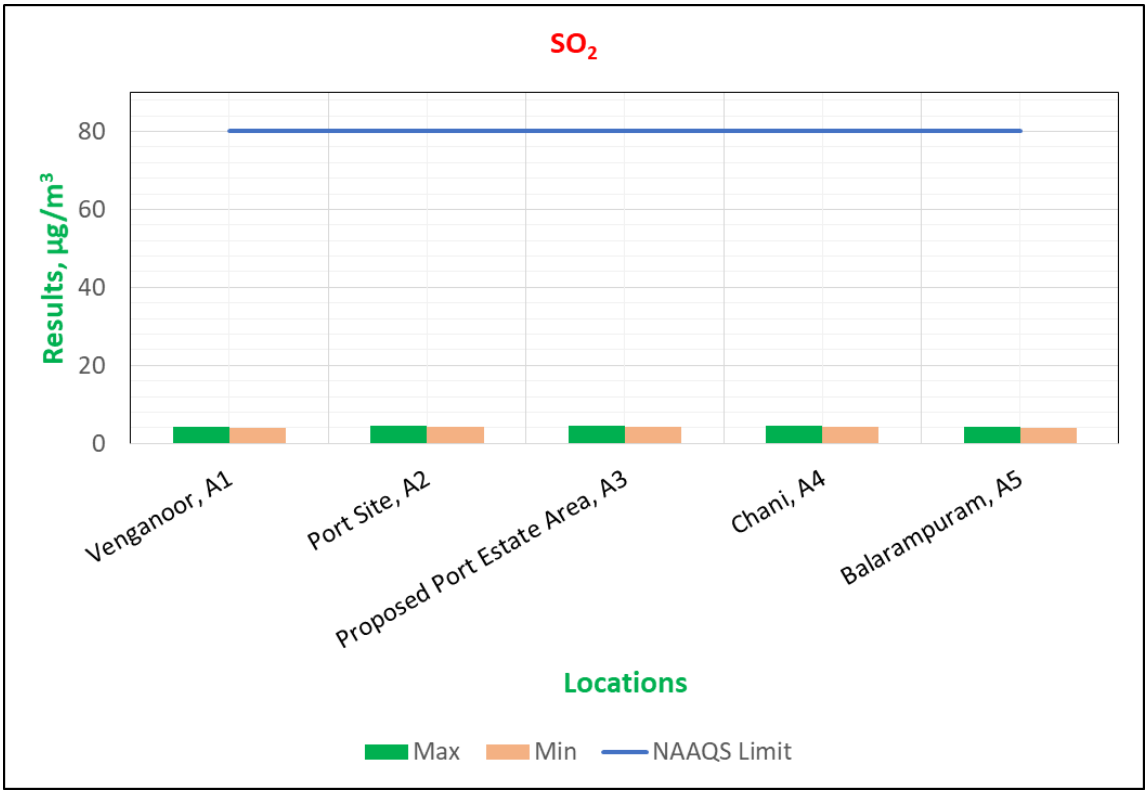
| Date of Sampling | Results | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ µg/m³ | $PM_{2.5}$ µg/m³ | $SO_2$ µg/m³ | $NO_x$ µg/m³ | CO mg/m³ | HC ppm |
| 03-08-2026 | 70.6 | 29.9 | 4.36 | 5.46 | BDL | BDL |
| 06-08-2026 | 67.3 | 31.2 | 4.18 | 4.76 | BDL | BDL |
| 10-08-2026 | 58.3 | 26.6 | 4.16 | 5.19 | BDL | BDL |
| 13-08-2026 | 68.3 | 32.9 | 4.19 | 4.99 | BDL | BDL |
| 17-08-2026 | 62.9 | 29.6 | 4.13 | 4.82 | BDL | BDL |
| 20-08-2026 | 63.2 | 31.4 | 4.26 | 5.25 | BDL | BDL |
| 24-08-2026 | 65.2 | 30.5 | 4.09 | 5.16 | BDL | BDL |
| 27-08-2026 | 59.3 | 26.9 | 4.17 | 4.88 | BDL | BDL |
| 31-08-2026 | 60.9 | 28.2 | 4.22 | 4.90 | BDL | BDL |
| **NAAQS 2009 Limits** | **100** | **60** | **80** | **80** | **4** | - |

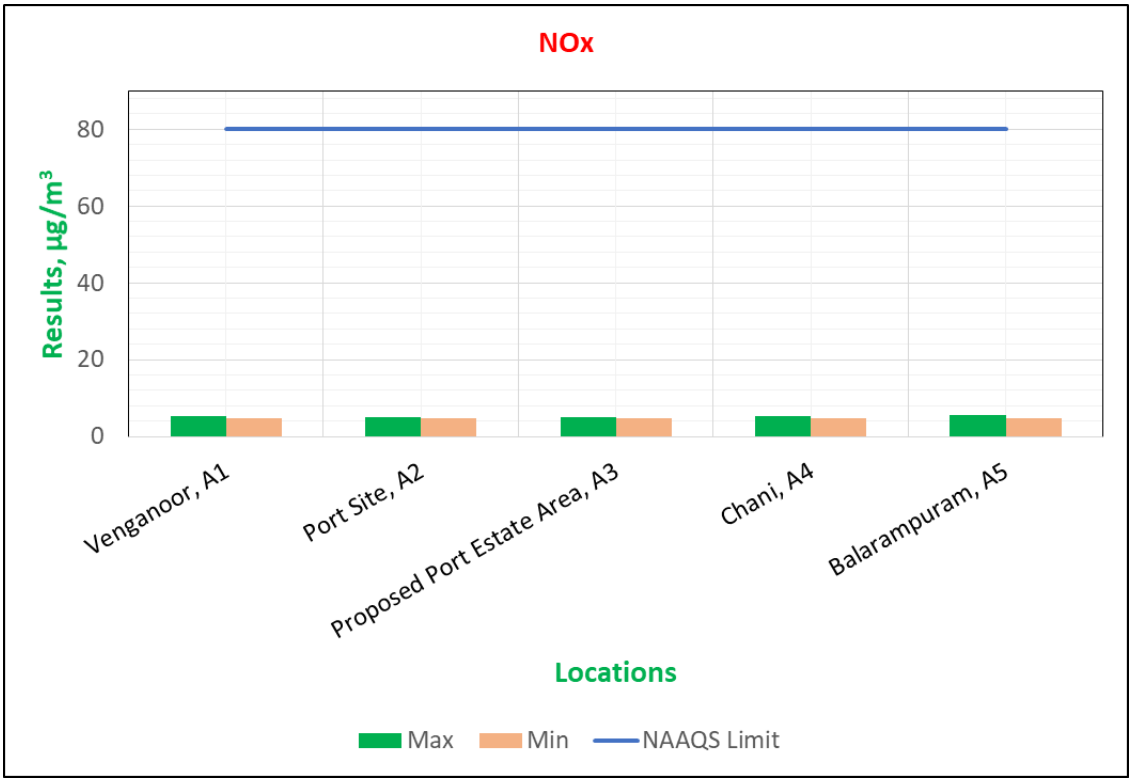
**Note:** National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area).
**BDL**: Below Detectable Limit

| EMR-2.1 | Statistical Analysis of Ambient Air Quality |
|---|---|




SO2
Results, µg/m3
80
60
40
20
0
Venganoor, A1
Port Site, A2
Proposed Port Estate Area, A3
Chani, A4
Balarampuram, A5
Locations
Max
Min
NAAQS Limit


NOx
Results, µg/m3
80
60
40
20
0
Venganoor, A1
Port Site, A2
Proposed Port Estate Area, A3
Chani, A4
Balarampuram, A5
Locations
Max
Min
NAAQS Limit

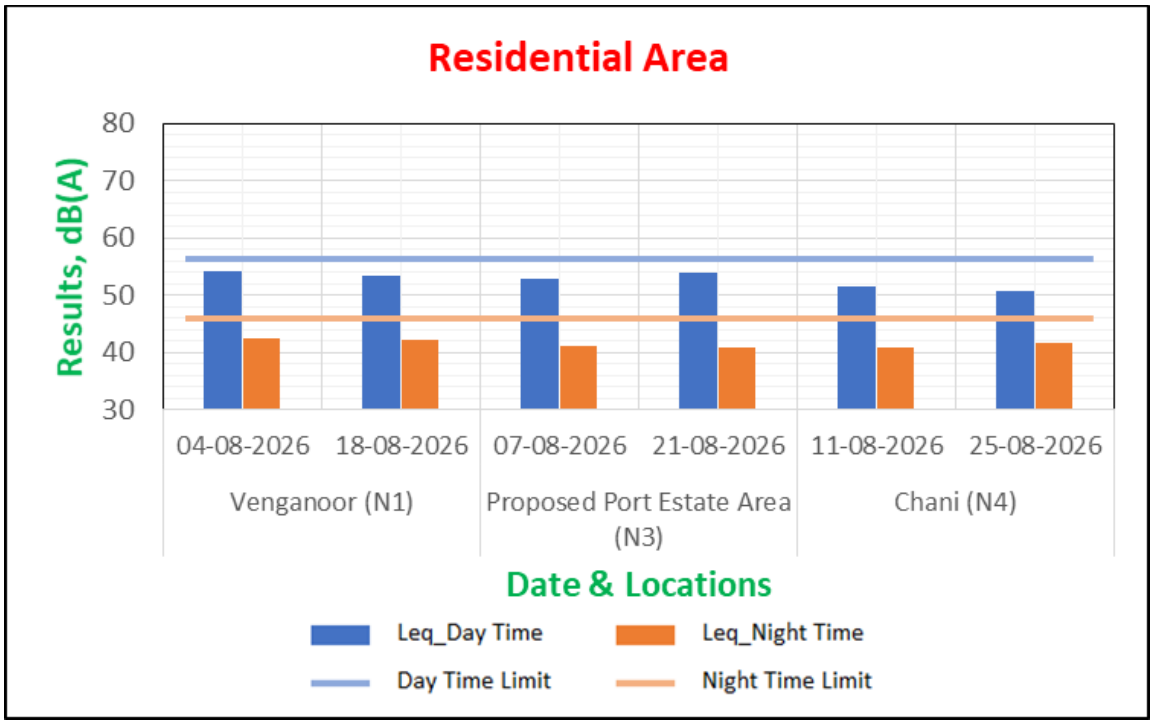
| EMR-3 | Ambient Noise Monitoring Report |
|---|---|

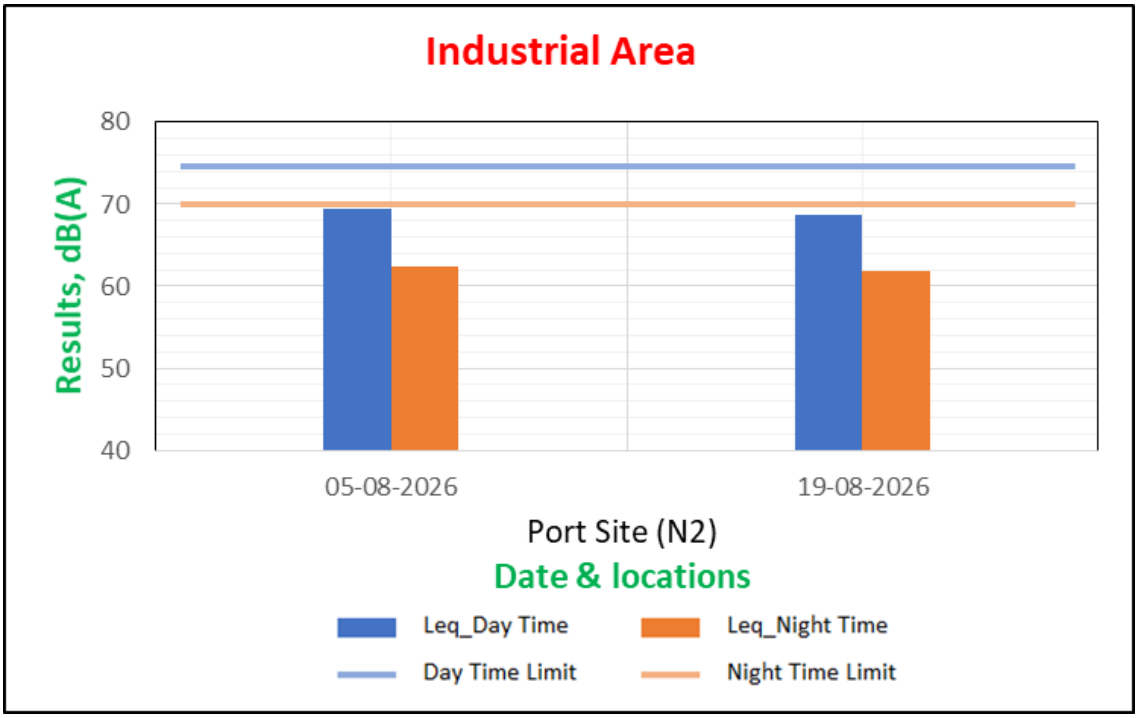
| Location & Legend | Date of Sampling | Results (dB(A)) | | | | | |
|---|---|---|---|---|---|---|---|
| | | $L_{max}$ Day time | $L_{max}$ Night time | $L_{min}$ Day time | $L_{min}$ Night time | $L_{eq}$ Day time | $L_{eq}$ Night time |
| **Venganoor (Residential) N1** | 04-08-2026 | 81.5 | 80.5 | 32.8 | 32.1 | 54.1 | 42.5 |
| | 18-08-2026 | 80.5 | 79.5 | 31.7 | 30.8 | 53.4 | 42.1 |
| **Port Site (Industrial) N2** | 05-08-2026 | 96.8 | 89.1 | 42.3 | 40.2 | 69.5 | 62.4 |
| | 19-08-2026 | 94.2 | 88.3 | 39.9 | 39.4 | 68.7 | 61.8 |
| **Proposed Port Estate Area (Residential) N3** | 07-08-2026 | 81.2 | 77.4 | 33.5 | 31.4 | 52.9 | 41.1 |
| | 21-08-2026 | 80.9 | 76.2 | 32.8 | 31.7 | 53.8 | 40.9 |
| **Chani (Residential) N4** | 11-08-2026 | 79.2 | 77.6 | 32.9 | 31.8 | 51.6 | 40.7 |
| | 25-08-2026 | 78.4 | 76.9 | 30.8 | 30.2 | 50.7 | 41.5 |
| **Balarampuram (Commercial) N5** | 14-08-2026 | 89.1 | 81.2 | 35.4 | 34.7 | 61.4 | 52.7 |
| | 28-08-2026 | 88.7 | 77.5 | 34.2 | 34.0 | 60.8 | 50.6 |

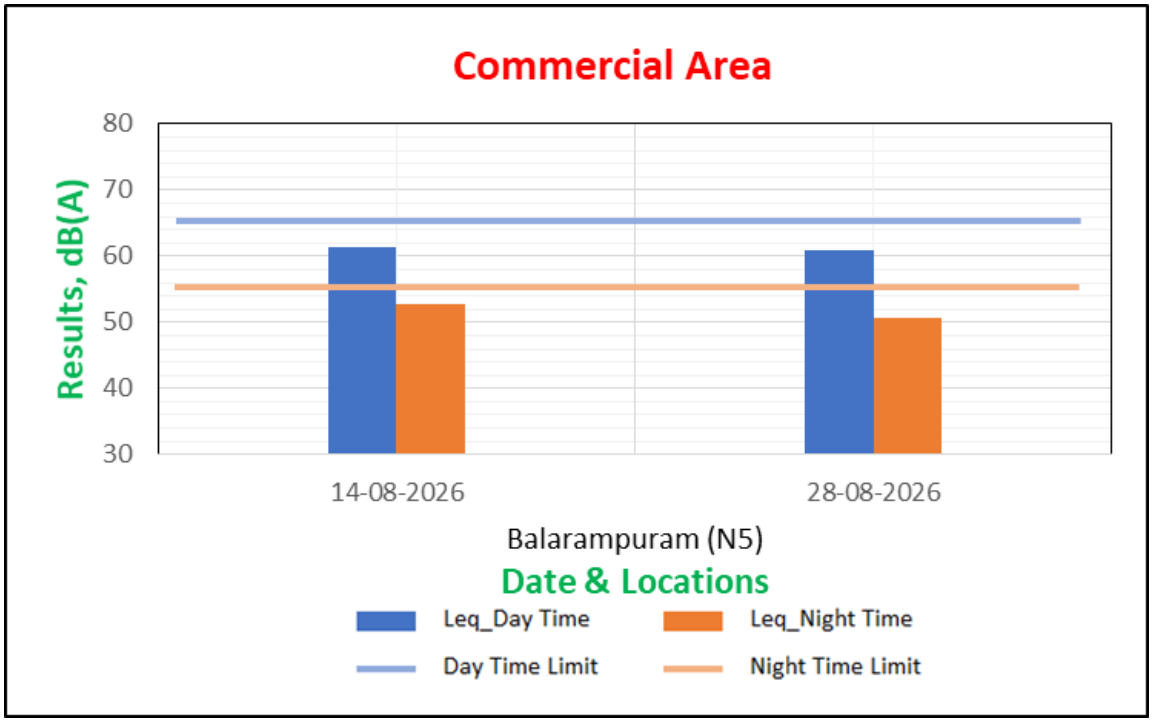
**As per the Noise Pollution (Regulation & Control) Rules, 2000 [Rules 3 (1) and 4(1)]**

| Area Code | Area Type | Limits in dB (A) $L_{eq}$ | |
|---|---|---|---|
| | | Day (6 a.m. to 10 p.m.) | Night (10 p.m. to 6 a.m.) |
| A | Industrial | 75 | 70 |
| B | Commercial | 65 | 55 |
| C | Residential | 55 | 45 |

| EMR-3.1 | Statistical Analysis of Ambient Noise Monitoring |
|---|---|




Commercial Area
Results, dB(A)
80
70
60
50
40
30
14-08-2026
28-08-2026
Balarampuram (N5)
Date & Locations
Leq_Day Time
Leq_Night Time
Day Time Limit
Night Time Limit

| EMR-4 | Marine Ecological Survey |
|---|---|

| EMR-4.1 | Marine Water Analysis Report |
|---|---|

| | |
|---|---|
| **Location, Legend** | **Near Kovalam Beach, M1** |
| **Date of Sampling** | **07-08-2026** |

| Parameter | Unit | Results | |
|---|---|---|---|
| | | **High Tide (09:50 – 11:00)** | **Low Tide (13:00 – 14:10)** |
| Temperature | °C | 27.5 | 27.4 |
| Colour | Hazen | 1 | 1 |
| pH Value | - | 7.68 | 7.77 |
| Turbidity | N.T.U. | 0.1 | 0.2 |
| Electrical Conductivity (at 25°C) | µmho/cm | 51290 | 51550 |
| Total Suspended Solids | mg/L | BDL | BDL |
| Total Dissolved Solids | mg/L | 32824 | 32990 |
| Dissolved Oxygen | mg/L | 7.0 | 7.1 |
| Biochemical Oxygen Demand (3 days, 27°C) | mg/L | BDL | BDL |
| Floating Materials (Oil, grease and Scum (Including Petroleum Products) | mg/L | BDL | BDL |
| Nitrite (as $NO_2$) | mg/L | 0.028 | 0.032 |
| Nitrate (as $NO_3$) | mg/L | BDL | BDL |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | BDL | BDL |
| Ammonical Nitrogen (as $NH_3$-N) | mg/L | BDL | BDL |
| Total Nitrogen (as N) | mg/L | BDL | BDL |
| Total Phosphorous (as P) | mg/L | BDL | BDL |
| Reactive Phosphorous | mg/L | BDL | BDL |
| Polycyclic Aromatic Hydrocarbon | mg/L | BDL | BDL |
| Salinity | ppt | 33.201 | 33.391 |
| Total Chlorophyll | $mg/m^3$ | 0.4 | 0.6 |
| Total Coliforms | MPN/100 ml | BDL | BDL |
| Fecal Coliforms | MPN/100 ml | BDL | BDL |
| **BDL**: Below Detectable Limit | | | |

| Location, Legend | Proposed Dredging Site, M2 |
|---|---|
| Date of Sampling | 07-08-2026 |

| Parameter | Unit | Results | |
|---|---|---|---|
| | | High Tide (09:50 – 11:00) | Low Tide (13:00 – 14:10) |
| Temperature | °C | 27.9 | 27.3 |
| Colour | Hazen | 1 | 1 |
| pH Value | - | 7.55 | 7.69 |
| Turbidity | N.T.U. | 0.1 | 0.2 |
| Electrical Conductivity (at 25°C) | µmho/cm | 51520 | 51780 |
| Total Suspended Solids | mg/L | BDL | BDL |
| Total Dissolved Solids | mg/L | 32972 | 33140 |
| Dissolved Oxygen | mg/L | 6.9 | 7.0 |
| Biochemical Oxygen Demand (3 days, 27°C) | mg/L | BDL | BDL |
| Floating Materials (Oil, grease and Scum (Including Petroleum Products) | mg/L | BDL | BDL |
| Nitrite (as $NO_2$) | mg/L | 0.022 | 0.029 |
| Nitrate (as $NO_3$) | mg/L | BDL | BDL |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | BDL | BDL |
| Ammonical Nitrogen (as $NH_3$-N) | mg/L | BDL | BDL |
| Total Nitrogen (as N) | mg/L | BDL | BDL |
| Total Phosphorous (as P) | mg/L | BDL | BDL |
| Reactive Phosphorous | mg/L | BDL | BDL |
| Polycyclic Aromatic Hydrocarbon | mg/L | BDL | BDL |
| Salinity | ppt | 33.369 | 33.358 |
| Total Chlorophyll | $mg/m^3$ | 0.4 | 0.5 |
| Total Coliforms | MPN/100 ml | BDL | BDL |
| Fecal Coliforms | MPN/100 ml | BDL | BDL |
| **BDL**: Below Detectable Limit | | | |

| Location, Legend | Port Basin, M3 |
|---|---|
| Date of Sampling | 07-08-2026 |

| Parameter | Unit | Results | |
|---|---|---|---|
| | | High Tide (09:50 – 11:00) | Low Tide (13:00 – 14:10) |
| Temperature | °C | 28.0 | 27.5 |
| Colour | Hazen | 1 | 1 |
| pH Value | - | 7.62 | 7.85 |
| Turbidity | N.T.U. | 0.3 | 0.5 |
| Electrical Conductivity (at 25°C) | µmho/cm | 51325 | 51840 |
| Total Suspended Solids | mg/L | BDL | BDL |
| Total Dissolved Solids | mg/L | 32848 | 33178 |
| Dissolved Oxygen | mg/L | 6.8 | 7.0 |
| Biochemical Oxygen Demand (3 days, 27°C) | mg/L | BDL | BDL |
| Floating Materials (Oil, grease and Scum (Including Petroleum Products) | mg/L | BDL | BDL |
| Nitrite (as $NO_2$) | mg/L | 0.028 | 0.035 |
| Nitrate (as $NO_3$) | mg/L | BDL | BDL |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | BDL | BDL |
| Ammonical Nitrogen (as $NH_3$-N) | mg/L | BDL | BDL |
| Total Nitrogen (as N) | mg/L | BDL | BDL |
| Total Phosphorous (as P) | mg/L | BDL | BDL |
| Reactive Phosphorous | mg/L | BDL | BDL |
| Polycyclic Aromatic Hydrocarbon | mg/L | BDL | BDL |
| Salinity | ppt | 33.227 | 33.602 |
| Total Chlorophyll | mg/m$^3$ | 0.4 | 0.5 |
| Total Coliforms | MPN/100 ml | BDL | BDL |
| Fecal Coliforms | MPN/100 ml | BDL | BDL |
| **BDL**: Below Detectable Limit | | | |

| Location, Legend | South of Breakwater, M4 |
|---|---|
| Date of Sampling | 07-08-2026 |

| Parameter | Unit | Results | |
|---|---|---|---|
| | | High Tide (09:50 – 11:00) | Low Tide (13:00 – 14:10) |
| Temperature | °C | 27.8 | 27.6 |
| Colour | Hazen | 1 | 1 |
| pH Value | - | 7.77 | 7.89 |
| Turbidity | N.T.U. | 0.3 | 0.8 |
| Electrical Conductivity (at 25°C) | µmho/cm | 51450 | 51750 |
| Total Suspended Solids | mg/L | BDL | BDL |
| Total Dissolved Solids | mg/L | 32926 | 33120 |
| Dissolved Oxygen | mg/L | 6.9 | 7.0 |
| Biochemical Oxygen Demand (3 days, 27°C) | mg/L | BDL | BDL |
| Floating Materials (Oil, grease and Scum (Including Petroleum Products) | mg/L | BDL | BDL |
| Nitrite (as $NO_2$) | mg/L | 0.026 | 0.035 |
| Nitrate (as $NO_3$) | mg/L | BDL | BDL |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | BDL | BDL |
| Ammonical Nitrogen (as $NH_3$-N) | mg/L | BDL | BDL |
| Total Nitrogen (as N) | mg/L | BDL | BDL |
| Total Phosphorous (as P) | mg/L | BDL | BDL |
| Reactive Phosphorous | mg/L | BDL | BDL |
| Polycyclic Aromatic Hydrocarbon | mg/L | BDL | BDL |
| Salinity | ppt | 33.318 | 33.536 |
| Total Chlorophyll | mg/m$^3$ | 0.4 | 0.6 |
| Total Coliforms | MPN/100 ml | BDL | BDL |
| Fecal Coliforms | MPN/100 ml | BDL | BDL |
| **BDL**: Below Detectable Limit | | | |

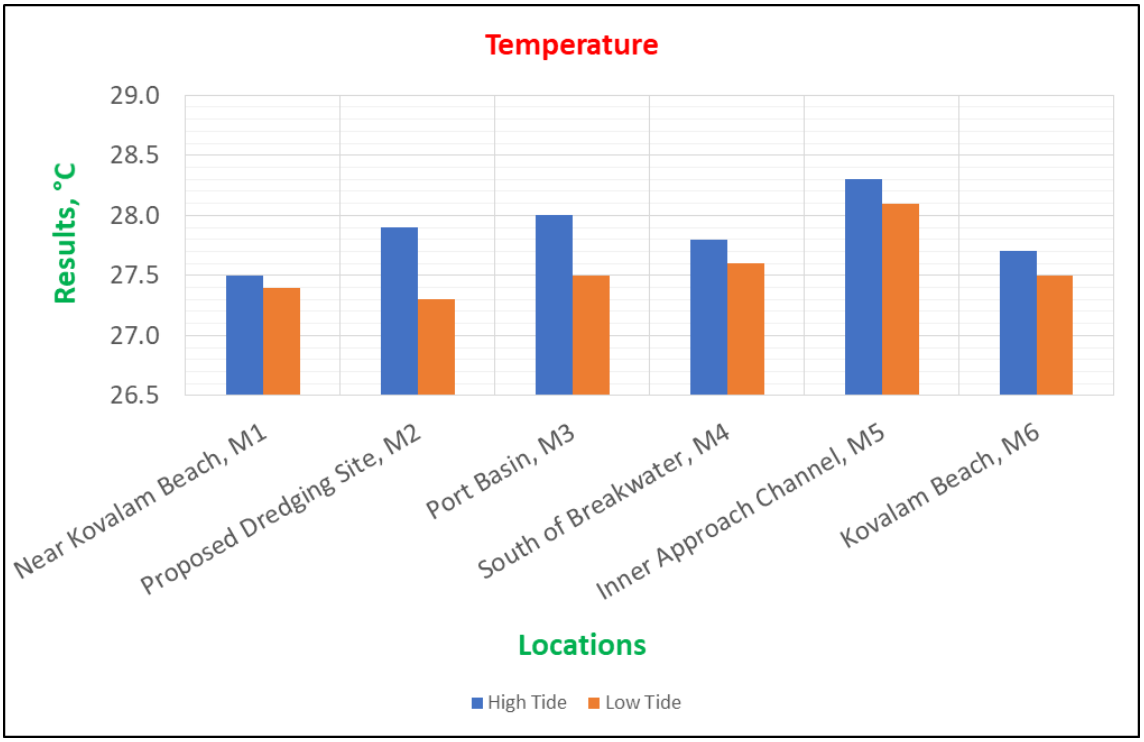
| Location, Legend | Inner Approach Channel, M5 |
|---|---|
| Date of Sampling | 07-08-2026 |

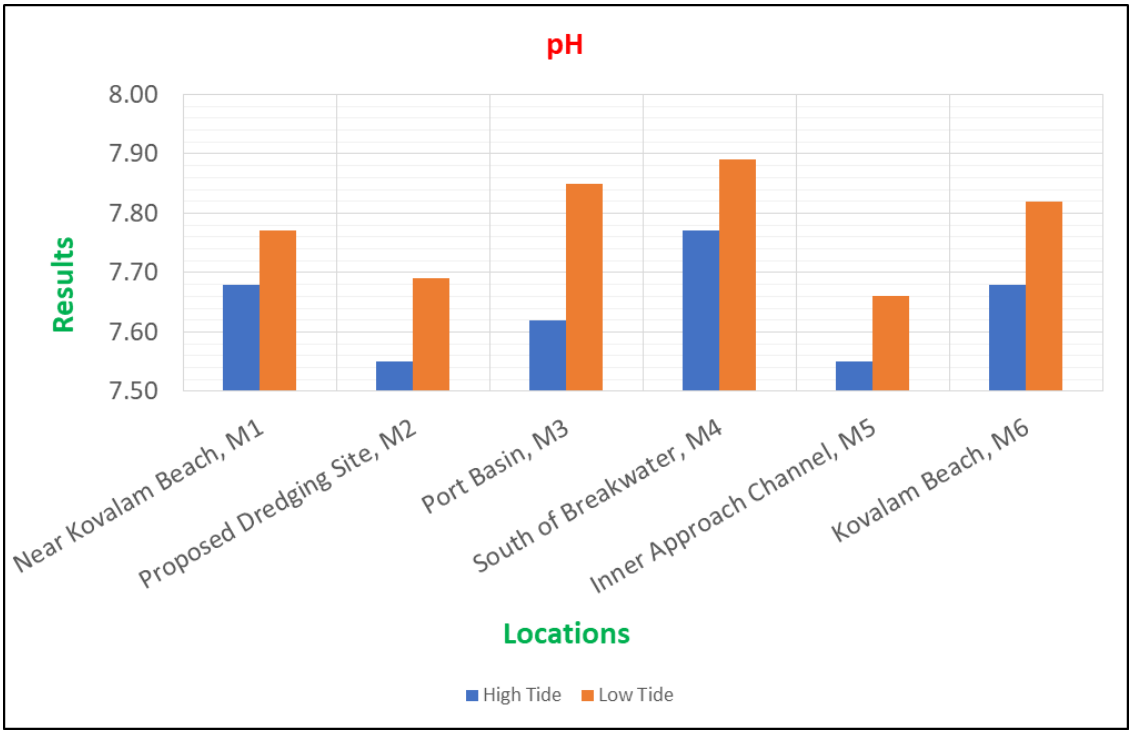
| Parameter | Unit | Results | |
|---|---|---|---|
| | | High Tide (09:50 – 11:00) | Low Tide (13:00 – 14:10) |
| Temperature | °C | 28.3 | 28.1 |
| Colour | Hazen | 1 | 1 |
| pH Value | - | 7.55 | 7.66 |
| Turbidity | N.T.U. | 0.9 | 1 |
| Electrical Conductivity (at 25°C) | µmho/cm | 51850 | 52100 |
| Total Suspended Solids | mg/L | BDL | BDL |
| Total Dissolved Solids | mg/L | 33184 | 33344 |
| Dissolved Oxygen | mg/L | 6.9 | 7.0 |
| Biochemical Oxygen Demand (3 days, 27°C) | mg/L | BDL | BDL |
| Floating Materials (Oil, grease and Scum (Including Petroleum Products) | mg/L | BDL | BDL |
| Nitrite (as $NO_2$) | mg/L | BDL | 0.026 |
| Nitrate (as $NO_3$) | mg/L | BDL | BDL |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | BDL | BDL |
| Ammonical Nitrogen (as $NH_3$-N) | mg/L | BDL | BDL |
| Total Nitrogen (as N) | mg/L | BDL | BDL |
| Total Phosphorous (as P) | mg/L | BDL | BDL |
| Reactive Phosphorous | mg/L | BDL | BDL |
| Polycyclic Aromatic Hydrocarbon | mg/L | BDL | BDL |
| Salinity | ppt | 33.609 | 33.792 |
| Total Chlorophyll | mg/m$^3$ | 0.4 | 0.5 |
| Total Coliforms | MPN/100 ml | BDL | BDL |
| Fecal Coliforms | MPN/100 ml | BDL | BDL |
| **BDL**: Below Detectable Limit | | | |

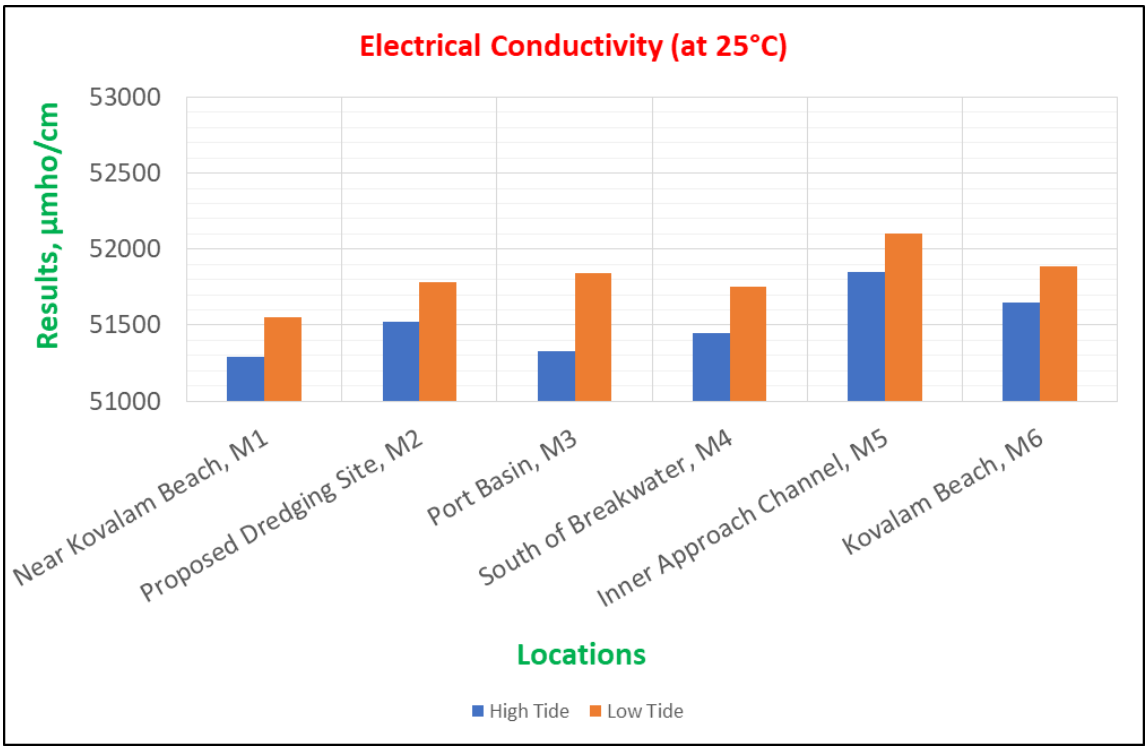
| Location, Legend | Kovalam Beach, M6 |
|---|---|
| Date of Sampling | 07-08-2026 |

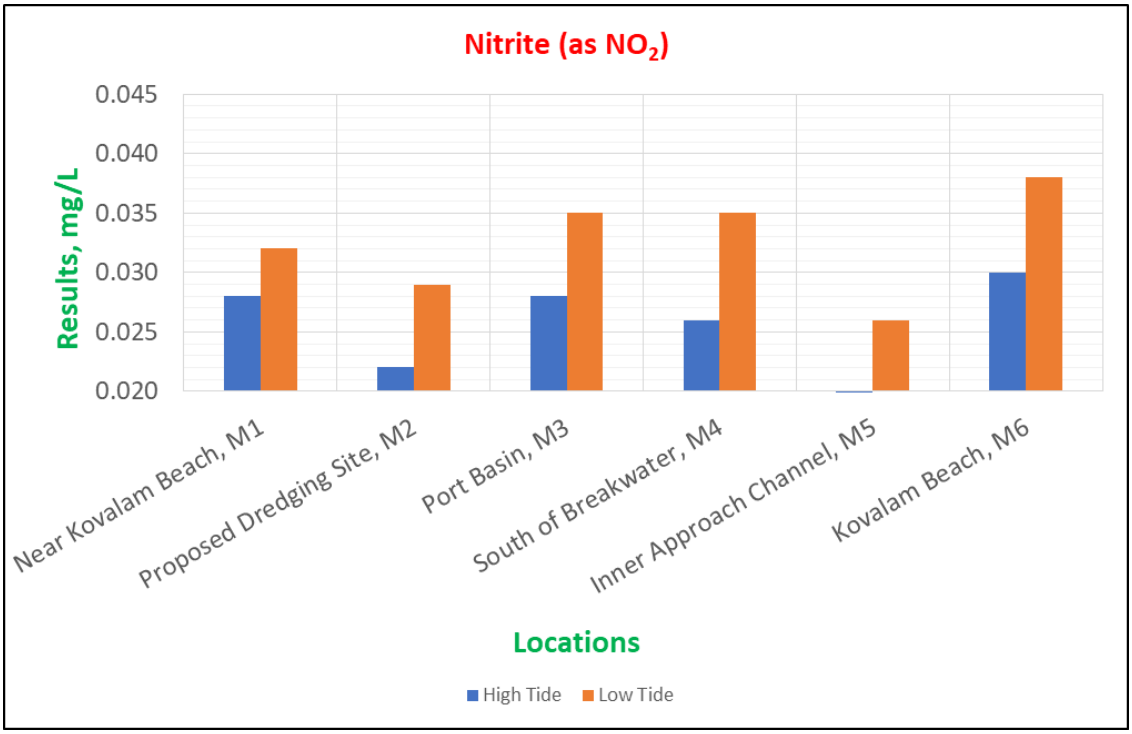
| Parameter | Unit | Results | |
|---|---|---|---|
| | | High Tide (09:50 – 11:00) | Low Tide (13:00 – 14:10) |
| Temperature | °C | 27.7 | 27.5 |
| Colour | Hazen | 1 | 1 |
| pH Value | - | 7.68 | 7.82 |
| Turbidity | N.T.U. | BDL | BDL |
| Electrical Conductivity (at 25°C) | µmho/cm | 51650 | 51890 |
| Total Suspended Solids | mg/L | BDL | BDL |
| Total Dissolved Solids | mg/L | 33056 | 33210 |
| Dissolved Oxygen | mg/L | 7.0 | 7.1 |
| Biochemical Oxygen Demand (3 days, 27°C) | mg/L | BDL | BDL |
| Floating Materials (Oil, grease and Scum (Including Petroleum Products) | mg/L | BDL | BDL |
| Nitrite (as $NO_2$) | mg/L | 0.030 | 0.038 |
| Nitrate (as $NO_3$) | mg/L | BDL | BDL |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | BDL | BDL |
| Ammonical Nitrogen (as $NH_3$-N) | mg/L | BDL | BDL |
| Total Nitrogen (as N) | mg/L | BDL | BDL |
| Total Phosphorous (as P) | mg/L | BDL | BDL |
| Reactive Phosphorous | mg/L | BDL | BDL |
| Polycyclic Aromatic Hydrocarbon | mg/L | BDL | BDL |
| Salinity | ppt | 33.464 | 33.639 |
| Total Chlorophyll | mg/m$^3$ | 0.4 | 0.6 |
| Total Coliforms | MPN/100 ml | BDL | BDL |
| Fecal Coliforms | MPN/100 ml | BDL | BDL |
| **BDL**: Below Detectable Limit | | | |

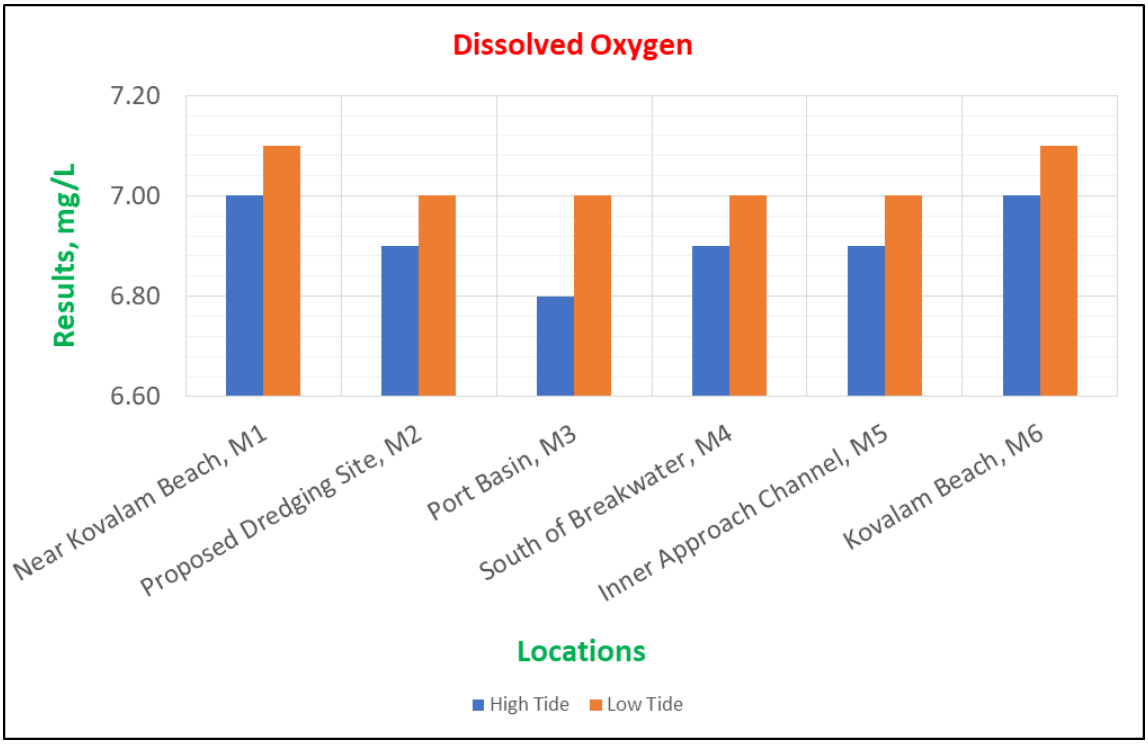
| EMR-4.2 | Statistical Analysis of Marine Water |
|---|---|

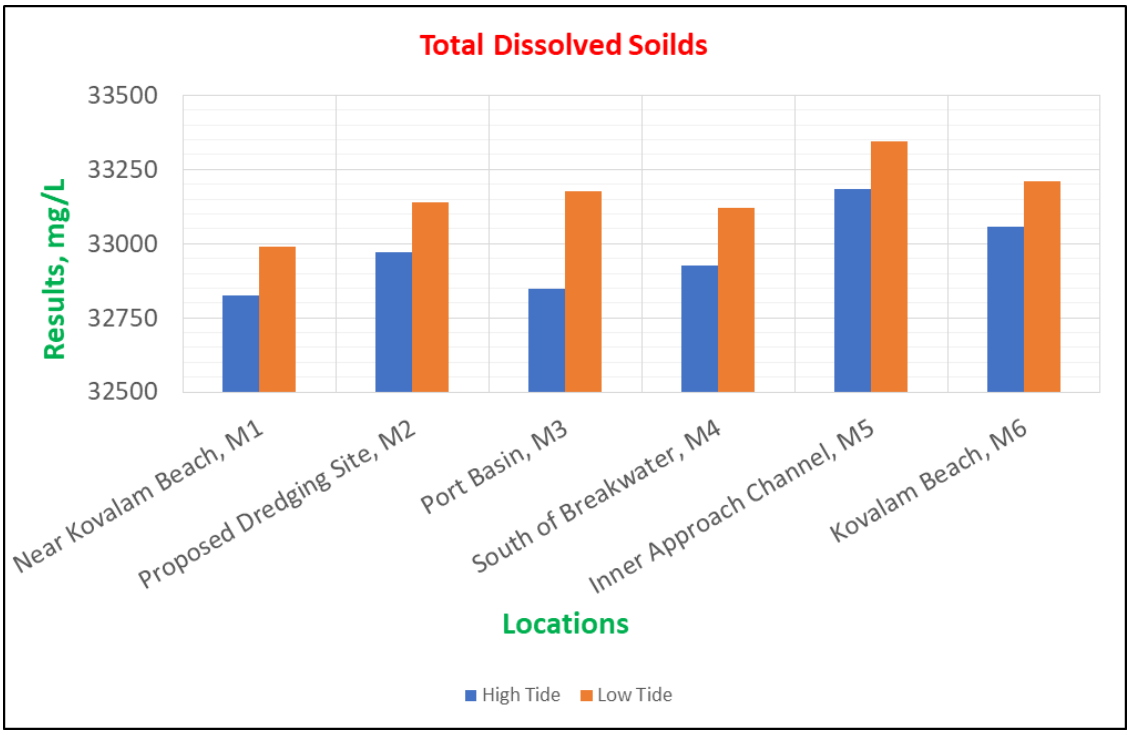


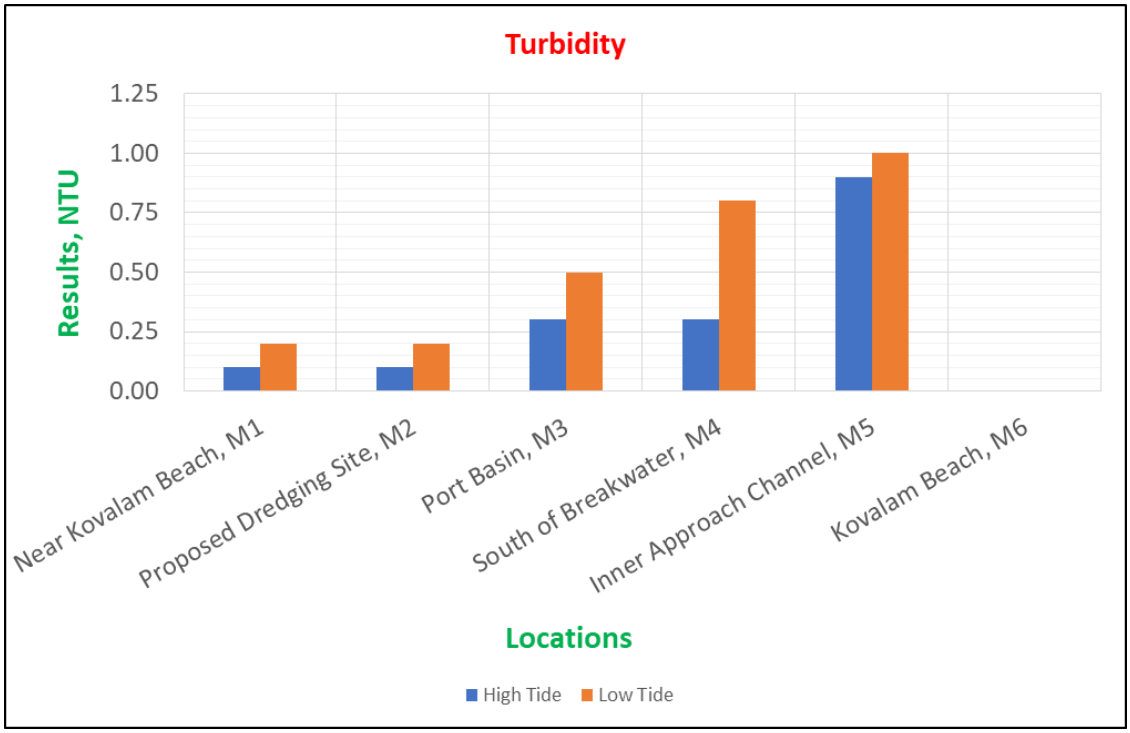



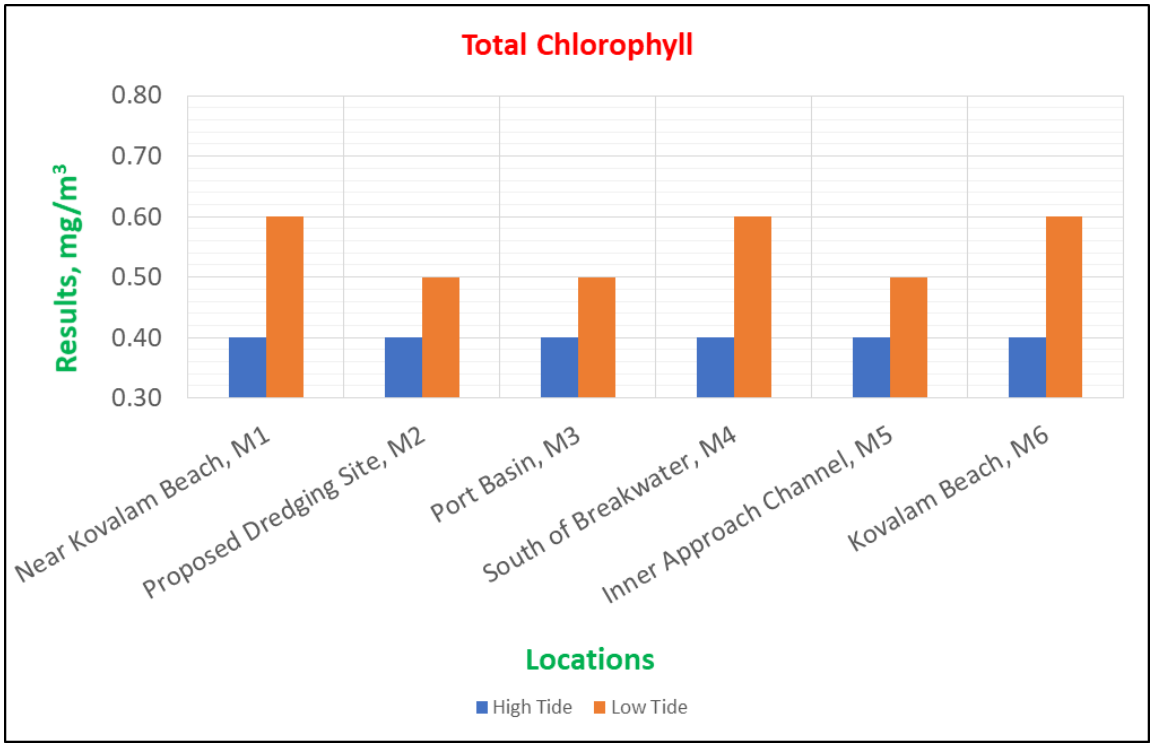

Electrical Conductivity (at 25°C)
Results, µmho/cm
53000
52500
52000
51500
51000
Near Kovalam Beach, M1
Proposed Dredging Site, M2
Port Basin, M3
South of Breakwater, M4
Inner Approach Channel, M5
Kovalam Beach, M6
Locations
High Tide
Low Tide

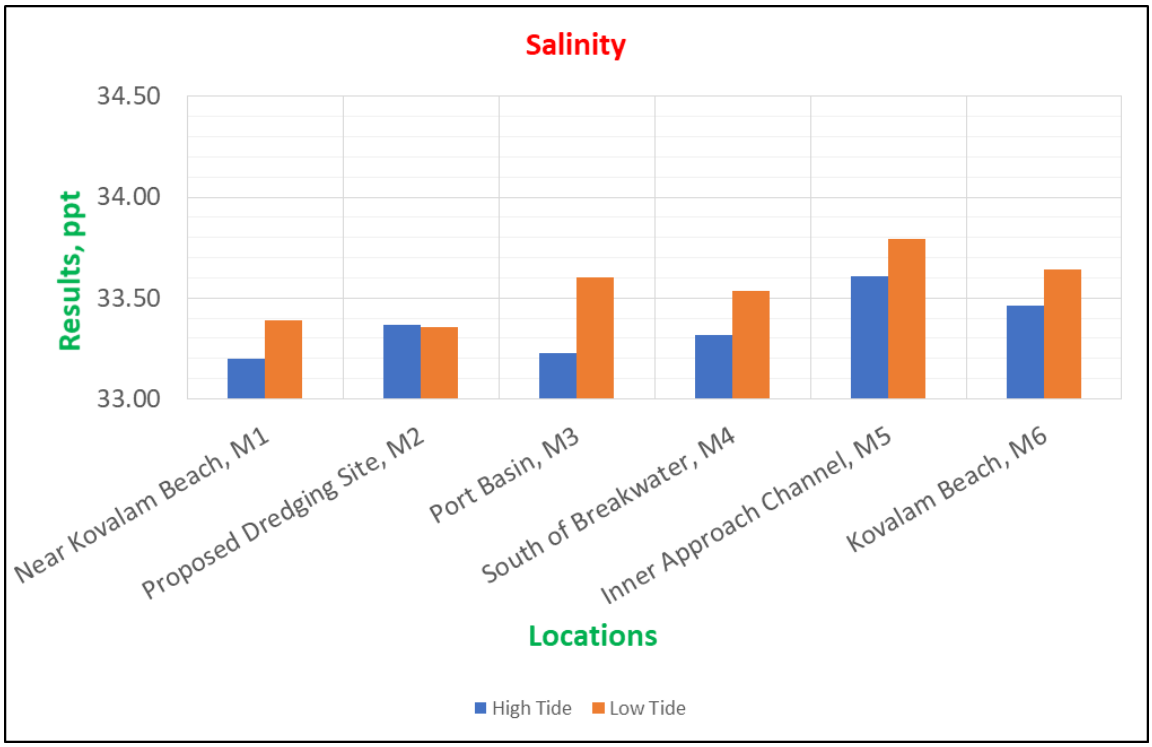

Nitrite (as $NO_2$)
Results, mg/L
0.045
0.040
0.035
0.030
0.025
0.020
Near Kovalam Beach, M1
Proposed Dredging Site, M2
Port Basin, M3
South of Breakwater, M4
Inner Approach Channel, M5
Kovalam Beach, M6
Locations
High Tide
Low Tide


Dissolved Oxygen
Results, mg/L
7.20
7.00
6.80
6.60
Near Kovalam Beach, M1
Proposed Dredging Site, M2
Port Basin, M3
South of Breakwater, M4
Inner Approach Channel, M5
Kovalam Beach, M6
Locations
High Tide
Low Tide


Total Dissolved Soilds
Results, mg/L
33500
33250
33000
32750
32500
Near Kovalam Beach, M1
Proposed Dredging Site, M2
Port Basin, M3
South of Breakwater, M4
Inner Approach Channel, M5
Kovalam Beach, M6
Locations
High Tide
Low Tide


Turbidity
Results, NTU
1.25
1.00
0.75
0.50
0.25
0.00
Near Kovalam Beach, M1
Proposed Dredging Site, M2
Port Basin, M3
South of Breakwater, M4
Inner Approach Channel, M5
Kovalam Beach, M6
Locations
High Tide
Low Tide


Total Chlorophyll
Results, mg/m³
0.80
0.70
0.60
0.50
0.40
0.30
Near Kovalam Beach, M1
Proposed Dredging Site, M2
Port Basin, M3
South of Breakwater, M4
Inner Approach Channel, M5
Kovalam Beach, M6
Locations
High Tide
Low Tide


Salinity
34.50
34.00
33.50
33.00
Results, ppt
Near Kovalam Beach, M1
Proposed Dredging Site, M2
Port Basin, M3
South of Breakwater, M4
Inner Approach Channel, M5
Kovalam Beach, M6
Locations
High Tide
Low Tide

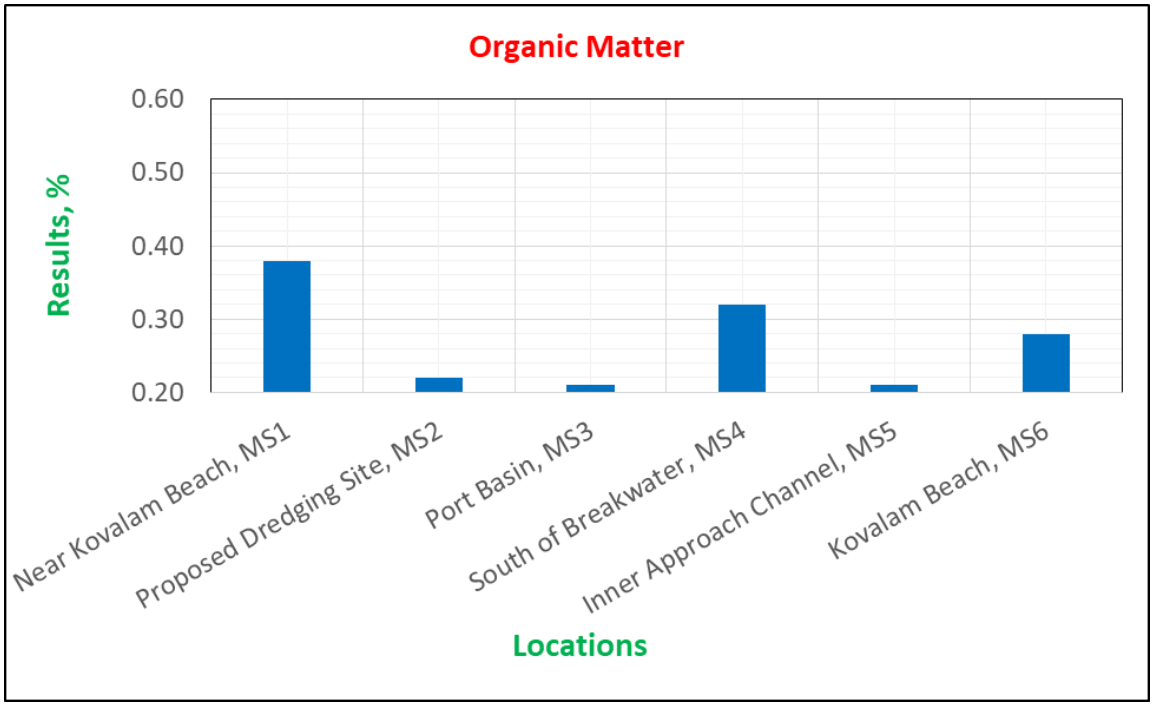
| EMR-4.3 | Sediment Analysis Report |
|---|---|

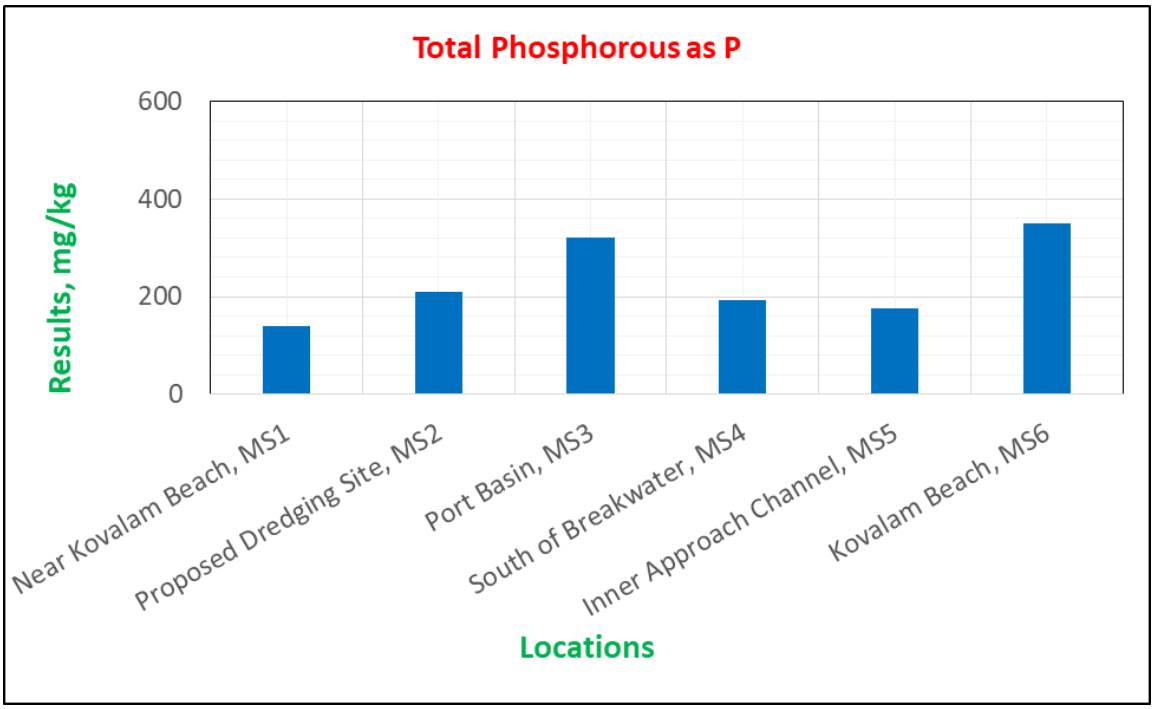
| Date of Sampling | 07-08-2026 |
|---|---|

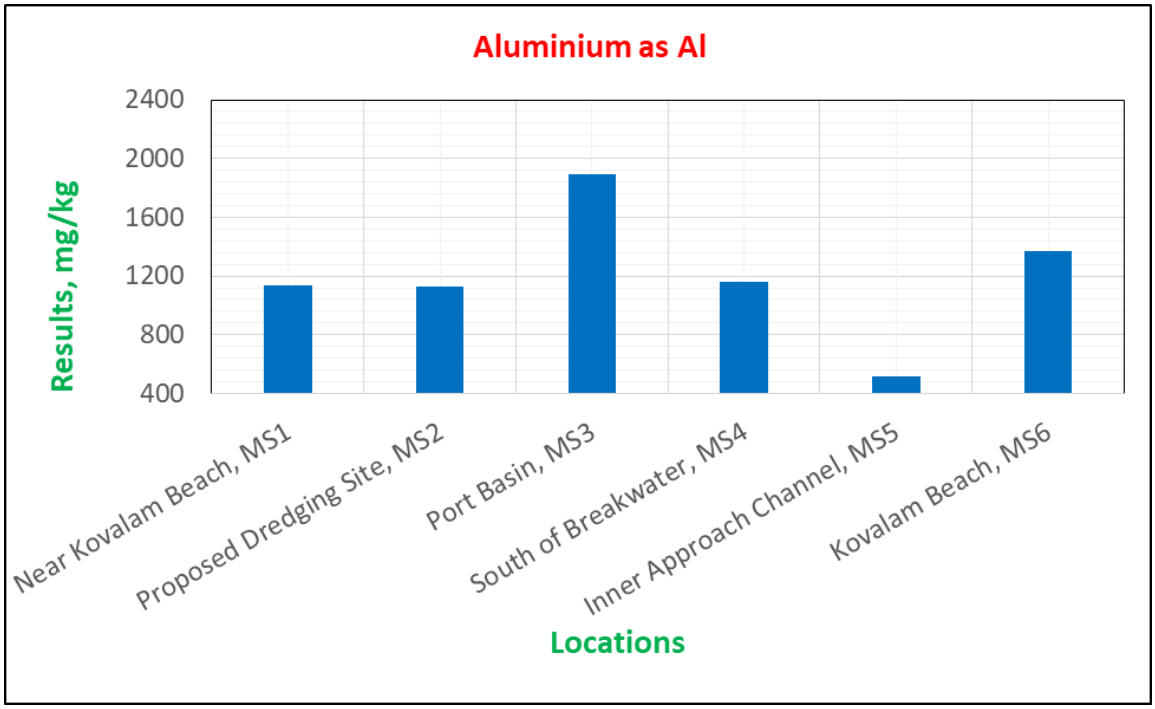
| Parameter | Unit | Results | | | | | |
|---|---|---|---|---|---|---|---|
| | | Near Kovalam Beach (MS1) | Proposed Dredging Site (MS2) | Port Basin (MS3) | South of Break Water (MS4) | Inner Approach Channel (MS5) | Kovalam Beach (MS6) |
| Texture | - | Sand | Sand | Sandy Loam | Sand | Sand | Sand |
| Organic Matter | % | 0.38 | 0.22 | 0.21 | 0.32 | 0.21 | 0.28 |
| Total Phosphorus (as P) | mg/kg | 140 | 210 | 320 | 192 | 175 | 350 |
| Aluminium (as Al) | mg/kg | 1140 | 1125 | 1896 | 1163 | 520 | 1368 |
| Chromium (as Cr) | mg/kg | BDL | BDL | BDL | BDL | BDL | BDL |
| Copper (as Cu) | mg/kg | BDL | BDL | BDL | BDL | BDL | BDL |
| Iron (as Fe) | mg/kg | 6088 | 1865 | 4563 | 2158 | 1236 | 1210 |
| Lead (as Pb) | mg/kg | BDL | BDL | BDL | BDL | BDL | BDL |
| Manganese (as Mn) | mg/kg | BDL | BDL | BDL | BDL | BDL | BDL |
| Mercury (as Hg) | mg/kg | BDL | BDL | BDL | BDL | BDL | BDL |
| Zinc (as Zn) | mg/kg | BDL | BDL | BDL | BDL | BDL | BDL |
| Nickel (as Ni) | mg/kg | BDL | BDL | BDL | BDL | BDL | BDL |
| Benthic Organism | | | | | | | |
| Micro Benthic Organism | No./m$^2$ | 67325 | 66124 | 67782 | 65879 | 66123 | 61785 |
| Macro Benthic Organism | No./m$^2$ | 63457 | 60785 | 66536 | 62227 | 65789 | 60785 |
| **Total** | **No./m$^2$** | **130782** | **126909** | **134318** | **128106** | **131912** | **122570** |

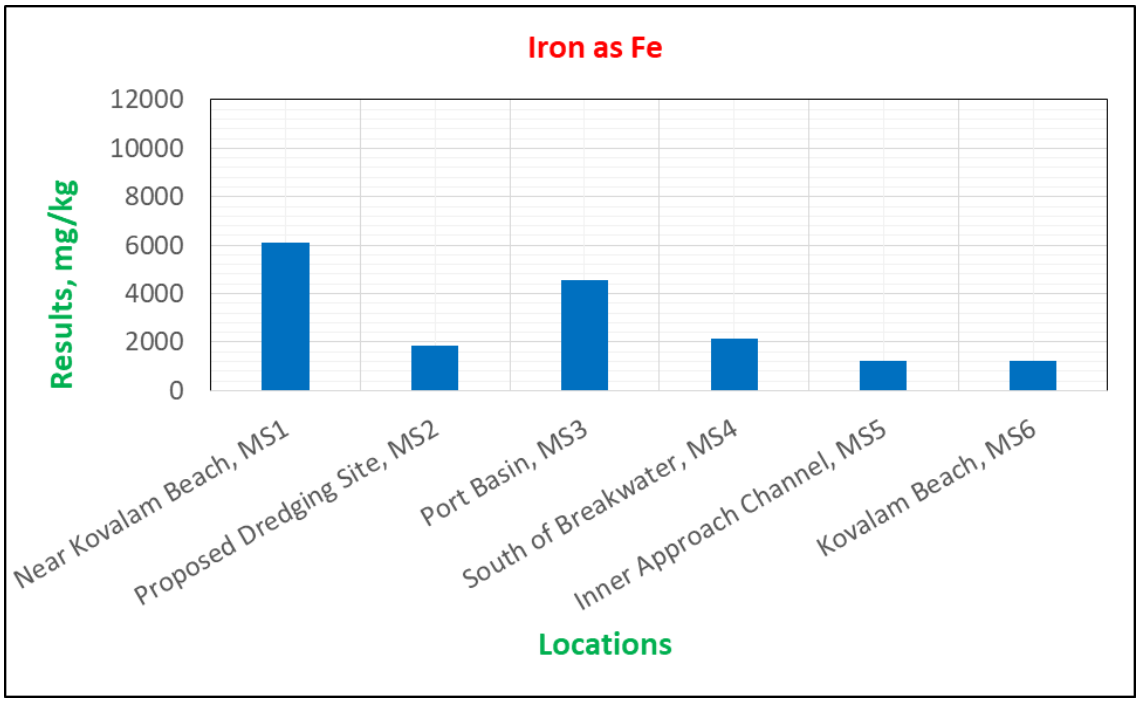
**BDL**: Below Detectable Limit

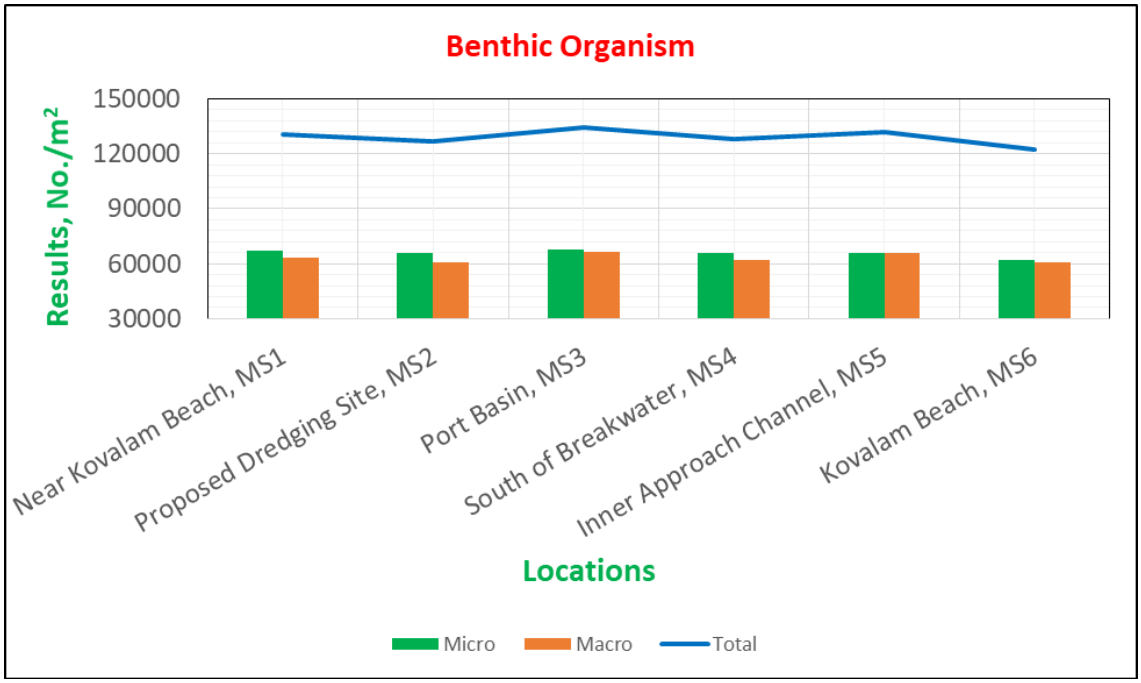
| EMR-4.4 | Statistical Analysis of Sediment |
|---|---|




Aluminium as Al
Results, mg/kg
2400
2000
1600
1200
800
400
Near Kovalam Beach, MS1
Proposed Dredging Site, MS2
Port Basin, MS3
South of Breakwater, MS4
Inner Approach Channel, MS5
Kovalam Beach, MS6
Locations


Iron as Fe
Results, mg/kg
12000
10000
8000
6000
4000
2000
0
Near Kovalam Beach, MS1
Proposed Dredging Site, MS2
Port Basin, MS3
South of Breakwater, MS4
Inner Approach Channel, MS5
Kovalam Beach, MS6
Locations

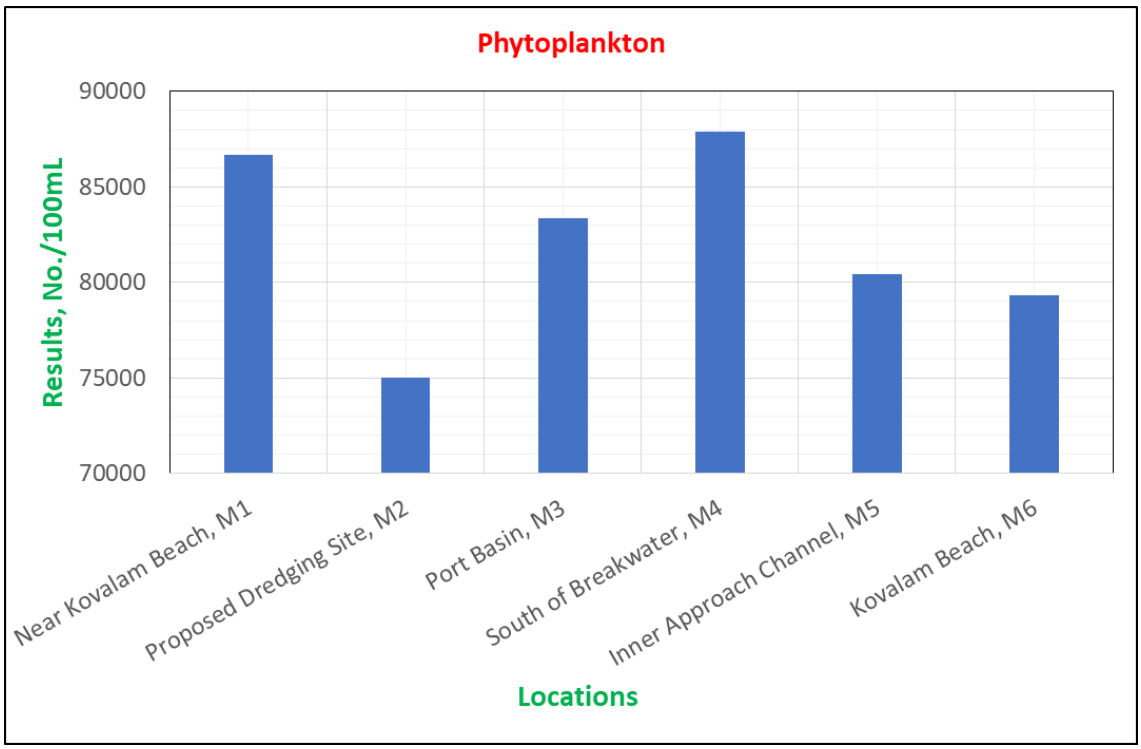

Benthic Organism
Results, No./m²
150000
120000
90000
60000
30000
Near Kovalam Beach, MS1
Proposed Dredging Site, MS2
Port Basin, MS3
South of Breakwater, MS4
Inner Approach Channel, MS5
Kovalam Beach, MS6
Locations
Micro
Macro
Total

| EMR-4.5 | Phytoplankton Analysis from Marine Water Samples |
|---|---|

| Date of Sampling | 07-08-2026 |
|---|---|

| Parameter | Unit | Results | | | | | |
|---|---|---|---|---|---|---|---|
| | | Near Kovalam Beach (M1) | Proposed Dredging Site (M2) | Port Basin (M3) | South of Break Water (M4) | Inner Approach Channel (M5) | Kovalam Beach (M6) |
| Fragilariaceae | No/100mL | 43568 | 35476 | 40125 | 40256 | 34785 | 38454 |
| Bacillariophyceae | | 24578 | 10445 | 18245 | 22548 | 23458 | 20478 |
| Cyanophyceoe | | 1156 | 6785 | 4268 | 6879 | 1259 | 1005 |
| Chlorophyceoe | | 426 | 2567 | 1125 | 5077 | 3689 | 1156 |
| Stephanodiscaceae | | 1089 | 854 | 1004 | 4258 | 965 | 1879 |
| Merismopediaceae | | 1965 | 798 | 1654 | 1876 | 874 | 1157 |
| Selenastraceae | | 0 | 0 | 0 | 0 | 0 | 0 |
| Scenedesmaceae | | 2114 | 1045 | 1235 | 546 | 604 | 782 |
| Zygnemataceae | | 564 | 1156 | 879 | 1236 | 1675 | 841 |
| Chlorellaceae | | 1887 | 8657 | 6985 | 1054 | 1895 | 9937 |
| Micractiniaceae | | 3014 | 1895 | 812 | 1325 | 1784 | 1248 |
| Chlorococcaceae | | 1289 | 1152 | 1347 | 975 | 1247 | 689 |
| Desmidiaceae | | 0 | 0 | 0 | 0 | 0 | 0 |
| Hildenbrandiaceae | | 0 | 0 | 0 | 0 | 0 | 0 |
| Microcystaceae | | 1412 | 1245 | 1265 | 235 | 1977 | 475 |
| Coscinodiscaceae | | 1598 | 1954 | 945 | 856 | 5324 | 412 |
| Naviculaceae | | 2006 | 998 | 3451 | 568 | 896 | 823 |
| Skeletonemataceae | | 0 | 0 | 0 | 194 | 0 | 0 |
| **Total** | | **86666** | **75027** | **83340** | **87883** | **80432** | **79336** |

| EMR-4.6 | Statistical Analysis of Phytoplankton |
|---|---|

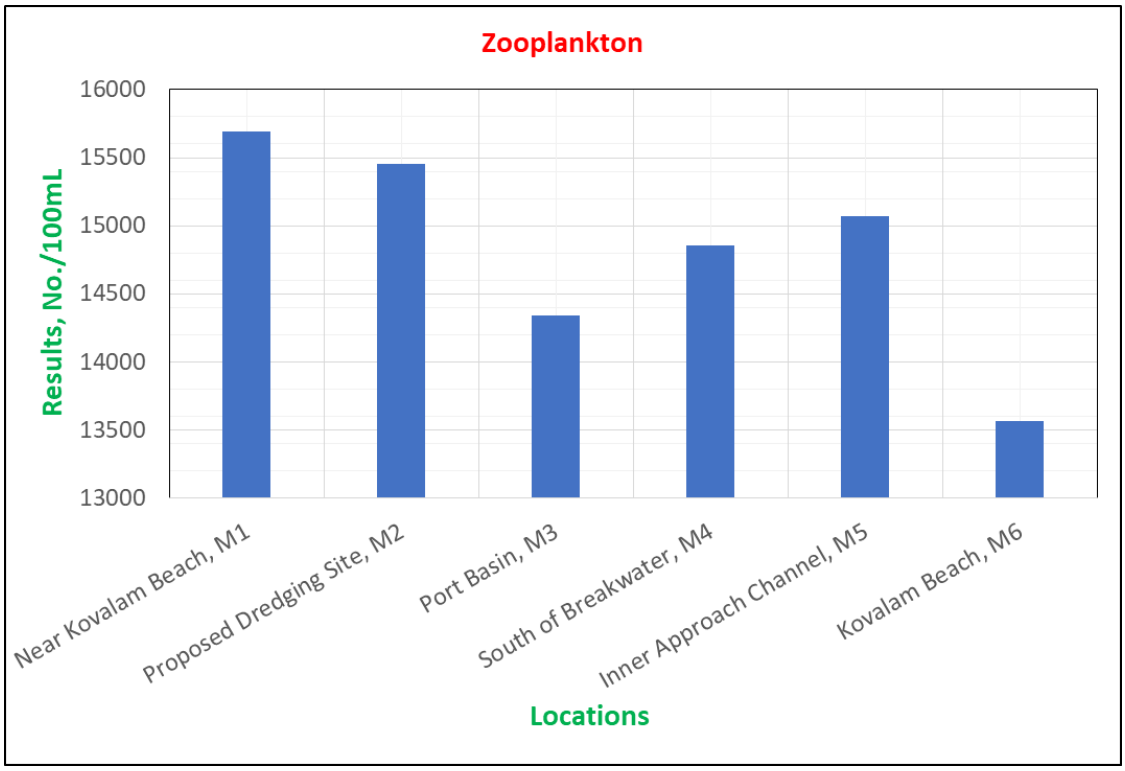


| EMR-4.7 | Zooplankton Analysis from Marine Samples |
|---|---|

| Date of Sampling | 07-08-2026 |
|---|---|

| Parameter | Unit | Results | | | | | |
|---|---|---|---|---|---|---|---|
| | | Near Kovalam Beach (M1) | Proposed Dredging Site (M2) | Port Basin (M3) | South of Break Water (M4) | Inner Approach Channel (M5) | Kovalam Beach (M6) |
| Amphipods | No/100mL | 524 | 621 | 589 | 256 | 955 | 846 |
| Bivalve larvae | | 915 | 679 | 438 | 738 | 628 | 312 |
| Copepods | | 7048 | 7654 | 6278 | 8536 | 5189 | 4978 |
| Decapods | | 2400 | 821 | 936 | 0 | 2856 | 2057 |
| Gastropods | | 0 | 0 | 0 | 0 | 0 | 0 |
| Chaetognaths | | 1125 | 1487 | 1996 | 1679 | 1324 | 967 |
| Polychaetes | | 0 | 0 | 0 | 0 | 0 | 0 |
| Ciliates | | 2004 | 1796 | 2896 | 2468 | 1278 | 3145 |
| Lucifer | | 0 | 1154 | 0 | 0 | 1168 | 0 |
| Siphonophore | | 1679 | 1245 | 1210 | 1179 | 1672 | 1258 |
| **Total** | | **15695** | **15457** | **14343** | **14856** | **15070** | **13563** |

| EMR-4.8 | Statistical Analysis of Zooplankton |
|---|---|



| EMR-5 | Ground Water Analysis Report |
|---|---|

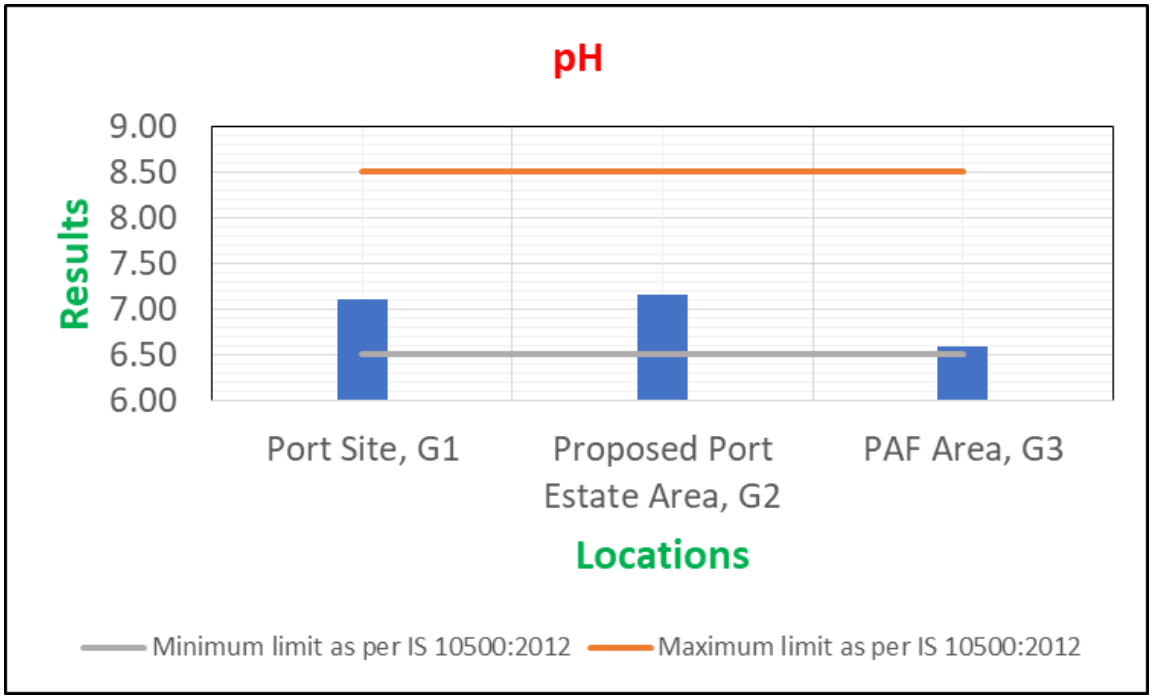
| Date of Sampling | 06-08-2026 |
|---|---|

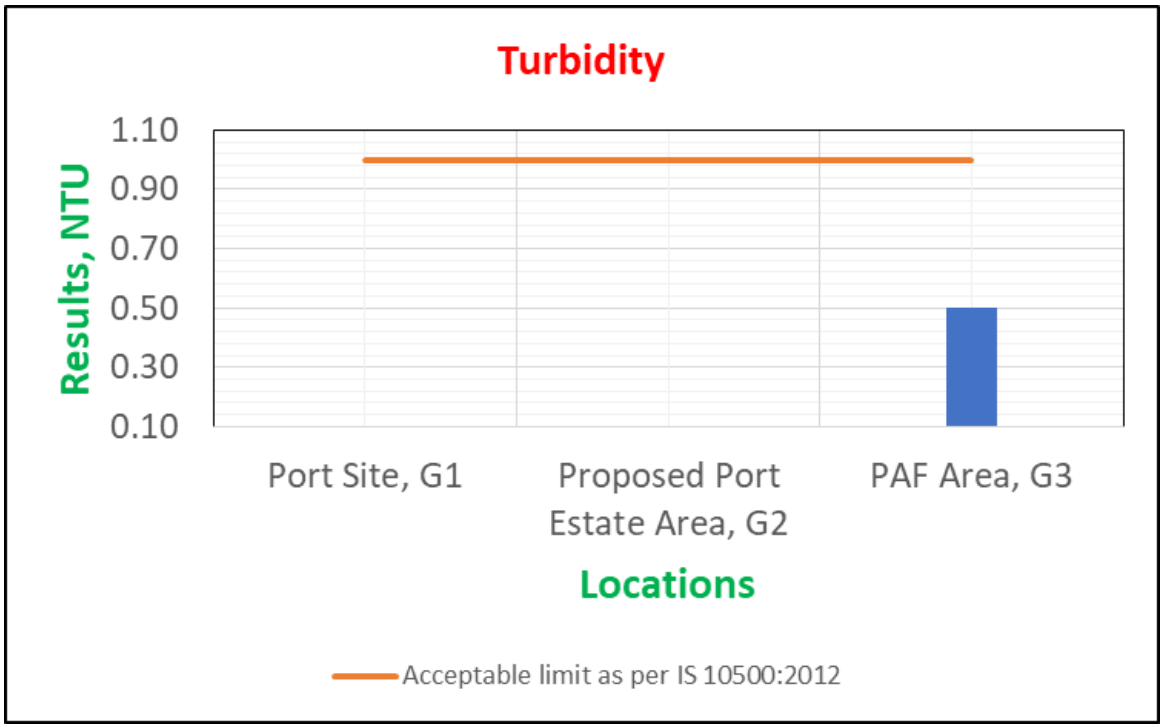
| S. No. | Parameters | Unit | Acceptable Limit as per IS 10500: 2012 | Results | | |
|---|---|---|---|---|---|---|
| | | | | Port Site (Open well) G1 | Proposed Port Estate Area (Open well) G2 | PAF Area (Open well) G3 |
| ***Organoleptic & Physical Parameters*** | | | | | | |
| 1. | Colour | Hazen Units | *Max.* 5 | 1 | 1 | 1 |
| 2. | Odour | - | Agreeable | Agreeable | Agreeable | Agreeable |
| 3. | pH Value | - | 6.5 to 8.5 | 7.10 | 7.15 | 6.58 |
| 4. | Turbidity | N.T.U. | *Max.* 1 | BDL | BDL | 0.5 |
| 5. | Total Dissolved Solids | mg/L | *Max.* 500 | 230 | 280 | 210 |
| ***General Parameters concerning substances undesirable in excessive amounts*** | | | | | | |
| 6. | Aluminium (as Al) | mg/L | *Max.* 0.03 | BDL | BDL | BDL |
| 7. | Ammonia (as $NH_3$-N) | mg/L | *Max.*0.5 | BDL | BDL | BDL |
| 8. | Anionic Detergents (as MBAS) Calculated as LAS mol.wt. 288.38 | mg/L | *Max.* 0.2 | BDL | BDL | BDL |
| 9. | Barium (as Ba) | mg/L | *Max.* 0.7 | BDL | BDL | BDL |
| 10. | Boron (as B) | mg/L | *Max.* 0.5 | BDL | BDL | BDL |
| 11. | Calcium (as Ca) | mg/L | *Max.* 75 | 12.8 | 16.8 | 11.2 |
| 12. | Chloramines (as $Cl_2$) | mg/L | *Max.* 4.0 | BDL | BDL | BDL |
| 13. | Chloride (as Cl) | mg/L | *Max.*250 | 39.7 | 74.4 | 49.6 |
| 14. | Copper (as Cu) | mg/L | *Max.*0.05 | BDL | BDL | BDL |
| 15. | Fluoride (as F) | mg/L | *Max.* 1 | BDL | BDL | BDL |
| 16. | Iron (as Fe) | mg/L | *Max.*1.0 | BDL | BDL | BDL |
| 17. | Magnesium (as Mg) | mg/L | *Max.* 30 | 4.38 | 4.87 | 3.41 |
| 18. | Manganese (as Mn) | mg/L | *Max.*0.1 | BDL | BDL | BDL |
| 19. | Mineral Oil | mg/L | *Max.*1.0 | BDL | BDL | BDL |
| 20. | Nitrate (as $NO_3$) | mg/L | *Max.*45 | BDL | BDL | BDL |
| 21. | Phenolic Compounds (as $C_6H_5OH$) | mg/L | *Max.* 0.001 | BDL | BDL | BDL |
| 22. | Selenium (as Se) | mg/L | *Max.* 0.01 | BDL | BDL | BDL |
| 23. | Silver (as Ag) | mg/L | *Max.* 0.1 | BDL | BDL | BDL |
| 24. | Sulphate (as $SO_4$) | mg/L | *Max.* 200 | 11.2 | 3.50 | 8.65 |
| 25. | Sulphide (as $H_2S$) | mg/L | *Max.* 0.05 | BDL | BDL | BDL |
| 26. | Total Alkalinity (as $CaCO_3$) | mg/L | *Max.*200 | 30 | 20 | 10 |
| 27. | Total Hardness (as $CaCO_3$) | mg/L | *Max.* 200 | 50.0 | 62.0 | 42.0 |
| 28. | Zinc (as Zn) | mg/L | *Max.* 5 | BDL | BDL | BDL |
| ***Parameters Concerning Toxic Substances*** | | | | | | |

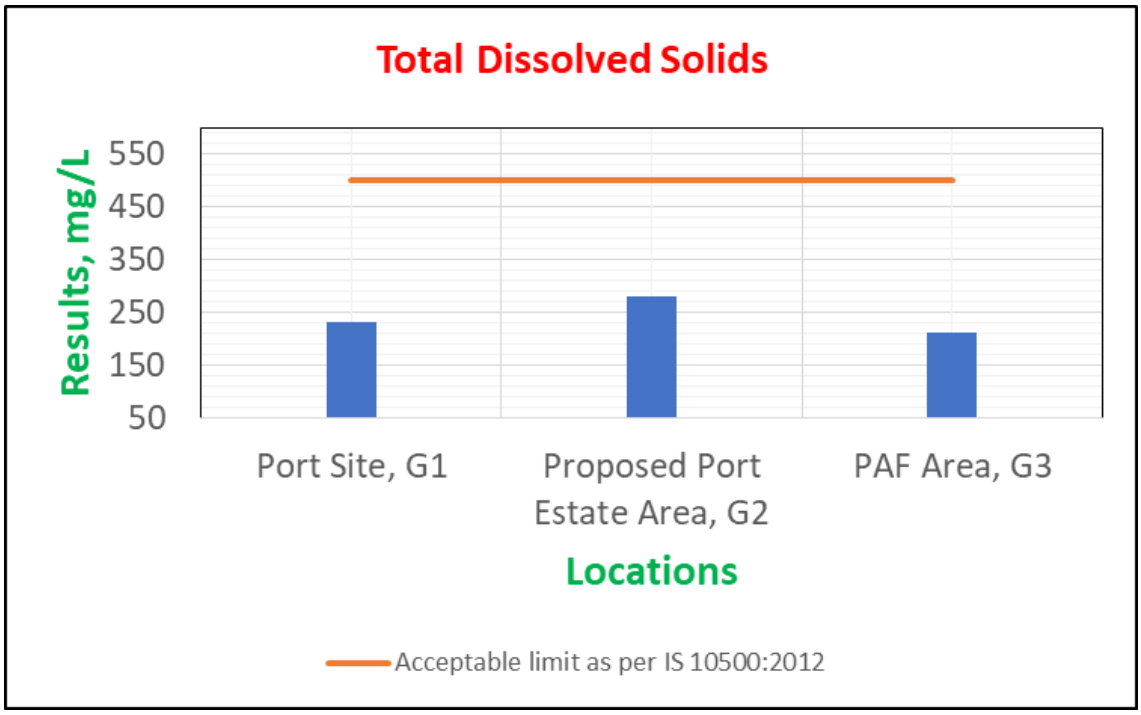
| S. No. | Parameters | Unit | Acceptable Limit as per IS 10500: 2012 | Results | | |
|---|---|---|---|---|---|---|
| | | | | Port Site (Open well) G1 | Proposed Port Estate Area (Open well) G2 | PAF Area (Open well) G3 |
| 29. | Cadmium (as Cd) | mg/L | *Max.* 0.003 | BDL | BDL | BDL |
| 30. | Cyanide (as CN) | mg/L | *Max.*0.05 | BDL | BDL | BDL |
| 31. | Lead (as Pb) | mg/L | *Max.* 0.01 | BDL | BDL | BDL |
| 32. | Mercury (as Hg) | mg/L | *Max.* 0.001 | BDL | BDL | BDL |
| 33. | Molybdenum (as Mo) | mg/L | *Max.* 0.07 | BDL | BDL | BDL |
| 34. | Nickel (as Ni) | mg/L | *Max.*0.02 | BDL | BDL | BDL |
| 35. | ***Pesticide Residues*** | | | | | |
| i. | Alachlor | µg/L | 20 | BDL | BDL | BDL |
| ii. | Atrazine | µg/L | 2 | BDL | BDL | BDL |
| iii. | Aldrin/Dieldrin | µg/L | 0.03 | BDL | BDL | BDL |
| iv. | Alpha HCH | µg/L | 0.01 | BDL | BDL | BDL |
| v. | Beta HCH | µg/L | 0.04 | BDL | BDL | BDL |
| vi. | Butachlor | µg/L | 125 | BDL | BDL | BDL |
| vii. | Chlorpyrifos | µg/L | 30 | BDL | BDL | BDL |
| viii. | Delta HCH | µg/L | 0.04 | BDL | BDL | BDL |
| ix. | 2,4D chlorophenoxyacetic acid | µg/L | 30 | BDL | BDL | BDL |
| x. | DDT (o,p & p,p- Isomers of DDT, DDE, DDD) | µg/L | 1 | BDL | BDL | BDL |
| xi. | Endosulfan (α,β & Sulphate) | µg/L | 0.4 | BDL | BDL | BDL |
| xii. | Ethion | µg/L | 3 | BDL | BDL | BDL |
| xiii. | γ HCH (Lindane) | µg/L | 2 | BDL | BDL | BDL |
| xiv. | Isoproturon | µg/L | 9 | BDL | BDL | BDL |
| xv. | Malathion | µg/L | 190 | BDL | BDL | BDL |
| xvi. | Methyl Parathion | µg/L | 0.3 | BDL | BDL | BDL |
| xvii. | Monocrotophos | µg/L | 1 | BDL | BDL | BDL |
| xviii. | Phorate | µg/L | 2 | BDL | BDL | BDL |
| 36. | Polychlorinated Biphenyls (PCB) | mg/L | *Max.*0.0005 | BDL | BDL | BDL |
| 37. | Polynuclear Aromatic Hydrocarbons (PAH) | mg/L | *Max.*0.0001 | BDL | BDL | BDL |
| 38. | Total Arsenic (as As) | mg/L | *Max.* 0.01 | BDL | BDL | BDL |
| 39. | Total Chromium (as Cr) | mg/L | *Max.* 0.05 | BDL | BDL | BDL |
| 40. | **Trihalomethanes** | | | | | |
| a) | Bromoform | mg/L | *Max.* 0.1 | BDL | BDL | BDL |
| b) | Dibromochloromethane | mg/L | *Max.* 0.1 | BDL | BDL | BDL |
| c) | Bromodichloroethane | mg/L | *Max.* 0.06 | BDL | BDL | BDL |
| d) | Chloroform | mg/L | *Max.* 0.2 | BDL | BDL | BDL |
| ***Bacteriological Analysis*** | | | | | | |
| 41. | *E. coli* | MPN/100 ml | Not Detectable | BDL | BDL | BDL |
| 42. | Total Coliforms | MPN/100 ml | - | BDL | BDL | BDL |

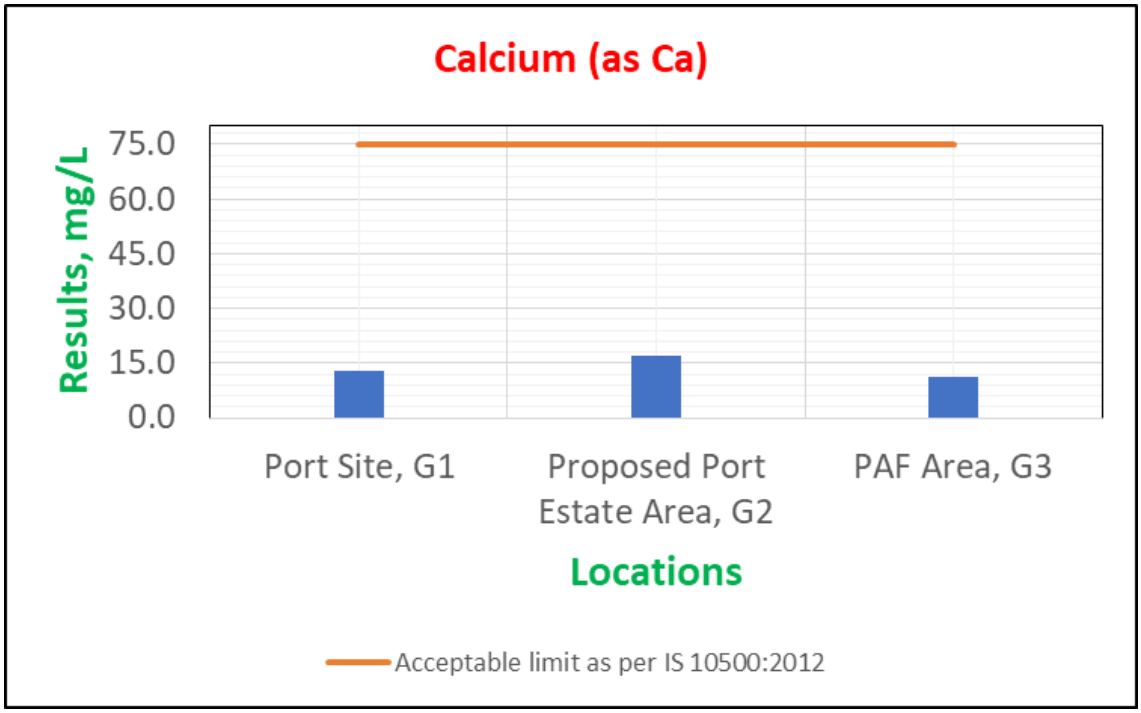
**BDL**: Below Detectable Limit

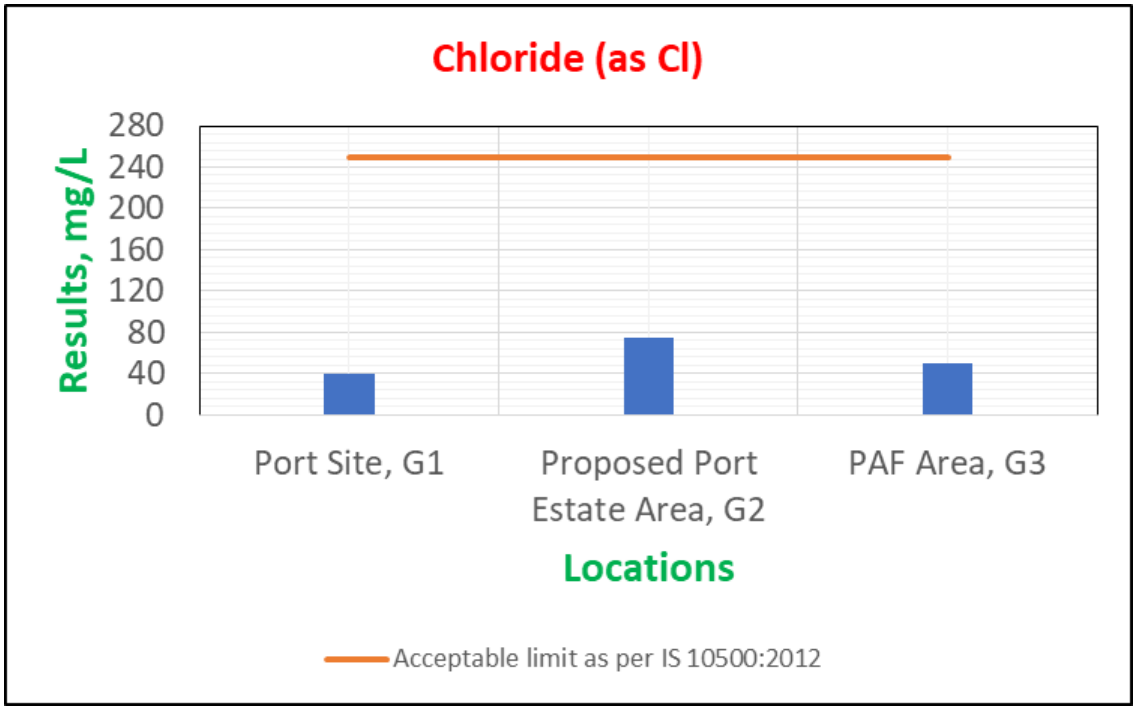
| EMR-5.1 | Statistical Analysis of Ground Water |
|---|---|

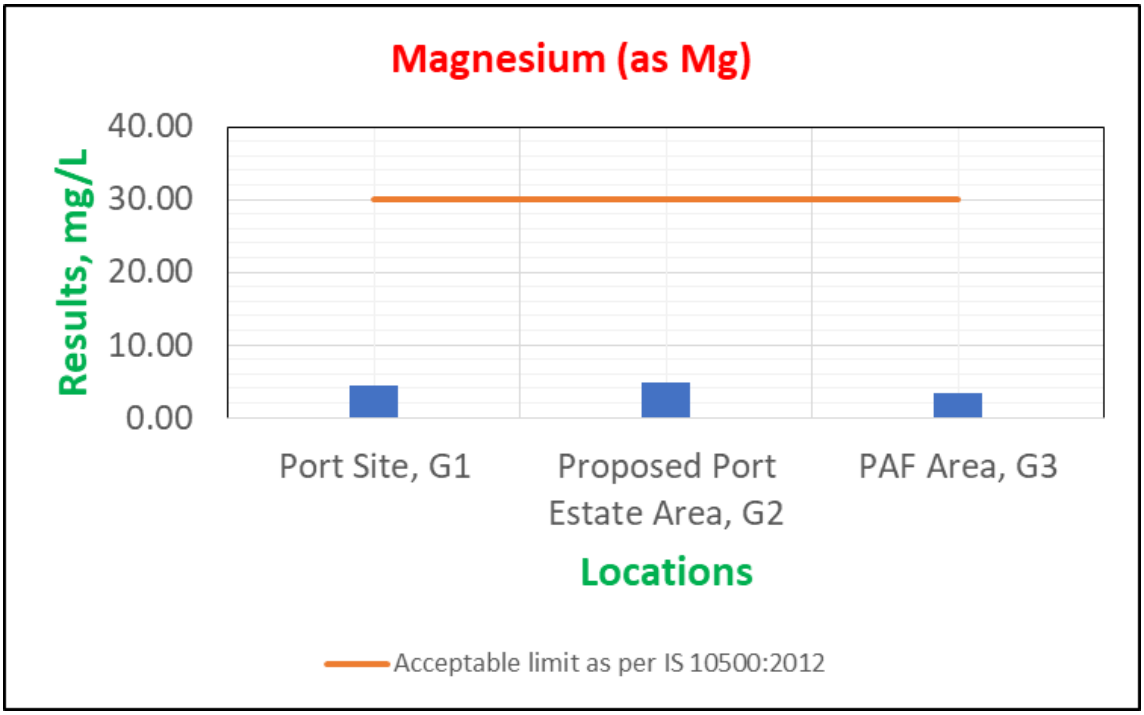


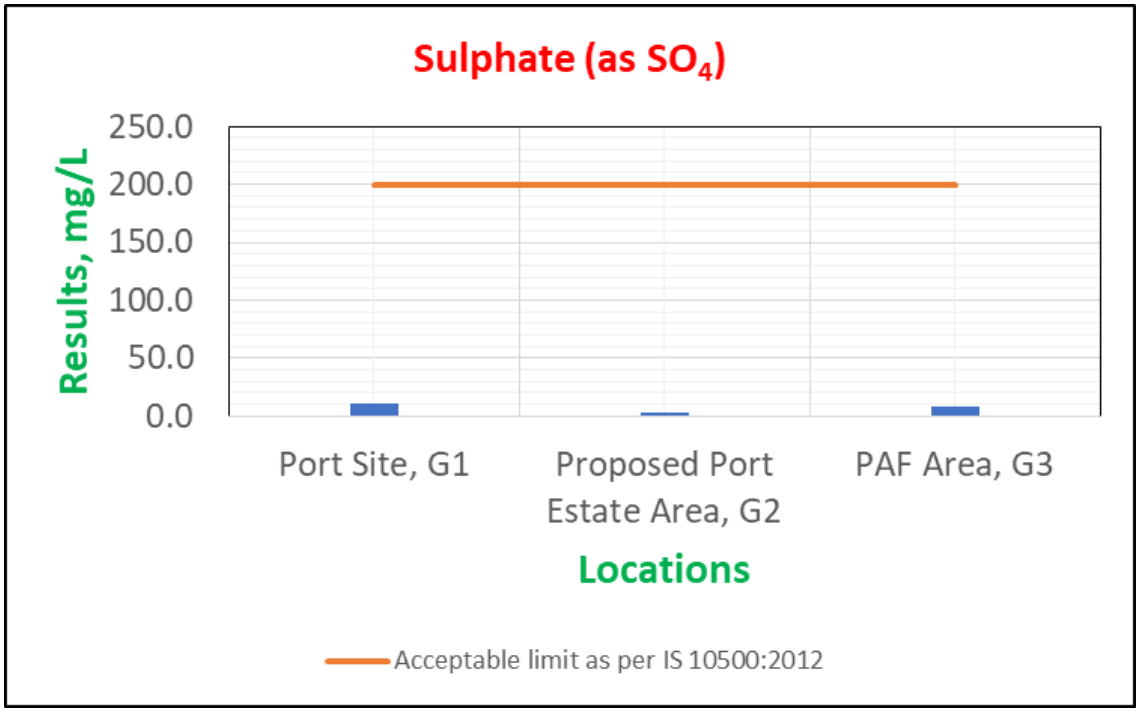



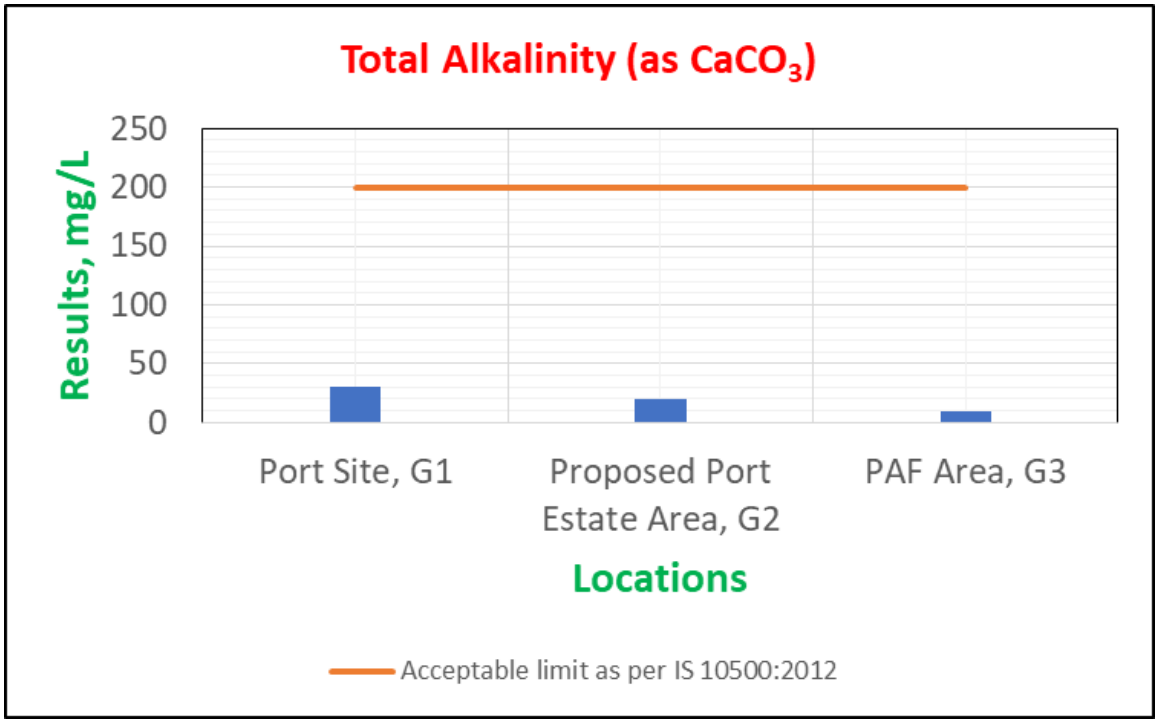

Total Dissolved Solids
Results, mg/L
550
450
350
250
150
50
Port Site, G1
Proposed Port Estate Area, G2
PAF Area, G3
Locations
Acceptable limit as per IS 10500:2012

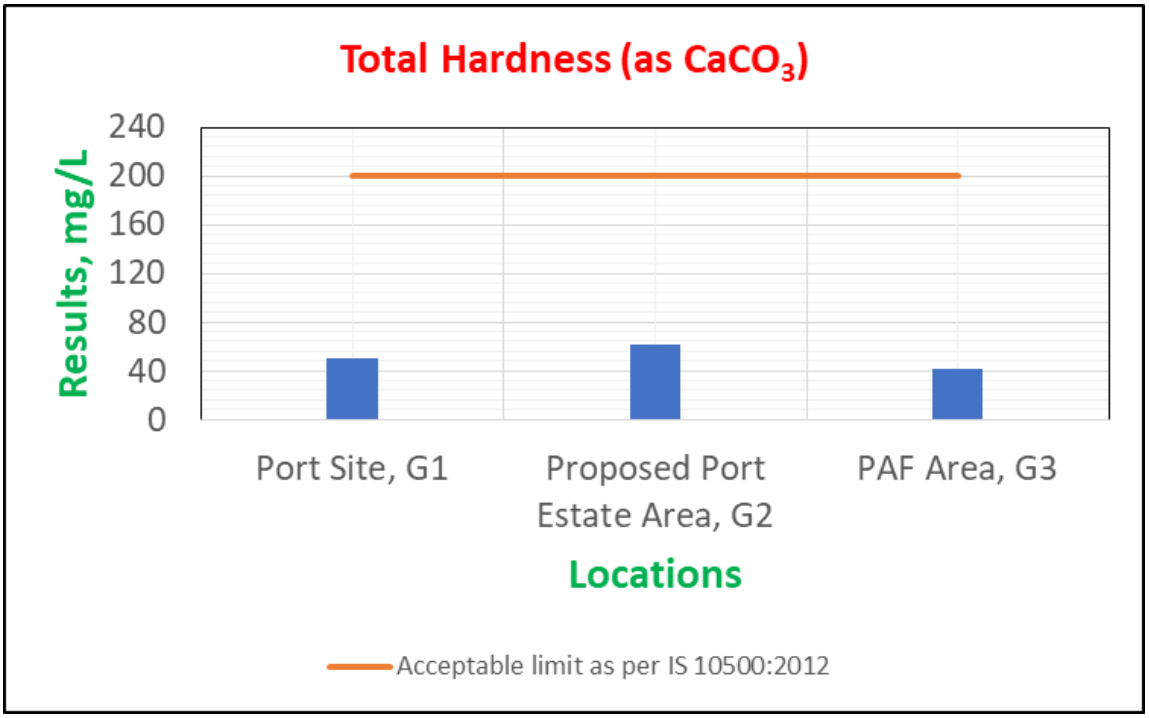

Calcium (as Ca)
Results, mg/L
75.0
60.0
45.0
30.0
15.0
0.0
Port Site, G1
Proposed Port Estate Area, G2
PAF Area, G3
Locations
Acceptable limit as per IS 10500:2012


Chloride (as Cl)
Results, mg/L
280
240
200
160
120
80
40
0
Port Site, G1
Proposed Port Estate Area, G2
PAF Area, G3
Locations
Acceptable limit as per IS 10500:2012


Magnesium (as Mg)
Results, mg/L
40.00
30.00
20.00
10.00
0.00
Port Site, G1
Proposed Port Estate Area, G2
PAF Area, G3
Locations
Acceptable limit as per IS 10500:2012


Sulphate (as $SO_4$)
Results, mg/L
250.0
200.0
150.0
100.0
50.0
0.0
Port Site, G1
Proposed Port Estate Area, G2
PAF Area, G3
Locations
Acceptable limit as per IS 10500:2012


Total Alkalinity (as $CaCO_3$)
Results, mg/L
250
200
150
100
50
0
Port Site, G1
Proposed Port Estate Area, G2
PAF Area, G3
Locations
Acceptable limit as per IS 10500:2012


Total Hardness (as $CaCO_3$)
Results, mg/L
240
200
160
120
80
40
0
Port Site, G1
Proposed Port Estate Area, G2
PAF Area, G3
Locations
Acceptable limit as per IS 10500:2012

| EMR-6 | Surface Water Analysis Report |
|---|---|

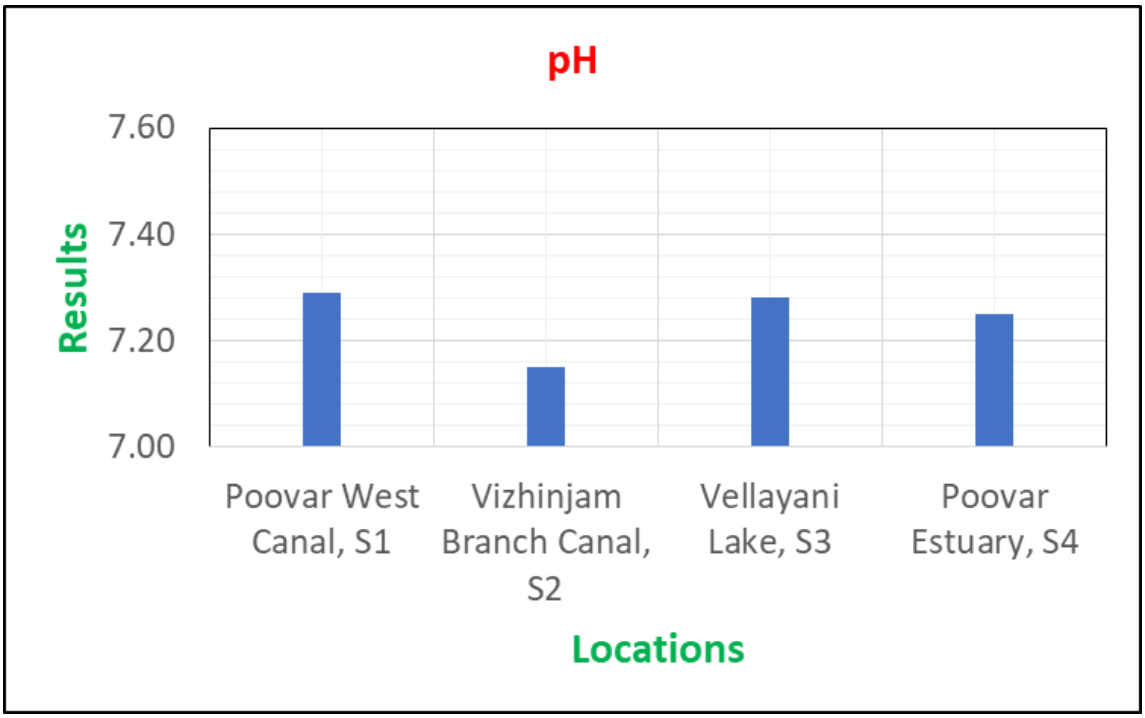
| Date of Sampling | 06-08-2026 |
|---|---|

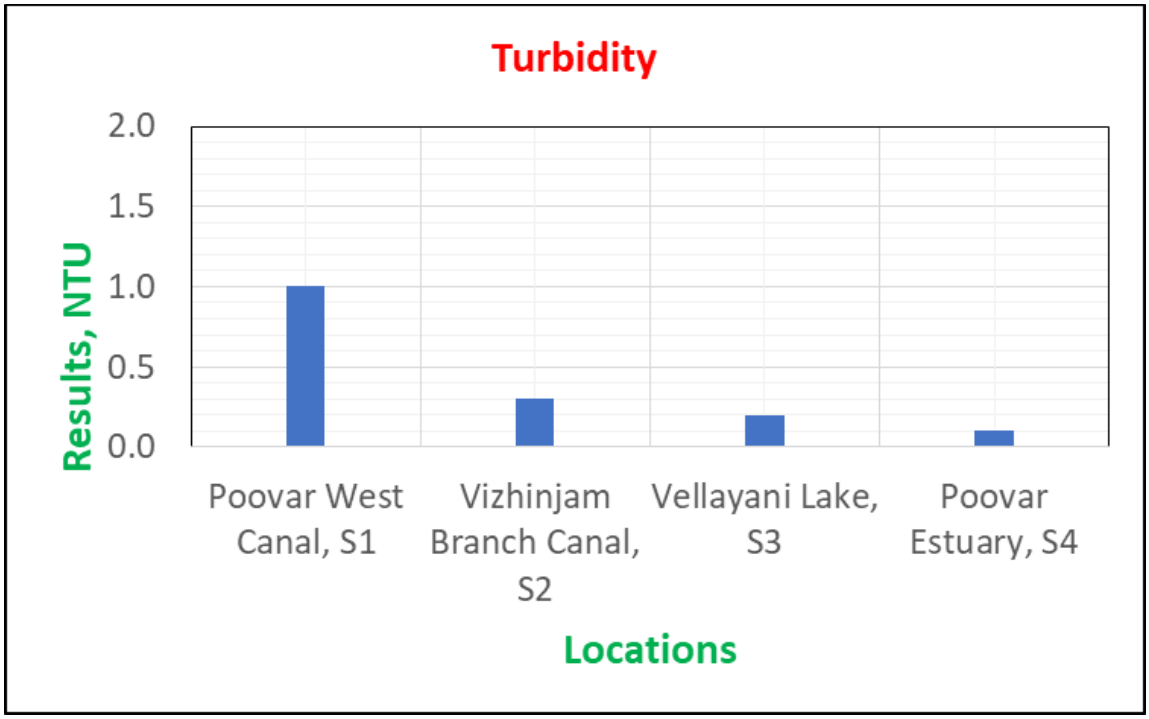
| S. No. | Parameters | Unit | Results | | | |
|---|---|---|---|---|---|---|
| | | | Poovar West Canal S1 | Vizhinjam Branch Canal S2 | Vellayani Lake S3 | Poovar Estuary S4 |
| ***Physical Parameters*** | | | | | | |
| 1. | Colour | Hazen Units | 1 | 1 | 1 | 1 |
| 2. | Odour | - | Agreeable | Agreeable | Agreeable | Agreeable |
| 3. | pH Value | - | 7.29 | 7.15 | 7.28 | 7.25 |
| 4. | Turbidity | N.T.U. | 1 | 0.3 | 0.2 | 0.1 |
| 5. | Electrical Conductivity (at 25°C) | µmho/cm | 1190 | 240 | 350 | 5100 |
| 6. | Total Dissolved Solids | mg/L | 760 | 150 | 224 | 3260 |
| ***Chemical Parameters*** | | | | | | |
| 7. | Dissolved Oxygen | mg/L | 6.9 | 7.0 | 7.1 | 7 |
| 8. | Biochemical Oxygen Demand (3 days, 27°C) | mg/L | BDL | BDL | BDL | BDL |
| 9. | Oil & Grease | mg/L | BDL | BDL | BDL | BDL |
| 10. | Free Ammonia | mg/L | BDL | BDL | BDL | 1.42 |
| 11. | Anionic Detergents (as MBAS) Calculated as LAS mol.wt. 288.38 | mg/L | BDL | BDL | BDL | BDL |
| 12. | Barium (as Ba) | mg/L | BDL | BDL | BDL | BDL |
| 13. | Boron (as B) | mg/L | BDL | BDL | BDL | BDL |
| 14. | Calcium (as Ca) | mg/L | 40.0 | 15.2 | 17.6 | 80 |
| 15. | Chloride (as Cl) | mg/L | 119 | 39.7 | 64.5 | 506 |
| 16. | Copper (as Cu) | mg/L | BDL | BDL | BDL | BDL |
| 17. | Fluoride (as F) | mg/L | BDL | BDL | BDL | BDL |
| 18. | Iron (as Fe) | mg/L | 0.48 | 0.38 | BDL | 0.41 |
| 19. | Magnesium (as Mg) | mg/L | 21.9 | 4.87 | 5.84 | 36.5 |
| 20. | Manganese (as Mn) | mg/L | BDL | BDL | BDL | BDL |
| 21. | Mineral Oil | mg/L | BDL | BDL | BDL | BDL |
| 22. | Nitrate (as $NO_3$) | mg/L | BDL | BDL | BDL | BDL |
| 23. | Phenolic Compounds (as $C_6H_5OH$) | mg/L | BDL | BDL | BDL | BDL |
| 24. | Selenium (as Se) | mg/L | BDL | BDL | BDL | BDL |
| 25. | Silver (as Ag) | mg/L | BDL | BDL | BDL | BDL |
| 26. | Sulphate (as $SO_4$) | mg/L | 22.5 | 10.4 | 2.80 | 188 |
| 27. | Total Phosphate (as $PO_4$) | mg/L | BDL | BDL | BDL | BDL |
| 28. | Total Alkalinity (as $CaCO_3$) | mg/L | 22 | 16 | 36.0 | 48.0 |
| 29. | Total Hardness (as $CaCO_3$) | mg/L | 190 | 58.0 | 68.0 | 350 |
| 30. | Calcium Hardness (as $CaCO_3$) | mg/L | 100 | 38.0 | 44.0 | 200 |

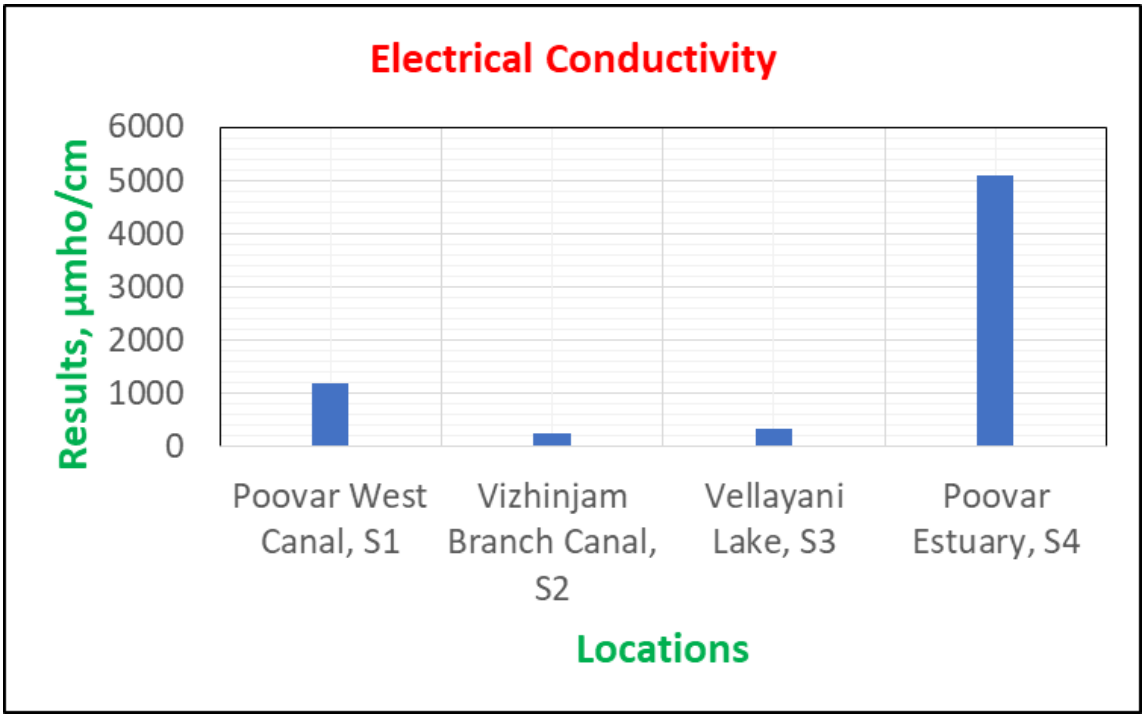
| S. No. | Parameters | Unit | Results | | | |
|---|---|---|---|---|---|---|
| | | | Poovar West Canal S1 | Vizhinjam Branch Canal S2 | Vellayani Lake S3 | Poovar Estuary S4 |
| 31. | Zinc (as Zn) | mg/L | BDL | BDL | BDL | BDL |
| 32. | Sodium (as Na) | mg/L | 70.2 | 16.4 | 32.1 | 315 |
| 33. | Potassium (as K) | mg/L | 12.4 | 2.15 | 2.78 | 21.5 |
| 34. | Sodium Adsorption Ratio | - | 2.214 | 0.936 | 1.692 | 7.319 |
| 35. | Salinity | ppt | 0.581 | 0.115 | 0.167 | 2.692 |
| 36. | Cadmium (as Cd) | mg/L | BDL | BDL | BDL | BDL |
| 37. | Cyanide (as CN) | mg/L | BDL | BDL | BDL | BDL |
| 38. | Lead (as Pb) | mg/L | BDL | BDL | BDL | BDL |
| 39. | Mercury (as Hg) | mg/L | BDL | BDL | BDL | BDL |
| 40. | ***Pesticide Residues*** | | | | | |
| i. | Alachlor | µg/L | BDL | BDL | BDL | BDL |
| ii. | Atrazine | µg/L | BDL | BDL | BDL | BDL |
| iii. | Aldrin/Dieldrin | µg/L | BDL | BDL | BDL | BDL |
| iv. | Alpha HCH | µg/L | BDL | BDL | BDL | BDL |
| v. | Beta HCH | µg/L | BDL | BDL | BDL | BDL |
| vi. | Butachlor | µg/L | BDL | BDL | BDL | BDL |
| vii. | Chlorpyrifos | µg/L | BDL | BDL | BDL | BDL |
| viii. | Delta HCH | µg/L | BDL | BDL | BDL | BDL |
| ix. | 2,4D chlorophenoxyacetic acid | µg/L | BDL | BDL | BDL | BDL |
| x. | DDT (o,p & p,p- Isomers of DDT, DDE, DDD) | µg/L | BDL | BDL | BDL | BDL |
| xi. | Endosulfan (α,β & Sulphate) | µg/L | BDL | BDL | BDL | BDL |
| xii. | Ethion | µg/L | BDL | BDL | BDL | BDL |
| xiii. | γ HCH (Lindane) | µg/L | BDL | BDL | BDL | BDL |
| xiv. | Isoproturon | µg/L | BDL | BDL | BDL | BDL |
| xv. | Malathion | µg/L | BDL | BDL | BDL | BDL |
| xvi. | Methyl Parathion | µg/L | BDL | BDL | BDL | BDL |
| xvii. | Monocrotophos | µg/L | BDL | BDL | BDL | BDL |
| xviii. | Phorate | µg/L | BDL | BDL | BDL | BDL |
| 41. | Polynuclear Aromatic Hydrocarbons (PAH) | mg/L | BDL | BDL | BDL | BDL |
| 42. | Total Arsenic (as As) | mg/L | BDL | BDL | BDL | BDL |
| 43. | Total Chromium (as Cr) | mg/L | BDL | BDL | BDL | BDL |
| ***Biological Analysis*** | | | | | | |
| 44. | Total Coliforms | MPN/100 ml | BDL | BDL | BDL | BDL |
| 45. | Faecal Coliforms | MPN/100 ml | BDL | BDL | BDL | BDL |

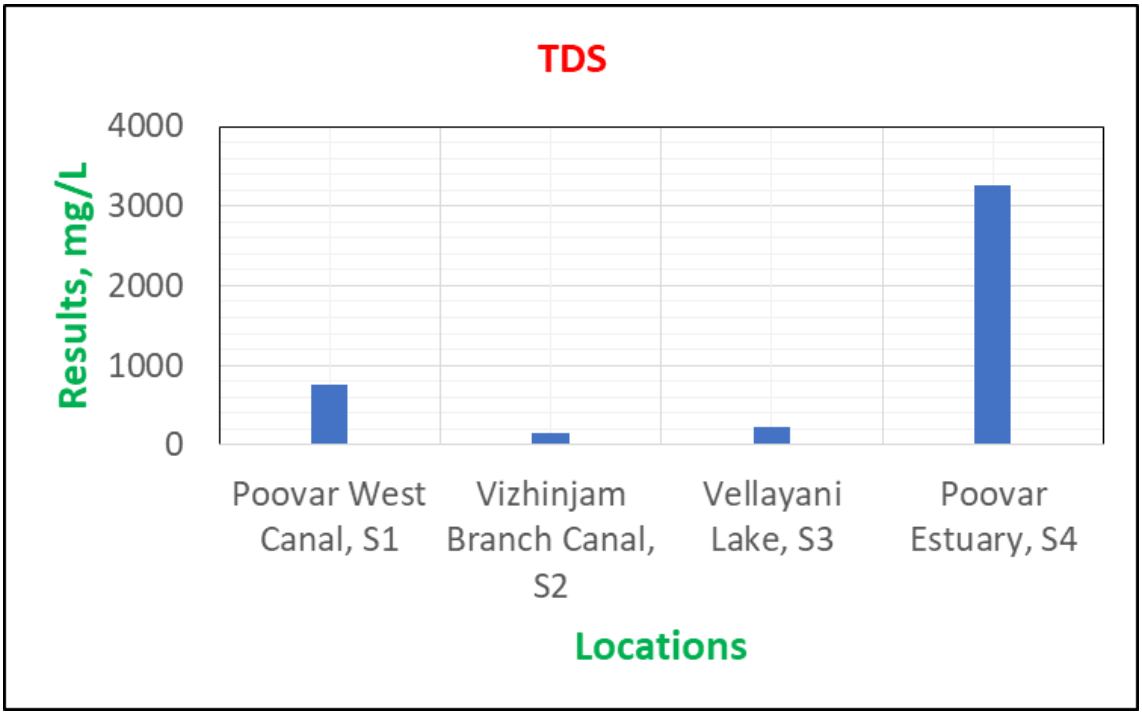
**BDL**: Below Detectable Limit

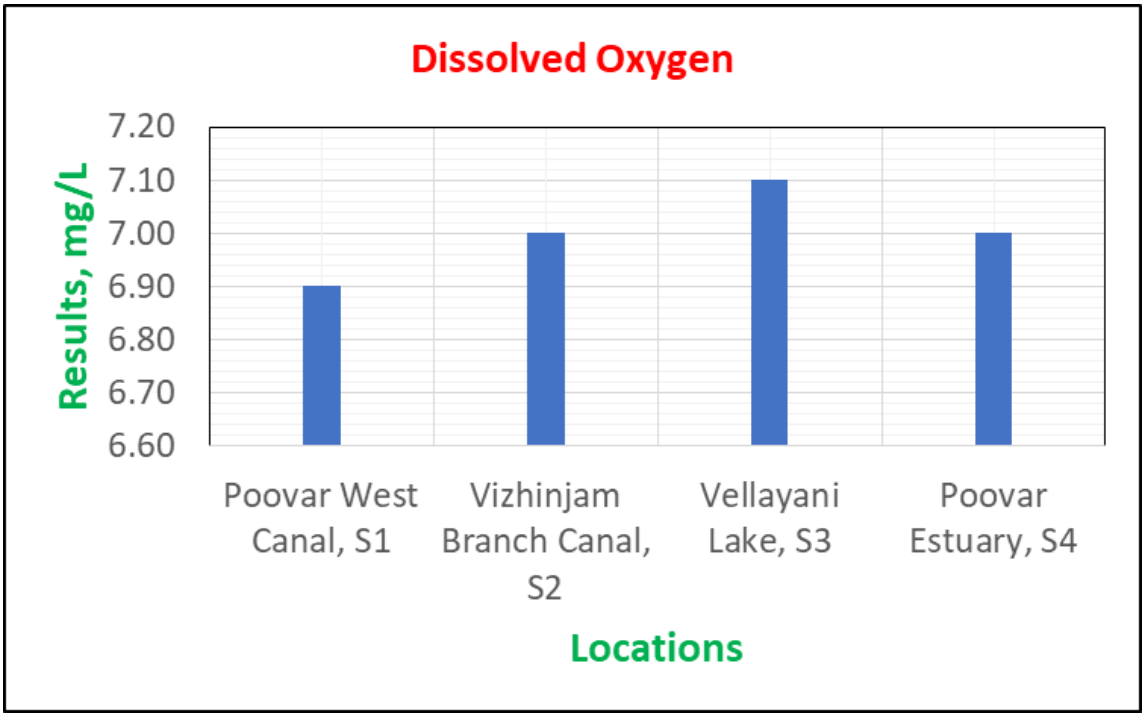
| EMR-6.1 | Statistical Analysis of Surface Water |
|---|---|

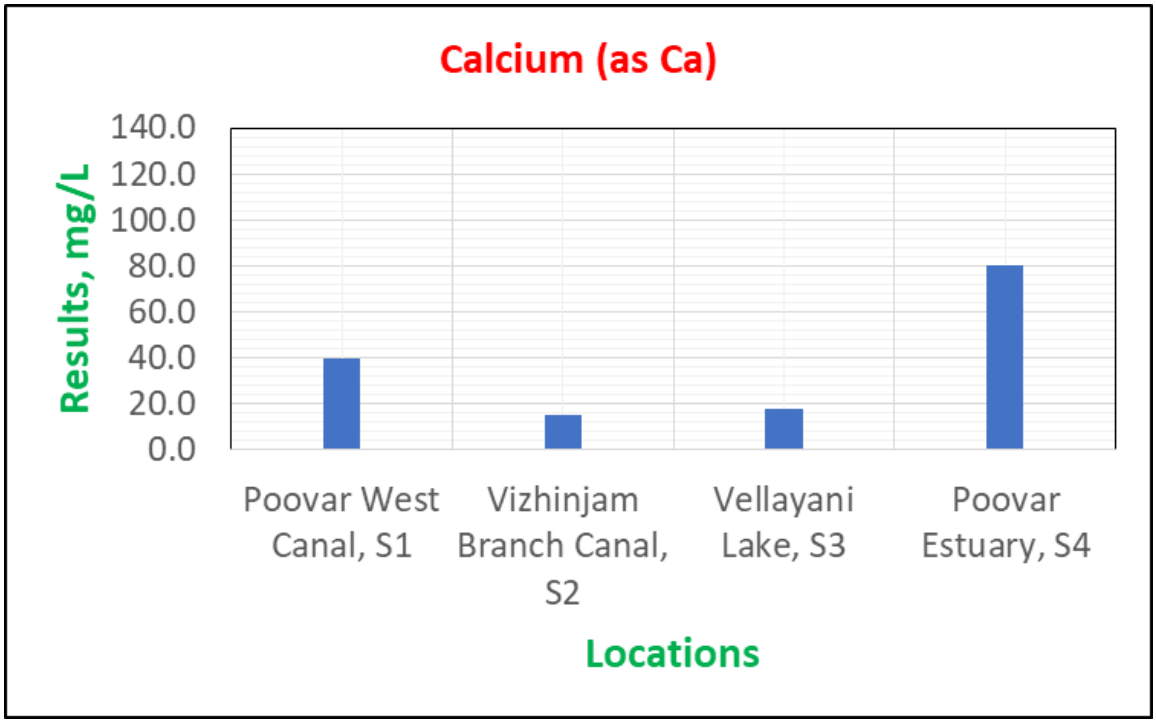


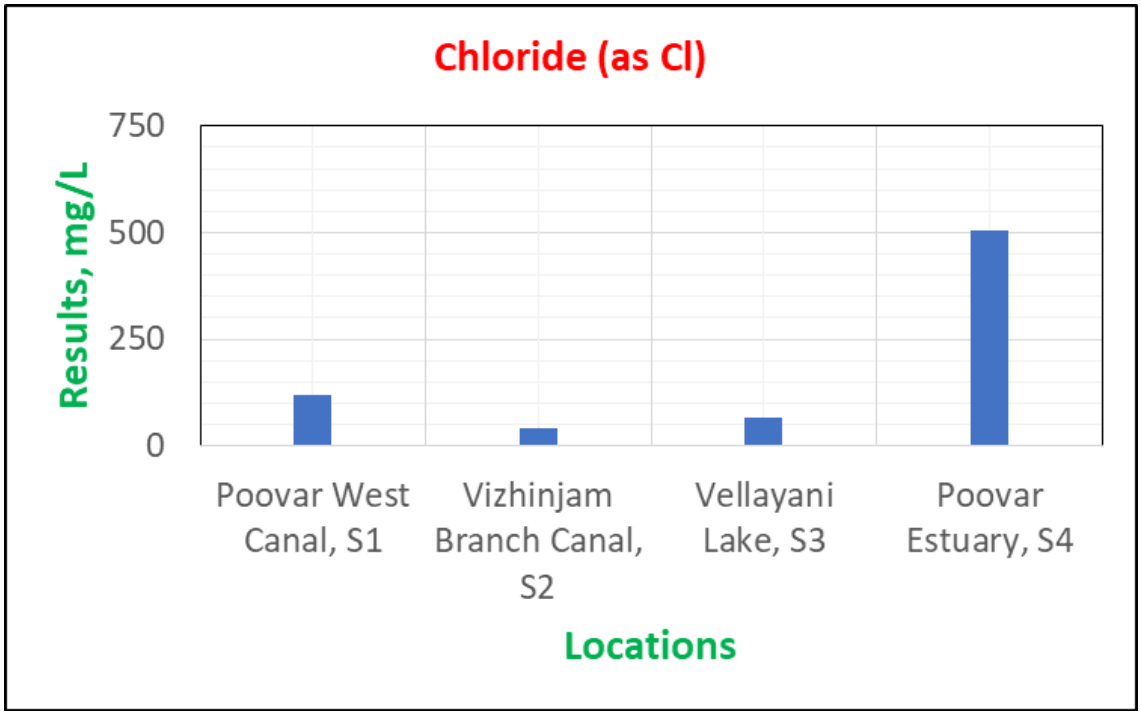



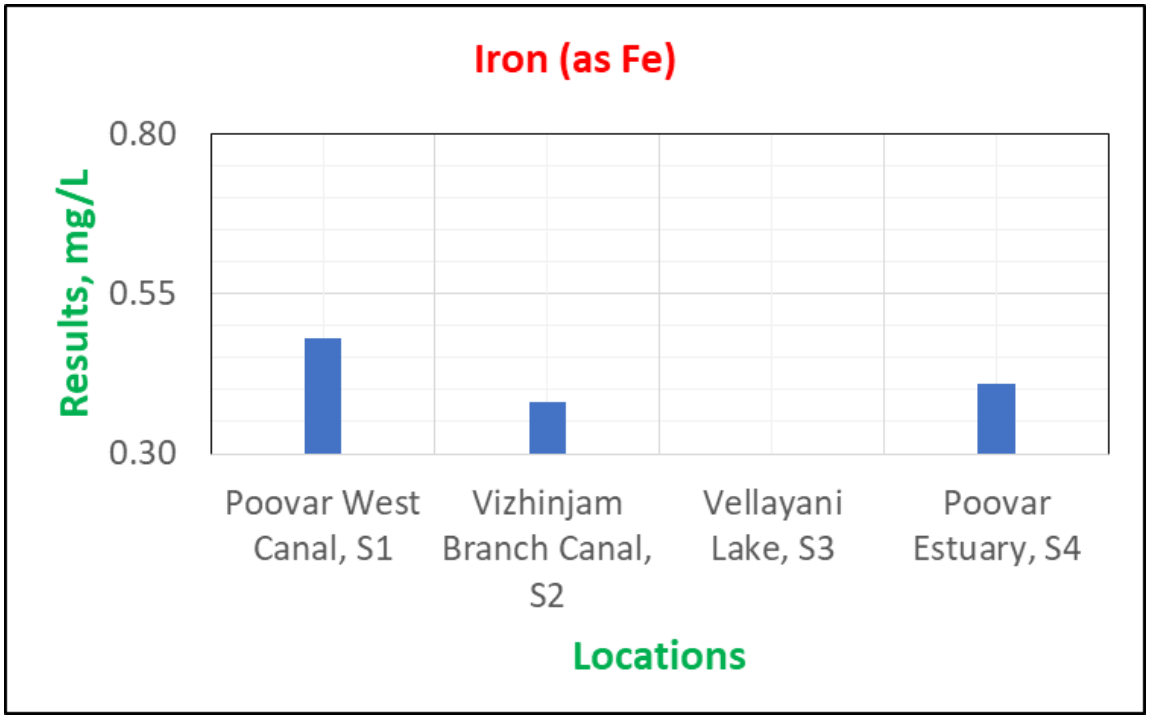

Electrical Conductivity
Results, µmho/cm
6000
5000
4000
3000
2000
1000
0
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations

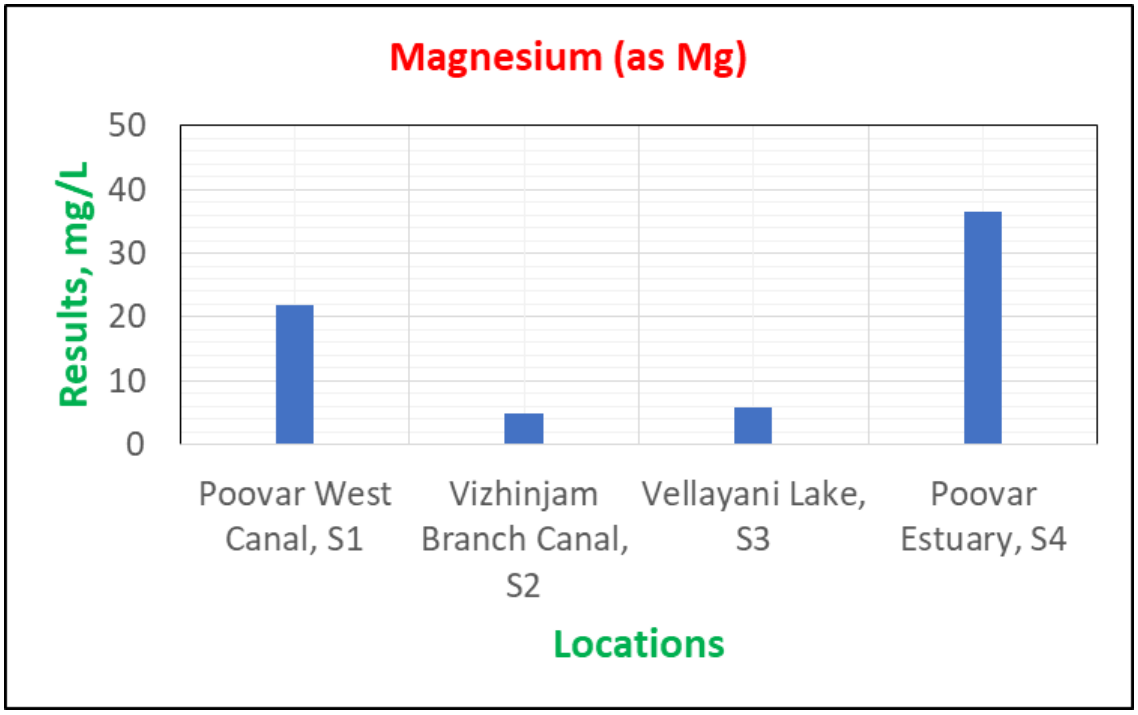

TDS
Results, mg/L
4000
3000
2000
1000
0
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations

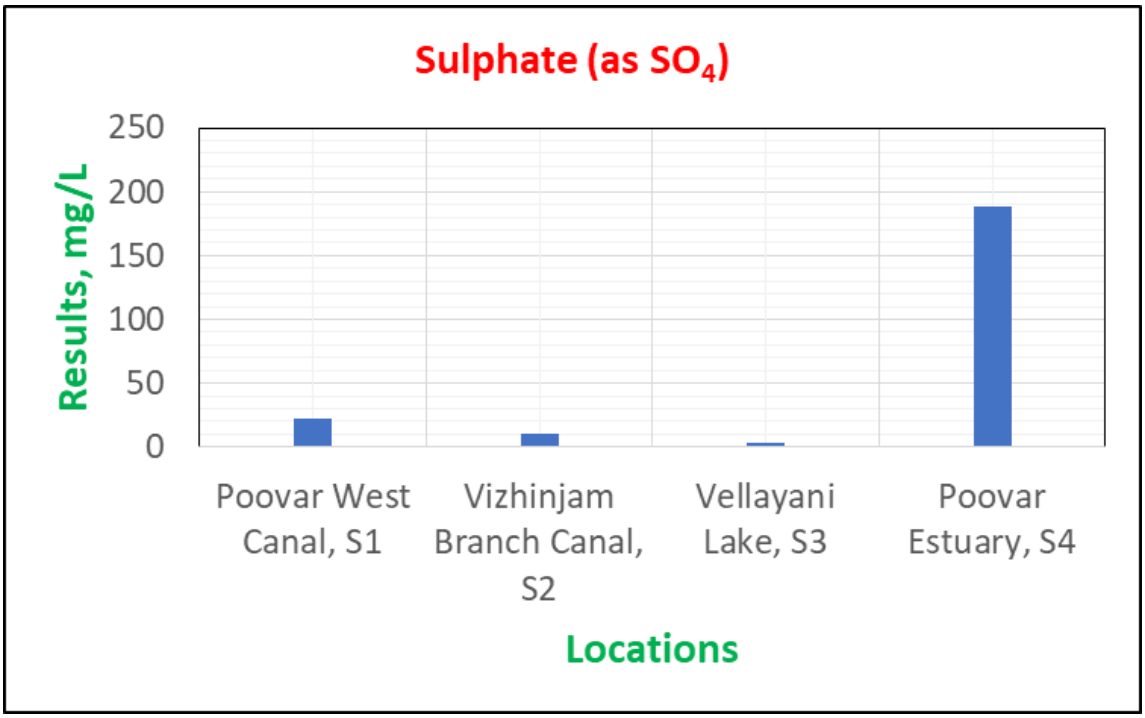

Dissolved Oxygen
Results, mg/L
7.20
7.10
7.00
6.90
6.80
6.70
6.60
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations

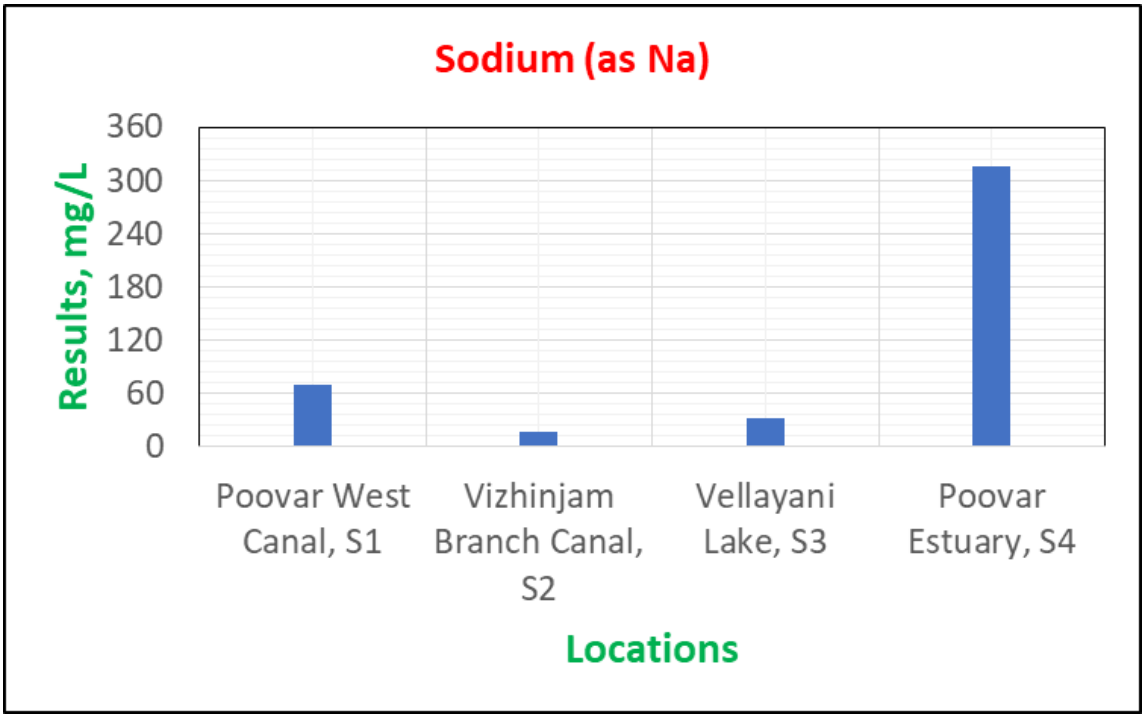

Calcium (as Ca)
Results, mg/L
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations

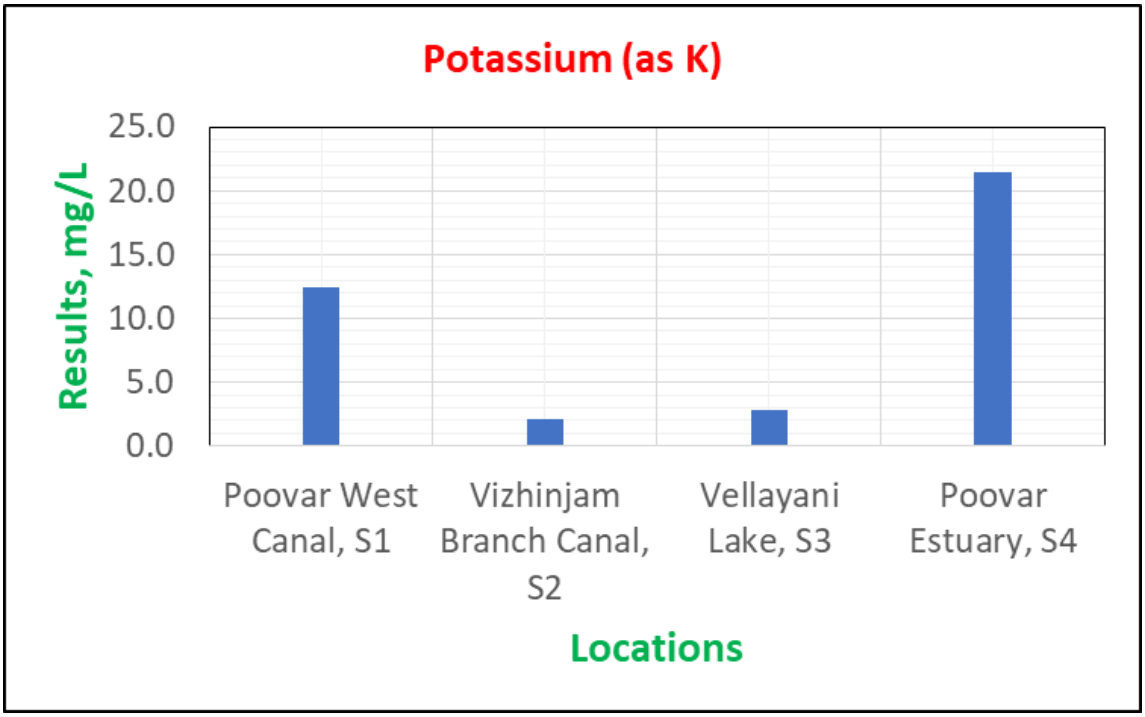

Chloride (as Cl)
Results, mg/L
750
500
250
0
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations

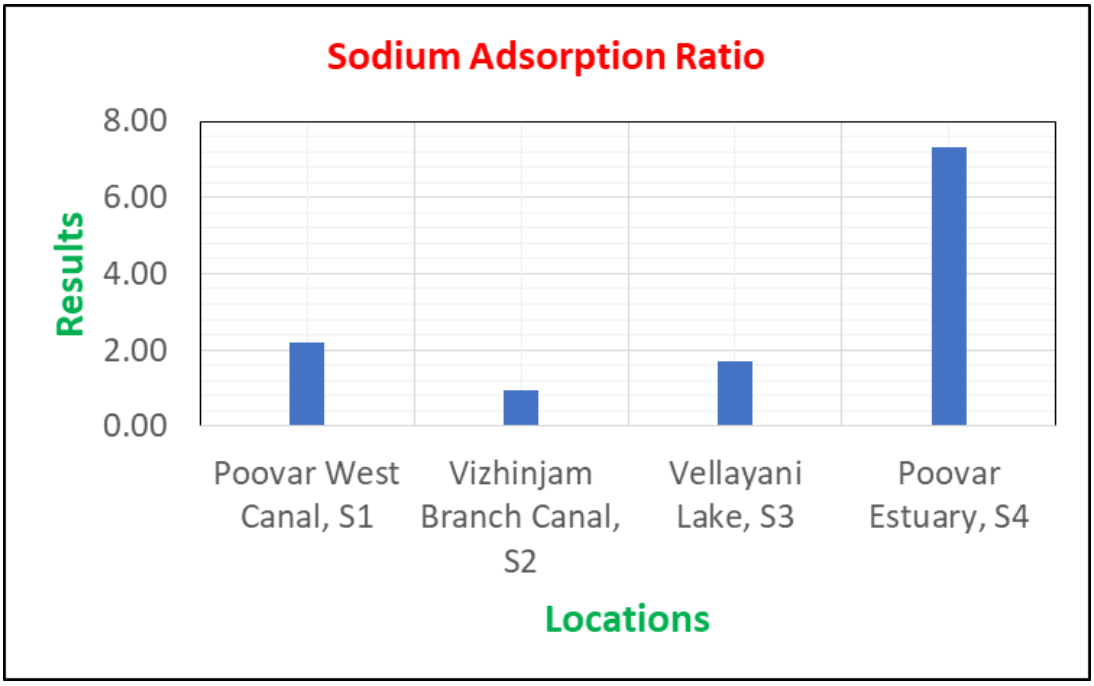

Iron (as Fe)
Results, mg/L
0.80
0.55
0.30
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations

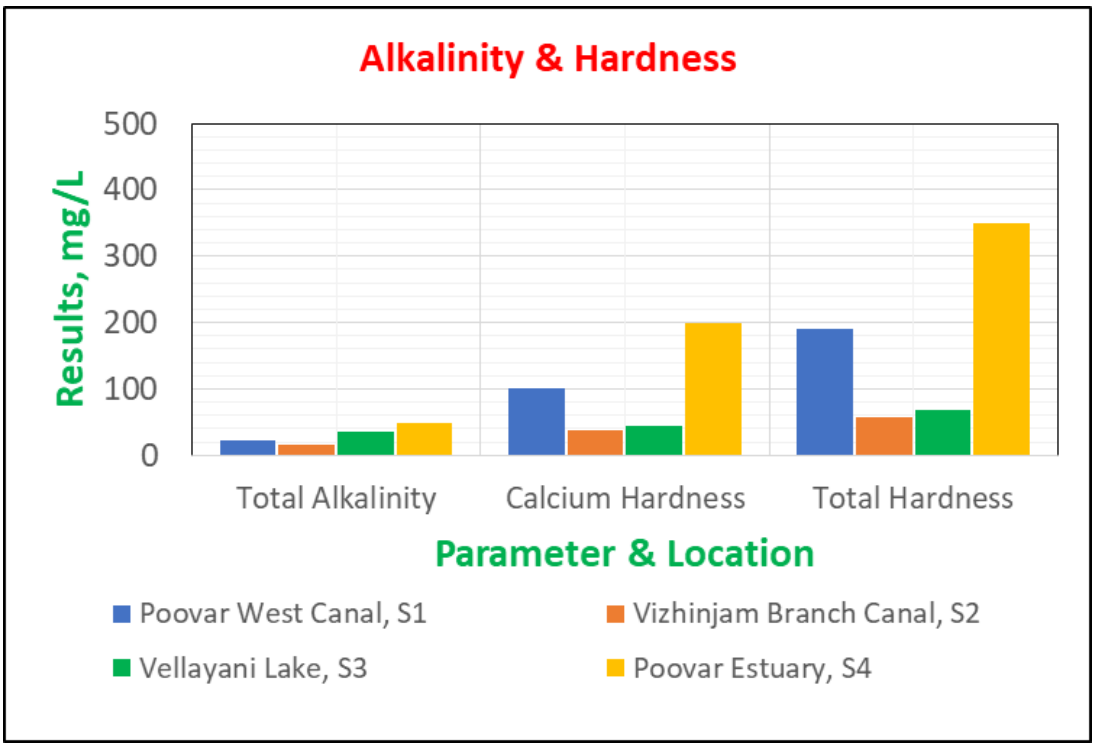

Magnesium (as Mg)
Results, mg/L
50
40
30
20
10
0
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations

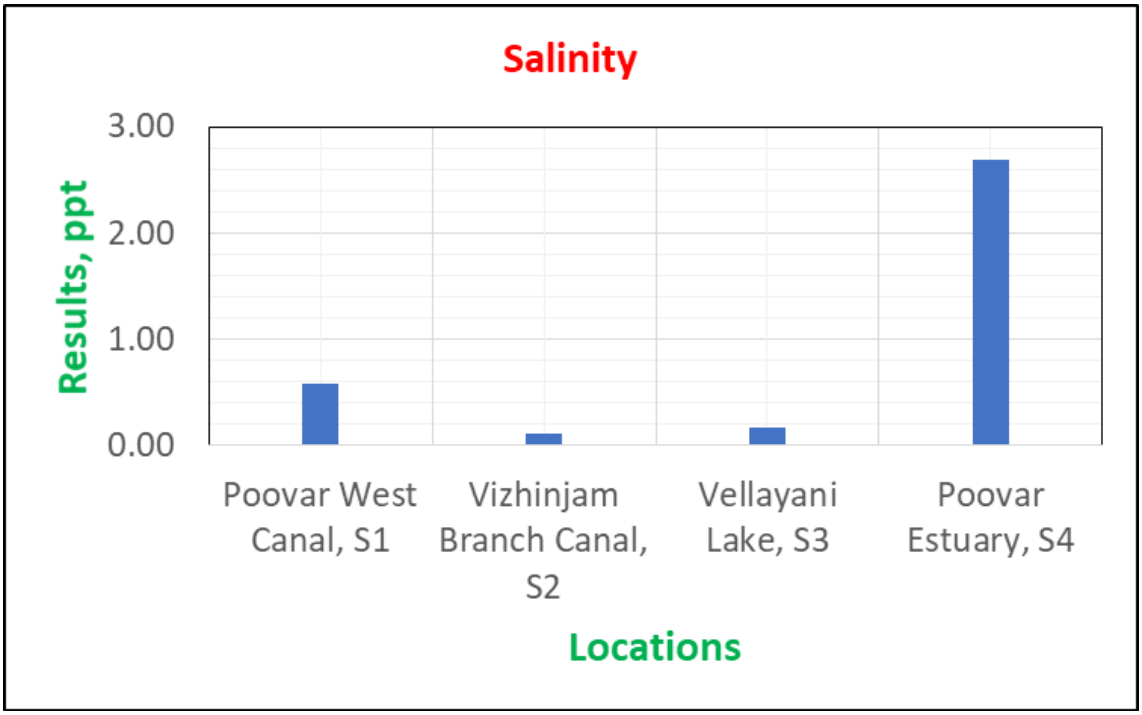

Sulphate (as $SO_4$)
Results, mg/L
250
200
150
100
50
0
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations


Sodium (as Na)
Results, mg/L
360
300
240
180
120
60
0
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations


Potassium (as K)
Results, mg/L
25.0
20.0
15.0
10.0
5.0
0.0
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations


Sodium Adsorption Ratio
Results
8.00
6.00
4.00
2.00
0.00
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations


Alkalinity & Hardness
Results, mg/L
500
400
300
200
100
0
Total Alkalinity
Calcium Hardness
Total Hardness
Parameter & Location
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4


Salinity
3.00
2.00
1.00
0.00
Results, ppt
Poovar West Canal, S1
Vizhinjam Branch Canal, S2
Vellayani Lake, S3
Poovar Estuary, S4
Locations

| EMR-7 | List of Parameters, Detection Limits and Methodology of Analysis |
|---|---|

| Sr. No. | Parameter | Unit | Detection Limit | Method Reference |
|---|---|---|---|---|
| **Ambient Air Analysis** | | | | |
| 1. | Particulate Matter (size less than 10 µm) or $PM_{10}$ | µg/m³ | 5.0 | IS 5182 (Part 23):2006 |
| 2. | Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$ | µg/m³ | 2.0 | IS 5182 (Part 24):2019 |
| 3. | Sulphur Dioxide ($SO_2$) | µg/m³ | 4.0 | IS 5182 (Part 2/Sec 1):2023 |
| 4. | Nitrogen Dioxide ($NO_2$) | µg/m³ | 4.0 | IS 5182 (Part 6):2006 |
| 5. | Carbon Monoxide (CO) | mg/m³ | 0.1 | IS 5182 (Part 10):1999 |
| 6. | Hydrocarbon (HC) | ppm | 1.0 | SEAAL/CHL/SOP/7.3/30 |
| **Surface and Ground Water Analysis** | | | | |
| 7. | Colour | Hazen Units | 1 | IS 3025 (Part 4): 2021 |
| 8. | Odour | - | -- | IS 3025 (Part 5): 2018 |
| 9. | pH Value | - | 2 | IS 3025 (Part 11): 2022 |
| 10. | Turbidity | N.T.U. | 0.1 | IS 3025 (Part 10):2023 |
| 11. | Electrical Conductivity (at 25°C) | µs/cm | 1.0 | IS 3025 (Part 14): 2013 |
| 12. | Total Dissolved Solids | mg/L | 5 | IS 3025 (Part 16): 2023 |
| 13. | Dissolved Oxygen | mg/L | 0.2 | IS 3025 (Part 38) : 2025 |
| 14. | Biochemical Oxygen Demand (3 days, 27°C) | mg/L | 2 | IS 3025 (Part 44) : 2023 |
| 15. | Oil & Grease | mg/L | 1 | IS 3025 (Part 39): 2021 |
| 16. | Aluminium (as Al) | mg/L | 0.2 | IS 3025 (Part 55):2003 |
| 17. | Ammonia (as $NH_3$- N) | mg/L | 0.1 | SEAAL/CHL/SOP/7.2/28 |
| 18. | Anionic Detergents (as MBAS) Calculated as LAS mol.wt. 288.38 | mg/L | 0.1 | IS 3025 (Part 68): 2019 |
| 19. | Barium (as Ba) | mg/L | 0.5 | IS 3025 (Part 65):2025 |
| 20. | Boron (as B) | mg/L | 0.2 | IS 3025 (Part 65):2025 |
| 21. | Calcium (as Ca) | mg/L | 1 | IS 3025 (Part 40):2024 |
| 22. | Chloramines (as $Cl_2$) | mg/L | 1 | APHA (24th Edn) 4500-Cl G : 2023 |
| 23. | Chloride (as Cl) | mg/L | 1 | IS 3025 (Part 32):2025 |
| 24. | Copper (as Cu) | mg/L | 0.05 | IS 3025 (Part 65):2025 |
| 25. | Fluoride (as F) | mg/L | 0.1 | IS 3025 (Part 60/Sec 1): 2023 |
| 26. | Iron (as Fe) | mg/L | 0.1 | IS 3025 (Part 65):2025 |
| 27. | Magnesium (as Mg) | mg/L | 1 | IS 3025 (Part 46):2023 |
| 28. | Manganese (as Mn) | mg/L | 0.05 | IS 3025 (Part 65):2025 |
| 29. | Mineral Oil | mg/L | 0.50 | IS 3025 (Part 39):2021 |
| 30. | Nitrate (as $NO_3$) | mg/L | 1 | IS 3025 (Part 34/Sec 1): 2023 |

| Sr. No. | Parameter | Unit | Detection Limit | Method Reference |
|---|---|---|---|---|
| 31. | Phenolic Compounds (as $C_6H_5OH$) | mg/L | 0.01 | IS 3025 (Part 43/Sec 1): 2022 |
| 32. | Selenium (as Se) | mg/L | 0.002 | IS 3025 (Part 65):2025 |
| 33. | Silver (as Ag) | mg/L | 0.1 | IS 3025 (Part 65):2025 |
| 34. | Sulphate (as $SO_4$) | mg/L | 1 | IS 3025 (Part 24/Sec 1): 2022 |
| 35. | Sulphide (as $H_2S$) | mg/L | 0.01 | IS 3025 (Part 29): 2022 |
| 36. | Total Phosphate (as $PO_4$) | mg/L | 0.1 | IS 3025 (Part 31/Sec 1): 2022 |
| 37. | Total Alkalinity (as $CaCO_3$) | mg/L | 1 | IS 3025 (Part 23): 2023 |
| 38. | Total Hardness (as $CaCO_3$) | mg/L | 1 | IS 3025 (Part 21): 2009 |
| 39. | Calcium Hardness (as $CaCO_3$) | mg/L | 1 | IS 3025 (Part 40): 2024 |
| 40. | Zinc (as Zn) | mg/L | 0.025 | IS 3025 (Part 65):2025 |
| 41. | Sodium (as Na) | mg/L | 1 | IS 3025 (Part 45) : 2024 |
| 42. | Potassium (as K) | mg/L | 0.5 | IS 3025 (Part 45) : 2024 |
| 43. | Sodium Absorption Ratio | - | 0.1 | IS 11624 : 2019 |
| 44. | Cadmium (as Cd) | mg/L | 0.03 | IS 3025 (Part 65):2025 |
| 45. | Cyanide (as CN) | mg/L | 0.01 | APHA (24th Edn) 4500 CN-C,E: 2023 |
| 46. | Lead (as Pb) | mg/L | 0.2 | IS 3025 (Part 65):2025 |
| 47. | Mercury (as Hg) | mg/L | 0.002 | IS 3025 (Part 65):2025 |
| 48. | Molybdenum (as Mo) | mg/L | 0.25 | IS 3025 (Part 65):2025 |
| 49. | Nickel (as Ni) | mg/L | 0.1 | IS 3025 (Part 65):2025 |
| 50. | ***Pesticide Residues*** | | | |
| i. | Alachlor | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| ii. | Atrazine | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| iii. | Aldrin/Dieldrin | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| iv. | Alpha HCH | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| v. | Beta HCH | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| vi. | Butachlor | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| vii. | Chlorpyrifos | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| viii. | Delta HCH | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| ix. | 2,4D chlorophenoxyacetic acid | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| x. | DDT (o,p & p,p- Isomers of DDT, DDE, DDD) | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| xi. | Endosulfan (α, β & Sulphate) | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| xii. | Ethion | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| xiii. | γ HCH (Lindane) | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| xiv. | Isoproturon | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| xv. | Malathion | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| xvi. | Methyl Parathion | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| xvii. | Monocrotophos | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |

| Sr. No. | Parameter | Unit | Detection Limit | Method Reference |
|---|---|---|---|---|
| xviii. | Phorate | µg/L | 0.005 | SEAAL/INS/SOP/7.2/03 |
| 51. | Polychlorinated Biphenyls (PCB) | mg/L | 0.000005 | SEAAL/INS/SOP/7.2/04 |
| 52. | Polynuclear Aromatic Hydrocarbons (PAH) | mg/L | 0.000005 | SEAAL/INS/SOP/7.2/05 |
| 53. | Total Arsenic (as As) | mg/L | 0.002 | IS 3025(Part 37) : 2022 |
| 54. | Total Chromium (as Cr) | mg/L | 0.4 | IS 3025 Part 52 :2003 |
| 55. | Volatile organic Compounds | | | |
| a) | Bromoform | mg/L | 0.005 | SEAAL/INS/SOP/7.2/02 |
| b) | Dibromochloromethane | mg/L | 0.005 | SEAAL/INS/SOP/7.2/02 |
| c) | Bromodichloroethane | mg/L | 0.005 | SEAAL/INS/SOP/7.2/02 |
| d) | Chloroform | mg/L | 0.005 | SEAAL/INS/SOP/7.2/02 |
| 56. | *E.coli* | MPN/100 ml | 2 | IS 1622: 1981 |
| 57. | Total Coliforms | MPN/100 ml | 2 | IS 1622: 1981 |
| 58. | Faecal Coliforms | MPN/100 ml | 2 | IS 1622: 1981 |
| **Marine Water Analysis** | | | | |
| 1. | Temperature | ˚C | 15 | IS 3025 (Part 9):2023 |
| 2. | pH Value | - | 2 | IS 3025 (Part 11): 2022 |
| 3. | Turbidity | N.T.U. | 0.1 | IS 3025 (Part 10) : 2023 |
| 4. | Electrical Conductivity (at 25°C) | µmhos/cm | 10 | IS 3025 Part 14: 2013 |
| 5. | Total Suspended Solids | mg/L | 5 | IS 3025 (Part 17): 2022 |
| 6. | Total Dissolved Solids | mg/L | 10 | IS 3025 (Part 16): 2023 |
| 7. | Dissolved Oxygen | mg/L | 0.2 | IS 3025 Part 38 : 2025 |
| 8. | Biochemical Oxygen Demand (3 days, 27°C) | mg/L | 2 | IS 3025 (Part 44): 2023 |
| 9. | Floating Materials – Oil, Grease and Scum (Including Petroleum Products) | mg/L | 1 | IS 3025 Part 39: 2021 |
| 10. | Nitrite (as $NO_2$) | mg/L | 0.02 | IS 3025 (Part 34/Sec 1): 2023 |
| 11. | Nitrate (as $NO_3$) | mg/L | 1 | IS 3025 (Part 34/Sec 1): 2023 |
| 12. | Phenolic Compounds (as $C_6H_5OH$) | mg/L | 0.01 | IS 3025 (Part 43/Sec 1): 2022 |
| 13. | Ammonical Nitrogen (as $NH_3$-N) | mg/L | 1 | IS 3025 (Part 34/Sec 1): 2023 |
| 14. | Total Nitrogen (as N) | mg/L | 1 | SEAAL/CHL/SOP/7.2/28 |
| 15. | Total Phosphorous (as P) | mg/L | 0.01 | IS 3025 (Part 31/Sec 1): 2022 |
| 16. | Reactive Phosphorous | mg/L | 0.01 | IS 3025 (Part 31/Sec 1): 2022 |
| 17. | Polycyclic Aromatic Hydrocarbon | mg/L | 0.000005 | SEAAL/INS/SOP/7.2/05 |
| 18. | Salinity | ppt | 0.0036 | APHA (24th Edn) 2520 - B: 2023 |
| 19. | Total Chlorophyll | $mg/m^3$ | 0.1 | APHA 24th Edn:10200. H |
| 20. | Total Coliforms | MPN/100 ml | 2 | IS 1622: 1981 |

| Sr. No. | Parameter | Unit | Detection Limit | Method Reference |
|---|---|---|---|---|
| 21. | Faecal Coliforms | MPN /100ml | 2 | IS 1622: 1981 |
| 22. | Phytoplanktons | No./100ml | -- | APHA 24th Edn:10200. F |
| 23. | Zooplanktons | No./100ml | -- | APHA 24th Edn:10200. G |
| **Sediment Analysis** | | | | |
| 1. | Texture | - | -- | SEAAL/CHL/SOP/7.2/21 |
| 2. | Organic Matter | % | 0.1 | IS 2720 (Part 22) :1972 |
| 3. | Total Phosphorus (as P) | mg/kg | 10 | SEAAL/CHL/SOP/7.2/12 |
| 4. | Aluminium (as Al) | mg/kg | 5 | SEAAL/CHL/SOP/7.2/19 |
| 5. | Chromium (as Cr) | mg/kg | 5 | SEAAL/CHL/SOP/7.2/19 |
| 6. | Copper (as Cu) | mg/kg | 1.5 | SEAAL/CHL/SOP/7.2/19 |
| 7. | Iron (as Fe) | mg/kg | 2.5 | SEAAL/CHL/SOP/7.2/19 |
| 8. | Lead (as Pb) | mg/kg | 5 | SEAAL/CHL/SOP/7.2/19 |
| 9. | Manganese (as Mn) | mg/kg | 1.5 | SEAAL/CHL/SOP/7.2/19 |
| 10. | Mercury (as Hg) | mg/kg | 0.10 | SEAAL/CHL/SOP/7.2/19 |
| 11. | Zinc (as Zn) | mg/kg | 1 | SEAAL/CHL/SOP/7.2/19 |
| 12. | Nickel (as Ni) | mg/kg | 2.5 | SEAAL/CHL/SOP/7.2/19 |
| 13. | Benthic Organism | No./$m^2$ | 1 | APHA 24th Edn:10750. B |
| **BDL:** Below Detectable Limit; **LOD**: Limit of Detection | | | | |

***End of Report***