DEENDAYAL PORT AUTHORITY
(Erstwhile: DEENDAYAL PORT TRUST)

दीनदयाल पत्तन प्राधिकरण
DEENDAYAL PORT AUTHORITY

Administrative Office Building
Post Box NO. 50
GANDHIDHAM (Kutch).
Gujarat: 370 201.
Fax: (02836) 220050
Ph.: (02836) 220038

www.deendayalport.gov.in

EG/WK/4751 (CCA Renewal)/ 132

Date: 08/07/2022

To,
The Member Secretary
Gujarat Pollution Control Board
Paryavaran Bhavan,
Sector 10A, Gandhinagar - 382010

Sub: Submission of Environmental statement in format form V for the financial year 2021-22 reg.

Ref.:
1) KPT letter no. MR/GN/1527(Part I)/535 dated 16/6/2012
2) KPT letter no. MR/GN/1527(Part I)/2011 dated 20/5/2013
3) KPT letter no. MR/GN/1527(Part I)/337 dated 17/05/2014
4) KPT letter no. MR/GN/1527/ (Part I)/dated 27/04/2015
5) KPT letter no. EG/WK/EMC/CCA (Part II)/218 dated 27/6/2016
6) KPT letter no. EG/WK/EMC/CCA (Part II)/214 dated 19/6/2017
7) DPT letter no. EG/WK/EMC/CCA (Part II)/294 dated 13/6/2018
8) DPT letter no. EG/WK/EMC/CCA (Part II) dated 27/5/2019
9) DPT letter no. EG/WK/4751 (CCA Renewal) dated 22/5/2020
10) DPT letter no. EG/WK/4751 (CCA Renewal)/14 dated (30)04/(4)5/2021

Sir,

It is requested to kindly refer above cited references for the said subject.

In this connection, it is to state that, the GPCB has renewed the consolidated consent & Authorization granted to Deendayal Port Authority (Erstwhile Deendayal Port Trust) and issued CCA order no. AWH-110594 vide PC/CA-KUTCH-812 (5)/GPCB ID 28494/581914 dated 21/01/2021 valid upto 21/07/2025

In this regard, as per statutory requirement, the DPA has regularly submitted Annual Returns (as mentioned in reference above) in format Form V to the GPCB.

Now please find the enclosed herewith Environmental Statement in Form V for the year 2021-22

This is for kind information and record please.

Encl : As above

Yours faithfully

Manager (Environment)
Deendayal Port Authority

Enclosure – A

Environmental Statement (Form V)
For Deendayal Port Authority, Kandla
For the FY @ 2021-2022

"FORM-V"
(See rule -14)

From:
Deendayal Port Authority,
Administrative Office Building,
Post Box No.: 50, Gandhidham,
Dist.: Kutch – 370 207. Gujarat State.
Tel No.: O: 02836-220038
Fax No.: 02836-220050

To,
The Member Secretary,
Gujarat Pollution Control Board,
Paryavaran Bhavan, Sector - 10A,
Gandhinagar – 382043

Environmental statement for the financial year ending the 31st March, 2022

"PART-A"

1) Name and Address of the owner/occupier of the industry or process		
➢ NAME	:	Mr. Raveendra Reddy Chief Engineer
➢ ADDRESS	:	**Deendayal Port Authority** Administrative Office Building, Post Box No.: 50, Gandhidham, Dist.: Kutch – 370 207. Gujarat State. Tel No.: O: 02836-220038 Fax No.: 02836-220050
➢ Industry Category Primary – (STC code) Secondary – (STC code)	:	Major port Authority under the administrative control of Ministry of Ministry of Ports, Shipping and waterways, GOI
➢ Year of Establishment	:	8th April 1955
➢ Date of the last Environment audit report submitted	:	27th June, 2016

"PART-B"

WATER AND RAW MATERIAL CONSUMPTION

Sr.No.	WATER CONSUMPTION	(M^3/Day)
1.	Process	2030.7
2.	Cooling	
3.	Domestic Purpose	
Total water consumption for the period from April 2021 to March 2022 was **741205.47 KL** hence, average water consumption for per day – **2030.7 M^3/day**		

I. Water Consumption

Sr. No.	Name of Products	Process Water Consumption per unit of products output	
		During the current financial year 2020-21	**During the current financial year 2021-22**
01.	Dry Cargo Handling	**117.558 MT**	**127.10 MT**
02.	Liquid Cargo Handling		
Deendayal Port Authority has only loading & unloading activities for dry cargo and liquid cargo. Hence consumption of process water consumption per unit of output with respective to production is not applicable. During FY 2021-22 Total Cargo Handled is **127.10** MMTPA However, Details of the Domestic water consumption for the financial year 2021-22 please refer **Annexure-1**			

II. Raw material Consumption

Sr.No.	Name of Raw Material	Name of Products	Consumption of Raw material per unit of output	
			During the current financial year 2020-21	**During the current financial year 2021-22**
1.	Deendayal Port Authority has only loading & unloading activities for dry cargo and liquid cargo. Hence consumption of raw material per unit of output with respective to production is not applicable			

"PART-C"

POLLUTION DISCHARGED TO ENVIRONMENT/UNIT OF OUTPUT (PARAMETERS AS SPECIFIED IN THE CONSENT)

Pollutant	Quantity of Pollutant Discharged (mass/day)	Concentration of Pollution in Discharge (mass/volume)	% of Variation from prescribed standard with reasons
Please Refer Annexure -II for Environmental Monitoring Reports of • Ambient Air Quality Monitoring • Drinking Water Quality Monitoring • Marine Water Monitoring • Noise Level Monitoring			

"PART-D"
HAZARDOUS WASTE
[AS SPECIFIED UNDER HAZARDOUS WASTE (MANAGEMNET AND HANDLING) RULES -1989 & AMENDMENT RULES -2008]

Sr.No.	Hazardous Waste	Total Quantity in MT/Year	
		During the current financial year 2020-21	During the current financial year 2021-22
1.	5.1- Waste Residue containing Oil	9874.84	9585.85
2.	5.2- Used Spent Oil		
• Details of Hazardous Waste generated during the financial year 2021-22 please refer Annexure-III			
a. From Process: NA b. From Pollution Control facility: NA			

"PART-E"

SOLID WASTE

Sr.No.	Solid Waste	Total Quantity in MT/year	
		During the current financial year 2020-21	**During the current financial year 2021-22**
1.	From Process	Nil	Nil
2.	From pollution Control Facility	Nil	Nil
a.	Quantity Recycled or Reutilized within the unit	Nil	Nil
b.	Sold	Nil	Nil
c.	Disposed Off	**817.94 MT**	**1724.08 MT**
Details of Solid Waste (Non-Hazardous Waste) generated during the financial year 2021-22 please refer Annexure-IV			

"PART-F"

PLEASE SPECIFY THE CHARACTERISTICS (IN TERMS OF CONCENTRATION AND QUANTUM) OF HAZARDOUS AS WELL AS SOLID WASTES AND INDICATE DISPOSAL PRACTICE ADOPTED FOR BOTH THESE CATEGORIES OF WASTES.

Hazardous Waste:

Companies authorized by Central Pollution Control Board (CPCB) and State Pollution Control Board (SPCB) have been awarded the work of collection, transporting and disposal of hazardous Waste by the Deendayal Port Authority. The same will be hand over to authorize parties for further Treatment & disposal.

Solid Waste:

Garbage facility is provided as per MARPOL Act 73/78 to the vessel berthed at Deendayal Port Authority. Companies authorized by Central Pollution Control Board (CPCB) and State Pollution Control Board (SPCB) have been awarded the work of collection, transporting and disposal of solid waste by the Deendayal Port Authority. The same will be hand over to authorize parties for further treatment and disposal.

"PART-G"

IMPACT OF THE POLLUTION ABATEMENT MEASURES TAKEN ON CONSERVATION OF NATURAL RESOURCES AND ON THE COST OF PRODUCTION.

DPA has awarded Environmental Monitoring Contract to Detox Corporation Pvt. Ltd., Surat for regularly monitoring of ambient air quality monitoring, Noise level monitoring, waste water and Marine water and sediment. Detox is a private laboratory and approved by NABL.

Further for Pollution Abatement measures taken for Conservation of Natural Resources DPA appointed renowned agency i.e M/s. GUIDE, Bhuj for the following work.

1. Regular Monitoring of Mangrove Plantation.

2. Preparation of detailed marine Biodiversity management plan for the impact of the project activities as per the requirement of EC & CRZ Clearance accorded by the MoEF&CC, GOI for the project "Creation of water front facilities (Oil jetties 8,9,10,11) and development of land of area 554 acres for associated facilities for storage at old Kandla, Gandhidham, kutch, Gujarat by M/s Deendayal Port Authority"

3. Regular monitoring of marine ecology in and around the Deendayal Port Authority area and continuous monitoring programme covering all season on various aspects of the coastal environ covering physico-chemical parameters of marine sediments samples coupled with biological indices, as per the requirement of EC & CRZ clearance accorded by the MoEF&CC,GOI to the various projects of the Deendayal port Authority.

4. Study on dredged material for presence of contaminant as per EC and CRZ clearance accorded by the MoEF&CC, GOI dated 19/12/2016 – specific condition vii

"PART-H"

ADDITIONAL MEASURES / INVESTMENT PROPOSAL FOR ENVIRONMENTAL PROTECTION INCLUDING ABATEMENT OF POLLUTION, PREVENTION OF POLLUTION

The allocation made under the scheme of "Environmental Services & Clearance there of other related Expenditure" during BE 2022-2023 is Rs. 345 Lakhs

"PART-I"

ANY OTHER PARTICULAR FOR IMPROVING THE QUALITY OF THE ENVIRONMENT

1. DPA is ISO 140001:2015 certified port for "Providing port facility and related maritime services for vessel and Cargo handling including storage
2. DPT has appointed M/s GEMI, Gandhinagar for the work "Making Deendayal Port a Green Port– Intended Sustainable Development under the Green Port Initiatives". M/s GEMI, Gandhinagar had submitted the Final Report on 10/03/2021
3. DPA has accorded the work of Afforestation project in Deendayal Port Area to Forest Department, GoG which includes plantation and maintenance work of 1100 plants per ha.
4. DPA has accorded the work of green belt development in Deendayal port Authority and its Surrounding areas charcoal site to GUIDE vide its work order dated 31/05/2022
5. DPA has planted 7500 trees in Deendayal port trust area during the year 2014-15 6000 trees during financial year 2016-17 and the same has been regularly maintained.
6. DPA has planted 4000 trees at A.O building, Gopalpuri residential colony and along the road side at Kandla. Further, approximately 885 no. of trees have been planted since September 2015 onwards.
7. Continuous water sprinkling has been carried out on the top of the heap of coal, at regular intervals to prevent dusting, fire and smoke. DPA already installed sprinkling system inside Cargo Jetty area for coal dust suppression in coal yard (40 Ha. Area) at the cost of Rs. 14.44 crores.
8. DPA has installed Mist Canon at the Port area to minimize the coal dust.
9. Deendayal port Authority (traffic department) issued a Circular (SOP) to the trade with regard to control of dust pollution arising out of coal handling and ensuring safety in coal handling. In case of any violations of SOP, provision of impose of penalty of Rs. 10000/- has been made and if violation is repeated thrice, the same will lead to ban of concerned party into port area. The DPA is taking all the measures to reduce coal dust by implementing the coal handling guidelines through port users.
10. All trucks before leaving the storage yard have been covered with tarpaulin and also trucks are also not over loaded as well as there is no spillage during

transportation and there is adequate space for movement of vehicles at the surrounding area.

11. DPA has constantly improving the house keeping in the dry cargo storage yard and nearby approved areas leading to roads. Adequate steps under the provisions of air prevention and control of pollution Act 1981, Environmental Protection Act 1986 are taken.
12. DPA appointed M/s. Detox Corporation, Surat for continuous monitoring of Environmental parameters (Air, Water, Noise etc)
13. DPA commissioned STP of capacity 1.5 MLD for treatment of domestic waste water for entire DPA area.
14. Deendayal Port Authority had carried out mangrove plantation in an area of 1500 ha. through various government agencies like Gujarat Ecology Commission, State Forest Department.
15. It is also relevant to mention here that, DPA entrusted work to Forest Department, GoG (Social Forestry Division, Bhuj) during August, 2019 for green belt development in and around port area 31.942 hectares (approx. 35200 plants at various locations) at a cost of Rs. 352.32 lakhs.
16. DPA is involved in various CER activities like providing the proper sanitation and development of better roads for connectivity
17. DPA is managing its plastic waste as per Plastic Waste Management Rules – 2016 and amendments made therein. In order to strictly implement the said rules, DPT had issued a circular regarding plastic waste minimization, source segregation, recycling etc. vide its Circular no. EG/WK/4751/Part 243(A) dated 03/09/2021

ANNEXURE – 1

WATER CONSUMPTION DETAILS

Statement Showing the quantity of water consumed from GWSSB from April 2021 to March 2022

Sr. No.	Month	Total Quantity Consumed In KL
1.	April 2021	47342.46
2.	May 2021	48920.55
3.	June 2021	47342.46
4.	July 2021	57490
5.	August 2021	67265.75
		2634.25
6.	September 2021	65095.89
		4694.11
7.	October 2021	67265.75
		4794.24
8.	November 2021	65095.89
		4644.11
9.	December 2021	64130
10.	January 2022	58490
11.	February 2022	60756.17
		11343.84
12.	March 2022	63900
Total	**741205.47**	

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SE (PL) and EMC (I/C)

ANNEXURE – 2

ENVIRONMENTAL MONITORING REPORT

ENVIRONMENT MONITORING REPORT OF DEENDAYAL PORT AUTHORITY

(Annual Report)

(March 2021 to February 2022)

(Report No-DCPL/DPA (19-22)/AMR/21-22/02)

Submitted to

Deendayal Port Authority

Prepared by
Detox Corporation Pvt. Ltd.
Detox House, Udhna Darwaja, RingRoad
Surat - 395002

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1. Introduction

The environmental Monitoring plan is the key document in the environmental management system and sets out the detailed targets, objectives and procedures that will be adopted in order to achieve the goals set out in the environmental policy. EMP document is a collation of background information relevant to the Kandla Port Environmental Management and Monitoring Plan (EMMP).

1.1 The Environment (Protection) Act, 1986

The EPA 1986 came into force in all of India in November of 1986, under an official notification. The Act contains 26 sections divided into 4 chapters. The Act has its genesis in Indian Constitution's Article 48(A) and Article 51 (A)g. The Act is a part of Article 253 of the Indian Constitution.

The rules of Environment protection came into force on 19th November1986 and these rules provide for the following:

- The standards of quality of air, soil and water for various areas and purposes of environment.
- The standard set up to know about the limits of the environmental pollutants.
- Rules include the procedure and safeguards needed to handle the hazardous substance.
- Restrictions and some prohibitions on handling the hazardous substances in different areas and premise
- The procedures and safeguards required for the prevention of accidents which may cause environmental pollution and also the remedies for it.
- The prohibition and restrictions possessed on the location of industries in different areas.

1.2 EIA and CRZ Notification

The Ministry of Environment, Forests & Climate Change (MoEF & CC), Government of India, exercising the powers conferred upon it under the provisions of the Environment (Protection) Act, 1986, issued the Environment Impact Assessment Notification, 2006 and its sub sequent amendments.

1.2.1 EIA Notification

The basic objective of the Environment Impact Assessment is to identify, predict, mitigate and communicate the possible impacts due the proposed project to the Government authority and people likely to be affected and incorporate the conditions for construction, operation, maintenance and waste disposal phases of the project to mitigate the negative (adverse) impacts and enhance the positive impacts for the sustainable development of the region.

Environmental Impact NotificationS.O.1533 (E), dtd.14th September2006as amended 2009, issued under Environment (Protection) Act 1986, has made it mandatory to obtain prior environmental clearance (EC)for scheduled development projects. The notification has classified projects under two categories A & B. Category A projects (including expansion and modernization of existing projects) require clearance from The Ministry of Environment, Forests & Climate Change (MoEF & CC), Govt. of India (GoI) and for category B from State Environmental Impact Assessment Authority(SEIAA),constituted by Govt. of India.

Some important features of the said Notification are:

I. Prior Environmental Clearance (EC) is required by all new projects or activities listed in the Schedule of the EIA Notification2006 and subsequent amendments thereafter.EC are required before Commencement of any construction work or preparation of land by the project management.

II. Prior EC is also required by the existing projects or activities if its capacity is likely to exceed the threshold limit mentioned in the said Schedule.

III. All category B projects where general condition does not apply, the project proponents are required to apply to the SEAC who will hear the case according to the procedure laid down in the EIA notification and

based on whose recommendation, EC may be granted or rejected by the SEIAA.

IV. For all category A projects and also category B projects where general condition applies, the project proponents are required to apply directly to The Ministry of Environment, Forests & Climate Change (MoEF & CC), Government of India, who would consider the project for grant or rejection of the EC based on the recommendation of the Expert Appraisal Committee at the central level.

V. If projects attract CRZ clearance, then clearance under CRZ rules is also required.

1.2.2. Coastal Regulation Zone (CRZ)

The Union Cabinet approved the Coastal Regulation Zone (CRZ) Notification,2018 which were last reviewed and issued in 2011. The notification was released after a series of representations received by the Ministry of Environment, Forest & Climate Change (MoEF&CC) from various Coastal States/UTs for a comprehensive review of the provisions of the CRZ Notification, 2011.

1.2.2.1. Classification of CRZ

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

CRZ-I A

CRZ-I A shall constitute the ecologically sensitive areas (ESAs) and the geomorphologic features which play a role in maintaining the integrity of the coast viz.: Mangroves, corals, biologically active mudflats, Marine national parks, turtle nesting grounds etc.

CRZ-I B

The intertidal zone i.e. the area between Low Tide Line and High Tide Line shall constitute the CRZ-IB.

CRZ-II

CRZ-II shall constitute the developed land areas up to or close to the shoreline, within the existing municipal limits or in other existing legally designated urban areas, which are substantially built-up with a ratio of built-up plots to that of total plots being more than 50 per cent and have been provided with drainage and approach roads and other infrastructural facilities, such as water supply, sewerage mains, etc.

CRZ-III

Land areas that are relatively undisturbed (viz. rural areas, etc.) and those which do not fall under CRZ-II, shall constitute CRZ-III, and CRZ-III shall be further classified into following categories:-

CRZ-III A

Such densely populated CRZ-III areas, where the population density is more than 2161 per square kilometer as per 2011 census base, shall be designated as CRZ-III A and in CRZ-III A, area up to 50 meters from the HTL on the landward side shall be earmarked as the "No Development Zone (NDZ)", provided the CZMP as per this notification, framed with due consultative process, have been approved, failing which, a NDZ of200meters shall continue to apply.

CRZ-III B

All other CRZ-III areas with population density of less than 2161 per square kilometer, as per 2011 census base, shall be designated as CRZ-III B and in CRZ-III B, the area up to 200 meters from the HTL on the landward side shall be earmarked as the " No Development Zone(NDZ)".

Land area up to 50meters from the HTL, or width of the creek whichever is less, along the tidal influenced water bodies in the CRZ III, shall also be earmarked as the NDZ in CRZ III.

CRZ-IV

The CRZ-IV shall constitute the water area and shall be further classified as under:

CRZ-IV A

The water area and the sea bed area between the Low Tide Line up to twelve nautical miles on the seaward side shall constitute CRZ-IV A.

CRZ-IV B

CRZ-IV B areas shall include the water area and the bed area between LTL at the bank of the tidal influenced water body to the LTL on the opposite side of the bank, extending from the mouth of the water body at the sea up to the influence of tide, i.e., salinity of five parts per thousand (ppt) during the driest season of the year.

1.2.3. EMMP Plan

As per the guidelines of Ministry of Environment Forests and Climate Change and also as per the environment management plans submitted by various agencies during their EIA studies, DPA has appointed M/s. Detox Corporation Pvt. Ltd. For the work of "Preparing and Monitoring of Environmental Management Plan for Deendayal Port Authority at Kandla vide Work Order No.EG/WK/EMC/11023/2011/IV/213Dated-07/12/2019.

As part of this assignment, M/s. Detox Corporation Pvt. Ltd. prepared an Environmental Management and Monitoring Plan (EMMP) and submitted this EMMP prior to commencement of the Environment Monitoring of Deendayal Port in February2020.The EMMP summarized the background information as are source to develop Environment Monitoring Plan, based on the results of the EIA studies carried out at Deendayal Port by several agencies.
This environmental Management and Monitoring Plan (EMMP) plan submitted in February2020 was the key document in the environmental management system and set out the detailed targets, objectives and procedures that are adopted in order to achieve the goals to efficiently manage the environmental policy of Deendayal Port Authority.

2. DEENDAYAL PORT Authority

Deendayal Port is one of the most important ports of India. This port is situated at Latitude23º01‟N and Longitude70º13‟E on the shores of the Kandla Creek. The Deendayal Port came into existence in the year 1931 with a single Pier construction. Later on with the loss of Karachi port to Pakistan during partition, after independence the Government of India chose Kandla as an ideal sea outlet. Thus the Deendayal Port was developed and since then Deendayal Port has played a pivotal role in enhancing country`s maritime trade.

The Port of Kandla was declared a major port in 1955. The Deendayal Port Authority was created by law in 1963 to manage the new port. In 1978, The Deendayal Port had commissioned the off-shore Oil Terminal facilities at Vadinar jointly with Indian Oil Corporation, by providing Single Buoy Mooring (SBM) system, having a capacity of 54 MMTPA, which was first of its kind in India. Further, significant quantum of infrastructure up-gradation has been effected, excellent maritime infrastructure has been created having capacity of 32 MMTPA by M/s Essar Oil Refinery in Jamnagar district.

The port governed by Deendayal Port Authority (DPA) is a gateway port to the hinterland in western and northern states of Jammu & Kashmir, Delhi, Punjab, Himachal Pradesh, Haryana, Rajasthan, Gujarat and parts of Madhya Pradesh, Uttaranchal and Uttar Pradesh. It is in the district of Kutch and is located on the west bank of Kandla creek which runs into the Gulf of Kutch at a distance of 90 nautical miles from the Arabian Sea. The Port is well connected by the network of rail and road and is a gateway port for export and import of goods for northern states (Map1). The width of the channel varies from 200 meters to 1,000 meters. The contour depth along the shipping channel is around 10 meters. The total length of the Deendayal Port approach Channel is around 23kms. Presently, the Port has sixteen cargo berths for handling dry cargo traffic,

six oil jetties for handling Petroleum Oil products and other liquid cargo traffic at Kandla Creek and 3 Single Buoy Mooring (SBM) at Vadinar for handling crude oil and two product jetties for handling petroleum products.

2.1. Environment Management Policy of Deendayal Port Authority

In 2013, the DPA achieved certification of its Environmental Management System to ISO 14001. In 2019, DPA obtained ISO 14001:2015 certifications. One of the key requirements of the ISO 14001 series is that the systems, plans and controls are under the operational control of the entity committed to managing the activity. The DPA also manages environmental risk to land and marine areas under its control arising from third party industrial activities. While these parties and the associated risks are covered in the risk register, the controls are managed by standalone EMP,s of the third party in accordance with the DPA development Approval Process and /or through direct state or central Government requirements as part of an:

- Environmental Clearance, CRZ Clearance, in the case of a new project; and
- Consent to Establish /NOC for an establishment, and Consent to Operate/NOC for operation of the projects.

2.1.1 The Key Objectives of Deendayal Port Authority

- To provide our Clientele, efficient and economical Port services. To render value for money and value added services to our Customers to their utmost satisfaction.
- To create facilities of international standards, and facilitate quicker turnaround of vessels.To maintain peaceful industrial relations by recognizing our work force as an asset and develop them to adopt to the changing Port scenario.
- To participate in social development by contributing our mite to the society at large.
- To be Environment friendly.

2.2. QHSE Policy of Deendayal Port

Quality, Occupational health, Safety and Environmental Policy (QHSE) of Deendayal Port Authority is the statement of its intentions, principles & commitment in relation to its overall QHSE performance, which provides a frame work for the action and for the setting of QHSE objectives & targets. QHSE policy has been developed through initial status review of quality, Occupational health, Safety and Environment Management comprising of following key areas namely;

- Legislative, regulatory and other requirements
- Identification of equipment and services supporting quality of final services.
- Identification of significant OH&S risks and Environmental aspects.
- Examination of all existing environmental & Occupational health and safety management practices and procedures.
- Evaluation and feedback from the investigation of previous incidents and accidents.

The QHSE policy of Deendayal Port Authority has been communicated at all levels through display in all the relevant places. The policy has also been communicated to external parties by way of displaying it at the main gate of Deendayal Port Authority in Hindi/English/local (vernacular) language.

Management representative of Deendayal Port Authority has established, implemented and maintaining the QHSE management system and continually improves its effectiveness by regular monitoring in accordance with the requirements of this international standard. MR has identified the various processes needed for the QHSE management system and their application throughout the organization.

The sequence and interrelation of these processes are determined to control the effectiveness of these processes & operations. The criteria & methods are determined necessary resources & information/details are made available at the point of use so that operations & processes can be monitored. (Ref: Department Operational Manual and their Process Flow Chart).

Measurement of these processes are timely analyzed and the relevant actions are implemented to achieve planned results & for continual improvement.

2.3. The Physical Environment

Deendayal Port ($23^0$02‟29.92”N, $70^0$13‟08.99”E) is located at the tail end of Gulf of Kachchh (GoK), an east west oriented Gulf system in the western part of Gujarat. It is about 90 nautical miles from the open waters of Arabian Sea. Kandla creek harboring the Deendayal Port is one of the major creeks of the inner Gulf of Kachchh. Gulf of Kachchh (GoK) is 75 km wide at its mouth and after running about 170 km away from the Arabian sea towards east, narrows down into a constriction at 70^0 20‟ E at *Sat Saida*Bet and then bifurcates into many creek systems (Map1).The Little Ran at the tail end of GoK has a network of many small and large creeks, intermingling with marshy tidal flats rich in fine clays. Kandla creek is one of the major tributaries of this creek system, which empties into the inner GoK. All these creeks bring water from the Little Ran into Kandla creek, which has a fairly good depth and stable banks.

Coastal and inland environmental setting of Kandla, similar to other parts of Kachchh, has marked climatological peculiarities like aridity, geomorphology and coastal and terrestrial ecosystems. Annual rainfall in Kachchh district was 458 mm during 2001- 10 whereas it was 443 mm at Gandhidham taluka during the same period which is often irregular. Rain during monsoon is confined to only 15-20 days and occurs as an instant downpour. The mean rainfall in year 2019 was 194mm.

On the terrestrial side there are no major rivers or rivulets or fresh water streams. Winter and summer temperatures range from 7°- 47°C with a yearly average humidity of 60% which increases to 80% during southwest monsoon and decreases to 50% during November-December. Average wind speed is 4.65 m/s with a maximum of 10.61 m/s during June. Drought is a common phenomenon in Kachchh with 2 drought year in a cycle of 5years. Annual temperature fluctuation in the district is extreme, rangingfrom4°Cto 47.5°C.

2.4. Biophysical Environment

a. Creek system

The creek system consists of 3 main creeks the Nakti, the Kandla and the Hansthal, and the Little Gulf of Kutch interconnecting through many other big and small creeks, all along the coast. Very few rivers drain into the Gulf and they carry only a small quantity of freshwater, except during the brief monsoon. They are broad-valleyed and their river bed is mostly composed of coarse sand and gravel. The Gulf is uniquely characterized by numerous hydrographic features like pinnacles, as much as 10 m high. The southern shore has numerous is lands and inlets covered with mangroves and surrounded by coral reefs. The northern shore is predominantly sandy or muddy confronted by numerous shoals.

The Marine water of Gulf of Kutch and its creeks like Kandla creek, Nakti creek and Khori creek are providing the suitable habitat for marine vegetation. The Gulf abounds in marine wealth and is considered as one of the biologically rich marine habitat along the west coast of India. The marine vegetation is highly varied, which includes sand dune vegetation, mangroves, sea grasses, macrophytes and phytoplankton. The dominant species of sand dune flora are *Euphorbia caudicifolia, E. nerifolia, Aloeverasp, Ephedrafoliata, Urochodrasetulosa, Sporobolus maderaspatenus, Eragrostis unioloides, Calotropis procera, Fimbristylis* sp, *Indigofera* sp and*Ipomoea pescaprae*. The common sea grasses found growing on the mud flats are *Halophila*

ovate and *H.beccarii*.

b. Mangroves

Deendayal Port Authority (DPA) is one of the largest ports of India in terms of volume of cargo handled. Among Indian ports, this port also has the largest coastal habitats such as mangroves (193.1km2)and mudflats(312.9 km2). DPA has implemented mangrove plantation in 1500 Ha during2005 - 2017 through various implementing agencies at Sat Saida Bet, Nakti creek and Kantiyajal. The Deendayal Port Authority has enauthorityed the task of evaluating 1500 ha of mangrove plantation in these three locations to Gujarat Institute of Desert Ecology (GUIDE), Bhuj.

Coastal belt in and around Kandla region is characterized by a network of creek systems and mudflats which are covered by sparse halophytic vegetation like scrubby to dense mangroves, creek water and salt encrusted land mass which forms the major land component. The surrounding environment in a radius of 10 km from the Port is mostly built up areas consisting salt works, human habitations and Port related structures on west and north, creek system, mangrove formations and mudflats in the east and south. Deendayal Port and its surroundings have mangroves, mud flats and creek systems as major ecological entities.

Mangrove plantation activity by DPA was initiated in 2005 as mandated by the Ministry of Environment, Forests & Climate Change (MoEF&CC). Subsequently, 1300 ha of mangrove plantation has been completed till the end of 2017 in different years in order to meet the legal mandate of Ministry of Environment, Forests and Climate Change (MoEF & CC). The mangrove plantation activities were carried out at Sat Saida Bet, Nakti creek and Kantiyajal of Bharuch district in South Gujarat. At Sat Saida Bet, Plantation activities were carried out in phased out manner i.e.20 ha during2005-2006, 200 ha during 2011-2012, 300 ha during 2012-2013, and 330 ha during 2013-2014 (Plate1). At Nakti creek plantation was carried out during 2008-2009 and 2010-2011 in 50 ha and 100 ha,respectively(GUIDE,2018).In 2015-17 300 ha by GEC at Kantiyajal, Bharuch District and 2018- 20 by GEC (At Satsaida bet : 50 Ha. And 300 ha at Kantiyajal 50 Ha Taluka : Hansot, District : Bharuch). In 2020-2021 -100 ha GEC, Gandhinagar.

A. marina was the preferred species for plantation activities in all the three locations due to prevailing high salinity and high success rate of this species. At Nakti creek *Rhizophora mucronata* and *Ceriops tagal* were also planted in small numbers along with*A. marina*. Likewise, at Kantiyajal attempts were made for planting *R.mucronata*a long with *A.marina*.

c. Marine Fauna

In the marine environment of Deendayal Port, there are eleven species of mollusca, seven species of shrimps (Prawn) and seven species of annelids. Besides these, there are twelve groups of phytoplankton, 7 groups of zooplanktons. The density of meio-fauna ranged from 382 to 670 nos/10cm^2. The density of benthic macro fauna ranged from 952 to 1092 no/m^2.Thedominant macro-faunal group was porifera (Mantec, 2014).

d. Terrestrial Biodiversity

Sensitive ecological habitats like forest, grassland, agricultural land, wetlands are absent within and in the proximity of the Deendayal Port due to its highly built-up nature. The species richness and abundance of aquatic birds and terrestrial fauna (reptiles, mammals) in the port environ and its surrounding was low with least conservation significance.

There are 11 species of herpetofauna (reptiles and amphibians), 53 species of terrestrial birds, 49 species of aquatic birds in the Port Environs. Due to absence of forest habitat in the immediate vicinity of Deendayal Port, only nine species of mammals were recorded with very low abundance.

3.0 Environment Management Plan

Port activities can often affect the quality of air, noise and marine water in the surrounding areas due to the wide range of port operation activities. For the determination of environment quality, need for identification of sources, control and disposal of waste from various point and non-point sources and for prediction of various parameters of sound environmental quality, regular monitoring and assessment are required.

The Environment management plan is the key document in the environmental management system and sets out the detailed targets, objectives and procedures that will be adopted in order to achieve the goals set out in the environmental policy.

It is extremely essential that port and harbour projects should have an environmental management plan (EMP), which also incorporates monitoring of air, noise, soil and marine water quality along with the collection of meteorological data.

Deendayal Port Authority targets the achievement of high environmental standards and strives to ensure that activities within the Port are environmentally and ecologically sustainable and have minimal impact on the natural environment.

Several developmental projects have been initiated and EIAs have been carried out for the said projects. These EIA studies have also submitted the suggestions on the environmental management of the project area and Deendayal Port in general. These suggestions and mitigation measures have also been considered in framing the current environment management plan.

The present Environment Management Plan summarizes the suggestions of the ECs received from the Ministry of Environment, Forests & Climate Change (MoEF & CC), and consents granted by Gujarat Pollution Control Board(GPCB).

The projects for which ECs were granted and which formed the frame work of the present EMP are as below;

- EC and CRZ Clearance for Construction of 13th to 16th Cargo berth at Kandla in year 2008
- EC & CRZ clearance for development of plots for construction of liquid storage tank farms at Kandla, district Kutchinyear2009
- Environmental and CRZ Clearance to DPA for development of plots for construction of warehouses/Godowns (stage II) in year2012.
- Environmental and CRZ clearance for Single Point Mooring (SPM) and Allied facilities off Veera in the Gulf of Kachchh for handling Crude Oil on BOT basis in year 2013.
- Developing seven integrated facilities within the Existing Kandla port at Kandla, Gujarat–December2016
- Proposed Smart Industrial Port City (SIPC) at green Field Site 1 (Adipur side– Northeast of Antarjaal, South of Tagore Road, 580Acres),Gandhidham, Kutch-Gujarat"-October2017
- Proposed Smart Industrial Port City (SIPC) at Green Field Site 2 (DPA Complex, 849.96Acres), Gandhidham, Kutch –Gujarat.–October2017.
- Construction of Interchange cum road over bridged (SIA/GJ/NCP/19832/2017)
- Creation of water front facilities of oil jetties of 8,9,10 & 11 & development of land (1432 areas) (IA/GI/MIS/61679/2017)
- Development of plots for constructing of warehouse/ godowns ad measuring 11,50,000 m2 area at outside west gate no 1 on national highway no 8A at Kandla (SIA/GJ/MIS/122861/2019)

- Up gradation of Barge handling facility at Sunder Basin at Kandla
- Multipurpose Cargo Terminal at Tekra off Tuna on BOT basis
- Construction of Rail Over Bridge at NH-8A near Nakti Bridge (crossing of NH 8A)
- Strengthening of oil jetty no. 1
- Modification and strengthening of Cargo Berth no. 6 at Kandla Port Trust
- Container terminal Tuna Tekra (Capacity 2.19 Million TEUs)
- Railway line (NH 8A to Tuna 11 km)
- Construction of port craft jetty & SNA section
- Development of integrated facility stage II (IA/GJ/MIS/27227/2015)
- Setting up 7th oil jetty at old Kandla
- Setting up Barge jetty at Veera
- Setting up Barge jetty at JafraWadi
- One administrative building at Tuna Tekra
- Construction of 15.5 km long road from Veera Barge Jetty to Tuna Gate
- Single point Mooring and allied facilities off Veera in Gulf of Kutch for handling crude oil on BOT basis in the state of Gujarat (IA/GJ/MIS/178779/2020)

Table: 1 Yearly Monitoring schedule

Yearly Monitoring schedule				
Sr. No	**Sampling Activity Description**	**Locations**	**Monthly Monitoring**	**Yearly Monitoring**
1	Ambient Air	6 locations (Kandla)	8	96
		2 locations (Vadinar)	8	96
2	Drinking Water	18 locations (Kandla)	1	12
		2 locations (Vadinar)	1	12
3	Waste water	2 locations (Gopalpuri Township & Kandla)	4	48
		1 location (Vadinar)	4	48
4	Soil	4 locations (Kandla)	1	12
		2 locations (Vadinar)	1	12
5	Noise	10 locations (Kandla)	1	12
		2 locations (Vadinar)	1	12
6	Marine Water sampling for Physico - Chemical Parameters, Biological parameters and sediments (Twice a month)	8 Locations (6- Kandla & 2- Vadinar)	2	24

4. Environment Monitoring Plan

Environment Monitoring Plan is very important for monitoring the environmental status of the port for sustainable development. The EMP mainly consists of monitoring of the Air quality, Marine water quality, Ecological and Biological quality and Noise quality of the Deendayal Port area. The monitoring program is also required to suggest suitable mitigation measures for the deviation found in the results of the monitoring, so as to keep the pollution level with in control.

The list of main elements for which Environmental monitoring is carried out is mentioned below.

- Air Quality Monitoring
- Drinking Water Monitoring
- Noise Monitoring
- Marine Water Monitoring
- Soil Monitoring
- Sewage Treatment Plant Monitoring
- Meteorological Monitoring

M/s Detox Corporation Pvt. Ltd. appointed by Deendayal Port Authority will carry out monitoring of the various environmental aspects of the port with following objectives;

- To review the locations of ambient air and marine water quality monitoring stations within the impacted region in and around DPA establishment, in view of the developmental projects.
- To assess the ambient air quality and marine water quality at selected stations in terms of gases and particulate matter, physical, chemical and biological parameters for the assignment period.
- To assess the marine water quality in terms of aquatic flora and fauna and sediment quality in terms of benthic flora and fauna.
- To assess the trends of air and water quality by comparing the data collected over a specified time period.
- To assess the trends of water quality in terms of marine ecology by comparing the data collected over a specified time period.
- To review the results and to check compliance with environmental quality standards.
- To suggest mitigation measures, if necessary, based on the findings of this study.
- To recommend future action plans on air and marine water quality monitoring programmed based on the findings of this study.
- Drinking Water samples at twenty stations will also be monitored for various physical, chemical and biological parameters viz., color, odor, turbidity, conductivity, pH, EC, total dissolved solids, chlorides, total hardness, iron, sulfate, NH3N, PO4, Turbidity, salinity, BOD, Hardness, Calcium, Magnesium, Sodium, Potassium, metals and bacterial count on a monthly basis.
- Every week a sample (inlet and outlet) of the Sewage Treatment Plant (STP) shall be analyzed to see the water quality being discharged by DPA. However, the results will be submitted every month. If in a particular month any deviation is observed, the same shall be submitted immediately to the Employer.
- Noise monitoring will be carried out twice a day at the representative stations for a period of 24 hours. A report of the same will be submitted to DPA.
- Meteorological parameters are very important from air pollution point of view and precise and continuous

data collection is of utmost importance. The data collected is analyzed as per the standards. Meteorological data on wind speed, wind direction, temperature, relative humidity, solar radiation and rainfall will be collected from one permanent station at DPA and one permanent station at Vadinar.

- All Locations & Monitoring parameters are tentative and subject to change as per GPCB/CPCB/MoEF &CC Guideline.

4.1 Selection of Sampling Locations

Sampling locations have been selected by Deendayal Port Authority considering various activities of Deendayal Port Authority and its environs and various Environment Impact Assessment Studies carried out in Deendayal Port. The sampling locations of various air, water and marine water surveys will be reviewed periodically and may be altered if required as per the suggestions/discussions with the Deendayal Port Authority and Environmental consultants engaged by the Deendayal Port Authority.

The major components of the monitoring are:

4.1.1. Air Quality Monitoring

Air Monitoring is done at eight fixed locations in port area. The description of stations is depicted in Table1. The monitoring cycle at all eight monitoring stations is twice in a week.

Method of Monitoring

Sampling and analysis will be carried out as per CPCB guidelines for Ambient Air Quality monitoring. The monitoring is carried-out for air quality parameters mentioned in the National Ambient Air Quality Standards (NAAQS), CPCB Notification published in 2019. Sampling for Particulate Matter PM_{10}, $PM_{2.5}$ and Total Suspended Particulate Matter (TSPM) is done for a twenty four hour period.

Frequency of AAQ Monitoring

The monitoring cycle at all eight monitoring Stations is twice in a week. Sampling for Particulate matter (PM_{10}, $PM_{2.5}$) and total suspended particulate matter is done for a twenty four hour period. Sampling for gaseous samples like SO_x, NOx will be done for a twenty four hour period with sample collection at every eight hour. Table 2 gives description of Ambient Air Monitoring Stations.

Table 2: Ambient Air Monitoring Stations

Sr. No.	Location	Station Description	Location Codes
1	6 Stations at Kandla	Marine Bhavan	AL-1
2		Oil Jetty	AL-2
3		Kandla Port Colony	AL-3
4		Gopalpuri Hospital	AL-4
5		Coal Storage Area	AL-5
6		Tuna Port	AL-6
7	2 Stations at Vadinar	Signal Building	AL-7
8		Vadinar Colony	AL-8

4.1.2. Monitoring of Drinking Water Quality Method of monitoring

The sampling and analysis will be done as per standard methods IS 10500:2012. The water samples will be analyzed for various parameters via; Color, Odor, Turbidity, Conductivity, pH, Chlorides, TDS, Total hardness, Iron, Sulphate, Salinity, Biological Oxygen Demand (BOD), Chlorides, Sodium(Na), Potassium(asK+), Calcium(asCa), Magnesium(Mg), Fluorides (F), Nitrate (NO_3), Nitrite (NO_2), Manganese (Mn), Iron (Fe), Chromium(Cr_6+), Copper(asCu), Cadmium(Cd), Arsenic(As), Mercury(Hg), Lead (Pb), Zinc (Zn), CFU, & bacterial count. The method will be manual at all monitoring stations.

- **Frequency of Drinking Water Monitoring:**

  The monitoring at all twenty drinking water stations will be done monthly once.

- **Drinking Water Monitoring Stations**

  A list of locations for collecting the drinking water samples is depicted in Table 3.

Table 3: Monitoring locations for Drinking Water

Sr. No	Monitoring Locations	Location Code		Sr. No	Monitoring Locations	Location Code
Location at Kandla				11	Hospital Kandla	DW-11
1	Nirman Building1	DW-1		12	A.O. Building	DW-12
2	P& C Building	DW-2		13	School Gopalpuri	DW-13
3	Main Gate(North)	DW-3		14	Guest House	DW-14
4	Canteen	DW-4		15	E-Type quarter	DW-15
5	West gatel	DW-5		16	F-type quarter	DW-16
6	Wharf area	DW-6		17	Hospital Gopalpuri	DW-17
7	Sewasadan-3	DW-7		18	Tuna Port	DW-18
8	Workshop	DW-8		**Locations at Vadinar**		
9	Custom building	DW-9		19	Nr. Vadinar Jetty	DW-19
10	Port Colony Kandla	DW-10		20	Port colony	DW-20

4.1.3. Monitoring of Marine Water Quality and Biological Parameters Methodology for Physico-chemical Monitoring

Water samples will be collected for analyzing physico-chemical and biochemical parameters viz. pH, Temperature, Colour, Odour, Salinity, Turbidity, SS, TDS, TS, DO, COD, BOD, Silicate, PO_4, SO_4, NO_3, NO_2, Ca, Mg, Na, K, Iron (as Fe), Chromium (as Cr), Copper (As Cu), Arsenic (as As),Cadmium (as Cd), Mercury (Hg), Lead (as Pb), Zinc (as Zn), petroleum hydro carbons, trace metals total coliform & fecal coliform.

Methodology for Biological Monitoring

Sampling will be conducted from sub surface layer in high tide period and low tide period of the tide from all sampling stations during consecutive spring tide and neap tide.

Net sampling for qualitative evaluation of mixed plankton will be conducted only once during between maximum high water and slack water and maximum low water and Slack water.

Sediment sampling for qualitative and quantitative evaluation of benthic organisms will be conducted only once during one tidal cycle during maximum low water and slack water.

The collected samples will be first collected in a clean bucket to reduce the heterogeneity. From the collected water sample 1 liter of water sample will be taken in an opaque plastic bottle for chlorophyll estimation. Quantitative plankton samples will be collected by filtering rest of the water sample using plankton net of 20µm mesh size.

Methodology adopted for Plankton sampling

Mixed plankton sample for qualitative evaluation will be obtained from the sub surface layer, at each sampling locations by towing the net horizontally with the weight during highest high tide and slack period and lowest low tide and slack period. After the tow of about 15-20 minutes at speed of 1- 1.5 m/s. For quantitative evaluation 50 L sample will be collected from the sub surface during high tide and low tide period will be filtered through 20 µm mesh size net assembly.

Methodology adopted for benthic fauna sampling

Van veen sampler (0.1 m^2) will be used for sampling bottom sediments during lowest low tide. The fixation of benthic fauna will be normally done by bulk fixation of the sediment sample. The bulk fixation will be done by using 10% formalin (buffered with borate) with Rose Bengal as stain. The organisms will be preserved with sea water as diluting agent.

Frequency

Phytoplankton (Qualitative & Quantitative) Zooplankton (Qualitative & Quantitative) & Benthos (Qualitative & Quantitative) samples will be collected during high tide and low tide during each spring and neap tides of the month.

Sampling Stations

The monitoring of marine environment for the study of biological and ecological parameters will be carried out in harbour regions of DPA (Table3) during Spring tide period of full moon phase of Lunar Cycle.

Table 4: Sampling Locations for Marine Monitoring

Sr.No	Monitoring locations	Location Code
Locations at Kandla		
1	Near passenger Jetty One	ML-1
2	Near Berth No.8&9	ML-2
3	Kandla Creek Near KPT colony	ML-3
4	Near13th&14thBerth	ML-4
5	Nakti Creek Near Tuna Port	ML-5
6	Nakti Creek Near NH-8A Bridge	ML-6
Locations at Vadinar		
7	Nr.SBM 2	ML-7
8	Nr. Vadinar Jetty	ML-8

4.1.4. Noise Monitoring

Noise sources in port operations include cargo handling, vehicular traffic, and loading / unloading of cargo to/from ships. Noise Monitoring will be done at 10 stationsat Kandla, and three locations in Vadinar.

Method and Frequency of monitoring

Sampling will be done at all stations for 24 hour period once in month. Data will be recorded using automated sound level meter. The intensity of sound will be measured in sound pressure level (SPL) and common unit of measurement is decibel (dB).

Sampling Stations

The sampling locations for noise monitoring as listed in table 5.

Table 5: Locations for Noise Monitoring

Sr. No	Name of locations	Location Code		Sr. No	Name of locations	Location Code
Locations at Kandla				8	Nirman Building 1	NL-8
1	West Gate no 1	NL-1		9	Tuna Port	NL-9
2	Main gate(North)	NL-2		10	Port & customs office	NL-10
3	Wharf area/Jetty Area	NL-3		**Location at Vadinar**		
4	Main road/Central Road	NL-4		11	Nr. Port Gate-Vadinar	NL-11
5	Canteen Area	NL-5		12	Nr. Vadinar Jetty	NL-12
6	ATM building	NL-6		13	Port colony Vadinar	NL-13
7	Marine Bhavan	NL-7				

4.1.5. Soil Quality Monitoring

Soil quality monitoring is important for evaluating the effects of environment management practices of a region/area.

Method of Monitoring

The soil samples will be collected from four locations in Kandla and two locations in Vadinar Port. The soil samples will be filled in polythene bags, labeled in the field with number and site name and taken to the laboratory for analysis (as per IS 2720). Physical and chemical properties of soil at selected locations will be studied.

Frequency of monitoring

Sampling will be done at all stations in Kandla and Vadinar once in a month.

Soil Quality Monitoring Stations

List of the locations for collecting the soil samples are as per Table 6.

Table 6: List of sampling locations for Soil Quality Monitoring

Sr. No	Name of locations	Location Code
Locations at Kandla		
1	Tuna Port	SL-1
2	IFFCO Plant	SL-2
3	Khori Creek	SL-3
4	Nakti creek bridge at NH-8A	SL-4
Location at Vadinar		
5	Nr. Vadinar Port Office	SL-5
6	Nr. Vadinar Colony	SL-6

4.1.6. Monitoring of performance of the Sewage Treatment Plant (STP) at Gopalpuri Township, Deendayal Port & Vadinar

The principal objective of waste water treatment is generally to allow human and industrial effluents to be disposed off without danger to human health or unacceptable damage to the natural environment.

Method of Monitoring

The parameters monitored will be pH, BOD, COD, residual chlorine, MLSS, MLVSS and TSS. The data collected will be analyzed as per the standards. The performance of the Sewage Treatment plant will be studied by collecting samples of the aeration tank and effluent tank.

Frequency of monitoring

Sampling will be done at all stations from inlet, aeration tank and outlet of an STP once in week.

Monitoring Stations:

Lists of the location for collecting the STP samples are as per table 7.

Table 7: List of sampling locations for STP

Sr. No	Sampling location
1	STP at Kandla
2	STP at Gopalpuri
3	STP at Vadinar

5. Monitoring Results

Based on the EMMP submitted, M/s Detox Corporation Pvt. Ltd. carried out monitoring of the following environmental aspects of the port for the period of March 2021 to February 2022.

5.1 Ambient Air

The monitoring was carried out twice a week. The results obtained from the sampling and analysis is submitted to Deendayal Port authority on monthly basis. The monthly averaged and annual results for the ambient air monitoring are given in the sections followed.

I. Total Suspended Particulate Matter (TSPM)

The frequency of sampling was twice a week for every sampling station.

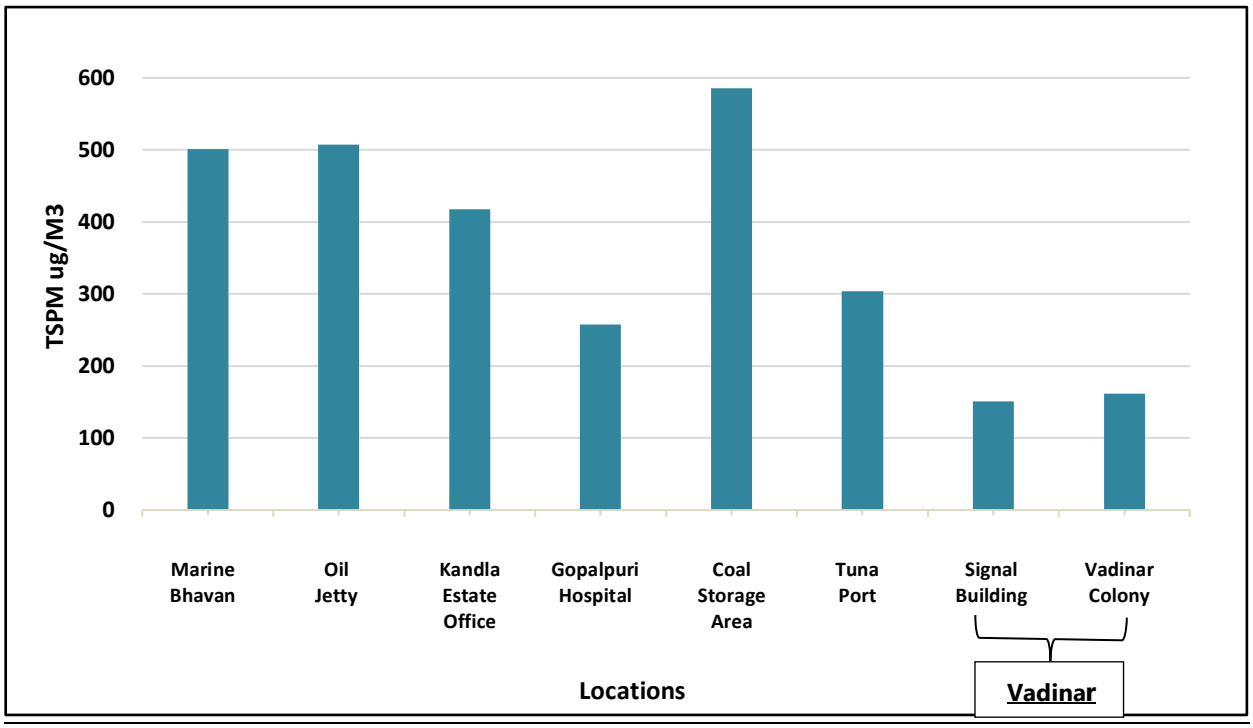
Table 8. TSPM (in µg/m^3) values at monitoring locations in Kandla and Vadinar Port

Months	Marine Bhavan	Oil Jetty	Kandla Estate Office	Gopalpuri Hospital	Coal Storage Area	Tuna Port	Signal Building	Vadinar colony
Mar-21	530	447	328	266	435	165	147	157
Apr-21	642	617	449	198	779	385	152	171
May-21	966	752	570	352	1341	273	134	161
Jun-21	374	312	267	173	596	125	59	60
Jul-21	467	578	463	307	354	372	105	146
Aug-21	495	520	488	229	548	347	155	138
Sep-21	449	554	341	194	324	238	164	169
Oct-21	364	465	402	274	527	362	157	211
Nov-21	460	489	487	357	598	387	219	205
Dec-21	442	480	427	251	518	362	176	183
Jan-22	417	480	417	251	484	348	164	164
Feb-22	412	393	371	243	523	284	171	186
Annual Mean	**502**	**507**	**418**	**258**	**586**	**304**	**150**	**163**

The mean TSPM values were highest at Coal Storage location and Marine Bhavan, followed by Oil Jetty. TSPM values were least at both the locations of Vadinar Port. The major cause of TSPM values at Coal Storage and Marine Bhavan is large amount of coal is handled at Berth No. 6, 7, 8and use of grabs for unloading of coal directly in the truck cause coal to spread in air as well as coal dust to fall on ground. This settled coal dust again mixes with the air during trucks movement through hit.

Also, the coal laden trucks are not always covered with tarpaulin sheets and these results in spillage of coal from trucks/dumpers during its transit from vessel to yard or storage site.

Fig 1. Observed values (annual mean) of TSPM at all eight monitoring stations



Interpretation of Results

- Maximum TSPM of 1341.0 µg/m^3 was recorded in the month of May"21 at Coal storage site and the minimum value was recorded in the month of June„21at Tuna Port 125.0µg/m$^{3.}$
- At Vadinar, maximum TSPM of 219 µg/m^3 was recorded in the month of November at Vadinar Signal Building site and the minimum value was recorded in the month of June "21 at Vadinar Signal Building (59µg/m^3).

II. Particulate Matter (PM_{10})

PM_{10} is particulate matters which are 10 micrometers or less in diameter. The frequency of sampling was twice a week for every sampling station.

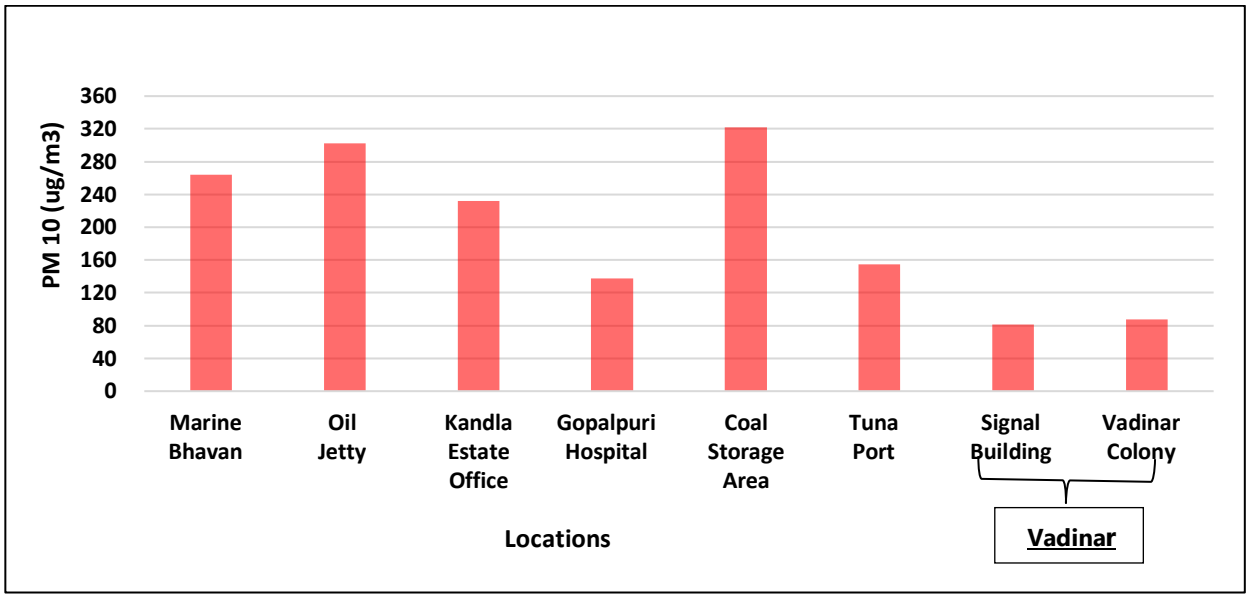
Table 9. PM_{10} (in µg/m^3) values at monitoring locations in Kandla and Vadinar Port

Months	Marine Bhavan	Oil Jetty	Kandla Estate Office	Gopalpuri Hospital	Coal Storage Area	Tuna Port	Signal Building	Vadinar colony
Mar-21	130	103	90	98	163	68	73	79
Apr-21	239	225	99	89	327	76	53	66
May-21	607	611	559	176	1149	160	73	99
Jun-21	130	82	69	52	140	59	33	33
Jul-21	373	496	366	230	206	250	75	81
Aug-21	262	322	276	133	327	217	98	77
Sep-21	333	442	211	123	200	126	97	95
Oct-21	190	246	219	140	203	163	82	116
Nov-21	193	190	217	187	292	195	115	108
Dec-21	245	263	243	142	295	194	88	98
Jan-22	227	437	217	142	264	184	93	97
Feb-22	237	213	215	139	300	161	98	104
Annual Mean	**264**	**303**	**232**	**138**	**322**	**154**	**82**	**88**

The mean PM_{10} Values were highest at Coal Storage location and Marine Bhavan, followed by Oil Jetty. PM_{10} values were least at both the locations of Vadinar Port. Higher PM_{10} values at Coal Storage and Marine Bhavan is a result of large amount of coal handling and its inappropriate transportation methods.

Coal laden trucks are seldom covered with tarpaulin sheets and these results in spillage of coal from trucks/dumpers resulting into higher PM_{10}values.

Fig 2. Observed values (annual mean) of PM_{10}at all eight monitoring stations



Interpretation of Results

- Maximum value of PM_{10} of 1149 µg/m^3 was recorded in the month ofMay"21 at Coal storage site and the minimum value was recorded in the month of June 2021 at Tuna Port 59.0µg/m^3.
- In Vadinar, maximum value of PM_{10} of 116 µg/m3 was recorded in the month of October 2021 at Vadinar Colony and the minimum value was recorded in the month of june- 2021atVadinarColony & Signal Building (33.0 µg/m3).

III. Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ particles are air pollutants with a diameter of 2.5 micrometers or less, small enough to invade even the smallest airways. $PM_{2.5}$ was also monitored twice a week for every sampling station.

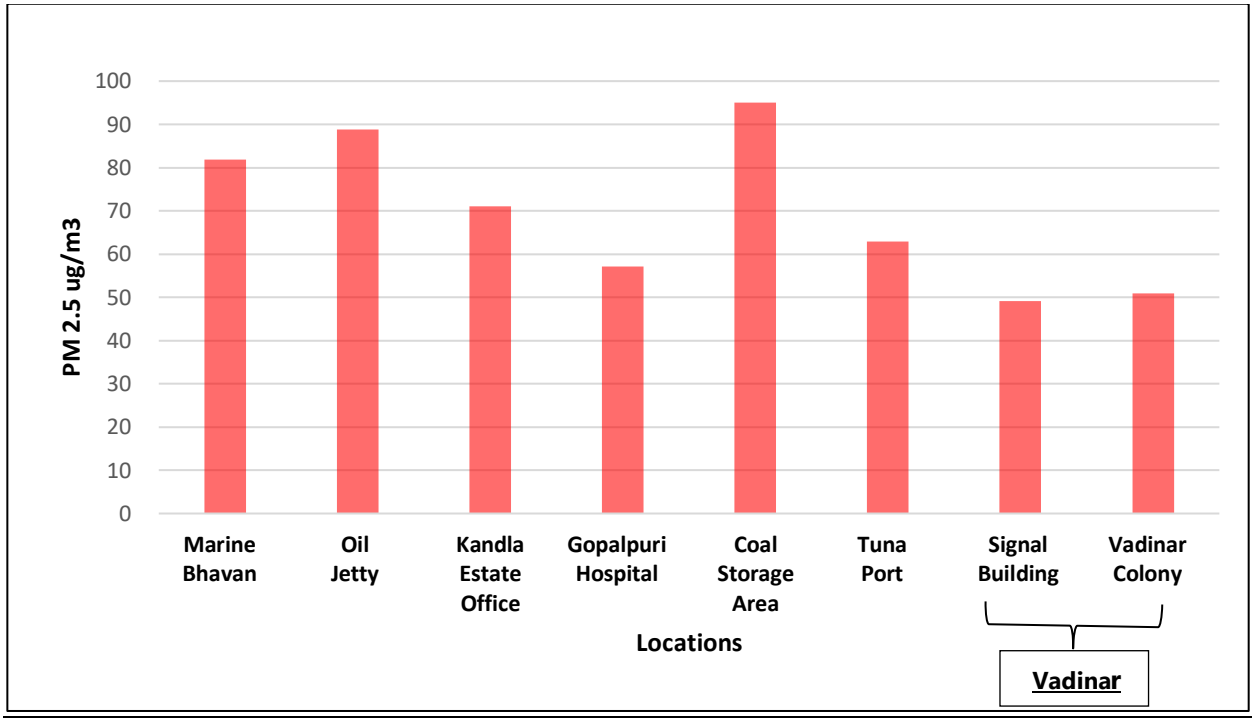
Table 10. $PM_{2.5}$ (in µg/m^3) values at monitoring locations in Kandla and Vadinar Port

Months	Marine Bhavan	Oil Jetty	Kandla Estate Office	Gopalpuri Hospital	Coal Storage Area	Tuna Port	Signal Building	Vadinar colony
Mar-21	56	50	34	29	67	24	21	41
Apr-21	73	52	44	15	101	18	35	17
May-21	41	37	40	27	102	23	33	36
Jun-21	108	113	61	33	138	33	38	22
Jul-21	89	47	56	63	40	58	40	44
Aug-21	71	73	71	51	80	63	39	45
Sep-21	81	83	60	46	80	55	44	42
Oct-21	82	89	90	79	105	96	49	70
Nov-21	90	97	97	87	104	98	84	82
Dec-21	104	102	98	87	101	93	71	75
Jan-22	95	232	99	87	111	79	66	60
Feb-22	92	90	102	82	112	114	69	76
Annual Mean	**82**	**89**	**71**	**57**	**95**	**63**	**49**	**51**

Average $PM_{2.5}$ values were highest at Oil Jetty location (mean=232.0 µg/m^3) followed by Coal Storage Area

(mean =138.0 µg/m^3) and Gopalpuri Hospital (mean=57.0 µg/m^3). $PM_{2.5}$ values At Vadinar Port the $PM_{2.5}$ values were significantly lower.

Fig 3. Observed values (annual mean) of $PM_{2.5}$ at all eight monitoring stations

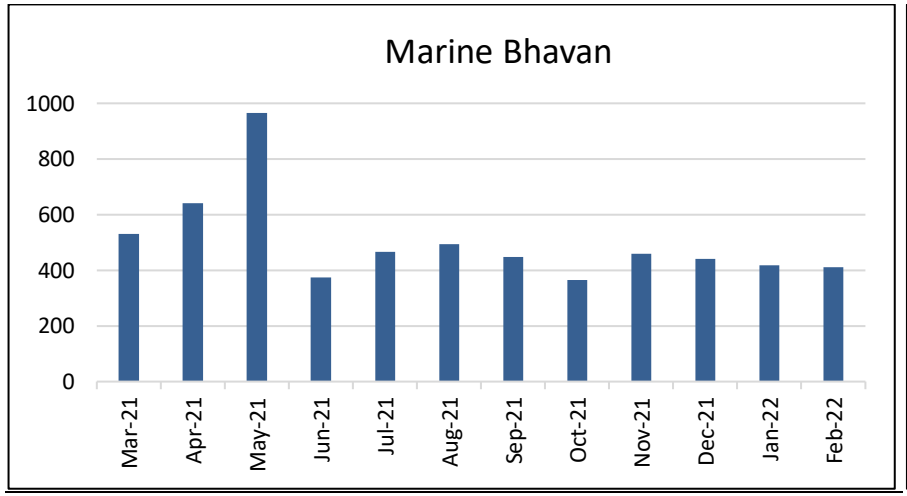


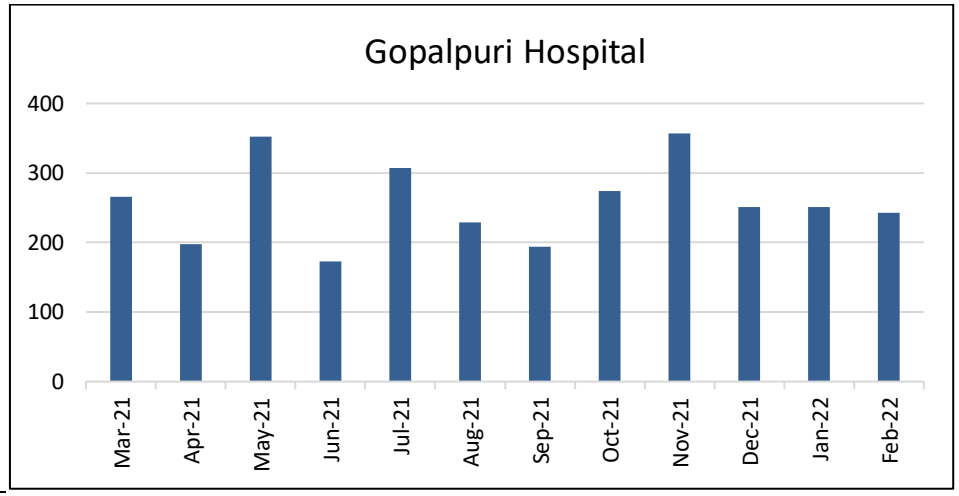
Interpretation of Results

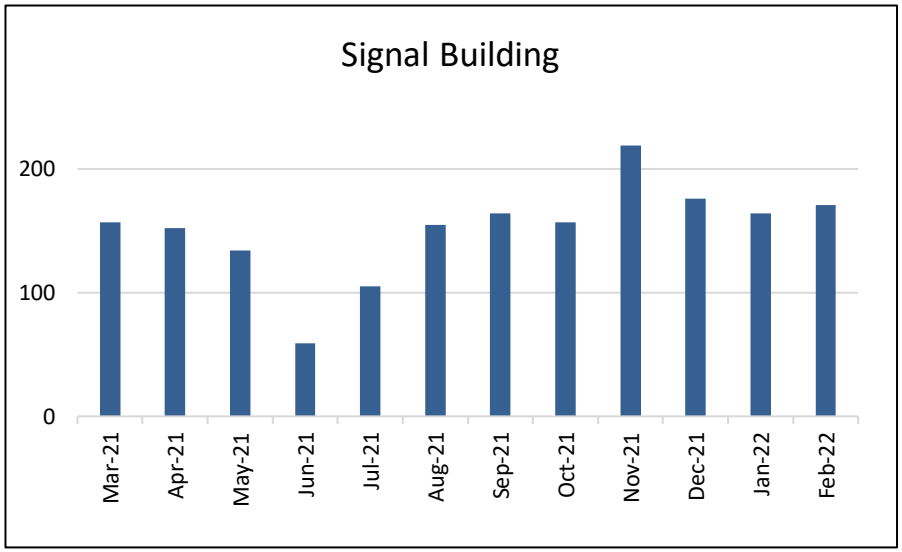
- Maximum value of $PM_{2.5}$232.0 µg/m^3) was recorded in the month of January 2022 at Oil Jetty site and the minimum value was recorded in the month of May 2021 at Gopalpuri Hospital (27.0µg/m^3).
- Annual mean values of $PM_{2.5}$ were highest at Coal Storage Area (95.0µg/m^3).
- In Vadinar, maximum value of $PM_{2.5}$ of 84.0 µg/m^3 was recorded in the month of November‟ 21 at Signal building site and the minimum value was recorded inthe month of April at Vadinar Port colony (17.0µg/m^3).

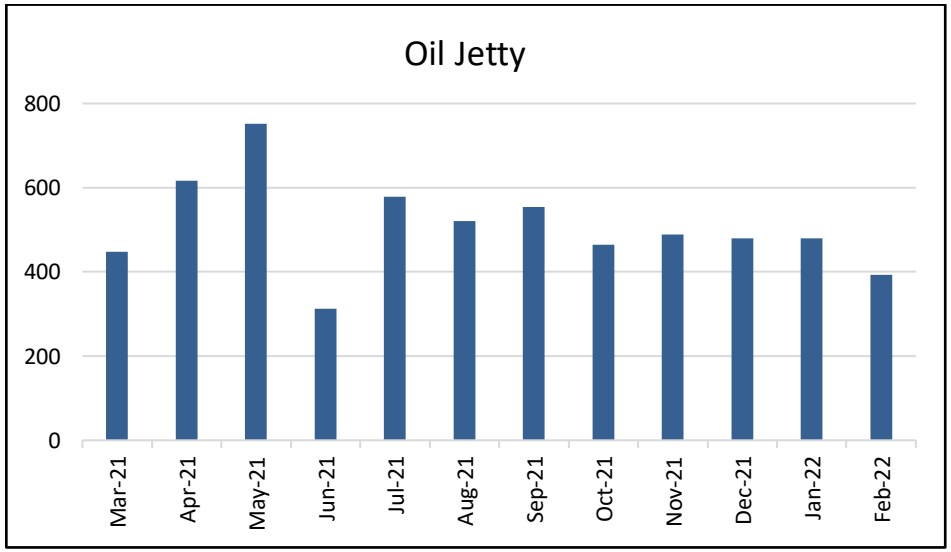
  Location wise graphs depicting trends in TSPM, PM_{10} and $PM_{2.5}$ in all locations of Kandla and Vadinar Port are depicted in 1 to 3.

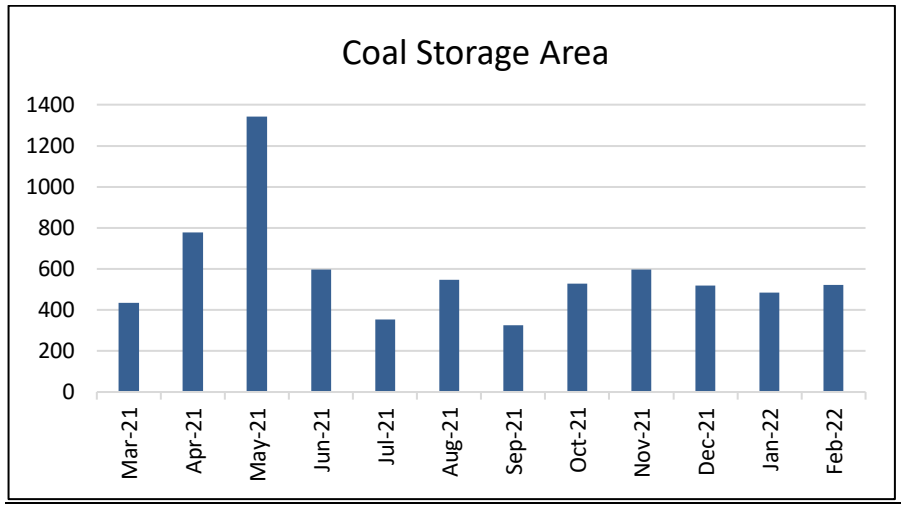
Fig 4. Trend in TSPM values of various AAQ Monitoring Locations

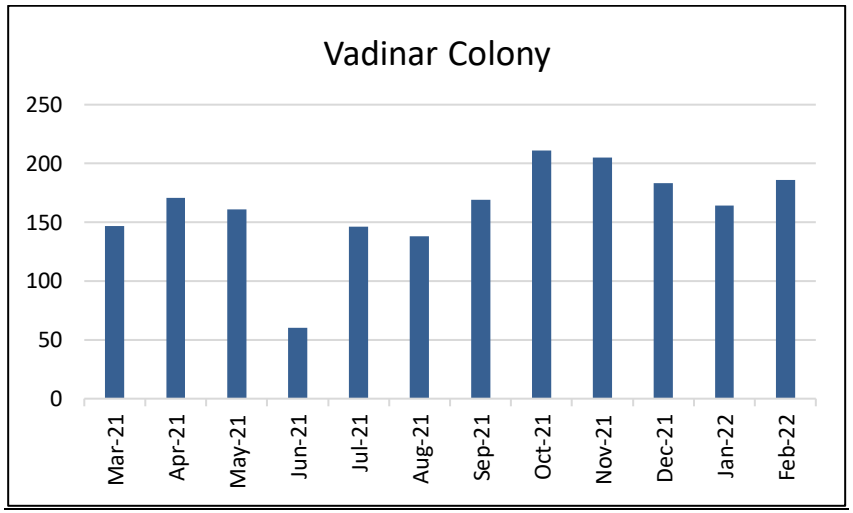


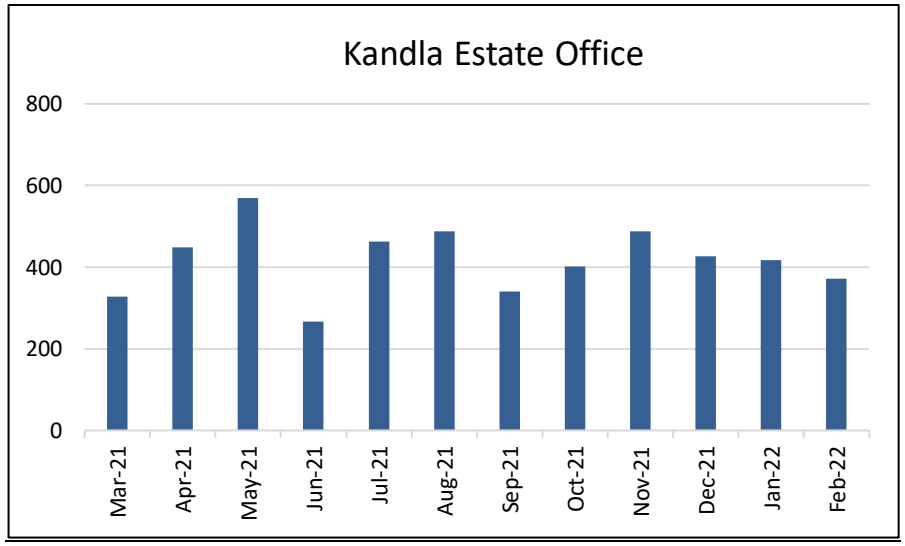







Coal Storage Area
1400
1200
1000
800
600
400
200
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22


Vadinar Colony
250
200
150
100
50
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22


Kandla Estate Office
800
600
400
200
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22

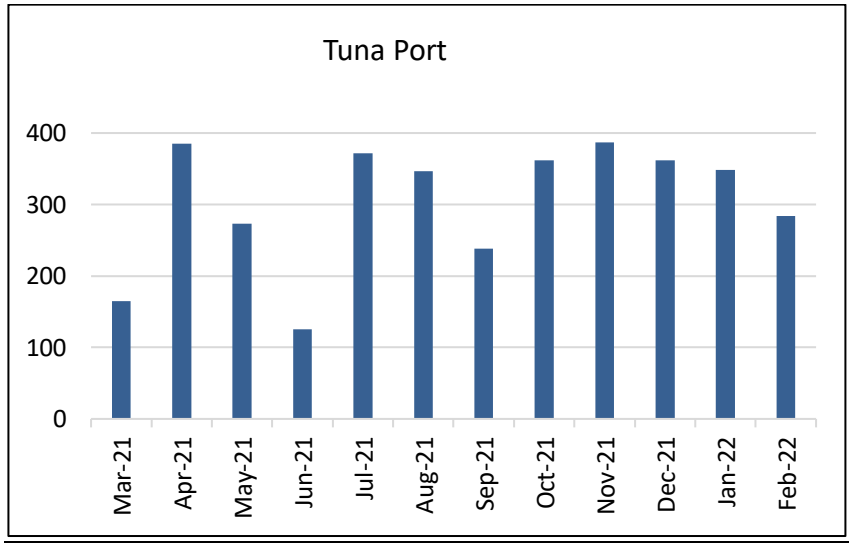
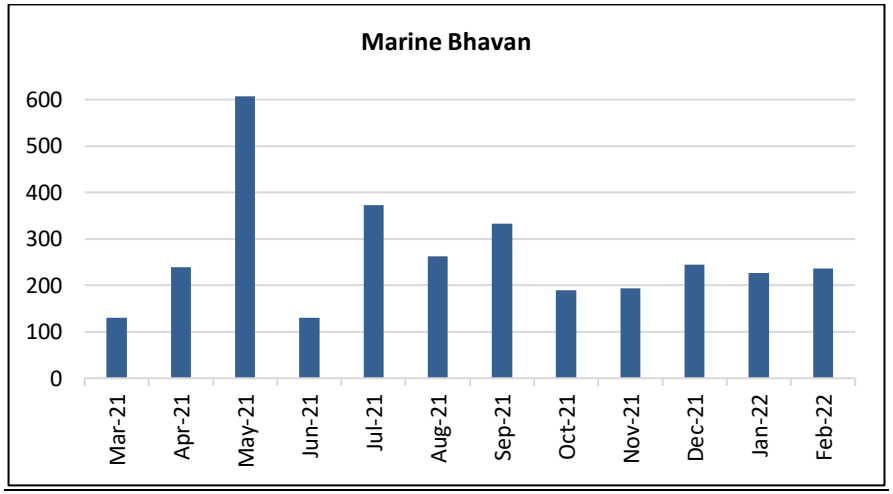
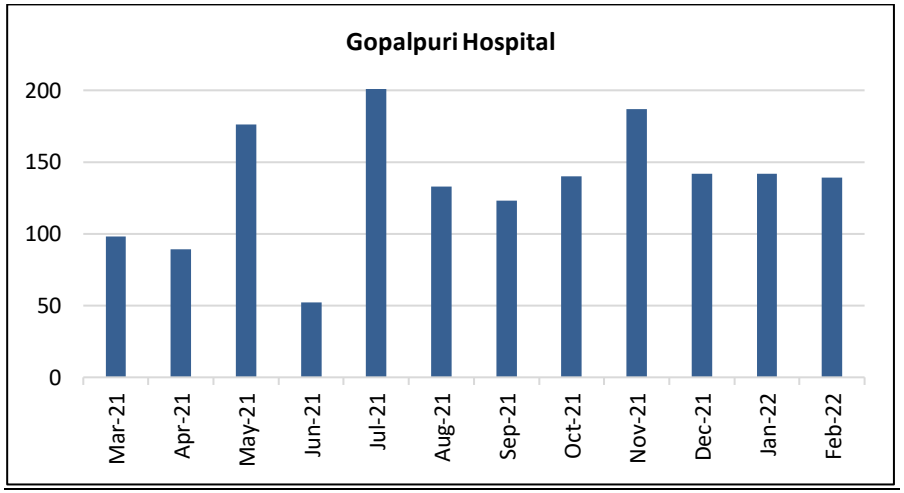
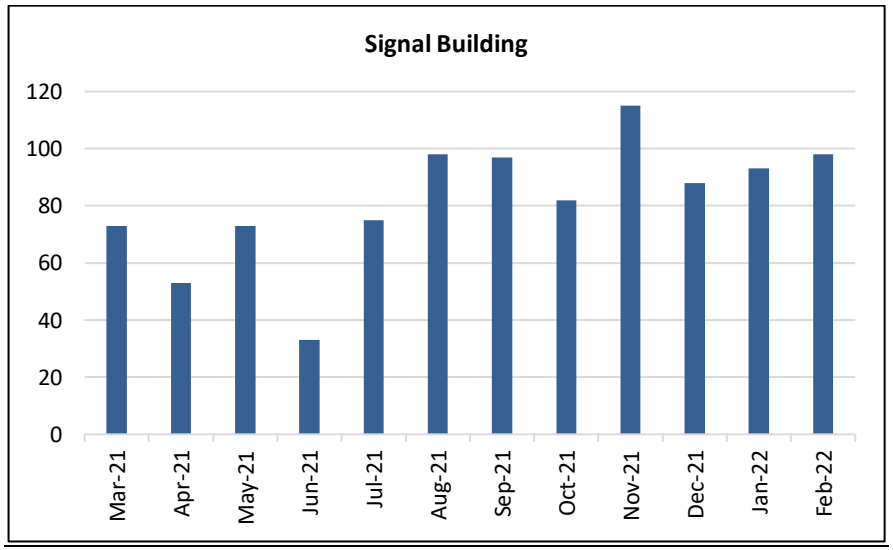
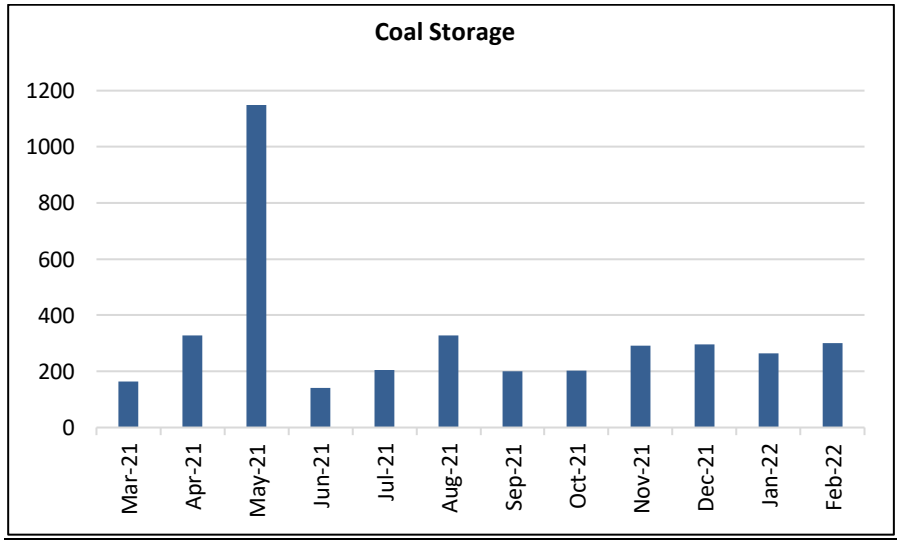

Tuna Port
400
300
200
100
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22

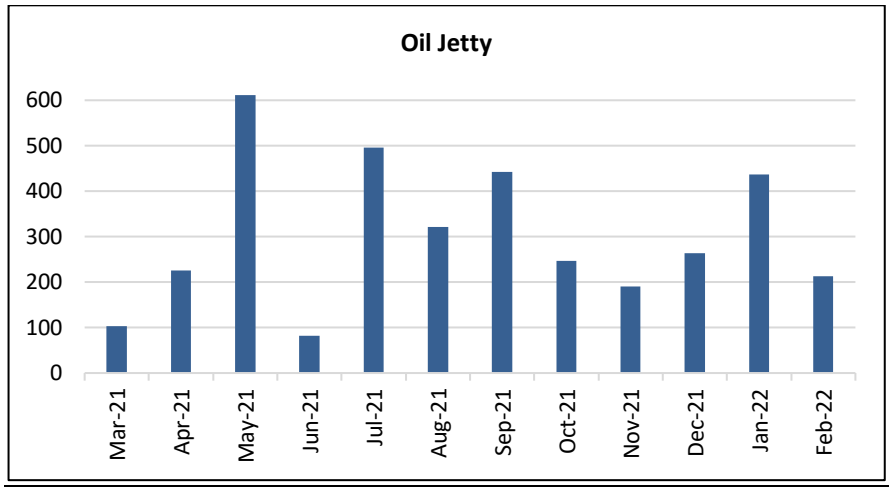
Fig 5. Trend in PM10 values of various AAQ Monitoring Locations

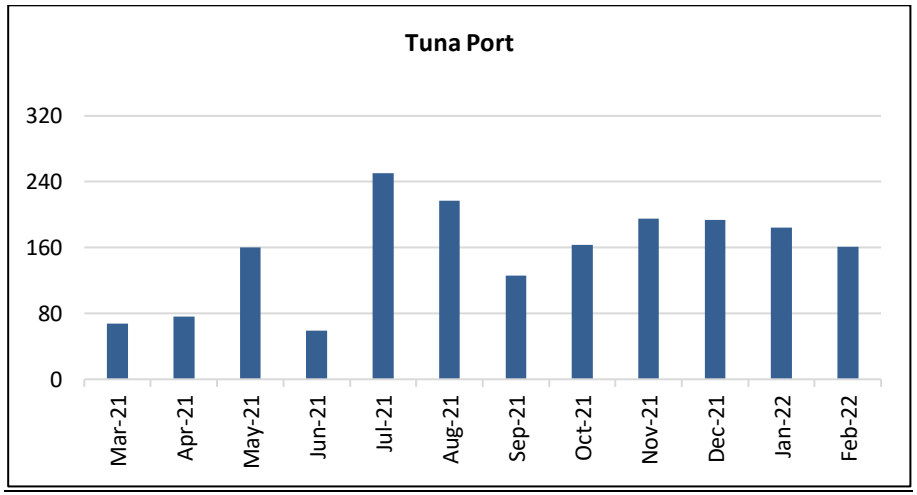


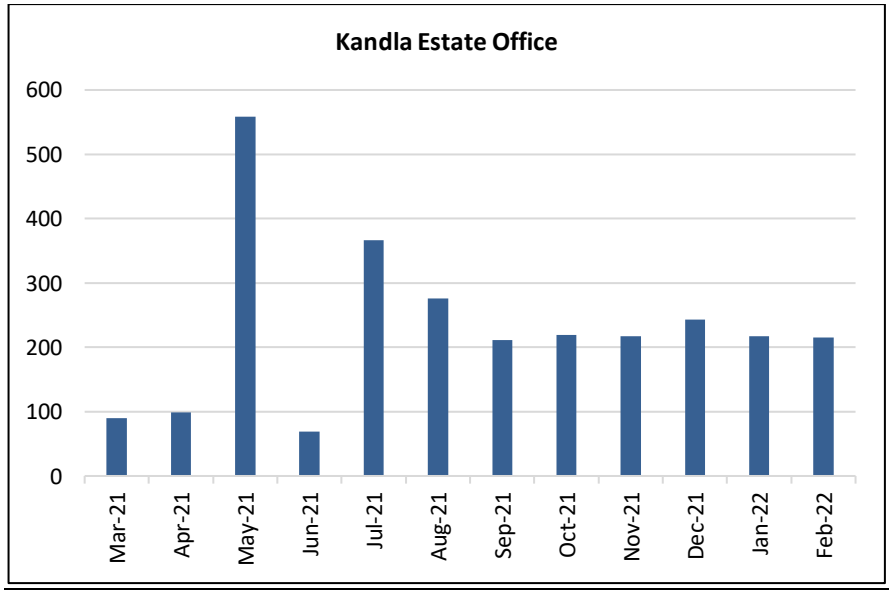







Oil Jetty
600
500
400
300
200
100
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22


Tuna Port
320
240
160
80
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22


Kandla Estate Office
600
500
400
300
200
100
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22

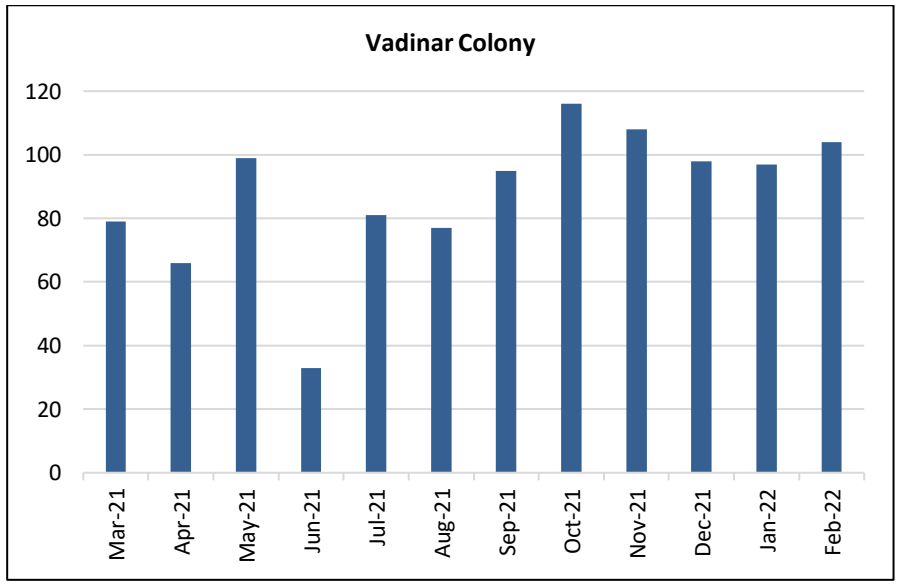
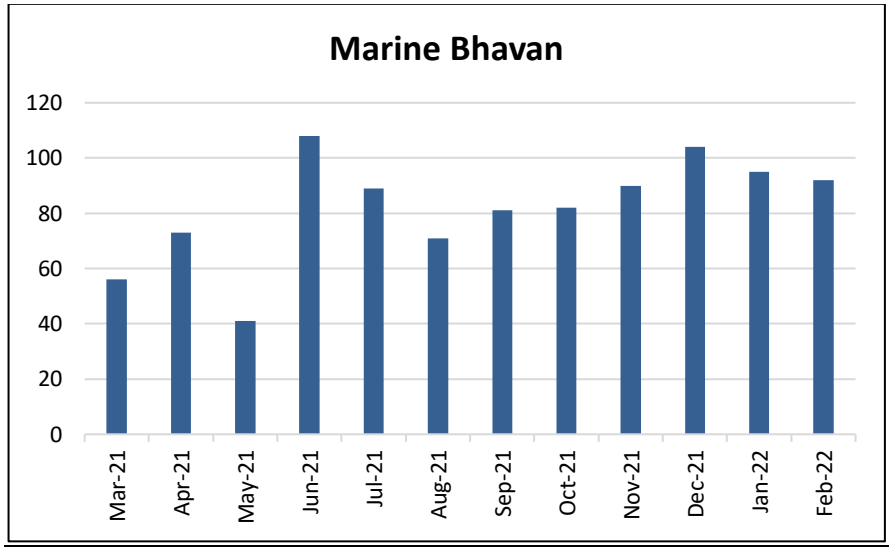
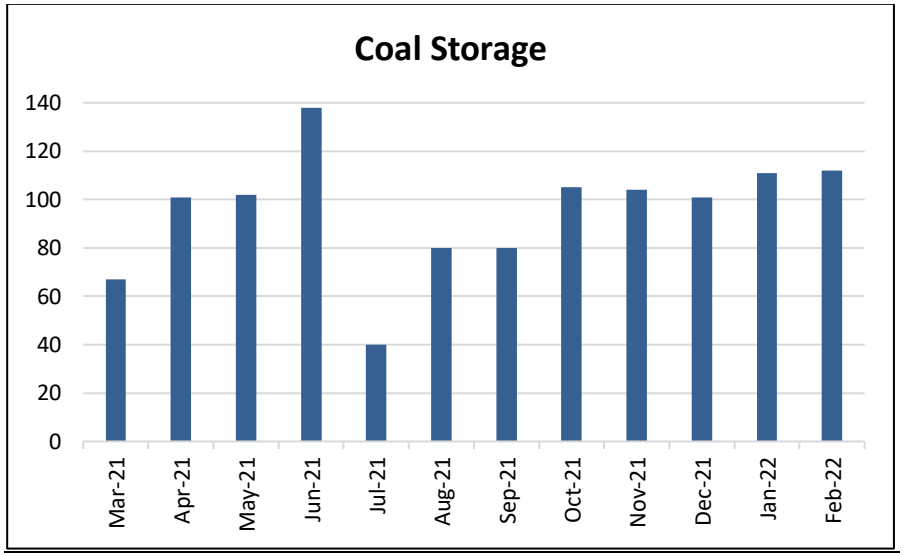
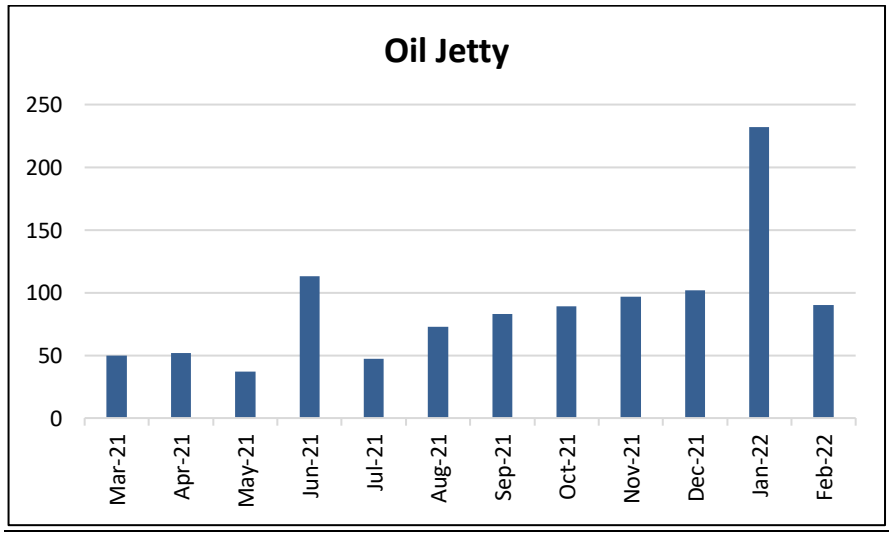
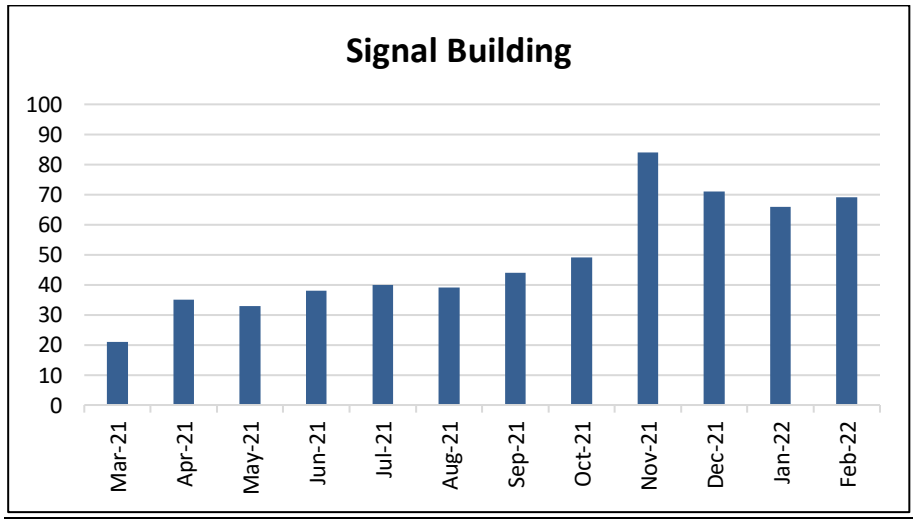

Vadinar Colony
120
100
80
60
40
20
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22

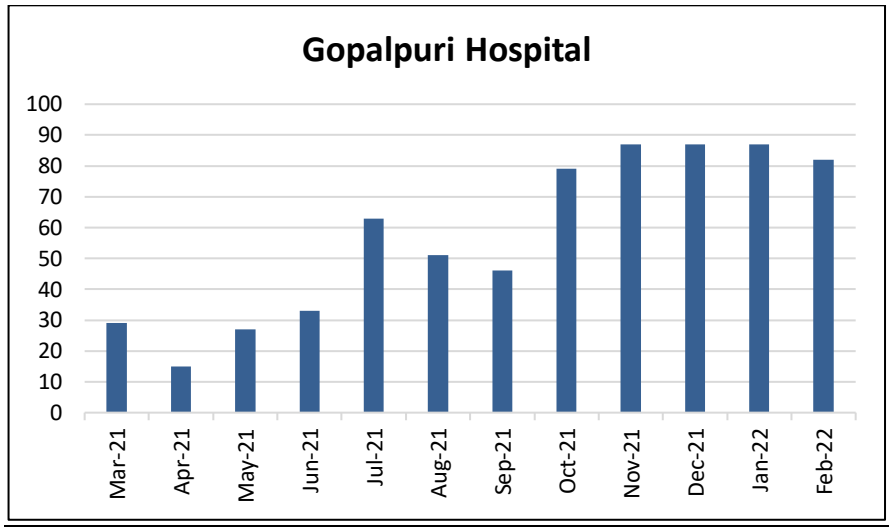
Fig 6. Trend in PM2.5 values of various AAQ Monitoring Locations

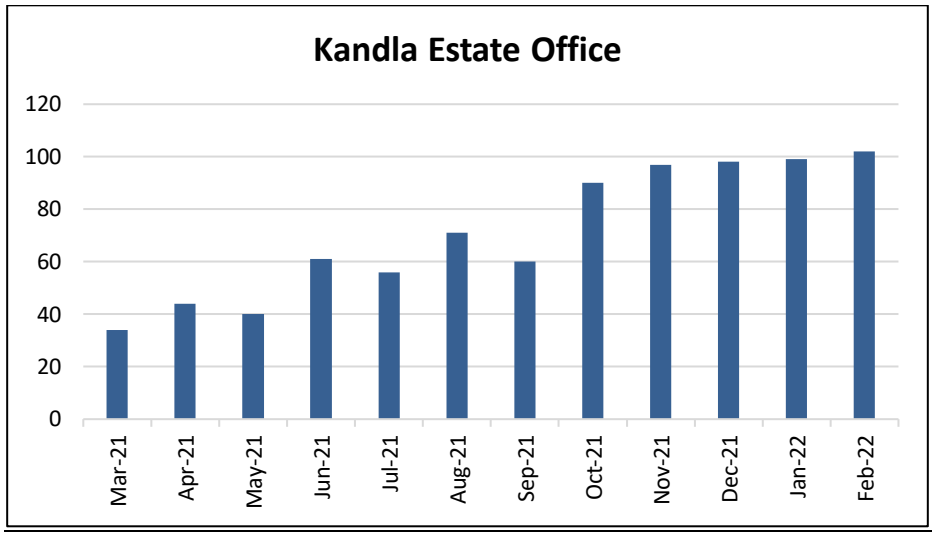


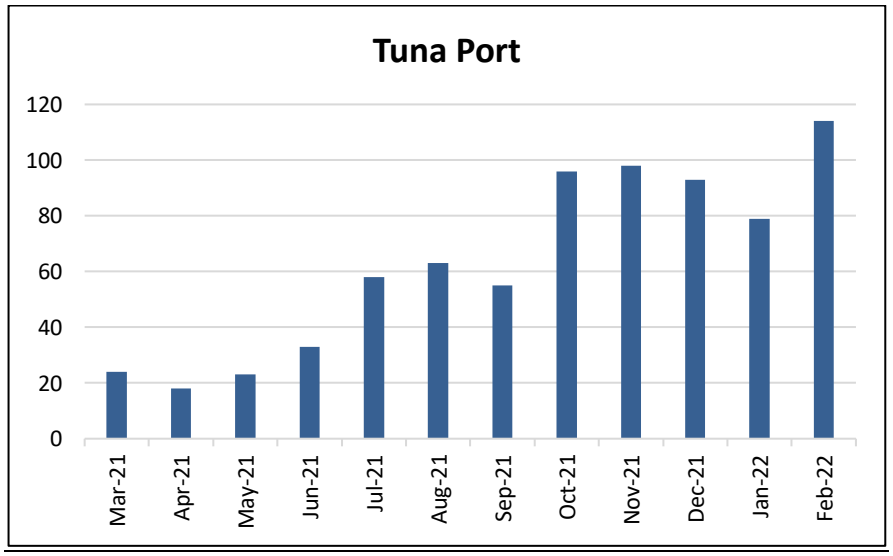


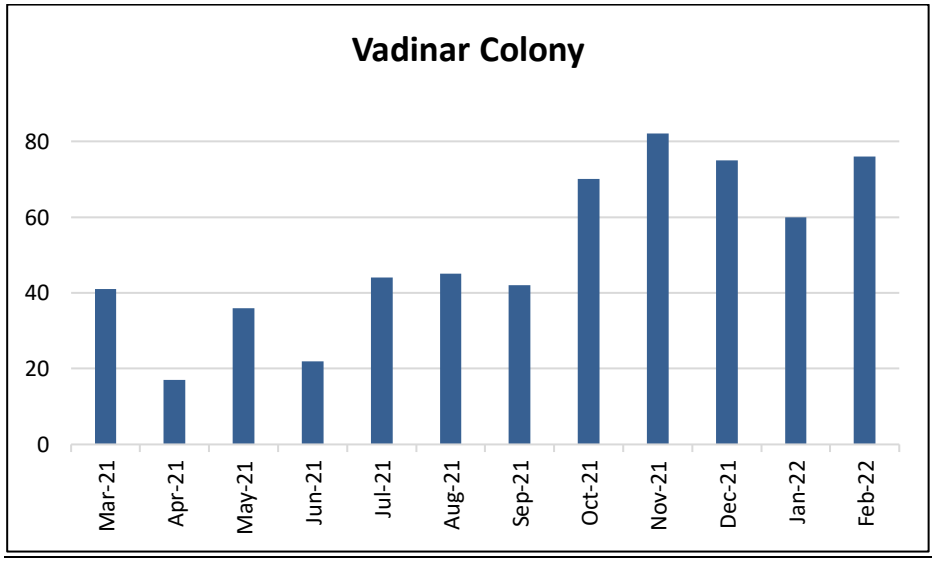





Gopalpuri Hospital
100
90
80
70
60
50
40
30
20
10
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22


Kandla Estate Office
120
100
80
60
40
20
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22


Tuna Port
120
100
80
60
40
20
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22


Vadinar Colony
80
60
40
20
0
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22

5.2 Drinking Water Quality Monitoring

Drinking Water Quality Monitoring was carried out at twenty stations at Kandla, Vadinar & Town ship Area of Deendayal Port.

Drinking water samples are collected from 20 locations (18 locations in Kandla and 2 locations in Vadinar). Samples for physico-chemical analysis are collected and analysed in laboratory for various parameters, viz. Color, Odor, Turbidity, Conductivity, pH, Chlorides, TDS, Total Hardness, Iron, Sulphate, Salinity, DO, BOD, Na, K, Ca, Mg, F, NO3, NO2, Mn, Cu, Cd, As, Hg, Pb, Zn, Bacterial Count (CFU).

Monitoring Results

Mean values of drinking water of Deendayal Port Locations are given in table 6.4. The values shown are the annual average of all the locations of Deendayal Port Colony, Port and Harbor area as well as Deendayal Port Authority office buildings.

Table 11 : Annual average values of Drinking water at Deendayal Port Authority

Sr. No.	Parameter		1st	2nd	3rd	4th	Value	Acceptable Limits	Permissible Limits
		Unit	Quarter Mean	Quarter Mean	Quarter Mean	Quarter Mean	(Annual Avg.)		
1	pH	pH Unit	7.38	7.41	7.46	7.38	7.41	6.5 to 8.5	6.5 to 8.5
2	Total Dissolved Solids	mg/L	1114.30	1083.67	1265.93	1155.75	1154.91	500	2000
3	Turbidity	NTU	0.53	0.48	0.47	0.45	0.48	1	5
4	Odor	-	Odorless	Odorless	Odorless	Odorless	Odorless	Agreeable	Agreeable
5	Color	Hazen Units	Colorless	Colorless	Colorless	Colorless	Colorless	5	15
6	Conductivity	µs/cm	2253.97	2064.35	2448.83	2108.38	2218.88	NS*	NS*
7	Bio.Oxygen Demand	mg/L	<2	<2	<2	<2	<2	NS*	NS*
8	Chloride as Cl	mg/L	651.10	579.99	484.50	539.53	563.78	250	1000
9	Ca as Ca	mg/L	74.21	59.34	62.83	61.72	64.53	75	200
10	Mg as Mg	mg/L	62.90	68.23	71.90	65.22	67.07	30	100
11	Total Hardness	mg/L	443.03	415.20	403.03	436.67	424.48	200	600
12	Iron as Fe	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.3	1
13	Fluorides as F	mg/L	0.45	0.69	0.55	0.64	0.58	1	1.5
14	Sulphate as SO_4	mg/L	211.96	193.41	229.75	220.67	213.95	200	400
15	Nitrite as NO2	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	NS*	NS*
16	Nitrate as NO3	mg/L	5.29	10.23	9.92	10.04	8.87	45	100
17	Salinity	%	1.26	1.05	0.88	0.97	1.04	NS*	NS*
18	Sodium as Na	mg/L	329.18	228.77	219.20	268.63	261.45	NS*	NS*
19	Potassium as K	mg/L	4.13	2.94	3.80	4.43	3.82	NS*	NS*
20	Manganese	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	0.1	0.3
21	Hexavalent Chromium	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	NS*	NS*
22	Copper	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	0.05	1.5
23	Cadmium	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	0.003	0.003
24	Arsenic	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	0.01	0.05
25	Mercury	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	0.001	0.001
26	Lead	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	0.01	0.01
27	Zinc	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	5	15
28	Bacterial Count	CFU/100 ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent

NS= Not specified, ND=Not detected

Discussion

The colour of all drinking water samples was colourless unit and odour of the samples was also agreeable. The values of turbidity, Iron as Fe and Ammonia as NH_3-N were observed to be below detection limits of measurement i.e. <0.1NT, <0.03mg/L and <0.1mg/L respectively. Apparently these parameters were not at alarming levels. Some important parameters for drinking water are discussed below in detail;

pH

pH value in the studied area varied from 7.37 to 7.47 pH unit during the first year of monitoring. The limit of pH value for drinking water is specified as 6.5 to 8.5. All the sampling points showed pH values within the prescribed limit by Indian Standards.

Total Dissolved Solids (TDS)

TDS values in the studied area varied between 1073.73-1201.26 mg/L. The mean TDS value was 1154.9 mg/L. None of the sampling points showed higher TDS values than the prescribed limit by Indian standards which are 500-2000mg/L.

Conductivity

Conductivity is used to measure the concentration of dissolved solids which have been ionized in a polar solution such as water. The conductivity in the samples collected during the month of June ranged from 2149.36-2320.63 µs/cm. Electrical conductivity standards do not appear in BIS standards for drinking water.

Chlorides

Chloride values in drinking water for the present year varied between 507.6 -647.63 mg/L. Excessive chloride concentration increase rates of corrosion of metals in the distribution system. This can lead to increased concentration of metals in the supply.

Calcium

Calcium value in drinking water for the present year the studied area varied between 62.32 – 68.91 mg/L. The mean Ca was observed to be 64.52 mg/L. If calcium is present beyond the maximum acceptable limit, it causes incrustation of pipes.

Magnesium

Magnesium value in the studied area for the present year varied from 65.80mg/L to 68.26 mg/L. All the locations had Magnesium within the prescribed limits of 30-100mg/L.

Total Hardness

Total Hardness value in the studied area for the present year varied between 389.03-447.43 mg/L. The prescribed limit by Indian Standards is 200-600mg/L.

Fluoride

Fluoride value in the studied area varied between 0.48 – 0.65 mg/L. The permissible limit as per Indian Standards is 1.0-1.5mg/L. Moderate amount of fluoride in water lead to dental effects, but long-term ingestion of large amounts can lead to potentially severe skeletal problems.

Sulphates

Sulphate value in the studied area varied between 195.75–225.46 mg/L. All the sampling points showed Sulphates values within the prescribed limits by Indian Standards (200-400 mg/L). Sulphate occurs naturally in water as are sult of leaching from gypsum and other common minerals. Sulphate content in drinking water exceeding the 400 mg/L imparts bitter taste.

Nitrites (NO_2)

Nitrite values in all the water samples were observed to be <0.01 mg/L. There are no specified standard values for Nitrites in drinking water. Ground water contains nitrate due to leaching of nitrate with the percolating water and by sewage and other wastes rich in nitrates.

Salinity

Salinity in drinking water in the present samples collected ranged from 0.92to 1.23 %. There are no prescribed Indian standards for salinity in Drinking water.

Heavy Metals in Drinking Water

In the present study period drinking water samples were analyzed for Mn, Cr, Cu, Cd, As, Hg, Pb and Zn. All these heavy metals were well below/ the permissible limits of the Indian Standards for drinking water.

Bacteriological Study

Analysis of the bacteriological parameter at all location shows that total Coliform values is observed to be 0.1 to cfu/100 ml. total Coliform and E-Coli values showed that all the drinking water samples were safe from any bacteriological contamination.

Conclusion

The results are compared with acceptable limits as well as Permissible Limits as prescribed in IS10500:2012 – Drinking Water Specification. It was observed from the data analysis that during the Third year (March 2021 to February 2022) the drinking water was safe for human consumption as per tested parameters only at all drinking water monitoring stations.

5.3 Marine Water Monitoring

Marine Water Monitoring was carried out at six stations at Deendayal Port and two locations at Vadinar Port.

Water samples were analyzed for physico-chemical and Biochemical parameters. Besides these, Phytoplankton (Qualitative & Quantitative) Zooplankton (Qualitative & Quantitative) & Benthos (Qualitative & Quantitative) samples were collected during spring tide and neap tide from all the eight fixed monitoring stations.

Results

The annual average values of monitored parameters for marine waters of DPA are given as per table 12.

Table 12. Annual average values of various physico-chemical parameters at Deendayal Port during neap tide. (Marine Sampling Station at Gulf of Kutch).

Sr. No.	Parameters	Unit	1st	2nd	3rd	4th
			Quarter Mean	Quarter Mean	Quarter Mean	Quarter Mean
1	pH	-	7.30	7.35	7.36	7.39
2	Color	-	Colorless	Colorless	Colorless	Colorless
3	Odor	-	Odourless	Odourless	Odourless	Odourless
4	Salinity	ppt	32.51	32.24	31.82	31.80
5	Turbidity	NTU	26.56	35.05	36.78	35.71
6	Total Dissolved Solids	mg/L	40307.26	39446.10	39151.25	34126.11
7	Total Suspended Solids	mg/L	468.54	393.35	503.95	630.73
8	Total Solids	mg/L	43192.33	41383.94	39672.71	34818.14
9	DO	mg/L	5.11	4.57	4.82	4.45
10	COD	mg/L	79.05	83.13	84.56	85.60
11	BOD	mg/L	0.00	0.00	0.00	0.00
12	Silica	mg/L	0.57	0.56	0.67	0.78
13	Phosphate	mg/L	0.29	0.25	0.19	0.20
14	Sulphate	mg/L	3499.62	2586.77	2451.53	2493.91
15	Nitrate	mg/L	4.15	3.23	3.80	3.97
16	Nitrite	mg/L	0.01	0.00	0.00	0.00
17	Calcium	mg/L	518.97	557.01	522.61	578.93
18	Magnesium	mg/L	1588.81	1739.01	1150.32	1680.46
19	Sodium	mg/L	9976.72	10571.44	10635.22	10265.40
20	Potassium	mg/L	314.39	367.85	324.11	343.54
21	Iron	mg/L	1.81	1.67	1.61	0.81
22	Chromium	mg/L	0.14	0.15	0.13	0.04
23	Copper	mg/L	0.07	0.10	0.04	0.00
24	Arsenic	mg/L	0.00	0.00	0.00	0.00
25	Cadmium	mg/L	0.06	0.07	0.06	0.02
26	Mercury	mg/L	0.00	0.00	0.00	0.00
27	Lead	mg/L	0.16	0.17	0.12	0.02
28	Zinc	mg/L	0.06	0.06	0.04	0.11

Discussion

Coastal ecosystems are characterized by daily fluctuations, driven by tidal amplitude, wind direction and also on the anthropogenic activities carried out on the coasts. Marine water parameters at Kandla Harbor and creek waters also showed an high array of fluctuations in several of its parameters such as TDS, TSS, salinity and salts. Some of the important parameters are explained below;

pH

The pH of all marine water samples collected from Deendayal Port variedfrom7.3to 7.39. The mean pH of all samples was 7.64pH unit.

Salinity

Salinity in the DPA marine water ranged from 31.8ppt to 32.51ppt. The mean salinity at was recorded to be 32.09 ppt.

Turbidity

Turbidity in the DPA marine water ranged from 26.56 – 36.78 NTU. The mean turbidity of all the locations of Deendayal Port was 33.52 NTU. Turbidity at Vadinar port was<1.0NTU.

Total Dissolved Solids (TDS)

TDS values varied from 34126.11 to 40307.26 mg/L at all locations of Deendayal Port. Mean TDS values at Deendayal Port was 38257.68mg/L.

Dissolved Oxygen (DO)

DO value in the studied area varied between 4.45-5.11 mg/L. The mean DO values of Kandla Marine waters were 4.7mg/L.

Nitrates (NO3)

The mean Nitrate values in all the marine water samples were of Deendayal Port was 3.78 mg/L at DPA waters. Nitrite was rarely detected from marine waters of Vadinar.

Sodium (Na)

Sodium value in the Deendayal Port marine waters varied between 9976.72-10635.22 mg/L. The mean Na recorded at DPA waters was 11448.78 mg/L.

Trace Metals

In the present study period water samples were analyzed for Mn, Cr, Cu, Cd, As, Hg, Pb and Zn. All these heavy metals reported below trace levels.

Bacteriological Study

Analysis of the bacteriological parameter at all location shows that total Coli form values is observed to be 0.1to cfu/100ml.

5.4 Productivity Study

Chlorophyll-A

Water Samples for the chlorophyll estimation collected from sub surface layer during high tide and low tide period of the tidal cycle for each sampling locations and analysed for Chlorophyll -a and after acidification for Pheophytin –a.

In the sub surface water chlorophyll-a was varying from 0.204 to 1.923 mg/m^3 in harbour region of DPA during sampling done in from March 2021 to February 2022. In the nearby creeks chlorophyll-a was varying from 0.153.93 to 1.923mg/m^3.

In the sub surface water chlorophyll-a was varying from 0.392 – 1.356mg/m3 at Vadinar jetty and 0.392 mg/m3 to 1.365 mg/m3near SPM during sampling done spring tide period and during Neap tide.

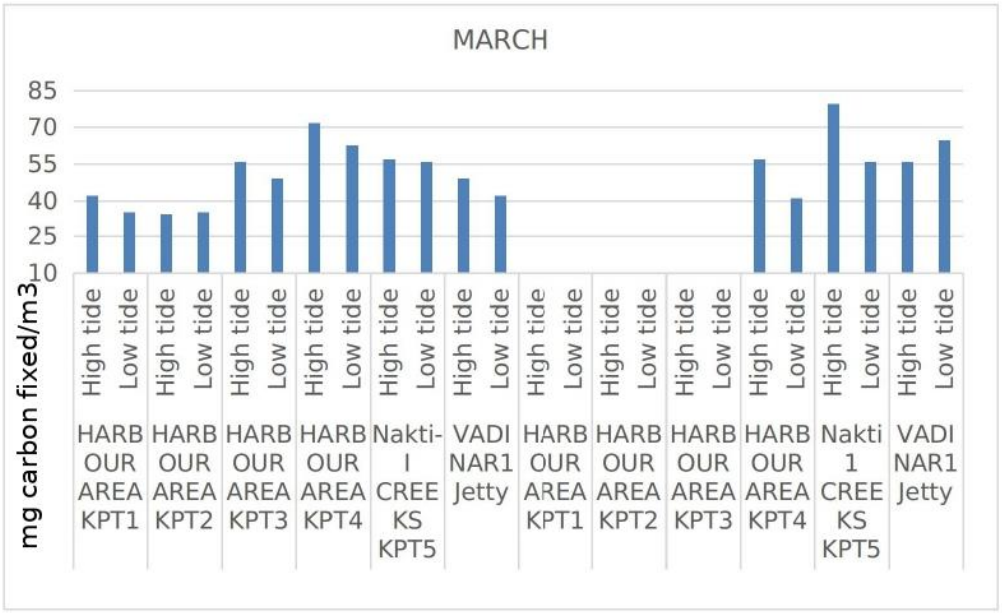
Algal Biomass

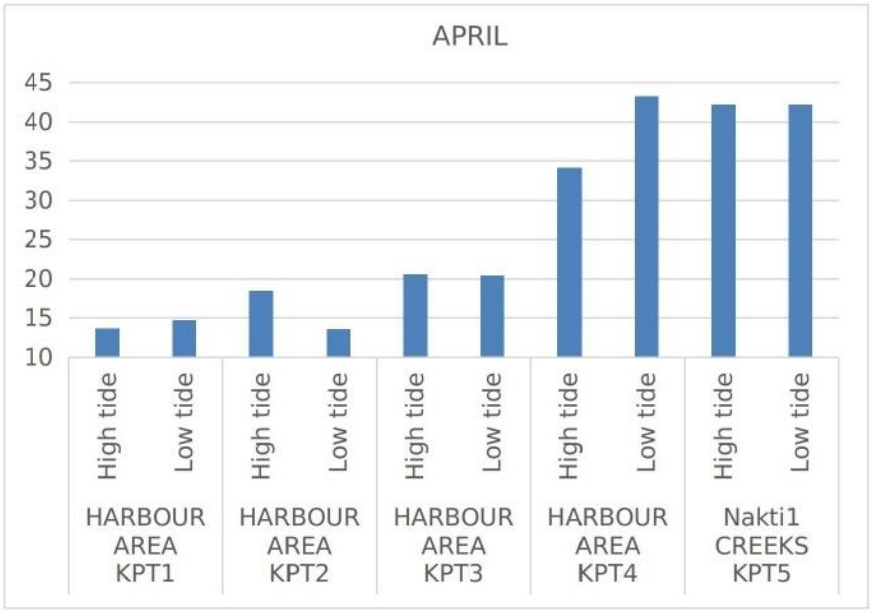
Chlorophyll-a value was used as algal biomass indicator (APHA 23rd Edition). Algal biomass was estimated by converting Chlorophyll value.

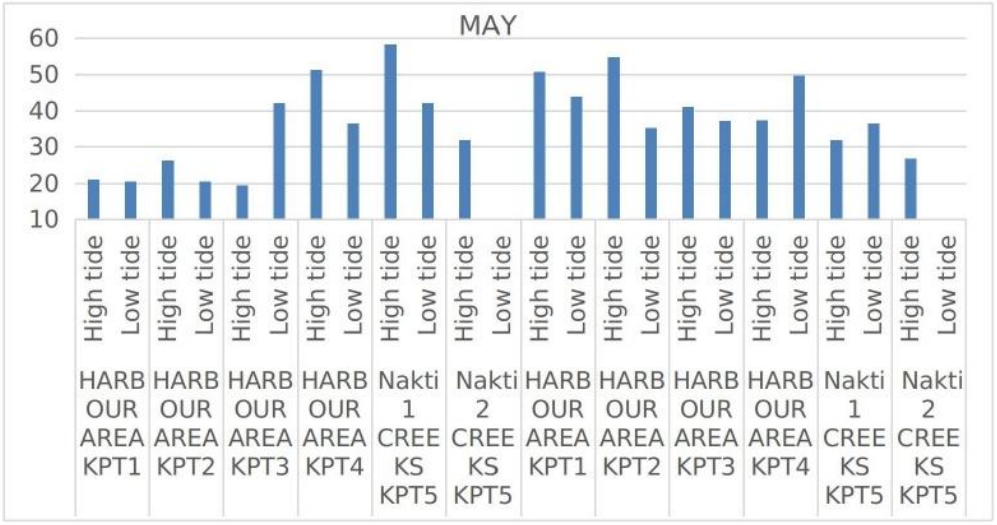
In the sub surface water algal biomass was varying from13.66to 128.84mg/m^3 in harbour region of DPA during sampling done in fromMarch2021 to February 2022. In the nearby creeks Algal Biomass was varyingfrom10.24to 128.84mg/m^3.

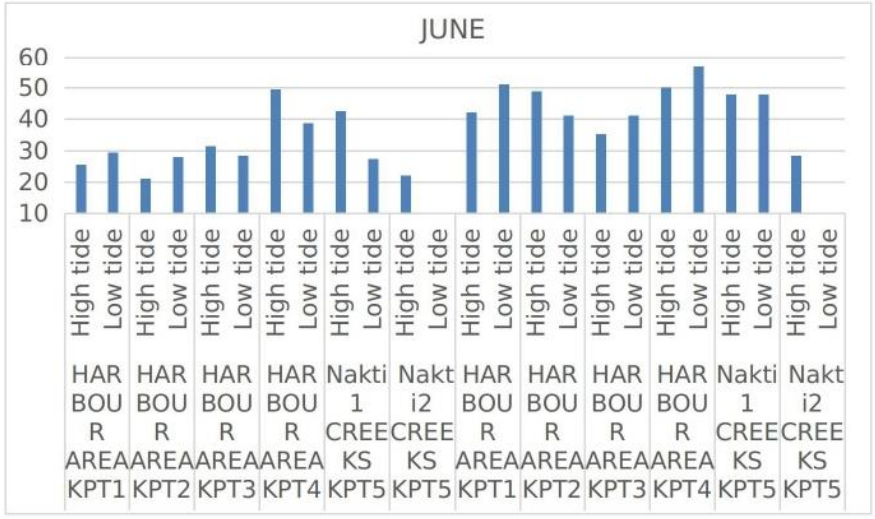
In the sub surface water algal biomass was varying from 26.26 – 90.85mg/m3 at Vadinar jetty and SPM during sampling done spring tide period and during Neap tide.

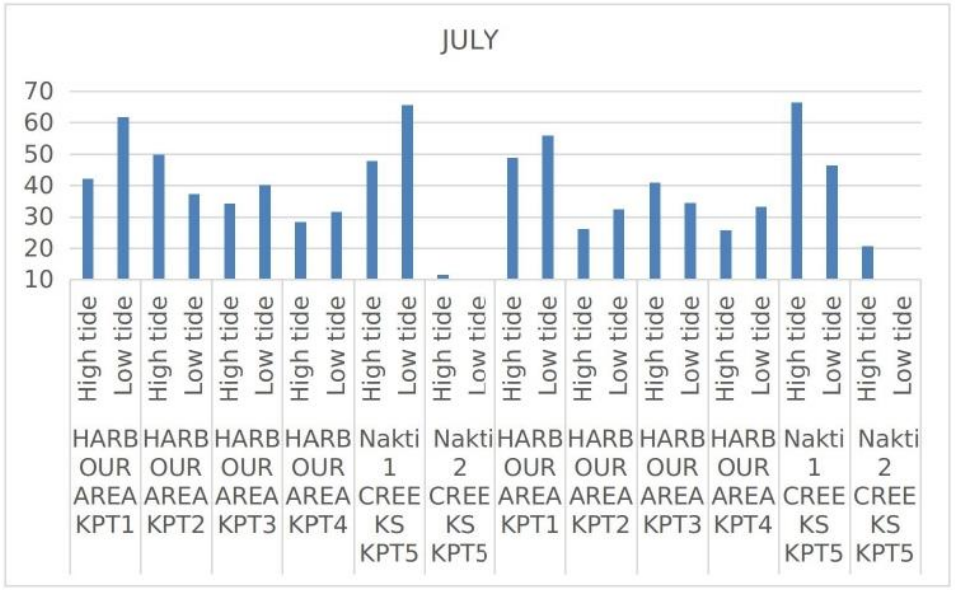
Fig 7. Monthly values of Algal Biomass in harbor waters of DPA

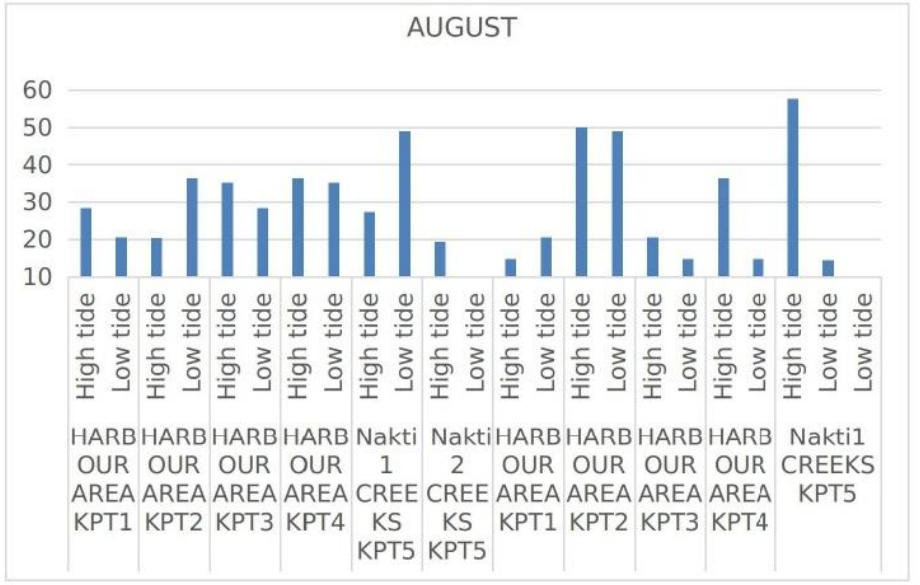


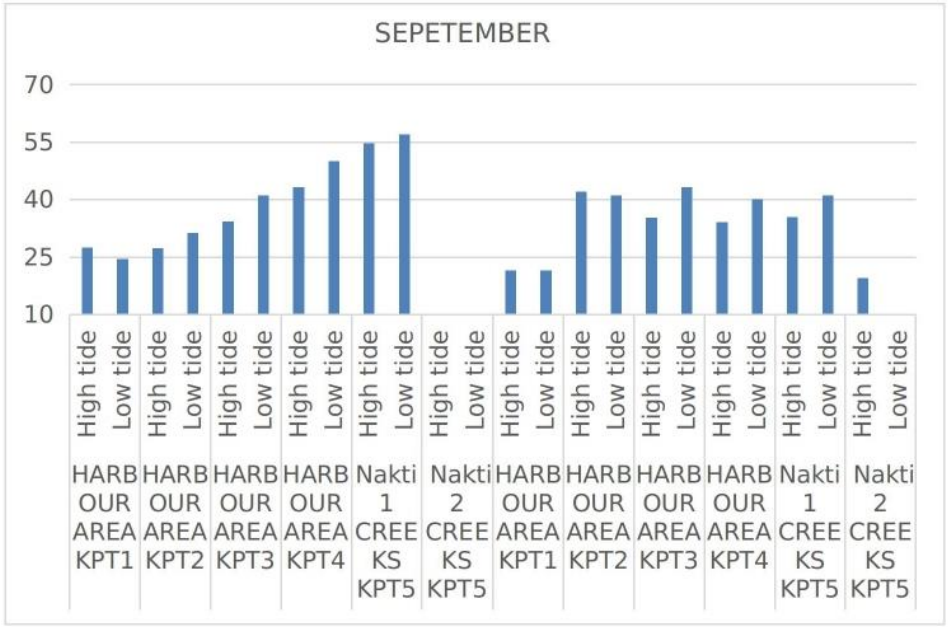


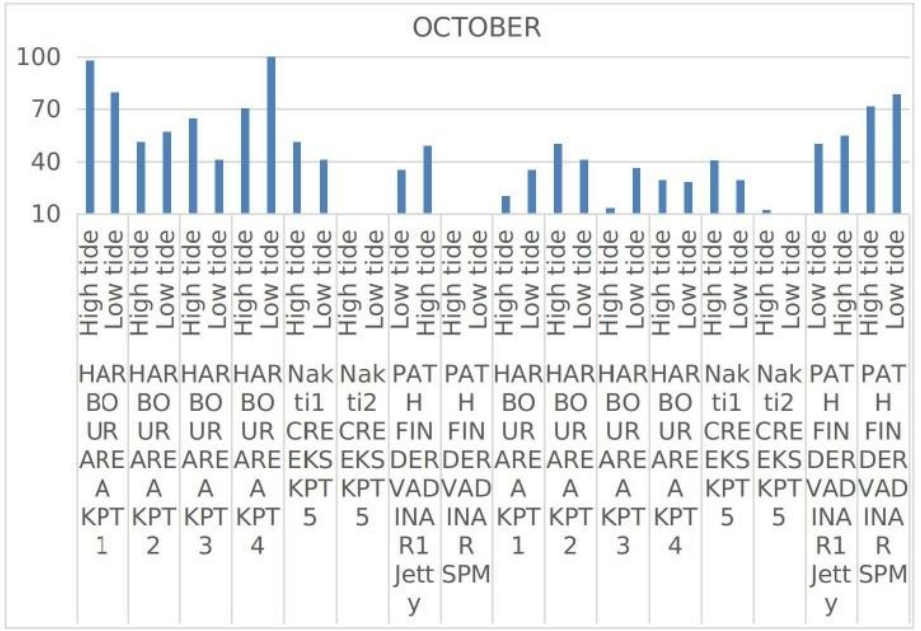


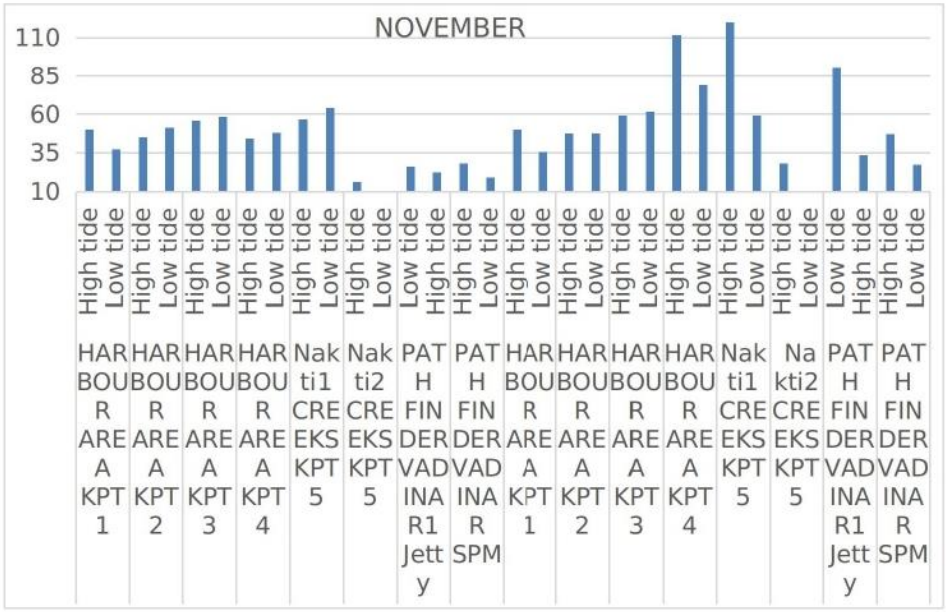


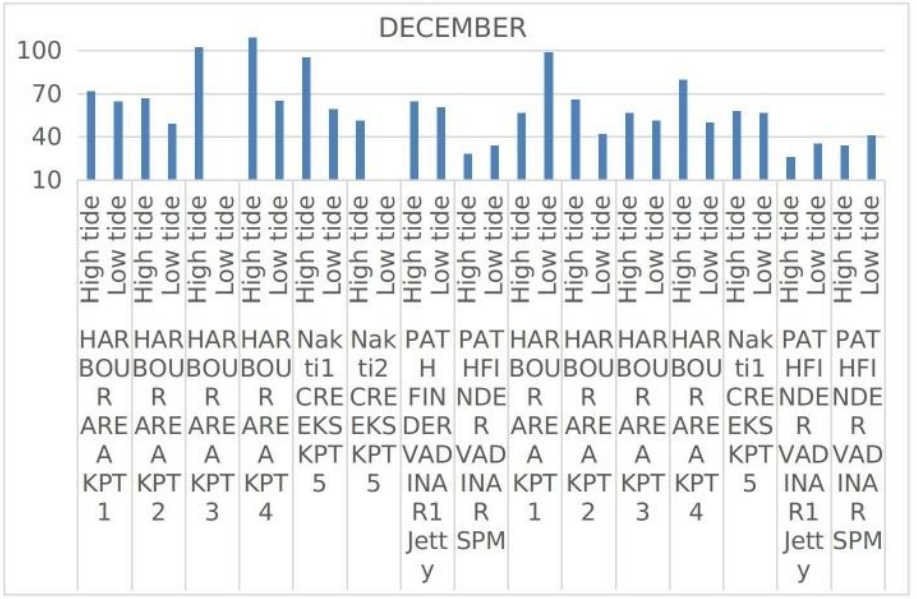

JULY
70
60
50
40
30
20
10
High tide
Low tide
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti 1 CREEKS KPT5
Nakti 2 CREEKS KPT5

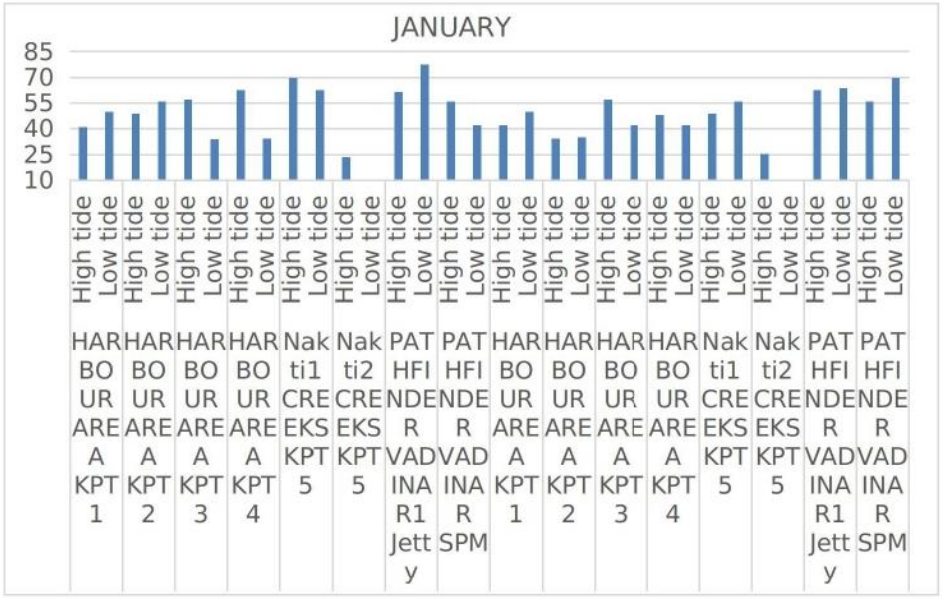

AUGUST
60
50
40
30
20
10
High tide
Low tide
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti 1 CREEKS KPT5
Nakti 2 CREEKS KPT5
Nakti1 CREEKS KPT5


SEPETEMBER
70
55
40
25
10
High tide
Low tide
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti 1 CREEKS KPT5
Nakti 2 CREEKS KPT5


OCTOBER
100
70
40
10
High tide
Low tide
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti1 CREEKS KPT5
Nakti2 CREEKS KPT5
PATH FINDER VADINAR1 Jetty
PATH FINDER VADINAR SPM


NOVEMBER
110
85
60
35
10
High tide
Low tide
HARBOUR AREA KPT 1
HARBOUR AREA KPT 2
HARBOUR AREA KPT 3
HARBOUR AREA KPT 4
Nakti1 CREEKS KPT 5
Nakti2 CREEKS KPT 5
PATH FINDER VADINAR1 Jetty
PATH FINDER VADINAR SPM


DECEMBER
100
70
40
10
High tide
Low tide
HARBOUR AREA KPT 1
HARBOUR AREA KPT 2
HARBOUR AREA KPT 3
HARBOUR AREA KPT 4
Nakti1 CREEKS KPT 5
Nakti2 CREEKS KPT 5
PATH FINDER VADINAR1 Jetty
PATH FINDER VADINAR SPM


JANUARY
85
70
55
40
25
10
High tide
Low tide
HARBOUR AREA KPT 1
HARBOUR AREA KPT 2
HARBOUR AREA KPT 3
HARBOUR AREA KPT 4
Nakti1 CREEKS KPT 5
Nakti2 CREEKS KPT 5
PATHFINDER VADINAR1 Jetty
PATHFINDER VADINAR SPM

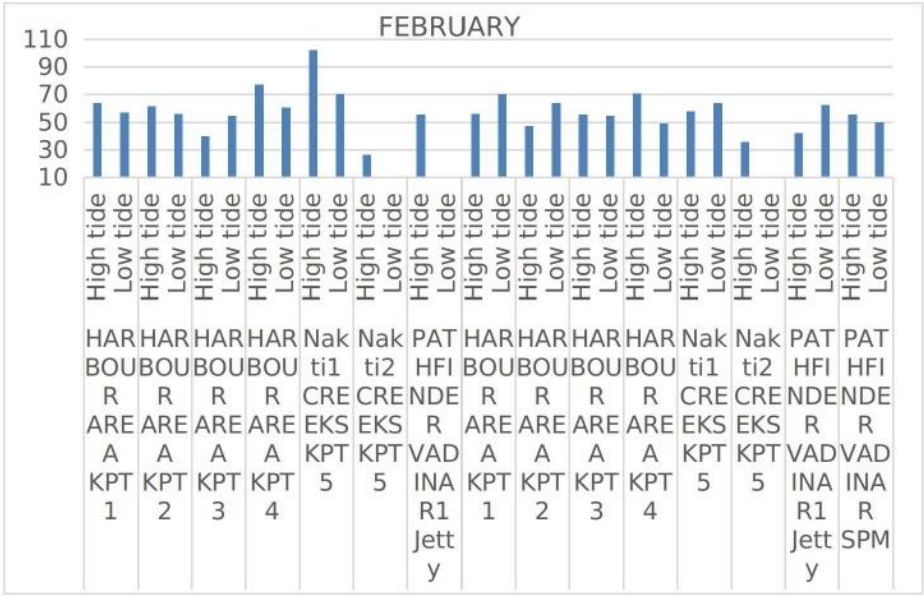
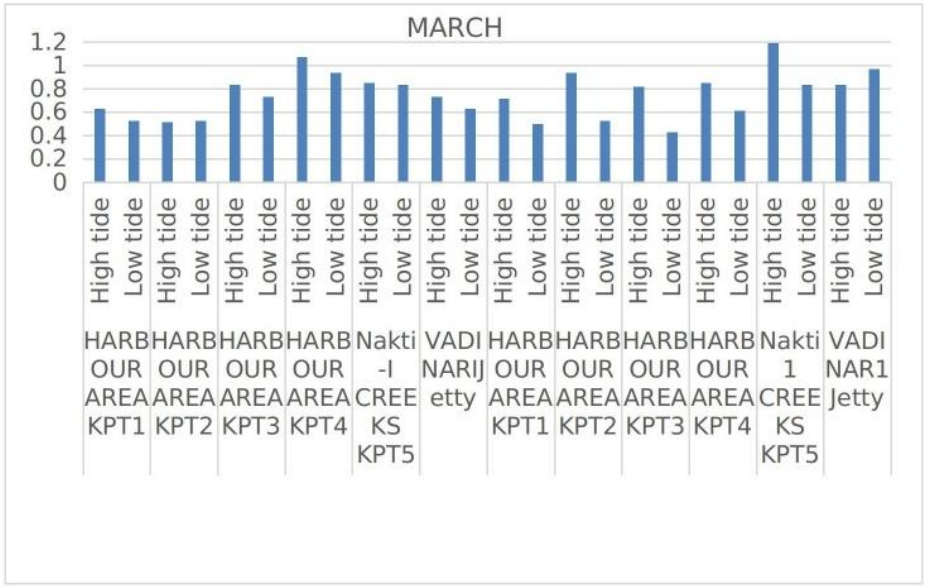
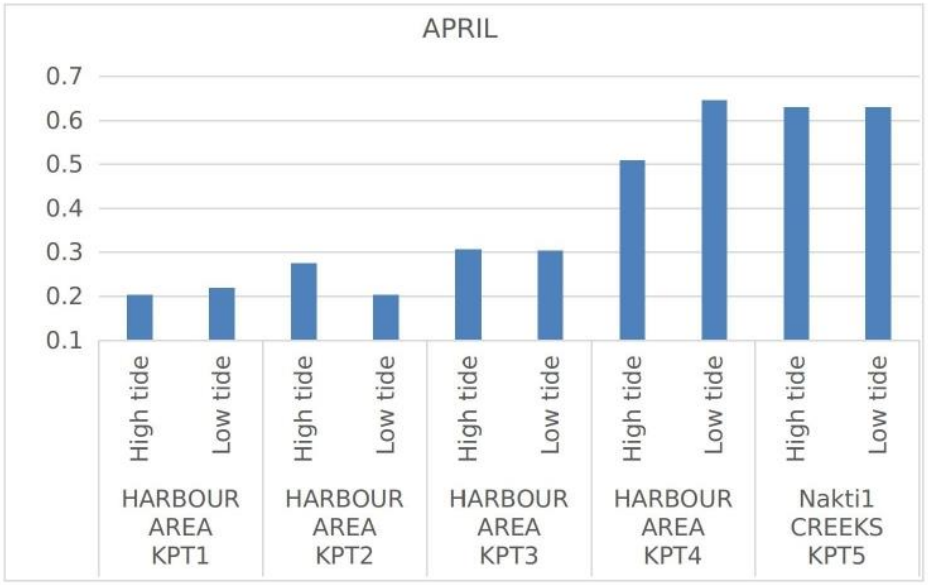
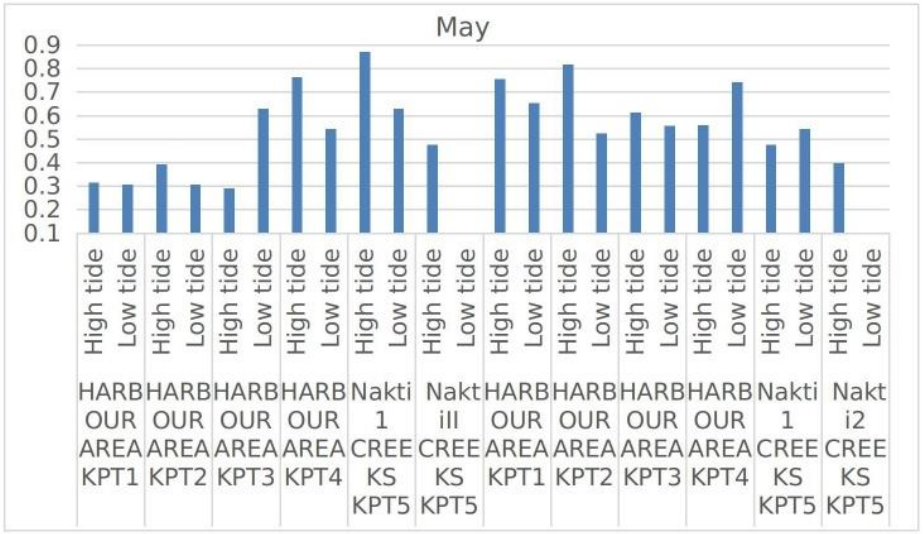
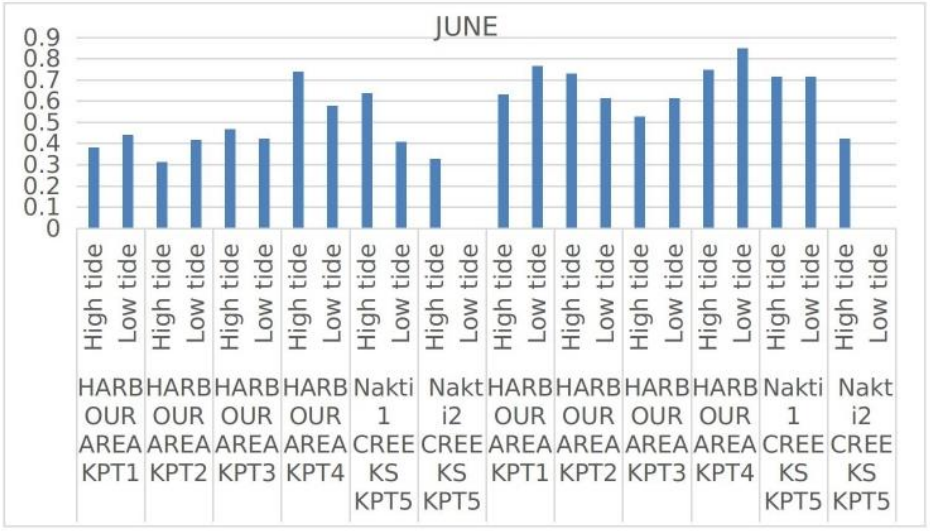

FEBRUARY
110
90
70
50
30
10
High tide
Low tide
HARBOUR AREA KPT 1
HARBOUR AREA KPT 2
HARBOUR AREA KPT 3
HARBOUR AREA KPT 4
Nakti1 CREEKS KPT 5
Nakti2 CREEKS KPT 5
PATHFINDER VADINAR1 Jetty
PATHFINDER VADINAR SPM

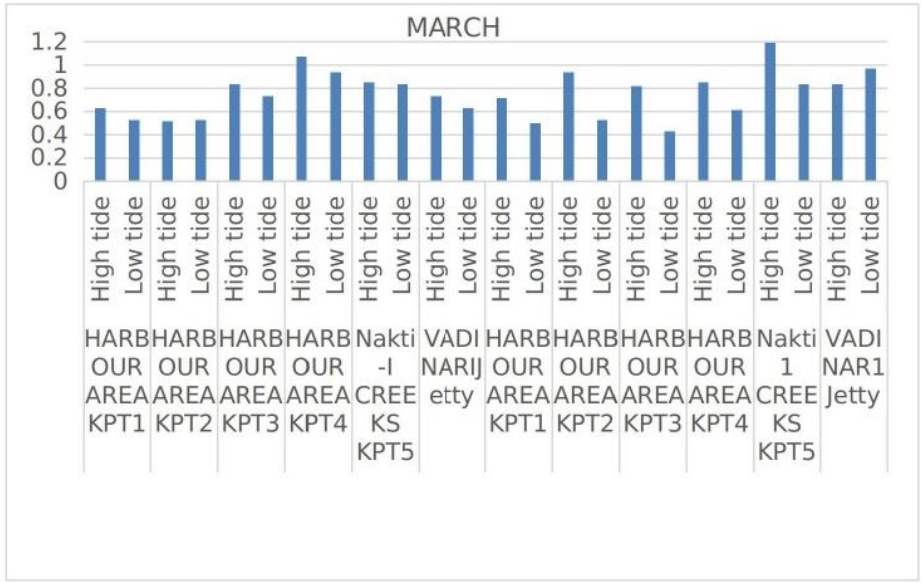
Fig 8. Annual average values of Chlorophyll-a in harbor waters of DPA

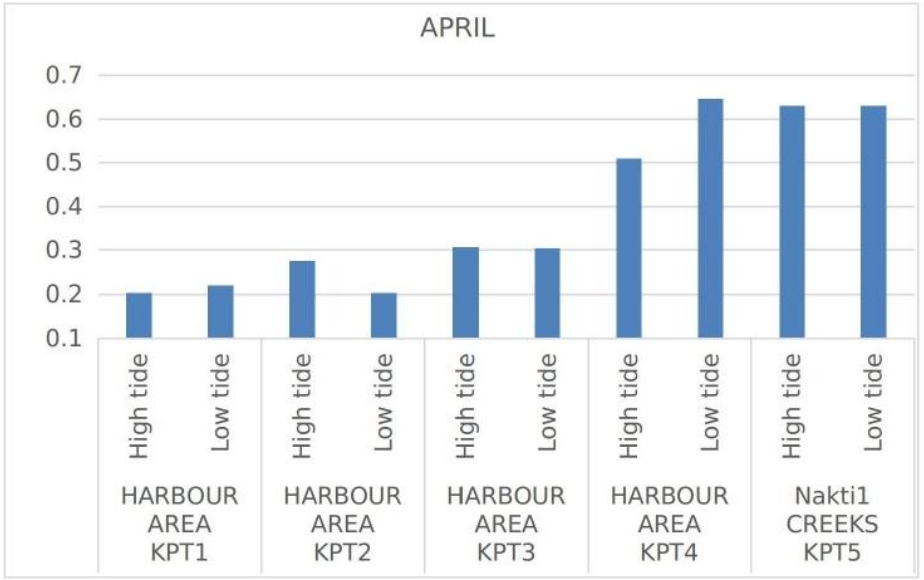


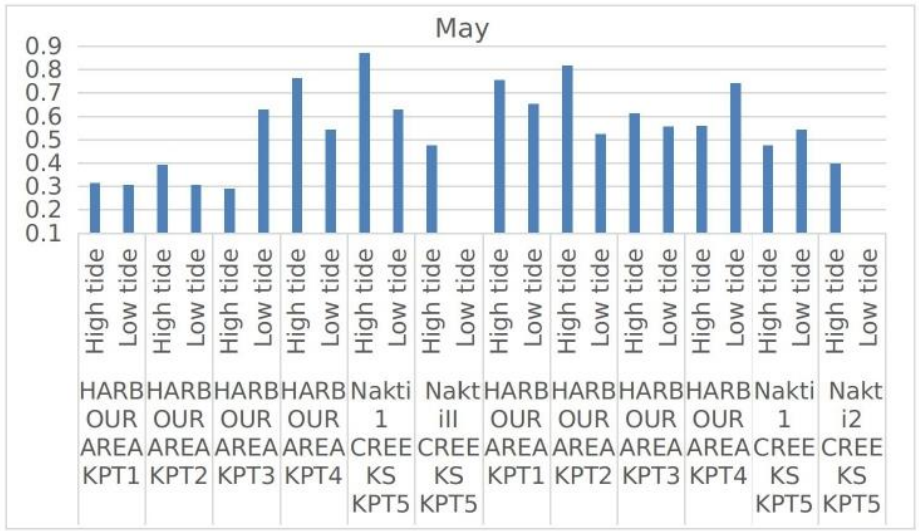


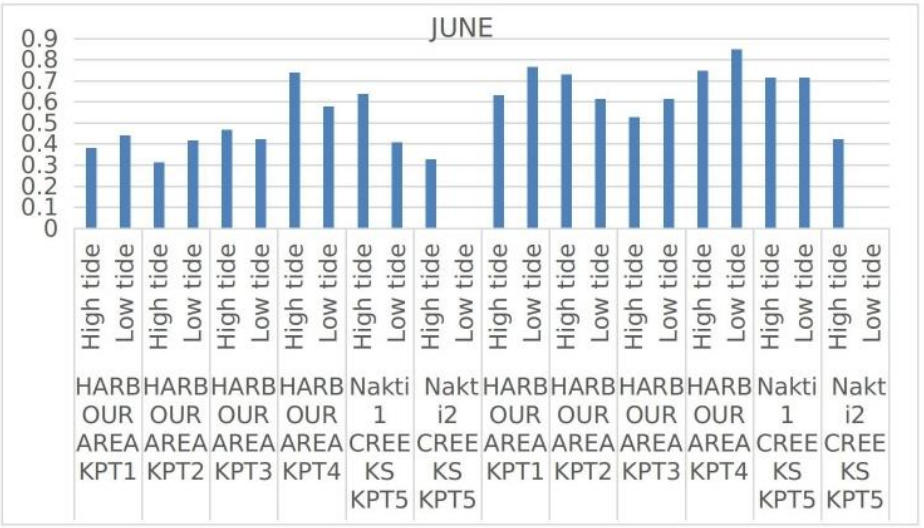





MARCH
1.2
1
0.8
0.6
0.4
0.2
0
High tide
Low tide
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti -I CREEKS KPT5
VADINARIJetty
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti 1 CREEKS KPT5
VADINAR1 Jetty


APRIL
0.7
0.6
0.5
0.4
0.3
0.2
0.1
High tide
Low tide
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti1 CREEKS KPT5


May
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
High tide
Low tide
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti 1 CREEKS KPT5
Nakti II CREEKS KPT5
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti 1 CREEKS KPT5
Nakti i2 CREEKS KPT5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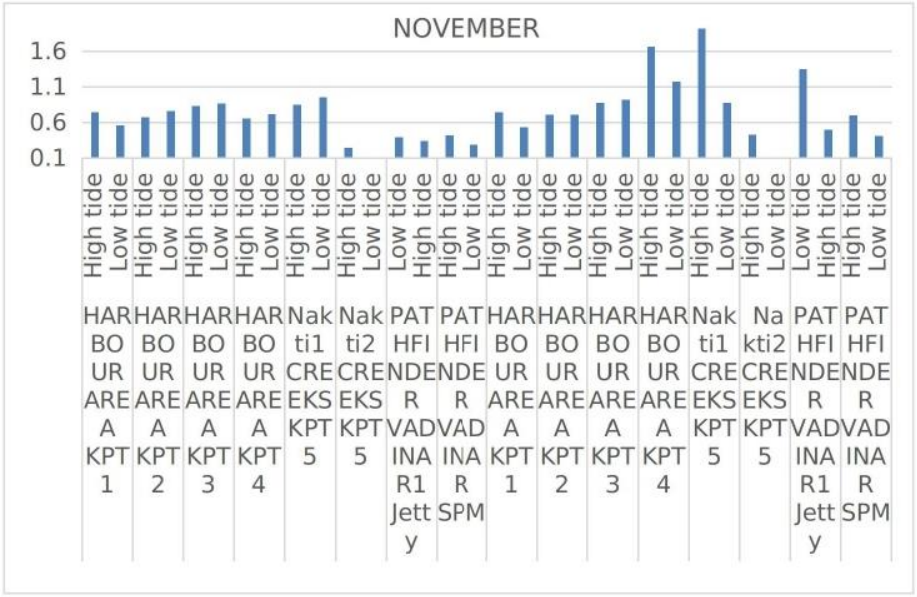
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
High tide
Low tide
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti 1 CREEKS KPT5
Nakti i2 CREEKS KPT5
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti 1 CREEKS KPT5
Nakti i2 CREEKS KPT5


NOVEMBER
1.6
1.1
0.6
0.1
High tide
Low tide
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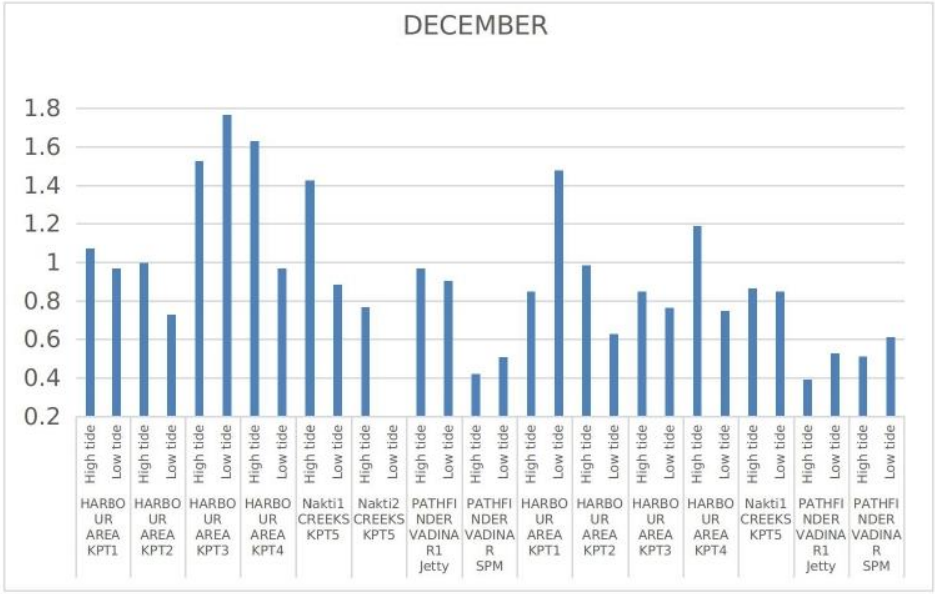
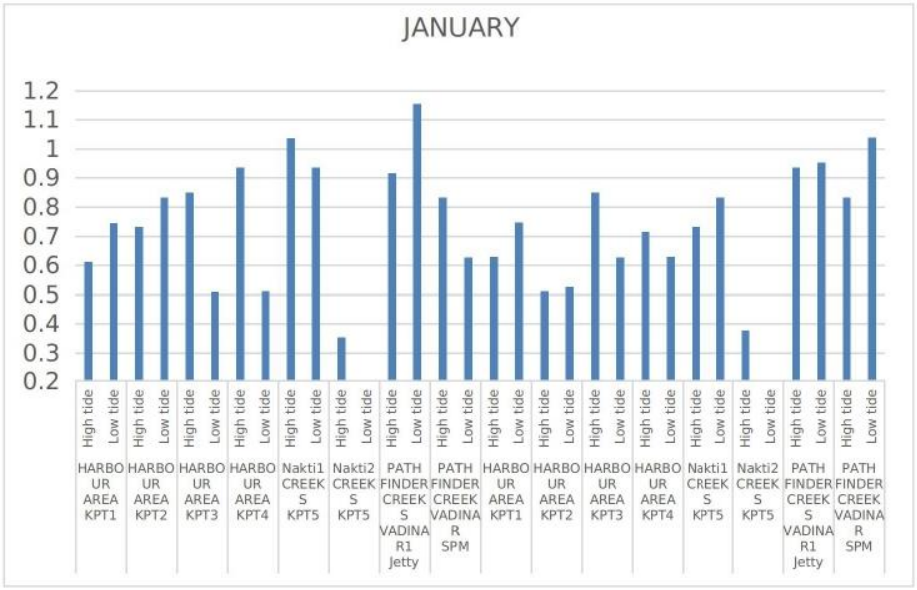
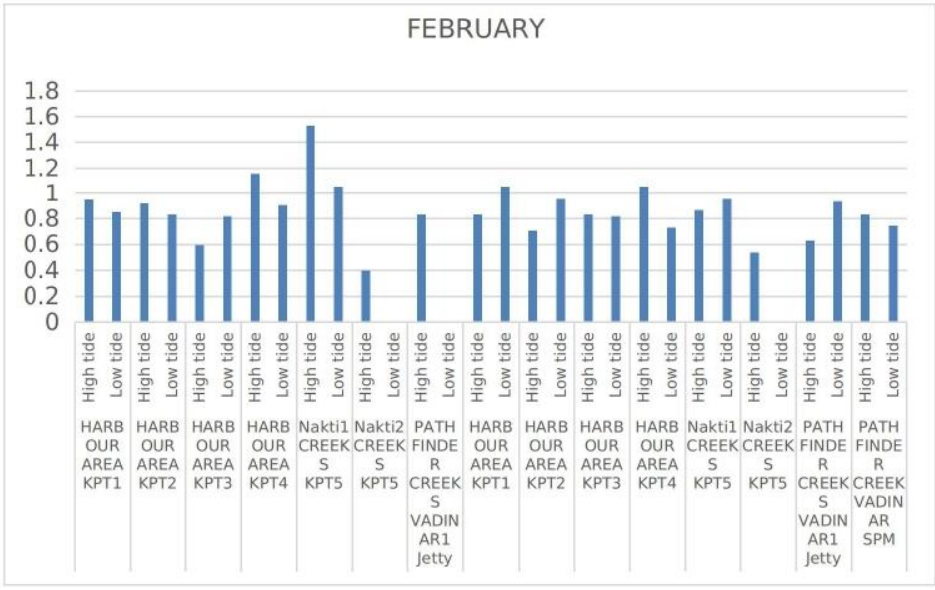
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti1 CREEKS KPT5
Nakti2 CREEKS KPT5
PATHFINDER VADINAR1 Jetty
PATHFINDER VADINAR SPM


DECEMBER
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
High tide
Low tide
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti1 CREEKS KPT5
Nakti2 CREEKS KPT5
PATHFINDER VADINAR1 Jetty
PATHFINDER VADINAR SPM


JANUARY
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
High tide
Low tide
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti1 CREEKS KPT5
Nakti2 CREEKS KPT5
PATHFINDER CREEKS VADINAR1 Jetty
PATHFINDER CREEK VADINAR SPM


FEBRUARY
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
High tide
Low tide
HARBOUR AREA KPT1
HARBOUR AREA KPT2
HARBOUR AREA KPT3
HARBOUR AREA KPT4
Nakti1 CREEKS KPT5
Nakti2 CREEKS KPT5
PATHFINDER CREEKS VADINAR1 Jetty
PATHFINDER CREEK VADINAR SPM

5.5 Phytoplankton and Zooplankton

The phytoplankton community of the sub surface water in the harbour and nearby creeks was represented by Blue green algae and diatoms during spring tide period and neap tide period. Diatoms were represented by 13 genera belonging to 3 classes, 9 orders and 12 families.

The Zooplankton community of the sub surface water in the harbour and nearby creeks is comparatively low and represented by mainly four groups Tintinids, Copepods, Foramiferans, and larval forms of Crustaceans.

However, Vadinar waters were observed to be rich in terms of diversity and abundance of phytoplankton and zooplanktons.

5.6 Noise Monitoring

Noise monitoring is carried out as per "Noise Pollution" (Regulation and Control) Rules, 2000. The results of noise monitoring results are annual mean of each location of Kandla and Vadinar Port (Table 13).

Table 13. Annual avg. of noise level at locations of Kandla (10 locations) and Vadinar (3locations) Port

Sr. No.	Locations	Day Time Average Noise Level(SPL) in dB(A)	Night Time Average Noise Level(SPL) in dB(A)
	Time	6 A.M.. And 10 P.M.	10 P.M. To 6 A.M.
1	Marine Bhavan	62.35	55.14
2	Nirman Building 1	58.41	53.72
3	Tuna Port	55.51	48.87
4	Main Gate North	62.58	57.54
5	West Gate I	66.68	60.97
6	Canteen Area	59.64	51.94
7	Main Road	65.06	56.39
8	ATM Building	67.37	58.00
9	Wharf /Jetty Area	69.50	64.12
10	Port & Custom Office	58.51	48.77
	Vadinar Port		
11	Nr. Vadinar Port Gate	59.25	52.99
12	Port Colony Vadinar	57.42	54.11
13	Nr. Vadinar Jetty	63.58	59.08

Observations:

- The Day Time Average Noise Level in all ten locations at Deendayal Port ranged from 55.51dB to 69.50dB
- The noise levels were within the day time limits (75 dB (A)) of industrial area.
- The Night Time Average Noise Level in all ten locations of Deendayal Port ranged from 48.77 dB to 64.12 dB and it was within the permissible limits of 70 dB A for the industrial area for the night time.
- The mean day time noise levels at Vadinar were 60.08dB and the mean noise levels at night hours was 55.39dB.

5.7 Soil Monitoring

Sampling and analysis of soil samples was under taken at six locations with in the study area (Deendayal Port and Vadinar Port). The soil monitoring locations are coastal soils and exhibits saline soil characteristics, typical of a muddy shore.

The texture of soil of all locations was Sandy Loam. The soil at all the locations is saline in nature. The mean pH of the soil at all the locations of Kandla was 8.08 pH unit suggesting it to be slightly to medium alkaline.

Electrical conductivity of the soil was high with low moisture and organic carbon indicating less productivity of the soil and its unsuitability for any agriculture activities.

Other metals like copper, nickel and lead were detected in traces or within permissible limits. The overall surrounding soils were found to be less in essential nutrients, hence less suitable for plant growth.

Table 14. Tuna port Soil Analysis Result

Sr.No	Month		March.21	April.21	May.21	June.21	July.21	Aug.21	Sept.21	Oct.21	Nov.21	Dec.21	Jan.22	Feb.22
	Parameter	Unit	Result											
1	Texture		Sandy Loam											
2	pH	-	8.71	9.02	8.38	7.3	8.56	8.6	8.58	8.62	8.42	8.2	8.2	8.59
3	Electrical conductivity	µs/cm	10600	8650	29500	33400	26800	23400	18400	16200	14070	10805	10805	2839
4	Moisture	%	21.72	22.9	14	21.45	23.66	20.42	21	17	18.17	6.06	6.06	22
5	Total Organic Carbon	%	1.62	2.25	0.94	0.31	0.16	0.18	0.48	0.52	0.2	0.49	0.49	0.96
6	Alkalinity	mg/kg	40.04	80.08	80.08	100.1	140.14	60.06	72.07	60.06	80.08	70.07	70.07	40.04
7	Total Nitrogen	%	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	BQL	BQL	BQL	BQL
8	Chloride	mg/kg	1244	2605.8	7896.2	6228.7	3908.6	4010	1506.6	1620	1956.8	709	709	3545
9	Sulphate	mg/kg	102	107.82	2502.08	2056.4	203	188	202	230	212	778.5	778.5	3891.18
10	Phosphorus	mg/kg	31.44	39.86	0.76	0.97	0.97	0.9	0.89	0.9	2.2	9.21	9.21	50.87
11	Potassium	mg/kg	1178	1028	1128	1161	779.4	786	386	396	539	143	143	192.3
12	Calcium	mg/kg	4843	228.4	320.64	641.3	2241	2341	1585	1620	5752	1315.7	1315.7	2466.12
13	Sodium	mg/kg	501	12092.4	11092.4	10821.6	144.29	160	228.46	230.32	200.4	152.3	152.3	284.57
14	Copper as Cu	mg/kg	52.2	62.2	10.2	11.21	42.6	32.2	52.2	17.4	14.9	35.9	35.9	26.2
15	Lead as Pb	mg/kg	5	4.8	5.4	3.1	4.2	3.8	4.9	6.4	5.8	13.4	13.4	7.5
16	Nickel as Ni	mg/kg	33.3	32.86	16.7	20.71	36.2	37.2	46.2	33.5	35.3	54.5	54.5	39.1
17	Zinc as Zn	mg/kg	56.2	58.26	22.6	32.26	58.6	59.36	66.2	55.9	40.6	89.7	89.7	58.2
18	Cadmium as Cd	mg/kg	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL

Table15. IFFCO Plant Soil Analysis Result

Sr.No	Month		March.21	April.21	May.21	June.21	July.21	Aug.21	Sept.21	Oct.21	Nov.21	Dec.21	Jan.22	Feb.22
	Parameter	Unit	Result											
1	Texture		Sandy Loam											
2	pH	-	7.98	8.78	8.25	8.16	8.11	8.1	8.16	8.1	7.92	7.77	7.77	8.6
3	Electrical conductivity	µs/cm	28900	36200	44400	48500	23800	20420	25620	26820	16210	22960	22960	1442
4	Moisture	%	23.97	22.1	20.91	13.94	22.09	21.16	22.2	18.2	9.01	6.4	6.4	28.37
5	Total Organic Carbon	%	6.29	1.4	1.52	0.19	0.24	0.18	1.24	1.02	0.49	0.69	0.69	0.71
6	Alkalinity	mg/kg	40.04	60.06	60.06	140.14	140.14	140.04	36.04	80.44	120.12	26.03	26.03	40.04
7	Total Nitrogen	%	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	BQL	BQL	BQL	BQL
8	Chloride	mg/kg	2487	4510	6866.3	6032.5	4309.5	4324	6381	5380	4112.2	4325.9	4325.9	2481.5
9	Sulphate	mg/kg	204	311.7	804.5	75.86	177.9	179.2	196	198	279	3359.5	3359.5	1650.89
10	Phosphorus	mg/kg	21.25	52.7	2.45	1.41	0.8	0.86	0.92	0.82	1.89	10.56	10.56	5.33
11	Potassium	mg/kg	1715	747	762	592.2	644.4	656	820	810	327.4	199.8	199.8	155.01
12	Calcium	mg/kg	4710	468.9	661.32	561.12	3556.8	3618	3386	3400	4061.6	1116.4	1116.4	1500.32
13	Sodium	mg/kg	601	4840.2	5832.2	2992.8	128.22	130	741.5	722.2	488.98	360.72	360.72	432.86
14	Copper as Cu	mg/kg	60.8	52.5	26.2	27.22	61.2	58.2	78.2	38.8	29.5	29.9	29.9	35.6
15	Lead as Pb	mg/kg	1	1.52	8.5	6.2	3.2	3.8	5.6	7.9	6.4	9.3	9.3	10.8
16	Nickel as Ni	mg/kg	27.52	22.62	2020	1823	31.6	32.4	28	13.9	16.6	30.8	30.8	42.9
17	Zinc as Zn	mg/kg	43.2	59.2	89.1	72.62	39.25	38.32	41.6	91.9	104.8	153.2	153.2	102.7
18	Cadmium as Cd	mg/kg	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL

Table 16. Khori Creek Soil Analysis Result

Sr.No	Month		March.21	April.21	May.21	June.21	July.21	Aug.21	Sept.21	Oct.21	Nov.21	Dec.21	Jan.22	Feb.22
	Parameter	Unit	Result											
1	Texture		Sandy Loam											
2	pH	-	8.75	8.82	8.13	8.36	8.38	8.42	8.46	8.75	8.44	8.53	8.53	8.68
3	Electrical conductivity	µs/cm	8500	16380	39900	21800	23700	23700	17880	16252	13680	22260	22260	1950
4	Moisture	%	19.04	21.2	28.1	18.82	24.41	23.22	24.1	19.1	21.39	9.02	9.02	21
5	Total Organic Carbon	%	1.46	2.2	1.7	0.26	0.32	0.25	0.48	0.62	0.2	0.61	0.61	0.98
6	Alkalinity	mg/kg	60.06	60.06	70.05	80.08	100.1	140.04	190.19	140.2	60.06	52.05	52.05	40.04
7	Total Nitrogen	%	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	BQL	BQL	BQL	BQL
8	Chloride	mg/kg	1144	3658.1	7160.6	2550.3	6114	5982	1701	1820	1800.9	3970.4	3970.4	2836
9	Sulphate	mg/kg	120	129.05	356.6	292	113.8	110	112	120	93.3	315.3	315.3	1292.27
10	Phosphorus	mg/kg	17.74	34.55	7.79	0.79	1.24	1.04	1.05	0.96	1.41	6.92	6.92	8.87
11	Potassium	mg/kg	903	698.4	578.4	700.2	1135.8	1162	345	366	409.2	139	139	160.36
12	Calcium	mg/kg	4235	284.6	460.92	701.4	3981.6	4220	2303	2122	3954	1234.8	1234.8	1839.79
13	Sodium	mg/kg	200	7437.6	6336.6	3164.4	168.3	170	248.5	252	252	144.29	144.29	232.46
14	Copper as Cu	mg/kg	40.6	38.6	29.4	28.2	38.2	42.2	46.2	21.2	9.8	30.8	30.8	31.8
15	Lead as Pb	mg/kg	4.2	3.62	31	23	3.6	3.6	3.2	29.1	3.5	11.1	11.1	5.4
16	Nickel as Ni	mg/kg	31.62	29.62	9	7.8	39.4	41.2	33.2	34.5	23.5	44.1	44.1	42
17	Zinc as Zn	mg/kg	46	42.62	95.8	65.9	52.4	53.4	68	77.9	25.4	76.8	76.8	76.7
18	Cadmium as Cd	mg/kg	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL

Table 17. Nakti Creek Soil Analysis Result

Sr.No	Month		March.21	April.21	May.21	June.21	July.21	Aug.21	Sept.21	Oct.21	Nov.21	Dec.21	Jan.22	Feb.22
	Parameter	Unit	Result											
1	Texture		Sandy Loam											
2	pH	-	8.39	8.68	7.91	8.26	8.33	8.3	8.26	8.33	8.23	8.02	8.02	8.47
3	Electrical conductivity	µs/cm	13340	4790	38200	37200	16260	17200	16520	17520	9240	14090	14090	2848
4	Moisture	%	22.65	4.13	26.2	14.26	23.65	20.12	18.8	20.22	21.08	23.84	23.84	24.88
5	Total Organic Carbon	%	1.61	0.7	1.58	0.24	0.1	0.11	3.93	3.1	0.72	0.87	0.87	0.84
6	Alkalinity	mg/kg	40.04	80.08	70.05	140.14	80.08	60.06	90.09	80.44	100.1	44.04	44.04	40.04
7	Total Nitrogen	%	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	BQL	BQL	BQL	BQL
8	Chloride	mg/kg	1386	4359.7	9416.7	7160.6	3959	4001	1878.9	2078	514.7	3048.7	3048.7	3190.5
9	Sulphate	mg/kg	214	299.4	3966.5	87.84	93.8	100	112	118	165.1	574.7	574.7	4950.89
10	Phosphorus	mg/kg	35.87	50.04	1.66	1.59	1.77	1.62	1.1	1.02	2.15	4.76	4.76	8.5
11	Potassium	mg/kg	743	865.8	755.8	765	766.8	780	422	460	667.6	121.9	121.9	178.48
12	Calcium	mg/kg	3453	493	821.64	661.32	3038.4	3122	1990	2012	1477	1426.3	1426.3	2450.29
13	Sodium	mg/kg	501	7165.8	6355.8	3736.8	224.4	220	468.94	470.42	470.42	192.38	192.38	492.9
14	Copper as Cu	mg/kg	21.2	19.2	33.7	31.78	22.6	23.4	33.8	35.1	27.6	25.8	25.8	25
15	Lead as Pb	mg/kg	6.8	2.8	15.3	11.4	3.8	4.1	4.8	7.6	8.2	10.5	10.5	7.6
16	Nickel as Ni	mg/kg	22.02	19.22	25.4	15.1	22.6	24.5	26.1	13.2	37.7	39.6	39.6	31.9
17	Zinc as Zn	mg/kg	62	59.8	87.3	77.21	46.6	48.5	49.55	81.9	55.2	59.1	59.1	48.1
18	Cadmium as Cd	mg/kg	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL

Table 18. Vadinar DPA Admin Site Soil Analysis Result

Sr.No	Month		March.21	April.21	May.21	June.21	July.21	Aug.21	Sept.21	Oct.21	Nov.21	Dec.21	Jan.22	Feb.22
	Parameter	Unit	Result											
1	Texture		Sandy Loam											
2	pH	-	8.46	8.86	8.76	7.27	8.12	8.09	8.02	8.1	7.79	8.07	8.07	7.64
3	Electrical conductivity	µs/cm	585	439	260	511	509	510	523	560	387	1994	1994	1417
4	Moisture	%	7.16	4.62	7.26	6.28	9.44	9.04	8.66	7.26	3.46	4.22	4.22	8.49
5	Total Organic Carbon	%	2.53	0.87	1.16	0.15	0.2	0.21	0.18	0.12	0.85	1.16	1.16	0.32
6	Alkalinity	mg/kg	60.06	40.04	60.06	60.06	100.1	100.1	60.06	60.06	60.06	42.04	42.04	60.06
7	Total Nitrogen	%	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	BQL	BQL	BQL	BQL
8	Chloride	mg/kg	280	90.2	29.43	68.66	39.3	42.2	52	62	21.7	567.2	567.2	141.8
9	Sulphate	mg/kg	330	268	23.2	14.37	13.4	14	12	16	44.7	52.7	52.7	250.38
10	Phosphorus	mg/kg	2.83	5.85	8.5	0.97	0.8	0.78	0.78	0.8	BQL	15.06	15.06	1..88
11	Potassium	mg/kg	131	212.8	302.8	626.4	129.6	130	110	120	70.4	73	73	30.01
12	Calcium	mg/kg	56	244.5	1703.4	124.2	1220	1224	990	910	72.8	65.1	65.1	153.5
13	Sodium	mg/kg	1303	236	246	2116.8	104.2	110	118	110	436.87	460.92	460.92	837.67
14	Copper as Cu	mg/kg	16.6	14.5	80.5	82.66	16.2	17.4	18.6	16.6	88.4	54	54	18.3
15	Lead as Pb	mg/kg	BQL	BQL	BQL	BQL	BQL	BQL	3.2	4.8	BQL	BQL	BQL	BQL
16	Nickel as Ni	mg/kg	26.42	18.26	35.3	25.46	18.3	19.3	18.2	13.2	33.8	42.1	42.1	60.2
17	Zinc as Zn	mg/kg	40	38.3	33.2	23.46	46.8	49.2	24	28	66	51	51	84.6
18	Cadmium as Cd	mg/kg	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL

Table 19. Vadinar DPA Colony Soil Analysis Result

Sr.No	Month		March.21	April.21	May.21	June.21	July.21	Aug.21	Sept.21	Oct.21	Nov.21	Dec.21	Jan.22	Feb.22
	Parameter	Unit	Result											
1	Texture		Sandy Loam											
2	pH	-	8.82	8.49	8.85	7.82	8.42	8.32	8.56	8.22	8.43	7.84	7.84	7.11
3	Electrical conductivity	µs/cm	875	634	513	464	419	400	420	480	314	490	490	299.6
4	Moisture	%	9.67	6.51	6.35	4.56	7.59	8.22	9.02	8.22	3.95	2.86	2.86	3.96
5	Total Organic Carbon	%	2.42	1.04	1.71	0.11	0.12	0.16	0.21	0.2	0.43	1.24	1.24	0.67
6	Alkalinity	mg/kg	60.06	60.06	70.05	100.1	60.06	80.04	100.1	80.44	80.08	40.04	40.04	40.04
7	Total Nitrogen	%	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	BQL	BQL	BQL	BQL
8	Chloride	mg/kg	290	120.3	40.09	78.47	68.7	67.8	67.8	77	113.4	283.6	283.6	70.9
9	Sulphate	mg/kg	210	424	4.02	13.58	15.5	16.2	18	20	27.7	14.7	14.7	BQL
10	Phosphorus	mg/kg	3.36	7.79	7.35	0.97	0.97	0.88	0.86	0.72	1.74	7.06	7.06	BQL
11	Potassium	mg/kg	103	140	152	876.4	180	182	172	160	62	17	17	28.87
12	Calcium	mg/kg	94	196.4	1463	172.3	1445.4	1400	810	888	65.9	15.9	15.9	20.32
13	Sodium	mg/kg	501	126	166	2565	56.11	68	72	82	256.51	328.66	328.66	472.94
14	Copper as Cu	mg/kg	17.4	18.2	71.6	72.42	23	23	28	17	48.4	77	77	62.3
15	Lead as Pb	mg/kg	BQL	BQL	BQL	BQL	BQL	BQL	1.1	2	4.2	6.7	6.7	BQL
16	Nickel as Ni	mg/kg	22.1	21.22	31.8	27.73	21.2	20.4	16.2	12.2	27.3	36.7	36.7	33.3
17	Zinc as Zn	mg/kg	36	35.36	33.5	43.2	38.2	40.4	38.5	36.22	30.5	98.9	98.9	44
18	Cadmium as Cd	mg/kg	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL

pH

The pH was found at tuna port from 7.3 to 9.02, at IFFCO plant from 7.77 to 8.78, at Khori creek from 8.13 to 8.82, at Nakti creek from 7.91 to 6.68, at Vadinar DPA admin site from 7.7 to 8.86 and 7.11 to 8.85 at Vadinar DPA colony.

Moisture

The moisture was found at tuna port 6.06 to 23.66%, at IFFCO plant 6.4 to 28.37%, at Khori creek 9.02 to 28.1%, at Nakti creek 4.13 to 26.2%, at Vadinar DPA admin site 3.46 to 9.44%, and 2.86 to 9.67% at Vadinar DPA colony.

Electrical conductivity

The Electrical Conductivity was found at tuna port 2839 to 33400 µs/cm, at IFFCO plant 1442 to 48500 µs/cm, at Khori creek 1950 to 39900 µs/cm, at Nakti creek 2848 to 38200 µs/cm, at Vadinar DPA admin site260 to 1994 µs/cm, and 299.6 to 875 µs/cm at Vadinar DPA colony.

Total Organic Carbon

The total organic Carbon was found at tuna port 0.16 to 2.25%, at IFFCO plant 0.18 to 6.29%, at Khori creek 0.2 to 2.2%, at Nakti creek 0.1 to 3.93%, at Vadinar DPA admin site 0.12 to 2.53%, and 0.11 to 2.42% at Vadinar DPA colony.

Texture

The texture was found sandy loam for all location.

Cadmium as Cd

The Cadmium was found below quantification limit for all location.

Zinc as Zn

The zink as Zn was found at tuna port 22.6 to 89.7 mg/kg , at IFFCO plant 38.32 to 153.2 mg/kg , at Khori creek25.4 to 95.8 mg/kg, at Nakti creek 46.6 to 87.3 mg/kg ,at Vadinar DPA admin site 23.46 to 84.6 mg/kg, and 30.5 to 98.9 mg/kg at Vadinar DPA colony.

5.8 Sewage Treatment Monitoring

This involve safe collection of waste water (spent/used water) from wash areas, bathroom, cargo operational units, etc., waste from toilets of various buildings and its conveyance to the treatment plant and final disposal inconformity with the requirement and guide lines of State Pollution Control Board and other statutory bodies.

The waste water is let into sewer network (network of pipes and manholes) and let by gravity and intermittent pumping stations to the main Sewage Treatment Plant (STP).

The Sewage Treatment Monitoring is carried out at Deendayal Port Colony (Gopalpuri), Vadinar Port and Deendayal Port.

STP at Gopalpuri Port Colony

Gopalpuri STP is working properly and overall performance of the existing STP was found satisfactory. The removal efficiency of BOD, TSS was in order. The individual units were also performing well and their removal efficiency is satisfactory. Thus with the sample tested in laboratory the plant is working satisfactory and the individual units are also working well.

STP at Kandla Port

STP with improved capacity of 1.5 MLD at Deendayal Port is operational. The newly installed sewage treatment plant has 1500 cum/day fluidized media reactor based STP to treat domestic waste water generated from the campus and treated water will be utilized for gardening and plantation purpose.

Table 20. Gopalpuri STP Outlet Annual Results

Sr. No.	Parameter	Unit	1st Quarter Mean	2nd Quarter Mean	3rd Quarter Mean	Value (Annual Avg.)	GPCB Prescribed Limit
1	pH	-	7.21	7.36	7.32	7.30	6.5 - 8.5
2	Total Suspended Solids	mg/l	42.94	83.3	105.41	77.22	100
3	Residual Chlorine	mg/l	<0.5	<0.5	<0.5	<0.5	No Limit
4	Chemical Oxygen Demand	mg/l	85.19	96.43	111.01	97.54	100
5	Biochemical Oxygen Demand	mg/l	19.69	25.56	32.87	26.04	30

Table 21. KPT STP Outlet Annual Results

Sr. No.	Parameter	Unit	1st Quarter Mean	2nd Quarter Mean	3rd Quarter Mean	Value (Annual Avg.)	GPCB Prescribed Limit
1	pH	-	7.15	7.37	7.40	7.31	6.5 - 8.5
2	Total Suspended Solids	mg/l	50.21	81.04	100.72	77.32	100
3	Residual Chlorine	mg/l	<0.5	<0.5	<0.5	<0.5	No Limit
4	Chemical Oxygen Demand	mg/l	62.58	90.53	110.26	87.79	100
5	Biochemical Oxygen Demand	mg/l	15.87	24.68	27.25	22.60	30

Table 22. Vadinar STP Outlet Annual Results

Sr. No.	Parameter	Unit	1st Quarter Mean	2nd Quarter Mean	3rd Quarter Mean	Value (Annual Avg.)	GPCB Prescribed Limit
1	pH	-	STP not Working	7.25	7.34	7.30	6.5 - 8.5
2	Total Suspended Solids	mg/l		46.68	55.44	51.06	100
3	Residual Chlorine	mg/l		<0.5	<0.5	<0.5	No Limit
4	Chemical Oxygen Demand	mg/l		62.56	81.72	72.14	100
5	Biochemical Oxygen Demand	mg/l		16.62	22.37	19.5	30

The GPCB specification for pH, TSS, Residual Chlorine , COD and BOD for STP outlet are 6.5 to 8.5 , 100 mg/l, 0.5 mg/l, 100 mg/l and 30 mg/l respectively. The average values for pH at all locations from 7.30 to 7.31, The average values for Total Suspended Solids at all locations from 51.06 to 77.32 mg/l , The average values for COD at all locations from 72.14 to 97.54 mg/l, The average values for BOD at all locations from 19.5 to 26.04 mg/l, Residual Chlorine were found below detectable limit. All parameters for STP outlet are within limit.

5.9 Weather

The data collected from Automatic weather station have been installed and other secondary sources to represent the metrological conditions of the project area has been reviewed and presented below for various attributes such as Temperature, Wind velocity, Relative Humidity, solar radiation, wind direction, Air pressure and Heat index.

Table 23. Weather Results

MONTH		Temperature (°C)	Solar Radiation (w/m2)	Relative Humidity (%)	Wind Velocity (m/s)	Wind Direction	Air pressure (hpa)	Heat index (°C)
March.21	MIN	28.4	166.7	24.7	1.9	North West	1013.2	29.0
	MAX	36.2	292.3	93.0	10.6		1017.3	43.0
April.21	MIN	31.5	134.4	57.0	1.9	South East	1009.0	24.2
	MAX	42.4	576.6	94.0	9.9		1014.1	48.0
May.21	MIN	32.7	157.7	60.2	2.0	South East	1005.3	38.1
	MAX	37.3	383.3	89.0	8.1		1010.6	47.0
June.21	MIN	29.8	208.3	66.0	2.7	South West	1004.9	35.2
	MAX	34.1	654.8	84.0	13.0		1008.9	44.0
July.21	MIN	28.5	158.4	71.2	2.7	South West	1002.4	36.1
	MAX	32.1	751.7	89.0	13.0		1004.1	43.0
Aug.21	MIN	34.1	232.4	73.0	3.0	South West	1001.2	34.7
	MAX	26.1	682.8	90.0	9.7		1008.3	42.0
Sept.21	MIN	26.7	136.0	83.5	1.9	South West	1002.3	33.5
	MAX	36.2	808.9	98.0	12.0		1010.1	49.0
Oct.21	MIN	26.5	252.2	60.0	1.3	South North	1009.3	33.8
	MAX	38.6	746.6	94.0	8.1		1016.5	55.0
Nov.21	MIN	26.5	252.2	60.0	1.3	South North	1009.3	33.8
	MAX	38.6	746.6	94.0	8.1		1016.5	55.0
Dec.21	MIN	10.5	109.9	39.0	1.7	North West	1018.0	27.0
	MAX	31.8	534.3	93.0	4.4		1021.2	30.0
Jan.22	MIN	12.6	115.3	47.2	1.2	North West	1015.9	27.2
	MAX	30.8	530.7	96.0	5.8		1021.9	32.0
Feb.22	MIN	12.6	119.2	45.6	1.3	North West	1006.3	27.8
	MAX	29.2	530.7	98.0	9.6		1022.0	33.0

Temperature

The min temperature for Deendayal Port was 10.5 °C on December. The maximum temperature was recorded 42.4°C on April.

Solar Radiation

The min Solar Radiation was recorded 109.9 w/m2 on December . The maximum solar radiation recorded in the September was 808.9 w/m2.

Relative Humidity

The min Relative humidity was recorded 24.7 % on March and maximum Relative humidity recorded was 98.0 % on February.

Wind Velocity and Wind Direction

The min wind velocity was recorded 1.2 m/s on January. Maximum wind velocity recorded was

13 m/s on June. The wind direction was mostly North West and south west throughout the year.

Air pressure

The min Air pressure was recorded 1001.2 hpa in August. Maximum Air pressure recorded was 1022 hpa on February.

Heat index

The min heat index was recorded 24.22 °C in April. Maximum heat index recorded was 55 °C on November.

6.0 Conclusion

A. Ambient Air

Ambient Air Quality monitoring results for the Second year shows TSPM, PM_{10} and $PM_{2.5}$ concentrations of the ambient air were above the permissible limits as per the National Ambient Air Quality Standards (NAAQS2019). The concentration of $PM_{10}$and $PM_{2.5}$was above the permissible limit at Coal Storage Area, Marine Bhavan and occasionally at Oil Jetty Area and ,Kandla Estate Office, Gopalpuri Hospital Tuna Port area at some occasions.

The concentration of PM_{10} was within the permissible limit at Vadinar locations except Signal Building in November and Vadinar Colony in October & November above the permissible limit.

Deendayal Port has handled 117.5 MMT to 127 MMT of dry cargo in 2021-22. This huge volume of dry cargo handled at DPA along with high winds in coastal areas causes slight rise in the Ambient Air Quality near coal berth.

Very high volume of dry cargo is being handled (especially coal) at berth no. 7, 8 and 9. Besides handling of coal, thousands of vehicles laded with coal and other dry cargo criss-cross the port/harbor roads causing the rise in suspended particles in the air.

B. Drinking Water Quality

The results of the current year monitoring suggest that, the drinking water parameters of all the locations (18 at Kandla and 2 at Vadinar Port) were found within the permissible limits as per the BIS 10500 (2012) drinking water specification.

C. Noise Quality

The day and night time noise quality was found within the permissible limits of the Noise Pollution (regulation and control) rules, 2000. The Day Time and Night Time Average Noise Level (SPL) in all ten locations at Deendayal

Port were within the permissible limits of 75 dB A (for day time) and 70 dB A (for the night time)for an industrial area.

D. Marine Water Quality

The marine water samples were collected from the harbour area and the creek area and were monitored for 28 different parameters. The mean DO levels of DPA waters ranged from 4.9 mg/L to 6.0 mg/L (mean = 5.6 mg/L), which is normal for marine waters of ports and harbors.

Evaluation of the Phytoplankton and Zooplankton population in DPA harbour area and within the immediate surroundings of the port suggests that the Kandla waters harbours low to moderate diversity and abundance of phytoplankton and zooplanktons.

E. Soil

The soil samples were collected from six locations. The 4 locations of Kandla (Tuna port, Khori Creek, Nakti creek, IFFCO plant) and 2 locations of Vadinar (Vadinar DPA Admin site and Vadinar DPA

colony). Soil samples were collected for monitored 18 different parameter.

The pH was found at tuna port from 7.11 to 9.02 Vadinar DPT colony and Tuna Port. Cadmium was found at all soil sample is BQL. (Below quantification limit).

F. Sewage Treatment Plant

Gopalpuri STP is working properly and overall performance of the existing STP was found satisfactory.

A new STP with improved capacity of 1.5 MLD at Deendayal Port is operational which is working as per the standards of CPCB/GPCB.

At Vadinar Port, a new STP was operational which is working as per the standards of CPCB/GPCB.

6.1. Steps taken by Deendayal Port to improve Environment

- "Safety Week" is being celebrated in Kandla Port by demonstrating mock drill, fire fighting, emergency preparedness, health checkup program etc.
- Regular Safety training and mock drill are being carried out and awareness is being created by lectures among the workers of the Port.
- Personal Protective Equipments (PPE like ear plugs, helmets, safety suits, etc are being used during Port Operational work.
- Sewage generated at Port Area as well as in Port colonies is being properly treated through Sewage Treatment Plants at outside Port area at Kandla and Port colony at Gopalpuri. However, DPA is planning to construct a new STP with the latest technology as the existing one is very old.
- Deendayal Port Authority have planted about one lakhs trees in road side dividers, colony areas at Kandla and Gopalpuri, in green belt area of Gandhidham & Adipur Township, Sewage Treatment Plants at Gopalpuri & Kandla and some green belt development plans initiated at different locations in Town ship areas.
- Deendayal Port Authority also carries out Environmental Audit through recognized till 2016 from environmental auditor (Schedule) of Gujarat Pollution Control Board from the year 2010 .Three Audit Reports for the year 2010, 2011 and 2012 were already submitted to GPCB as per the norms.
- DPA planted Mangroves in an area of 1500 hectares from 2005 to 2021: Mangrove Plantation Plan carried out in following phases;

1)	Year2005-06–20 hectares
2)	Year2008-09-50 hectares
3)	Year2010-11–100 hectares
4)	Year2011-12–200 hectares
5)	Year2012-13–300 hectares
6)	Year2013-14-330 hectares
7)	Year2015-17-300 hectares
8)	Year 2018- 20 - 100 hectares
9)	Year2020- 21-100 hectares
Total	**1500hectares**

- Water sprinkling on coal is regularly done to prevent coal dust pollution in the port area.

- To control the dust from bulk cargo like fertilizer, coal, sulphur, etc, the Port-users are encouraged to use hopper during discharge from vessels.
- Annual maintenance contracts have been awarded for garbage collection, cleaning of buildings and roads.
- Deendayal Port Authority is maintaining the records for collection and disposal of Solid Wastes generated from Port area, Residential area and Office Buildings.
- Deendayal Port Authority is regularly submitting the Hazardous Waste Statement in From – IV and Form V in environment sheet every financial year to the Gujarat Pollution Control Board, Gandhinagar.
- Are port on collection and disposal of the wastes from ships is submitted it to GPCB recognized body on regular basis.
- All trucks before leaving the storage yards are covered with tarpaulin and not over loaded as well as there is no spillage during transportation.
- Sewage generated at Port area and Port colonies is being properly treated through Sewage Treatment Plants outside Port area at Kandla and Port Colony at Gopalpuri.
- Deendayal Port has engaged CPCB/GPCB authorized agencies for the disposal of Hazardous waste (spent / used oil from ships) as per the Hazardous Wastes (Management and Handling) Rules.
- Pollution under Control (PUC) Certificate is mandatory for vehicles and equipments operating in the Port.
- Deendayal Port has awarded several projects to M/s Gujarat Institute of Desert Ecology(GUIDE) ,Bhuj relating to monitoring of Marine environment viz;

  - Regular Monitoring of Marine Ecology of Kandla Port Area since 2017-18
  - Creek Bathymetry
  - Analysis of dredging contaminants
  - Strategic Regional Impact Assessment Studies
  - Assessment and Monitoring of Mangrove Plantation in 1500 Ha area.
  - Biodiversity Action Plan for DPA and its surrounding areas

6.1.1 ISO 14001:2015 - Environmental Management System of Deendayal Port Authority

Deendayal port has appointed QMS India Ltd. As for Continual Improvement of ISO 14001:2015 - Environmental Management System with following scope;

- Review of environmental aspect-impacts,
- Review and monitoring of legal requirement
- Review and monitoring of emergency preparedness
- Management review by every six months
- Training of internal auditors and EMC members
- Active participation during external audit.

6.1.2 Green Ports Initiative

Deendayal Port is committed to sustainable development and adequate measures are being taken to maintain the Environmental well-being of the Port and its surrounding environs. Weighing in the environmental perspective for sustained growth, the Ministry of Shipping had started "Project Green Ports" which will help in making the Major Ports across India cleaner and greener. 'Project Green Ports" will have two verticals-one is "Green Ports Initiatives" related to environmental issues and second is **"Swachh Bharat Abhiyaan."**

The Green Port Initiatives include twelve initiatives such as preparation and monitoring plan, acquiring equipments required for monitoring environmental pollution, acquiring dust suppression system, setting up of sewage/waste water treatment plants/ garbage disposal plant, setting up Green Cover area, projects for energy generation from renewable energy sources, completion of shortfalls of Oil Spill Response (OSR) facilities (Tier-I), prohibition of disposal of almost all kind of garbage at sea, improving the quality of harbor wastes etc.

Deendayal port has also appointed GEMI as an Advisor for "Making Deendayal Port a Green Port- Intended Sustainable Development under the Green Port Initiatives.

- Deendayal Port has also signed MoU with Gujarat Forest Department in August 2019 for Green Belt Development in an area of 31.942 Ha of land owned by Deendayal Port Authority. The plantation is being carried out by the Social Forestry division of Kachchh.

7. Suggestions

7.1 Ambient Air Quality

PM_{10} values at Coal storage area, Marine Bhavan, Oil Jetty and Tuna Port were occasionally found above the permissible standards and $PM_{2.5}$ was occasionally found above permissible limits at Coal storage area. (100µg/m^3 for PM_{10}& 60 µg/m^3 for $PM_{2.5}$). The principle reason for higher PM_{10}values at Coal Storage and Marine Bhavan are bulk handling of coal, other dry cargo and heavy traffic of transport vehicles.

7.1.1 Sprinkling

- Heavy duty Water sprinklers should be used inside port where large scale dry cargo is handled.
- Mobile air Sprinklers should also be procured, which suppresses the fine dust from blowing during handling of dry cargo.

7.1.2 Enclosed conveyors

- Port users should be motivated to use enclosed conveyors which prevents secondary dust emissions due to wind in the port area.

7.1.3 Mechanized handling systems

- This involves using screw type un loaders which results in much less spillage and loss of material as compared to bucket un loaders. Mechanized systems can also use pre-packed containers for ease and pollution free loading unloading. Diligent use of various systems can keep the pollution due to ports at minimum level.

- Besides these prevention measures, Gujarat Pollution Control Board (GPCB) has also issued guidelines for handling of Coal. Guidelines for Coal Transport, Storage and Handling given below should be strictly followed; (*https://gpcb.gujarat.gov.in/uploads/coal-handling-guidelines1.pdf)*

7.2 GPCB Guidelines for Coal handling units:

(A) Location criteria

- In case of coal handling activities at the ports and jetties or extension thereof, the distance and land use criteria may be relaxed and compensated by advanced/sophisticated pollution control measures and mechanization & thick plantation, however all such ports and jetties, where coal handling is

carried out, shall provide closed conveyor belt and mechanization for handling of coal.

(B) Storage and handling criteria

- Coal handling unit/Agency shall store coal in such a way that coal heap should not be higher than 5 meter and clear distance between two adjoining heaps at G.L. should be 5 meters, so that in case of fire, approach is available.
- There should be mechanized loading/unloading system from the loading /unloading area to the stacking yards and in to the vehicles.
- Coal handling unit/Agency shall take all corrective steps to resolve the issue of air pollution at permitted coal storage/handling area where coal is being stored.

(C) Transport criteria

- Coal handling unit/Agency shall ensure that all trucks before leaving the storage yard shall be showered with water with adequate system, Shall be covered with tarpaulin or any other effective measure/device completely and also that trucks are not overloaded as well as there is no spillage during transportation.
- The vehicle carrying the coal should not be overloaded by raising the height of carriage. Weigh scale shall be provided within the loading area only and port/coal park authority shall ensure that no over loading is done.
- The top of the vehicle should be covered with fixed cover to avoid spillage or dusting of coal.

(D) Pollution prevention criteria

- Coal handling unit/Agency shall provide paved approach with adequate traffic carrying capacity
- Coal handling unit/Agency shall construct compound wall all along periphery of the premises with minimum 9 meters height
- Continuous water sprinkling shall be carried out on the top of the heap at regular intervals to prevent dusting, fire & smoke. To prevent fugitive emission during loading/unloading, fixed pipe network with sufficient water storage and pump shall be installed. Water sprinkling shall be carried out at each and every stage of handling to avoid generation of coal dust or other dust within premises
- Coal handling unit/Agency shall ensure regular sweeping of coal dust from internal and main road and also ensure that there is adequate space for free movement of vehicles.
- The following adequate Air Pollution Control Measures shall be installed and to be operated efficiently.
- Construction of effective wind breaking wall suitable to local condition to prevent the suspension of particles from the heaps.
- Construction of metal road & RCC Pucca flooring in the plot area/godown etc.
- System for regular cleaning and wetting of the floor area within the premises.
- Entire coal storage area/godown should be covered with permanent weather shed roofing and side walls i.e., in closed shed, in case of crushing/sieving/grading activity is carried out (i.e. G. I. Sheet)along with adequate additional APCM should be installed. Coal handling unit/Agency shall carryout three rows plantation with tall growing tress all along the periphery of the coal handling premises, inside & outside of the premises along with road.

- Proper drainage system shall be provided in all coal storage area so that water drained from sprinkling & runoff is collected at a common tank and can be reused after screening through the coal slit or any other effective treatment system.
- All the engineering control measures and state of art technology including covered conveyer belts, mechanized loading and unloading, provision of silo etc. shall be provided in addition to the measurers commended in the environmental guidelines for curbing the pollution.

(E) Safety requirement

- Coal handling unit/Agency shall provide adequate fire-fighting measure to avoid any fire or related hazards including adequate water storage facility, and the premises shall be exclusively used for storage of the coal.

- An onsite emergency plan shall be prepared and implemented by coal handling unit.

(F) Legal criteria

- Necessary permission from all the applicable regulatory authorities and adequate steps under the provisions of applicable environmental acts/rules shall be taken.

- Coal handling unit/Agency shall prepare EMP (Environment Management Plan) and implement the same in true spirit and thus maintain overall environment of that area.

- Coal handling unit/Agency shall not carry out the operation of loading/unloading of coal/coal dust at any place, till adequate air pollution control equipment for dust control/suppression are installed and efficiently operated and the consent under the provisions of Air (Prevention & Control of Pollution) Act, 1981 is obtained by the coal yard owners/Coal handling unit/Agency/coal importers.

- Coal handling unit/Agency shall operate continuous Ambient Air Quality Monitoring Stations as per CPCB guideline.

- In case of port which provides the facility to individual developers an agreement/MoU shall be made between port authority and developer for curtailment of pollution. Port authority shall be responsible for supervising and controlling the pollution control related activities and implementation of the environmental guidelines.

7.3 Sewage Treatment Plant at Vadinar

- At Vadinar, the sewage waste water from the colony is connected in to new STP. Is commissioned and fully operational to handle the Sewage Waste Water.

8.0 ANNEXURE I-A
Ambient Air Quality Standards (NAAQS)

Pollutants	Time weighted average	Concentration in Ambient air µg/m³		
		Industrial Areas	Residential /Rural & Other areas	Sensitive Areas
Sulphur Dioxide (SO_2	Annual	50	50	20
	24hours**	80	80	80
Respirable Particulate Matter(size>10um) (RPM) PM_{10}	Annual	60	60	60
	24hours**	100	100	100
Particulate Matter(size>2.5um) $PM_{2.5}$	Annual	40	40	40
	24hours**	60	60	60
Nitrogen Dioxide (NO_2)	Annual	40	40	30
	24hours**	80	80	80

- Annual arithmetic mean of minimum of 104 measurements in a year taken twice a week. 24 hourly at uniform interval
- 24 hourly / 8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days

Note:

- National Ambient Air Quality Standard: The levels of air quality with an adequate margin of safety, to protect the public health, vegetation and property.
- Wherever and whenever two consecutive values exceeds the limit specified above for the respective category, it would be considered adequate reason to institute regular/continuous monitoring and further investigations.
- The State Government/State Board shall notify the sensitive and other areas in the respective states within a period of six months from the date of Notification of National Ambient Air Quality Standards.

[{S.O.384 (E), Air (Prevention & Cont. of Pollution) Act,1981 dated April 11,1994]

ANNEXURE I-B

Drinking Water Standards (BIS)

Sr. No.	Parameter	Unit	Acceptable Limits	Permissible Limits
1	pH	-	6.5 to 8.5	6.5 to 8.5
2	Total Dissolved Solids	mg/L	500	2000
3	Turbidity	NTU	1	5
4	Odor	-	Agreeable	Agreeable
5	Color	Hazen Units	5	15
6	Conductivity	µs/cm	NS*	NS*
7	Bio.Oxygen Demand	mg/L	NS*	NS*
8	Chloride as Cl	mg/L	250	1000
9	Ca as Ca	mg/L	75	200
10	Mg as Mg	mg/L	30	100
11	Total Hardness	mg/L	200	600
12	Iron as Fe	mg/L	0.3	NS*
13	Fluorides as F	mg/L	1	1.5
14	Sulphate as SO_4	mg/L	200	400
15	Nitrite as NO2	mg/L	NS*	NS*
16	Nitrate as NO3	mg/L	45	NS*
17	Salinity	%	NS*	NS*
18	Sodium as Na	mg/L	NS*	NS*
19	Potassium as K	mg/L	NS*	NS*
20	Manganese	mg/L	0.1	0.3
21	Hexavalent Chromium	mg/L	NS*	NS*
22	Copper	mg/L	0.05	1.5
23	Cadmium	mg/L	0.003	NS*
24	Arsenic	mg/L	0.01	0.05
25	Mercury	mg/L	0.001	NS*
26	Lead	mg/L	0.01	NS*
27	Zinc	mg/L	5	15
28	Bacterial Count	CFU/100ml	Absent	Absent

*Not specified in IS10500:2012

Bacteriological Standards (for Drinking water)

	Organisms	Requirements
All water intended for drinking		
	(a)E.coliorthermo-tolerant Coli form bacteria	Shall not be detectable in any 100 ml sample
Treated water entering the distribution system		
	a)E.coliorthermo-tolerant Coliformbacteria	Shall not be detectable in any 100 ml sample
	b)Total Coli form bacteria	Shall not be detectable in any 100 ml sample
Treated water in the distribution system		
	a)E.coliorthermo-tolerant Coli form bacteria	Shall not be detectable in any 100 ml sample
	b)TotalColiformbacteria	Shall not be detectable in any 100 ml sample

(BIS specifications (IS10500-2012)

ANNEXURE -I-C

Noise Quality Standards

Area Code	Category of Area	Limits in dB(A) Leq	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

- Day Time is recorded in between 6.00 A.M. and 10.00 P.M.
- Night time is recorded in between 10.00 P.M. to 6.00 A.M.
- Silence zone is defined as areas up to 100 meters around such premises as hospitals, educational institutions and courts. The silence zones are to be declared by the Competent Authority.
- Use of vehicular horns, loud speakers and bursting of crackers shall be banned in these zones.
- Mixed categories of areas should be declared as one of the four above mentioned categories by the Competent Authority and the corresponding standards shall apply.

[Source: EPA Notification [G.S.R.1063 (E) dt.26.12.1989 published in the Gazette No.643 dt.26.12.1989.]

ANNEXURE – 3

DETAILS OF HAZARDOUS WASTE GENERATED

Annexure -I

DEENDAYAL PORT AUTHORITY
MARINE DEPARTMENT

Statement of Hazardous & Non Hazardous Waste disposal from the vessels at Kandla & Vadinar Port
YEAR 2021-22

Sr. No.	MONTH	YEAR	Hazardous (Sludge)	Non Hazardous (Garbage)
1	APRIL	**2021**	3006.02	95.13
2	MAY	**2021**	1014.18	118.78
3	JUNE	**2021**	830.21	148.35
4	JULY	**2021**	863.36	105.89
5	AUGUST	**2021**	762.38	133.90
6	SEPTEMBER	**2021**	898.80	208.42
7	OCTOBER	**2021**	193.08	175.53
8	NOVEMBER	**2021**	210.06	194.18
9	DECEMBER	**2021**	381.77	167.02
10	JANUARY	**2022**	261.94	109.80
11	FEBRUARY	**2022**	254.66	96.03
12	MARCH	**2022**	909.39	171.05
	TOTAL		**9585.85** MT	**1724.08** MT

Deputy Conservator
Deedayal Port Authority

03/2164
30/6/22

Marine Department

Statement showing the Collection and disposal of Hazardous and Non-Harardous Wastes carried out by various parties from April - 2021 to Mar - 2022

Sr. No.	Name of Party	Validity of License	Type of Licence	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21
1	Alicid Organic Industries Limited	27-Oct-22	Hazardous	-	70.45	-	-	19.81	-
2	Amar Hydrocarbon Pvt. Ltd	22-Feb-23	Hazardous	-	-	-	-	-	-
3	Atlas Organics Pvt. Ltd	17-Oct-22	Hazardous	20.17	-	-	18.78	19.81	50.85
4	Aviation Corporation	14-Jun-22	Hazardous	-	-	-	151.18	71.53	133.63
5	Fine Refiners Pvt. Ltd	22-Jun-22	Hazardous	48.59	31.88	115.80	-	-	14.88
6	Priyansi Corporation	16-Dec-22	Hazardous	-	-	33.83	9.62	-	-
7	Revolution Petrochem LLP	01-Apr-22	Hazardous	2,658.01	531.52	442.73	546.48	524.09	456.01
8	Shana Oil Process	12-Feb-22	Hazardous	-	-	-	-	-	-
9	United Shipping Company	13-Sep-22	Hazardous	279.25	380.33	237.85	137.30	127.14	243.43
10	**Vaccant**	-	-	-	-	-	-	-	-
11	Chitrakut Trading & Industries	17-Nov-22	Non-Hazardous	-	0.98	-	0.65	0.39	-
12	Golden Shipping Services	30-May-23	Non-Hazardous	25.76	19.01	72.77	28.84	36.86	49.81
13	Green Earth Marine Solutions	23-Mar-23	Non-Hazardous	-	-	-	-	-	-
14	Harish A. Pandya	03-Feb-23	Non-Hazardous	4.86	0.68	3.95	0.90	1.23	8.00
15	K M Enterprise	04-May-23	Non-Hazardous	-	57.04	43.81	53.40	29.93	28.26
16	Naaz Shipping Services Ent	05-Jun-22	Non-Hazardous	6.40	-	2.80	-	0.60	12.30
17	New India Marine Works	22-Feb-23	Non-Hazardous	-	-	-	-	-	-
18	Omega Marine Services	28-Jun-22	Non-Hazardous	46.01	30.99	18.29	-	27.59	61.62
19	Vishwa Trade-link Inc.	25-Jun-22	Non-Hazardous	-	-	-	10.80	17.28	15.12
20	V K Enterprise	16-Nov-22	Non-Hazardous	12.10	10.08	6.73	11.30	20.02	33.31
			Hazardous - Total	**3,006.02 MT**	**1,014.18 MT**	**830.21 MT**	**863.36 MT**	**762.38 MT**	**898.80 MT**
			Non-Hazardous - Total	**95.13 MT**	**118.78 MT**	**148.35 MT**	**105.89 MT**	**133.90 MT**	**208.42 MT**

Copy to : GPCB, Gandhidham / Harbour Master

Marine Department

Statement showing the Collection and disposal of Hazardous and Non-Harardous Wastes carried out by various parties from April - 2021 to Mar - 2022

Sr. No.	Name of Party	Validity of License	Type of Licence	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Total
1	Alicid Organic Industries Limited	27-Oct-22	Hazardous	-	-	-	-	-	-	**90.26**
2	Amar Hydrocarbon Pvt. Ltd	22-Feb-23	Hazardous	-	-	-	-	-	-	**-**
3	Atlas Organics Pvt. Ltd	17-Oct-22	Hazardous	30.82	140.02	-	-	-	92.47	**372.92**
4	Aviation Corporation	14-Jun-22	Hazardous	-	-	-	-	-	-	**356.34**
5	Fine Refiners Pvt. Ltd	22-Jun-22	Hazardous	-	-	-	6.20	-	-	**217.35**
6	Priyansi Corporation	16-Dec-22	Hazardous	-	-	-	-	-	-	**43.45**
7	Revolution Petrochem LLP	01-Apr-22	Hazardous	-	-	-	-	-	507.63	**5,666.47**
8	Shana Oil Process	12-Feb-22	Hazardous	-	-	-	-	-	-	**-**
9	United Shipping Company	13-Sep-22	Hazardous	162.26	70.04	381.77	255.74	254.66	309.29	**2,839.06**
10	**Vaccant**	-	-	-	-	-	-	-	-	**-**
11	Chitrakut Trading & Industries	17-Nov-22	Non-Hazardous	0.27	0.10	-	-	-	0.10	**2.49**
12	Golden Shipping Services	30-May-23	Non-Hazardous	43.90	41.41	66.73	51.67	42.02	95.34	**574.12**
13	Green Earth Marine Solutions	23-Mar-23	Non-Hazardous	-	-	-	-	-	-	
14	Harish A. Pandya	03-Feb-23	Non-Hazardous	0.27	0.27	-	-	-	2.82	**22.98**
15	K M Enterprise	04-May-23	Non-Hazardous	78.13	106.72	100.29	58.13	23.80	27.75	**607.26**
16	Naaz Shipping Services Ent	05-Jun-22	Non-Hazardous	-	-	-	-	-	-	**22.10**
17	New India Marine Works	22-Feb-23	Non-Hazardous	-	-	-	-	-	10.80	**10.80**
18	Omega Marine Services	28-Jun-22	Non-Hazardous	24.34	40.28	-	-	16.20	25.56	**290.88**
19	Vishwa Trade-link Inc.	25-Jun-22	Non-Hazardous	-	-	-	-	-	-	**43.20**
20	V K Enterprise	16-Nov-22	Non-Hazardous	28.62	5.40	-	-	14.01	8.68	**150.25**
			Hazardous - Total	**193.08 MT**	**210.06 MT**	**381.77 MT**	**261.94 MT**	**254.66 MT**	**909.39 MT**	**9,585.85 MT**
			Non-Hazardous - Total	**175.53 MT**	**194.18 MT**	**167.02 MT**	**109.80 MT**	**96.03 MT**	**171.05 MT**	**1,724.08 MT**

Copy to : GPCB, Gandhidham / Harbour Master

LIST OF AUTHORIZED RECYCLERS

Marine Department

STATEMENT SHOWING DEENDAYAL PORT REGISTERED PARTIES FOR REMOVAL OF GARBAGE, USED OIL/WASTE OIL ETC.

Sr. No.	Name of Party	Licensce of Removal	Last Validity of License	Remarks
1	**M/s. Alicid Organic Industries Ltd** Office No. 35, First Floor, Grain Marchan Association Building, Plot No. 297, Ward 12/B, Near Old Court, Gandhidham Email: naazshipping service@yahoo.com Phone: 02836- 237106	Hazardous	**27-Oct-22**	
2	**M/s. Atlas Organics Pvt. Ltd** Office No. 204-206, Elisbridge Shopping Center, Opp. Town Hall, Ashram Road, Ahmedabad - 380006 Email : atlasorganics@yahoo.com Mobile : 9825063459 / 9909723532	Hazardous	**17-Oct-22**	
3	**M/s. Fine Refiners Pvt. Ltd** Plot No. 40, GIDC, Chitra Vartej, Bhavanagar - info@finerefiners.com Mobile : 9825209314 / 9979898686	Hazardous	**21-Jun-22**	
4	**M/s. Amar Hydrocarbon Pvt. Ltd.** FF-12, Sahara Complex, B/h Navajivan Hotel, S. G. Highway, Sarkhej, Ahmedabad – 382210. amarhydrocarbon@gmail.com	Hazardous	**22-Feb-22**	
5	**M/s. Aviation Corporation** 62/2/1, Shikarpur Taluka Bhachau - Kutch - Gujarat aviationcorporation1983@gmail.com	Hazardous	**14-Jun-22**	
6	**M/s. Priyansi Corporation** C-1, 804 - 806, GIDC, Bamanbore, Ta. Chotila, Dist - Surendranagar Email: operation.priyansicorporation@gmail.com Mob: 09825226095	Hazardous	**16-Dec-22**	

Marine Department

STATEMENT SHOWING DEENDAYAL PORT REGISTERED PARTIES FOR REMOVAL OF GARBAGE, USED OIL/WASTE OIL ETC.

Sr. No.	Name of Party	Licensce of Removal	Last Validity of License	Remarks
7	**M/s. SHANA OIL PROCESS** New Good Luck Market, Nr. Aksha Masjid Chandola Lake, Narol Raod, Ahmedabad Email: kandla_sludgeremoval35@gmail.com Mob : 09824286952	Hazardous	**11-Feb-22**	
8	**M/s. United Shipping Company** Rising House -I, Ground Floor, Plot No. 82, Sector No. 1/A, Gandhidham - Kutch 370201 Email: sunil@risinggroup.co Phone : 02836 - 233060	Hazardous	**13-Sep-22**	
9	**M/s. Revolution Petrochem LLP** Office No. C-214, 2nd Floor, Shop No. 234-235, Kutch Arcade Platinum, Mithirohar **Gandhidham - 370201**	Hazardous	**31-Mar-23**	
12	**M/s. Chitrakut Trading & Industries** 15, Brahm Samaj Building, Plot No. 106, Sector No. 8, Behind OSLO Cinema, Gandhidham - Kutch 370201. Email: info@harishpandya.com Mob: 09426218125	Non-Hazardous	**17-Nov-22**	
13	**M/s. Golden Shipping Services** Kidana Nirmal Nagar, Survey No. 133, Plot No. 83 Gandhidham - Kutch	Non-Hazardous	**30-May-23**	
14	**M/s. Harish A. Pandya** 15, Brahm Samaj Building, Plot No. 106, Sector No. 8, Behind OSLO Cinema, Gandhidham - Kutch 370201. Email: info@harishpandya.com Mob: 09426218125	Non-Hazardous	**03-Feb-23**	

Marine Department

STATEMENT SHOWING DEENDAYAL PORT REGISTERED PARTIES FOR REMOVAL OF GARBAGE, USED OIL/WASTE OIL ETC.

Sr. No.	Name of Party	Licensce of Removal	Last Validity of License	Remarks
15	**M/s. Naaz Shipping Services Enterprise** Office No. 35, First Floor, Grain Marchan Association Building, Plot No. 297, Ward 12/B, Near Old Court, Gandhidham Email: naazshipping service@yahoo.com Phone: 02836- 237106	Non-Hazardous	**05-Jun-22**	
16	**M/s. Omega Marine Services** Reg. Office No. 2, Plot NO. 106, Sector - 8, Braham Samaj Building Gandhidham - Kutch Email: operations@omegamarineservices.com Mob: 9537329203 - 9727589185	Non-Hazardous	**28-Jun-22**	
17	**M/s. VISHWA TRADE-LINK INC.** 214, 2nd Floor, "Kutch Arcade" - Platinium Building Mithi Rohar Road, NH 8/A, GANDHIDHAM Email : vishwatradelink@gmail.com Mob: 09879595087 - 02836-283261	Non-Hazardous	**16-Nov-22**	
18	**Green Earth Marine Solutions** Office No. 202, Plot No. 578, Ward 12-C, Shakti Avenue, Gandhidham - Kutch operation@greenearthmarine.com	Non-Hazardous	**23-Mar-23**	
19	**M/s. V. K. Enterprise** 2, Plot No. 16, Sector 1/A, Shakti Nagar Road, Gandhidham - Kutch Email: vkenterprise2001@gmail.com Mob : 9825246142	Non-Hazardous	**25-Jun-23**	
20	**M/s. K. M. Enterprise** Plot No. 13, Sector – 8, Near BM Petrol Pump, Opp. Sharma Motors, Gandhidham – Kutch. Email: kmenterprisekandla@gmail.com Mob: 9427792986 - 9879986952	Non-Hazardous	**04-May-23**	