ANNEXURE - I

ENVIRONMENTAL COMPLIANCE MONITORING REPORT
for
Navi Mumbai International Airport (NMIA)

Sponsor:

City And Industrial Development Corporation of Maharashtra Ltd (CIDCO)

Period:

July to December 2016

PREPARED BY

ADITYA ENVIRONMENTAL SERVICES PVT.LTD.
MOEFCC Recognized Laboratory under EP Act 1986
Accredited under ISO 9001: 2008 & OHSAS 18001: 2007 by ICQS
QCI NABET Accredited EIA Consultancy Organization
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1. INTRODUCTION

Mumbai Metropolitan Region (MMR) comprises of areas in and around Mumbai city and includes parts of Mumbai, Thane and Raigad Districts. Mumbai is known as the commercial capital of India and MMR is an industrial and technologically advanced region, which has experienced rapid growth in income and employment. The increasing trend in trading, business and financial services, demands highest order of infrastructure. There is need to enhance the capacity of airport as the existing airport in Mumbai experiencing tremendous pressure for meeting the air traffic demands of this vibrant region. Realizing the need of second airport for Mumbai, the Government of Maharashtra granted approval and appointed City & industrial Development Corporation of Maharashtra Limited (CIDCO) as Nodal agency for implementation.

The site for the airport was selected near Panvel in Raigad district of Maharashtra state with central coordinates 18°59'33.00"N and 73°4'18.00"E. The Director General of Civil Aviation (DGCA) has approved the site. Environmental Impact Assessment (EIA) study was conducted by Centre for Environmental Science and Engineering (CESE), Indian Institute of Technology (IIT) Mumbai and updated report submitted in April 2011. Environmental Clearance was granted by Ministry of Environment and Forests vide F. No. 10-53/2009- IA.III dt 22.11.2010.

Pre-development works for the site started in September 2016 and as compliance to the Environmental clearance, CIDCO appointed Aditya Environmental Services Pvt. Ltd. (AESPL) to conduct Compliance Environmental Monitoring for the New Mumbai International Airport (NMIA) vide order no. CIDCO / T&C / CGM (T & A)/ STE (S-I& A)/2015/867 dated 28.05.2015. The assignment comprises monitoring of following parameters in and around the surrounding project area:

- Ambient air monitoring
- Ambient noise level monitoring
- Soil, ground/surface water
- Marine water and sediments for biological and physicochemical parameters.

The sampling locations fixed by CIDCO for compliance monitoring every quarter as per Tender No. CIDCO / T&C / NIMA / EC-22-11-2010/7.I.vii/xiii/xxx/010/251 dated. 16.02.2012 are as given in Chapter II.

2. SCOPE OF MONITORING WORK

2.1 Scope of Monitoring Work as per CIDCO Tender:

Scope of monitoring work as per CIDCO tender are as given below:

Table 2.1 *Scope of Environmental Monitoring Work as per CIDCO Tender*

Sr. No.	Parameters – as per Annexure B	Location	Frequency	Samples / Year
1.	**Ambient Air Quality:** PM 2.5, PM 10, SO_2, NO_X, CO, Lead, Ammonia, Hydrocarbon (nMHC).	12	2 Stations per Month, @ one sample per station	24
2.	**Noise: Parameters: Leq Noise level** - Day time & Night time separately.	12	Same as per Air Quality	24
3.	**Soil: Parameters:** pH, Texture class, Organic carbon, Electrical Conductivity, Available Nitrogen, Available Phosphorus, Available Potassium, SO_4, Chloride, Calcium, Magnesium, Iron, Manganese, Cu, Hg, Cd, As, Pb, Zn, Al, Ni, Co, Cr, Na & K.	10	1 Sample at each station per 6 monthly periods. 10 x 1 x2 =20 samples per year	20
4.	**Ground Water Quality Parameters:** pH, Temperature, Turbidity, Alkalinity, Salinity, Total Nitrogen, Total Phosphorous, DO, BOD, COD, O&G, Residual Chlorine, Total Hardness, Chloride, TDS, Na, Fluorides (as F), NO_3, Mn, K, Fe, SO_4, Phenol, Hexa Chromium, Cu, Cd, As, Hg, Pb, Zn, Fecal Coliform (MF count/ml), Coliform Colonies, Phytoplankton, Total Heterotrophic Bacteria (spc /mL) & Chlorophyll.	10	5 Location per Month @ 1 Sample per location = 5 samples per month	60
5.	**Marine/Surface Water Quality: Physico Chemical parameters:** PH, Floating materials, Turbidity, Temperature, Salinity (ppt, %0), TSS, TDS, TOC, DO, BOD, O&G, SO_4, NO_2, NO_3, NH_3-N, Inorganic PO_4, Ca, Mg, Fe, Cr, Cu, As, Cd, Hg, Pb, Zn.	13	For 3 seasons No. of samples 26 samples per season 26 x 3 =78 samples per year	78
6.	**Marine/Surface Water Quality: Biological parameters:** Seasonal sampling & testing (SPC) of: Phytoplankton, Zooplankton, Macrofauna, Meiofauna, Microbiology, Benthos, Diversity Indices & Coliform colonies (MPN)	3 (2 at Gadhi river entrance & 1 at Ulwe River)	For 3 seasons. No. of Samples - 3x3 **= 9** per year	9

2.2 Locations of Monitoring:

Sampling Locations have been specified by CIDCO in its Tender. The monitoring was carried out at the same locations as fixed by CIDCO. Details of monitoring stations for Ambient Air Quality, Ambient Noise, Soil, Ground Water, Marine Water- physicochemical & biological and Sediment, and along with location maps showing station locations are as given below:

Table 2.2 *Details of Ambient Air Quality Monitoring Stations as per CIDCO Tender*

Station Code	Station	Remarks
A1	Panvel CIDCO Office	Location of meteorological station and in residential zone
A2	Khandeshwar Railway Station	Commercial activity center
A3	Kalamboli CIDCO Office	Receptor oriented as it is in residential zone
A4	Kharghar Nodal Office	Receptor oriented as it is in residential zone
A5	Belapur CIDCO Bhavan	Major commercial activity center, heavy traffic movement
A6	Pargaon High School	Rural and mixed area
A7	Gavanphata Water Tank	Near to main traffic junction and hence heavy traffic movement
A8	Ambuja Cement Ltd	Industrial activity center
A9	Kille Gaothan Guest House	Receptor oriented as it is in residential zone
A10	Panchsheel Guest House	Receptor oriented as it is in residential zone
A11	Airport Entry – West	High vehicular movement at the entry / exit at the west side, near Aamra Marg
A12	Airport Entry – East	High vehicular movement at the entry / exit at the east side, near NH4B

Figure 2.1: *Map of Ambient Air Quality Monitoring Stations as per CIDCO Tender*

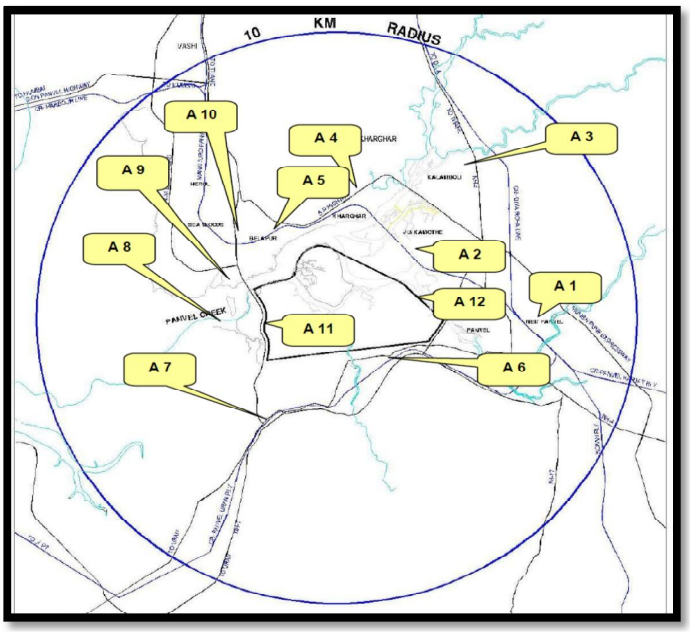


Table 2.3: *Ambient Noise Level Monitoring Stations as per CIDCO Tender*

Sr. No.	Station Name	Category of area
N1	Ambuja Cement Limited	Industrial area
N2	CIDCO Bhavan, CBD Belapur	Commercial area
N3	Palaspa Junction	Commercial area
N4	Teen Tank Gavanphata	Commercial area
N5	Panvel CIDCO Office	Residential Area (Mixed category)
N6	Kharghar Nodal Office	Residential Area
N7	Panchsheel Guest House	Residential Area
N8	Pargaon School	Sensitive area (Mixed category)
N9	MES School	Sensitive area (Mixed category)
N10	MGM Hospital, Kalamboli	Sensitive area (Mixed category)
N11	Swapna Nagri	Residential Area (Mixed category)
N12	Karnala Bird Sanctuary	Sensitive area

Figure 2.2: *Map of Noise Level Monitoring Stations as per CIDCO Tender*

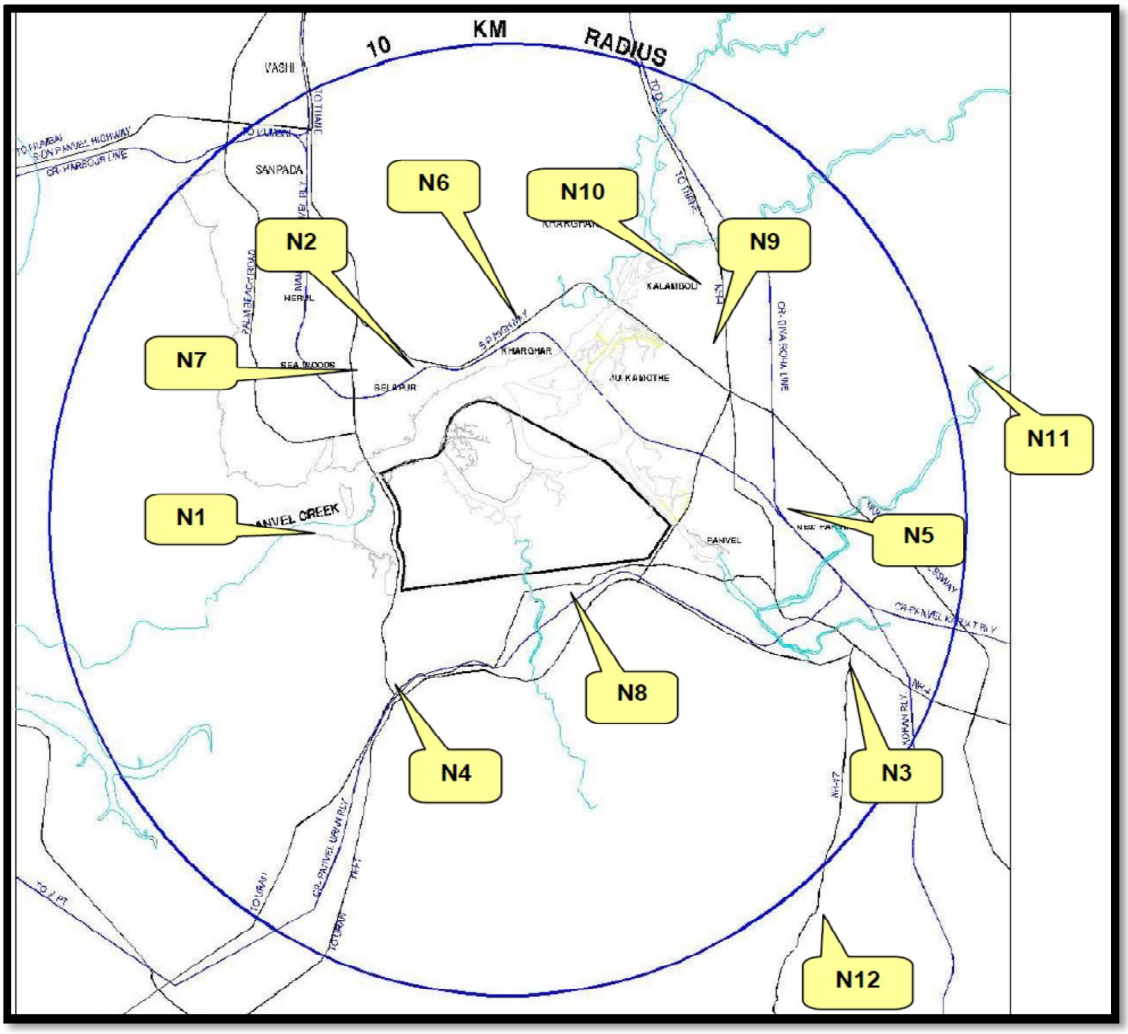


Table 2.4 *Soil Quality Monitoring Stations as per CIDCO Tender*

Station Code	Stations Name
S1	Targhar
S2	Kopar
S3	Kombadbhuje
S4	Koli
S5	Vaghivali
S6	Ganeshpuri
S7	Ulve
S8	Pargaon
S9	Vaghivalivada
S10	Chinchpada

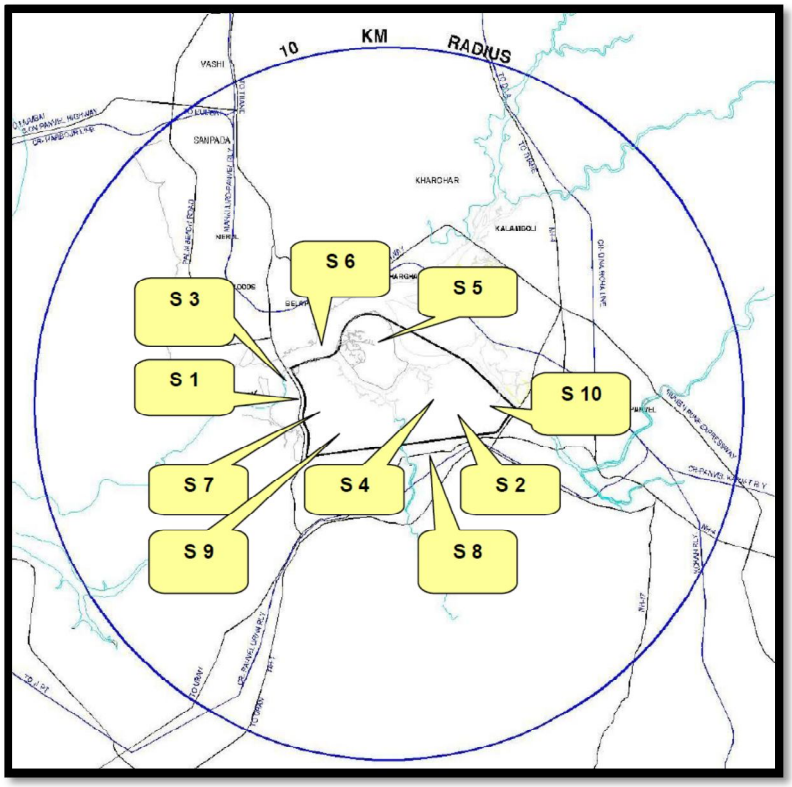


Figure 2.3: ***Map of Soil Quality Monitoring Stations as per CIDCO Tender***

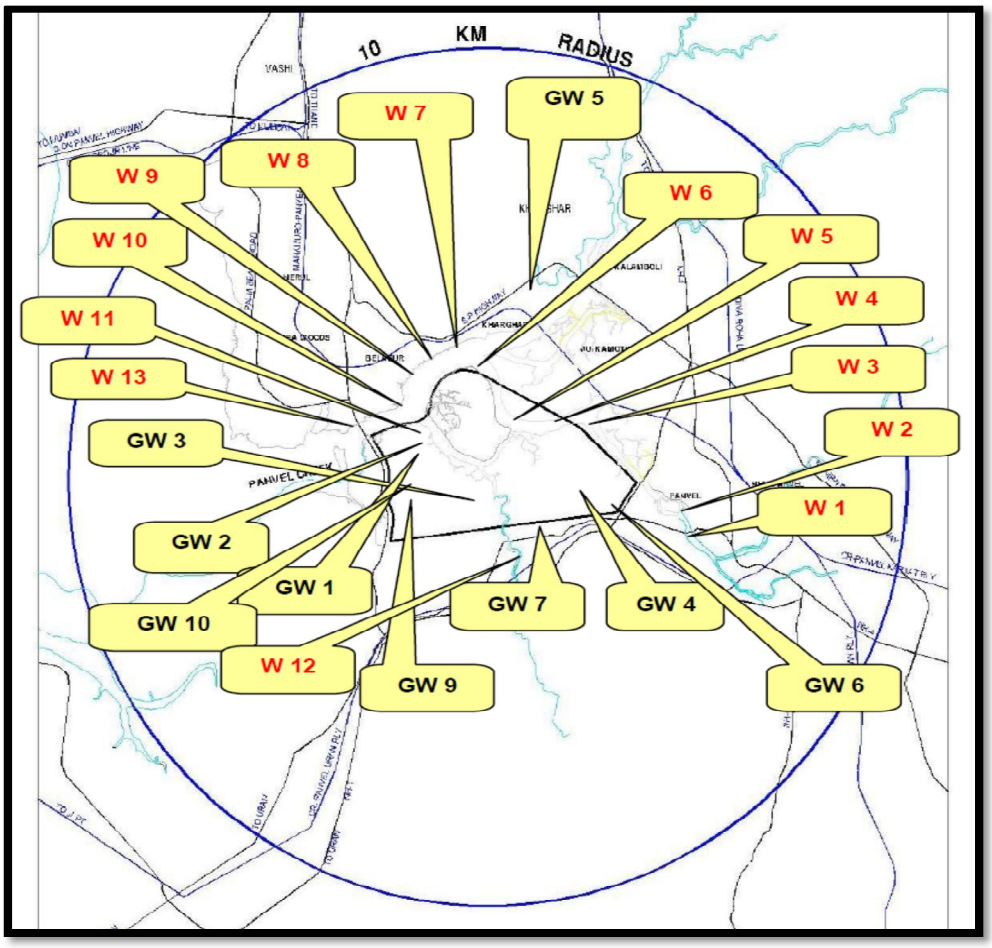
Table 2.5: ***Details of Ground Water Quality Monitoring Stations as per CIDCO Tender***

Station Code	Stations Name
GW1	Open well at Kombadbhuje
GW2	A well near pond at Ganeshpuri
GW3	Open well at Vaghivalivada
GW4	Open well at Koli
GW5	Open well at Kopar
GW6	Open well at Chinchpada
GW7	A well near pond at Pargaon
GW8	A well near pond at Vaghivali
GW9	Open well at Ulwe
GW10	A well near pond at Targhar

Table 2.6: *Details of Marine Water Quality Monitoring Stations as per CIDCO Tender*

Station Code	Station details / Location
W1	Extreme end of Gadhi River (upstream side)
W2	Near Pargaon village (200m from W1) in Gadhi River
W3	Near Jui Village (300m from W2) in Gadhi River
W4	Near Kopar Khadi (300m from W3) in Gadhi River
W5	Near Vaghivali village (500m from W4) in Gadhi River
W6	Vaghivali creek junction (300m from W5) in Gadhi River
W7	Near Kharghar Rly Station (300m) in Gadhi River
W8	Near Belpada (300m from W7) in Gadhi River
W9	Near Konkan Bhavan (300m from W8) in Gadhi River
W10	Near Divala village (300m from W10) in Gadhi River
W11	At Junction of Ulwe and Gadhi Rivers in Panvel Creek
W12	In Ulwe River
W13	Near Rathi bander in Panvel Creek

Figure 2.4: *Map of Surface Marine and Ground Water & Sediment Monitoring Stations as per CIDCO Tender*



2.3 Period/Time of Sampling:

The sampling survey was carried out as per following schedule during the July to December 2016.

Table 2.7: *Period/Time of Sampling for this Survey*

Month	Parameter	Sampling Stations	Dates of Sampling	Time Period
July 2016	AAQ	A8 & A7	27.07.16	24 hours starting from 1000am
	NLS	N3 & N12	29.07.16	24 hours starting from 1000am
	Soil	S1 & S6	30.07.16	Grab sample
	Ground Water	Gw1, GW2, GW8, GW9 & GW10	30.07.16	Grab sample
August 2016	AAQ	A1 & A3	30.08.16	24 hours starting from 1000am
	NLS	N5 & N10	30.08.16	24 hours starting from 1000am
	Soil	S2 & S4	30.08.16	Grab sample
	Ground Water	GW3, GW4, GW5, GW6 & GW7	30.08.16	Grab sample
September 2016	AAQ	A4 & A5	28.09.16	24 hours starting from 1000am
	NLS	N2 & N6	30.09.16	24 hours starting from 1000am
	Soil	S3 & S7	28.09.16	Grab sample
	Ground Water	GW1, GW2, GW8, GW9 & GW10	28.09.16	Grab sample
October 2016	AAQ	A2 & A6	26.10.16	24 hours starting from 1000am
	NLS	N9 & N8	26.10.16	24 hours starting from 1000am
	Soil	S9 & S10	27.10.16	Grab sample
	Ground Water	GW3, GW4, GW5, GW6 & GW7	27.10.16	Grab sample
November 2016	AAQ	A8 & A7	30.11.16	24 hours starting from 1000am
	NLS	N1 & N4	30.11.16	24 hours starting from 1000am
	Soil	S5 & S8	30.11.16	Grab sample
	Ground Water	GW1, GW2, GW8, GW9 & GW10	30.11.16	Grab sample
December 2016	AAQ	A9 & A10	30.12.16	24 hours starting from 1000am
	NLS	N7 & N11	30.12.16	24 hours starting from 1000am
	Soil	S8 & S10	31.12.16	Grab sample
	Ground Water	GW3, GW4, GW5, GW6 & GW7	31.12.16	Grab sample

As per the Tender Conditions Marine & surface water physico- chemical sampling was required to be done for 3 stations per quarter @ 2 samples per station – 13 stations to be accommodated in one of the quarter- total 78 samples as also Marine Biological/sediment Analysis was required to be done at 9 locations per year. This would have meant to cover totally different 3 locations every quarter – which would not have given any meaningful interpretation. AESPL therefore approached CIDCO vide its email dt 10.10.2015 requesting for covering all 13 sample locations in each quarter at two samples per location- i.e. 26 samples totally. Thus over 3 quarters, total 78 samples will be covered. CIDCO has vide its email dt 05.11.2015 clarified that they are acceptable to revised work plan. Hence, AESPL team collected samples at 13 locations from29-30 July 2016 during monsoon and 25-26 November 2016 during post monsoon.

2.4 Constraints in completing Environmental Baseline Monitoring as per CIDCO Tender:

- Sediment samples at locations W2 and W11 could not be collected due to rocky substratum.

3. METHODOLOGY ADOPTED FOR ENVIRONMENTAL MONITORING

3.1 AMBIENT AIR QUALITY

3.1.1 Reconnaissance Survey:

Reconnaissance survey in study area (10km around proposed airport site) shows that sources of air pollution include the following:

- heavy traffic along Amara Marg, NH4B and Uran / JNPT Road
- construction activity
- industries in Panvel industrial estate (private)
- burning of poor quality fuels in villages within proposed site and nearby

In order to arrest the deterioration in air quality, Govt. of India has enacted Air (Prevention and Control of Pollution) Act in 1981. The responsibility has been further emphasized under Environment (Protection) Act, 1986. Therefore, Central Pollution Control Board had published guideline for measurement of Ambient Air Pollutants Quality Monitoring (NAAQM) in November 2009 at national level.

3.1.2 Methodology for Ambient Air Quality Monitoring:

To monitor Air Pollutants in Ambient air following method of analysis adopted

S N	Parameter	Sampling Equipment	Method of Analysis	Reference
1.	PM_{10}	RSPM Sampler/ Glass Fiber filter paper.	Gravimetric analysis	CPCB Guidelines Manual 2011
2.	$PM_{2.5}$	$PM_{2.5}$ Sampler/Filter – PTFE, Teflon membrane	Gravimetric analysis	CPCB Guidelines Manual 2011
3.	SO_2	Absorption in TCM	West & Gaeke Method	CPCB Guidelines Manual 2011
4.	NO_X	Absorption in NaOH	Jacob – Hochheiser (Sodium Arsenic)	CPCB Guidelines Manual 2011
5.	CO	Sampling in Tedler bags / CO Meter	GC with Methaniser	CPCB Guidelines Manual 2011
6.	Lead	Sampling using EPM 2000 equivalent Glass Fiber Filter paper	AAS Method	CPCB Guidelines Manual 2011
7.	NH_3	Absorption in sulfuric acid	Indophenol Method	CPCB Guidelines Manual 2011
8.	nMHC	Collection Activated Carbon	Gas Chromatography	APHA

AMBIENT AIR SAMPLERS

RSPM Sampler(PM10) being Installed

Installed $PM_{2.5}$ Sampler

3.1.3 SELECTION OF AIR SAMPLING LOCATION

Selection of representative location is very important. Following precautions to be taken:

- It should be away from source & other interferences
- Install sampler at free flowing well mixed area (3m) above ground level
- Install Pre - Calibrated Air Samplers with pre weighted Filter papers
- Transport the samples to reach earliest at laboratory for further analysis
- Gaseous Samples were preserved in cold box before taking to laboratory

3.2 AMBIENT NOISE LEVEL

3.2.1 Reconnaissance Survey:

Reconnaissance survey in study area (10km around proposed airport site) shows that sources of air pollution include the following:

- heavy traffic along Amara Marg, NH4B and Uran/JNPT Road
- construction activity
- industries in Panvel industrial estate (private)
- noise from human habitats/villages within proposed site and nearby

Noise pollution in urban areas is now being recognized as a major environmental issue around the world. With increasing awareness of the adverse impacts of noise on human health, more and more people becoming less tolerant to environmental noise. The objective of this exercise is to assess the baseline status within study area and to compare the noise levels with Ambient Noise Standards for the area.

3.2.2 Methodology for Sample Collection

Integrated Sound Level Meter C390 was used for undertaking the surveys and installed on tripods at the selected locations over a 24-hour period. This Meter is then taken to laboratory where the data collected is downloaded onto PC using specialized software.

Center C-390 Sound level Meter with data logger

Noise is measured in decibel (dB) and 'A' weighting is used for this entire monitoring since in this method of frequency weighting, the signal generated reproduces the way the human ear responds to a range of acoustic frequencies. Leq: The equivalent continuous Sound Pressure Level for a particular duration. The Day-Night Equivalent Sound Level refers to average sound exposure over a 24- hour period. Leq day & night values are calculated from hourly Leq values, with the Leq values for the night time increased by 10 dB to reflect the greater disturbance potential from night time noises.

3.3 Soil

The purpose of soil testing is to identify the soil fertility that the plants or crop, in a given area will experience.

3.3.1 Reconnaissance Survey:

The study area is rural in character and large tracts are being cultivated as paddy fields. Soil is also seen plentifully at bottom of hills where it supports large vegetation.

3.3.2 Methodology of Sample Collection:

Soil samples are collected after removing top two inches – which may contain high amount of organic carbon and humus. The soil area and volume could be a large field, a small garden, or simply the root zone of a single tree or shrub. The most difficult step in soil testing is accurately representing the desired area of soil. When the sampling area is determined, a sufficient number of soil cores taken to acquire a representative sample. This is generally 10 to 20 cores. The depth of sample for surface soils was taken from 0 to 6 inches or as deep as the primary tillage.

Soil samples collected from proposed project stations by using stainless steel soil sampling probe, packed in labeled polythene bags & send for analyze the physicochemical characteristics. The sample so collected is then made representative by coning- quartering and then stored in plastic bags, sealed and then sent to laboratory for analysis.

3.4 GROUND WATER SAMPLING

3.4.1 Reconnaissance Survey:

The villages in study area use ground water from open/bore well and use it for drinking and other domestic purposes. Ground water gets contaminated due to bad sanitary habits such as
washing of utensils, cattle and bathing and location of septic tanks in/near the open wells.

3.3.2 Methodology of Sampling:

Ground water sample is collected by using containers and the sampling container is rinsed before using it for storing water samples. Ground water samples are stored in two separate containers for Physicochemical & Microbiological analysis and preservatives added as recommended by Standard Methods APHA, stored in cold storage box and transferred to the laboratory for the further analysis.

Figure 3.1: Ground Water Sampling in Progress

3.5 MARINE WATER, SEDIMENTS & PLANKTON SAMPLING EQUIPMENTS

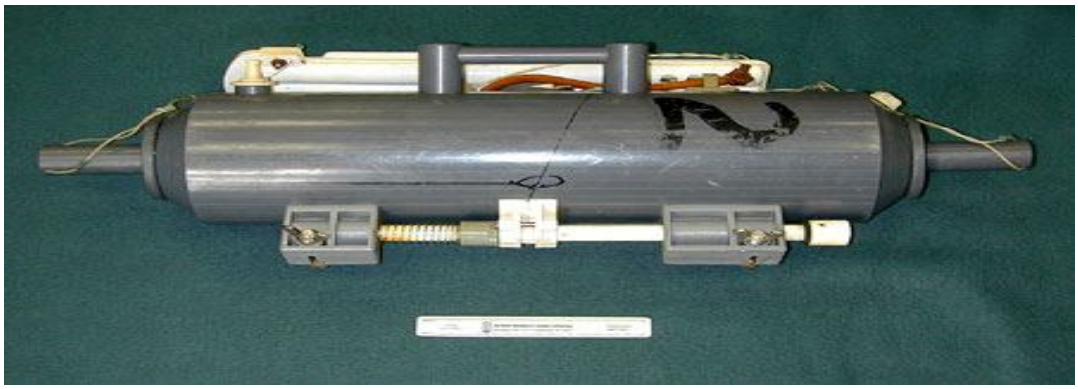
3.5.1 Reconnaissance Survey:

The study area represents complex hydrodynamic system. The Ulwe river flows down through the mountains (to the south) in the centre of project site and joins the Panvel creek. The Gadhi river flows from the East to the West. The Ulwe river will be diverted/retrained as part of the project and the Gadhi river will be partly retrained towards the northern part of the site. The river Gadhi receives sewage from Panvel town and nearby areas. Both the rivers drain into the Panvel creek which drains into the Arabian sea to the west. The Panvel creek also received effluents from CETP at MIDC Taloja and sewage from NMMC STPs in Nerul.

3.5.2 Methodology of Sampling:

3.5.2.1 Niskin Bottle - Marine Water Sampler

This Water Sampler is used to collect samples at various water depths and can operate at any depth on a cable or line with a messenger.



3.5.2.2 Plankton Net - Biological Samples

This plankton net operates a cable or lined by hand or behind a boat, it can be towed vertically or horizontally. Nets comes in varieties of size (Mesh no 00 equal an aperture of 0.30 inches)

3.5.2.3 Grab Sampler - For Marine Sediments

Sediment grab operate at any depth on a cable or line by free fall (without a messenger). It is extremely heavy and can take samples of hardest rocky ocean bottoms.

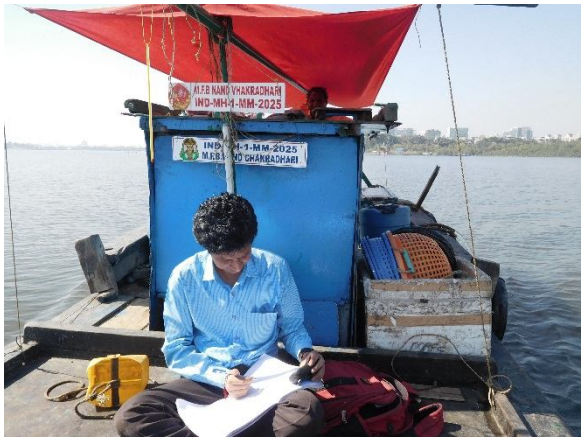
Grab Sampler

3.5.2.4 Selection of Stations, Preservation and Transportation of Samples:

Marine samples were collected from sampling locations in Gadhi River, Ulwe River and Panvel Creek at the locations indicated by CIDCO – in all 26 samples were collected from 13 sampling locations for physicochemical samples (Stations 1 to 10 are located in Gadhi River & Station 11 & 13 are in Panvel Creek while station 12 in Ulwe River), while 3 samples were collected 1 from Ulwe river and 2 at entrance of Gadhi rivers for biological samples. A good amount of mangrove vegetation was noted on either side of stream from station 4 to 6. Sampling locations were approached by boat (wherever possible) and collection done irrespective of tide. Depending of water depth at sampling location during sampling, both (surface and bottom) samples were collected. The samples were preserved and taken to laboratory using vehicle on same day.

Zooplankton sampling in progress

Sediment sampling in progress



noting sampling coordinates by GPS

Bottom marine water sampling in progress

General arrangement onboard

Marine water sampling in progress

Marine Water Sampling in Progress

3.6 Laboratory Credentials

Sampling and analysis was done by laboratory of Aditya Environmental Services Pvt Ltd located at Plot P-1, MIDC Commercial plots, Mohopada, Tal Panvel, Dist Raigad.

- Our Environmental Laboratory is recognized by Ministry of Environment & Forest (MoEFCC), Govt. of India under Environment (Protection) Act, 1986
- Environmental sampling conducted by our experienced, qualified environmental staff & Analysis and reporting by approved Government Analyst.
- Instruments used for sampling are from reputed manufacturer & are regularly calibrated.
- Chemicals used will be Analytical Reagent grade and from reputed manufacturer.
- Analytical Instrumentation used in the laboratory is regularly calibrated.
- We have regular program of Preventive Maintenance & Annual Maintenance for all critical equipment's.
- Ground Water, Soil Analysis - using APHA, BIS, ASTM & CPCB standards Methods for water Analysis.
- Standard Methods Adopted in the laboratory are those prescribed by APHA, BIS, ASTM & CPCB for water, waste & marine water analysis using methods as per NIO (National Institute of Oceanography) Manual
- We have CRMs (Certified Reference Material) for heavy metals from reputed manufacturers for heavy metals and Standard sea water which we use for analysis
- We are regularly participating in Proficiency testing with reputed Organizations like Central Pollution Control Board (CPCB), Goa State Pollution Control Board and others as also Intra laboratory QC testing to check performance of our chemists
- Overall approach & methodology is with Annexure IA Scope of the work & the Best practices as per prevailing norms of Central Pollution Board /Ministry of Environment & Forest etc / Internationally adopted practices.

4. COMPILATION OF DATA & INFERENCE

4.1 AMBIENT AIR QUALITY MONITORING REPORT

4.1.1 AAQM DATA

Ambient Air quality was monitored with relevant parameters as per NAAQS standards published by CPCB in November 2009 considering that the present project is for development of International Airport for Navi Mumbai area. Data is compiled and presented below:

Table 4.1: *Ambient air quality monitoring of various stations of project area during July to December 2016*

Sampling Locations	Ambuja Cement (A8)	Gavanphata Water Tank (A7)	Panvel CIDCO Office (A1)	Kalmboli CIDCO Office (A3)	Kharghar CIDCO Office (A4)	CBD CIDCO Office (A5)	Pargaon High School (A6)	Near Khandeshwar Rly. Station (A2)	Ambuja Cement (A8)	Gavanphata Water Tank (A7)	Kille Gavthan (A9)	Panchshil Guest House (A10)	Limit #	Unit
Sampling Date	**27.07.2016**		**30.08.2016**		**28.09.2016**		**26.10.2016**		**30.11.16**		**30.12.16**			
$PM_{2.5}$	36.3	42.5	45.6	48.7	50.4	46.6	48.7	50.4	42.5	40.4	38.7	40.4	60	µg/m³
PM_{10}	60.8	64.6	59.5	61.6	62.5	64.1	62.9	58.7	61.2	57.9	56.2	58.7	100	µg/m³
SO_2	12.4	13.2	13.4	13.0	11.9	12.4	12.4	13.0	11.0	12.1	12.0	12.1	80	µg/m³
NO_X	13.5	14.0	13.4	13.5	13.0	13.4	13.6	12.8	12.9	13.1	13.2	13.3	80	µg/m³
CO	0.2	0.2	0.6	0.8	0.5	0.4	0.6	0.7	0.5	0.4	1.45	1.6	4	mg/ m³
Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	µg/m³
NH_3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	400	µg/m³
NMHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	MD	0.24	ppm

ND – Not detected. (Note # Limits as per National Ambient Air Quality Standards (NAAQS), 2009)

4.1.2 INFERENCE OF AAQM DATA

The concentration of Particulate Matter – 10 μ (PM10) matter was observed above 50 $\mu g/m^3$ at all sampling locations in this period. The level of Particulate Matter - 2.5 μ (PM 2.5) was observed under NAAQS limit. Amongst gaseous pollutant, Nitrogen Oxide level, Sulfur dioxide levels and Carbon monoxide are under NAAQS limit. Concentration of Lead, Ammonia and NMHC was not detected during the survey period. Over all air pollutants level was observed below NAAQS standards.

4.2 AMBIENT NOISE LEVEL MONITORING REPORT

4.2.1 Noise Level Data

Ambient Noise level was monitored over 24 hours' duration for Day and Night time as per Schedule - II of Environmental Protection Act 1986. Results of analysis are compiled below:

Table 4.2: *Ambient noise level monitoring of various stations of project area during July to December 2016.*

Stn Code	Sampling Location	Sampling Date	Observed Value (Leq) (dB(A))						Limiting Standard (Leq) as per EP Act Schedule II. dB(A)	
			Day Time			Night Time				
			Max	Min	Avg	Max	Min	Avg	Day Time	Night Time
N3	Palaspa Junction	**29.07.16**	81.3	39.3	44.2	60.4	33.7	32.8	**75**	**70**
N12	Karnala Bird Sanctuary		84.3	27.3	50.4	72.7	26.5	39.3	**75**	**70**
N5	Panvel CIDCO Office	**30.08.16**	81.8	56.3	69.0	83.5	48.9	60.9	**75**	**70**
N10	Kalamboli CIDCO Office		86.6	32.4	45.7	40.3	26.4	34.7	**75**	**70**
N6	Kharghar CIDCO Office	**28.09.16**	74.7	58.4	62.4	69.0	51.3	58.1	**75**	**70**
N2	CBD CIDCO Office		77.9	42.2	56.4	55.2	49.5	52.1	**75**	**70**
N9	MES School	**26.10.16**	85.5	31.8	49.5	52.5	27.7	32.5	**75**	**70**
N8	Paragaon High School		90.9	33.2	49.5	48.8	29.0	33.9	**75**	**70**
N1	Ambuja Cement Ltd.	**30.11.16**	74.5	49.6	55.5	61.3	41.1	47.6	**75**	**70**
N4	Teen Tank Gavanphata		85.9	33.8	46.4	54.2	31.5	35.8	**75**	**70**
N11	Kille Gaothan	**30.12.16**	85.5	31.8	49.5	52.5	27.7	32.5	**75**	**70**
N7	Panchsheel Guest House		90.9	33.2	49.5	48.8	29.0	33.9	**75**	**70**

4.2.2 Inference of Noise Data

During day time, the average noise level was observed in the range of 44.2-69.0 dB(A) & during Night time 32.5-60.9 dB(A) at all locations during sampling period. It is observed average sound sound level are below EP Act Standards at all stations during day and as well as time.

4.3 SOIL QUALITY MONITORING REPORT

4.3.1 Soil Analysis Data

Data on soil analysis is compiled and presented below for the sampling period:

Table 4.3: *Soil analysis of various stations of project area during July to December 2016*

Sr. No.	Locations	Targhar (S1)	Ganesh puri (S6)	Kopar (S2)	Koli (S4)	Kombad bhuje (S3)	Ulve (S7)	Vaghivalivada (S9)	Chinchpada (S10)	Vaghivali (S5)	Pargaon (S8)	Pargaon (S8)	Chinchpada (S10)	Unit
	Sampling Date	**30.07.2016**		**30.08.2016**		**28.09.2016**		**27.10.2016**		**30.11.16**		**31.12.16**		
1.	pH	7.21	6.72	6.68	6.51	7.22	6.77	6.60	7.04	7.20	6.82	7.04	6.74	--
2.	TOC	7.4	3.4	2.8	3.4	1.1	3.0	3.8	2.8	1.4	1.8	2.8	0.2	%
3.	TKN	5.04	3.3	5.6	5.6	5.6	2.8	6.2	3.4	5.3	5.6	3.4	2.8	mg/kg
4.	Conductivity	164.2	194.1	113.8	146.5	172.4	148.1	156.2	124.4	156.4	152.3	124.4	112.3	µS/cm
5.	Calcium	82	82	94	72	80	56	120	160	60	58	160	120	mg/kg
6.	Magnesium	36	28	36	48	42	36	56	53	16	14	53	56	mg/kg
7.	Sulphate	68	83	214	186	64	76	224	14	61	64	14	224	mg/kg
8.	Chlorides	131	152	38	84	104	128	68	97	109	124	97	68	mg/kg
9.	Sodium	6	4	02	05	04	08	04	03	5	4	03	04	mg/kg
10.	Potassium	112	108	103	135	11	96	114	98	54	66	98	114	mg/kg
11.	Phosphates	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/kg
12.	Iron	1.6	1.9	1.8	1.8	0.8	0.5	3.2	1.4	0.5	0.3	1.4	3.2	mg/kg
13.	Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/kg
14.	Copper	1	2	ND	ND	2	2	ND	ND	1	1	ND	ND	mg/kg
15.	Nickel	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/kg
16.	Zinc	0.1	0.1	ND	ND	01	02	ND	ND	2	3	ND	ND	mg/kg
17.	Chromium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/kg
18.	Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/kg
19.	Manganese	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/kg
20.	Aluminum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/kg
21.	Cobalt	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/kg
22.	Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/kg
23.	Arsenic	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/kg

4.3.2 Soil Data Inference:

There was marginal high level of heavy metals observed (at Koli, Kopar, Chinchpada & Pargaon). This may be due to previous landfilling activity by CIDCO at these sites. Over all soil quality was observed fertile in nature and suitable to grow local plants varieties at all locations.

4.4 GROUND WATER QUALITY ANALYSIS REPORT

4.4.1 GW Analysis Data

The physicochemical analysis of ground water study showed considerable variation and is compiled and presented below

Table 4.4: *Ground water analysis of various stations of project area during July to December 2016*

Sr. No.	Sampling Locations	Ulwe (GW 9)			Ganeshpuri (GW 2)			Vaghivali (GW8)			Targhar (GW 10)			Kombadbhuje (GW 1)			Koli (GW 4)			Kopar (GW 5)			Paragaon (GW 7)			Chinchpada (GW 6)			Vaghiwali wada (GW 3)		
	Sampling month	Jul	Sep	Nov	Jul	Sep	Nov	Jul	Sep	Nov	Jul	Sep	Nov	Jul	Sep	Nov	Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec
1	pH	6.49	6.76	7.14	6.71	6.99	7.21	716	7.25	7.16	7.16	7.21	7.28	6.94	7.08	7.32	7.19	7.21	6.96	7.48	7.46	7.14	7.26	7.42	6.88	7.26	7.21	7.09	7.11	7.11	6.79
2	Temperature, ° C	27.1	27.6	29.1	29.1	29.1	27.1	28.1	28.1	27.6	28.1	27.1	27.7	29.0	27.7	28.1	27.6	27.6	28.3	27.8	28.0	28.7	27.9	27.9	25.0	28.1	28.0	27.9	28.0	28.0	27.9
3	Turbidity, NTU	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	12	15	ND	ND	ND	15	10	10	ND	ND	ND
4	Alkalinity, mg/L	160	130	106	100	96	90	46	80	27.6	144	70	132	148	132	84	150	142	202	168	150	204	102	104	206	178	164	246	124	120	190
5	Salinity, ppt	1.5	0.4	1.4	0.6	0.4	1.2	1.5	1.7	138	0.90	1.2	0.9	0.85	0.78	2.1	1.4	1.4	1.4	1.2	1.4	1.6	1.4	1.6	1.8	1.7	1.1	2.2	1.6	1.4	1.6
6	TKN, mg/L	1.68	2.8	1.12	0.84	1.12	5.6	ND	1.9	0.4	9.8	8.7	0.28	6.7	0.56	1.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.12	1.1	ND
7	Total P, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	1.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	1.0	ND	1.3	1.1	1.8	1.7	1.0	1.3	ND	ND	ND
8	DO, mg/L	5.1	5.7	5.6	5.1	5.5	5.5	5.7	5.6	ND	5.2	5.5	5.6	4.9	5.6	5.8	5.2	5.5	5.6	5.9	6.0	5.9	6.0	6.0	5.7	5.6	5.8	5.9	5.4	5.6	5.9
9	BOD, mg/L	16	06	04	06	04	04	02	12	5.7	06	04	04	10	04	12	12	12	04	20	28	12	18	14	12	20	20	16	24	24	08
10	COD, mg/L	57	19	09	29	09	19	10	38	08	29	19	19	38	19	38	38	38	19	67	80	18	57	60	48	57	57	58	76	76	29
11	Oil & Grease, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12	Residual Free Chlorine, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13	Hardness (as $CaCO_3$), mg/L	128	242	148	156	144	110	122	116	ND	156	110	120	184	220	134	200	202	246	244	144	240	138	130	240	400	284	632	142	152	284
14	Chlorides (as Cl), mg/L	42	57	48	36	41	112	79	123	246	38	111	82	64	58	123	37	54	47	38	51	49	43	43	68	188	88	328	25	72	45
15	TDS, mg/L	80	120	230	60	130	190	120	210	56	80	190	180	120	130	320	80	90	120	110	150	130	90	90	150	260	220	410	60	110	110
16	Na, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	120	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
17	Fluoride (as F), mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

(Jul – Dec 2016)

Sr. No.	Sampling Locations	Ulwe (GW 9)			Ganeshpuri (GW 2)			Vaghivali (GW8)			Targhar (GW 10)			Kombadbhuje (GW 1)			Koli (GW 4)			Kopar (GW 5)			Paragaon (GW 7)			Chinchpada (GW 6)			Vaghiwali wada (GW 3)		
	Sampling month	Jul	Sep	Nov	Jul	Sep	Nov	Jul	Sep	Nov	Jul	Sep	Nov	Jul	Sep	Nov	Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec
18	Nitrate, mg/L	ND	ND	1.1	0.31	1.4	ND	ND	ND	ND	ND	ND	1.1	3.9	3.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
19	Mn, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
20	K, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
21	Iron (as Fe), mg/L	0.10	0.10	0.03	0.06	0.13	0.01	0.12	0.08	0.01	0.07	0.07	0.02	0.02	0.09	0.02	0.22	0.12	0.13	0.15	0.17	0.09	0.17	0.10	0.06	0.08	0.08	0.15	0.10	0.10	0.07
22	Sulphate, mg/L	18	36	42	16	30	43	36	33	32	29	42	22	26	42	48	29	35	36	24	32	33	32	42	29	36	46	41	23	24	35
23	Phenol, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
24	Hexavalent Chromium, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
25	Cu, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
26	Cd, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
27	As, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
28	Hg, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
29	Pb, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
30	Zn, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
31	Fecal Coliform	<2	<2	500	<2	<2	500	<2	<2	900	<2	<2	<2	<2	<2	500	110	<2	900	70	900	70	1600	500	110	900	1600	500	900	900	110

(Jul – Dec 2016)

Sr. No.	Sampling Locations	Ulwe (GW 9)			Ganeshpuri (GW 2)			Vaghivali (GW8)			Targhar (GW 10)			Kombadbhuje (GW 1)			Koli (GW 4)			Kopar (GW 5)			Paragaon (GW 7)			Chinchpada (GW 6)			Vaghiwali wada (GW 3)		
	Sampling month	**Jul**	**Sep**	**Nov**	**Jul**	**Sep**	**Nov**	**Jul**	**Sep**	**Nov**	**Jul**	**Sep**	**Nov**	**Jul**	**Sep**	**Nov**	**Aug**	**Oct**	**Dec**	**Aug**	**Oct**	**Dec**	**Aug**	**Oct**	**Dec**	**Aug**	**Oct**	**Dec**	**Aug**	**Oct**	**Dec**
32	Coliform Colonies	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Absent	Present	Present	Present	Present	Absent	Present	Present	Present	Present	Present	Present	Present	Absent	Present	Present	Absent	Present	Present
33	Phytoplankton (no x 10^3/L)	ND	2.1	2.3	ND	1.2	1.3	2.6	2.2	2.0	ND	1.6	1.2	ND	1.8	1.6	2.4	2.1	2.3	2.1	2.3	1.4	1.6	1.5	1.7	3.1	2.0	2.1	2.2	2.3	2.1
34	Total Hetrotrophic Bacteria (spc/ml)	95	90	102	111	98	109	98	105	142	105	112	114	88	109	98	95	112	124	103	107	92	109	109	102	79	99	114	87	92	86
35	Chlorophyll (mg/m^3)	ND	1.5	1.6	ND	0.6	1.2	1.6	1.3	1.5	ND	0.8	0.6	ND	1.1	0.8	1.6	1.2	1.5	1.1	1.6	1.0	1.4	1.6	1.5	1.7	0.8	1.6	1.7	1.8	1.7

4.4.2 GW Analysis Inference:

The ground water quality showed considerable variation. Some ground water parameters were within desirable limit, some between desirable and permissible limit and few exceeded the permissible limit. The ground water did not fully comply the quality requirements as per IS 10500 revised in 2012 for purpose of drinking water.

The quality of collected ground water was not suitable for drinking purpose due to the presence of Fecal coliform, E. coli colonies & heterotrophic bacteria at all locations i.e. Koli, Kopar, Pargaon, Chinchpada, Vaghiwaliwada, Ulwe, Ganeshpuri, Vaghivali, Targhar & Kombadbhuje.

4.5 MARINE WATER QUALITY ANALYSIS REPORT (PHYSICOCHEMICAL PARAMETERS)

4.5.1 Analytical Data - Physicochemical Parameters during monsoon:

Table 4.5: *Marine water physicochemical analysis of various stations of project area during July 2016*

Sr. No.	Parameter	W 1	W 2	W 3	W 4	W 5	W 6		W 7		W 8	
		S	S	S	S	S	S	B	S	B	S	B
1.	pH	7.06	7.31	7.46	6.56	7.28	7.44	7.53	7.26	7.49	7.32	6.55
2.	Floating Matter	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
3.	Turbidity, NTU	ND	ND	ND	ND	ND	ND	ND	8.3	10.8	ND	ND
4.	Temperature, °C	28.2	27.0	27.2	28.0	27.0	28.0	28.0	27.0	28.0	28	28.6
5.	Salinity, ppt	2.6	3.0	6.3	9.6	11.8	10.3	11.4	11.4	10.1	11.2	11.4
6.	TSS, mg/L	88	100	144	136	244	186	210	310	330	78	96
7.	TDS, mg/L	1880	990	1820	2220	2100	2040	2540	2260	2380	3210	3200
8.	TOC, mg/L	1.5	1.6	1.4	1.7	1.3	1.2	1.2	1.8	2.4	1.2	ND
9.	DO, mg/L	5.5	5.2	5.4	5.6	5.5	5.5	5.8	4.9	5.2	5.5	5.3
10.	BOD, mg/L	10	28	24	12	18	12	22	12	18	26	24
11.	O&G, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12.	Sulphate, mg/L	16.8	13.2	27.2	12.2	15.4	18.9	9.8	26.5	28.2	30.2	33.5
13.	Nitrite, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
14.	Nitrate, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
15.	TAN, mg/L	6.2	2.6	2.8	10.6	3.2	11.4	9.4	6.2	6.4	2.6	2.8
16.	Inorganic PO_4, mg/L	1.8	2.8	ND	ND	6.2	1.8	ND	ND	ND	ND	ND
17.	Ca, mg/L	112	186	520	148	35.2	76	43.0	59	47.2	60	52
18.	Mg, mg/L	22.4	30.0	52	78	41.2	28	47	20.4	20.9	35	10.9
19.	Fe, mg/L	0.06	ND	ND	0.06	0.08	0.02	0.03	0.03	0.05	0.06	0.04
20.	Cr, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Sr. No.	Parameter	W 1	W 2	W 3	W 4	W 5	W 6		W 7		W 8	
		S	S	S	S	S	S	B	S	B	S	B
21.	Cu, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
22.	As, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
23.	Cd, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
24.	Hg, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
25.	Pb, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
26.	Zn, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 4.5: *Marine water physicochemical analysis of various stations of project area during July 2016* ***continued....***

Sr. No.	Parameter	W 9		W 10		W 11		W 12	W 13	
		S	B	S	B	S	B	S	S	B
1.	pH	6.88	6.67	7.45	7.05	6.77	7.10	7.18	7.32	7.44
2.	Floating Matter	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
3.	Turbidity, NTU	1.4	2.6	5.5	4.8	2.4	11.2	ND	2.8	10.5
4.	Temperature, °C	28.5	27.2	26.9	27.3	27.4	27.6	28.1	26.3	26.9
5.	Salinity, ppt	9.6	11.4	10.6	10.4	11.5	9.5	10.2	12.4	12.4
6.	TSS, mg/L	110	150	180	154	214	251	184	156	246
7.	TDS, mg/L	2390	2580	1730	1820	3010	2910	2850	3110	3050
8.	TOC, mg/L	1.8	1.6	1.3	1.7	1.2	1.3	2.6	ND	1.3
9.	DO, mg/L	5.4	5.7	5.2	5.6	5.4	5.6	5.8	5.8	5.2
10.	BOD, mg/L	16	18	16	18	26	32	32	18	22
11.	O&G, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
12.	Sulphate, mg/L	14.5	11.8	18	16.6	31.2	28.6	42.0	32.1	30.4
13.	Nitrite, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
14.	Nitrate, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
15.	TAN, mg/L	7.2	6.9	11.5	7.7	7.5	6.4	5.6	2.24	1.56
16.	Inorganic PO_4, mg/L	1.5	1.8	ND	ND	ND	ND	1.8	ND	ND
17.	Ca, mg/L	37.6	56.8	44.6	51.2	38.6	41.8	42.4	40.0	44.8
18.	Mg, mg/L	12.8	11.4	10.9	11.4	10.6	11.8	13.2	11.5	12.4
19.	Fe, mg/L	0.04	0.09	0.08	0.10	0.04	0.06	0.06	0.03	0.03
20.	Cr, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
21.	Cu, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
22.	As, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
23.	Cd, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
24.	Hg, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
25.	Pb, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
26.	Zn, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND

4.5.2 Inference - Physicochemical Parameters during monsoon:

The pH value ranged from 6.74 to 7.45 at surface and 6.67 to 7.44 at bottom suggest the acidic to basic nature of water. Salinity was low due to influx of fresh water. The high total suspended solids were found at bottom water at station 7 and bottom water at Station 11 due to accumulation of discharge from surrounding villages in the Panvel Creek.

The Total dissolved solids were noted high which suggest the high concentration of dissolved salts and deteriorated quality of water. Total organic carbon was noted low which suggest there were no accumulation of organic matter in water body.

Dissolve Oxygen level within normal limit suggest good amount of dissolved oxygen in the water body to support living organism. BOD value suggest the presence of biodegradable organic wastes present in water body which comes as domestic waste and discharge of sewage from surrounding areas.

The Sulphate value were found in low concentration which represents anthropogenic contamination. Total ammonical nitrogen were low in water body. Inorganic phosphate was found in low concentration. The concentration of Calcium, Manganese and Iron were low due natural origin.

4.5.3 Analytical Data - Physicochemical Parameters during post monsoon:

Table 4.6: *Marine water physicochemical analysis of various stations of project area during November 2016*

Sr. No.	Parameter	W 1	W 2	W 3	W 4	W 5		W 6		W 7		W 8	
		S	S	S	S	S	B	S	B	S	B	S	B
1.	pH	6.74	7.17	7.24	6.94	6.82	6.80	7.21	7.26	7.26	7.32	7.31	6.92
2.	Floating Matter	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
3.	Turbidity, NTU	ND	ND	ND	ND	ND	ND	ND	ND	12.3	12.8	ND	ND
4.	Temperature, ° C	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.1	28.0	28.1
5.	Salinity, ppt	3.4	3.8	11.2	12.8	11.6	12.2	12.3	14.1	13.1	13.1	14.4	14.6
6.	TSS, mg/L	128	104	214	150	326	268	214	326	268	324	96	106
7.	TDS, mg/L	1940	1040	2130	2520	2440	2360	3140	3260	2280	2360	2530	2830
8.	TOC, mg/L	1.3	1.4	1.6	1.9	1.5	1.8	1.4	2.3	2.1	2.6	1.3	ND
9.	DO, mg/L	5.6	5.4	5.8	5.6	5.4	5.2	5.8	5.6	5.0	5.6	5.4	5.6
10.	BOD, mg/L	6	16	18	14	10	16	16	18	12	12	12	20
11.	O&G, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12.	Sulphate, mg/L	22	14	24	10	10.8	12.9	22.0	20.0	28	24	38	34

Sr. No.	Parameter	W 1	W 2	W 3	W 4	W 5		W 6		W 7		W 8	
		S	S	S	S	S	B	S	B	S	B	S	B
13.	Nitrite, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
14.	Nitrate, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
15.	TAN, mg/L	5.6	2.8	5.6	11.2	2.8	2.8	5.6	5.6	7.2	6.8	5.6	2.8
16.	Inorganic PO_4, mg/L	1.1	1.1	ND	ND	1.2	1.1	1.0	ND	ND	ND	ND	ND
17.	Ca, mg/L	108	114	812	162	37.6	52.0	84	46	62	48	56	48
18.	Mg, mg/L	20.4	18.0	72	72	98.2	11.8	30	52	21	24	35	10.9
19.	Fe, mg/L	0.06	ND	ND	0.06	0.04	0.06	0.01	0.02	0.02	0.01	0.03	0.02
20.	Cr, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
21.	Cu, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
22.	As, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
23.	Cd, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
24.	Hg, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
25.	Pb, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
26.	Zn, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 4.6: *Marine water physicochemical analysis of various stations of project area during November 2016* ***continued....***

Sr. No.	Parameter	W 9		W 10		W 11		W 12	W 13	
		S	B	S	B	S	B	S	S	B
1.	pH	6.73	6.74	7.14	7.04	6.62	6.97	7.18	7.14	7.23
2.	Floating Matter	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
3.	Turbidity, NTU	2.8	3.2	8.2	9.8	4.4	5.2	ND	4.2	6.8
4.	Temperature, ° C	28.0	28.1	28	28.3	28.1	28.1	28.1	28.1	28.0
5.	Salinity, ppt	13.4	13.4	12.9	12.4	14.9	14.6	10.2	12.4	12.4
6.	TSS, mg/L	148	171	188	196	294	302	184	240	246
7.	TDS, mg/L	2890	2810	2890	3180	3150	3260	2850	2820	2900
8.	TOC, mg/L	1.6	1.8	1.5	1.9	1.3	1.5	2.6	ND	1.7
9.	DO, mg/L	5.4	5.0	5.2	5.6	5.8	6.0	5.8	5.4	5.8
10.	BOD, mg/L	18	18	18	24	24	30	32	18	26
11.	O&G, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
12.	Sulphate, mg/L	14	13	36	35.2	24.0	14.0	42.0	36.0	30.0
13.	Nitrite, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
14.	Nitrate, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
15.	TAN, mg/L	8.4	7.6	7.6	5.6	11.2	8.4	5.6	2.24	2.8
16.	Inorganic PO_4,	1.0	1.1	ND	ND	ND	ND	1.8	ND	ND

Sr. No.	Parameter	W 9		W 10		W 11		W 12	W 13	
		S	B	S	B	S	B	S	S	B
	mg/L									
17.	Ca, mg/L	38.2	46.8	54.2	55.1	52.4	58.8	42.4	40.0	44.8
18.	Mg, mg/L	12.4	12.0	12.3	12.6	12.8	14.2	13.2	10.2	11.0
19.	Fe, mg/L	0.02	0.03	0.06	0.08	0.06	0.05	0.06	0.01	0.01
20.	Cr, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
21.	Cu, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
22.	As, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
23.	Cd, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
24.	Hg, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
25.	Pb, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
26.	Zn, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND

4.5.4 Inference - Physicochemical Parameters during post monsoon:

The pH value ranged from 6.62 to 7.31 at surface and 6.74 to 7.32 at bottom suggest the acidic to basic nature of water. Salinity was low due to influx of fresh water. The high total suspended solids were found at surface water at station 5 and bottom water at Station 6 due to accumulation of discharge from surrounding villages in the Panvel Creek.

The Total dissolved solids were noted high which suggest the high concentration of dissolved salts and deteriorated quality of water. Total organic carbon was noted low which suggest there were no accumulation of organic matter in water body.

Dissolve Oxygen level within normal limit suggest good amount of dissolved oxygen in the water body to support living organism. BOD value suggest the presence of biodegradable organic wastes present in water body which comes as domestic waste and discharge of sewage from surrounding areas.

The Sulphate value were found in low concentration which represents anthropogenic contamination. Total ammonical nitrogen were low in water body. Inorganic phosphate was found in low concentration. The concentration of Calcium, Manganese and Iron were low due natural origin.

4.6 MARINE WATER QUALITY ANALYSIS REPORT (BIOLOGICAL PARAMETERS)

4.6.1 Analytical Data - Biological Parameters during monsoon:

Biological parameters viz. Phytoplankton, Zooplankton, Benthos and Microbiology were analyzed and compiled data is presented below:

Table 4.7: Marine water biological analysis of various stations of project area during July 2016

Parameter	W 2	W 11		W12
	S	S	B	S
Phytoplankton				
Population(nox10³/L)	22.4	24.8	19.2	42.6
Total Genera	9	14	8	23
Major Genera	*Leptocylindrus, Scenedesmus, Thalassiosira, Navicula*	*Leptocylindrus, Skeletonema, Thalassiosira, Nitzschia*	*Leptocylindrus, Thalassiosira, Skeletonema, Cyclotella*	*Leptocylindrus, Pleurosigma, Skeletonema, Thalassiosira*
Diversity Index	2.2	1.1	1.8	2.3
Zooplankton				
Population (no x 10³/100m³)	2251	3429		4083
Total Group	7	6		6
Major Groups	Copepod, Decapods larvae, Polychaetae			
Biomass (ml/100m³)	525	480		382.5
Diversity Index	0.29	0.06		0.026
Benthos				
Population	Sample could Not	458.26		291.62

Parameter	W 2	W 11		W12
	S	S	B	S
(no x 10^{2}/ m^2)	be collected due hard substratum			
Total Group		1		2
Major group		Polychaete		Polychaete Amphipods
Biomass (gm/ m^2)		1.42		1.16
Diversity Index		0.00		0.4
Microbiology				
Coliform/100 ml	*P	*P	*P	*P
E. coli	*A	*A	*A	*A

Inferences - Biological Parameters during monsoon:

4.6.1.1 Phytoplankton

In July 2016, Phytoplankton population density ranges from 22.2-42.6 x 10^3/l at surface of stations 2, 11 and 12; population was noted 19.2 x 10^3/l at bottom of Station 11. Highest phytoplankton population at surface water of station 12 may be due to influx of domestic water from surrounding villages; total generic groups ranges from 8-23 nos. in July 2016. Maximum generic diversity 23 is observed at Station 12.

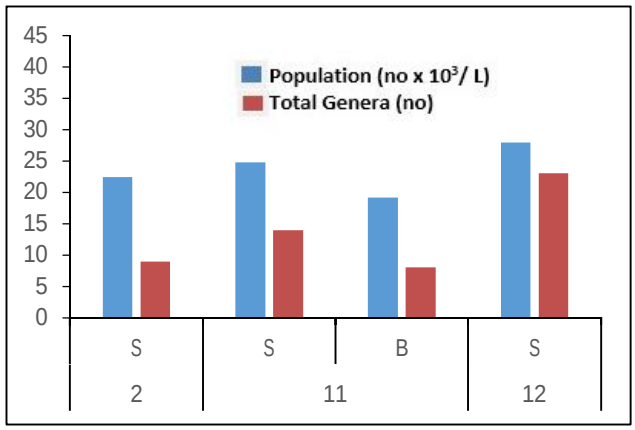


Figure 4.1 : Graphical representation of phytoplankton population and total genera *for July 2016*

Leptocylindrus, *Chaetoceros*, *Skeletonema* are most common ones, followed by rest of observed genera like *Thalassiosira*, *Pleurosigma*, *Coscinodiscus*. *Navicula*, *Nitzschia*.

The other fresh water phytoplankton genera found are *Pediastrum* and *Phacus* (Solitary) in Ulwe River (Station 12). *Leptocylindrus*, *Thalassiosira* and *Skeletonema* are common Genera noted in all stations 2, 11 and 12 mostly present in surface water. Graphical representations of phytoplankton population and total genera is represented in Figure 4.1.

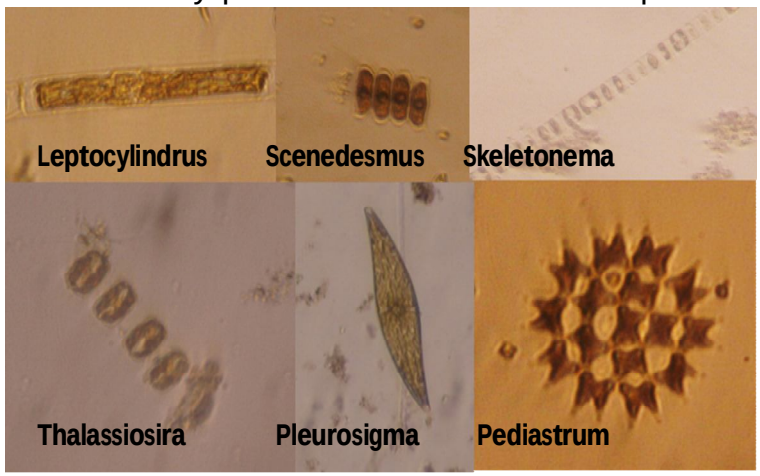


Figure 4.2: Phytoplankton found in samples

The above graph represents the population of phytoplankton is more at station 11 and 12; and less at station 2 at Gadhi River, which represents there is discharge of sewage and domestic waste. The phytoplankton trend with respect to total number of genera is almost same throughout all stations. Some of the major

genera seen were photographed and shown in figure 4.2.

4.6.1.2 Zooplankton

In July 2016, the zooplankton biomass ranged from 382.5-525.0 ml/100 m^3 with population density of 2251-4083 no x 10^3/100m^3 while having low faunal group ranging from 6-7 nos. The zooplankton was noted with high population and averagely group diversity in river. Copepods, decapods larvae, gastropods, Polychaeta were common groups observed as, figures next represents zooplankton standing stock graphically.

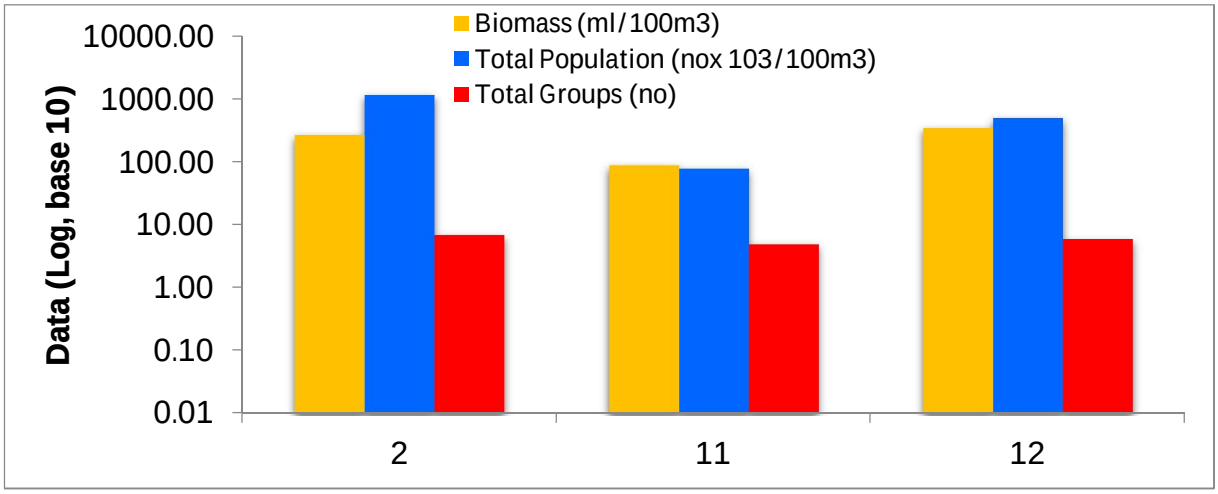


Figure 4.3: *Graphical representations of Zooplankton Biomass, Population and total group for* **July** *2016*

The above graph represents that average standing stock reported from all stations; Station 11 shows less population and biomass when compared to station 2 & 12.

4.6.1.3 Benthos

Macro-benthic biomass noted 1.16-1.42 gm/m^2 with population 291.6-458.3 x 10^2/m^2 and faunal group found were Polychaetes and Amhipods at station 12. No benthic sample was collected at station 2 because of hard bottom. The benthos observed was good in terms of biomass of Benthos.

Figure 4.4: Common Benthic organism found in samples

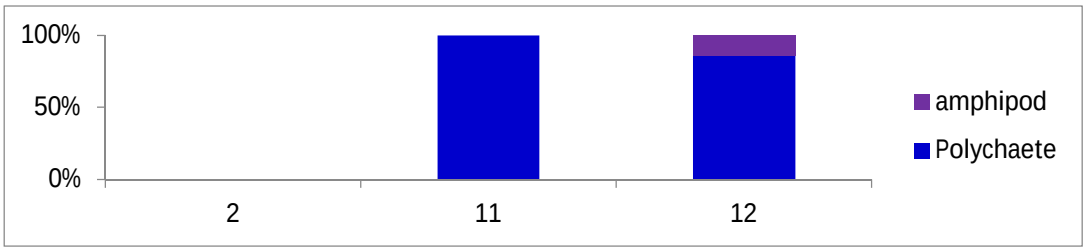


Figure 4.5: Graphical representation of benthic population for **July** 2016

The benthic organisms found at sampling area shown in **Figure 4.5** and **Figure next** represents the graphical representations of population of benthic organisms' groups in percentage.

The graphs represent the Polychaete as major stable benthic component.

4.6.1.4 Microbiology

Coliform microbes were present at all stations in surface and bottom levels. E coli like organisms were absent in all surface and bottom levels. No specific trend was observed.

4.6.2 Analytical Data - Biological Parameters during post monsoon:

Biological parameters viz. Phytoplankton, Zooplankton, Benthos and Microbiology were analyzed and compiled data is presented below:

Table 4.8: *Marine water biological analysis of various stations of project area during November 2016*

Parameter	W 2	W 11		W12
	S	S	B	S
Phytoplankton				
Population(nox10³/L)	12.8	564.8	297.6	424.0
Total Genera	7	11	17	19
Major Genera	*Pediastrum, Thalassiosira, Coscinodiscus, Navicula*	*Leptocylindrus, Chaetoceros, Skeletonema, Thalassiosira*	*Chaetoceros, Leptocylindrus, Skeletonema Thalassiosira*	*Nitzschia, Rhizosolenia, Cymbella, Navicula*
Diversity Index	1.4	1.6	1.3	2.4
Zooplankton				
Population (no x 10³/100m³)	1191	79		507
Total Group	7	5		6
Major Groups	Copepod, Gastropods, Polychaete			
Biomass (ml/100m³)	300	100		400
Diversity Index	0.29	0.83		0.23
Benthos				
Population (no x 10²/ m²)	Sample could Not be collected due rocky substratum	1208.1		41.66
Total Group		1		1
Major group		Polychaete Gastropods		Polychaete Gastropods
Biomass (gm/ m²)		2.67		0.20
Microbiology				
Coliform/100 ml	*P	*P	*P	*P
E. coli	*A	*A	*A	*A

4.6.3 Inferences - Biological Parameters during post monsoon:

4.6.3.1 Phytoplankton

In November 2016, Phytoplankton population density ranges from 12.8-564.6 x 10^3/l at surface of stations 2, 11 and 12; population was noted 297.6 x 10^3/l at bottom of Station 11. Highest phytoplankton population at surface water of station 11 may be due to influx of domestic water from surrounding villages; total generic groups ranges from 7-14 nos. in November 2016 at surface and 17 genera observed at bottom of station 11. Maximum generic diversity 19 is observed at Station 12.

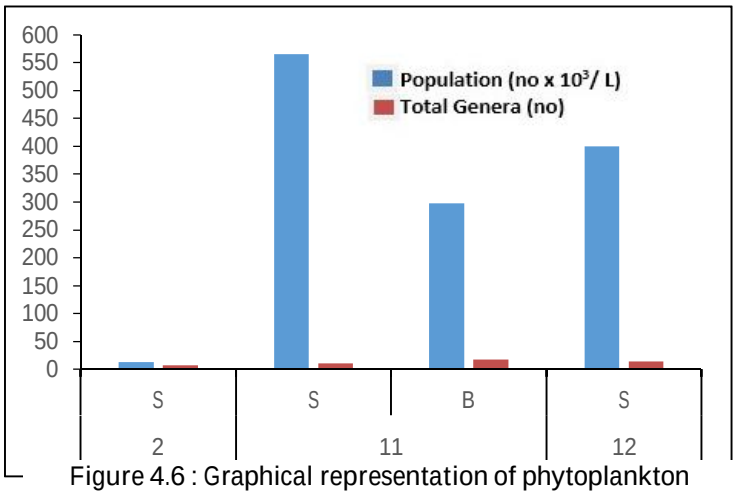


Figure 4.6 : Graphical representation of phytoplankton population and total genera *for November 2016*

Leptocylindrus, *Chaetoceros*, *Skeletonema* are most common ones, followed by rest of observed genera like *Thalassiosira*, *Coscinodiscus*. *Navicula*, *Pleurosigma*.

The other fresh water phytoplankton genera found are *Pediastrum* and *Cymbella* (Solitary) in Ulwe River (Station 12). *Thalassiosira* and *Coscinodiscus* are common Genera noted in all stations 2, 11 and 12 mostly present in surface water. Graphical representations of phytoplankton population and total genera is represented in Figure 4.1.

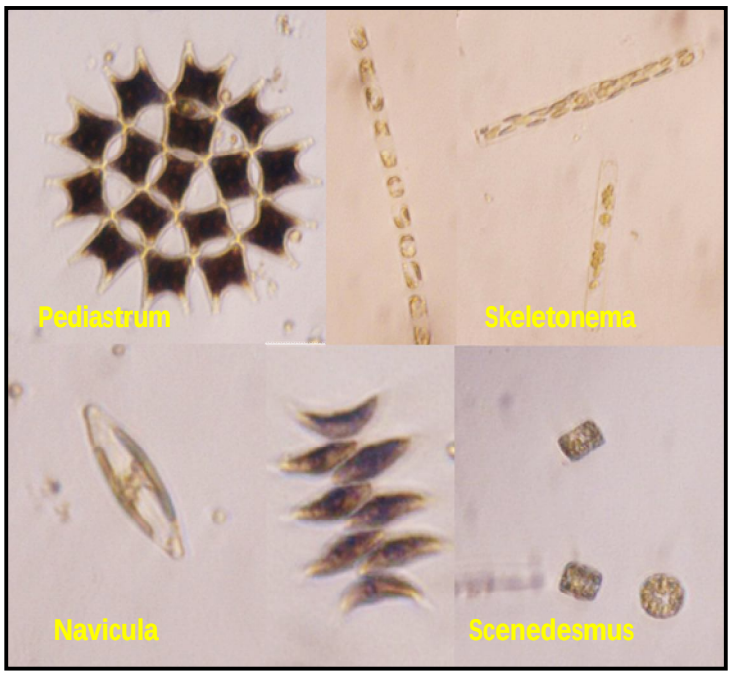


Figure 4.7: Phytoplankton found in samples

The above graph represents the population of phytoplankton is more at station 11 and 12; and less at station 2 at Gadhi River, which represents there is discharge of sewage and domestic waste. The phytoplankton trend with respect to total number of genera is almost same throughout all stations. Some of the major genera seen were photographed and shown in figure 4.2.

4.6.3.2 Zooplankton

In November 2016, the zooplankton biomass ranged from 100-400ml/100 m^3 with population density of 79-1191 nox10^3/100m^3 while having low faunal group ranging from 5-7 nos. The zooplankton was noted with high population and averagely group diversity in river. Copepods, decapods larvae, gastropods, polychaete were common

groups observed as, figures next represents zooplankton standing stock graphically.

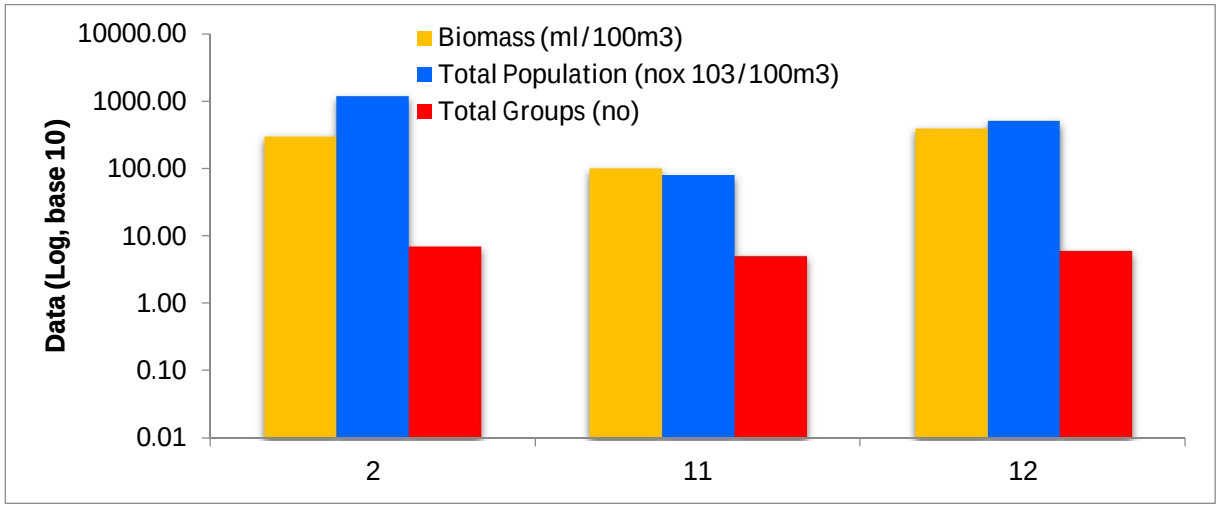


Figure 4.8: *Graphical representations of Zooplankton Biomass, Population and total group for November 2016*

The above graph represents the high biomass reported from station 2; Station 11 shows less population and biomass when compared to station 2 & 12.

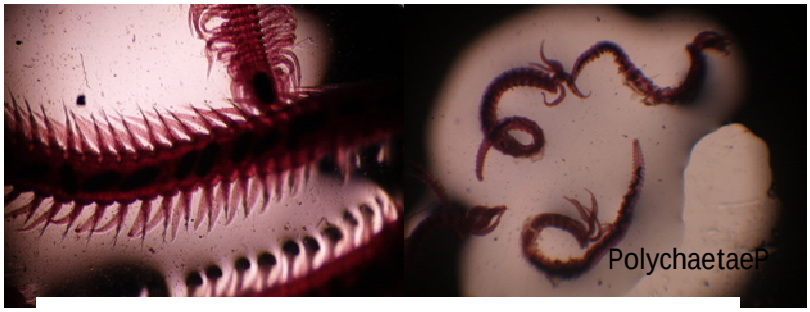


Figure 4.9: *Benthic organism found in samples*

4.6.3.3 Benthos

Macro-benthic biomass ranged from o.2-2.67 gm/m^2 with population 41.66-1208.14 x 10^2/m^2 and faunal group found were Polychaetes and Gastropods at station 11 & 12. No benthic sample was collected at station 2 because of rocky bottom. The benthos observed was good in terms biomass of living system of Benthos.

The benthic organisms found at sampling area shown in **Figure 4.5** and **Figure next** represents the graphical representations of population of benthic organisms' groups in percentage

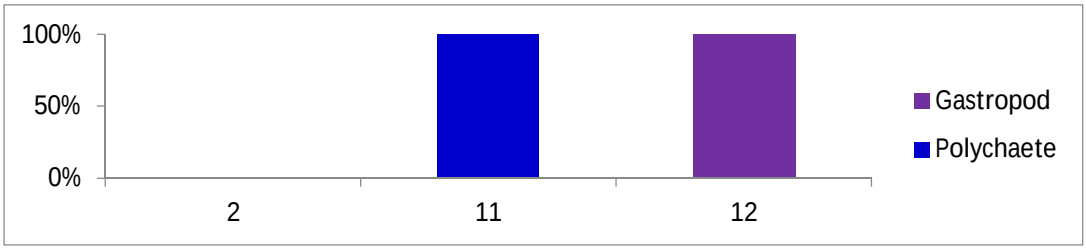


Figure 4.10: *Graphical representation of benthic population for November 2016*

The graph represents the Polychaetae as major stable benthic component.

4.6.3.4 Microbiology

Coliform microbes were present at all stations in surface and bottom levels. E coli like organisms were absent in all surface and bottom levels. No specific trend was observed.

5. CHAPTER V: CONCLUSION & RECOMMENDATION

Based on the study of activities planned during pre-development works and on the basis of the environmental baseline monitoring results, certain issues have been identified and steps proposed to mitigate the environmental impacts as suggested below:

5.1 Ambient Air Quality

5.1.1 Observations

As can be seen from analysis data, Table 4.1, the particulate levels are under NAAQS limit in terms of PM10 and PM2.5 – particularly the PM2.5 which is mostly from very heavy automobile traffic.

5.1.2 NMIA Pre- Development Activities and impacts anticipated on Air Quality:

- Construction activities at NMIA during pre-development works include:
- demolition of hill which will generate material like murum and rock of which will be utilized within site
- Rehabilitation and re-settlement of nearly 3500 households presently staying in 7 villages within NMIA area

The air will get polluted by activities like excavation, land filling, controlled blasting, construction, material handling and transportation during construction phase due to traffic and high dust levels.

5.1.3 Mitigation Measures Proposed:

Following mitigation measures are strongly proposed to ensure minimal impacts on ambient air quality:

- Use of temporary screens of tin or fabric to create barriers against dust
- Provision for water sprinkling at the construction site and along roads for dust suppression
- Wheel wash system on roads leading out of site to ensure that truck tyres do not spew out dust
- Trucks carrying earth, sand or stone should be covered with tarpaulin to avoid spillage. Overloading of such trucks should be strictly avoided
- Workers working in high dust areas and on earth moving machineries should be provided with face masks/goggles for their protection- such provision should be built into the contract documents
- High tech equipment should be used for controlled (delayed) blasting with proper blast pattern along with cover on rock surface being excavated which will generate minimal noise as well as dust
- Construction machinery and equipment should be maintained in good working condition with PUC Certification for all transport vehicles used. All vehicles & construction equipment which do not meet vehicular pollution standards will not be allowed within construction site

5.2 Ambient Noise:

5.2.1 Observations from Data:

Ambient Noise levels are within the limits prescribed under Schedule II of Environmental Protection Act 1986, however both Day and Night Time values are towards the higher side (barely meeting the Noise standards)

5.2.2 NMIA Pre- Development Activities and impacts anticipated on Ambient Noise Levels:

Construction activities at NMIA during pre-development works include:

- demolition of hill which will generate material like murum and rock will be utilized within site and balance will be taken to fill up nearby areas
- Rehabilitation and re-settlement of nearly 3500 households presently staying in 7 villages within NMIA area

The ambient noise levels will get affected by activities like (a) use of Earth moving machinery like Excavators, Wheel Loaders etc and trucks for handling and re-handling of excavated material (b) controlled blasting (c) demolition of houses and existing structures

5.2.3 Mitigation Measures Proposed:

Following mitigation measures are strongly proposed to ensure minimal impacts on ambient noise levels:

- Use of te11mporary screens of tin to create barriers against noise propagation in active construction areas
- Workers working in high noise areas and on earth moving machineries should be provided with ear muffs/ear plugs for their protection- such provision should be built into the contract documents
- Trucks and construction machinery should be well maintained to ensure low noise generation. Norms of Noise levels for Construction machinery as specified under EP Act should be strictly followed
- High tech equipment should be used for controlled (delayed) blasting with proper blast pattern along with cover on rock surface being excavated which will generate minimal noise
- construction activity should not be carried out night time hours
- construction machineries and DG sets used should be provided with silencers
- DG sets used should conform to EP Act norms for air pollution and noise
- Before controlled blasting the surrounding villages should be informed, so that they can go to a safe place away from the project site.

5.3 Soil

5.3.1 Observations from Data:

Soil is fertile and can support vegetation.

5.3.2. NMIA Pre – Development Activities and impacts anticipated on soil:

Construction activities at NMIA during pre-development works include:

- demolition of hill which will generate material like murum and rock of which will be utilized within site and balance will be taken to fill up nearby areas
- Site level is currently low and will be increased to +5.5 m RL by using excavated material

The soil will get affected by above activities.

5.3.3 Mitigation measure proposed:

Following mitigation measures are strongly proposed to ensure minimal impacts on soil quality:

- removal of existing top soil within site by excavating and storing the same for future use.
- Such excavated soil should be stored separately and used as final top layer after landfilling is completed

5.4 Ground Water:

5.4.1 Observations from Data:

Ground Water quality is poor and fails to meet IS 10500:2012 norms at number of locations. The area of the site is low lying and partially inundated during high tide. Ground water occurrence is high and mostly open dug wells are seen in the area.

5.4.2 NMIA Pre- Development Activities and impacts anticipated on Ground Water Quality:

Construction activities at NMIA during pre-development works include:

- demolition of hill which will generate material like murum and rock of which will be utilized within site and balance will be taken to fill up nearby areas
- Site level is currently low and will be increased to +5.5 m AMSL by using excavated material

The ground water quality will get affected by above activities.

5.4.3 Further Study Suggested:

- As per clause (vii) under specific conditions of the Environmental clearance granted for the NMIA project by MOEFCC, "systematic and periodic monitoring mechanism need to be put in place by CIDCO to assess the impact on sub surface flow /impact on aquifers as well as surface water bodies in different seasons.

Necessary additional environmental protection measures to be adopted to address the impact of proposed development in coastal sub surface flow as well as impact on aquifers"

The above study needs to be undertaken by a Functional Area Expert specializing in Hydrology/Geo- hydrology urgently in view of the fact that pre-development activities have started.

5.4.4 Mitigation Measures for Rehabilitated Settlements:

As can be seen ground water quality is poor and hence CIDCO should make adequate piped water supply available for people to be accommodated in Rehabilitated settlements

5.5 Marine Water:

5.5.1 Observations from Data:

Marine Water quality is moderate, may be due to hindrances.

5.5.2 NMIA Pre- Development Activities and impacts anticipated on Marine Water Quality:

Construction activities at NMIA during pre-development works include:

- demolition of hill which will generate material like murum and rock of which will be utilized within site and balance will be taken to fill up nearby areas
- Site level is currently low and will be increased to +5.5 mAMSL by using excavated material
- The area of the site is partially inundated during high tide.

The marine water quality will get affected by activities such as land filling, re-coursing of Ulwe creek.

5.5.3 Mitigation Measures for protection of Marine Water Quality:

Mitigation measures which should be taken up at NMIA during pre-development works:

- landfilling should be taken up in areas away from those land parcels which are inundated during high tide
- for excavated areas and freshly filled up areas, proper garland drains leading to settlement basins followed by filter bunds should be provided so that rain water does not carryover the loose excavated material into marine areas
- polyelectrolytes should be used to help settle loose suspended material in the settlement basins