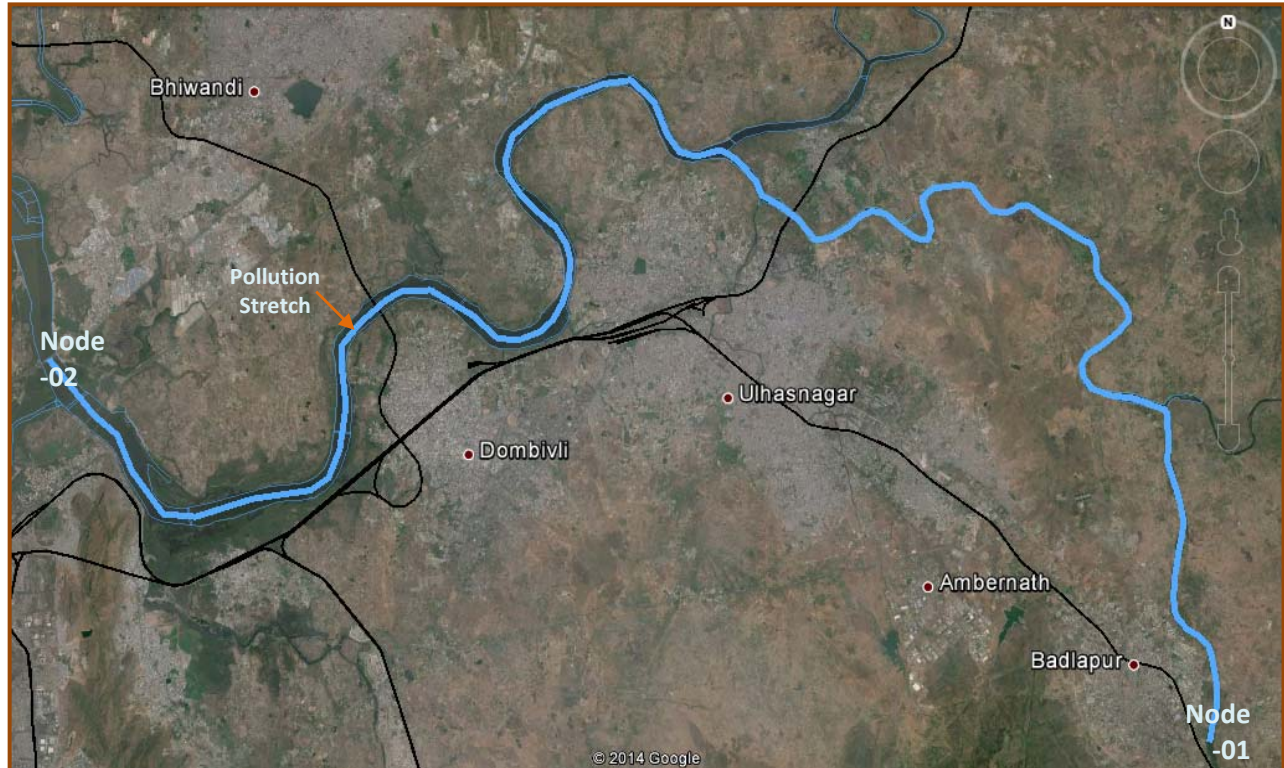


***Comprehensive Study on Polluted River Stretch of Ulhas River –
Downstream of Mohane, Kalyan***

for

Maharashtra Pollution Control Board - Kalyan



Prepared By

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CHAPTER 1: INTRODUCTION

1.1 Ulhas River

Ulhas River is a westward flowing river in western India in the state of Maharashtra which originates in the Sahyadri hill ranges of Ulhas valley near Udhewadi in the south which drains an area of 4,637 sq. km.

1.2 Course of River

From the point of origin the river flows north turning left where it is joined by River Salpe, which is its right-bank tributary. It then begins its north-eastward journey through the Khandpe village. The river bypasses the Palasdhari village where it receives the discharge from the Palasdhari Dam starting a northward course beyond this point coming to lie parallel to the rail tracks only to be distracted by the town of Karjat. Meandering through Karjat, it reaches further north synapsing with River Peg between Bhivpuri road and Neral. Continuing its run along Neral it is joined by River Poshir, another right-bank tributary, at Nikhop village. It flows north skirting Badlapur where it receives the run-off from Chikoli Dam. Near Raw water pump house of MIDC Jambhul the river meets Barvi Dam discharge water also called as Barvi River. The confluence is a tourist and fishing hub for villagers around. The river flows through Ulhasnagar to which it gives its name. It then passes under the rail bridge connecting Ambivali and Shahad and shortly after confluences with its biggest tributary formed by merging of River Bhatsa and River Kalu which together accounts for 55.7% of the total catchment area of River Ulhas.

Beyond Kalyan the river, nearly flowing at sea level, merges with the creek waters and its flow comes to be influenced by the tidal forces. From here on it forms an estuary and also supports a mangrove forest near Dombivali, Diva & Mumbra. In rainy season and during low tide the river continues to flow till Thane where splits into two branches which flow west and south, respectively, around Salsette Island, on which lies the metropolis of Mumbai. The main branch turns northwestward to Ghodbunder, flowing through the north of Sanjay Gandhi National Park & finally it opens into the estuary of Vasai Creek. Thane Creek flows south to empty into Bombay Harbour during the course the river flows through dense mangroves. The estuary of the Ulhas is the site of the historical ports of Kalyan, Kopri (Chersonesus/Coprostaneum) and Shurparaka (now Sopara). The total length of the river from its origin to its outfall in the Arabian Sea is 122 km.

1.3 Objectives of the Study

- 1.3.1 To Identify the pollution stretch of Ulhas downstream river
- 1.3.2 To identify sources of waste water (major outfalls) coming into the river stream (along with quality and quantity)
- 1.3.3 To identify the Treatment Technology and Process Adopted by each Industrial Unit
- 1.3.4 To check the possibility of application of Common Effluent Treatment Plants for such Clusters
- 1.3.5 To Identify the Site for construction of WWTP's and probable scope for treatment technology to be adopted.

1.4 Scope of study

The major interest of the present study is to identify the pollution sources in the concerned stretch of Ulhas River & to suggest suitable mitigation measures. This requires detailed information with respect to water quality & flora & fauna of the segment of river under consideration. The detailed scope of the study is given below;

I. Identification of No. of Cities and Towns on the identified Polluted Stretch of Ulhas Downstream River (both sides).

II. Industrial Pollution

A. Large and Medium Industries

- i Identification and Listing of Polluting Industries (Small, Large and Medium Scale) (Green, Orange and Red) (both sides)
- ii Pollution Load from those industries covering the Parameters as per Sr. no. 2/A (b).
- a) Identification of source of Water Supply and volume of Waste water generation from each industrial Unit.
- b) Characterization of **Influent** and **Effluent** Quality of Waste water from **each Industrial Unit** in terms of;

BOD: 3 Days at 27⁰C

COD: Open Reflux Method

Conductivity: Conductivity Meter

Heavy Metals:

Aluminium (Al)	Cobalt (Co)	Potassium (K)	Boron (B)	Magnesium (Mg)	Beryllium (Be)
Antimony (Sb)	Copper (Cu)	Selenium (Se)	Cadmium (Cd)	Manganese (Mn)	Lithium (Li)
Arsenic (As)	Iron (Fe)	Silver (Ag)	Calcium (Ca)	Mercury (Hg)	Strontium (Sr)
Barium (Ba)	Lead (Pb)	Sodium (Na)	Chromium (Total) (Cr ³)	Nickel (Ni)	Tin (Sn)
Zinc (Zn)	Vanadium (V)	--	--	--	--

Pesticides:

Organochlorine Pesticides	Poly Aromatic Hydrocarbons
Organophosphorous Pesticides	Poly Chlorinated Biphenyls

pH: pH Meter (On the Spot)

TSS: Gravimetric Method @105⁰C

TDS: Gravimetric Method @180⁰C

- iii Identification of Treatment Technology and Process adopted by each Industrial Unit
- iv Identification of Final discharge /utilization of Treated Waste water by an individual industry.

B. Small Scale Industries

- i Identification and Listing of Polluting Industries and quantification of waste water (generated from Clusters of Small Scale Industries)
 - ii Characterization of Quality of **effluents** generated from **each Small-scale Industries** in terms of;
- BOD: 3 Days at 27⁰C
- COD: Open Reflux Method
- Conductivity: Conductivity Meter

Heavy Metals:

Aluminium (Al)	Cobalt (Co)	Potassium (K)	Boron (B)	Magnesium (Mg)	Beryllium (Be)
Antimony (Sb)	Copper (Cu)	Selenium (Se)	Cadmium (Cd)	Manganese (Mn)	Lithium (Li)
Arsenic (As)	Iron (Fe)	Silver (Ag)	Calcium (Ca)	Mercury (Hg)	Strontium (Sr)

Barium (Ba)	Lead (Pb)	Sodium (Na)	Chromium (Total) (Cr ³)	Nickel (Ni)	Tin (Sn)
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TDS: Gravimetric Method @180⁰C

- iii Possibility of application of Common Effluent Treatment Plants for such Clusters.

III. Domestic Pollution

- Identification of number of waste water outfalls coming directly into the River along with their locations.
- Estimation of the Quantity of Municipal Waste water generation based upon the capacity of CWWTP wherever available and by identifying the area of contamination (both sides of River).
- Collection of samples from the source of Municipal Waste Water and to perform the Qualitative analysis for the following Parameters;

BOD: 3 Days at 27⁰C

COD: Open Reflux Method

Conductivity: Conductivity Meter

Heavy Metals:

Aluminium (Al)	Cobalt (Co)	Potassium (K)	Boron (B)	Magnesium (Mg)	Beryllium (Be)
Antimony (Sb)	Copper (Cu)	Selenium (Se)	Cadmium (Cd)	Manganese (Mn)	Lithium (Li)
Arsenic (As)	Iron (Fe)	Silver (Ag)	Calcium (Ca)	Mercury (Hg)	Strontium (Sr)
Barium (Ba)	Lead (Pb)	Sodium (Na)	Chromium (Total) (Cr ³)	Nickel (Ni)	Tin (Sn)
Zinc (Zn)	Vanadium (V)	--	--	--	--

Pesticides:

Organochlorine Pesticides	Poly Aromatic Hydrocarbons
Organophosphorous Pesticides	Poly Chlorinated Biphenyls

pH: pH Meter (On the Spot)

TSS: Gravimetric Method @105⁰C

TDS: Gravimetric Method @180⁰C

- Identification of extent of Pollution Control needed in a view of critical flow conditions and comparing with desired quality criteria.
- Identification of the sources utilizing the Waste water for Agriculture purposes along with the Quantity.

IV. River Water Quality

- Measurement of River Flow at specific distance considering the Geographical condition of that particular stretch or ingress of major source of pollution.
- Collection of samples from polluted stretch at a specific distance or at a point of ingress of major source of pollution and to perform the Qualitative analysis for the following Parameters;

BOD: 3 Days at 27⁰C

COD: Open Reflux Method

Conductivity: Conductivity Meter

Heavy Metals:

Aluminium (Al)	Cobalt (Co)	Potassium (K)	Boron (B)	Magnesium (Mg)	Beryllium (Be)
Antimony (Sb)	Copper (Cu)	Selenium (Se)	Cadmium (Cd)	Manganese (Mn)	Lithium (Li)
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Barium (Ba)	Lead (Pb)	Sodium (Na)	Chromium (Total) (Cr ³)	Nickel (Ni)	Tin (Sn)
Zinc (Zn)	Vanadium (V)	--	--	--	--

Pesticides:

Organochlorine Pesticides	Poly Aromatic Hydrocarbons
Organophosphorous Pesticides	Poly Chlorinated Biphenyls

pH: pH Meter (On the Spot)

TSS: Gravimetric Method @105°C

TDS: Gravimetric Method @180°C

- iii Projection of quality of River water in those stretches if effluents are either diverted or discharged after adequate treatment only.
- iv Identification and quantification of Industries contributing the Municipal Waste.

V. Site Selection for WWT and Treatment Technology

- i Identification of Site for the construction of WWTP as per the Geographical conditions and the probable scope of Treatment Technology to be adopted.

1.5 Approach strategy

It is inevitable that the release of treated effluent & untreated domestic sewage into Ulhas River would cause certain adverse impact on the riverine ecology, the intensity of which would vary depending on various factors such as quality & quantity of the effluent, assimilative capacity of the receiving water and the degree of the ecological sensitivity of the region. The enhancement in the levels of pollutants in the receiving water over the natural background is the major factor to influence the ecology.

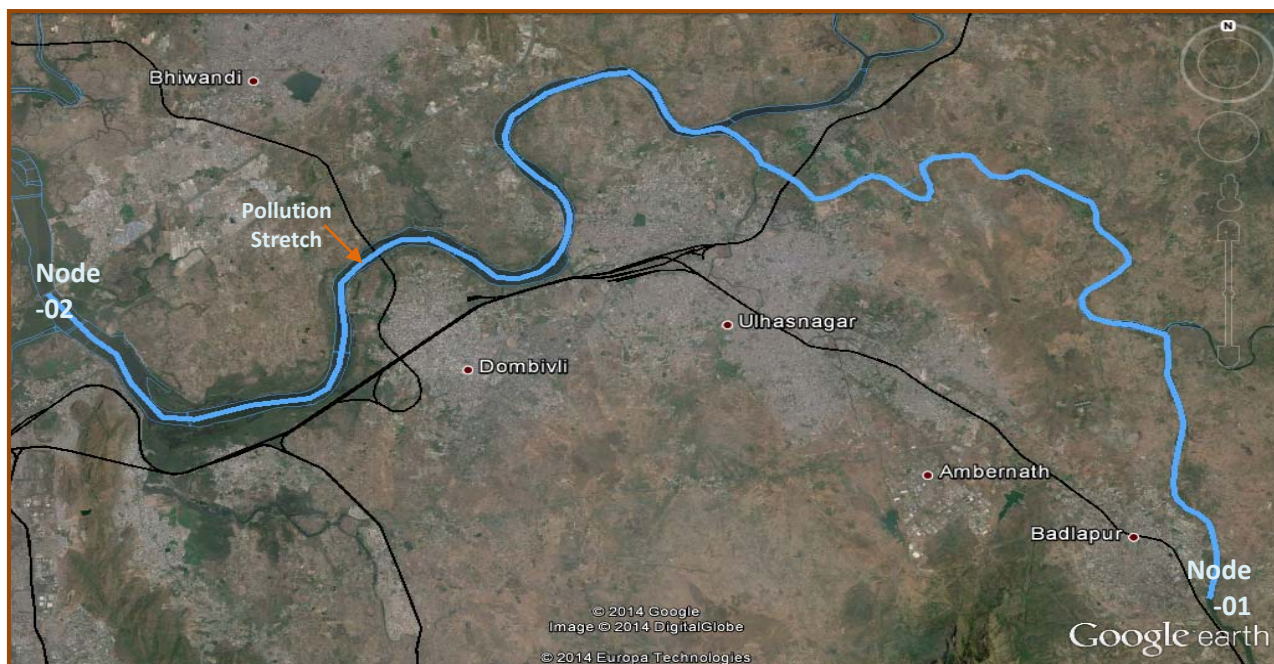
However, as the estuarine & riverine environment can undergo changes on the short time scales, the prevailing conditions needs to be assessed. Hence a comprehensive study on water quality was conducted in Ulhas River during Pre monsoon 2014. M/s Sadekar Enviro Engineers Pvt. Ltd. has undertaken field investigations in different locations in the Ulhas River.

1.5.1 Identification of pollution stretch

For the study purpose the stretch is identified based on the closed proximity of large habitations (Commercial & residential) along the course of river Ulhas which is irrespective of its length.

The pollution stretch started from barrage dam near Kharvai, Badlapur (Node -01) and ends at Pipeline road, Raheja complex (fly over), Majiwada, Thane (Node -02) and the total length of the pollution stretch is coming around 50km in length.

Fig. no. 01: Identified pollution stretch of Ulhas River (Google imaginary)



1.6 Purpose of the Study

Maharashtra Pollution Control Board (MPCB) has received letter from Central Pollution Control Board (CPCB) vide letter No. K-14011/1/2013/MON dt. 25/06/2013 regarding the Comprehensive Study on Polluted River Stretches of River Ulhas & downstream of Mohane in Kalyan region. MPCB Regional Office, Kalyan through its letter MPCB/ROK/TB-140217FT0191 dt. 17/2/2014 allotted the work to M/s Sadekar Enviro Engineers Pvt. Ltd. The purpose is to evaluate the physicochemical characteristics of River Ulhas and its health status through performing the monitoring at different locations along the polluted stretch.

CHAPTER 2: PROJECT DESCRIPTION

2.1 Pollution Stretch

For the comprehensive study on the polluted river stretch downstream of Mohane, Kalyan region the identified river stretch is identified from barrage dam near Kharvai, Badlapur (Node -01) and ends at Pipeline road, Raheja complex (fly over), Kasheli, Thane (Node -02) (Ref. Fig. no. 01).

2.2 Background

CPCB is monitoring the water quality in India under National Water Quality Monitoring Programme. The water quality data is analyzed and the monitoring locations exceeding the water quality criteria are identified as polluted locations with respect to risk. The criterion for the priority (as 1, 2, 3, 4 & 5) is defined by the CPCB which have been considered as a basis for this study.

Criteria for Priority 1:

- ◆ Monitoring locations exceeding BOD concentration 30 mg/l has been considered as it is the standard of sewage treatment plant and in river it appears without dilution. (River locations having water quality exceeding discharge standards for BOD to fresh water sources)
- ◆ All monitoring locations exceeding BOD concentration 6 mg/l on all occasions.
- ◆ Monitoring locations exceeding 3 mg/l BOD are not meeting desired water quality criteria but does not affect to Dissolved Oxygen level in water bodies. If BOD exceeds 6mg/l in water body, the Dissolved Oxygen is reduced below desired levels.
- ◆ The raw water having BOD levels upto 5 mg/l are does not form complex chemicals on chlorination for municipal water supplies. Hence the water bodies having BOD more than 6 mg/l are considered as polluted and identified for remedial action.

Criteria for Priority 2:

- ◆ Monitoring locations having BOD between 20-30 mg/l
- ◆ All monitoring locations exceeding BOD concentration 6 mg/l on all occasions

Criteria for Priority 3:

- ◆ Monitoring locations having BOD between 10-20 mg/l
- ◆ All monitoring locations exceeding BOD concentration 6 mg/l on all occasions

Criteria for Priority 4:

- ◆ Monitoring locations having BOD between 6-10 mg/l

Criteria for Priority 5:

- ◆ Monitoring locations having BOD between 3-6 mg/l
- ◆ The locations exceeding desired water quality of 3mg/l BOD

Use based classification of surface waters in India

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	1. Total Coliforms Organism MPN/100ml shall be 50 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 6.0mg/l or more 4. Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Outdoor bathing (Organised)	B	1. Total Coliforms Organism MPN/100ml shall be 500 or less 2. pH between 6.5 and 8.5

		3. Dissolved Oxygen 5mg/l or more 4. Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Drinking water source after conventional treatment and disinfection	C	1. Total Coliforms Organism MPN/100ml shall be 5000 or less 2. pH between 6 to 9 3. Dissolved Oxygen 4mg/l or more 4. Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Propagation of Wild life and Fisheries	D	1. pH between 6.5 to 8.5 2. Dissolved Oxygen 4mg/l or more 3. Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	1. pH between 6.0 to 8.5 2. Electrical Conductivity at 25°C micro mhos/cm Max.2250 3. Sodium absorption Ratio Max. 26 4. Boron Max. 2mg/l

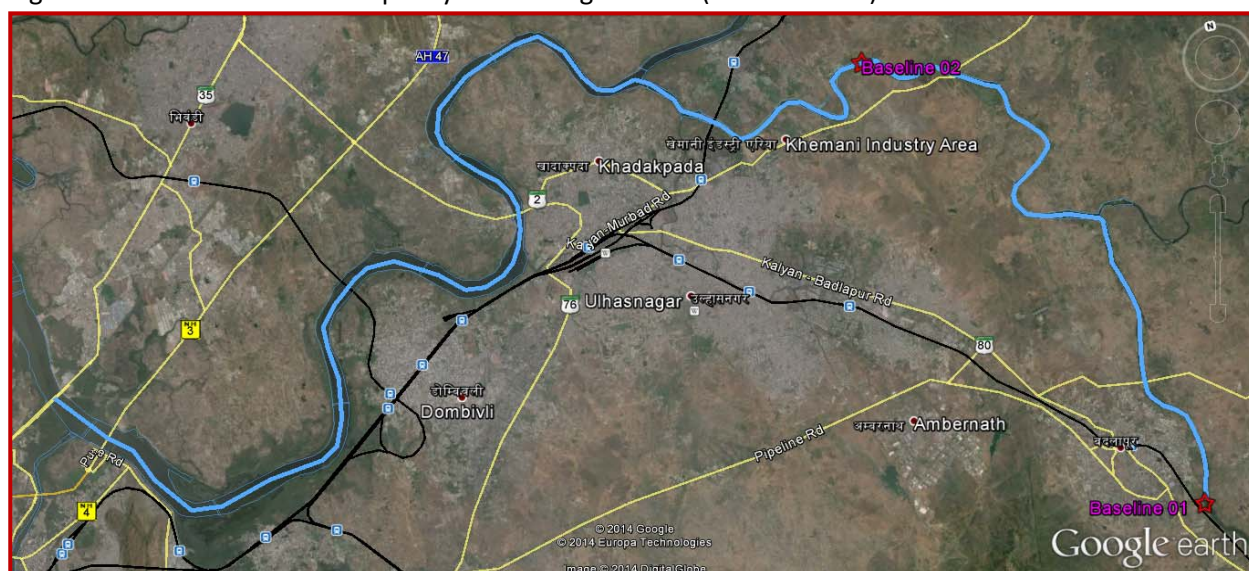
River	Polluted Stretch	Source/Town	Monitoring Location	BOD (mg/l)
POLLUTED RIVER STRETCHES (BOD Between 6-10 mg/l)				
Ulhas	Mohane	Industrial & Domestic runoff Ulhasnagar	1. U/S Of NRC Bund at Mohane	6.0
			2. Jhambul Water Works	7.5
POLLUTED RIVER STRETCHES (BOD between 3-6 mg/l)				
Ulhas	Along Badlapur	--	1. U/s of Badlapur	3.4

Based on the above referred data the pollution stretch of river Ulhas is falling under **Priority 4** and **5** at three different locations as identified by CPCB (Ref. Polluted River Stretch in India –Criteria & Status by CPCB)

2.3 Period of Study and Sampling Locations

To evaluate the physico-chemical characteristics as a baseline data of the pollution stretch at different locations, two different points of sampling is fixed for the comparison of pollution load in Ulhas river as Baseline -01 and Baseline -02. (Ref. Fig. no. 02)

Fig. no. 02: Locations of water quality monitoring stations (baseline data)



The present study was undertaken during April 2014 (pre monsoon) at 22 locations (WQ 1R -22R) as shown in Fig. no. 03 and it has repeated fortnightly. Also the sampling was done at identified Major outfalls (MOF) as shown in Fig. no. 04 to know the pollution load contributed by these sources.

Fig. no. 03: Locations of River water quality monitoring stations (sampling locations of 1st half)

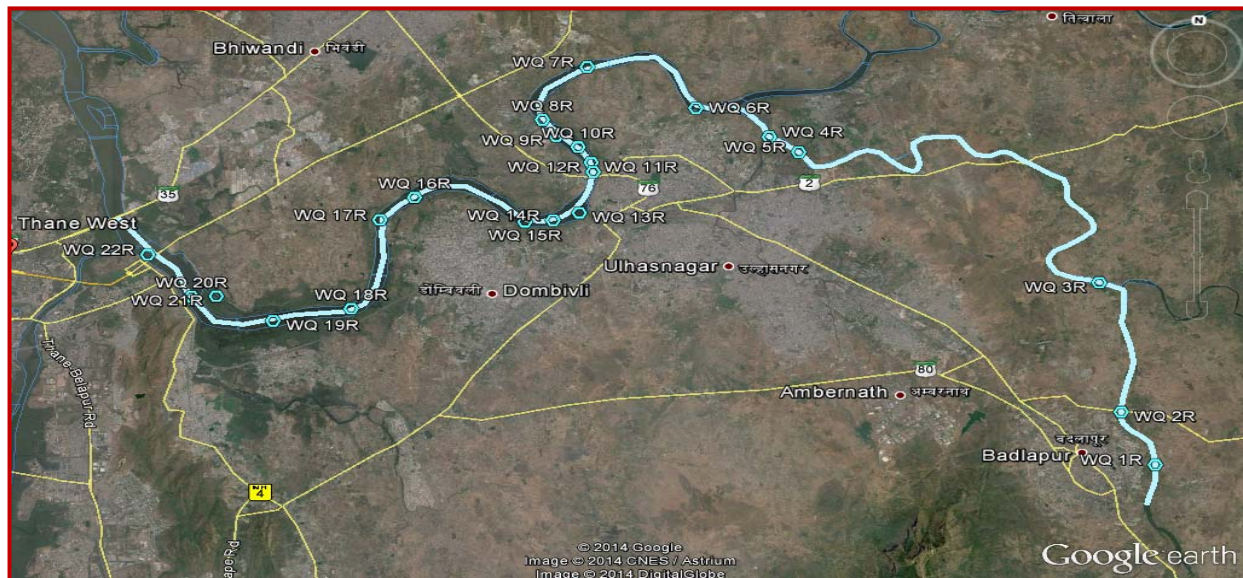


Table no. 01: Details of River water quality sampling locations across the river Ulhas (collected in 1st half)

Water Quality Sampling Locations	Latitude & Longitude	Segment of Estuary/River
WQ 1R	19° 9'49.50"N and 73°15'16.58"E	River Upstream
WQ 2R	19°10'46.07"N and 73°14'44.65"E	
WQ 3R	19°13'6.66"N and 73°14'19.64"E	
WQ 4R	19°15'34.87"N and 73° 9'28.94"E	
WQ 5R	19°15'19.12"N and 73° 9'54.95"E	Lower Estuary
WQ 6R	19°16'3.79"N and 73° 8'24.45"E	
WQ 7R	19°16'45.10"N and 73° 6'49.00"E	
WQ 8R	19°15'45.78"N and 73° 6'13.02"E	Middle Estuary
WQ 9R	19°15'28.60"N and 73° 6'25.80"E	
WQ 10R	19°15'17.27"N and 73° 6'45.14"E	
WQ 11R	19°15'0.82"N and 73° 6'57.12"E	
WQ 12R	19°14'50.57"N and 73° 6'59.32"E	
WQ 13R	19°14'5.26"N and 73° 6'49.40"E	
WQ 14R	19°13'56.30"N and 73° 6'27.15"E	Upper Estuary
WQ 15R	19°13'53.59"N and 73° 6'3.10"E	
WQ 16R	19°14'16.53"N and 73° 4'26.97"E	
WQ 17R	19°13'50.77"N and 73° 3'58.37"E	
WQ 18R	19°12'12.71"N and 73° 3'37.98"E	

WQ 19R	19°11'56.74"N and 73° 2'31.55"E	
WQ 20R	19°12'20.35"N and 73° 1'20.22"E	
WQ 21R	19°12'21.74"N and 73° 1'41.46"E	
WQ 22R	19°13'4.67"N and 73° 0'40.51"E	

Note: R –River

Fig. no. 04: Locations of water quality monitoring stations (sampling locations for MOF)

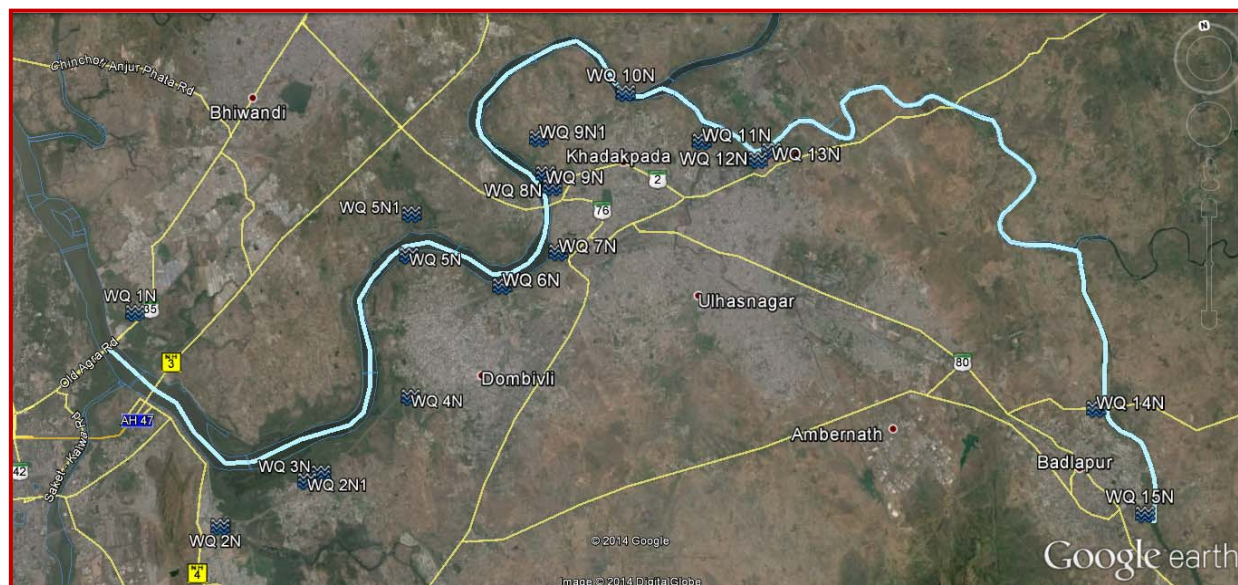


Table no. 02: Details of water quality sampling locations for Nallah (MOF) meeting the river Ulhas

Water Quality Sampling Locations	Latitude & Longitude	Segment of Estuary /River to which the Nallah Joins
WQ 1N	19°14'2.26"N and 73° 0'39.65"E	Upper Estuary
WQ 2N	19°10'54.67"N and 73° 1'26.31"E	
WQ 2N1	19°11'21.24"N and 73° 2'48.85"E	
WQ 3N	19°11'26.01"N and 73° 3'2.11"E	
WQ 4N	19°12'17.26"N and 73° 4'31.66"E	
WQ 5N	19°14'14.41"N and 73° 4'49.13"E	
WQ 5N1	19°14'48.43"N and 73° 4'56.97"E	
WQ 6N	19°13'37.20"N and 73° 6'7.12"E	Middle Estuary
WQ 7N	19°13'57.90"N and 73° 7'1.33"E	
WQ 8N	19°14'52.52"N and 73° 7'4.93"E	
WQ 9N	19°15'4.51"N and 73° 7'0.63"E	
WQ 9N1	19°15'34.60"N and 73° 6'59.59"E	
WQ 10N	19°16'0.91"N and 73° 8'22.25"E	Lower Estuary
WQ 11N	19°15'11.14"N and 73° 9'22.86"E	
WQ 12N	19°14'48.34"N and 73°10'9.82"E	River Upstream
WQ 13N	19°14'54.32"N and 73°10'22.93"E	
WQ 14N	19°10'39.24"N and 73°14'33.89"E	
WQ 15N	19° 9'6.11"N and 73°15'2.59"E	

Note: N -Nallah

2.4 Materials and Methods

Water samples were collected at a number of sampling points along the polluted stretch of the Ulhas River (Fig. no. 2 & 3). Two sets of samples taken from unpolluted upstream regions at Pawshepada and Badlapur as a baseline data (background result).

The water samples were monitored for the parameters as given in scope of study (Point 1.4 part III and IV). Sampling was carried out fortnightly along the pollution stretch of river Ulhas and MOF over a period of month where the pollution is visibly noticeable. All field collection of water samples were performed in polyethylene bottles and preserved for laboratory analysis as per the table given below;

Table no. 03: Collection and Preservation of Environmental samples

Sr. No.	Determination	Container	Minimum Sample Size (ml)	Sample Type	Preservation	Maximum Storage recommended	Regulatory
1.	BOD	P.G.	1000	g, c	Refrigerate	6 h	48 h
2.	COD	P.G.	100	g, c	Analyze as soon as possible or add H ₂ SO ₄ to pH <2.0	7 d	28 d
3.	Colour	P.G.	500	g, c	Refrigerate	48 h	4 h
4.	Odor	G.	500	g	Analyze as soon as possible, refrigerate	6 h	--
5.	pH	P.G.	50	g	Analyze immediately	0.25 h	0.25 h
6.	Conductivity	P.G.	50	g, c	Refrigerate <6 ⁰ C	28 d	28 d
7.	Solids	P.G.	200	g, c	Refrigerate	7 d	2-7 d, see cited reference
8.	Temperature	P.G.	-	g	Analyze immediately	0.25 h	0.25 h
9.	Heavy Metals	P.G.	1000	g, c	Filter immediately add HNO ₃ to pH <2.0, refrigerate at <6 ⁰ C	6 M	6 M
10.	Pesticides	P.G.	1000	g, c	Refrigerate at <6 ⁰ C and add 1000 mg Ascorbic acid per Lit (if residual Cl ⁻ present add 0.008% Sodium thiosulfate)	7 d	7 d, until extraction & 40 d after extraction

Note: P –Polyethylene; G –Glass; g –Grab; c –Composite; d –Day; h –Hour; M –Month

Methods adopted for the analysis of parameters as per the scope of study (Point 1.4 part III and IV) is given in table no. 04. Calibration curves were prepared for respective elements with acceptable standards.

Sr. No.	Parameters	Method	Instrument
1.	pH	APHA 4500 – H ⁺ B (22 nd Edition – 2012)	pH Meter -Eutech
2.	TSS	APHA 2540 – D (22 nd Edition – 2012)	Hot Air Oven - Metlab

3.	TDS	APHA 2540 – C (22 nd Edition – 2012)	Water Bath - Metlab
4.	Conductivity	APHA 2510 – B (22 nd Edition – 2012)	Cond. Meter -Systronics
5.	BOD	APHA 5220 – B (22 nd Edition – 2012)	BOD Incubator -Metlab
6.	COD	APHA 5210 – B (22 nd Edition – 2012)	COD Digester -Spectralab
7.	Heavy Metals	APHA 3111 /12 – B & 3114 – C (22 nd Edition – 2012)	AAS –Chemito AA-203
8.	Pesticides	EPA 8081 -B /8141 -B /8100 /8082 -A	GC –Agilent 7890 B

CHAPTER 3: PREVAILING ENVIRONMENT

3.0 Locations of Cities and Towns

The identified pollution stretch is falling under Thane district. It has got close proximity of following cities and towns;

Cities: (population as on 2011)

1. Thane : 18,18,872
2. Ulhasnagar : 5,06,937
3. Bhiwandi : 7,11,329
4. Kalyan- Dombivli : 12,46,381

Towns: (population as on 2011)

1. Ambernath : 7,01,752
2. Badlapur : 1,75,516
3. Diva : --
4. Shahad : --

(Ref. District collector website and Census of India)

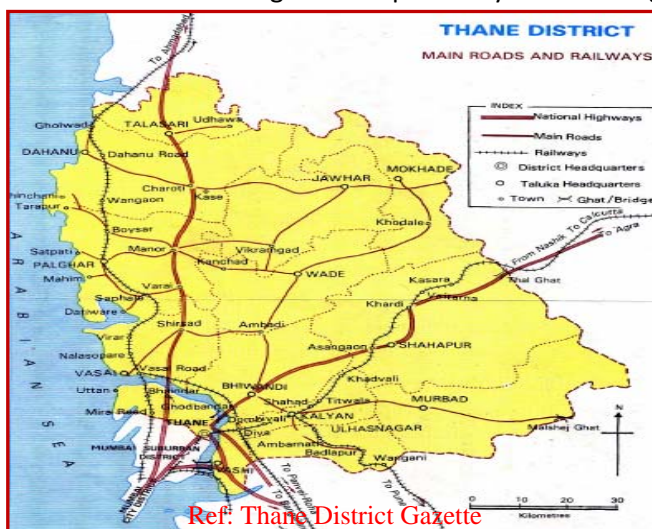
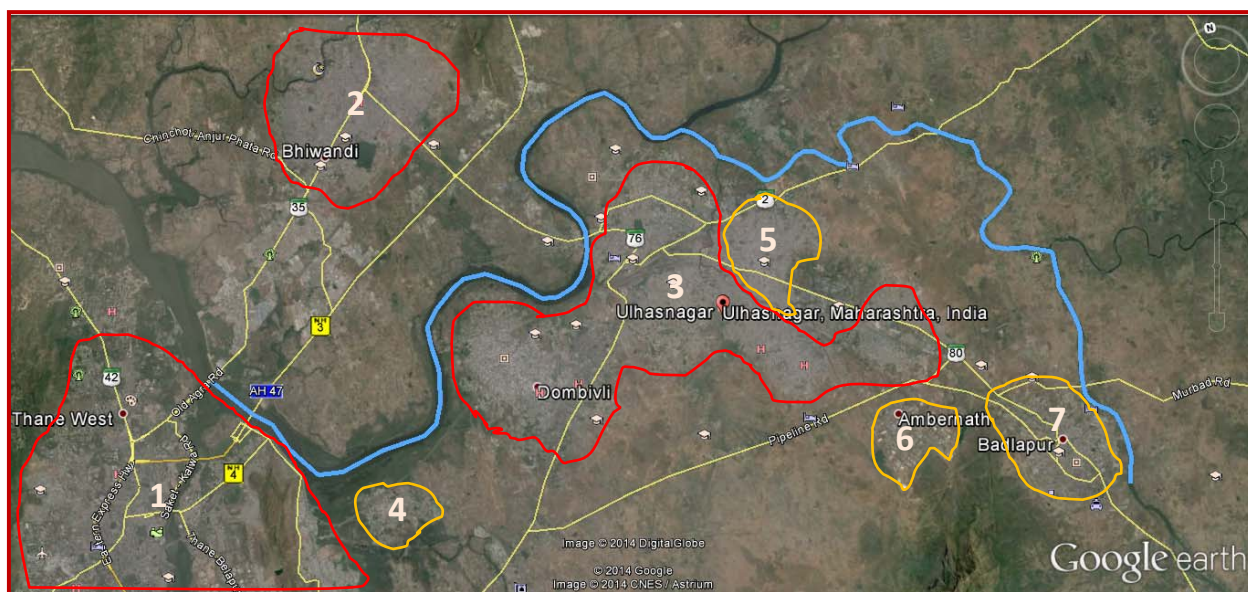


Fig. no. 05: Cities and towns across the polluted stretch of river Ulhas



Note: 1, 2 & 3 –Cities and 4, 5, 6 & 7 are Towns

3.1 Polluting Industries (from Notified Industrial Estates/ Area)

The notified industrial areas viz. Dombivli MIDC, Khemani Industrial Area, Ambernath MIDC & Badlapur MIDC exists along the identified pollution stretch of the river. All the industrial units in the notified industrial area have CETP membership in the respective notified industrial hence, the industries/ units which are located out of the notified industrial area are taken into

account as potential polluting industries. The industries/units located out of the notified industrial area are as mentioned in the below table:

Table no. 04: Listing of pollution generating industries (Large, Medium & Small scale)

Sr. No.	Name & Address of Industry	Type of Industry	Category of Industry	Consented Effluent quantity (m ³ /d)	Status of ETP (P+S+T)	CETP Member Y/N	Pollution Potential
1	Century Rayon, P.B. No. 22,Shahad,Ulhasnagar	Synthetic Yarn	LSI	13000	P+S	N	Moderate
2	Paramount Minerals & chemicals, C-6,MIDC Chemical Zone, Ambernath	Chemical	LSI	210	P+S+T	N	High
3	Shree Ganesh Electroplaters, Amit Ind. Estate,Gala No. 14, Opp. Vecter Ind inside Bhauji Nagar, Vitthalwadi stn. Road,Ulhasnagar,Thane	Metal	SSI	1	P	N	Moderate
4	Ajanta Paper & General products Vill. Vadavali, Tal Kalyan	Pulp & Paper	MSI	950	P	N	High
5	Balkrishna Paper Mills., Vill. Ambivali, Tal Kalyan	Pulp & Paper	LSI	1840	P+T	N	Moderate
6	National Peroxide ltd., Vill vadavali, Chemical Tal kalyan	Chemical	LSI	240	P+S+T	N	Moderate
7	Century Chemical Vill. Shahad, Tal kalyan	Chemical	LSI	82	P+T	N	Moderate

8	Parag Velvet Pvt. Ltd., Rice Mill Compound, Manpada Road, Dombivli.	Textile	SSI	225	P	Y	Moderate
9	Dhanlaxmi Fabrics Ltd., Sr. No. 41 (pt), 42 (pt), 256)pt), &259 (pt) Village Bhopar, Dombivali	Textile	MSI	400	P	Y	High
10	Krishna Alkali (Bombay) Pvt. Ltd. Ravindra Compound, Vill: Pisavali, Tal: Kalyan.	Textile	MSI	530	P+S+T	N	High

3.1.1 Pollution load from Industries located out of the Notified Industrial Area

Table no. 05: Pollution load from Ajanta Paper & General Products

Date	07.05.14	17.07.14	21.08.14	10.09.14
Parameter				
pH	6.8	7.2	7.1	7.4
BOD (3 days 27 deg C) (mg/l)	150	115	150	6
COD(mg/l)	368	312	396	16
SS	72	122	72	14
O & G (mg/l)	BDL	BDL	BDL	BDL
TAN (mg/l)	0.4	0.1	1	0.2
R.Cl. (mg/l)	BDL	BDL	BDL	BDL
TDS (mg/l)	384	500	655	1324
Chloride (mg/l)	45	46	54	487.3
Sulphate (mg/l)	25	131.3	101.1	82.1

Table no. 06: Pollution load from M/s. Balkrishna Paper Industries Ltd.

Date	06.01.14	15.02.14	04.03.14	02.04.14	07.05.14	23.06.14	17.07.14	10.09.14
Parameter								
pH	7.5	7.8	7.5	7.4	7.4	6.9	7	6.9
BOD (3 days 27 deg C) (mg/l)	4	5	4	5	5.4	200	76	6
COD (mg/l)	16	20	16	20	24	388	208	16
SS (mg/l)	10	10	10	8	8	52	26	10
O & G (mg/l)	BDL	BDL	BDL	BDL	BDL	1.2	BDL	BDL
TAN (mg/l)	...	...	....	...	-	-	-	0.3
R.Cl. (mg/l)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Table no. 07: Pollution load from M/s Century Chemicals Ltd.

Date	06.01.14	04.03.14	02.04.14	07.05.14	23.06.14	28.07.14
Parameter						
pH	6.5	7.5	6.8	6.6	6.8	7.0
BOD (3 days 27 deg C) (mg/l)	10.0	12.0	16.0	12.0	9.0	15.0
COD (mg/l)	40.0	48.0	48.0	40.0	32.0	40.0

SS (mg/l)	16.0	18.0	8.0	12.0	14.0	20.0
O & G (mg/l)	BDL	BDL	BDL	BDL	BDL	BDL
R.Cl. (mg/l)	BDL	BDL	BDL	BDL	BDL	BDL
Sulphate (mg/l)	197.0	73.7	148.7	16.8	17.8	13.2
Chlorides (mg/l)	749.80	407.90	769.80	454.90	34.00	589.80
TDS (mg/l)	....	....			1857.0	672.0

Table no. 08: Pollution load from M/s Dhanalaxmi Fabrics Ltd.

Date	08.01.14	03.03.14	30.03.14	03.05.14	09.06.14	01.07.14	30.07.14	11.09.14
Parameter								
pH	7.3	7	7	7.6	7.1	7.5	7	6.7
BOD (mg/l)	36	4700	200	210	900	110	140	64
COD (mg/l)	104	13280	648	624	1904	356	368	140
SS (mg/l)	22	42	160	118	46	62	24	38
O & G (mg/l)	BDL	6.4	3.2	2.4	2	BDL	BDL	BDL
TAN (mg/l)	0.7	...	0.6	0.6	3.5	0.5	14.5	5.2
Detergent (mg/l)	BDL	...	1.1	0.6	5.1	0.4	0.1	0.2
R.Cl. (mg/l)	BDL	....	BDL	BDL	BDL	BDL	BDL	BDL

Table no. 09: Pollution load from M/s Krishna Processors & Industries Pvt. Ltd.

Date	06.01.14	21.02.14	05.04.14	03.05.14	09.06.14	16.07.14	11.08.14	10.09.14	04.10.14
Parameter									
pH	7.2	7.5	8.1	8.4	7.7	8.3	8.6	6.8	7.9
BOD (mg/l)	150	46	40	35	38	42	130	60	160
COD (mg/l)	448	140	132	120	120	108	312	144	344
SS (mg/l)	142	36	22	18	40	62	56	60	48
O & G (mg/l)	2.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.8
TAN (mg/l)	1	1.1	0.2	0.2	0.6	3.5	6	1.3	0.9
Detergent (mg/l)	1.3	BDL	0.5	0.2	0.1	BDL	2.1	0.1	0.2
TRC (mg/l)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Table no. 10: Pollution load from M/s National peroxide Ltd.

Date	06.01.14	04.03.14	02.04.14	22.07.14
Parameter				
pH	6.9	7.9	7.5	6.6
BOD (mg/l)	5.0	38.0	24.0	6.4
COD (mg/l)	20.0	116.0	80.0	16.0
SS (mg/l)	22.0	14.0	10.0	8.0
O & G (mg/l)	BDL	BDL	BDL	BDL
TDS (mg/l)	61.0	1827.0	2305.0	20.0

Table no. 11: Pollution load from M/s Parag Velvet Pvt. Ltd.

Date	08.01.14	06.03.14	24.06.14	16.07.14	28.08.14	24.09.14
Parameter						
pH	8.3	7.4	7.3	5.8	7.3	7.4
BOD (mg/l)	80	68	60	230	110	32
COD (mg/l)	232	212	140	612	288	88
SS (mg/l)	62	64	34	90	26	12
O & G (mg/l)	BDL	BDL	BDL	1.2	BDL	BDL
TAN (mg/l)	....	....	0.5	0.8	0.3	0.2
Detergent (mg/l)	....	....	BDL	0.4	BDL	BDL
TRC (mg/l)	....	....	BDL	BDL	BDL	BDL

3.2 Pollution Load from Notified Industrial Estate/Area

All the notified industrial estate /area are provided with CETP and State Pollution Control Board (SPCB) is not issuing the Consent unless individual industry assures that they have taken the membership with the respective CETP.

The source of water supply to all industries is through resp. MIDC /Estates. The CETP's under jurisdiction of Sub Regional Office, Kalyan I &Kalyan II are as follows:

Table no. 12: Pollution Load from Notified Industrial Estate/Area

Sr. No.	Name of CETP	Design Capacity in MLD	Actual Effluent load in MLD	Disposal Point
1	Dombivali Better Environment System Association CETP, Plot No. OS- 8, MIDC, Phase-I, Dombivali	16	14.5	Ulhas Creek through Khambalpada Nallah
2	Dombivli Common Effluent Treatment Plant, Plot No. R-4, MIDC, Phase-I, Dombivali	1.5	1.5	Ulhas Creek through Bhopar Nallah
3	ACMA CETP, Ambernath	0.25	0.15	Waldhuni – Ulhas Creek
4	Chikhloli Morivali, Ambernath	0.8	0.3-0.4	Waldhuni – Ulhas Creek
5	Badlapur CETP	8	7	Waldhuni – Ulhas Creek
6	Ambarnath CETP Co. Pvt Ltd. MIDC Addl. Ambarnath CETP	7.5	3	Waldhuni – Ulhas Creek

Table no. 13: Pollution Load from Dombivli CETP (Chemical), Phase – II

Parameters	Dombivli CETP (Chemical), Phase – II, Results for 2014																		
	Jan		Feb		Mar		Apr		May		June		July		Aug		Sept		
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet
pH	7.3	7.2	7.5	7.7	8	7.5	7.4	7.3	7.3	7.2	7.7	7.4	7.9	7.2	8.8	7.8	7.5	7.3	7.4
BOD (mg/l)	630	138.6	667.5	240	662.5	232.5	542	221.2	510	163.5	542	176.6	423.7	237.5	146.5	45.3	480	67.5	372.5
COD (mg/l)	1701	476	1630	676	1826	544	1267.2	493.6	1128	387	1120.8	462.4	986	521	345	117	1111	189	1164
SS (mg/l)	264	159.3	229.5	91	275	244	270	191.6	311	132	286	134.4	193	118	140	58	149.5	61	193.5
O & G (mg/l)	3.2	1.8	4.2	1.6	4.2	2.1	3.6	1.5	2.6	0.95	1.48	0.68	1.55	0.6	0.5	0	1.7	0	1.1

Table no. 14: Pollution Load from DBESA CETP (Textile), Phase – I

Parameters	DBESA CETP (textile), Phase – I, Results for 2014																							
	Jan		Feb		Mar		Apr		May		June		July		Aug		Sept		Oct		Nov		Dec	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
pH	8.7	7.3	7.8	7.5	7.9	7.4	7.9	7.8	7.6	7.4	7.8	7.6	8.1	7.5	8.3	7.7	8	7.5	7.7	7.4	7.6	7.4	7.2	7.3
BOD (mg/l)	866.6	226.6	401.5	145.5	592.5	191.5	667.5	265	681.2	237.5	518	164	465	267.5	526.6	87.6	268	61.6	365	112	462.5	140	590	166.25
COD (mg/l)	2624	761.3	1121	343	1701	505	1628	642	1446	504	1200	334	1132	590	1328	220	610.4	162.6	940	356	1184	368	1614	500
SS (mg/l)	212	129.3	177.5	102	390	372	288.5	150.5	287	175.5	238.8	126.5	203	111.5	198.6	77.3	133.6	188	81	139.5	106	134	100.5	
O & G (mg/l)	4	2.5	2.7	1	4.4	1.9	4.2	2.5	3.2	1.35	2	0	1.4	0.5	2.5	0	1.4	0.2	1.1	0	1.4	0.6	1.55	1.35

Table no. 15: Pollution Load from Chikloli-Morivli CETP(CMET), Ambernath

	Chikloli - Morivli CETP (CMET), Ambernath Results for 2014					
	June	July	Aug	Sept	Oct	Nov

	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
pH	7.4	7.3	7.6	7.6	7.1	7.5	7.7	7.4	8.1	7.3	7.8	8
BOD (mg/l)	221	33	182	30	333.6	21.5	272	15.1	378.7	17.2	290	20
COD (mg/l)	642	106	468.8	92	792.8	55.2	937.3	37.3	1037	61	1352	62
SS (mg/l)	154.2	27.7	180.8	32.4	178	16.4	265.3	20.6	194.5	21.5	173.5	31.5
O & G (mg/l)	0.4	0	0.2	0	0.2	0	0.5	0	1.55	0	4	0.8

Table no. 16: Pollution Load from Chemical Zone CETP (ACMA), Ambernath

Parameters	Chemical Zone CETP (ACMA), Ambernath, Results for 2014											
	June		July		Aug		Sept		Oct		Nov	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
pH	7	7.2	7.1	7.2	6.8	7.1	6.7	7.3	7.3	7	7.3	7
BOD (mg/l)	259	43.6	155	38.3	155	38.7	210	30.6	247.5	53	191.2	32.5
COD (mg/l)	708.8	136	412	110	412	110	562	81.6	668	164	484	96
SS (mg/l)	200	29.6	190	36	190	36	147.5	31.6	266.5	51	265.5	34
O & G (mg/l)	0.9	0	0.2	0	0.2	0	0.9	0	1.2	0	1	0

Table no. 17: Pollution Load from Additional Ambernath CETP

Parameters	Additional Ambernath CETP Results for 2014											
	June		July		Aug		Sept		Oct		Nov	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
pH	5.6	8	6.3	7	5.6	7.2	5.9	7	5.9	8	5.3	8.2
BOD (mg/l)	6398	75.2	2496.6	80	1785	52.3	2167.2	84.8	3762	97	2475	94
COD (mg/l)	12483	205	5688	232	3644	150.6	4828.8	243.2	5699.2	265.6	5600	270
SS (mg/l)	247	34.8	212.6	95.6	259	48.3	204	90.8	301.6	70.8	223	88.5
O & G (mg/l)	6.9	0	5.3	0	5.4	0	4.2	0	9.8	0	6.5	0

Table no. 18: Pollution Load from Badlapur CETP

Parameters	Badlapur CETP Results for 2014											
	June		July		Aug		Sept		Oct		Nov	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
pH	6.8	6.6	7.4	7.8	7.9	7.7	7.5	7.8	7.8	7.8	8.6	7.9
BOD (mg/l)	687.5	82.1	360	69.2	485	113.6	388.3	103.3	491.2	106.2	307.5	85
COD (mg/l)	1653.3	216.5	891.2	202.4	1305.3	299.2	1102.6	293.3	1588	274	882	216
SS (mg/l)	249.6	46.2	115.2	82.8	193.6	108.8	206.6	87.3	158.5	78	174	73.5
O & G (mg/l)	2.1	0	1.2	0	2	0	1.2	0.3	1.5	0	1.4	0

3.3 Application of CETPs for Cluster of Small Scale Industries

Considering the pollution load from the operation of small scale industries in terms of quality and quantity (as indicated in Table no. 05), the feasibility of application of CETP is very less in order to cater the pollution load.

3.4 Domestic pollution

The pollution stretch also witnessed the ingress of domestic waste water directly into the Ulhas River; the details of the same are given in Table no. 03. All are found to be natural storm water drain (now converted into nallah, some of them are constructed up to certain extent) which are contaminated due to domestic as well as commercial activities occurred along the nallah passes through civilized area /slum, etc.

At most of the places the nallah become unaerobic due to restriction in flow because of encroachment, dumping of debris, etc. The quantity of waste water discharged into Ulhas River through various STP's is as follows:

Table no. 19: Quantity of Domestic Sewage released into Ulhas River

Sr. No.	Urban Local Body	Total Sewage (MLD)	Population	Sewage Collection (MLD & Coverage of Sewer line)	No. of STP's	Future Plans for Providing STP's	Present status of STP's	Disposal
1	KulgaonBadlapur Municipal Council	18	1,03,000	30% Drainage Work completed However Individually Septic tank/s &	1 (Proposed)	22 MLD under JNNURM Scheme	No STP Provided, but proposed STP for 22 MLD.	Ulhas River

				soak pit/s have been provided				
2	Ambernath Municipal Council	43,	2,03,000	28 MLD i.e. 90% - sewage collection system provided)	1	Proposed 54 MLD STPs under JNNURM Scheme taking into consideration population at 2042	28 MLD STP in Operation. Disposal to Ulhas creek through Waldhuni	Waldhuni River
3	Ulhasnagar Municipal Corporation	90	4,70,000	Existing STP capacity 28 MLD	1	Proposed 180 MLD STP taking into consideration population at 2041.	Existing STP in Operation about 9-10MLD	Partly to Ulhas River &Waldhuni River
4	KalyanDombivali Municipal Corporation	200	30 MLD		2- Existing & 6 Proposed	Proposed 6 STPs of 130 MLD capacity. At various places, most of the work is completed however 6 STPs yet to be commissioned	16 MLD at Adharwadi at Kalyan and 14 MLD at Motagaon, Dombivli in operation	Ulhas Creek

The quantity & quality (parameters) of effluents for Polluting Industries from (Notified Industrial Estates/Areas), Pollution load from Notified Industrial Estate/Area, Domestic Pollution as described above is largely based on the data provided by Regional Office, MPCB, Kalyan.

3.4.1 Major Outfalls

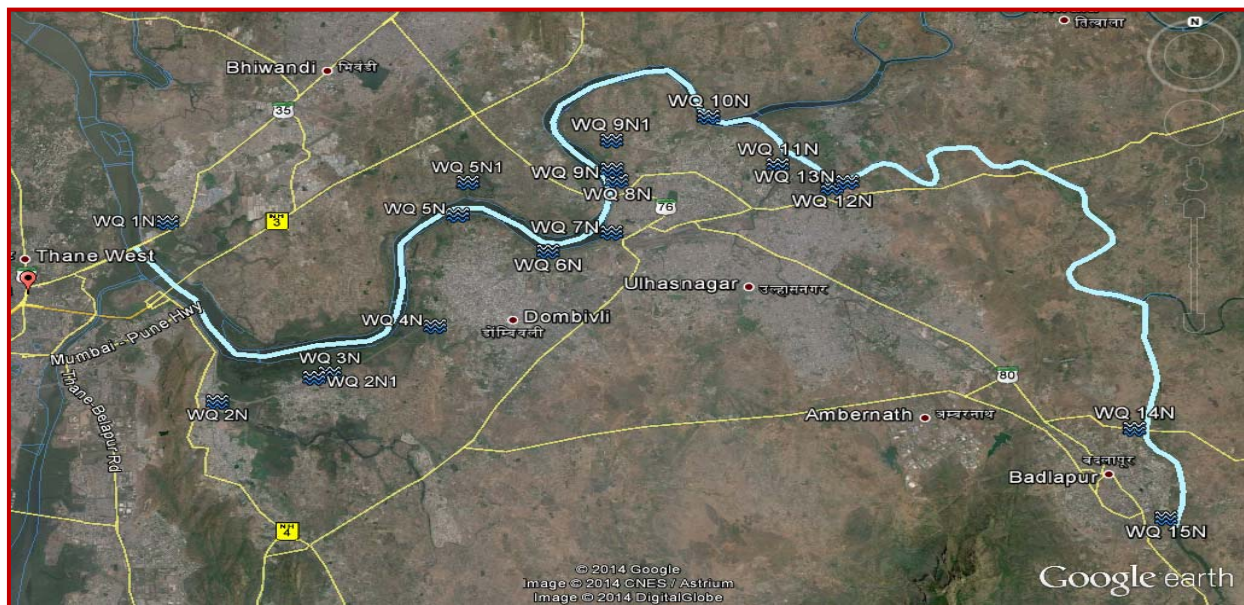
The major outfalls are identified across the pollution stretch of River Ulhas as shown in Fig. no. 04. The locations are marked as MOF -01 to MOF -15. The MOF are decided based on the size, shape of the drain /nallah.

Table no. 20: The details of the identified MOF across the pollution stretch of river Ulhas

Note: All 6.0m width Nallahs are Civic drain

Major Outfalls (MOF)	Latitude & Longitude	Width of Nallah mouth (m)	Segment of Estuary /River
MOF -01	19°14'12.82"N and 73°0'15.66"E	40.2	Upper Estuary
MOF -02	19°11'46.82"N and 73°1'31.19"E	63.0	
MOF -02A	19°11'26.95"N and 73°2'46.85"E	6.0	
MOF -03	19°11'48.41"N and 73°2'47.26"E	6.0	
MOF -04	19°12'16.57"N and 73°4'1.80"E	30.5	
MOF -05	19°14'19.05"N and 73°4'41.34"E	6.0	
MOF -05A	19°14'42.75"N and 73°4'56.12"E	39.0	
MOF -06	19°13'48.16"N and 73°6'5.78"E	20.0	
MOF -07	19°14'6.18"N and 73°6'56.96"E	25.5	Middle Estuary
MOF -08	19°14'52.65"N and 73°7'5.40"E	7.0	
MOF -09	19°15'4.33"N and 73°7'0.48"E	2.5	
MOF -09A	19°15'34.60"N and 73°6'59.59"E	6.0	
MOF -10	19°16'1.93"N and 73°8'23.08"E	2.5	
MOF -11	19°15'30.92"N and 73°9'26.95"E	33.0	Lower Estuary
MOF -12	19°15'0.89"N and 73°10'8.26"E	6.0	
MOF -13	19°15'1.85"N and 73°10'17.73"E	2.5	River Upstream
MOF -14	19°10'41.68"N and 73°14'42.07"E	10.0	
MOF -15	19° 9'5.40"N and 73°15'6.87"E	5.0	

Fig. no. 06: Locations of major outfalls meeting Ulhas River



3.4.2 Characterization of Municipal Waste Water

The quantification of discharge of municipal waste water into the Ulhas River is based on the designed capacity of the existing Common Sewage Treatment Plant (CSTP) and current load they are receiving. The details of the same are given below:

Table no. 21: The details of STP's releasing domestic waste water in to Ulhas River

Sr. No.	Urban Local Body	Total Sewage (MLD)	Population	Sewage Collection (MLD & Coverage of Sewer line)	No. of STP's	Future Plans for Providing STP's	Present status of STP's	Disposal
1	KulgaonBadlapur Municipal Council	18	1,03,000	30% Drainage Work completed However Individually Septic tank/s & soak pit/s have been provided	1 (Proposed)	22 MLD under JNNURM Scheme	No STP Provided, but proposed STP for 22 MLD.	Ulhas River
2	Ambernath Municipal Council	43,	2,03,000	28 MLD i.e. 90% - sewage collection system provided)	1	Proposed 54 MLD STPs under JNNURM Scheme taking into consideration population at	28 MLD STP in Operation. Disposal to Ulhas creek through Waldhuni	Waldhuni River

						2042		
3	Ulhasnagar Municipal Corporation	90	4,70,000	Existing STP capacity 28 MLD	1	Proposed 180 MLD STP taking into consideration population at 2041.	Existing STP in Operation about 9-10MLD	Partly to Ulhas River &Waldhuni River
4	KalyanDombivali Municipal Corporation	200	30 MLD		2- Existing & 6 Proposed	Proposed 6 STPs of 130 MLD capacity. At various places, most of the work is completed however 6 STPs yet to be commissioned	16 MLD at Adharwadi at Kalyan and 14 MLD at Motagaon, Dombivli in operation	Ulhas Creek

3.4.3 Identification of extent of Pollution Control needed in a view of critical flow conditions

The critical flow conditions are considered as the period when there is sudden increase in generation of municipal waste water and would not be possible to treat in CSTP. Processing of such waste water could hamper the designed and stabilized capability of CSPT. It is very significant to address and tackling of critical flow conditions which generates at the time of different festivals, communal occasions /gathering, major events etc.

This report would suggest emphasizing on prevention of generation at the source instead of putting control measures to cater the pollution generated during different communal events.

It is not advisable to control the utilization of water during the festive season as Ulhas River witnessed the different communal growth along its stretch. But the generation of waste water from different activities like gatherings, major events, tournaments, etc. can be restricted to the maximum extent by putting them under regulatory frame work as given below;

- a. Registration of all above mentioned events through local municipal authority and CSTP and SPCB shall keep informed best before one month prior to such activity been carried out.
- b. SPCB shall impose certain stipulations /guidelines to the organizer in order to restrict the pollution at source.
- c. Municipal authority in coordination with SPCB shall impose certain conditions to organizer to provide the permanent infrastructure for the treatment of domestic waste water generated at source and it should meet the criteria of discharge as per the CSTP norms.
- d. CSTP shall provide NOC to such organizer to discharge the treated waste water into the municipal drain.
- e. Apart from this a small scale service /process industry contributing to domestic waste water under the roof of Corporate Housing Society (CHS) shall be restricted to discharge there waste water to full-fledged in-house STPs and shall be governed by SPCB.
- f. The above conditions can be regularized under law.

Considering the 3 cities and 4 towns across the pollution stretch of Ulhas river and there geographical conditions as they are much compacted and un-planned it will be difficult to implement above given recommendations. It would be advisable to provide the lagoon nearest to the CSTP in order to tackle the situation under critical flow conditions. This has to be restricted through fencing or other means.

3.4.4 Utilization of Waste water

There are 15 identified MOF which are meeting Ulhas River; the only utilization of waste water is mentioned in table given below;

Table no. 22: Latitude & Longitude of MOF

Major Outfalls (MOF)	Latitude & Longitude	Utilization of Waste water
MOF -01	--	Nil
MOF -02	19°11'27.82"N /73°1'26.77"E	Agricultural
MOF -02A	19°11'27.82"N /73°1'26.77"E	Agricultural
MOF -03	19°11'33.10"N /73°2'48.15"E	Agricultural
MOF -04	19°12'11.91"N /73°4'57.30"E To 19°12'10.01"N /73°5'11.26"E	Agricultural
MOF -05	--	Nil
MOF -05A	--	Nil
MOF -06	19°13'48.31"N /73°6'5.80"E To 19°13'22.04"N /73°6'11.58"E	Agricultural
MOF -07	19°13'57.11"N /73°7'4.44"E	Agricultural
MOF -08	19°15'7.28"N /73°7'0.43"E and 19°15'3.50"N /73°6'39.63"E	Agricultural
MOF -09	--	Nil
MOF -10	19°15'59.12"N /73°8'19.01"E	Agricultural
MOF -11	19°15'29.12"N /73°9'29.19"E To 19°14'44.70"N /73°9'10.26"E	Agricultural
MOF -12	--	Nil
MOF -13	--	Nil
MOF -14	19°10'17.50"N /73°14'32.70"E	Agricultural
MOF -15	--	Nil

3.5 Water Quality in identified Pollution Stretch of Ulhas River

The prevailing water quality of the Ulhas Estuary is the balance between the contaminants entering its water through a variety of sources & the capacity of the estuary to assimilate them. The prevailing water quality of the concerned stretch is described in the Annexure –I.

3.5.1 River Flow

Measured river flow at 8 nos. of identified pollution stretch along the Ulhas River is mentioned in table given below;

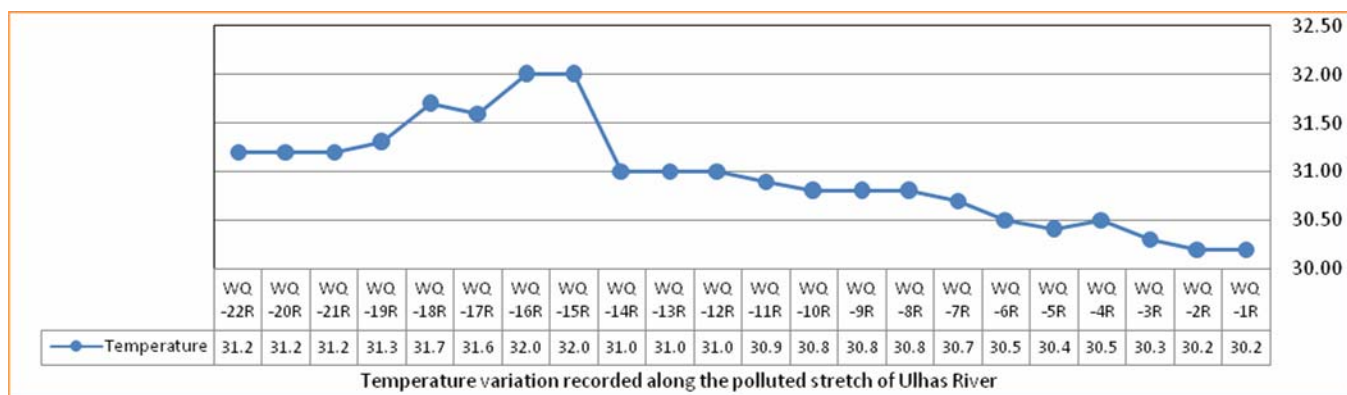
Table no. 23: River flow at the identified pollution stretch

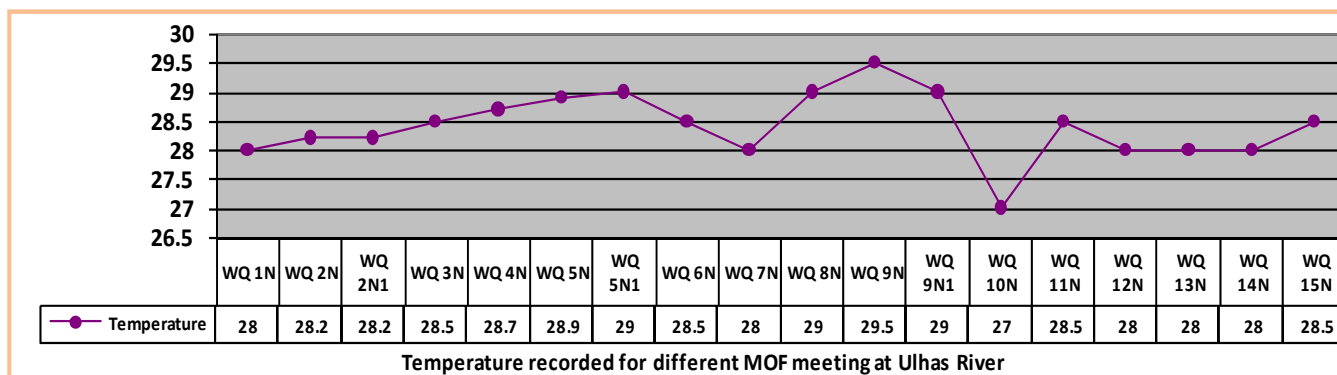
Sr. No.	Polluted Stretch	Coordinates	River Flow (s/m)
1	Badlapur Gaon Road	Lat -190 09' 48.79"N Long -730 15' 15.11"E	9.27
2	State Highway 80	Lat -190 10' 46.26"N Long -730 14' 44.39"E	4.50
3	State Highway 222 for Rayate	Lat -190 15' 14.63"N Long -730 13' 12.99"E	2.40
4	Near NRC Bund	Lat -190 15' 19.42"N Long -730 10' 46.69"E	24.6
5	DR to Devrung	Lat -190 16' 03.51"N Long -730 08' 28.59"E	14.53
6	Kalyan Chaupati	Lat -190 14' 51.60"N Long -730 06' 59.87"E	11.8
7	Reti Bunder	Lat -190 12' 59.38"N Long -730 00' 43.56"E	18.67
8	Old Agra Road	Lat -190 13' 43.48"N Long -730 00' 08.23"E	5.50

3.6 Graphical representation of Parameters for Samples collected from UE, ME, LE & RU

3.6.1 Temperature

The samples were collected from the 22 nos. of sampling points (monitoring stations) in the month of April 2014 from the pollution stretch of Ulhas River. The sampling was planned for a whole day period and collected accordingly. The temperature was measured at the spot of sample collection. Also the same type of sampling was done for 18 nos. of identified major outfalls. The graphical representation is given below.

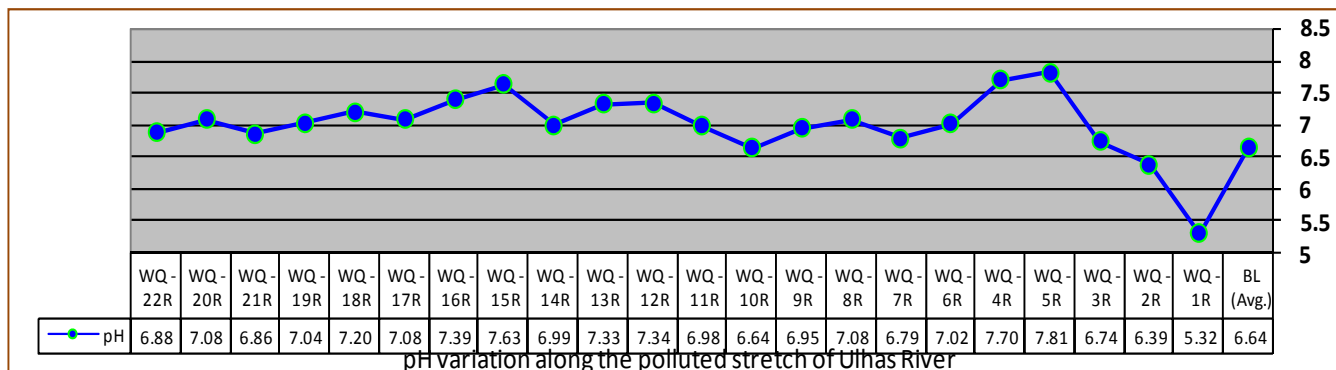




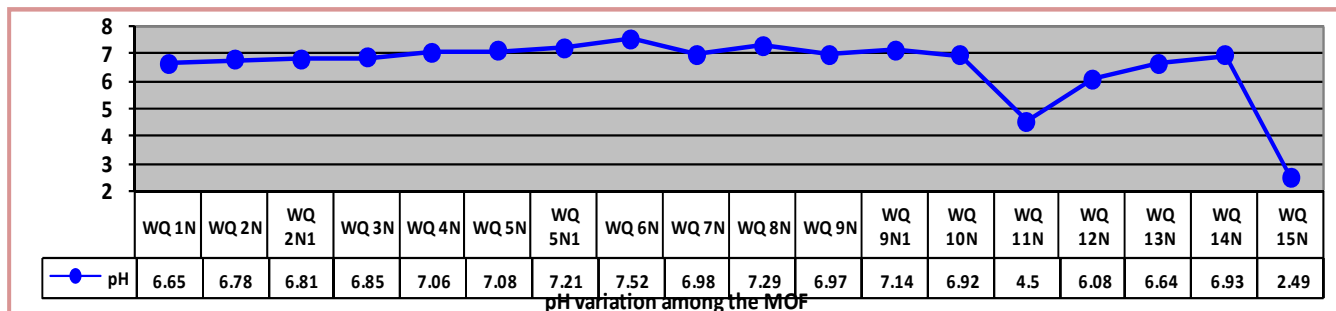
Temperature (Avg.)	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
River	31.5	30.5	30.6	30.3	°C
MOF	28.5	28.5	28.3	28.2	

Conclusion: Temperature ranges between 30.2 to 32.0 °C along the Ulhas River pollution stretch and minimum temperature recorded was 27.0 and maximum temperature was 29.5 °C among 18 nos. of MOF.

3.6.2 pH



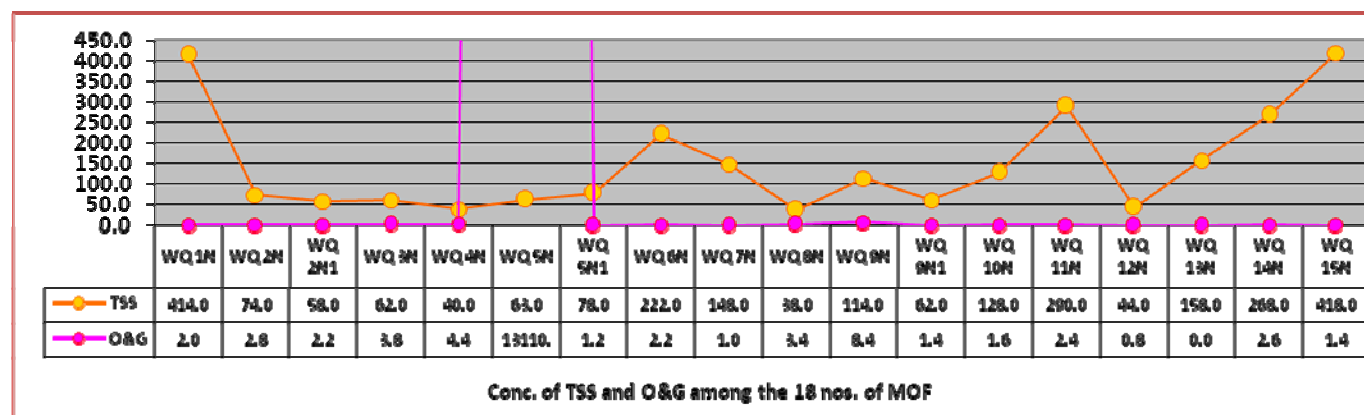
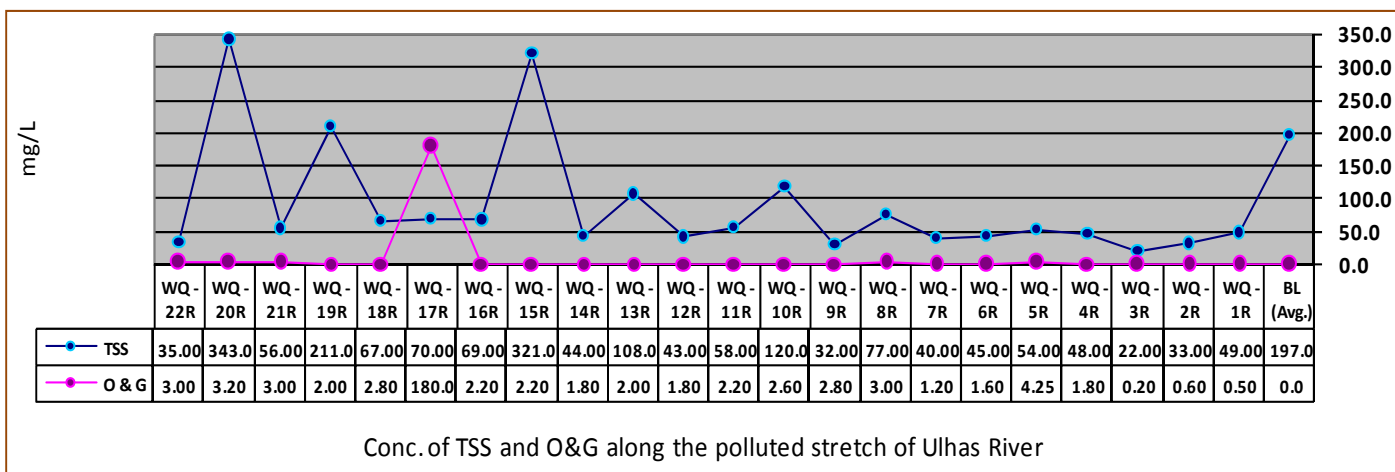
The pH was checked and recorded at the spot of sampling. The variation in pH for river water sample and MOF are expressed here.



pH (Avg.)	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
River	7.15	7.04	7.17	7.10	-
MOF	7.00	7.06	5.29	5.37	

Conclusion: Minimum pH recorded as 5.30 at monitoring location WQ -1R which is hardly 1.3km away from the MOF no. WQ -15N of which minimum pH was recorded as 2.49 (highly acidic). Whereas maximum pH recorded were 7.8 for the polluted stretch and 7.5 for MOF resp.

3.6.3 TSS and O&G



TSS (Avg.)	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
River	146.5	68.9	46.3	38.0	mg/L
MOF	126.4	98.0	167.0	281.3	

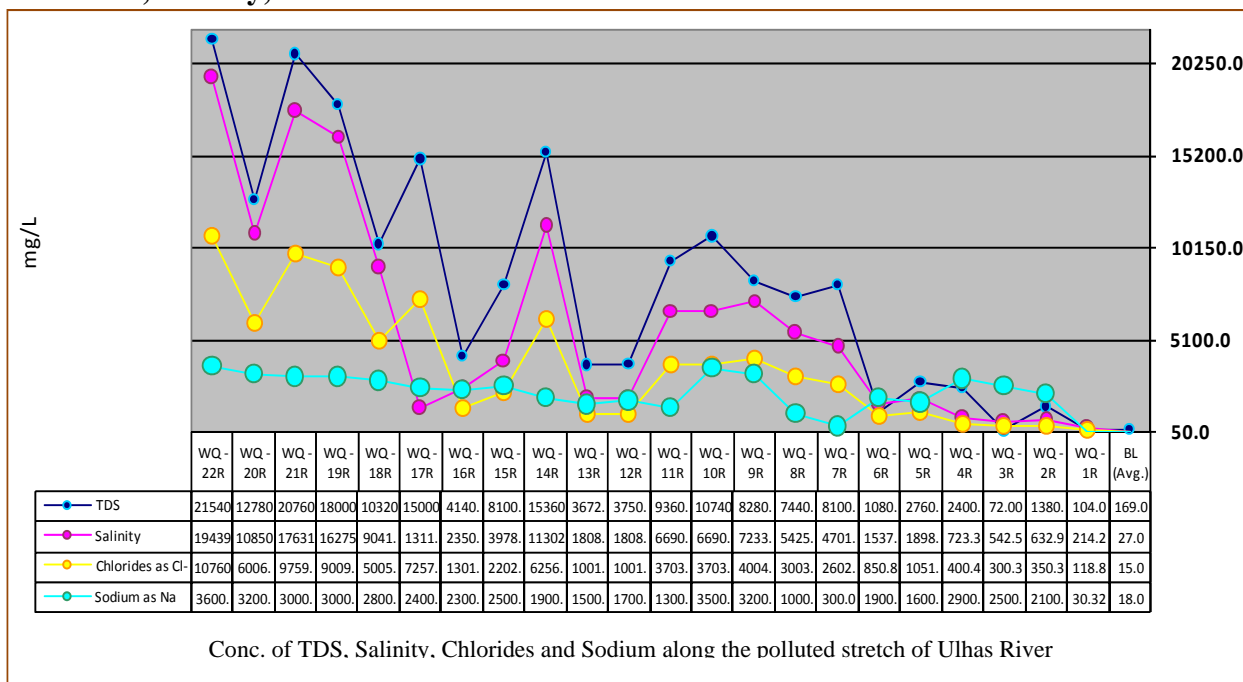
O&G (Avg.)	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
River	24.8	2.2	2.5	0.9	mg/L

MOF	1641.1	3.16	1.6	2.0	
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Conclusion: The source of TSS along the polluted river stretch are trees and transportation. The minimum conc. of TSS was 22.0 mg/l and maximum conc. was 343.0 mg/l recorded. O&G was recorded as 0.2 mg/l (min.) and 180.0 mg/l (max.) resp. along the polluted river stretch of Ulhas river.

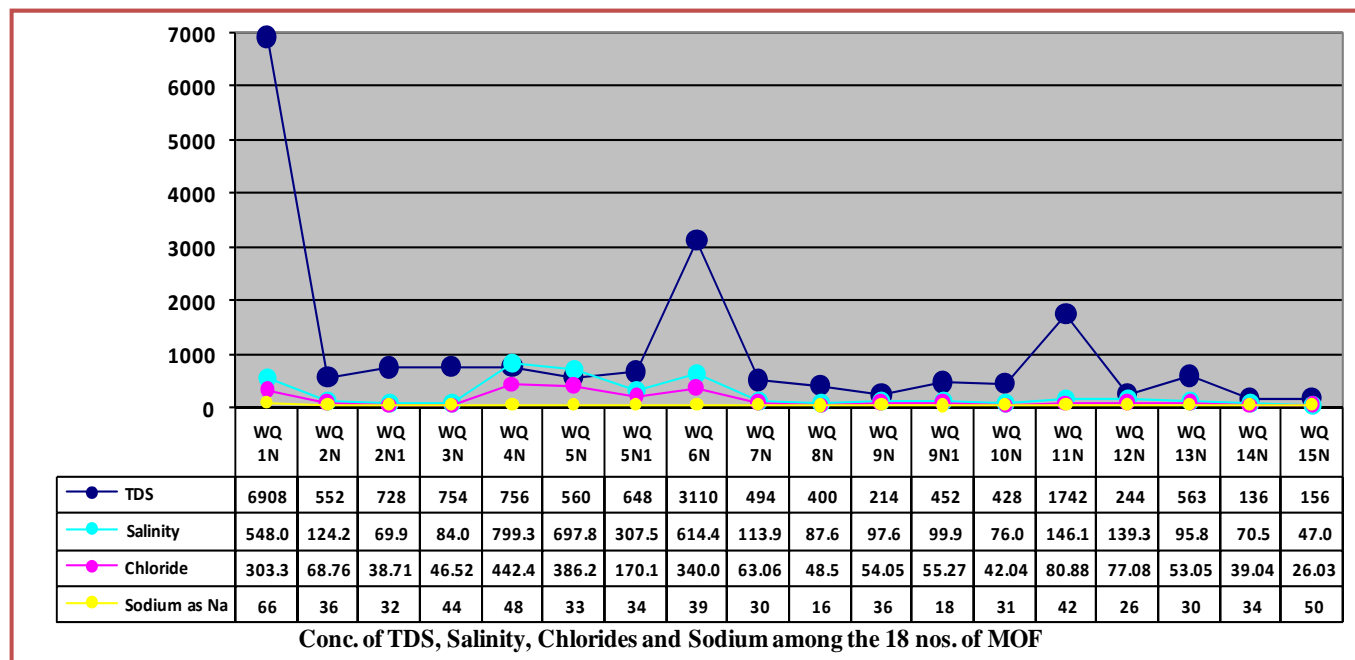
Whereas the conc. of TSS was recorded as 38.0 mg/l (min.) and 418.0 mg/l (max.) and conc. of O&G was NIL and 13110.0 mg/l (max.) among the 18 nos. of MOF.

3.6.4 TDS, Salinity, Chlorides and Sodium



Salinity has derived from the amount of chlorides determined from the sample collected from polluted water stretch of Ulhas River and 18 nos. of MOF . It plays very significant role in lentic ecosystem as sudden changes in salinity may cause high mortality of biota including fish due to salinity shock.

Normally sea water salinity is 35.5 ppt which may vary depending on balance between evaporation & precipitation and addition of fresh water.



TDS (Avg.)	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
River	13830.0	8371.7	3980.0	981.8	mg/L
MOF	1752.0	397.6	993.0	285.0	

Salinity (Avg.)	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
River	10109.8	5851.3	2712.5	481.5	mg/L
MOF	405.6	95.0	142.7	71.1	

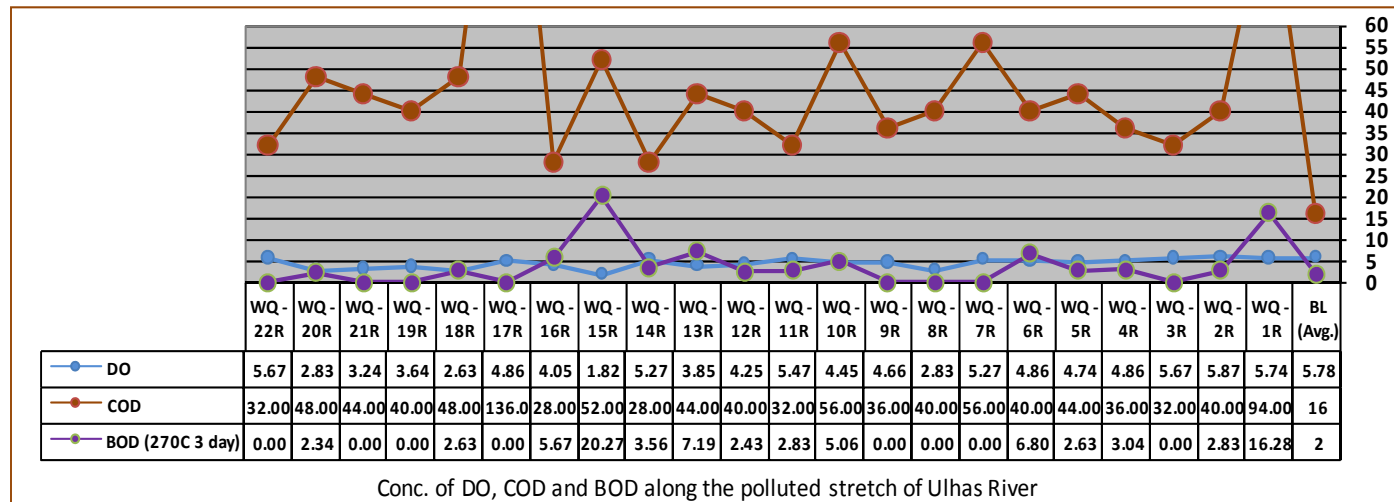
Chlorides (Avg.)	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
River	6412.6	3239.0	1501.5	266.5	mg/L
MOF	224.5	52.6	78.9	39.4	

Sodium (Avg.)	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
River	2850.0	2014.3	1266.7	1876.3	mg/L
MOF	41.5	26.2	34.0	38.0	

Conclusion: The maximum salinity of 19439.8 mg/L (19.4 ppt) was observed at upper estuary and low salinity of 347.2 mg/L (0.35 ppt) was observed at upstream river water. From the result obtained the tidal effect can be observed till the end of lower estuary (near Godrej Hill area).

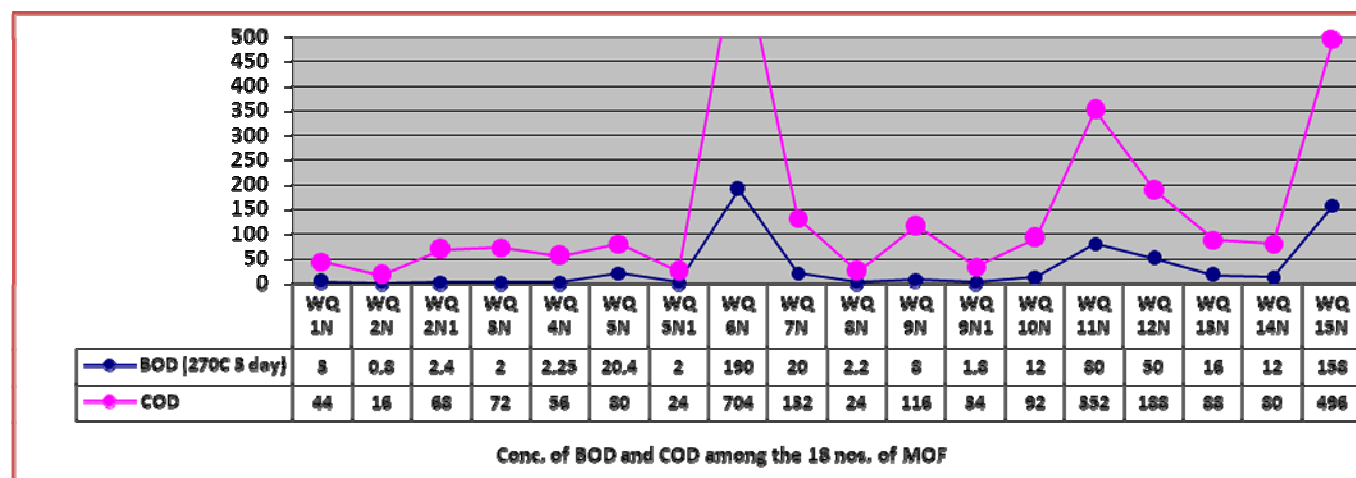
Whereas the conc. of Salinity at MOF was 799.3 mg/L observed at MOF -04 and 47.0 mg/L recorded as minimum conc. for salinity.

3.6.5 DO, COD and BOD



DO (Avg.)	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
River	3.59	4.40	4.96	5.54	mg/L
MOF	-	-	-	-	

DO was fixed at location of sampling as it plays very important role to define the health of any water body. It reflects the self assimilative capacity of any ecosystem whether it will sustain or not. From the study it has observed that the maximum DO was recorded as 5.9 mg/L and minimum was 1.82 along the polluted stretch of Ulhas River which makes it more critical parameter. The DO is not determined from the Nallah samples.



BOD (Avg.)	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
River	7.73	4.21	4.72	7.38	mg/L
MOF	30.69	11.33	65.0	62.0	

COD (Avg.)	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
River	53.5	39.4	46.7	50.5	mg/L
MOF	133.0	79.6	270.0	221.3	

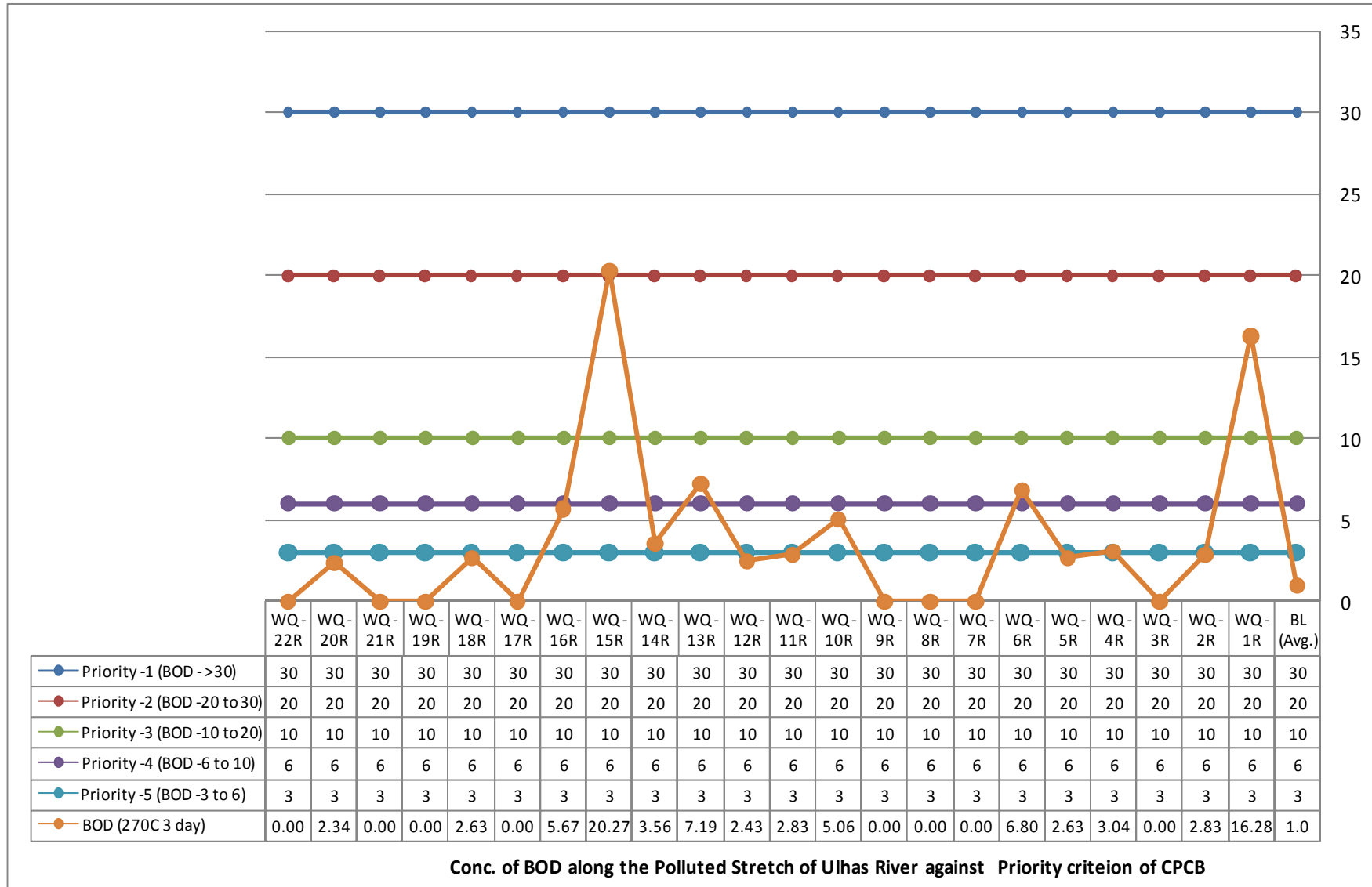
Conclusion: The health of aquatic life is closely linked with the DO in water thereby making it most critical parameter while assessing the water quality. It has been observed that DO below 3 mg/l may not support good & diversified aquatic life. The DO was recorded as 2.83, 1.82, 2.63, 2.83mg/l at sampling location no. WQ -8R, WQ -15R, WQ -18R, WQ -20R resp.

BOD conc. plays concluding role deciding the polluted stretch along the Ulhas River. It has observed that among 22 nos. of sampling points, WQ -15R is in Priority 2 with BOD level of 20.3 mg/l and WQ -1R is in Priority 3 with BOD level of 16.3 mg/l.

Sampling points no. WQ -6R and WQ -13R are falling in Priority 4 with BOD level of 6.8 mg/l and 7.19 mg/l resp.

Whereas sampling points no. WQ -4R, WQ -10R, WQ -14R and WQ -16R are falling in Priority 4 with BOD level of 3.04 mg/l, 5.06 mg/l, 3.56 mg/l and 5.67 mg/l resp.

BOD conc. of sampling point no. WQ -11R shows close proximity to the Priority 5.



3.6.6 Metals

Sr. no.	SAMPLING CODES	BL (Avg.)	WQ - 1R	WQ - 2R	WQ - 3R	WQ - 5R	WQ - 4R	WQ - 6R	WQ - 7R	WQ - 8R	WQ - 9R	WQ - 10R	WQ - 11R	WQ - 12R	WQ - 13R	WQ - 14R	WQ - 15R	WQ - 16R	WQ - 17R	WQ - 18R	WQ - 19R	WQ - 21R	WQ - 20R	WQ - 22R	UOM
1	Chromium as Cr	ND	ND	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	mg/lit
2	Zinc as Zn	ND	0.05	0.03	<0.02	<0.01	2.00	<0.02	0.03	0.07	0.06	<0.07	0.05	0.03	0.14	0.06	0.08	0.05	0.09	<0.02	<0.02	<0.02	<0.02	<0.02	mg/lit
3	Iron as Fe	ND	10.60	<0.02	<0.02	<0.02	46.40	<0.02	0.62	1.55	<0.02	<0.02	<0.02	<0.02	3.19	<0.02	0.43	<0.02	<0.02	<0.02	<0.01	<0.02	0.34	0.18	mg/lit
4	Calcium as Ca	15.63	34.70	20.04	16.03	16.03	92.18	72.14	104.20	232.46	132.26	308.61	144.28	88.17	60.12	184.36	60.12	80.16	264.52	188.37	256.51	240.48	232.46	304.60	mg/lit
5	Magnesium as Mg	3.00	20.05	51.22	19.50	34.14	90.21	92.66	190.24	229.19	295.14	309.65	282.93	87.77	75.59	356.11	95.11	92.66	473.17	275.58	531.73	678.14	424.39	722.00	mg/lit
6	Sodium as Na	18.00	30.32	2100.0	2500.0	2900.0	1600.0	1900.0	300.0	1000.0	3200.0	3500.0	1300.0	1700.0	1500.0	1900.0	2500.0	2300.0	2400.0	2800.0	3000.0	3000.0	3200.0	3600.0	mg/lit
7	Cobalt as Co	ND	ND	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	mg/lit
8	Arsenic as As	ND	ND	<0.02	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01	mg/lit
9	Cadmium as Cd	ND	ND	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/lit
10	Copper as Cu	ND	ND	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/lit
11	Potassium as K	4.70	21.80	73.00	59.00	67.00	69.00	12.00	43.00	41.00	81.00	53.00	67.00	12.00	14.00	111.00	39.00	23.00	121.00	39.00	84.00	960.00	54.00	116.00	mg/lit
12	Mercury as Hg	ND	ND	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/lit
13	Lead as Pb	ND	ND	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/lit
14	Manganese as Mn	ND	0.12	<0.01	<0.01	<0.01	0.97	0.67	0.31	0.51	0.16	0.58	0.16	0.07	0.15	<0.01	<0.01	0.12	<0.01	23.58	10.92	6.18	19.68	<0.01	mg/lit
15	Nickel as Ni	ND	ND	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/lit
16	Aluminium as Al	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
17	Antimony as Sb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
18	Barium as Ba	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
19	Berelium as Be	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
20	Boron as B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
21	Lithium as Li	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
22	Selenium as Se	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
23	Silver as Ag	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
24	Strontium as Sr	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
25	Tin as Sn	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
26	Vanadium as V	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit

Note: BL –Baseline data

Segments	Upper Estuary	Middle Estuary	Lower Estuary	Upstream	UOM
Chromium as Cr	ND	ND	ND	ND	mg/lit
Zinc as Zn	0.07	0.07	0.03	0.69	mg/lit
Iron as Fe	0.32	2.37	0.62	28.5	mg/lit
Calcium as Ca	203.4	164.3	88.2	35.8	mg/lit
Magnesium as Mg	411.6	233.8	141.5	43.0	mg/lit
Sodium as Na	2850.0	2014.3	1100.0	1826.1	mg/lit
Cobalt as Co	ND	ND	ND	ND	mg/lit
Arsenic as As	ND	ND	ND	ND	mg/lit
Cadmium as Cd	ND	ND	ND	ND	mg/lit
Copper as Cu	ND	ND	ND	ND	mg/lit
Potassium as K	179.5	54.1	27.5	49.1	mg/lit
Mercury as Hg	ND	ND	ND	ND	mg/lit
Lead as Pb	ND	ND	ND	ND	mg/lit
Manganese as Mn	12.1	0.27	0.49	0.55	mg/lit
Nickel as Ni	ND	ND	ND	ND	mg/lit
Aluminium as Al	ND	ND	ND	ND	mg/lit
Antimony as Sb	ND	ND	ND	ND	mg/lit
Barium as Ba	ND	ND	ND	ND	mg/lit
Berelium as Be	ND	ND	ND	ND	mg/lit
Boron as B	ND	ND	ND	ND	mg/lit
Lithium as Li	ND	ND	ND	ND	mg/lit
Selenium as Se	ND	ND	ND	ND	mg/lit
Silver as Ag	ND	ND	ND	ND	mg/lit
Strontium as Sr	ND	ND	ND	ND	mg/lit
Tin as Sn	ND	ND	ND	ND	mg/lit
Vanadium as V	ND	ND	ND	ND	mg/lit

3.7 Outcome of the Study:

The priority wise no. of polluted stretches along the Ulhas River is given below:-

Priority	Total number of Sampling Locations falling under Priority criterion
Priority 1	Nil
Priority 2	01
Priority 3	01
Priority 4	02
Priority 5	04

POLLUTED RIVER STRETCHES (BOD between 20 & 30 mg/l)				
River	Polluted Stretch with Sampling Code	Source /Town	Monitoring Location	BOD (mg/l)
Ulhas	Thakurli –WQ 15R	Dombivli	19°13'53.59"N /73° 6'3.10"E	20.27

POLLUTED RIVER STRETCHES (BOD between 10 & 20 mg/l)				
River	Polluted Stretch	Source /Town	Monitoring Location	BOD (mg/l)
Ulhas	Rameshwadi Bridge – WQ 1R	Badlapur	19° 9'49.50"N /73°15'16.58"E	16.28

POLLUTED RIVER STRETCHES (BOD between 6 & 10 mg/l)				
River	Polluted Stretch	Source /Town	Monitoring Location	BOD (mg/l)
Ulhas	Godrej Hill –WQ 6R	Kalyan	19°16'3.79"N /73° 8'24.45"E	6.80
	Bhoiwada –WQ 13R	Kachore	19°14'5.26"N / 73° 6'49.40"E	7.19

POLLUTED RIVER STRETCHES (BOD between 3 & 6 mg/l)				
River	Polluted Stretch	Source /Town	Monitoring Location	BOD (mg/l)
Ulhas	Mohane –WQ 4R	NRC Bund	19°13'6.66"N /73°14'19.64"E	3.04
	Kon –WQ 10R	Sai Colony	19°15'17.27"N / 73° 6'45.14"E	5.06
	Thakurli –WQ 14R	Dombivli	19°13'56.30"N /73° 6'27.15"E	3.56
	Dombivli	Kalunagar	19°14'16.53"N / 73° 4'26.97"E	5.67

CHAPTER 4: SITE SELECTION AND TREATMENT TECHNOLOGY

4.1 Site Identification and proposed Treatment

Table showing conc. of BOD contributed by MOF into the Ulhas River requires attention

Priority Criterion as per CPCB	WQ - 16R	WQ - 5N	WQ - 5N1	WQ - 15R	WQ - 6N	WQ - 14R	WQ - 13R	WQ - 7N	WQ - 10R	WQ - 9N1	WQ - 6R	WQ - 11N	WQ - 4R	WQ - 12N	WQ - 13N	WQ - 1R	WQ - 15N	UOM
Priority -1 (BOD - >30)	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	mg/l
Priority -2 (BOD -20 to 30)	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	mg/l
Priority -3 (BOD -10 to 20)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	mg/l
Priority -4 (BOD -6 to 10)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	mg/l
Priority -5 (BOD -3 to 6)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	mg/l
BOD (270C 3 Day)	5.67	20.4	8.00	20.27	190.0	3.56	7.19	20.0	5.06	10.16	6.80	80.0	3.04	50.0	16.0	16.28	158.0	mg/l
Priority Class	5	-	-	2	-	5	4	-	5	-	4	-	5	-	-	3	-	-

Note: R –River and N –Nallah (MOF)

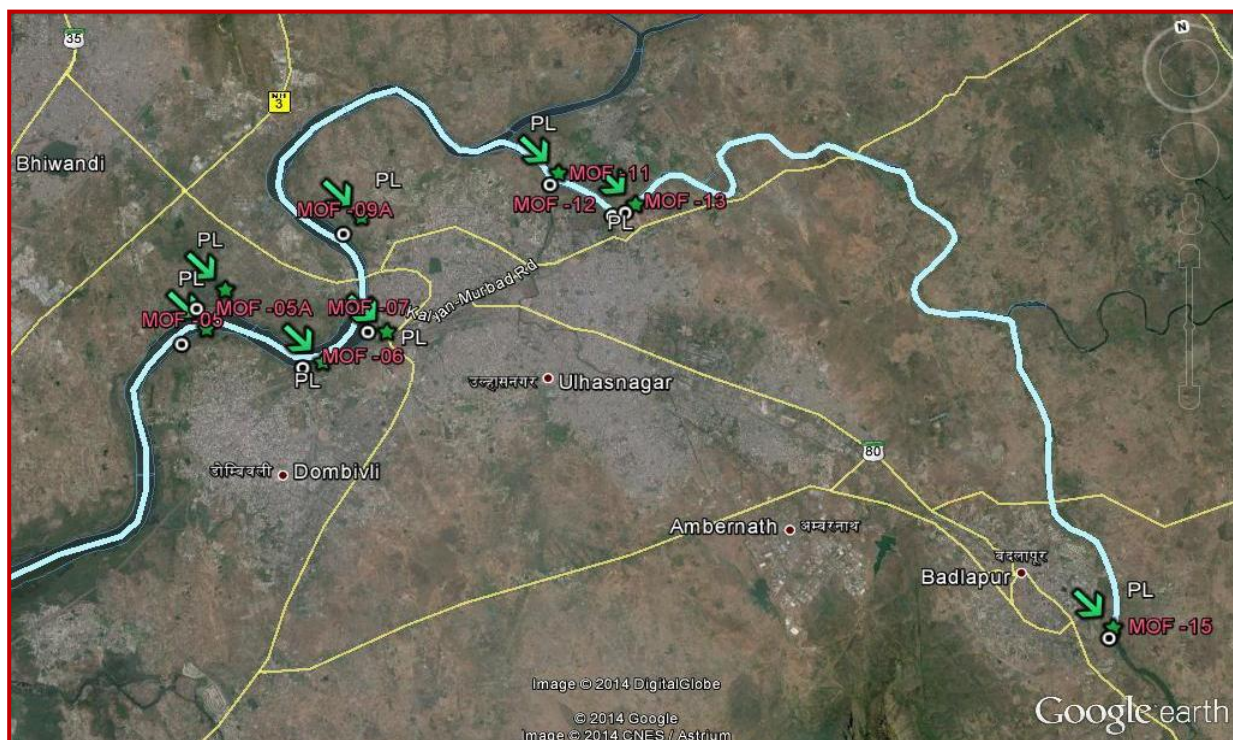
The site identification for STP is based on the close proximity to the Nallah (MOF) contributing BOD load to the Ulhas River and availability of open land along the bank. The list of the same is given below;

Sr. No.	Code of MOF contributing BOD load into the Ulhas river stretch	Conc. of BOD (mg/L)	Coordinates for proposed STP	Treatment Technology to be adopted
1	MOH -5	20.4	Lat -19°14'20.23"N Long -73°4'48.15"E	Settling Pond
2	MOH -5A	8.00	Lat -19°14'46.01"N Long -73°5'6.17"E	Settling Pond
3	MOH -6	190.0	Lat -19°13'42.94"N Long -73°6'7.84"E	Biological Reactor with Clarisettler
4	MOH -7	20.0	Lat -19°13'56.96"N Long -73°6'57.62E	Settling Pond
5	MOH -9A	10.2	Lat -19°15'22.53"N Long -73°6'53.21"E	Settling Pond
6	MOH -11	80.0	Lat -19°15'30.92"N Long -73°9'26.95"E	Biological Reactor with Clarisettler
7	MOH -12	50.0	Lat -19°14'59.48"N Long -73°10'13.24"E	Biological Reactor with Clarisettler
	MOH -13	16.0		
8	MOH -15	158.0	Lat -19°9'5.43"N Long -73°15'6.58"E	Biological Reactor with Clarisettler

The settling ponds are recommended to the MOH with BOD conc. less than 100 mg/l, as the suspended particulates can be removed through physical separation. It is suitable for MOH -5, 5A, 7, 9A, 11, 12 and 13.

Whereas MOH -6 and 15 are recommended with Biological Reactor with Clarifier considering the high BOD load.

4.2 Google Imaginary for the proposed location of STP



Note: PL –Proposed Location

4.3 Treatment Technology

4.3.1 Settling Tank:

The objective of treatment by gravity settling is to remove readily settleable solids & thus reduce the suspended solids content & organic load. Gravity settling in settling pond help to reduced the BOD load. Primary sedimentation is generally plain sedimentation without the use of chemicals. Settling pond is natural settling process; the particles do not remain discrete as in the case of grit, but tend to agglomerate during settling. Thus, their diameter keeps increasing and settlement proceeds at an over increasing velocity. Consequently, they trace a curved profile.

4.3.2 Bio reactor:

Bioreactors consists supply of a free-flowing, chemically inert medium which acts as a receptacle for the bacteria that break down the raw sewage. Examples of these bioreactors often have separate, sequential tanks and a mechanical separator or cyclone to speed the separation of water and bio solids. Aerators supply oxygen to the sewage and medium, further accelerating breakdown. Submersible mixers provide agitation in anoxic bioreactors to keep the solids in suspension and thereby ensure that the bacteria and the organic materials "meet". In the process, the liquid's Biochemical Oxygen Demand (BOD) is reduced sufficiently to render the contaminated water fit for reuse. The bio solids can be collected for further processing, or dried and used as fertilizer.

Biological reactors are reactors in which organic matter, which serves as substrate or food to micro organisms, is utilized for the growth of micro organisms. These processes are:

- a) Aerobic Biological Suspended Growth Processes: Conversion of colloidal, dissolved & residual suspended organic matter into setttable biofloc & stable inorganic.
- b) Aerobic Biological Attached Growth Processes: Conversion of colloidal, dissolved & residual suspended organic matter into setttable biofloc & stable inorganic.

4.3.3 CLASSIFICATION OF THE PROCESSES

A number of treatment processes are available depending upon method of disposal, degree of treatment, waste water influent quality (domestic or industrial), availability of the land etc and requirement of recycling treated waste water. Waste Water Treatment Methodology commonly adopted for treatment of domestic waste may be any of the following:

Biological Processes

In these processes a mixture of wastewater and microorganisms (biomass) is agitated and aerated. Certain microbes, mainly bacteria of specific kind, have the capability to oxidize the dissolved organic matter in the waste water. Microbial growth is accelerated and controlled in the process. Thus, reduction or removal of organic matter in waste is brought about by microorganisms by oxidation. After oxidation, the sludge is separated from wastewater.

Aerobic Processes- The following conventional methodologies are examples of Aerobic Processes-

- a) Activated sludge process (ASP)
- b) Trickling filters
- c) Facultative aerated lagoons
- d) Extended aeration process

- e) Wet Lands
- f) Oxidation ponds
- g) Oxidation ditches

In modern nomenclature the aerobic processes are divided into Aerobic Suspended and Attached Growth Processes and the Soil Biotechnology.

Aerobic Suspended Growth Processes (SGP) The conventional activated sludge process (ASP) is the best known suspended growth aerobic system and is the process most commonly used in large, centralized WWTPs though it can also be used in small plants. Some of the process variants of ASP are-

- a. Sequencing Batch Reactor (SBR)
- b. Extended Aeration
- c. Membrane Bioreactors (MBR)

4.3.4 Clarifier

The clarifier are recommended to remove the settleable sludge carried over from the biological reactor and to discharge the clear water into the river.

ANNEXURE 1: ANALYSIS RESULTS

I. Water Quality at Polluted River Stretch

Table no. 01: Water Quality of samples collected from Upper Estuary (UE) as Baseline data

SAMPLING CODEs	BL -1	BL -2	UOM
Colour	Colourless	Colourless	-
Odour	Odourless	Odourless	-
Temperature	30.20	30.20	°C
pH	7.08	6.20	-
COD	Nil	16.00	mg/lit
BOD (270C 3 day)	Nil	2.00	mg/lit
TSS	78.00	316.00	mg/lit
TDS	230.00	108.00	mg/lit
EC	0.16	0.172	mS/cm
Chromium as Cr	ND	ND	mg/lit
Zinc as Zn	ND	ND	mg/lit
Iron as Fe	ND	ND	mg/lit
Calcium as Ca	14.42	16.83	mg/lit
Magnesium as Mg	3.00	3.00	mg/lit
Sodium as Na	20.00	16.00	mg/lit
Cobalt as Co	ND	ND	mg/lit
Arsenic as As	ND	ND	mg/lit
Cadmium as Cd	ND	ND	mg/lit
Copper as Cu	ND	ND	mg/lit
Potassium as K	3.40	6.00	mg/lit
Mercury as Hg	ND	ND	mg/lit
Lead as Pb	ND	ND	mg/lit
Manganese as Mn	ND	ND	mg/lit
Nickel as Ni	ND	ND	mg/lit
Aluminium as Al	ND	ND	mg/lit
Antimony as Sb	ND	ND	mg/lit
Barium as Ba	ND	ND	mg/lit
Berelium as Be	ND	ND	mg/lit
Boron as B	ND	ND	mg/lit
Lithium as Li	ND	ND	mg/lit
Selenium as Se	ND	ND	mg/lit
Silver as Ag	ND	ND	mg/lit
Strontium as Sr	ND	ND	mg/lit
Tin as Sn	ND	ND	mg/lit

Vanadium as V	ND	ND	mg/lit
Chloride	12.01	18.02	mg/lit
SO ₄	17.59	24.12	mg/lit
Alkalinity	16.00	13.00	mg/lit
Hardness	70.00	76.00	mg/lit
NO ₃	<0.01	0.09	mg/lit
SiO ₂	<0.01	0.06	mg/lit
DO	6.08	5.47	mg/lit
O&G	ND	ND	mg/lit
Poly Aromatic Hydrocarbons	ND	ND	µg/lit
Organo Phosphorous Pesticides	ND	ND	µg/lit
Organo Chlorine Pesticides	ND	ND	µg/lit
Salinity	21.6	32.5	mg/lit
Turbidity	0.92	1.24	mg/lit
Phosphate	ND	ND	mg/lit
Phenolic compound	ND	ND	mg/lit

Table no. 02: Water Quality of samples collected from River Upstream (RU) (including Valdhuni)

SAMPLING CODEs	WQ -1R	WQ -2R	WQ -3R	WQ -4R	UOM
Colour	Yellowish	Colourless	Colourless	Light Brown	-
Odour	Organic	Foul	Organic	Organic	-
Temperature	30.20	30.20	30.30	30.40	⁰ C
pH	7.45	6.39	6.74	7.70	-
COD	94.00	40.00	32.00	36.00	mg/lit
BOD (270C 3 day)	16.28	2.83	< 2.0	3.04	mg/lit
TSS	49.00	33.00	22.00	48.00	mg/lit
TDS	75.00	1380.00	72.00	2760.00	mg/lit
EC	121.00	2.30	119.00	4.60	mS/cm
Chromium as Cr	ND	<0.01	<0.01	<0.01	mg/lit
Zinc as Zn	0.03	0.03	<0.02	2.00	mg/lit
Iron as Fe	ND	<0.02	<0.02	46.40	mg/lit
Calcium as Ca	8.81	20.04	16.03	92.18	mg/lit
Magnesium as Mg	3.00	51.22	19.50	90.21	mg/lit
Sodium as Na	5.00	2100.00	2500.00	1600.00	mg/lit
Cobalt as Co	ND	<0.10	<0.10	<0.10	mg/lit
Arsenic as As	ND	<0.02	<0.01	<0.02	mg/lit
Cadmium as Cd	ND	<0.003	<0.003	<0.003	mg/lit
Copper as Cu	ND	<0.01	<0.01	<0.01	mg/lit
Potassium as K	0.58	73.00	59.00	69.00	mg/lit
Mercury as Hg	ND	<0.001	<0.001	<0.001	mg/lit
Lead as Pb	ND	<0.01	<0.01	<0.01	mg/lit
Manganese as Mn	1.95	<0.01	<0.01	0.97	mg/lit
Nickel as Ni	ND	<0.02	<0.02	<0.02	mg/lit
Aluminium as Al	ND	ND	ND	ND	mg/lit
Antimony as Sb	ND	ND	ND	ND	mg/lit
Barium as Ba	ND	ND	ND	ND	mg/lit
Berelium as Be	ND	ND	ND	ND	mg/lit
Boron as B	ND	ND	ND	ND	mg/lit
Lithium as Li	ND	ND	ND	ND	mg/lit
Selenium as Se	ND	ND	ND	ND	mg/lit
Silver as Ag	ND	ND	ND	ND	mg/lit
Strontium as Sr	ND	ND	ND	ND	mg/lit
Tin as Sn	ND	ND	ND	ND	mg/lit
Vanadium as V	ND	ND	ND	ND	mg/lit
Chloride	15.01	350.35	300.30	1051.05	mg/lit
SO4	2.67	163.89	144.87	146.90	mg/lit
Alkalinity	NA	100.00	120.00	180.00	mg/lit

Hardness	NA	260.00	120.00	600.00	mg/lit
NO3	NA	0.14	0.25	0.18	mg/lit
SiO2	NA	8.90	6.47	5.45	mg/lit
DO	5.74	5.87	5.67	4.74	mg/lit
O&G	1.00	0.60	0.20	4.25	mg/lit
Poly Aromatic Hydrocarbons	ND	ND	ND	ND	µg/lit
Organo Phosphorous Pesticides	ND	ND	ND	ND	µg/lit
Organo Chlorine Pesticides	ND	ND	ND	ND	µg/lit
Salinity		632.92	542.50	1898.77	mg/lit
Turbidity	NA	0.78	0.46	19.40	mg/lit
Phosphate	NA	0.03	0.08	0.05	mg/lit
Phenolic compound	<0.001	<0.001	<0.001	<0.001	mg/lit

Table no. 03: Water Quality of samples collected from Lower Estuary (LE)

SAMPLING CODES	WQ -5R	WQ -6R	WQ -7R	UOM
Colour	Colourless	Colourless	Colourless	-
Odour	Foul	Odourless	Odourless	-
Temperature	30.50	30.50	30.70	⁰ C
pH	7.81	7.02	6.79	-
COD	44.00	40.00	56.00	mg/lit
BOD (270C 3 day)	2.63	6.80	<2.0	mg/lit
TSS	54.00	45.00	40.00	mg/lit
TDS	2400.00	1080.00	8100.00	mg/lit
EC	4.00	1.80	13.50	mS/cm
Chromium as Cr	<0.01	<0.01	<0.01	mg/lit
Zinc as Zn	<0.01	<0.02	0.03	mg/lit
Iron as Fe	<0.02	<0.02	0.62	mg/lit
Calcium as Ca	16.03	72.14	104.20	mg/lit
Magnesium as Mg	34.14	92.66	190.24	mg/lit
Sodium as Na	2900.00	1900.00	300.00	mg/lit
Cobalt as Co	<0.10	<0.10	<0.10	mg/lit
Arsenic as As	<0.02	<0.01	<0.02	mg/lit
Cadmium as Cd	<0.003	<0.003	<0.003	mg/lit
Copper as Cu	<0.01	<0.01	<0.01	mg/lit
Potassium as K	67.00	12.00	43.00	mg/lit
Mercury as Hg	<0.001	<0.001	<0.001	mg/lit
Lead as Pb	<0.01	<0.01	<0.01	mg/lit
Manganese as Mn	<0.01	0.67	0.31	mg/lit
Nickel as Ni	<0.02	<0.02	<0.02	mg/lit
Aluminium as Al	ND	ND	ND	mg/lit
Antimony as Sb	ND	ND	ND	mg/lit
Barium as Ba	ND	ND	ND	mg/lit
Berelium as Be	ND	ND	ND	mg/lit
Boron as B	ND	ND	ND	mg/lit
Lithium as Li	ND	ND	ND	mg/lit
Selenium as Se	ND	ND	ND	mg/lit
Silver as Ag	ND	ND	ND	mg/lit
Strontium as Sr	ND	ND	ND	mg/lit
Tin as Sn	ND	ND	ND	mg/lit
Vanadium as V	ND	ND	ND	mg/lit
Chloride	400.40	850.85	2602.60	mg/lit
SO4	165.78	156.76	154.99	mg/lit
Alkalinity	130.00	290.00	160.00	mg/lit

Hardness	180.00	560.00	1040.00	mg/lit
NO3	0.17	0.20	0.19	mg/lit
SiO2	6.87	8.65	5.87	mg/lit
DO	4.86	4.86	5.27	mg/lit
O&G	1.80	1.60	1.20	mg/lit
Poly Aromatic Hydrocarbons	ND	ND	ND	µg/lit
Organo Phosphorous Pesticides	ND	ND	ND	µg/lit
Organo Chlorine Pesticides	ND	ND	ND	µg/lit
Salinity	723.34	1537.10	4701.72	mg/lit
Turbidity	1.88	9.00	0.91	mg/lit
Phosphate	0.05	0.02	0.03	mg/lit
Phenolic compound	<0.001	<0.001	<0.001	mg/lit

Table no. 04: Water Quality of samples collected from Middle Estuary (ME)

SAMPLING CODEs	WQ -08R	WQ -09R	WQ -10R	WQ -11R	WQ -12R	WQ -13R	WQ -14R	UOM
Colour	Light Brown	Colourless	Colourless	Colourless	Colourless	Light Brown	Light Brown	-
Odour	Organic	Odourless	Foul	Organic	Foul	Organic	Organic	-
Temperature	30.80	30.80	30.80	30.90	31.00	31.00	31.00	⁰ C
pH	7.08	6.95	6.64	6.98	7.34	7.33	6.99	-
COD	40.00	36.00	56.00	32.00	40.00	44.00	28.00	mg/lit
BOD (270C 3 day)	<2.0	<2.0	5.06	2.83	2.43	7.19	3.56	mg/lit
TSS	77.00	32.00	120.00	58.00	43.00	108.00	44.00	mg/lit
TDS	7440.00	8280.00	10740.00	9360.00	3750.00	3672.00	15360.00	mg/lit
EC	12.40	13.80	17.90	15.60	6.25	6.12	25.60	mS/cm
Chromium as Cr	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01	<0.02	mg/lit
Zinc as Zn	0.07	0.06	<0.07	0.05	0.03	0.14	0.06	mg/lit
Iron as Fe	1.55	<0.02	<0.02	<0.02	<0.02	3.19	<0.02	mg/lit
Calcium as Ca	232.46	132.26	308.61	144.28	88.17	60.12	184.36	mg/lit
Magnesium as Mg	229.19	295.14	309.65	282.93	87.77	75.59	356.11	mg/lit
Sodium as Na	1000.00	3200.00	3500.00	1300.00	1700.00	1500.00	1900.00	mg/lit
Cobalt as Co	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	mg/lit
Arsenic as As	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/lit
Cadmium as Cd	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/lit
Copper as Cu	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/lit
Potassium as K	41.00	81.00	53.00	67.00	12.00	14.00	111.00	mg/lit
Mercury as Hg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/lit
Lead as Pb	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/lit
Manganese as Mn	0.51	0.16	0.58	0.16	0.07	0.15	<0.01	mg/lit
Nickel as Ni	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/lit
Aluminium as Al	ND	ND	ND	ND	ND	ND	ND	mg/lit
Antimony as Sb	ND	ND	ND	ND	ND	ND	ND	mg/lit
Barium as Ba	ND	ND	ND	ND	ND	ND	ND	mg/lit
Berelium as Be	ND	ND	ND	ND	ND	ND	ND	mg/lit
Boron as B	ND	ND	ND	ND	ND	ND	ND	mg/lit
Lithium as Li	ND	ND	ND	ND	ND	ND	ND	mg/lit
Selenium as Se	ND	ND	ND	ND	ND	ND	ND	mg/lit
Silver as Ag	ND	ND	ND	ND	ND	ND	ND	mg/lit
Strontium as Sr	ND	ND	ND	ND	ND	ND	ND	mg/lit
Tin as Sn	ND	ND	ND	ND	ND	ND	ND	mg/lit
Vanadium as V	ND	ND	ND	ND	ND	ND	ND	mg/lit
Chloride	3003.00	4004.00	3703.70	3703.70	1001.00	1001.00	6256.25	mg/lit
SO4	137.98	184.98	176.64	163.34	165.98	165.49	174.56	mg/lit
Alkalinity	320.00	250.00	550.00	270.00	300.00	350.00	230.00	mg/lit

Hardness	1520.00	1540.00	2040.00	1520.00	580.00	460.00	1980.00	mg/lit
NO3	0.16	0.21	0.24	0.15	0.21	0.17	0.19	mg/lit
SiO2	7.89	6.75	7.89	7.12	4.88	6.78	8.75	mg/lit
DO	2.83	4.66	4.45	5.47	4.25	3.85	5.27	mg/lit
O&G	3.00	2.80	2.60	2.20	1.80	2.00	1.80	mg/lit
Poly Aromatic Hydrocarbons	ND	ND	ND	ND	ND	ND	ND	µg/lit
Organo Phosphorous Pesticides	ND	ND	ND	ND	ND	ND	ND	µg/lit
Organo Chlorine Pesticides	ND	ND	ND	ND	ND	ND	ND	µg/lit
Salinity	5425.06	7233.42	6690.91	6690.91	1808.35	1808.35	11302.22	mg/lit
Turbidity	27.40	1.06	28.20	1.60	5.60	1.07	1.02	mg/lit
Phosphate	<0.01	0.05	0.03	0.08	0.03	0.04	0.05	mg/lit
Phenolic compound	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/lit

Table no. 05: Water Quality of samples collected from Upper Estuary (UE)

SAMPLING CODEs	WQ -15R	WQ -16R	WQ -17R	WQ -18R	WQ -19R	WQ -20R	WQ -21R	WQ -22R	UOM
Colour	Light Brown	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless	
Odour	Organic	Foul	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless	
Temperature	32.00	32.00	31.60	31.70	31.30	31.20	31.20	31.20	⁰ C
pH	7.63	7.39	7.08	7.20	7.04	6.86	7.08	6.88	-
COD	52.00	28.00	136.00	48.00	40.00	44.00	48.00	32.00	mg/lit
BOD (270C 3 day)	20.27	5.67	<2.0	2.63	<2.0	<2.0	2.34	<2.0	mg/lit
TSS	321.00	69.00	70.00	67.00	211.00	56.00	343.00	35.00	mS/cm
TDS	8100.00	4140.00	15000.00	10320.00	18000.00	20760.00	12780.00	21540.00	mg/lit
EC	13.50	6.90	25.00	17.20	30.00	34.60	21.30	35.90	mg/lit
Chromium as Cr	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	mg/lit
Zinc as Zn	0.08	0.05	0.09	<0.02	<0.02	<0.02	<0.02	<0.02	mg/lit
Iron as Fe	0.43	<0.02	<0.02	<0.02	<0.01	<.02	0.34	0.18	mg/lit
Calcium as Ca	60.12	80.16	264.52	188.37	256.51	240.48	232.46	304.60	mg/lit
Magnesium as Mg	95.11	92.66	473.17	275.58	531.73	678.14	424.39	722.00	mg/lit
Sodium as Na	2500.00	2300.00	2400.00	2800.00	3000.00	3000.00	3200.00	3600.00	mg/lit
Cobalt as Co	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	mg/lit
Arsenic as As	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01	mg/lit
Cadmium as Cd	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/lit
Copper as Cu	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/lit
Potassium as K	39.00	23.00	121.00	39.00	84.00	960.00	54.00	116.00	mg/lit
Mercury as Hg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/lit
Lead as Pb	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/lit
Manganese as Mn	<0.01	0.12	<0.01	23.58	10.92	6.18	19.68	<0.01	mg/lit
Nickel as Ni	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/lit
Aluminium as Al	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Antimony as Sb	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Barium as Ba	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Berelium as Be	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Boron as B	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Lithium as Li	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Selenium as Se	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Silver as Ag	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Strontium as Sr	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Tin as Sn	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Vanadium as V	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Chloride	2202.20	1301.30	7257.00	5005.00	9009.00	9759.75	6006.00	10760.75	mg/lit
SO4	143.00	167.33	167.98	Nil	167.78	175.89	134.54	154.09	mg/lit
Alkalinity	1320.00	420.00	270.00	400.00	280.00	250.00	400.00	1500.00	mg/lit

Hardness	540.00	580.00	2600.00	1600.00	2820.00	3380.00	2320.00	3720.00	mg/lit
NO3	0.17	0.23	0.12	0.14	0.23	0.17	0.15	0.19	mg/lit
SiO2	4.89	5.88	6.89	6.98	5.76	8.77	6.66	7.87	mg/lit
DO	1.82	4.05	4.86	2.63	3.64	3.24	2.83	5.67	mg/lit
O&G	2.20	2.20	180.00	2.80	2.00	3.00	3.20	3.00	mg/lit
Poly Aromatic Hydrocarbons	ND	ND	ND	ND	ND	ND	ND	ND	µg/lit
Organo Phosphorous Pesticides	ND	ND	ND	ND	ND	ND	ND	ND	µg/lit
Organo Chlorine Pesticides	ND	ND	ND	ND	ND	ND	ND	ND	µg/lit
Salinity	3978.38	2350.32	1311.13	9041.78	16275.20	17631.47	10850.13	19439.83	mg/lit
Turbidity	0.97	1.07	0.83	1.05	0.97	0.97	1.02	1.74	mg/lit
Phosphate	<0.01	0.06	0.04	0.05	0.04	<0.01	0.06	0.02	mg/lit
Phenolic compound	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/lit

II. Water Quality of identified Major Outfalls (MOF)

Table no. 06: Water Quality of samples collected from Upper Estuary (UE)

SAMPLING CODEs	WQ 1N	WQ 2N	WQ 2N1	WQ 3N	WQ 4N	WQ 5N	WQ 5N1	WQ 6N	UOM
Colour	Yellowish	Blackish	Blackish	Blackish	Light Brown	Blackish	Colourless	Dark Brown	-
Odour	Foul	Foul	Foul	Foul	Organic	Foul	Foul	Organic	-
Temperature	28.00	28.20	28.20	28.50	28.70	28.90	29.00	28.50	⁰ C
pH	6.65	6.78	6.81	6.85	7.06	7.08	7.21	7.52	-
COD	44.00	16.00	68.00	72.00	56.00	80.00	24.00	704.00	mg/lit
BOD (270C 3 day)	3.00	7.90	4.05	4.86	7.29	20.40	8.00	190.00	mg/lit
TSS	414.00	74.00	58.00	62.00	40.00	63.00	78.00	222.00	mS/cm
TDS	6908.00	552.00	728.00	754.00	756.00	560.00	648.00	3110.00	mg/lit
EC	10.90	9.80	9.20	8.80	5.10	2.20	1.07	1.50	mg/lit
Chromium as Cr	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Zinc as Zn	ND	ND	ND	0.03	0.16	0.08	ND	0.19	mg/lit
Iron as Fe	0.21	0.34	ND	ND	0.62	1.07	ND	6.73	mg/lit
Calcium as Ca	153.30	25.20	31.40	28.80	42.40	26.70	60.12	52.20	mg/lit
Magnesium as Mg	71.00	17.00	6.00	3.00	10.00	9.00	10.00	7.00	mg/lit
Sodium as Na	66.00	36.00	32.00	44.00	48.00	33.00	34.00	39.00	mg/lit
Cobalt as Co	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Arsenic as As	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Cadmium as Cd	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Copper as Cu	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Potassium as K	26.00	1.96	8.00	12.00	3.66	4.12	2.38	16.00	mg/lit
Mercury as Hg	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Lead as Pb	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Manganese as Mn	ND	ND	0.47	0.35	0.32	0.19	ND	0.30	mg/lit
Nickel as Ni	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Aluminium as Al	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Antimony as Sb	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Barium as Ba	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Berelium as Be	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Boron as B	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Lithium as Li	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Selenium as Se	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Silver as Ag	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Strontium as Sr	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Tin as Sn	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Vanadium as V	ND	ND	ND	ND	ND	ND	ND	ND	mg/lit
Chloride	303.30	68.76	38.71	46.52	442.43	386.25	170.18	340.08	mg/lit

SO ₄	23.18	24.15	18.54	24.03	61.88	195.42	40.18	124.21	mg/lit
O&G	2.00	2.80	2.20	3.80	4.40	13110.0	1.20	2.20	mg/lit
Poly Aromatic Hydrocarbons	ND	ND	ND	ND	ND	ND	ND	ND	µg/lit
Organo Phosphorous Pesticides	ND	ND	ND	ND	ND	ND	ND	ND	µg/lit
Organo Chlorine Pesticides	0.056	0.127	0.075	0.069	0.423	0.331	0.089	0.574	µg/lit
Salinity	548.0	124.2	69.9	84.0	799.3	697.8	307.5	614.4	mg/lit

Table no. 07: Water Quality of samples collected from Middle Estuary (ME)

SAMPLING CODEs	WQ 7N	WQ 8N	WQ 9N	WQ 9N1	WQ 10N	UOM
Colour	Blackish	Colourless	Colourless	Colourless	Light Brown	-
Odour	Foul	Foul	Foul	Foul	Organic	-
Temperature	28.00	29.00	29.50	29.00	27.00	⁰ C
pH	6.98	7.29	6.97	7.14	6.92	-
COD	132.00	24.00	116.00	34.00	92.00	mg/lit
BOD (270C 3 day)	20.00	6.48	8.00	10.16	12.00	mg/lit
TSS	148.00	38.00	114.00	62.00	128.00	mS/cm
TDS	494.00	400.00	214.00	452.00	428.00	mg/lit
EC	0.75	1.60	0.79	0.50	0.57	mg/lit
Chromium as Cr	ND	ND	ND	ND	ND	mg/lit
Zinc as Zn	ND	0.06	ND	ND	ND	mg/lit
Iron as Fe	ND	ND	ND	ND	ND	mg/lit
Calcium as Ca	44.08	50.80	48.09	39.70	34.46	mg/lit
Magnesium as Mg	8.00	18.00	12.00	12.00	6.00	mg/lit
Sodium as Na	30.00	16.00	36.00	18.00	31.00	mg/lit
Cobalt as Co	ND	ND	ND	ND	ND	mg/lit
Arsenic as As	ND	ND	ND	ND	ND	mg/lit
Cadmium as Cd	ND	ND	ND	ND	ND	mg/lit
Copper as Cu	ND	ND	ND	ND	ND	mg/lit
Potassium as K	3.22	3.52	4.00	2.04	2.48	mg/lit
Mercury as Hg	ND	ND	ND	ND	ND	mg/lit
Lead as Pb	ND	ND	ND	ND	ND	mg/lit
Manganese as Mn	ND	0.20	0.15	ND	ND	mg/lit
Nickel as Ni	ND	ND	ND	ND	ND	mg/lit
Aluminium as Al	ND	ND	ND	ND	ND	mg/lit
Antimony as Sb	ND	ND	ND	ND	ND	mg/lit
Barium as Ba	ND	ND	ND	ND	ND	mg/lit
Berelium as Be	ND	ND	ND	ND	ND	mg/lit
Boron as B	ND	ND	ND	ND	ND	mg/lit
Lithium as Li	ND	ND	ND	ND	ND	mg/lit
Selenium as Se	ND	ND	ND	ND	ND	mg/lit
Silver as Ag	ND	ND	ND	ND	ND	mg/lit
Strontium as Sr	ND	ND	ND	ND	ND	mg/lit
Tin as Sn	ND	ND	ND	ND	ND	mg/lit
Vanadium as V	ND	ND	ND	ND	ND	mg/lit
Chloride	63.06	48.50	54.05	55.27	42.04	mg/lit
SO4	18.36	19.37	36.12	28.80	31.69	mg/lit
O&G	1.00	3.40	8.40	1.40	1.60	mg/lit

Poly Aromatic Hydrocarbons	ND	ND	ND	ND	ND	µg/lit
Organo Phosphorous Pesticides	ND	ND	ND	ND	ND	µg/lit
Organo Chlorine Pesticides	0.186	0.024	0.987	0.051	0.048	µg/lit
Salinity	113.9	87.6	97.6	99.9	76.0	mg/lit

Table no. 08: Water Quality of samples collected from Lower Estuary (LE) & River Upstream (RU) (Valdhuni)

SAMPLING CODEs	WQ 11N	WQ 12N	WQ 13N	WQ 14N	WQ 15N	UOM
Colour	Brown	Colourless	Colourless	Brown	Brown	-
Odour	Organic	Foul	Foul	Organic	Organic	-
Temperature	28.50	28.00	28.00	28.00	28.50	⁰ C
pH	4.50	6.08	6.64	6.93	2.49	-
COD	352.00	188.00	88.00	80.00	496.00	mg/lit
BOD (270C 3 day)	80.00	50.00	16.00	12.00	158.00	mg/lit
TSS	290.00	44.00	158.00	268.00	418.00	mS/cm
TDS	1742.00	244.00	563.00	136.00	156.00	mg/lit
EC	2.30	0.62	0.62	0.50	0.61	mg/lit
Chromium as Cr	ND	ND	ND	ND	ND	mg/lit
Zinc as Zn	2.60	0.07	0.02	ND	0.19	mg/lit
Iron as Fe	71.40	0.10	0.21	ND	41.20	mg/lit
Calcium as Ca	168.33	33.66	62.52	51.30	120.24	mg/lit
Magnesium as Mg	16.00	5.00	7.00	8.00	54.00	mg/lit
Sodium as Na	42.00	26.00	30.00	34.00	50.00	mg/lit
Cobalt as Co	ND	ND	ND	ND	ND	mg/lit
Arsenic as As	ND	ND	ND	ND	ND	mg/lit
Cadmium as Cd	ND	ND	ND	ND	ND	mg/lit
Copper as Cu	ND	ND	ND	ND	ND	mg/lit
Potassium as K	4.00	3.09	3.60	2.34	42.00	mg/lit
Mercury as Hg	ND	ND	ND	ND	ND	mg/lit
Lead as Pb	ND	ND	ND	ND	ND	mg/lit
Manganese as Mn	0.40	ND	0.13	ND	1.80	mg/lit
Nickel as Ni	ND	ND	ND	ND	ND	mg/lit
Aluminium as Al	ND	ND	ND	ND	ND	mg/lit
Antimony as Sb	ND	ND	ND	ND	ND	mg/lit
Barium as Ba	ND	ND	ND	ND	ND	mg/lit
Berelium as Be	ND	ND	ND	ND	ND	mg/lit
Boron as B	ND	ND	ND	ND	ND	mg/lit
Lithium as Li	ND	ND	ND	ND	ND	mg/lit
Selenium as Se	ND	ND	ND	ND	ND	mg/lit
Silver as Ag	ND	ND	ND	ND	ND	mg/lit
Strontium as Sr	ND	ND	ND	ND	ND	mg/lit
Tin as Sn	ND	ND	ND	ND	ND	mg/lit
Vanadium as V	ND	ND	ND	ND	ND	mg/lit
Chloride	80.88	77.08	53.05	39.04	26.03	mg/lit
SO4	100.24	23.15	17.59	28.97	112.47	mg/lit

O&G	2.40	0.80	NIL	2.60	1.40	mg/lit
Poly Aromatic Hydrocarbons	ND	ND	ND	ND	ND	µg/lit
Organo Phosphorous Pesticides	ND	ND	ND	ND	ND	µg/lit
Organo Chlorine Pesticides	0.035	0.670	0.044	0.070	0.060	µg/lit
Salinity	146.1	139.3	95.8	70.5	47.0	mg/lit

ANNEXURE II: PHOTOGRAPHS



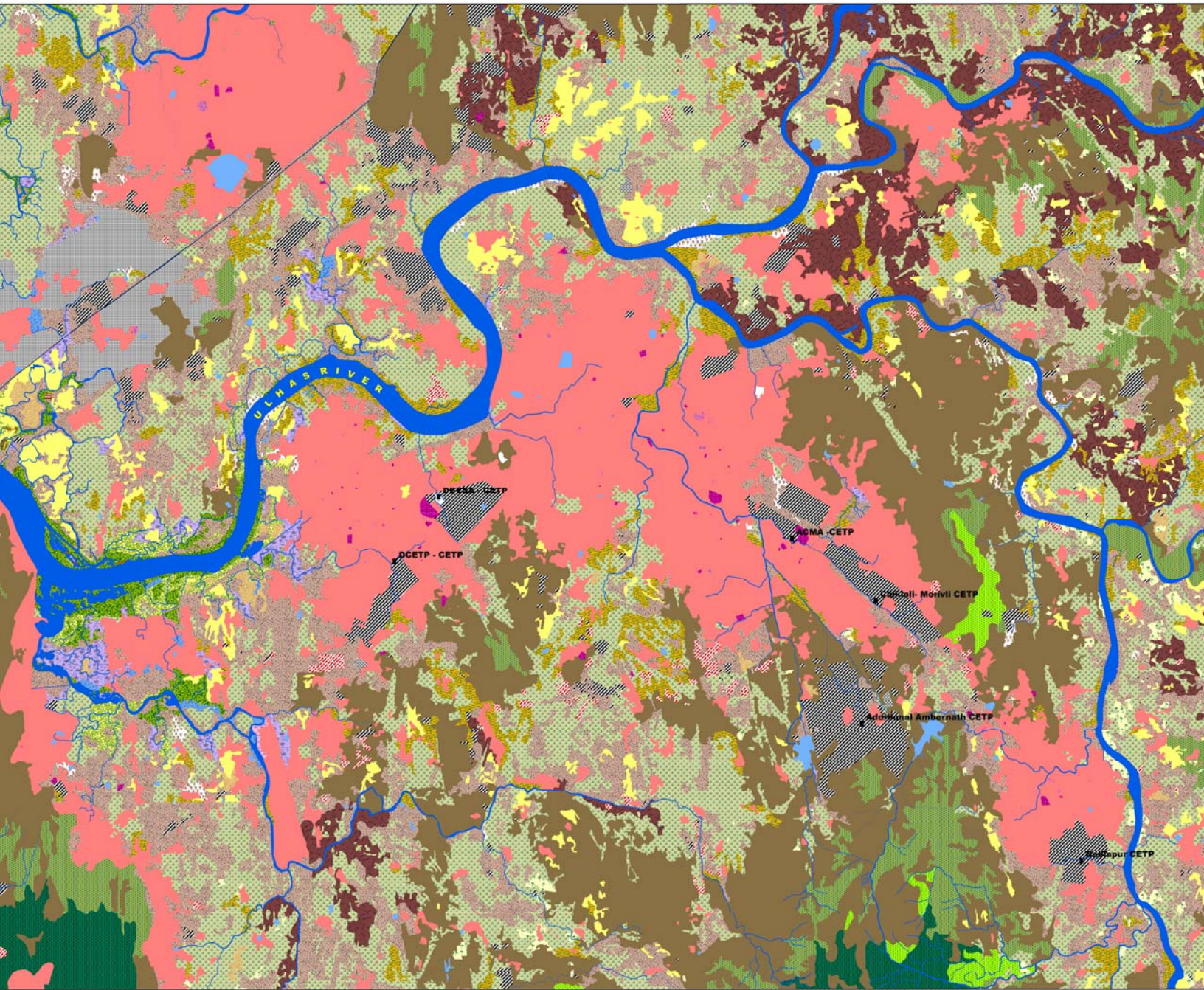








LANDUSE\LANDCOVER MAP



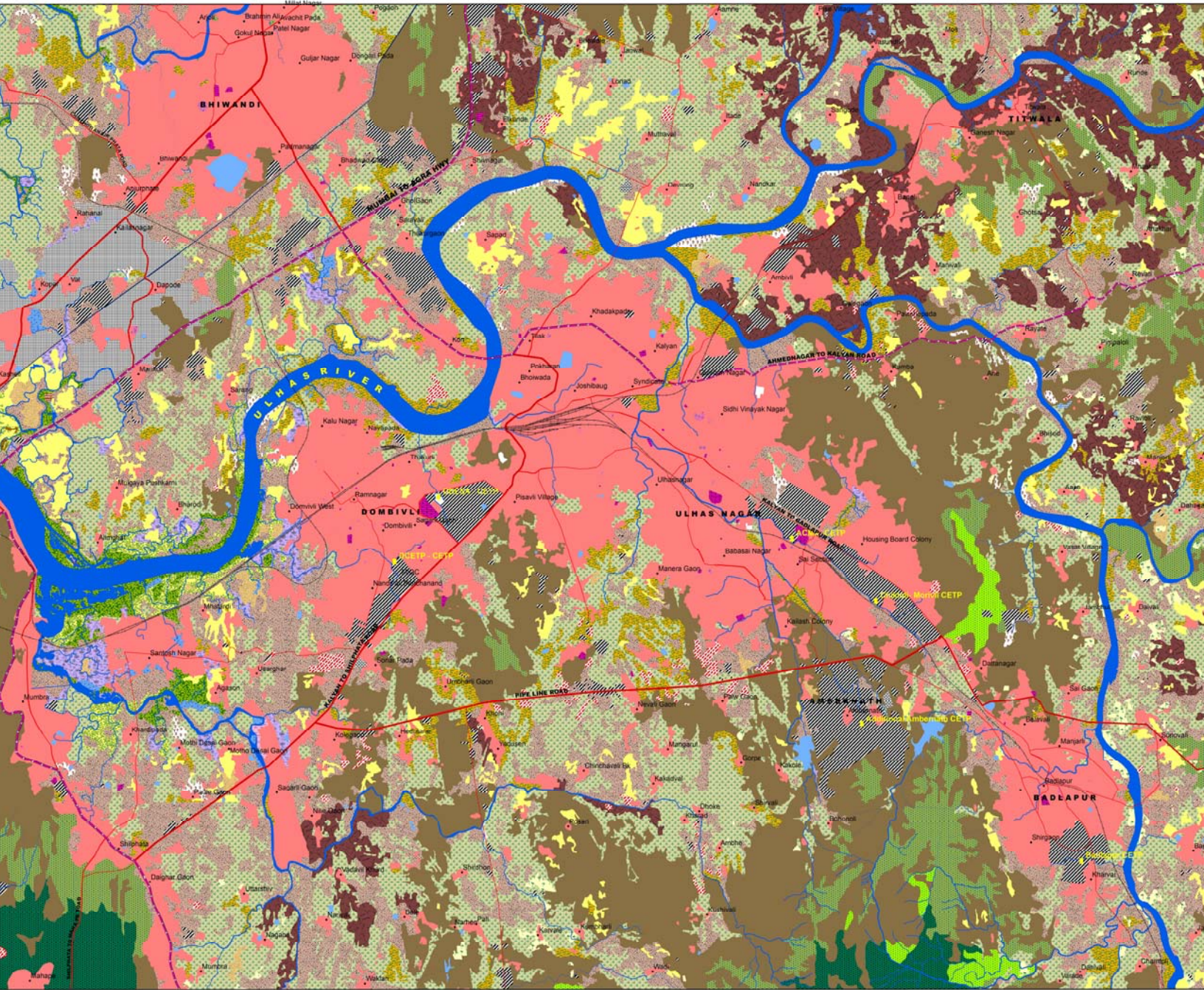
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|----------------------------|---------------------|----------------------|------------------------|----------------------------------------|
| Dead Trees | Fallow Land | Land without Scrub | Medium Dense Mangroves | Recreational (Park/Garden/Play Ground) |
| Commercial/Industrial Area | Golf Ground | Low Dense Forest | Mudflat | Reservoir/Dam/Tank |
| Open Land | Highly Dense Forest | Mangrove (Dense) | Permanent Fallow Land | River |
| Educational Institute | Industrial Area | Marshy/Wet Land Area | Plantation | Common Effluent Treatment Plant |
| Electrical Station | Land with Scrub | Medium Dense Forest | Railway Shed | Under Development |
| | | | | Upland \ Barren Area |
| | | | | Water Logged Area |

Sl.No.	Latitude	Longitude	Location/Name
1	19°12'16.75"N	73°5'53.32"E	DCETP - CETP
2	19°13'4.28"N	73°6'22.45"E	DBESA - CETP
3	19°12'45.36"N	73°0'46.20"E	ACMA - CETP
4	19°12'3.88"N	73°11'52.56"E	Chikoli - Morvi CETP
5	19°10'35.97"N	73°11'47.03"E	Additional Ambernath CETP
6	19°9'6.91"N	73°14'36.12"E	Bodapur CETP

SCALE -



LANDUSE/LANDCOVER MAP

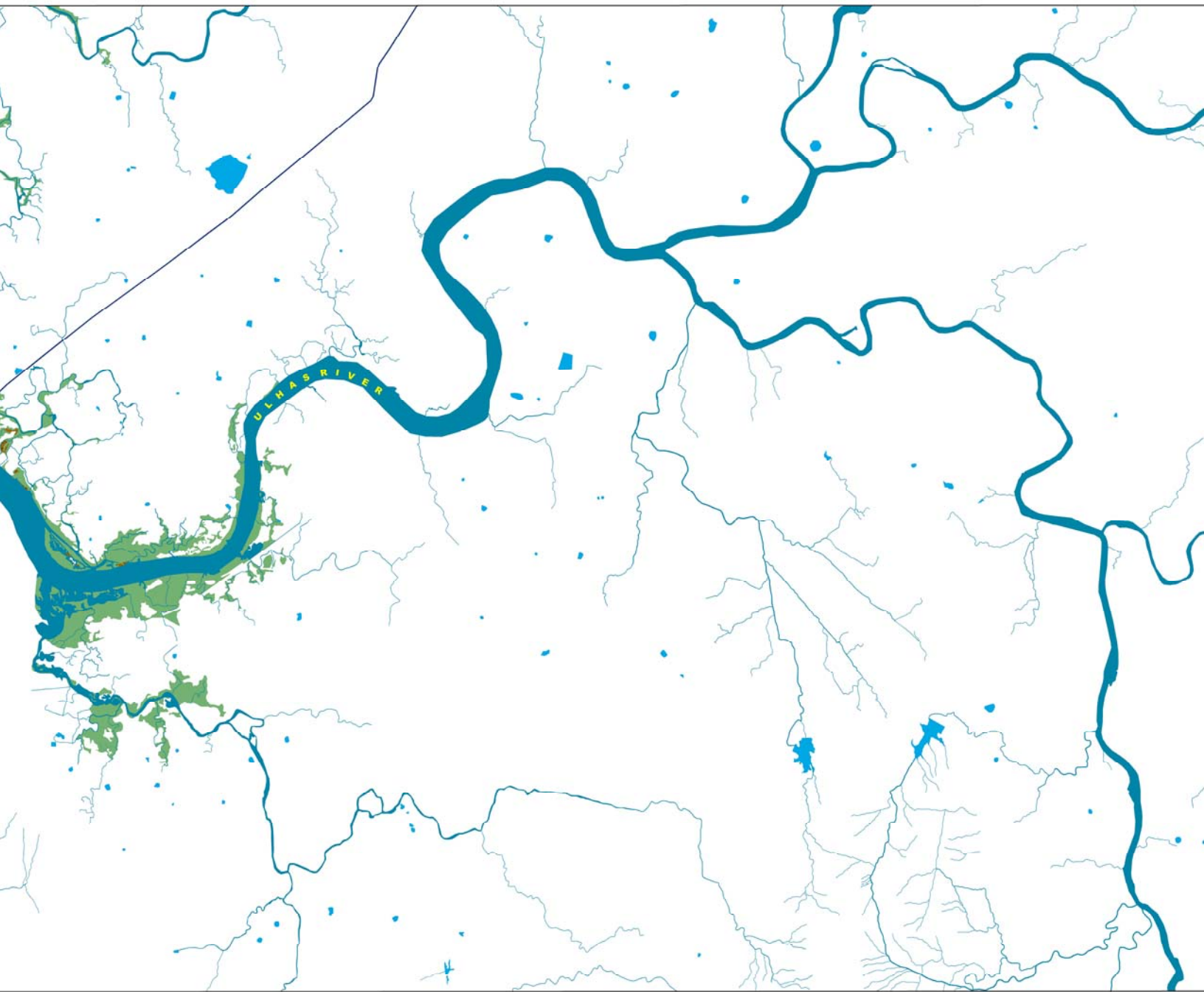


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|-----------------|---------------------|----------------------|------------------------|----------------------------------------|
| Land with Scrub | Fallow Land | Land without Scrub | Medium Dense Mangroves | Recreational (Park/Garden/Play Ground) |
| Land with Scrub | Golf Ground | Low Dense Forest | Mudflat | Reservoir/Dam/Tank |
| Land with Scrub | Highly Dense Forest | Mangrove (Dense) | Permanent Fallow Land | River |
| Land with Scrub | Industrial Area | Marshy/Wet Land Area | Plantation | Common Effluent Treatment Plant |
| Land with Scrub | Industrial Area | Medium Dense Forest | Railway Shed | Under Development |
| Land with Scrub | Industrial Area | Medium Dense Forest | | Upland \ Barren Area |
| Land with Scrub | Industrial Area | Medium Dense Forest | | Water Logged Area |

SL.No.	Latitude	Longitude	Location/Name
1	19°12'16.75"N	73°5'53.32"E	DCETP - CETP
2	19°14'4.78"N	73°6'22.45"E	DCETP - CETP
3	19°12'45.36"N	73°10'48.20"E	ACMA - CETP
4	19°12'5.88"N	73°11'52.58"E	Chikoli - Marolli CETP
5	19°10'35.97"N	73°11'47.03"E	Additional Ambemath CETP
6	19°9'8.91"N	73°14'36.12"E	Badlapur CETP



DRAINAGE MAP



Vegetation

- Reservoir/Dam/Tank
- River
- Water Logged Area

