

## GOVERNMENT OF MAHARASHTRA WATER RESOURSE DEPARTMENT

## HYDROLOGY PROJECT (SW) Chief Engineer Hydrology Project, Nashik



Water quality Lab Level-II, Kolhapur

ANNUAL REPORT 2014-2015

Superintending Engineer Data Collection, Planning & Hydrology Circle, Nashik

## **PREFACE**

Well equipped (level-II) grade water quality laboratory at Kolhapur, is set up under technical assistance of World-Bank aided Hydrology Project, for monitoring the surface water quality of Krishna basin and west flowing rivers of Konkan region (in Ratanagiri & Sindhudurg district) in Maharashtra state.

The present annual report is prepared for the water - year 01/06/2014 to 31/05/2015 with the consideration of monsoon season from June to September and non-monsoon from October to May.

This report includes water quality data in Krishna Basin and Part of Konkan (west flowing rivers) for the period of June 2014 to May 2015. The data has been interpreted to known the affected locations.

This report attempts to briefly describe an over view and general conclusion based on the basis of water quality data of water samples collected from selected locations for define frequencies for the reported period.

Govt. Analyst WQ Lab level - II HP Sub-Division Kolhapur Assistant Engineer Gr.I HP Sub- Division Kolhapur ExecutiveEngineer Hydrology Project Division Pune - 1

## **Annual Report**

# On Water Quality Monitoring through Water Quality Lab Level-II, Kolhapur for the Year 2014 - 15

## INDEX

Chapter	Particulars	Page No.
Ι	Executive Summary	6-8
II	Introduction	10-17
III	Methodology	19-25
IV	Result & Observation	27-53
V	Conclusion	55
VI	Other Activities	57
VII	Annexure	58-63

# **Annual Report**

# On Water Quality Monitoring through Water Quality Lab Level-II, Kolhapur for the Year 2014 - 15

### ANN E X U R E

Chapter	Particulars	Page No.
Ι	List of Clients 2014 - 15	59-60
Π	Quality Policy towards ISO 9001: 2008	62
III	Мар	63

# CHAPTER - I

# **Executive Summery**

#### Chapter - 1

#### **Executive Summery**

#### **Annual Report**

# On Water Quality Monitoring through Water Quality Lab Level-II, Kolhapur for the Year 2014- 15

#### **1.1 Preamble:**

Water is the most vital resources for life. With the increasing population & changing life patterns, consumption of water has increased many folds particularly for domestic, agriculture, & industrial consumption. "The negative change in physical, chemical & biological properties of natural water due to addition of pollutants causing adverse effect on aquatic life, & other living being, including man is known as water pollution."

The water quality monitoring in the area of surface water is performed in order to determine the quality of water. There are 26 stations comes under Kolhapur Level – II, from Kolhapur, Sangli, Satara, Ratnagiri & Sindhudurga district. For each station 29 parameters are analyzed in the laboratory and 6 parameters are tested at field level. All these records store monthly in SWDES and used for preparing the annual report. These data are considered in order to specify the quality of water at each location. This also helps to identify concentration of water pollution in each source of water at each station.

#### **1.2 Water Quality Monitoring – Objectives**

The main objectives of surface water quality monitoring in Maharashtra state is to collect the comprehensive data on the status of present health of important water resources i.e. rivers & reservoirs so as:

- 1) To establish Base Line water quality.
- 2) To detect the trends in water quality changes.
- 3) To provide warning of potentially deleterious changes.
- 4) Surveillance of available resources for drinking and/or irrigation use.

Observations of analysis of physical & chemical parameters as per "Uniform Protocol for Water Quality Monitoring Order 2005" for each location followed by Operation and Maintenance of Water Quality Laboratory Level-II, Kolhapur as per Standard Guidelines and mandates including collection, transportation and analysis of samples , data entry in SWDES Software. Preparation of the Annual Report as per specific guidelines issued by Superintending Engineer, Hydrology Project Circle (Collection), Nashik,

#### **1.3 Water Quality Monitoring**

The Annual Report is prepared for the year 2014 - 15 in combined. The Table below shows the number of sample analyzed during the reported period. In order to study water quality status station wise, all locations covered under this lab during the year 2014- 15 are considered.

#### TABLE SHOWING SAMPLES ANALYSED DURING THE REPORTING PERIOD

Sr. No.	Year	Baseline Sample	Flux Sample	Trend Sample	Dam Sample	Total
1	2014 - 15	16	12	141	12	181

Seasonal averages of all analyzed parameters are calculated for study of seasonal water quality trend at each location.

#### **1.4 Methodology:**

Analysis of Physical and Chemical parameters is done in the laboratory on the basis of Standard Analytical Methods, Instrument Operating Instructions, Water Quality Manuals, CPCB Guidelines and APHA, 21st Ed., 2005.

Every month after analysis of sample data is collected, validated & entry is carried out in rough data sheet. This finally validated data is entered in SWDES software & then send it to the Data Storage Center, Nashik by mail for storage as per instructions of water quality manual.

#### **1.5 Result and Observation:**

After observing all this data it is clear that most of the physical parameters are within tolerance limit.

Most of the chemical parameters are also within tolerance limits.

Bacteriological parameters like Total Coliform and Faecal Colifroms are also exceeding the limits.

#### **1.6 Conclusion**

Biological parameter in all locations contain higher bacterial count is due to the discharge of sewage, drainage waste in to the water sources. Even human activities also increase number of various types of bacteria in the water, which increase the number of count in the water.

#### **1.7 Recommendations/Remedial Measures:**

- Domestic effluents should be treated and disinfected before discharging.
- Effluents from the non-point sources should be identified. These are required to be collected and treated.
- Use of water of such polluted locations may be useful for salt tolerance crop and is recommended based on special study.
- Use of direct source of water should be avoided.
- Bathing at such location should be restricted.

#### **1.8 Suggestions:**

- Create mass awareness in general public regarding surface and ground water quality aspects.
- Water quality Annual Report shall be publicly published every year.

# CHAPTER - II

# Introduction

#### Chapter - 2

#### Introduction

#### 2.1 General

To check the pollution load & water safety for different uses there is need to regularly monitor water quality by using laboratory analysis method. The test includes physico-chemical parameters & biological parameters.

The water quality monitoring in the area of surface water is performed in order to determine the quality of water. There are 26 stations come under Kolhapur lab Level – II, from Kolhapur, Sangli, Satara, Ratnagiri & Sindhudurga district. For each station 29 parameters are analyzed in the laboratory and 6 parameters are tested at field level. All these records store monthly in SWDES and used for preparing the annual report. These data are considered in order to specify the quality of water at each location. This also helps to identify concentration of water pollution in each source of water at each station.

#### 2.2 Water Quality Monitoring - Objectives

The main objectives of surface water quality monitoring in Maharashtra state is to collect the comprehensive data on the status of present health of important water resources i.e. rivers & reservoirs so as:

- 1) To establish Base Line water quality.
- 2) To detect the trends in water quality changes.
- 3) To provide warning of potentially deleterious changes.
- 4) Surveillance of available resources for drinking and/or irrigation use.

Observations of analysis of physical & chemical parameters as per "Uniform Protocol for Water Quality Monitoring Order 2005" for each location followed by Operation and Maintenance of Water Quality Laboratory Level-II, Kolhapur as per Standard Guidelines and mandates including collection, transportation and analysis of samples , data entry in SWDES Software and preparation of the said Annual Report as per specific guidelines issued by Superintending Engineer, Hydrology Project Circle( Collection), Nashik.

#### 2.3 Water Quality Monitoring – Scope

- Seasonal averages of all analyzed parameters are calculated for study of seasonal water quality trend at each location.
- Used analysed data for preparation of annual report or study purpose.
- Find out major pollutants in river water at each station.
- Identify remedial measures for water quality.

#### 2.4 Other activities

Other than working of regular Water Quality Monitoring for Water Quality lab level II at Kolhapur, we also analyzed water sample of Government, Semi Government, and Private sector.

Apart from HP sample drinking water, industrial effluent bore water, lake water, and irrigation water analysis is carried out in lab. Most of the students are also approach for analysis of water for study purpose.

During the year 2014 - 15 many clients approached to the laboratory. Are as follows -

- 1) Kolhapur Irrigation Division
- 2) Ghatage Patil industry Ltd.Unit II, Unchgaon, Kolhapur.
- 3) Aadhar nursing home, Kolhapur.
- 4) Shivaji University Students, Kolhapur.
- 5) Dudhaganga Canal Division.
- 6) Podar Education Trust, Kolhapur.
- 7) Ichalkaranji Nagarparishad, STP Sample.
- 8) Hotel Greenland, NH4 High way Kaneriwadi, Kolhapur.
- 9) Sayaji Hotel Kavala Naka, Kolhapur.

## The revenue collected during the reported period is as follows.

Sr. No	Year	Amount
1.	2014 - 2015	2,26,144/-

## 2.5 Extra activity

Water Quality Lab Level – II @ Kolhapur is achieved 95% marks in CPCB AQC December 2014.

# SALIENT FEATURES OF WATER QUALITY LABORATORY, AT RAJARAM TANK, KOLHAPUR.

Address	:	Hydrology Project Sub-Division, Kolhapur Water Quality Lab Level- II. At Rajaram Tank, Opp. Shivaji University, Sarnobat wadi Road Kolhapur – 416 004.
Latitude	:	16° 42' 41''
Longitude	:	74° 17' 00''
Year of Establishment	:	1 <sup>st</sup> - February-2003.
No. of Baseline Sample locations	:	4 Nos.
No. of Flux locations	:	2 Nos.
No. of Trend Sample locations	:	19 Nos.
No. of Reservoir locations	:	1 No.
No. of Parameters Analysed	:	34 Nos.
Staff Position	:	Work of Operation & Maintenance of Lab. on annual contract basis.
Government officer/ staff related to the laboratory		<ol> <li>Er. S. D. Raval Executive Engineer</li> <li>Mrs. S. C. Mane . Assistant Engineer gr. – I</li> <li>Er. M.T. Chougule. Govt. Analyst Sectional Engineer</li> </ol>

Agency	Staff	related	to	the		M/S	Waingade	Enviro	And	Agree	Solutions,
laborator	У				:	Chinc	hwad, Pune.				
						1.	Mr. Amar	Waingade			
							Managing I	Director.			
						2. Miss. T. S. Chougale.					
						Chief Chemist.					
						3. Miss. M. S. Shinde.					
						Senior Research. Assistant.					
						4. Miss. V. V. Patil.					
							Laboratory	Chemist.			
						5.	Mr. A. S. M	Machale.			
							Field Chem	ist.			
Other Ac	tivities					1.Participation in AQC (Intra Lab exercise & CPCB					
						AQC In SW Maharashtra)					

# Scope of Work: Operation and Maintenance of water Quality Laboratory Level - II, Kolhapur

#### **Outdoor Work**:

Collection of surface water and transporting the sample from selected Water Quality network sampling points

as per schedule of sampling during the said period.

#### The Surface Water sampling includes:

- a) Field determination as per standard guideline.
- **b**) Field parameters to be tested on site & entry to be taken on ID form.
- c) Sample to be transported to laboratory within prescribed time limit.

#### **Indoor Work:**

- Day to Day Operation and Maintenance of Water Quality Laboratory Level II.
- The work includes analysis of water samples as per the test procedures.
- Operating the instruments as per specified instruction manual.
- Entry of data in SWDES Software.
- Participating in Analytical Quality Control Exercise (AQC) round.
   i) Within Laboratory AQC ii) Intra Laboratory AQC

The Laboratory staff employed;

- 1) Chief Chemist: 1 No.
- 2) Sr. Research Officers: 1 No.
- **3**) Research Assistant: 2 Nos.
- 4) Lab. Assistant: 1 No.
- The Indoor work also includes keeping data record.
- Log book of Lab equipment
- Preparation of monthly sampling Schedule.
- Keeping sampling record, instruments operation, Laboratory Management, demonstration
- Training to Departmental staff as and when required.

Information to visitors & Customer Satisfaction. Work is carried out as per flow chart.



## Table showing No. of Location Covered under the jurisdiction of Water

Sr.	Station	Name of Diver	Frequency of	No. Of Samples			
no	Station	Name of Kiver	sampling	2014-15			
	ŀ	<b>KOLHAPUR DISTR</b>	RICT	•			
1.	Radhanagari I	Bhogawati	Monthly	12			
	SANGLI DISTRICT						
1.	Mhaisal	Krishna	Monthly	08			
2.	Shigaon	Warana	Monthly	08			
		SATARA DISTRIC	СТ				
1.	Ambwade	Yerala	Monthly	04			
2.	Bhuinj	Krishna	Monthly	08			
3.	Parli	Urmodi	Monthly	04			
4.	Rasati	Koyana	Monthly	08			
5.	Shivade	Krishna	Monthly	08			
		SOLAPUR DIS	ГІСТ				
1.	Devikavathe	Bhima	Monthly	05			
	F	ATNAGIRI DISTR	RICT				
1.	Anjanari	Kajavi	Monthly	07			
2.	Barewadi	Bav	Monthly	04			
3.	Chatav	Jagbudi	Monthly	06			
4.	Kumbharkhani	Gad	Monthly	06			
5.	Latwan	Bharaja	Monthly	04			
6.	Pastewadi	Kajavi	Monthly	06			
7.	Pawarwadi	Bhambedi	Monthly	08			
8.	Raipatan	Arjuna	Monthly	08			
	SINDHUDURGA DISTRICT						
1.	Araye	Achara	Monthly	07			
2.	Banda	Terekhol	Monthly	08			
3.	Baparde	Local Nala	Monthly	06			
4.	Belane	Gad	Monthly	08			
5.	Ghonsari-L	Devghar	Monthly	08			
6.	Kerawade	Karli	Monthly	07			
7.	Kudal	Bhansari	Monthly	08			
8.	Shirshingi	Terekhol	Monthly	07			
9.	Shivdav	Gad	Monthly	08			

#### Quality Lab Level-II, Kolhapur.

Total No. of Samples collected and analyzed during Reported Period (i.e. June 2014 to May 2015) = 181

# CHAPTER - III

# Methodology

#### Chapter - 3

#### Methodology

#### 3.1 General:

Water, is the most essential element to life on earth, for survival of all living organisms. Water on earth is present in two forms i.e. fresh water & marine water. Fortunately almost the entire country is criss-crossed by rivers. Geographical area of the state is divided in five river basins viz. Godavari. Tapi, Narmada, Krishna and west flowing rivers in Konkan region.

In the last century the water sources increasingly polluted due to industrilization,m urbnization & population explision.

#### **3.2 Aim and Objective**

The Hydrology Project goals & main objectives of water quality monitoring in Krishna basin & West Flowing River Tapi from Konkan region are -

- Establish base line quality
- Observe the trend in water quality over a period of time
- To create public awareness as regards water pollution & its prevention.
- Surveillance over pollution through to water quality.

#### **3.3 Monitoring Frequency**

Previously the frequency of sample collection for Baseline Stations was once in a month and that of trend stations was twice in a month.

There has been change in the frequency of sample collection from August 2003 given below.

Base Line : Once in a month (June to September)

Trend stations : once in a month

Flux stations : Once in month

Reservoirs : Fortnightly

#### **3.4 Sampling Details**

The water samples were collected stations from the main flowing stream of river at depth of 30 cm from the surface. The samples thus collected were transported to the laboratory within 48 hours from the time of collection.

The samples collected in this lab from Kolhapur, Sangli, Satara, Ratnagiri and Sindhudurga district.

#### **3.5 Methodology**

Analysis of Physical and Chemical parameters is done in the laboratory on the basis of Standard Analytical Methods, Instrument Operating Instructions, APHA, 21st Ed., 2005.

Data analyzed further validated with prescribed method as per Water Quality Manuals to verify various Ratios manually and is entered in SWDES Software for Water Quality Data Entry. Further the data is sent to State Data Center for further dissemination to user end.

Furthermore to get an idea of about data generated for the period it is decided and instructed to analyzed the generated data for the said period in the form of Annual report with the help of various tools in SWDES Software to find out critical parameters and critical locations in the jurisdiction of this Lab.

The Annual Report is prepared for the year 2014 - 15 in combined. The Table below shows the number of sample analyzed during the reported period. In order to study water quality status station wise, all locations covered under this lab during the year 2014 - 2015 are considered.

Sr. No.	Year	Baseline Sample	Flux Sample	Trend Sample	Dam Sample	Total
1.	2014- 15	16	12	141	12	181
Total Samples analyzed during reporting period					181	

#### TABLE SHOWING SAMPLES ANALYSED DURING THE REPORTING PERIOD

#### **3.6 Flow Chart**

The work of analysis of sample is being monitored on the basis of flow chart generated in the lab as per standard guidelines and analysis of sample is performs as per guidelines of world bank with APHA ,21 st Ed, 2005 as a standard procedures for analysis of samples.

As well refers BIS standards IS:10500 and other relevant BIS standards for analysis of various samples received from users for various purposed like Drinking, Irrigation, Ice preparation, Bathing (Swimming Tank),Construction, study and various Research & Development Activities.

#### FLOW CHART OF ANALYSIS OF HP WATER SAMPLE

Sample Collection from Sampling Source with the help of Depth Sampler

**Treatment:** D.O. Fixing, Preservation of MPN Sample, Colour, Odour Temp, pH, EC, tested of field, and fill up ID form.

At Laboratory: Inward the Sample, Giving the Sr. No. to the sample noted into sample entry register

ID form entry taken into SWEDS Software

Tests are carried out in lab as per Protocols. These tests are: Microbiological test, Chlorophyll-Temp, pH, EC, D.O., B.O.D, Ammonia, Nitrate, Nitrite, TDS, TSS, C.O.D., Turbidity, Alkalinity, Carbonate & Bicarbonate, Chloride, Fluoride, Boron, Iron, Sodium, Potassium, Total Hardness, Phosphorous, and Calcium etc.

Observations & calculations of all Analyzed Parameters are entered in the Data Sheet

The results of parameters are checked & validated

After Validation Check, all the data is entered in to Data Record and Validation Register

This data is finally entered in to SWEDS Software

Data sent to Executive Engineer, HDP Division, Nashik for further action

# Methodology For the analysis of Water Quality samples the following parameters were analyzed during the Period 2014 - 15

Sr. No	Parameters	Methodology		
1.	Colour	APHA, 21 <sup>st</sup> Ed., 2005, 2120-B, 2-2		
2.	Odour	IS 3025 (Part 5): 1983, Reaffirmed 2006		
3.	Temperature	APHA, 21 <sup>st</sup> Ed., 2005, 2550-B, 2-61		
4.	рН	APHA, 21 <sup>st</sup> Ed., 2005, 4500-H <sup>+</sup> - B, 4-90		
5.	Electric ConductivityAPHA, 21st Ed., 2005, 2510- B, 2-47			
6.	Dissolved Oxygen	IS 3025 (Part 38): 1989, Reaffirmed 2003		
7.	Turbidity	APHA, 21 <sup>st</sup> Ed., 2005, 2130-B, 2-9		
8.	Total Solids	IS 3025 (Part 15): 1984, Reaffirmed 2003, Amds.1		
9.	Dissolved Solids	IS 3025 (Part 16): 1984, Reaffirmed 2006, Ed.2.1 (1999-12)		
10.	Suspended Solids	IS 3025 (Part 17): 1984, Reaffirmed 2006, Amds.1		
11.	NH <sub>3</sub> -N	APHA, 21 <sup>st</sup> Ed., 2005, 4500-NH <sub>3</sub> F, 4-110		
12.	$NO_2^-$	APHA, 21 <sup>st</sup> Ed., 2005, 4500-NO <sub>2</sub> -B, 4-118		
13.	NO <sub>3</sub> -	APHA,21 <sup>st</sup> Ed., 2005, 4500-NO <sub>3</sub> , B -4 -120		
14.	Total Phosphorous	APHA, 21 <sup>st</sup> Ed., 2005, 4500 P, E, 4-153		
15.	Biochemical Oxygen Demand	IS 3025 (Part 44): 1993, Reaffirmed 2003, Amds.1		
16.	Chemical Oxygen Demand	APHA, 21 <sup>st</sup> Ed., 2005, 5220-B, 5-15		
17.	Potassium K <sup>+</sup>	IS 3025 (Part 45): 1993, Reaffirmed 2003, Amds.1		
18.	Sodium Na <sup>+</sup>	IS 3025 (Part 45):1993, Reaffirmed 2003, Amds.1		
19.	Calcium Ca++	APHA, 21 <sup>st</sup> Ed., 2005, 3500-B, 3-65		
20.	Magnesium Mg <sup>++</sup>	APHA, 21 <sup>st</sup> Ed., 2005, 3500-Mg, B, 3-84		
21.	Iron (as Fe)	APHA, 21 <sup>st</sup> Ed., 2005, 3111-B, 3-17		
22.	Carbonate CO <sub>3</sub>	APHA, 21 <sup>st</sup> Ed., 2005, 2320-B, 2-27, 5 -1 & 4500-CO <sub>2</sub> -D, 4-34		
23.	Bi-Carbonate H CO <sub>3</sub>	APHA, 21 <sup>st</sup> Ed., 2005, 2320-B, 2-27, 5 -3 & 4500-CO <sub>2</sub> -D, 4-34		
24.	Chloride Cl	APHA, 21 <sup>st</sup> Ed., 2005, 4500-Cl, B, 4-70		
25.	Fluoride F	APHA, 21 <sup>st</sup> Ed., 2005, 4500-F <sup>-</sup> , D, 4-85		
26.	Boron B	APHA, 21 <sup>st</sup> Ed., 2005, 4500-B-C, 4-23		

Table showing List of parameters and the methodology used for the analysis.

27.	Total Coliforms	APHA, 21 <sup>st</sup> Ed., 2005, 9221-B, 9-49
28.	Faecal Coliforms	APHA, 21 <sup>st</sup> Ed., 2005, 9221-E, 9-56
29.	Alkalinity	IS 3025 (Part 23): 1986, Reaffirmed 2003, Amds.1

#### **Annual Report**

# On Water Quality Monitoring through Water Quality Lab Level –II , Kolhapur for the Year 2014– 15

#### TABLE SHOWING SAMPLES ANALYSED DURING THE REPORTING PERIOD

Sr. No.	Year	Baseline Sample	Flux Sample	Trend Sample	Dam Sample	Total
1.	2014 - 15	16	12	141	12	181
	·		Total Samples	analyzed during r	eporting period	181

# CHAPTER - IV

# **Result & Observation**

Chapter - 4 Result & Observation



Wilcox Diagram

Table 1 -Classification of location on the basis of Wilcox technique
towards use of water for irrigation purpose

Sr.	Name of	Year	Class as per Wilcox	Recommendation			
No.	Location		technique				
		1	I. Krishna R	iver			
1.	Bhuinj	2014 - 15	C1 & S1	Water is good for Irrigation purpose.			
2.	Mhaisal	2014 - 15	C2 & S1	Water is suitable for Irrigation purpose.			
3.	Shivade	2014 - 15	C2 & S1	Water is suitable for Irrigation purpose.			
			II. Urmodi R	iver			
1.	1.Parli2014 - 15S1Unable to classify because of inadeque						
		1	III. Koyana I	River			
1.	Rasati	2014 - 15	C1 & S1	Water is good for Irrigation purpose.			
			IV. Warana	River			
1.	Shigaon	2014 - 15	C1 & S1	Water is good for Irrigation purpose.			
			V Bhima R	iver			
1.	Devikavate	2014-2015	S1	Unable to classify because of inadequate data			
			VI Yrala R	iver			
1	Ambawade	2014-2015	S1	Unable to classify because of inadequate data			

Sr. No.	Name of Location	Year	Class as per Wilcox Technique	Recommendation
VII. W	VII. West Flowing River (WFR)Konkan		kan	
1.	Araye	2014 - 15	S1	Unable to classify because of inadequate data
2.	Anjanari	2014 - 15	S1	Unable to classify because of inadequate data
3.	Banda	2014 - 15	S1	Unable to classify because of inadequate data
4.	Baparde	2014 - 15	S1	Unable to classify because of inadequate data

5.	Barewadi	2014 - 15	S1	Unable to classify because of inadequate data
6.	Belane	2014 - 15	S1	Unable to classify because of inadequate data
7.	Chatav	2014 - 15	S1	Unable to classify because of inadequate data
8.	Ghonsari – L	2014 - 15	S1	Unable to classify because of inadequate data
9.	Kerwade	2014 - 15	S1	Unable to classify because of inadequate data
10.	Kudal	2014 - 15	S1	Unable to classify because of inadequate data
11.	Kumbharkhani	2014 - 15	S1	Unable to classify because of inadequate data
12.	Latwan	2014 - 15	S1	Unable to classify because of inadequate data
13.	Pastewadi	2014 - 15	S1	Unable to classify because of inadequate data
14.	Pawarwadi	2014 - 15	S1	Unable to classify because of inadequate data
15.	Raipatan	2014 - 15	S1	Unable to classify because of inadequate data
16.	Shirshingi	2014 - 15	S1	Unable to classify because of inadequate data
17.	Shivdav	2014 - 15	S1	Unable to classify because of inadequate data
VIII. I	Dam location			
1.	Radhanagari	2014 - 15	<b>S</b> 1	Unable to classify because of inadequate data

Sr. No.	River	Year	Observation
1.	Krishna River	2014 - 15	Along the Krishna river there are 3 locations & as per above classification (table $-1$ ) it shows that Bhuinj, Mhaisal, & shivade having suitable water for irrigation purpose without any treatment.
2.	Urmodi River	2014 - 15	Only one location comes under river Urmodi that is Parali. As per above classification (table - 1) There water sample unable to classify because of inadequate data
3.	Koyana River	2014 - 15	Along the Koyana river there is 1 location namely Rasati. There water sample is good for Irrigation purpose.
4.	Warana River	2014 - 15	There is only one location such as Shigaon. There water is good for Irrigation purpose.
5.	West Flowing River Konkan	2014 - 15	Along Waste flowing river there are 17 locations and as per above (table - 1) classification it shows that Araye, Anjanari, Baparde, Barewadi, Chatav, Ghonsari – (L). Kudal, Kumbharkhani, Pawarwadi, Raipatan, Banda, Belane, Kerwade, Latwan Pastewadi, Shirshingi & Shivdav there water is unable to classify because of inadequate data.
6.	Dam Location	2014 - 15	1 locations goes under dam i. e. Radhanagari and as per above (Table - 1) classification it shows that there water is unable for classification because of inadequate data.

 Table 2 - Observation on the basis of classification of location

Table 3	- Abstract for	classification of	f water towards	Irrigation	purpose

Sr. No.	Year	Good for irrigation	Suitable for irrigation	Suitable for salt tolerant plant	Inadequate data	Total
1.	2014 - 15	03	02	0	21	26



# Data Abstract For 2014 – 15

Table – 1				KOI	LHAPUR	DISTRI	CT				
						Season					
Parameter	Unit	Monsoon				Winter			Summer		
		Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	
			S	Station : R	adhanaga	ri					
DO	mg/L	6.5	7.6	7.05	6.9	7.4	7.15	6	8.3	7.15	
BOD	mg/L	1	1.2	1.1	1	1.1	1.05	1.1	1.2	1.15	
COD	mg/L	7	8	7.5	7	9	8	6	8	7	
Total colliforms	MPN/100 ml	14	33	23.5	14	26	20	9	26	17.5	
Total Dissolved Solids	mg/L	10	17	13.5	20	28	24	18	60	39	
Table – 2	SANGLI DISTRICT										
						Season					
Parameter	Unit	Monsoon				Winter			Summer		
		Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	
				Station :	Shigaon						
DO	mg/L	5.6	7.5	6.55	5.8	7.9	6.85	6.8	7.8	7.3	
BOD	mg/L	1	1.2	1.1	1.1	1.2	1.15	1	1.4	1.2	
COD	mg/L	10	10	10	9	10	9.5	9	9	9	
Total colliforms	MPN/100 ml	800	5400	3100	2200	3500	2850	500	500	500	
Total Dissolved Solids	mg/L	24	88	56	34	62	48	62	36	49	
			-	Station :	Mhaisal				-		
DO	mg/L	5.3	7.8	6.55	5.6	8.2	6.9	7.1	8	7.55	
BOD	mg/L	1	1	1	1.1	1.2	1.15	1.2	1.3	1.25	
COD	mg/L	8	9	8.5	9	10	9.5	19	10	14.5	
Total colliforms	MPN/100 ml	840	9000	4920	1700	2400	2050	900	1300	1100	
Total Dissolved Solids	mg/L	66	199	132.5	48	98	73	86	74	80	

				SA	TARA	DISTRIC	CT					
		Season										
Parameter	Unit		Monsoon			Winter			Summer	_		
		Min	Max	Mean	Min	Max	Mean	Min	Max	Mean		
				Station	: Bhuinj							
DO	mg/L	5.6	7.6	6.6	5.5	6.7	6.1	6.1	7.5	6.8		
BOD	mg/L	1.1	1.2	1.15	1.1	1.2	1.15	1.2	1.2	1.2		
COD	mg/L	9	10	9.5	8	10	9	6	8	7		
Total colliforms	MPN/100 ml	1400	2400	1900	2400	2400	2400	900	900	900		
Total Dissolved Solids	mg/L	78	62	70	24	38	31	58	64	61		
				Station	n: Parli							
DO	mg/L	5.2	7.5	6.35	-	-	-	-	-	-		
BOD	mg/L	1.1	1.4	1.25	-	-	-	-	-	-		
COD	mg/L	8	9	8.5	-	-	-	-	-	-		
Total colliforms	MPN/100 ml	390	3000	1695	-	-	-	-	-	-		
Total Dissolved Solids	mg/L	84	30	57	-	-	-	-	-	-		
				Station:	Shivade	•	L	•		•		
DO	mg/L	5.5	6.5	6	5.6	6.1	5.85	6.7	7.7	7.2		
BOD	mg/L	1.1	1.2	1.15	1	1.2	1.1	1.2	1.1	1.15		
COD	mg/L	8	9	8.5	9	10	9.5	8	10	9		
Total colliforms	MPN/100 ml	630	1400	1015	2100	2800	2450	1300	2800	2050		
Total Dissolved Solids	mg/L	44	144	94	30	36	33	52	62	57		
				Station	: Rasati							
DO	mg/L	5.6	8	6.8	6.9	7.4	7.15	6.4	8	7.2		
BOD	mg/L	1	1.1	1.05	1	1	1	1.1	1.3	1.2		
COD	mg/L	8	8	8	7	9	8	9	9	9		
Total colliforms	MPN/100 ml	480	2200	1340	2200	2400	2300	300	1700	1000		
Total Dissolved	mg/L	24	74	49	14	38	26	46	94	70		

				Station : A	Ambawade	2				
DO	mg/L	I	-	I	-	-	-	I	-	-
BOD	mg/L	-	-	-	-	-	-	-	-	-
COD	mg/L	-	-	-	-	-	-	-	-	-
Total colliforms	MPN/100 ml	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	-	-	-	-	-	-	-	-	-

Table – 4				RAT	NAGIRI E	DISTRICT				
						Season				
Parameter	Unit		Monsoon			Winter			Summer	
		Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
				Station :	Latwan					
DO	mg/L	5.9	7.8	6.85	-	-	-	-	-	-
BOD	mg/L	1.2	1.2	1.2	-	-	-	-	-	-
COD	mg/L	8	10	9	-	-	-	-	-	-
Total colliforms	MPN/100 ml	3500	9000	6250	-	-	-	-	-	-
Total Dissolved Solids	mg/L	25	36	30.5	-	-	-	-	-	-
				Station :	Chatav					
DO	mg/L	6.1	6.7	6.4	6.9	7.2	7.05	6.2	7.1	6.65
BOD	mg/L	1.1	1.2	1.15	1	1.1	1.05	1.2	1.2	1.2
COD	mg/L	9	10	9.5	7	8	7.5	9	9	9
Total colliforms	MPN/100 ml	2100	9000	5550	2200	5000	3600	2800	3500	3150
Total Dissolved Solids	mg/L	18	24	21	22	24	23	22	56	39
			Sta	ation : K	umbharkh	ani				
DO	mg/L	6.2	6.3	6.25	7.3	7.6	7.45	5.2	6	5.6
BOD	mg/L	1	1.1	1.05	1	1.2	1.1	1	1	1
COD	mg/L	7	10	8.5	9	9	9	8	8	8
Total colliforms	MPN/100 ml	2200	1600	1900	1700	3000	2350	2800	2800	2800
Total Dissolved Solids	mg/L	10	34	22	18	22	20	24	66	45

				Station :	Pastewadi	i				
DO	mg/L	7.2	6.6	6.9	7.5	9.1	8.3	-	-	-
BOD	mg/L	1	1.2	1.1	1	1.2	1.1	-	-	-
COD	mg/L	8	9	8.5	8	8	8	-	-	-
Total colliforms	MPN/100 ml	1500	5000	3250	2800	3000	2900	-	-	-
Total Dissolved Solids	mg/L	16	26	21	14	28	21	-	-	-
	1			Station :	Raipatan					
DO	mg/L	6.7	7.1	6.9	6.8	8.9	7.85	7.3	7.9	7.6
BOD	mg/L	1	1.2	1.1	1.1	1.2	1.15	1.2	1.2	1.2
COD	mg/L	7	9	8	7	8	7.5	9	9	9
Total colliforms	MPN/100 ml	840	2400	1620	1100	1700	1400	1100	1400	1250
Total Dissolved Solids	mg/L	23	32	27.5	10	30	20	32	58	45
	-11			Station :	Pawarwad	i				
DO	mg/L	6.5	7.6	7.05	7.1	7.4	7.25	6.5	8	7.25
BOD	mg/L	1.1	1.2	1.15	1.2	1.2	1.2	1.2	1.3	1.25
COD	mg/L	8	8	8	9	9	9	7	9	8
Total colliforms	MPN/100 ml	3500	1500	2500	2600	3000	2800	1300	1700	1500
Total Dissolved Solids	mg/L	28	24	26	10	14	12	20	56	38
				Station :	Anjanari					
DO	mg/L	5.6	6.5	6.05	6.8	7.1	6.95	5.9	6.1	6
BOD	mg/L	1	1.1	1.05	1.1	1.2	1.15	1	1.1	1.05
COD	mg/L	8	8	8	8	8	8	8	9	8.5
Total colliforms	MPN/100 ml	2700	5000	3850	2200	5000	3600	1100	1400	1250
Total Dissolved Solids	mg/L	14	34	24	28	34	31	24	62	43
				Station :	Barewadi					
DO	mg/L	5.4	7.2	6.3	-	-	-	-	-	-
BOD	mg/L	1.1	1.2	1.15	-	_	-	-		-
COD	mg/L	8	10	9	-	-	-	-	-	-
Total colliforms	MPN/100 ml	1700	4300	3000	-	-	-	-	-	-
Total Dissolved Solids	mg/L	20	38	29	-	-	-	-	-	-

Table – 5			SI	NDHUDU	JRGA D	ISTRICT				
						Season				
Parameter	Unit		Monsoon			Winter			Summer	
		Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
				Station :	Shirshing	i				
DO	mg/L	5.4	6.8	6.1	6.9	7.9	7.4	6.9	6.9	6.9
BOD	mg/L	1	1.2	1.1	1	1.2	1.1	1.1	1.1	1.1
COD	mg/L	8	10	9	7	8	7.5	9	9	9
Total colliforms	MPN/100 ml	1700	5400	3550	1700	2400	2050	1700	1700	1700
Total Dissolved Solids	mg/L	10	24	17	8	32	20	42	42	42
301103				Station :	Kerwade					
DO	mg/L	4.6	5.3	4.95	6.4	7.3	6.85	7.1	7.1	7.1
BOD	mg/L	1	1	1	1	1.1	1.05	1.1	1.1	1.1
COD	mg/L	7	9	8	8	8	8	8	8	8
Total colliforms	MPN/100 ml	2100	3500	2800	2400	2800	2600	1100	1100	1100
Total Dissolved Solids	mg/L	11	34	22.5	26	38	32	34	34	34
				Station :	Shivdav					
DO	mg/L	6.8	7.1	6.95	6.7	6.9	6.8	6	7.2	6.6
BOD	mg/L	1	1.1	1.05	1	1.2	1.1	1	1	1
COD	mg/L	7	9	8	8	9	8.5	8	9	8.5
Total colliforms	MPN/100 ml	2100	5000	3550	1400	2400	1900	1700	1700	1700
Total Dissolved Solids	mg/L	14	62	38	12	42	27	24	44	34
				Station : C	Ghonsari- I	L				
DO	mg/L	5.5	7	6.25	6.3	7.3	6.8	5.8	9.8	7.8
BOD	mg/L	1	1.1	1.05	1.1	1.2	1.15	1.1	1.1	1.1
COD	mg/L	8	10	9	9	10	9.5	8	9	8.5
Total colliforms	MPN/100 ml	2800	9000	5900	1700	2400	2050	1400	1400	1400
Total Dissolved Solids	mg/L	7	26	16.5	24	16	20	42	38	40

Station : Banda										
DO	mg/L	5	7.2	6.1	6.7	7.2	6.95	6.7	7.6	7.15
BOD	mg/L	1.1	1.2	1.15	1.1	1.1	1.1	1.2	1.2	1.2
COD	mg/L	8	10	9	9	10	9.5	7	8	7.5
Total colliforms	MPN/100 ml	2800	5400	4100	2400	3000	2700	800	1300	1050
Total Dissolved Solids	mg/L	16	36	26	14	36	25	42	44	43
				Station	: Kudal			1		
DO	mg/L	5.6	6.9	6.25	6.3	7	6.65	6.6	8.7	7.65
BOD	mg/L	1	1.2	1.1	1.1	1.2	1.15	1	1.3	1.15
COD	mg/L	8	10	9	8	10	9	7	8	7.5
Total colliforms	MPN/100 ml	940	16000	8470	1100	2100	1600	260	2200	1230
Total Dissolved Solids	mg/L	17	26	21.5	22	44	33	54	70	62
Station : Belane										
DO	mg/L	6.1	7	6.55	6.1	6.3	6.2	5.8	6.9	6.35
BOD	mg/L	1	1.2	1.1	1	1.2	1.1	1	1.2	1.1
COD	mg/L	7	8	7.5	7	9	8	8	9	8.5
Total colliforms	mPN/100 ml	700	5400	3050	1400	2800	2100	2300	2400	2350
Total Dissolved Solids	mg/L	26	43	34.5	20	52	36	22	24	23
				Station	: Araye					
DO	mg/L	6.5	7.8	7.15	6.2	7.2	6.7	6.1	7.1	6.6
BOD	mg/L	1	1.2	1.1	1	1.2	1.1	1.1	1.2	1.15
COD	mg/L	8	10	9	8	9	8.5	9	10	9.5
Total colliforms	MPN/100 ml	940	2800	1870	2200	2800	2500	2100	2400	2250
Total Dissolved Solids	mg/L	12	36	24	20	20	20	32	62	47
Station : Baparde										
DO	mg/L	6.3	6.5	6.4	6.4	6.5	6.45	6	8.7	7.35
BOD	mg/L	1	1.2	1.1	1	1.1	1.05	1.1	1.2	1.15
Total	mg/L MPN/100 ml	400	3500	9 1950	8 1700	3500	8.5 2600	8 2100	9 2200	8.5 2150
Total Dissolved Solids	mg/L	12	50	31	22	32	27	20	66	43

Table – 6	SOLAPUR DISTRICT									
	Season									
Parameter	Unit		Monsoon Winter				Summer			
		Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Station : Devikavate										
DO	mg/L	8.4	9.7	9.05	4.5	6.4	5.45	-	-	-
BOD	mg/L	1.1	1.4	1.25	1.3	1.4	1.35	-	-	-
COD	mg/L	9	10	9.5	10	10	10	-	-	-
Total coliforms	MPN/100 ml	580	1400	990	260	330	295	-	-	-
Total Dissolved Solids	mg/L	31	110	70.5	36	56	46	-	-	-

#### PART I: RESULT OBTAINED DURING 2014-2015

#### A) Dissolved Oxygen

#### 1) Kolhapur District



From the above graph it is observed that DO level of Radhanagari is within tolerance limit during all the seasons.

#### **Graphical Representation for Dissolved Oxygen** 7.8 7.6 7.4 7.2 7 6.8 Mansoon Winter 6.6 Summer 6.4 6.2 Tolerance 6 Limit Shigaon Mhaisal >5 mg /L

#### 2) Sangli District

From the above graph it is observed that DO level of all the stations is within limit.

#### 3) Satara District



From the above graph it is observed that DO level of all the stations is within limit.



#### 4) Ratnagiri District

From the above graph it is observed that DO level of all the stations is within limit.

#### 5) Sindhudurga District



From the above graph it is observed that DO level of all the stations is within limit.



#### 6) Solapur District

From the above graph it is observed that DO level of Devikavathe stations is exceed the limit during monsoon & winter.

#### **B) Bio-Chemical Oxygen Demand**

#### 1) Kolhapur District



From the above graph it is observed that BOD level of Radhanagari station is within limit.



#### 2) Sangli District

From the above graph it is observed that BOD level is within desirable limit for all the stations.

#### 3) Satara District



From the above graph it is observed that BOD level is within desirable limit for all the stations.



#### 4) Ratnagiri District

From the above graph it is observed that BOD level is within desirable limit for all the stations.

#### 5) Sindhudurga District



From the above graph it is observed that BOD level is within desirable limit for all the stations.



#### 6) Solapur District

From the above graph it is observed that BOD level is within desirable limit for all the stations.

#### **C) Chemical Oxygen Demand**

#### 1) Kolhapur District



From the above graph it is observed that Radhanagari station shows COD level between 6 to 9 mg/L.



#### 2) Sangli District

From the above graph it is observed that COD level of all station are shows 8 to 10mg/L in all seasons.

#### 3) Satara District



From the above graph it is observed that COD level of all station goes up to 9 mg/L during all season.



#### 4) Ratnagiri District

From the above graph it is observed that COD level of all station goes up to 7 to 10 mg/L in all seasons.

#### 5) Sindhudurga District



From the above graph it is observed that COD level of all station goes up to 7 to 9 mg/L during all season.



## 6) Solapur District

From the above graph it is observed that COD level of all station shows high during all seasons.

### **D) Total Coliforms (TC)**

#### 1) Kolhapur District



From the above graph it is observed that Radhanagari station shows high bacterial count i.e. above the tolerance limit during all seasons.



#### 2) Sangli District

From the above graph it is observed that, Total coliform count of all station is high than tolerance limit during all seasons.

#### 3) Satara District



From the above graph it is observed that, Total coliform count of all station is high than tolerance limit during all seasons.



#### 4) Ratnagiri District

From the above graph it is observed that, Total coliform count of all station is high than tolerance limit during all seasons.

#### 5) Sindhudurga District



From the above graph it is observed that, Total coliform count of all station is high than tolerance limit during all seasons.

#### 6) Solapur District



From the above graph it is observed that, Total coliform count of all station is high than tolerance limit during all seasons.

#### **E) Total Dissolved Solids (TDS)**

#### 1) Kolhapur District



From the above graph it is observed that, TDS level of Radhanagari station is within desirable limit during all seasons.



Mansoon

Winter

Summer

Limit 500mg/L

#### 2) Sangli District

0

From the above graph it is observed that, TDS level of all the station is within desirable limit during all the seasons.

Mhaisal

Shigaon

#### 3) Satara District



From the above graph it is observed that, TDS level of all the station is within desirable limit during all the seasons.



#### 4) Ratnagiri District

From the above graph it is observed that, TDS level of all the station is within desirable limit during all the seasons.

#### 5) Sindhudurga District



#### . . . . .



From the above graph it is observed that, TDS level of all the station is within desirable limit during all the seasons.

# CHAPTER – V

Conclusion

### Chapter - 5

### Conclusion

#### **CONCLUSION FOR 2014–15**

Many water quality parameters are used to reflect the impact of various impurities on selected water uses, as well as to quantify the extend of such impact of. Such water quality parameters may be either physical, chemical or biological.

From the previous chapter we concluded that, bacterial count of Ratnagiri district is very high than other stations during all season. This is an indicator of high organic pollution in the river body. Due to the human activity & release of industrial effluent in a river basins, it is very serious problem which dealing with this sites.

The Concentration of coliform bacteria of both faecal & non- faecal origin was found very high. This is a strong indicator of both urban pollution & discharge of city sewage in the water body.

Thus the water is not suitable for drinking purposes without any conventional treatment & disinfection.

#### **REMEDIAL MEASURS**

- ▶ For Industrial effluent & sewage water give treatment before discharge into river body.
- ▶ Use of such water for salt tolerance crop is recommended based on special study.
- Avoid human activities like cattle washing, bathing etc. in river basins.
- Awareness in local people about river water pollution.
- Classification of source may be as per use of water for irrigation based on Sodium Absorption Ratio, Percent Sodium, and Residual Sodium Carbonate.

# CHAPTER – VI

# **Other Activities**

### Chapter - 6

### **Other Activities**

#### 6.1 REVENUE GENERATION TO GOVERNMENT OF MAHARASHTRA

Apart from monitoring of water quality network for Water Quality lab level II at Kolhapur, the infrastructure facility is made available to the users from various Government, Non-Government, as well as individuals.

The revenue collected in this lab during the water year 2014-2015 is as follows.

Sr. No	Month	Amount		
1.	June	6396/-		
2.	July	16,947/-		
3.	August	12,722/-		
4.	September	35,100/-		
5.	October	10,825/-		
6.	November	5697/-		
7.	December	26,785/-		
8.	January	20,097/-		
9.	February	30,625/-		
10.	March	16,570/-		
11.	April	29,356/-		
12.	12. May			
	Total Amount	2,26,144/-		

#### **Graphical Representation for Revenue Collection**



# CHAPTER – VII

# Annexure

# List Of Cilent 2014-2015

Sr.	Name Of Client	Purpose		
No.		i uipose		
1.	Kolhapur Irrigation Division, Kolhapur	Irrigation Purpose		
2.	Podar International School Kolhapur	Drinking Purpose		
3.	Hotel Pnchawati, Kolhapur	Drinking Purpose		
4.	Dudhaganga Canal Dv. No. 1, Kolhapur	Drinking & Irrigation Purpose		
5.	Mr. Sanjay Maruti Rajmane, Sontali, Kolhapur	Drinking Purpose		
6.	Menon Piston Pvt. Ltd. Shiroli MIDC, Kolhapur	Drinking Purpose		
7.	Aadhar Nursing Home Kolhapur	Drinking Purpose		
8.	Ichalkaranji Nagarparishad (STP)	Industrial Purpose		
9.	Prof. Ravindr Maruti Garud Ichalkaraji	Study Purpose		
10.	Mr. Mete Kuldeep D. Shivaji University, Kolhapur	Study Purpose		
11.	Mr. Rushikesh S. Patil Shivaji University Kolhapur	Study Purpose		
12.	Power Grid Corporation Of India Ltd. Kalamba,	Drinking Purpose		
13.	Ghatage Patil Industries Ltd. Kagal MIDC	Drinking Purpose		
14.	Ghatage Patil Industries Ltd. Unchgaon Kolhapur	Industrial Purpose		
15.	Mr. U.G. Kulkarni Kolhapur	Drinking Purpose		
16.	Panhala Public School, Panhala	Drinking Purpose		
17.	Apple Sarswati Multispeciality Hospital Kadamwadi	Drinking Purpose		
18.	Hotel Atriya Kolhapur	Industrial Purpose		
19.	Indus Ferrotech Ltd. Five star MIDC Kagal.	Industrial Purpose		
20.	Shri Datt S.S.K. Ltd. Unit Of Dalmiya Asurle Porle.	Drinking Purpose		
21.	Sayaji Hotel Kolhapur	Drinking Purpose		
22.	Ashokrao Mane Pharmacy College, Vathar	Drinking Purpose		
23.	Menon & Menon Pvt. Ltd. Kagal MIDC	Drinking Purpose		
24.	Mr. Satish Patil Kasaba Bawada, Kolhapur.	Drinking Purpose		

25.	Mr. Raviraj Powar Kolhapur.	Industrial Purpose
26.	Mehata Dairy Kolhapur	Industrial Purpose
27.	Mr. Suraykant V. Patil Panchgaon	Drinking Purpose
28.	Yeshwantrao Chavan College Warnanagar	Study Purpose
29.	Raymond Luxry Cotton Pvt. Ltd. Kagal.	Industrial Purpose
.30.	Mr. Abhishek Patil Kolhapur	Drinking Purpose

# **Quality Policy**

We at Water Quality Lab – Level II are committed to provide services for all interested parties as per their need & expectations to achieve total customer satisfaction.

This shall be achieved through continual improvement in all process and service quality with the help of implementation of QMS as per the ISO 9001 : 2008

(Er. S.D. Raval ) Executive Engineer Hydrology Project Division, Pune

Management ensures that the Quality Policy :

- a) Is appropriate to the purpose of the organization,
- b) Includes a commitment to comply with requirements and continually improve the effectiveness of the Quality Management System,
- c) Provides a framework for establishing and reviewing Quality Objectives,
- d) Is communicated through display and understood within the organization, and
- e) Is reviewed in each MRM for continuing suitability.



# CERTIFICATE

The Certification Body of TÜV SÜD South Asia Private Limited

certifies that

Water Quality Lab.Level-II Opp. Shivaji University, Near Rajaram Tank, Kolhapur – 416 006, INDIA

has implemented a Quality Management System

in accordance with ISO 9001:2008

For Scope of

Services for Water Testing & River Water Monitoring for Water Quality

The certificate is valid From 2015-09-22 until 2018-09-21 Subject to successful completion of follow up audit before 2016-06-06 The present status of this Certificate can be obtained on <u>www.tuv-sud in</u> Further clarifications regarding the scope of this certificate may be obtained by consulting the certification body

Certificate Registration No. 99 100 11168

Date of Initial certification : 2009-09-22

bon's F

Certification Body of TÜV SÜD South Asia Private Limited, Mumbal Member of TÜV SÜD Group



TOV

TÜV SÜD South Asia Pvt. Ltd. • TÜV SÜD House • Saki Naka • Andheri (East) • Mumbai – 400072 • Maharashtra • India

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書

◆ CEPTNΦNKAT ◆ CERTIFICAD0 ◆ CERTIFICAT

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