

Government of Maharashtra

WATER RESOURCES DEPARTMENT



WATER YEAR BOOK 2017



DATA ANALYSIS CIRCLE NASHIK

HYDROMETEOROLOGICAL DATA PROCESSING DIVISION, NASHIK

CHIEF ENGINEER, PLANNING & HYDROLOGY (SW), NASHIK

JALVIDNYAN BHAVAN, CDO-MERI Campus, Dindori Raod, Nashik – 422 004 (INDIA). Tel. 0253-2532964 E-Mail: <u>cehp.nashikwrd@maharashtra.gov.in</u>, <u>eehdpd.nashikwrd@maharashtra.gov.in</u>, Web: <u>www.mahahp.gov.in</u>



CHIEF ENGINEER PLANNING & HYDROLOGY (SW) WATER RESOURCES DEPARTMENT GOVERNMENT OF MAHARASHTRA



Shri. M.A. Matey

FOREWORD

Water plays crucial role as a basic, life sustaining resource, as a source of irrigation for agriculture, drinking water, sanitation and industrial uses. Water is vital for agriculture development and in turn food grain production. The utilization of this resource has increased manifold, to meet the demands of the growing population and an expanding economy. The increasing demand for water from all sections of society has put the supply system in a stressful situation. This necessitates the need for understanding the facts about Water Availability , its use by different groups and evolving optimized solutions on equitable basis so that everybody is given his/her due share.

The information on rainfall, river discharges and meteorological parameters as well as on surface water quality plays vital role in deriving sustainable solution to the water related problems.

This document of Water Year Book is a sample of what kind of Hydrometeorological data available with the state data storage center (SDSC), Nashik. End users who are interested in getting detailed data of a particular parameter, in a particular area, can become HDUG member and obtain the data as per prescribed procedure. Hydrometeorological data processing division (HDPD) has prepared this Water Year Book which is the backbone of validation and hence play a great role in making available the factual data. I appreciate and would like to put on record the efforts taken by Mr. R.B.Kshirsagar Superintending Engineer, Data Analysis Circle, Nashik, Mr. A.A.Dabhade, Superintending Engineer, Data Collection, Planning & Hydrology Circle, Nashik, and Mr. A.A.Pandit, Executive Engineer, HDPD and his team for bringing out this water year book.

(Shri. M.A.Matey)



SUPERINTENDING ENGINEER DATA ANALYSIS CIRCLE NASHIK

SUPERINTENDING ENGINEER DATA COLLECTION PLANNING AND HYDROLOGY CIRCLE NASHIK



Shri. R.B. Kshirsagar

Shri. A.A. Dabhade

PREFACE

This water year book comprises the information regarding Water Quality & Hydrometeorological field data collection through the Network stations established under WB aided Hydrology Project, which is ready for dissemination at State Data Storage Center Nashik to the users. An accurate HIS information is being disseminated to the users after complete processing and validation by trained Hydrologists of the processing as well as storage centers of the state.

An accurate HIS information is developed as a result of strict implementation of the standardized protocols for various HIS activities such as station set up, staffing plan, HIS job descriptions, field data collection O&M of network stations.

The hydrologists & Experts staffs are working with full enthusiasm & zeal for timely data dissemination to the users. It is worthwhile to note here "Efforts taken by, S.K.Kasar SDE, A.L.Vispute SDO, A.B.Bharamgunde, SDO, A.P.Khairnar SO, V.R.Junnare AE-II, S.P.Joshi Sect. Engr, R.D.Anjikhane JE, D.S.Rapatwar JE, A.B.Gound JE, S.N. Band JE., which resulted into preparation of excellent Water Year Book of Hydrology Project for year 2017."

(Shri. R.B.Kshirsagar)

(Shri. A.A.Dabhade)

INDEX

Sr. No.	Description	Page No.
1	Introduction	1
2	Hydrology review	3
3	Review of Maximum and Minimum Temperature	14
4	Review of Evaporation	20
5	Discharges at Gauge Discharge Site for various basins in Maharashtra & Line diagram	24
6	Interpretation Of Various Statistics presented in the Water Yearbook	44
7	Water quality Monitoring	45
8	Data Dissemination	50
9	Annexure A - Data Request form	53
10	Annexure B – Sample Outputs- Rainfall Data	54
11	Annexure C – Sample Outputs- Climatic Data	55

1.

INTRODUCTION

Water plays crucial role in the socio-economic development of the country. Safe drinking water is required for very large and growing population. Water has also become a major constraining factor for the growth of the agricultural and industrial sectors. In contrast, frequent flooding threatens populations and civil structures.

The Hydrological Information System provides information about Hydrological and Hydro meteorological parameters that vary with respect to time and space. The information is useful to the decision/policy makers, designers and researchers.

Earlier, Water Resources Department (GOM) was collecting the Hydrometeorological Data and was recording manually in the form of registers for the use of Water Resources Department only. In 1995 National Hydrology Project was established in collaboration with Ministry of Water Resources, Government of India, CWC, CGWB, National Institute of Hydrology (Roorkee), CWPRS (Pune), CPCB, India Meteorological Department, with nine states i.e. Maharashtra, Orissa, Tamilnadu, Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Gujrat, Karnataka & Kerala to develop sustainable HIS with following characteristics.

- Demand driven i.e. output is as per the users needs.
- Use of standardized equipments and adequate procedures for data Collection and processing.
- Computerized, comprehensive and easily accessible database.
- Proper infrastructure to ensure sustainability.

Under this Project since 1995, Hydrology Project (SW) Water Resources Department, Maharashtra State has started to collect the data on these lines and entering it in electronic mode. Stage discharge data is measured on GD stations. Hourly & Daily rainfall is measured on ARG & SRG stations respectively. On FCS station climatic parameters namely minimum & maximum temperature, dry & wet bulb temperature, humidity, pan evaporation, wind direction & wind velocity, pan water temperature, sunshine duration are measured. On water quality sampling stations water samples are collected and tested in the laboratory for turbidly, BOD, COD, PH etc. All these data is observed either daily, twice daily or hourly.

Three softwares are used for data entry, validation and data dissemination.

1. SWDES (Surface Water Data Entry System) for data entry and primary validation

2. HYMOS (Hydrological Modeling System) for secondary validation

3. WISDOM (Water Information System Data Online Management) for data storage and dissemination

The finally validated data is then given to Hydrological Data Users Group (HDUG) members online/ offline with nominal cost.

The idea of preparing and publishing water year book is to communicate the intended data users, the kind of meteorological and hydrological scenario in the basins of the state during the hydrological year under consideration. The intended users can have this data from data bank as per the procedure laid down. Analysis of data is illustrated basin wise and basin is the unit for presentation of this data for Maharashtra State.

This water year book contains following information of the Maharashtra State.

- 1. Extreme rainfall events
- 2. District wise average rainfall.
- 3. Basin wise annual Isohyets.
- 4. Extreme temperature events.
- 5. Basin wise monthly average evaporation.
- 6. Discharges at Gauge Discharge sites.

HYDROLOGICAL REVIEW

2.1 Basins of Maharashtra and network:

There are five river basins in Maharashtra namely Godavari, Krishna, Tapi, Narmada and West Flowing Rivers. However length & spread of Godavari basin is much more, it is divided into two parts in Maharashtra as Upper Godavari basin up to Nanded district & Lower Godavari covering Vidarbha districts up to boundary of Maharashtra state for convenience of administration & operation purpose. For year 2017, Rainfall and GD data is not available for Upper Godavari basin due to some technical errors. Hence, Upper Godavari basin is not considered for Rainfall and GD data analysis. However, Temperature and Evaporation analysis is performed for Upper Godavari Basin.



Fig 2.1 Map showing Major River Basins in Maharashtra

Table 2.1 Network of Hydrology	<pre>/ Project (SW)</pre>	Maharashtra
--------------------------------	---------------------------	-------------

S. N.	Name o	ARG	SRG	FCS	GD	
1	Godavari	Upper Godavari	35	181	34	42
	Lower Godavari	120	89	34	55	
2	Тарі		40	48	14	42
3	Narmada		-	3	-	-
4	Krishna		31	128	45	55
5	West Flowing	Rivers	114	192	26	70
	Total		340	641	153	264

2.

2.2 Maximum Rainfall in Basins:

After analyzing the daily rainfall data, it is observed that the maximum daily rainfall varies from basin to basin. Also it is observed that the maximum daily rainfall is not occurring on same station. It varies with respect to the location and period. It is also observed that yearly maximum rainfall and maximum daily rainfall may or may not occur on the same station. The comparison is shown in the table given below.

Table 2.2 Comparison of	Annual Maximum	Rainfall and	Maximum Daily
Rainfall for y	year 2017		-

Sr.	Bacin	Maximum	Daily rainfall in	n mm	Annual Maximum Rainfall in mm			
No.	Dasin	Station	Dist/ Tal	Dist/ Tal Rainfall		Dist/ Tal	Rainfall	
1	Lower Godavari	Gosekhurd	Bhandara/ Pauni	275.6	Gondiya	Gothangaon Bori/Arjuni - Morgaon	1687	
2	Krishna	kitwade	Kolhapur/ Ajara	409	kitwade	Kolhapur/ Ajara	6417.70	
3	Narmada	Dab	Nandurbar/ Shahada	110	Dab	Nandurbar/ Shahada	1453.6	
4	Тарі	Malkatar	Dhule/ Shirpur	146	Rahu	Amravati/ Chikhaldara	1660	
5	West Flowing Rivers (Konkan)	Payarpada	Palghar	384.4	Amboli	Sindudurg	7136.09	

Fig 2.2: Graph of Basin wise maximum Daily Rainfall in mm for Year 2017.





Fig 2.3: Graph of Basin wise Annual maximum Rainfall in mm for Year 2017.

Table 2.3 Following table shows comparison of average annual rainfall for various basins

Sr.	Name of Pasin	Average Rainfall in mm
No	Name of Basin	Year
		2017
1	Lower Godavari	803.16
2	Krishna	1537.66
3	Narmada	774.96
4	Тарі	612.85
5	West Flowing Rivers (Konkan)	3579.68

Fig 2.4: Graph of Basin wise Average Annual Rainfall in mm for Year 2017.



.

2.3 District wise yearly average rainfall:

District wise yearly average rainfall for year 2017 over Maharashtra is shown in following table. Maximum average rainfall occurred at Sindhudurga district for year 2017. Minimum average rainfall occurred at Washim district for year 2017. (**Note**: Disctricts in Upper Godavari basin are not considered. Reason for the same is as mentioned in 2.1)

Sr. No.	Name of Region	Name of District	Average Rainfall in mm (Year 2017)
1	Konkan	Thane	3212.17
2		Palghar	3503.86
3		Raigad	3629.44
4		Ratnagiri	3325.47
5		Sindhudurga	3914.26
6	Nashik	Dhule	420.01
7		Nandurbar	586.56
8		Jalgaon	616.50
9		Ahemadnagar	803.75
10	Pune	Pune	1527.73
11		Satara	1323.91
12		Sangli	650.77
13		Solapur	691.81
14		Kolhapur	2278.01
15	Amravati	Buldhana	661.82
16		Akola	586.22
17		Washim	363.98
18		Amarawati	771.27
19		Yavatmal	548.83
20	Nagpur	Wardha	887.9
21		Nagpur	914.9
22		Bhandara	849.2
23		Gondia	756.4
24		Chandrapur	669.6
25		Gadchiroli	1042

Table 2.4: District wise average Rainfall for year 2017

Fig 2.5: Graph of District wise Average Annual Rainfall in mm for Year 2017.



Sr. No.	Name of District	Rainfall in mm Year 2017
1	Solapur	691.81
2	Chandrapur	669.6
3	Buldhana	661.82
4	Sangli	650.77
5	Jalgaon	616.5
6	Nandurbar	586.56
7	Akola	586.22
8	Dhule	420.01

Table 2.5:Rainfall in scarcity zone for year 2017:

Comparison of Rainfall in scarcity zone i.e. rainfall < 750mm shows that in year 2017, 8 districts were in scarcity zone.

2.4 Basin wise Number of rainy days in month: - Following table shows average number of rainy days in month for year 2017. Months of June to October are considered. IMD criteria which states that, "a day with a rain amount of 2.5 mm or more is considered as a rainy day" is applied to calculate rainy days.

Table 2.6: Comparison of Monthly average rainy days in various basins inMaharashtra of 2017

Name of	Montl	hly ave	erage r	ainy da	Max Painy Days in Month	
Basin	June	July	Aug.	Sept.	Oct	Max Kally Days III Molitii
West Flowing Rivers South of Tapi (Konkan)	14	22	20	12	7	31 days in july & August at Amboli, Bhave, Chouk, Digawale, Dodamarg, Golwan, Gulvane, Harcheri, Hardkhala, Het, Kalamb, Kamarli, Kankawali, Kharepathan, Kolthare,Kothere, Mahan, Naldhe, Nardave Palsamb, Phondaghat, Poynar, Savantwadi, Shirgaon, Shirshingi, Suksale, Suryamal, Tarandale,Turai, Varandoli, Virdi, Waki, Walawal.
Lower Godavari	8	14	10	7	3	20 Days in July at Chavela, Deori and Petta
Krishna	12	18	14	13	8	31 days in july & August at Whiram,Radhanagari,Revechiwadi
Тарі	7	11	8	7	4	24 days in july at Tarubanda
Narmada	4	19	12	2	0	21 days in july at Dab

2.5 Basin wise annual rainfall:

Following figures shows isohytal maps of basins in Maharashtra for year 2017.



Fig. No. 2.6 : Isohytes of tapi Basin for year 2017









3.

Review of Maximum Minimum Temperature

Following table shows daily maximum & minimum temperature for various basins for period 2008 to 2017.

Sr.no.	Year	Max Temp ^o c	Name of station	Min Temp ⁰ c	Name of station
1	2008	47.3	Lakhandur	1.0	Kamtikhairi
2	2009	48.8	Lakhandur	0.9	Bori
3	2010	50.0	Lakhandur	3.5	Mathani
4	2011	48.0	Bhamragad	2.0	Warudbagaji
5	2012	48.6	Bhamragad	2.4	Warudbagaji
6	2013	48.0	Bori	4.4	Warudbagaji
7	2014	47.5	Gosekhurda	5.1	Kamtikhairi
8	2015	47.5	Hinganghat	1.0	Armori
9	2016	47	Wagholibutti	1.0	Armori
10	2017	48.8	Bhimkund	6.0	Kamtikhairi

Fable 3.1: Daily maximum & minin	mum temperature for Lower Godava	ri Basin
----------------------------------	----------------------------------	----------

Fig3.1: Yearly Graph of Daily maximum temperature for Lower Godavari Basin







Sr.no.	Year	Max Temp ⁰c	Name of station	Min Temp ⁰c	Name of station
1	2008	46.5	Bhusaval	3.2	Jamner
2	2009	47	Bhusaval,Aurangpur, Belval, Padalse	3.5	Manasgaon
3	2010	48	Bhusaval	2.5	Aurangpur
4	2011	47	Bhusaval	2.0	Furdapur, Padalse, Shirla, Aurangpur
5	2012	46	Bhusaval	2.0	Furdapur
6	2013	47	Khariya	2.0	Padalse
7	2014	46.5	Khariya& Aurangpur	2.0	Belval
8	2015	47	Dhule	2.5	Jamner
9	2016	48	Bhusawal	3.0	Fardapur, Jamner
10	2017	47	Khariya	2.0	Malegaon Girna

Table 3.2: Daily maximum & minimum temperature for Tapi Basin

Fig 3.3: Yearly Graph of Daily maximum temperature for Tapi Basin



Fig 3.4: Yearly Graph of Daily minimum temperature for Tapi Basin



 Table 3.3: Daily maximum & minimum temperature for West Flowing River

 Basin

Sr.no.	Year	Max Temp ⁰c	Name of station	Min Temp ⁰c	Name of station
1	2008	48.5	Parali	4.5	Alman
2	2009	45.2	Suksale	2.0	Suksale
3	2010	45.3	Suksale	8.3	Suksale
4	2011	43.5	Suksale	6.2	Suksale
5	2012	43	Awlegaon, Bhatsanagar, Karak,Suksale	1.5	Suksale
6	2013	44	Karak	6.2	Suksale
7	2014	45	Karak	10.0	Bhatsanagar
8	2015	46	Pawarwadi	7	Raipatan
9	2016	45	Karak	8	Pawarwadi, Raipatan
10	2017	42	Ghonsari(L)	7.5	Raipatan

Fig 3.5: Graph of Daily maximum temperature for West Flowing River Basin



Fig 3.6: Graph of Daily minimum temperature for West Flowing River Basin



Sr.no.	Year	Max Temp ^o c	Name of station	Min Temp ^o c	Name of station
1	2008	44.6	Manoor	3.0	Newasa
2	2009	45.0	Potnandgaon	1.5	Newasa
3	2010	46.0	Potanandgaon, Manoor	4.5	Newasa
4	2011	44.4	Sundgi	1.0	Potanandgaon
5	2012	45.5	Sundgi	2.0	Kopargaon
6	2013	45.0	Potanandgaon,shahgad, sundgi, Nandednagapur	4.0	Padali
7	2014	45.0	Sundgi	5.0	Mannor, Jaffrabad
8	2015	46.0	Sundgi, Potanandgaon	4.5	Takli
9	2016	46.0	Nanded, Manoor Potanandgaon,	5	Jaffrabad, Kopargaon, Newasa
10	2017	46.0	Nanded Naga	5	Awadshirpur, Manoor

Table 3.4: Daily maximum & minimum temperature for Upper Godavari Basin









Sr.no.	Year	Max Temp ^o c	Name of station	Min Temp ^o c	Name of station
1	2008	43.5	Barur	4.0	Barhanpur, Paud, Velhe
2	2009	43.5	Barur, Kashti, Sidhewadi(Sol)	1.5	Ambawade
3	2010	45.0	Barur	2.5	Parali
4	2011	42.5	Pargaon	4.0	Pargaon
5	2012	43.0	Barur	4.0	Kashti
6	2013	43.5	Barur	4.0	Kashti
7	2014	43.0	Barur	5.0	Kashti
8	2015	43.0	Rosa	5.0	Patryachiwadi
9	2016	44.0	Rosa	5.0	Sakhar
10	2017	43.0	Sidhewadi(Sol)	5.0	Sakhar

Table 3.5: Daily maximum & minimum temperature for Krishna Basin

Fig 3.9: Yearly Graph of Daily maximum temperature for Krishna Basin



Fig 3.10: Yearly Graph of Daily minimum temperature for Krishna Basin



Inference from comparison of maximum and minimum temperature:

Variation in minimum and maximum temperature up to some extent is observed in all basins. In last 10 years, Maximum temperature reached up to 50° C at station Lakhandur in 2010 and 0.9° C at station Bori in 2009. Also, for year 2017 Maximum temperature observed is 48.8 $^{\circ}$ C at Bhimkund and minimum temperature 2° C is observed at Malegaon Girna.

4.

Review of Evaporation

Following tables show Evaporation for various basins. All available data is considered up to Year 2017 for computing average monthly evaporation.

	Fight	arasiitie										
Name		Monthly Average Evaporation in mm										
of Basin	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Lower Godavari	87.80	98.48	152.79	221.30	242.47	170.38	98.36	97.80	107.86	84.87	92.68	87.96
Upper Godavari	125.93	148.12	214.30	269.68	319.13	209.26	141.55	122.13	122.97	140.82	128.01	122.61
Krishna	114.62	129.79	176.36	221.53	230.73	138.28	97.85	90.37	90.13	93.49	97.84	101.05
Тарі	112.61	145.88	198.05	265.98	327.55	207.48	138.50	140.60	130.46	127.23	116.42	99.50
West Flowing Rivers (Konkan)	122.96	140.18	176.99	199.40	200.84	95.08	82.24	88.12	86.81	100.09	117.84	103.60

Table 4.1: Monthly Average Evaporation (in mm.) for Various Basins in Maharashtra.

Fig. 4.1 Graph of Monthly Average Evaporation of Lower Godavari Basin in mm





Fig. 4.2 Graph of Monthly Average Evaporation of Upper Godavari Basin in mm

Fig. 4.3 Graph of Monthly Average Evaporation of Krishna Basin in mm



Fig. 4.4 Graph of Monthly Average Evaporation of Tapi Basin in mm



Fig. 4.5 Graph of Monthly Average Evaporation of West Flowing River Basin South of Tapi (Konkan) in mm.



Table 4.2: Average Maximum & Minimum Evaporation (in mm.) in month for Various Basins of Maharashtra.

	Avera	Average Maximum, Minimum Evaporation in the month & Yearly Total in mm.							
Name of Basin	Maxim um	Month	Minimum	Month	Av. Yearly Total				
Lower Godavari	242.5	Мау	84.9	October	1542.7				
Upper Godavari	319.13	Мау	122.13	August	2064.51				
Krishna	230.73	May	90.13	September	1582.03				
Тарі	327.5	May	99.5	December	2010.3				
West Flowing Rivers South of Tapi (Konkan)	200.84	May	82.24	July	1514.15				

Fig. 4.6 Graph of Average Maximum Monthly Evaporation in Various Basins of Maharashtra in mm.



Fig. 4.7 Graph of Average Minimum Monthly Evaporation in Various Basins of Maharashtra in mm.



Fig. 4.8 Graph of Average Yearly Evaporation in Various Basins of Maharashtra in mm.



For computing averages of evaporation all available data considered up to year 2017. It is observed that average maximum evaporation is observed in Tapi basin and Upper Godavari basin in the month of May - 327.5 & 319.13 mm. respectively. Also, Average minimum evaporation is observed in West Flowing Rivers basin (Konkan) in the month of July - 82.24 mm. Considering over all Maharashtra, average maximum evaporation is observed in month of May and average minimum evaporation is observed in the month of September for Krishna, in December for Tapi basin ; in month of October for Lower Godavari Basin ; In the month of August for Upper Godavari Basin and in the month of July for West flowing Rivers South of Tapi (Konkan). Average yearly maximum evaporation is observed in Upper Godavari Basin 2064.51 mm. and Minimum in West Flowing River basin (Konkan) as 1514.15 mm.

5. Discharges at GD sites in various basins in Maharashtra

Maharashtra is divided into five major river basins namely Godavari, Krishna, Tapi, WFR south of Tapi and Narmada. Hydrometeorological network is spread all over the Maharashtra. There are 264 Gauge Discharge stations under the control of Hydrology Project (SW) Maharashtra. (**Note**: GD sites of Upper Godavari basin are not considered. Reason for the same is as mentioned in 2.1)

5.1 Discharges at GD sites in Lower Godavari basin:

The catchment area of Lower Godavari Basin in Maharashtra is 81097 SqKm. There are 43 Gauge discharge stations in this catchment. Following table shows discharges for year 2017 for GD stations on which discharge data is available in this catchment.

Discharges in Mm³

Anantwadi, Tal. Mahagaon, Dist. Yavatmal, Area 1629.00sqkm									
Year	June	July	August	September	October	Monsoon Total in Mm ³			
2017	21.24	33.95	49.15	20.50	0.27	125.10			

Armori, Tal. Armori, Dist. Gadchiroli, Area 1455.20sqkm										
Year	June	July	August	September	October	Monsoon Total in Mm ³				
2017	0.00	78.02	62.26	1.37	0.00	141.64				

Bamni, Tal. Dhanora, Dist. Gadchiroli, Area 857.70 sqkm									
Year	June	July	August	September	October	Monsoon Total in Mm ³			
2017	0.00	371.97	300.19	265.34	211.19	1148.69			

Damrench, Tal. Aheri, Dist. Gadchiroli, Area 36317.00 sqkm									
Year	June	July	August	September	October	Monsoon Total in Mm ³			
2017	0.00	9036.35	5809.01	3220.64	1054.60	19120.59			

Dhaba, Tal. Gondpipri, Dist. Chadrapur, Area 45795.00sqkm									
Year	June	July	August	September	October	Monsoon Total in Mm ³			
2017	362.18	892.44	857.86	952.65	851.63	3916.76			

Ga	Gadbori, Tal. Sindewahi, Dist. Chadrapur, Area 1051.00 sqkm										
Year	June	July	August	September	October	Monsoon Total in Mm ³					
2017	1.76	13.78	10.35	24.36	0.00	50.25					

GhotangaonBori, Tal. Arjuni –Morgaon, Dist. Gondia, Area 1051.00 sqkm									
Year	June	July	August	September	October	Monsoon Total in Mm ³			
2017	0.86	0.00	46.50	20.62	4.06	72.04			

Hamdapur, Tal. Samudrapur, Dist. Vardha, Area 2297.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	44.63	99.05	58.61	69.62	34.10	306.01		

Hingangaht, Tal. Hingangaht, Dist. Vardha, Area 4109.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	20.78	290.21	15.45	163.01	30.60	520.05		

Khadka, Tal. Arni, Dist. Yavatmal, Area 4484.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	59.78	72.59	99.88	148.76	47.13	428.15		

KolgaonGod, Tal. Vani, Dist. Yavatmal, Area 23046.00 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	78.84	91.16	161.78	165.21	4.47	501.47		

KoliBk, Tal. Ghatanji, Dist. Yavatmal, Area 2698.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	6.72	16.42	7.15	34.34	0.15	64.79		

Mahagaon, Tal. Aheri, Dist. Gadchiroli, Area 100395.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	1756.59	7568.31	8017.57	9870.91	7954.68	35168.06		

Mandvi Vain, Tal. Tirora, Dist. Yavatmal, Area 20440.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	0.00	208.89	222.28	230.05	29.01	690.24		

Mathani, Tal. Mouda, Dist. Nagpur, Area 12259.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	0.00	380.47	394.22	377.73	43.27	1195.70		

Murli, Tal. Umerkhed, Dist. Yavatmal, Area 8334.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	21.50	33.20	136.90	593.51	251.80	1036.91		

Parsewada, Tal. Shironcha, Dist. Gadchiroli, Area 146.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	0.00	67.63	62.69	36.34	5.01	171.68		

Petta, Tal. Ettapali, Dist. Gadchiroli, Area 1474.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	91.81	829.48	747.81	339.68	111.74	2120.52		

Pipriya, Tal. Satekasa, Dist. Gondia, Area 607.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	0.00	22.20	28.58	24.80	0.00	75.59		

Saiphal, Tal. Ghatanji, Dist. Yavatmal, Area 17108.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	206.66	149.05	239.95	275.22	113.72	984.59		

Shivni, Tal. Armori, Dist. Gadchiroli, Area 1810.53sqkm							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	0.00	307.95	366.83	272.13	143.93	1090.84	

Temburdoh, Tal. Saoner, Dist. Nagpur, Area 5105.00sqkm									
Year	June	July	August	September	October	Monsoon Total in Mm ³			
2017	0.00	0.00	3.28	42.70	0.00	45.98			
Bham	aragad, Ta	l. Bhamara	gad, Dist. (Gadchiroli, Ar	ea 5953.00)sqkm			
Year	June	July	August	September	October	Monsoon Total in Mm ³			
2017	57.93	523.78	147.69	119.66	66.73	915.79			

Bhimkunda, Tal. Chamroshi, Dist. Gadchiroli, Area 754.40sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	0.00	274.34	278.50	296.35	104.84	954.03		

Bori, Tal. Aheri, Dist. Gadchiroli, Area 950.00sqkm							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	48.90	137.13	82.21	100.74	112.58	481.56	

Dechali, Tal. Aheri, Dist. Gadchiroli, Area 476.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	4.26	56.65	29.81	16.05	2.35	109.12		

Deori, Tal. Gondia, Dist. Gondia, Area 16068.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	61.88	1050.65	1059.62	886.15	0.00	3058.30		

Mangdatola, Tal. Armori, Dist. Gadchiroli, Area 783.82sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	2.48	23.92	16.56	14.09	14.74	71.79		

Lakhandur, Tal. Lakhandur, Dist. Nagpur, Area 2575.00sqkm							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	0.00	33.57	208.37	68.07	38.71	348.72	

Sirpur, Tal. Deoli, Dist. Bhandara, Area 10239.65sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	30.51	69.15	40.51	40.59	84.75	265.50		

Soitdindora, Tal. Warora, Dist. Chadrapur, Area 17776.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	86.44	282.31	84.45	766.36	0.00	1219.56		

Takali, Tal. Zari Jamni, Dist. Yavatmal, Area 1366.00sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	46.92	45.51	6.23	20.94	0.16	119.76		

Wadsachicholi, Tal. Brahmapuri, Dist. Chadrapur, Area 38172.00 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	30.28	739.64	1606.14	1397.20	395.25	4168.50		

5.2 Discharges at GD sites in Krishna basin:

The catchment area of Krishna Basin in Maharashtra is 68397 sq km. There are 50 Gauge discharge stations in this catchment. Following table shows discharges for some GD stations in Krishna basin.

Discharges in Mm³

Ambeghar (K), Tal. Bhor, Dist. Pune, Area 249.44 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	3.21	114.93	74.78	83.76	10.13	286.81		

Pargaon , Tal. Daund, Dist. Pune, Area 6251.00 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	121.90	1239.51	1005.74	649.65	342.14	3358.93		

Sakhar, Tal. Velhe, Dist. Pune, Area 182.57 sq km							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	5.76	56.61	12.80	22.15	6.66	103.99	

Gudhe, Tal. Patan, Dist. Satara, Area 229.92 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	0.00	87.76	89.16	122.01	57.13	356.06		

Jambre Umgaon, Tal. Chandgad, Dist. Kolhapur, Area 26.43 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017		13.17	0.04	0.03		13.24		

Kadal, Tal. Gadhinglaj, Dist. Kolhapur, Area 869.98 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	52.00	434.02	176.16	266.28	129.83	1058.29		

Kagal (NH4), Tal. Kagal, Dist. Kolhapur, Area 642.71 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	83.14	210.46	52.35	206.74	106.10	658.79		

Mhaisal, Tal. Miraj, Dist. Sangli, Area 12740.59 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	164.06	2101.51	773.87	1520.37	992.55	5552.36		

Nadgadwadi , Tal. Chandgad, Dist. Kolhapur, Area 557.92 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	0.00	518.66	363.91	421.09	384.65	1688.32		

Nitwade, Tal. Karveer, Dist. Kolhapur, Area 600.30 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	196.21	855.40	445.31	493.15	218.54	2208.61		

Shivade, Tal. Karhad, Dist. Satara, Area 3261.03 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	65.66	141.02	77.22	147.43	145.30	576.63		

Tarewadi , Tal. Gadhinglaj, Dist. Kolhapur, Area 326.71 sq km							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	76.16	865.31	415.11	455.78	133.41	1945.77	

Wadange (RT), Tal. Karveer, Dist. Kolhapur, Area 1940.34 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	287.39	2134.37	785.91	1076.33	394.01	4678.02		

Ichalkaranji , Tal. Hatkanangale, Dist. Kolhapur Area 2374.74 sq km							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	299.33	2169.94	726.28	1017.31	400.82	4613.68	

Bubnal , Tal. Shirol, Dist. Kolhapur Area 15391.71 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	993.61	4612.49	2263.02	3160.32	2261.13	13290.57		

Pandharpur , Tal. Pandharpur, Dist. Solapur Area 24082 sq km							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	0.00	0.00	517.59	1939.56	1625.23	4082.38	

Devikawathe , Tal. Akkalkote, Dist. Solapur Area 46706 sq km							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	27.83	0.00	4.84	1186.68	868.61	2087.96	

Ankali Bridge , Tal. Miraj, Dist. Sangli Area 12341 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	82.82	1340.54	451.76	1100.42	854.78	3830.32		

Sangli, Tal. Sangli, Dist. Sangli Area 13700 sq km								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	141.13	994.36	371.03	799.16	707.36	3013.04		

5.3 Discharges at GD sites in Tapi basin:

The catchment area of Tapi Basin in Maharashtra is 55101.54 sqkm. There are 28 Gauge discharge stations in this catchment. Following table shows discharges for some GD stations in this catchment.

Discharges in Mm³

Aurangpur, Tal. Murtizapur, Dist. Akola, Area 1418 sqkm							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017		15.23	21.65	15.28	3.45	55.62	

Bhusawal, Tal. Bhusawal, Dist. Jalgaon, Area 29871 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017		413.41	765.48	803.10	13.05	1995.04		

Daryapur, Tal. Daryapur, Dist. Amrawati, Area 1309sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017			1.01	0.79	0.61	2.41		

Fardapur, Tal. Mehekar, Dist. Buldhana, Area 1250 sqkm							
Year June July August September October To					Monsoon Total in Mm ³		
2017	1.72			2.83	3.52	8.06	

Jamner, Tal. Jamner, Dist. Jalgaon, Area 746 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	3.65		13.27	27.25	17.43	61.59		

Khariya, Tal. Dharni, Dist. Amravati, Area 5945 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	0.35	298.75	340.88	461.73	15.84	1117.56		

Malegoan Girna, Tal. Malegaon, Dist. Nashik, Area 2741 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017		59.12	49.31	50.84	31.74	191.02		

Manasgaon, Tal. Shegaon, Dist. Buldhana, Area 12016 sqkm								
Year June July August September October To								
2017	47.96	77.18	138.44	168.83	139.05	571.45		

PalTapi, Tal. Jalgaon, Dist. Jalgaon, Area 253 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017			69.66	74.14		143.80		

Sukwad, Tal. Kalvan, Dist. Nashik, Area 51916 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017		192.14	200.26	325.97	129.61	847.98		

Suple, Tal. Shirpur, Dist. Dhule, Area 157 sqkm							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017		79.99	119.14	54.69	32.82	286.65	

Tonda, Tal. Shirpur, Dist. Dhule, Area 1739 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017		12.70	25.16	11.68	15.61	65.16		

5.4 Discharges at GD sites in West Flowing River basin:

The catchment area of West Flowing River basin in Maharashtra is 18062.29 sqkm. There are 60 Gauge discharge stations in this catchment. Following table shows discharges for some GD stations in this catchment.

ALMAN, Tal. Wada, Dist. Thane, Area 647.51 sqkm							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	38.68	630.15	352.47	130.17	8.75	1160.21	

Discharges in Mm³

ASGA, Tal: Lanja,Dist: Ratnagiri, Area 6.65 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	3.97	8.65	4.19	5.20	2.39	24.41		

AWALEGAON, Tal: Kudal, Dist: Sindhudurg, Area 67.32 sqkm

Year	June	July	August	September	October	Monsoon Total in Mm ³
2017	65.72	142.62	35.52	95.49	29.58	368.94

BHAVE,Tal: Deogad, Dist: Mahad, Area 45.62 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	109.62	541.98	697.03	641.89	624.79	2615.31		

BIRWADI, Tal: Deogad, Dist: Sindhudurg, Area 338.80 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	586.85	1958.86	1819.03	1435.38	882.96	6683.09		

BURMALI, Tal. Sudhagad, Dist. Raigad, Area 61.74 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	26.21	65.83	52.49	52.68	10.75	207.97		

CHATAV, Tal. Khed, Dist. Ratnagiri, Area 116.09 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	394.12	1038.89	564.51	558.42	57.62	2613.56		

DUKANWADI, Tal. Kudal, Dist. Sindhudurga,Area 130.40 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	60.63	214.38	119.86	110.35	51.28	556.51		

GADHI, Tal. Panvel, Dist. Raigad, Area 125.22 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	20.11	142.91	71.06	57.98	22.42	314.47		

GAHELI, Tal. Jawhar, Dist. Thane, Area 636.96 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	19.08	365.72	344.54	272.93	20.03	1022.30		

HET, Tal. Vaibhavwadi, Dist. Sindhugurga, Area 28.77 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	50.12	85.98	39.36	33.23	15.06	223.75		

KAKEWADI, Tal. Rajapur, Dist. Ratnagiri, Area 13.95 sqkm							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	1.87	48.22	33.33	29.18	20.50	133.09	

KALAMB, Tal. Karjat, Dist. Raigad,Area 110.85 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	35.80	207.68	130.34	86.54	46.43	506.79		

KAMAN, Tal. Vasai, Dist. Thane, Area 12.44 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	25.55	169.55	135.13	109.77	145.29	585.30		

KANGULE, Tal. Poladpur, Dist. Raigad, Area 379.28 sqkm							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	96.66	665.26	356.66	352.05	206.23	1676.86	

KANPOLI, Tal. Panvel, Dist. Raigad, Area 31.35 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	5.43	44.48	43.58	34.49	27.33	155.31		

KARAK, Tal. Rajapur, Dist. Ratnagiri Area 31.74 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	26.32	97.18	48.28	40.61	20.13	232.52		

KHAPARI, Tal. Murbad, Dist. Thane, Area 227.30 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	207.69	809.02	700.66	707.05	352.08	2776.50		

KOCHARA, Tal. Murbad, Dist. Thane, Area 203.76 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	51.98	201.66	161.92	103.32	43.36	562.23		

KOKARE, Tal. Raigad, Dist. Mahad, Area 84.43 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	16.37	85.80	43.07	36.22	15.85	197.31		

KOLHARE, Tal. Karjat, Dist. Raigad Area 306.04 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	310.82	1045.60	909.91	447.11	142.05	2855.49		

KOTHURDE, Tal. Mahad, Dist. Raigad, Area 33.87 sqkm							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	11.64	64.03	36.03	23.35	10.64	145.69	

KUMBHARKHANI, Tal. Ratnagiri, Dist. Sangmeshvar, Area 143.53 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	22.93	204.65	138.33	89.64	27.78	483.33		

MAHAN, Tal. Alibag, Dist. Raigad Area 29.96 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	32.27	132.74	104.08	57.80	24.90	351.79		

MIRVANE, Tal. Chiplun, Dist. Ratnagiri, Area 6.18 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	1.88	14.71	12.61	10.81	2.51	42.52		

NALDHE, Tal. Karjat, Dist. Raigad Area 94.41 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	33.10	131.94	88.39	57.07	19.86	330.36		

PALI, Tal. Sudhagad, Dist. Raigad Area 308.82 sqkm							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	108.40	324.41	322.13	108.50	50.44	913.88	

PASTEWADI, Tal. Sangmeshvar, Dist. Ratnagiri, Area 49.52 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	15.62	55.43	28.95	17.76	11.35	129.12		

PAWARWADI, Tal. Lanja, Dist. Ratnagiri, Area 40.98 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	18.20	65.90	31.73	26.36	18.11	160.30		

POYNAR, Tal. Khed, Dist. Ratnagiri, Area 30.77 sqkm									
Year	June	July	August	September	October	Monsoon Total in Mm ³			
2017	190.42	289.29	53.78	317.24	40.13	890.86			

RAIPATAN, Tal. Rajapur, Dist. Ratnagiri , Area 91.08 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	57.92	160.54	87.41	94.22	43.08	443.17		

SAIVAN, Tal. Vasai, Dist. Thane, Area 519.56 sqkm									
Year	June	July	August	September	October	Monsoon Total in Mm ³			
2017	90.78	635.22	445.91	279.66	49.13	1500.70			

SAJGAON, Tal. Khalapur, Dist. Raigad, Area 28.53 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	50.97	181.47	145.14	82.33	54.73	514.64		

SALINDE, Tal. Pen, Dist. Raigad, Area 84.91 sqkm									
Year	June	July	August	September	October	Monsoon Total in Mm ³			
2017	29.58	126.44	103.29	64.90	36.38	360.60			

SANGULWADI, Tal. Vaibhavawadi, Dist. Sindhudurga, Area 50.28 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	38.68	101.71	46.28	53.02	23.43	263.11		

SARAMBALA, Tal. Savantwadi, Dist. Sindhudurga Area 70.98 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017		130.77	55.69	66.33	21.54	274.32		

SHEMBAVANE, Tal. Rajapur, Dist. Ratnagiri, Area 15.97 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	9.91	98.54	77.73	26.11	20.13	232.43		

SHIRSHINGI, Tal. Savantwadi, Dist. Sindhudurga, Area 36.83 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	9.86	60.92	22.81	18.49	2.36	114.44		

SHIVDAV, Tal. KAnkavali, Dist. Sindhudurga, Area 247.51 sqkm								
Year	June	July	August	September	October	Monsoon Total in Mm ³		
2017	125.02	419.70	142.56	165.73	35.77	888.78		

SUDKOLI, Tal. Roha, Dist. Raigad Area 37.42 sqkm									
Year	June	July	August	September	October	Monsoon Total in Mm ³			
2017	9.26	21.82	20.59	13.13	3.62	68.42			

TURADE, Tal. Panvel, Dist. Raigad, Area 317.57 sqkm							
Year	June	July	August	September	October	Monsoon Total in Mm ³	
2017	15.76	41.31	31.70	16.89	1.59	107.24	

VIRDI, Tal. Dodamarg, Dist. Sindhudurga Area 35.43 sqkm						
Year	June	July	August	September	October	Monsoon Total in Mm ³
2017	14.66	46.47	12.41	23.02	4.06	100.63

Wadi, Tal. Peth, Dist. Nashik, Area 138.26 sqkm						
Year June July August September October Total in Mm ³						Monsoon Total in Mm ³
2017	63.72	139.18	186.20	116.90	31.67	537.67











6. Interpretation Of Various Statistics presented in the Water Yearbook

Some important terms used in interpretation of various statistics are explained as follows:

6.1 Daily rainfall –Time frame of daily rainfall refers to:

All rainfall observations are made at 0830 hrs IST daily. The quantity of rainfall recorded at 0830 hrs is the rainfall of the preceding 24 hours ending at 0830 hrs of the observation day (Today's date). In other words, the rainfall of the day is the total rainfall collected in the rain gauge from 0830 hrs IST of previous day to 0830 hrs IST of the day and is recorded (entered) against today's date.

5.2 Mean Daily Runoff – The mean daily runoff is computed as follows:

To facilitate comparison between rainfall and runoff, it is usual practice to express values of rainfall and runoff in similar terms. Both may be expressed as a total volume over a specified period (in metre cube, thousand metre cube (TCM), or million metre cube (Mcum). Alternatively, discharge may be expressed as a depth in millimetres over the catchment.

Volume is simply the rate in metre cube /sec (Cumecs), multiplied by the duration of the specified period in seconds, i.e. for daily volumes in cubic metres with respect to daily mean flow *Qd* in cumecs following equation may be used:

Vd (m^3) = (24 x 60 x 60 seconds) Qd(cumecs) = 86400 Qd (m^3)

Runoff depth (Rd) is the volume expressed as depth over the specified catchment area with a constant to convert units to millimeters; i.e. for daily runoff:

$$Rd(mm) = Vd(m^{3})*10^{3}$$

$$= Vd(m^{2})*10^{6}$$

$$= Vd(m^{3})$$

$$= Vd(m^{3})$$

$$= 86.4Qd (Cumecs)$$

$$= 86.4Qd (Cumecs)$$

$$= area(km^{2})$$

7. Water Quality Monitoring In Maharashtra

7.1 Introduction

The Water Quality Monitoring is carried out by various agencies in the Maharashtra State viz Central Water Commission (SW), Central Pollution Control Board, Groundwater Surveys & Development Agency (GW), Hydrology Project (SW), Maharashtra Pollution Control Board, Central Ground Water Board (GW), Directorate of Irrigation Research & Development (DIRD). Hydrology Project takes care of surface water quality through sampling stations spread over the State throughout the year. DIRD monitors dug wells in the command area of major and medium Irrigation Projects. Ground Water Surveys & Development Agency also monitors the dug wells as well as ground water levels of the State intermittently.

Sr. No.	Monitoring Agency	Water Quality Monitoring Sites
(A)	State	
1.	Water Resources Department, Hydrology Project (SW)	129
2.	Groundwater Surveys & Development Agency (GW)	1871
(B)	Central	
3.	Central Pollution Control Board (CPCB) (SW) through Maharashtra Pollution Control Board (MPCB)	48
4.	Central Water Commission (SW)	12
5.	Central Pollution Control Board (CPCB) (GW) through Maharashtra Pollution Control Board (MPCB)	25
6.	Central Ground Water Board (CGWB, NHNS) (GW)	803
	Total no. of stations for surface water	187
	Total no. of stations for ground water	2701

Table 7.1 Agency wise Water Quality Monitoring Details:

7.2 Hydrology Project and HIS

Hydrology Project (SW) aims at establishing a Hydrological Information System (HIS) in the state and the HIS includes Water Quality Monitoring of Surface Water. The basic objectives for WQ Monitoring are:

- a) Monitoring for establishing baseline water quality.
- b) Observing trend in water quality changes.
- c) Calculating flux of water constituents of interest.
- d) Control and management of water pollution.

7.3 Protocol of Water Quality Monitoring under HP(SW) Maharashtra

Notification on dated 17th June 2005 from Ministry of Environment & Forest, New Delhi has published a 'Uniform Protocol for Water Quality monitoring order 2005' & is mandatory to all agencies working in the field of water quality. The protocol consists of all guidelines regarding sample collection, location type, Sampling methods, parameter selection, frequency of sampling, data validation & data sharing.

7.4 Present Practice under HP(SW) : Maharashtra

Water samples are collected from the sampling locations and the parameters are tested at various water quality Level-II & II+ Lab as per the standard guidelines laid down in Protocol The results of analysis are entered in software called Surface Water Data Entry System (SWDES). Validated WQ data is stored at State Data Storage Centre; Nashik in SWDES format. Further this consolidated water quality data generated by HP (SW) Maharashtra is sent to MPCB for further processing as per mandates of Uniform Protocol.

7.5 Type of Water Quality Laboratories and their Functions

Level I Lab: The basic 6 field parameters such as Colour, Odour, Temperature, Acidic Value (pH), Electrical Conductivity and Dissolved Oxygen are tested at these labs. 38 Level I labs were established for this purpose.

Level II Labs: Having capacity of testing Physical, Chemical and Biological parameters These Laboratories have capacity to analyzed total 37 parameters

Level II+ Lab: Having Capacity of testing Physical, Chemical and Biological parameters and in addition of other parameters 11 Metal with the help of AAS (Atomic Absorption Spectrophotometer) and various Pesticides with the help of GC- Gas chromatograph (Newly Installed Sophisticated Advance and Modern Instruments)

Distribution of 129 WQ sampling locations is done amongst 6 Level-II laboratories located at different places of Maharashtra i.e

Table 7.2 Laboratory location, Type of laboratory and no. of sample collectionlocations.

Location of	Type of	No. of sample collection
Laboratory	Laboratory	locations
Pune	Level-II	15
Nashik	Level-II+	17
Nagpur	Level-II	27
Aurangabad	Level-II	28
Kolhapur	Level-II	26
Kalwa (Thane)	Level-II	16

Table 7.3 The WQ Sampling location category & frequency of samplingdesigned for SW, Maharashtra:-

WQ Sampling Location Category	Sampling Frequency upto first 3 years	After 3 years monitoring
Baseline - 50 no.	Monthly One Sample	Break for 3 years
Trend - 67 no.	Fortnightly One Sample	After classification as 'Trend' monthly one sample
Flux - 09 no.	Fortnightly One Sample	After classification as 'Flux' fortnightly one sample
Trend / Flux – 03 no.	Fortnightly One Sample	After classification as 'Trend/Flux' fortnightly one sample.

Table 7.4 Statement showing Frequency of Sampling & Parameters to beanalyzed

Station	Sampling Frequency	Test Parameters	Remark
Baseline	Once in a month first 3 years	30 parameters for 1st sample 20 Parameters for remaining Sample	After 3 years monitoring break for 3 years
Baseline after 3 years break and classification as baseline stations	Once in 2 months	30 parameters for 1st sample 20 Parameters for remaining Sample	One year monitoring again break for 3 years.
Trend	Twice a month	do	Initially 3 year monitoring
Trend (after classification as trend)	Once in a month	do	Continuous monitoring
Flux	Twice a month	do	Initially 3 year monitoring
Flux (after classification as Flux)	Twice a month	do	Continuous monitoring with flow measurements
Reservoir and lakes (treated as Trend)	Twice a month	32 parameters for 1st samples. 22 parameters for remaining sample	Continuous monitoring

Note: - The parameters to be analyzed as mentioned above are minimal requirement. This is not however restricted. Additional parameters shall be analyzed as per the requirement or on the basis of geographical location of stations or certain circumstances.

Table 7.5 List of Parameters

Sr. No.	Parameter 32	Parameter 30	Parameter 22	Parameter 20
1	Colour	Colour	Colour	Colour
2	Odour	Odour	Odour	Odour
3	Temperature	Temperature	Temperature	Temperature
4	рН	рН	рН	рН
5	Electric Conductivity	Electric Conductivity	Electric Conductivity	Electric Conductivity
6	Dissolved Oxygen	Dissolved Oxygen	Dissolved Oxygen	Dissolved Oxygen
7	Turbidity	Turbidity	Total Solids	Total Solids
8	Total Solids	Total Solids	Dissolved Solids	Dissolved Solids
9	Dissolved Solids	Dissolved Solids	NO2	NO2
10	Suspended Solids	Suspended Solids	NO3	NO3
11	NH3-N	NH3-N	B.O.D.	B.O.D.
12	NO2	NO2	C.O.D.	C.O.D.
13	NO3	NO3	Total Coliforms	Total Coliforms
14	Total Phosphorous	Total Phosphorous	Faecal Coliforms	Faecal Coliforms
15	B.O.D.	B.O.D.	Turbidity	Turbidity
16	C.O.D.	C.O.D.	NH3-N	NH3-N
17	Potassium K+	Potassium K+	Total Phosphorous	Total Phosphorous
18	Sodium (Na)	Sodium (Na)	Chloride (Cl)	Chloride (Cl)
19	Calcium (Ca)	Calcium (Ca)	Alkalinity	Alkalinity
20	Magnesium	Magnesium	Sodium	Sodium
21	Carbonate (CO3)	Carbonate (CO3)	Total Kjeldhal Nitrogen	
22	Bi-Carbonate (H CO3)	Bi-Carbonate (H CO3)	Chlorophyll	
23	Chloride (Cl)	Chloride (Cl)		
24	Sulphate (SO4)	Sulphate (SO4)		

25	Fluoride	Fluoride	
26	Boron	Boron	
27	Total Coliforms	Total Coliforms	
28	Faecal Coliforms	Faecal Coliforms	
29	Alkalinity	Alkalinity	
30	Total hardness	Total hardness	
31	Total Kjeldhal Nitrogen		
32	Chlorophyll		

It is also decided to monitor water quality testing of reservoirs, lakes considering separate issue & frequency of sampling for such locations are considered twice in a month continuously & parameters are to be analyzed 32 for the first sample in the water year (June to May) and 30 parameters for rest of the samples.

8. Data Dissemination

8.1 Introduction

In the set up of the Hydrological Information System, the first question to be addressed is the type of information to be provided. This determines the layout of the observation network (parameters, network density, observation frequency, equipment, etc.) and the data available in the databases. The type of information to be provided requires an analysis of the potential hydrological data users. The Central and State Government agencies, which support the Hydrological Information System, are the major users of the generated information. There are sources of other governmental, non-governmental and private agencies also, which make good use of this information. It is obvious that the hydrological data needs of the users also changing over time. Therefore, it is very important to identify the potential data users and regularly analyse their data needs. Normally, it is expected that the hydrological information service agencies satisfy most of the genuine data needs of the potential users in particular and society at large. For ensuring an optimal use of the public resources spent for maintaining such a Hydrological Information Service, it is therefore very essential to have a proper balance between the data needs of various users and mandate of various services supporting the hydrological information system. To ensure that the HIS output remains at all times 'demand driven' each state/agency has to constitute a Hydrological Data Users Group (HDUG). These HDUGs must represent all potential users within the State or intended to be covered by an agency.

Hydrological Data Users Group is a State or National Level Representative Group of current & potential large scale and repeat users of HIS data who have a stake in water resources utilization, assessment & management.

Purpose

- 1) To provide a common platform for discussion between hydrology data users & data provider.
- To create awareness amongst users about Hydrological Information System (HIS) data & educate them.
- 3) To understand, analyze & update information on the changing needs of data users.
- 4) To review & recommend addition /deletion in the data collection networks related to HIS, if appropriate.

Table 8.1 The extent of data availability

Sr. No.	Data Type	Data Availability
1	Rainfall	Since 1976
2	River gauge	Since 1980
3	Climatic	Since 1980
4	Water Quality	Since 2002

8.2 The user can request for the data as below

The HDUG member can request the data by filling the data request form.

(Please see Annexure-A). Data is made available online/offline through any available media such as E-mail, CD, hard copy against payment for the required data. Catalogue services are being launched on central NIC server, shortly and will be available on Internet.

The registration form may be downloaded from our website *www.mahahp.gov.in*

8.3 The pricing of data:

1	ARG Data	Rs.225 /Station/Year

- 2 SRG Data..... Rs.225 /Station/Year
- 3 FCS Data..... Rs.225 /Station/parameter/Year
- 4 GD Data..... Rs.600 /Station/Year
- 5 Sedimentation Data.... Rs.600 /Station/Year
- 6 W.Q.Data Rs.240 /Station/ parameter/Year

Discounts: -

- 1 For Research or Academic purpose, 25 % of above sanctioned rates will be charged.
- 2 Individual students having no grants for research from any source, data will be supplied free of cost.
- 3 For individual farmers, 50 % of above sanctioned rates will be charged.
- 4 For Private organisations, double of the above sanctioned rates will be charged as the data is used for commercial purpose.

8.4 The members of HDUG can be

- 1 Government Institutions.
- 2 Voluntary Non Government Organizations.
- 3 Universities, Educational & Research Institutions
- 4 Associations Farmers, Water users, Industrial
- 5 Individuals engaged in Operational Research & Development
- 6 All Professional Bodies
- 7 Consulting Representatives

8.5 Various Data Users:

Data Disseminated by this office is utilized by different categories as shown in the table below. Maximum data is utilized for educational research purpose. Many students from renowned colleges/institutes have utilized this data for their M.Tech, Ph. D degrees such as students from UNESCO-IHE Delft- Netherlands, IIT Mumbai, IIT Rurkee, IIT Kharagpur, different NIT's , College of Engineering Pune, Government college of Aurangabad, VJTI Mumbai, National Institute of Oceanography Mumbai, Nowrosjee Wadia College Pune, SP College Mumbai, VIT Pune, TERI University, , Indian Agricultural Research Institute New Delhi etc. These users have also submitted their project reports to this office as an acknowledgement of usage of data. Few references for the same are

- 1) Hydrologic modeling of runoff & sediment yield.
- 2) Rainfall runoff modeling using ANN.
- 3) Soil erosion modeling of agriculture watershed using GIS.
- 4) Study of estimating evaporation.
- 5) Silt load assessment & watershed management.
- 6) Watershed modeling using remote sensing & GIS.
- 7) Surface water quality analysis.
- 8) Spatiotemporal analysis of the effects of forest covers on water yield in the western ghats of peninsular India.
- 9) Multivariate Flood Frequency analysis using copulas.
- 10) Risk assessment of hydro climatic variability on ground water levels in Manjara basin aquifers using Archimedean copulas.

Data provided to the offices under Government category is utilized for the work of SWIP (Surface Water Integrated Plan for different basins of Maharashtra), Design of water resources structures (such as dams, barrages, KT Weir, Bridges etc.) Preparation of Master Plan, Hydro Power Potential, Irrigation Management, Water Quality etc. There are total 106 newly added HDUG users in year 2017.

Table 8.2 Revenue generated for period 2017(Period: 1 Jan 2017 to 31 Dec 2017)

Sr No.	Category	Cost of Data Disseminated (in Lakhs of Rs.)	Revenue generated (in Lakhs of Rs.)
1	Educational	52.67	0.024
2	Farmers	0	0
3	Government	4.92	2.68
4	NGO	0	0
5	Private	0.22	0.10
6	Semi-Government	0.77	0.27
7	HDU Membership	-	0.52
	Total	58.60	3.08

53

Annexure : A

Ref: No. :

DATA REQUEST FORM

The Superintending Engineer, Data Analysis Circle, Hydrology Project (SW) Nashik- 422 004

Sub: Data Request Form

Sir,

The DRF is submitted herewith for the following data.

					Pe							
							From	То				
1												
2												
3												
4												
5												
6												
Name):				Organization:							
Phon	e Number:				Email:							
Posta	al Address:											
Media for Dissemination *			Floppy / Hard Copy / CD / DAT Cartridge									
Format for Dissemination *				MS Access / MS Excel / CSV								
Purpose of Data *			Academic / Research / Design of Water Resource Structures / Design of Roads, Rail, Bridges etc / Navigational Purpose / Hydro Power Potential / Irrigation Management / Sedimentation / Water Quality / Other (Specify)									
Communication method for password of protected file. *			Telephone / E-Mail / Post									

* Tick $\sqrt{Whichever}$ is applicable

Terms and Conditions:

I / We agreed hereby to abide by the following conditions in respect of the data requested:

- 1. The data will be used strictly for the said purpose for which the data has been asked for.
- 2. The data will not be supplied to any governmental/non-governmental or public sector undertaking without the prior concurrence/fresh permission from the owner agency.
- 3. The data will not be published in any form without the prior permission of the owner agency.
- 4. The data shall not be used for commercial purpose.
- 5. The data will not be put on Internet or NIC Net.
- 6. Any inference drawn based on these data will be the sole responsibility of the Users and the Owner agency will not be responsible for any kind of loss or damage in any form occurring due to the use of data.

Please send the Demand note of data pricing at the above address by Post / Email.

 This DRF form can be downloaded from the download section of the website
 Signature

 http://www.mahahp.gov.in
 Email: sdsc@mahahp.org

 Phone:0253-2531777
 Name

For Office Use: HDUG Reg. No

Joining Date:

Category:

Date: / /

Annexure : B



Sample Daily Rainfall for Year 2017

	ANANTWADI	ARNI	KOLIBK	SAIPHAL	SHARAD
	MPS	MPS	MPS	MPS	MPS
01/07/2017	0	0	3.2	3	0
02/07/2017	0	15.2	10.4	1.4	0
03/07/2017	3	13.4	14	30	22.2
04/07/2017	8.2	11.4	38	24	8.4
05/07/2017	0	0	0	0	0
06/07/2017	0	0	0	0	0
07/07/2017	0	0	0	0	0
08/07/2017	0	0	0	0	0
09/07/2017	0	0	0	0	0
10/07/2017	0	0	0	0	0
11/07/2017	0	0	8.6	7	5
12/07/2017	0	0	0	0	0
13/07/2017	3.4	1.8	0	2	0
14/07/2017	2.6	2	0	0	0
15/07/2017	4	1.6	8	0	6.2
16/07/2017	30.2	41.4	12.4	22	8.2
17/07/2017	15.4	8.6	6.2	11	8
18/07/2017	6.4	2.4	0	0	2.6
19/07/2017	23.6	31.2	28	4	50.4
20/07/2017	4	9	11	0	6.4
21/07/2017	0	0.8	0	2	0
22/07/2017	0	0	0	0	0
23/07/2017	0	8.2	4.6	0	1.8
24/07/2017	0	6.4	5.8	0	4.6
25/07/2017	0	2	0	0	0
26/07/2017	0.6	0	0	0	0
27/07/2017	0	6.2	6	18	12.8
28/07/2017	0	0	0	0	0
29/07/2017	0	2.8	1.8	2	0
30/07/2017	0	0	0	0	0
31/07/2017	0	0	0	0	0

Annexure C

Sample Twice Daily Climatic Data, Aug 2017

Station Code: Nasik River: Godavari

Station Name: Nasik Sub-division: SDDPC, Nasik

Day	Hour	Min Temper ature (⁰C)	Max Temp eratur e (ºC)	Dry Bulb Temp. (⁰C)	Wet Bulb Temp. ⁰C	Relative Humidity (%)	Inst. Wind Speed (kms/hr)	Av. Wind Speed (kms/hr)	Wind Direction (16 pts)	Rainfall (mm)	Pan Evapor ation (mm)	Temp - Pan Water (ºC)
1	08:30	19.0	28.0	24.0	22.0	83.0	4.0	3.8	NW	0.4	0.8	21
	17:30	20.5	29.5	25.0	23.0	84.0	6.0	4.5	NW	0.0	2.8	25
2	08:30	20.0	29.0	28.0	24.0	70.0	2.0	4.3	SW	0.0	0.8	22
	17:30	20.5	28.5	25.5	23.5	84.0	12.0	7.9	WSW	1.0	2.8	25
3	08:30	19.0	28.5	23.0	22.0	92.0	10.0	5.1	NW	1.0	0.8	21
	17:30	21.5	29.0	28.0	24.0	70.0	8.0	4.7	SW	0.4	3.2	25
4	08:30	19.5	29.0	25.0	22.0	76.0	8.0	4.8	NW	0.6	1	22
	17:30	22.5	30.5	28.0	24.5	74.0	14.0	7.5	SW	0.0	3.4	27
5	08:30	20.0	28.0	27.0	24.0	77.0	12.0	5.2	NW	0.0	1	23
	17:30	21.5	29.5	27.5	26.0	88.0	6.0	4.5	NW	0.0	3.4	27
6	08:30	20.0	28.0	25.0	22.0	76.0	2.0	3.6	NW	0.0	1	21
	17:30	22.0	30.0	29.0	26.0	78.0	0.0	3.5	NW	0.0	3.4	28.5
7	08:30	18.5	29.0	24.0	22.0	83.0	0.0	2.2	NW	0.0	0.8	22
	17:30	22.5	30.5	29.5	25.5	71.0	2.0	2.0	SW	0.0	3	27.5
8	08:30	18.5	29.5	24.0	22.0	83.0	2.0	1.5	SW	0.0	0.8	22
	17:30	20.5	30.0	27.0	24.0	77.0	12.0	7.5	NW	0.0	3.2	26.5
9	08:30	19.0	29.5	25.0	22.0	76.0	0.0	0.9	SW	0.0	0.8	23
	17:30	21.0	30.0	25.0	24.0	92.0	8.0	6.1	NW	2.0	3.2	26
10	08:30	18.5	29.0	24.0	22.0	83.0	0.0	1.1	SW	0.0	0.8	22
	17:30	19.5	28.0	25.5	23.0	80.0	10.0	5.6	SW	0.0	3.2	27
11	08:30	19.0	29.0	24.0	21.0	75.0	4.0	1.3	SW	1.0	0.8	22
	17:30	19.5	29.0	25.5	24.0	86.0	12.0	7.3	W	2.2	3.4	26.5
12	08:30	19.0	28.0	25.0	23.0	84.0	2.0	2.1	SW	0.0	0.8	22
	17:30	19.5	29.0	24.0	22.0	83.0	4.0	3.0	NW	1.0	3.4	26
13	08:30	18.0	28.0	24.0	22.0	83.0	8.0	4.3	SW	10.0	0.8	21
	17:30	19.0	28.0	22.0	20.0	82.0	10.0	6.8	SW	2.4	3	25.5
14	08:30	18.5	28.5	24.0	22.0	83.0	0.0	1.9	NW	1.6	0.8	22
	17:30	19.5	27.5	24.0	23.0	92.0	2.0	4.3	NW	11.0	2.8	24.5
15	08:30	18.0	27.5	23.0	21.0	83.0	2.0	1.3	SW	1.4	0.8	21
	17:30	21.0	28.0	26.0	24.0	84.0	4.0	3.0	NW	2.0	2.8	26
16	08:30	18.0	27.5	23.5	22.0	87.0	0.0	2.0	SW	0.0	0.8	21.5
	17:30	21.0	28.0	26.5	24.0	81.0	2.0	3.0	NW	0.0	3	25
17	08:30	17.5	27.5	24.0	22.0	83.0	2.0	2.5	SW	1.0	0.8	22
	17:30	20.5	29.0	26.0	20.0	55.0	8.0	5.6	SW	0.0	3.2	26.5
18	08:30	19.0	28.0	24.0	22.0	83.0	0.0	1.8	SW	9.0	0.8	22
	17:30	20.0	29.0	26.0	22.0	68.0	0.0	1.6	SW	0.0	3	26.5
19	08:30	19.0	26.0	23.0	22.0	92.0	2.0	2.5	SW	0.0	0.8	21
	17:30	20.0	26.5	23.0	20.5	79.0	2.0	3.5	NW	0.0	2.6	26
20	08:30	17.0	26.0	22.0	21.5	95.0	4.0	3.1	NW	29.0	0.6	19.5
	17:30	18.0	23.5	21.5	19.0	78.0	4.0	3.8	NW	8.0	2.4	24
21	08:30	16.0	23.0	20.0	19.0	91.0	4.0	4.9	NW	14.0	0.6	19
	17:30	17.0	23.5	20.0	17.0	73.0	10.0	7.4	SW	18.2	2.2	25
22	08:30	16.5	24.0	23.0	21.0	83.0	8.0	4.0	SW	0.0	0.6	21
	17:30	22.0	28.0	27.0	23.0	70.0	6.0	4.7	SW	0.0	2.6	24.5
23	08:30	18.0	27.0	24.0	22.0	83.0	8.0	4.8	SW	0.0	0.8	27.0
23	17:30	23.0	29.0	28.0	24 0	70.0	4.0	2.0	NW	0.0	.0	26
24	08:30	18.0	28.0	24.0	22.0	83.0	6.0	3.1	SW	0.0	0.8	20
-7	17.30	19.5	29.5	23.5	20.0	71 0	8.0	47	NW/	76	0.0 2 R	25
25	08:30	18.0	26.5	23.0	22.0	92.0	2.0	1.9	SW	0.6	0.8	20
	• • •									0.0	0.0	- •

	17:30	19.5	28.5	24.0	22.0	83.0	2.0	2.7	NW	4.0	2.8	25
26	08:30	18.0	28.0	23.0	22.0	92.0	10.0	4.5	SW	10.0	0.8	22
	17:30	19.5	29.5	27.0	24.5	81.0	0.0	1.9	SW	0.0	2.8	24.5
27	08:30	18.5	28.0	24.0	22.0	83.0	4.0	3.0	SE	0.4	0.6	21
	17:30	19.0	26.0	21.0	20.0	92.0	2.0	2.2	NW	10.0	2.4	24.5
28	08:30	16.5	26.0	23.0	21.0	83.0	0.0	1.7	SW	8.0	0.6	21
	17:30	20.0	25.0	24.5	22.0	80.0	4.0	3.0	NW	6.4	2.4	24
29	08:30	18.5	28.0	25.0	22.0	76.0	4.0	2.9	SW	11.6	0.6	21.5
	17:30	19.0	30.0	25.0	23.0	84.0	6.0	4.0	NW	0.0	2.4	24.5
30	08:30	18.5	28.0	22.0	21.0	92.0	6.0	4.8	SW	6.0	0.6	21.5
	17:30	18.5	26.5	24.0	22.0	83.0	10.0	7.0	NW	3.0	2.2	24
31	08:30	18.0	26.0	22.0	21.0	92.0	2.0	2.2	SW	0.0	0.8	20
	17:30	19.0	27.0	24.0	22.0	83.0	8.0	5.2	NW	0.0	2.4	24

Note : Rainfall at 08:30 hrs is pertaining to previous day

Graphical Representation of above Data



Plot of Twice Daily Pan Evaporation at Potanandgaon : September, 2017

Plot of Twice Daily Wind Direction at Potanandgaon : September, 2017



Plot of Twice Daily Humidity & Diff of Wet and Dry Bulb Temperatures at Potanandgaon : September, 2017



Plot of Twice Daily Temperature at Potanandgaon: September, 2017

