HYDROLOGY PROJECT
Technical Assistance

DHV CONSULTANTS & DELFT HYDRAULICS with HALCROW, TAHAL, CES, ORG & JPS

Surface Water Hydrological Data

<Name of State/Region>

<YYYY>
YEARBOOK

STATE WATER DATA CENTRE <NAME OF STATE/REGION>

CSMRS Building, 4th Floor, Olof Palme Marg, Hauz Khas, New Delhi - 110016 (INDIA). Tel: 26861681-84
Fax : +91 11 26861685 E-Mail : dhvdelft@del2.vsnl.net.in / hydrologyproject@vsnl.com

Surface Water Hydrological Data

<Name of State>

<YYYY>

YEARBOOK

An account of rainfall, river flows and water quality

FOREWORD

<The yearbook may include a foreword by an officer considered suitable by the agency. This person can typically be the Chief Engineer who has the overall authority and responsibility of the functioning of the HIS in that agency>

…
Chief Engineer

Table of Contents

1 Introduction

<The text given hereunder is not the actual text which must be included as the "Introduction" but could help in appreciating the background with which the new style yearbook is intended to be developed. Also all the examples used in the text, including tables and figures, are only indicative and do not refer to any actual case, basin or state.>

<For briefing the readers adequately on the background, the first of the new style yearbook may include the text giving the evolution of yearbooks in the past and how the contents of the new style would be in line with the user needs and the available technology. This text must also bring up issues of switching over from paper yearbook to the electronic yearbook. And also how the paper yearbook may still be relevant to be produced, however in very less numbers, for and on demand from specific users. One of the benefits, which the water yearbook can still bring for the HIS in the country, is the fact that the target of preparing the yearbook itself makes it mandatory on the part of the system to finalise data in time and produce water yearbooks within the prescribed time frame. It also is a tangible output of the system by which the accomplishment of data observation and data finalisation for the year under consideration can be seen.>

<It is very important in these times to evaluate which medium will be most suited for publishing the yearbooks. The traditional way of bringing out the yearbook as printed documents could now turn towards electronic yearbooks. The electronic yearbooks may still have the same content (one may even afford to include more, in fact, if required) and structure as the hard copy yearbook. However, they are presented to the users in the form of a CD or may even be accessible (in a controlled manner as per the guidelines of the agency) through internet instead of distribution as hard copies. First of all, the system has to ascertain the genuine requirement of the hard copy water yearbooks, as printing yearbooks in large numbers may need a lot of funding. Also, hard copy yearbooks may not always be so effective a medium for the users to get data and information, specially nowadays when most of the information flows digitally. However, there would always be a need to also have a hard copy yearbook, even if it will be required in very few numbers. One of the benefits of the hard copy yearbook is that it serves as an additional paper archive of most of the data. Secondly, for certain users and situations, hard copy yearbooks will be the preferred medium as against the electronic yearbook, which always necessitate availability of a computer. An objective approach could be followed while deciding on the extent upto which the contents of the yearbook has to be printed and distributed as hard copies. For the purpose of archives and as the key reference document for internal use by the agency (like, in the data centres and in design and planning wings), it may be required to print the whole yearbook. Such full copies could be in a limited number. However, the hard copies that are required for distribution to other hydrological data users, may be limited to an abridged version of the whole yearbook. This abridged version may include most of the items of the full yearbook except all the data tables. Data tables for only very few stations could be included, mainly as samples. For such readers, it is assumed that they would not require to refer data for any particular station. They would only be interested to know about the hydro-meteorological and hydrological behaviour in the region in general and that they could preferably use the electronic water year book for any reference whenever needed.>

<The major change in the style of water yearbook is in introducing more graphs and pictures that may enable necessary and adequate comprehension that the reader may like to have about the hydro-meteorology of the region. Pictorial options allow large volumes of data to be summarised in a nutshell. Notwithstanding the fact that these graphical representations could be sufficient for most of the readers and also the fact that most of the data could be

readily made available from the organised databases to the requesting users, it would still be essential that the data is also presented and available in well laid-out data tables. As was the case in earlier editions of the yearbooks, it would be desirable that most of the data on daily or larger interval is presented in these tables. Such availability of nicely laid-out tables would enable the data to be presented in an attractive format whenever some reference is required to be made.>

<Another addition to the earlier yearbooks may be by including few interesting articles on some relevant themes of the hydrological regime of the region. It would always be interesting for any reader to get to know about some significant trends in the rainfall or flow or water quality patterns in the region. Floods and droughts continue to haunt people in most of the regions of our country. It could be appropriate to highlight some of the hydrological features of such extreme flood and drought situations. Similarly, awareness about quality of water has grown manifold in the last 1-2 decades due to enormous pressure on water as natural resource and unavailability of good water in sufficient amounts for most of the uses. In such a situation it can be helpful if some alarming water quality situations are highlighted in the form of articles. Besides these articles being informative on one hand, they would many times be eye openers for the policy makers and managers of the water resources systems. At the same time they would make interesting reading for others and also incidentally help in reminding the personnel working for the HIS to understand and appreciate the importance of data being collected and information being derived.>

<The central idea of the yearbook is to review and communicate, to the target readers, what kind of hydro-meteorological and hydrological scenario prevailed in the region during the year under consideration. For this, it is appropriate to first give information about the water resources, drainage system and land use in the region followed by the layout of the monitoring network on the basis of which all the information is obtained and derived. Both, hydro-meteorological and river gauging (including water quality) networks can be shown in the form of maps. Further, hydrological reviews could be given which describe the behaviour of the hydrological processes in the region. Various types of data, viz. rainfall, evaporation, river levels and flows and water quality can be summarized with the help of graphs and data tables. Graphical illustrations showing the process during the year under consideration against the long term pattern could be very effective. Together with the graphical illustrations summarizing the hydrological and hydro-meteorological behaviour, it is worthwhile to tabulate the daily data and the important monthly and yearly statistics along with it. Such tabulations enable easy referencing to any particular data at any point of time, without requiring to interrogate the databases for retrieving the same.>

<Further, it could be valuable for the readers, to include valuable reference material such as bibliography of previous yearbooks or other information sources on the matter, brief notes on procedures followed for observations in the field and notes on the interpretations of the terms used in the yearbook.>

2 Water and Life in …….. <put the name of the region being reported upon>

<The idea is to include few articles in the yearbook so as to make it appealing to various users. Traditionally, the yearbooks have been focusing more on presenting the data tables and less on highlighting some of the extreme events or events which may be of concern or interest to the users in general and designers, planners or managers in particular. Typically, what interests more is something that is different from the average, like severe storms, flooding or drought situations or a changing pattern in rainfall or flows in the region. Similarly, growing concern for water quality warrants bringing up some of the deteriorating WQ situations in the region, for the benefit of the users. Some such articles that are informative and sometimes even can be an eye opener could be written by DPC staff members and included in the yearbook. It is not essential that the yearbook must necessarily contain a specific number of articles. Emphasis would be more towards capturing the readers' attention rather then simply producing the data tables.>

2.1 Article 01 – Extreme rainfall events of 1997

<Such article can include some of the heaviest rain events of the year under consideration. Severe events of particular duration like 1 hr., 3 hr., 6 hr., 12 hr., 1 day, 2 days or 3 days could be identified. A comparison of such identified events with the previously recorded heaviest storms in the region can indicate the importance of such events for derivation of revised heaviest storms for given duration.>

<Illustrations are given in Figure 2.1 and 2.3, showing the spatial distribution of 1 day and 2 days heavy storm over the catchment for the year under consideration. Temporal distribution of this storm as recorded at two stations is also given subsequently in Figure 2.2 and 2.4. Such graphs can help understand the type of temporal distributions of these extreme events. Temporal distribution of previous heaviest 1 day event in the region as recorded at one of the stations is also shown in Figure 2.5 for the purpose of reference.>

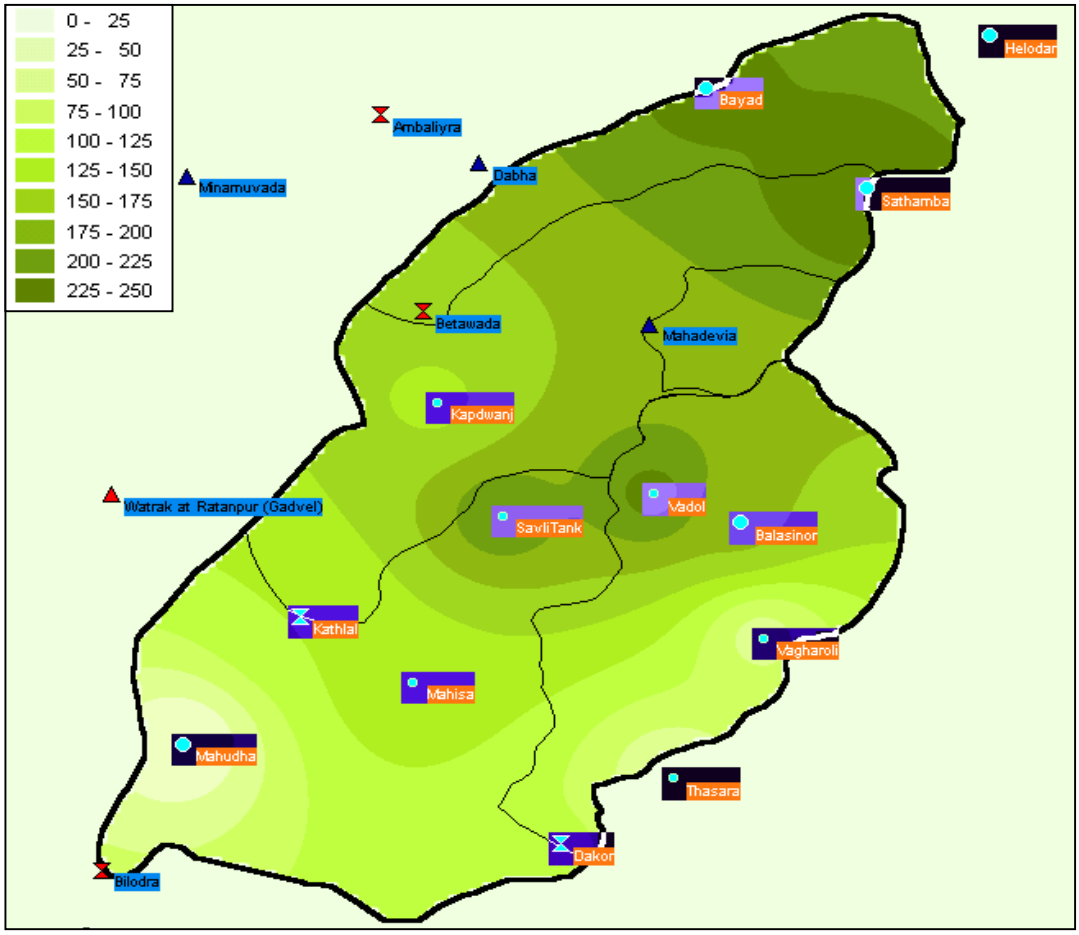


Figure 2.1: Spatial distribution of 1 day storm over the catchment (1 August 1997)

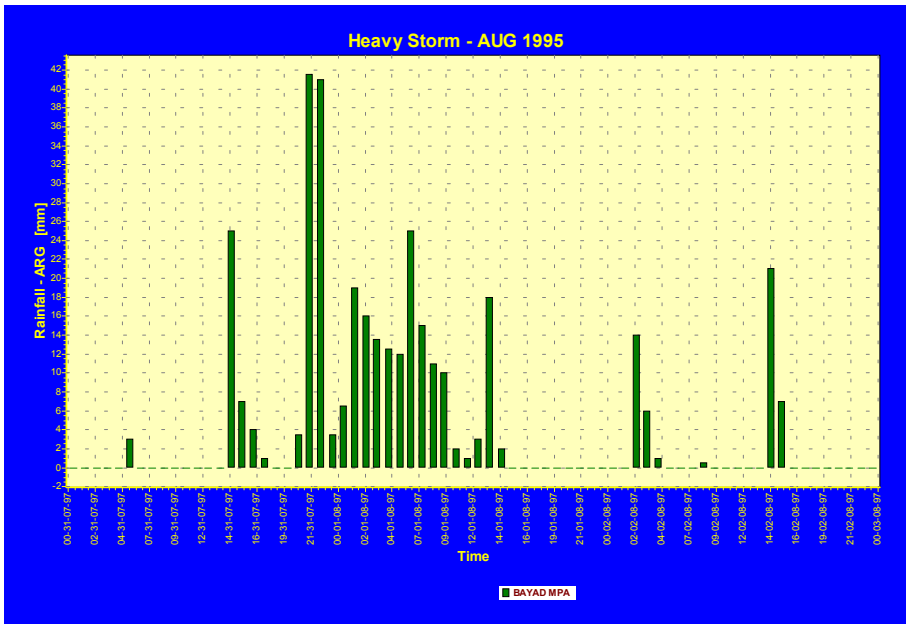


Figure 2.2: Temporal distribution of rainfall on 31 Jul - 1 Aug. 1997 at Station Bayad (290 mm)

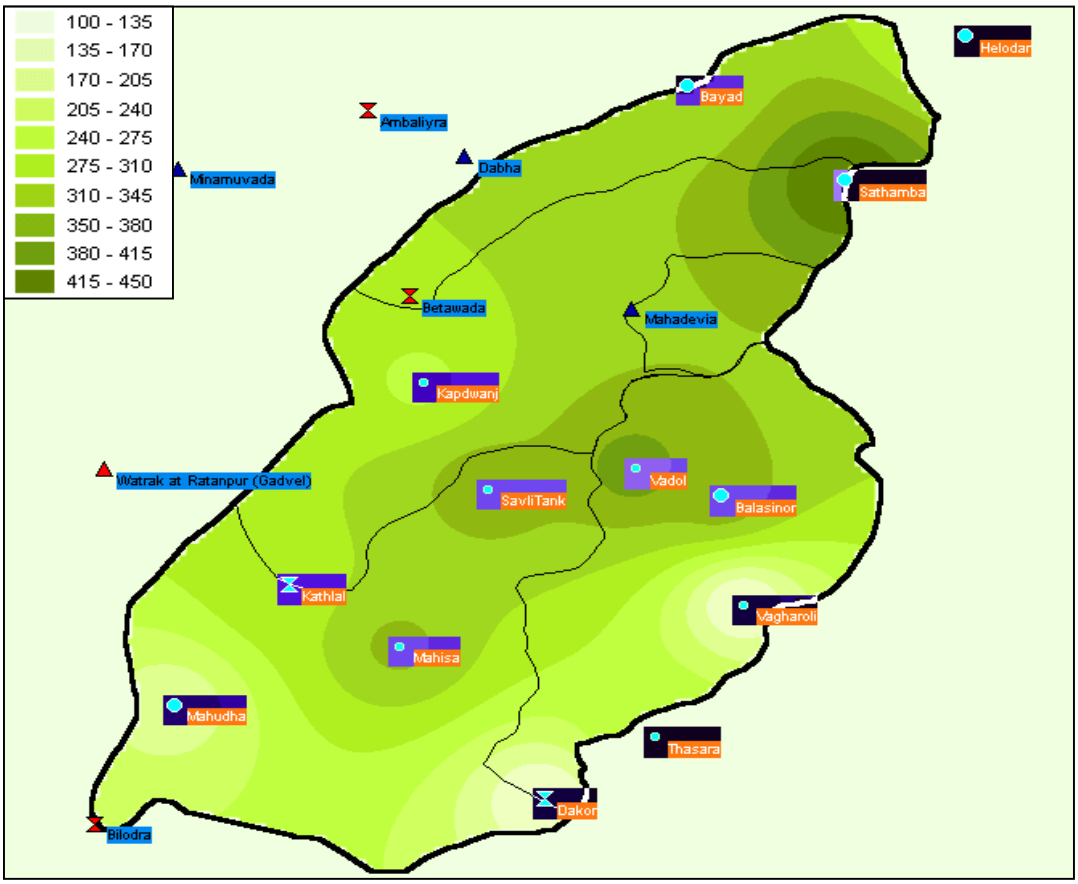


Figure 2.3: Spatial distribution of 2 day storm over the catchment (1-2 August 1997)

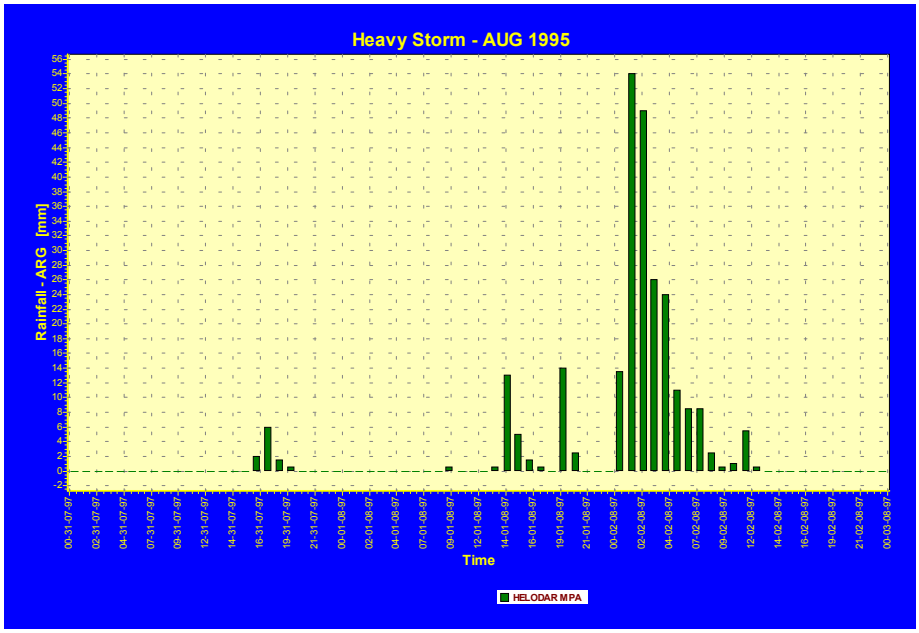


Figure 2.4: Temporal distribution of rainfall on 1-2 August 1997 at Station Helodar (240 mm) (seems to have a 1 day shift in the data)

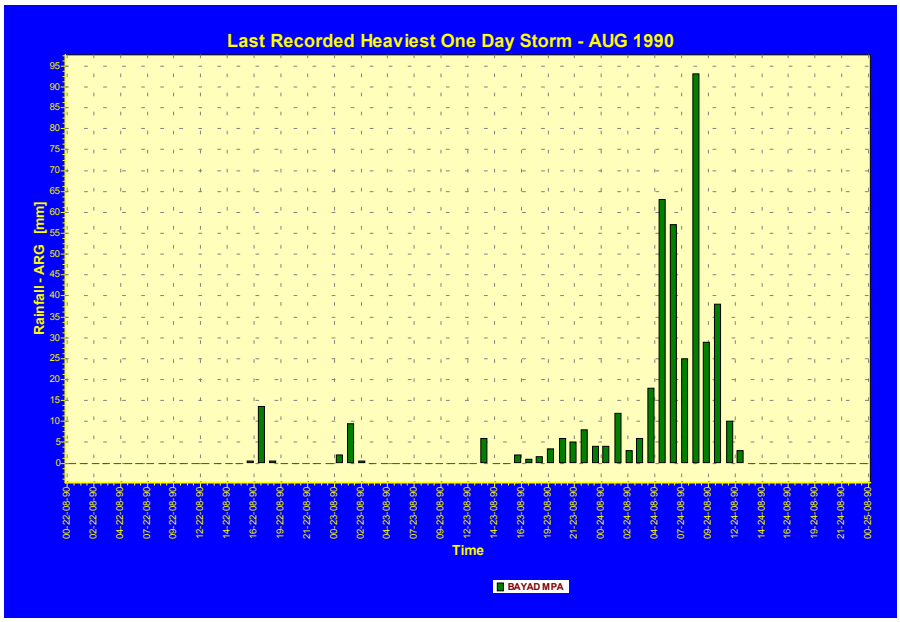


Figure 2.5: Temporal distribution of heaviest 1 day storm recorded in past - 23-24 August 1990 at Station Bayad (398 mm)

2.2 Article 02 – Flooding in the region

<One of the important objectives for continuously monitoring and organising the hydrological data is to be able to mitigate natural disasters as floods and droughts. Inspite of the best efforts, these hazards continue to haunt the societies or settlements. In many cases there still remains a lot to be done in terms of providing further protection from floods and droughts by taking specific structural and non-structural measures. >

<In view of this, it would be appropriate to include some interesting articles on extreme flooding, experienced in parts of the region in the year of reporting. These articles could be supported by some illustrative photographs and hydrographs or other graphs. These articles could create more interest about such extreme events and about hydrological data in general. Incidentally, such articles may provide good reference to such events at a later date to the interested investigators.>

Figure 2.6: Scenes of severe flooding and damage in the region

<Together with giving an account of the severe flooding, with the help of text and photographs, it could be appropriate to include hydrographs at certain locations along the river during the flooding period. Such graphs would give a good view of how long the waters remained above the danger levels and how severe was the flooding. >

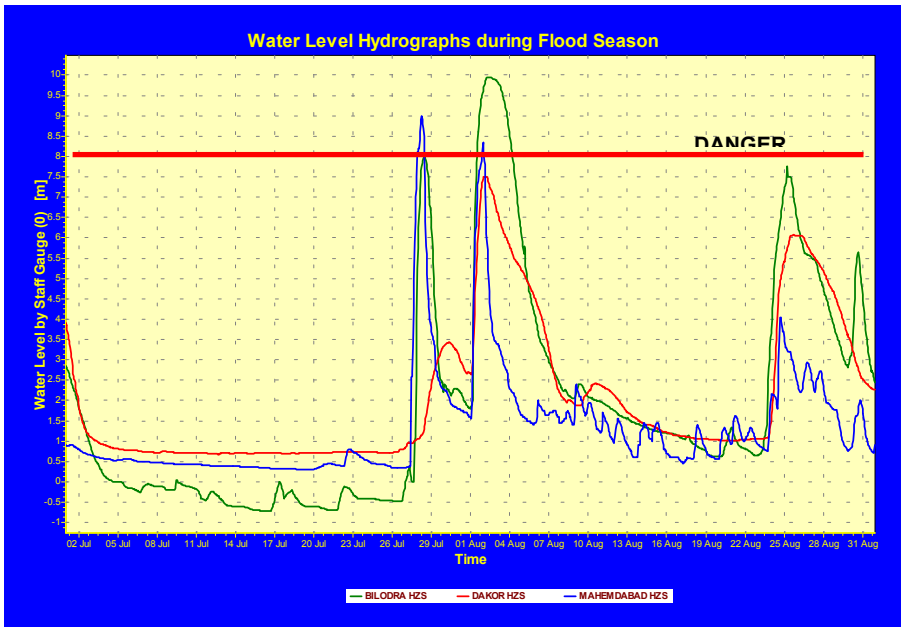


Figure 2.7: Water levels in the rivers at specific locations during flood season

2.3 Article 03 – Drought condition in the region

<Similar to floods, many of the regions in most of the states of the country continue to remain vulnerable to drought conditions. It would be appropriate to bring out some salient features of the droughts passed by, so as to arouse curiosity and generate interest among the data users in general and people responsible for drought mitigation measures in the region in particular.>

<One of the benefits that comes from the preparation of such articles is that the officers engaged in processing the data tries to look at the data closely, learn about the behaviour of the hydrological regime in the region, and becomes familiar with the past important events.>

<Such articles on droughts could be supported by some very illustrative photographs and patterns of the droughts both spatially and temporally and also magnitude wise. Such pictures and graphical patterns are given as examples in Figures 2.8 to 2.11 respectively.>

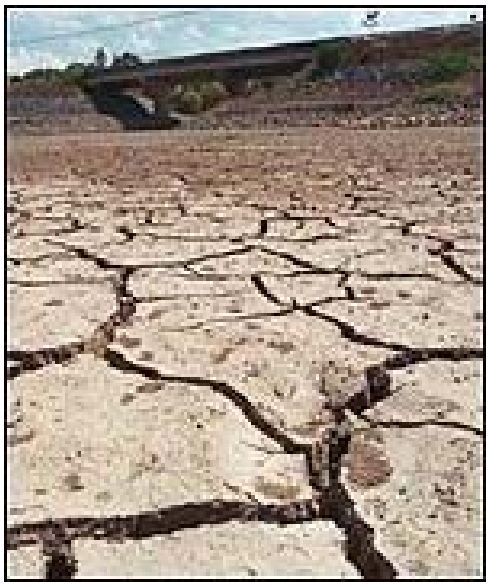


Figure 2.8:
Scenes of severe drought situation in the region

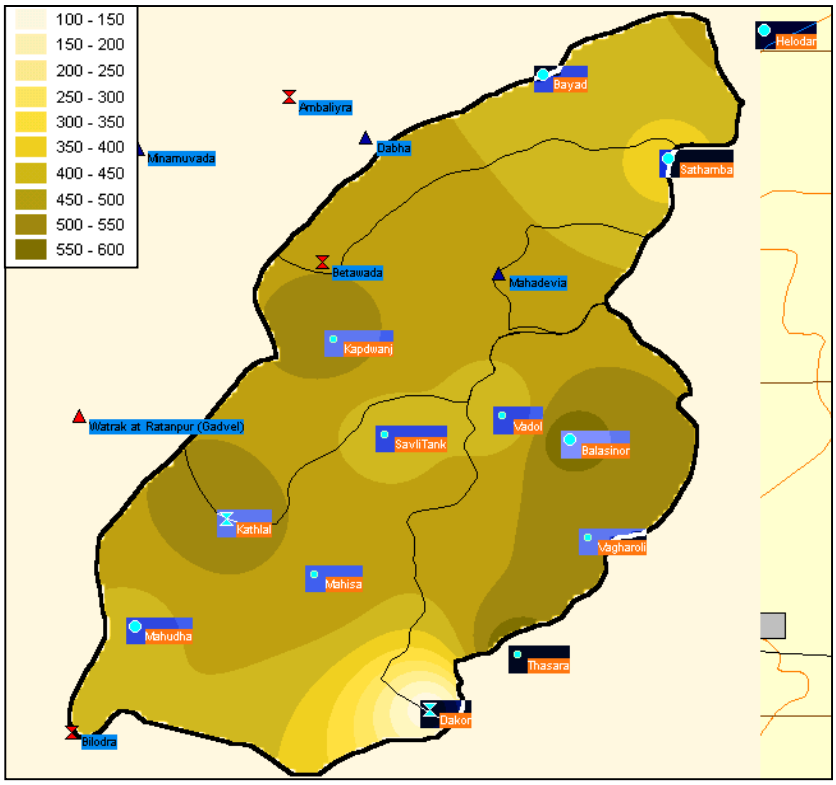


Figure 2.9: Annual rainfall pattern in the drought stricken region

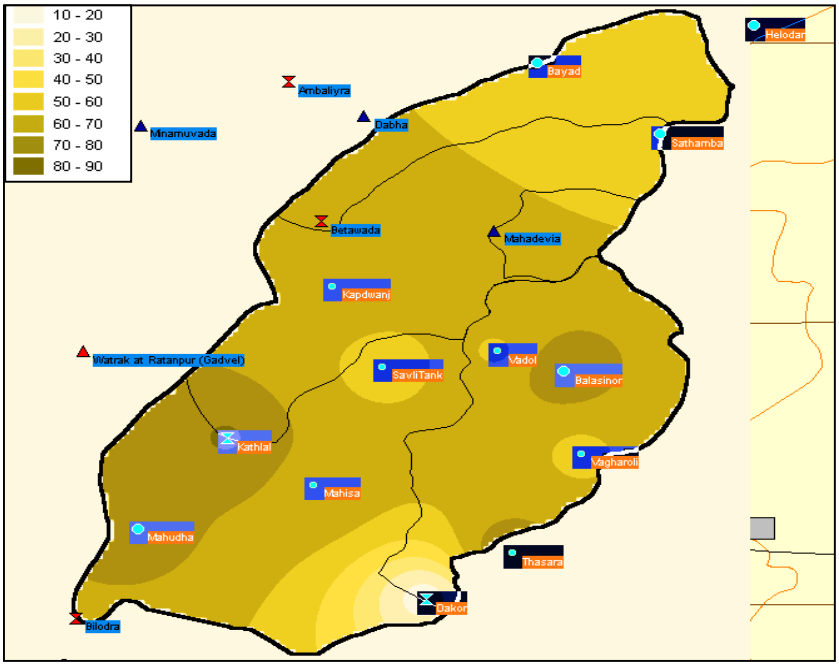


Figure 2.10: Rainfall pattern as percentage of long term annual rainfall

2.4 Article 04 – Trends in rainfall in the region/flows in …<put name of river>

<There is tremendous pressure on water as a resource, specially in our country due to increasing population. At the same time there is growing concern about possible changes in rainfall and runoff regimes in the regions due to global and/or local factors. There is

substantial shift in the land use pattern in most of the regions of the country where more and more areas are being brought under cultivation, settlements and industries. In such circumstances the earlier flow patterns are likely to change. One of the basic objectives of hydrological monitoring is to keep abreast with these changing patterns of hydro-meteorological and hydrological factors in the region. In order to highlight any such significant shifts in the patterns, it will be appropriate to include illustrative articles documenting such trends with the help of graphs and interpretations.>

2.5 Article 05 – Water Quality concerns

<As for articles on quantitative aspects of the hydro-meteorological regimes, it would be highly useful and relevant to include articles on water quality aspects. A short example is given hereunder that is having only an indicative value.>

Trends in water quality

A time series plot for BOD (3 years period i.e. from 1996 to 1998), all dates and annual average is plotted as shown in Table 2.1 and Figure 2.11 below. As revealed from the graph BOD values up to 1997 varied between 0.1 and 1.1 mg/L with an average of 0.45 mg/L. The observed increase of the maximum and average value in 1998, 1.4 and 0.67 mg/L respectively are very small compared to the large spread of the data, caused by the sharp decrease in the number of observation in 1998. The data therefore do not indicate a significant increase in BOD at this station.

☞ ***A similar plot as presented in Figure 2.11 may be included for longitudinal analysis of a river or river stretch: different monitoring stations are presented on the horizontal axis of the graph.***

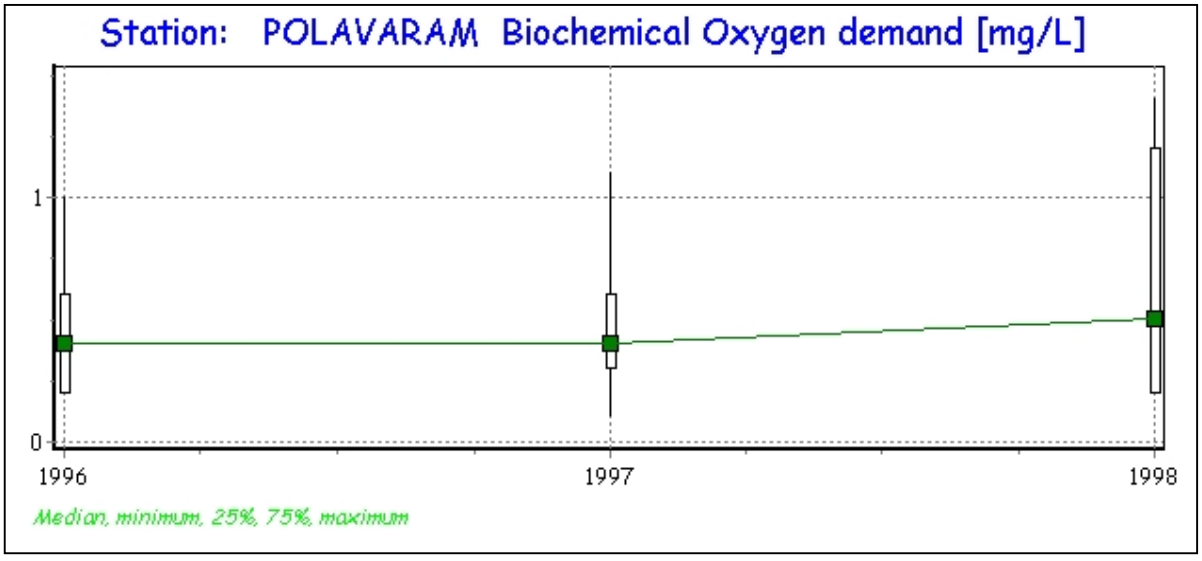


Figure 2.11: Box-whisker graph for BOD at station Polavaram

Year	1995	1996	1997	1998	1999	2000
Max	-	1.000	1.100	1.400	-	-
Mean	-	0.444	0.463	0.667	-	-
Min	-	0.200	0.100	0.200	-	-
Median	-	0.400	0.400	0.500	-	-
10%	-	0.200	0.200	0.200	-	-
25%	-	0.200	0.300	0.200	-	-
75%	-	0.600	0.600	1.200	-	-
90%	-	0.900	0.800	1.400	-	-
No. data	0	32	32	6	0	0

Table 2.1: Yearly time-series for summary statistics for BOD at station Polavaram

3 Hydrological Information System

3.1 Water Resources of …<put the name of the region being reported upon>

<This section would highlight the salient features of the surface water resources available in the region by briefly introducing all major river basins, natural lakes and artificial reservoirs. Together with the appraisal of the drainage and water resource systems available in the region, it would be appropriate to highlight the various types of uses the land is put to. The uses like forest, grazing, agriculture, industry, urban settlement etc. will help in appreciating the tremendous pressure on water in various places of the region. This will indirectly also emphasis the need to better manage the available waters.>

<Much of the information will be available through various maps included in this section, as listed here under. >

<**MAP 01 -** A MAP OF THE PHYSIOGRAPHIC FEATURES – ELEVATION, RIVERS & BASINS, LAKES, RESERVOIRS>

<**MAP 02 -** ANOTHER MAP THAT MAY BE USEFUL IS THE LAND USE MAP OF THE SAME REGION AS GIVEN IN MAP ABOVE >

<ALL MAPS TO BE GIVEN ON FULL PAGES>

< In fact, such a graphical presentation of the water resource systems will provide the background and link for why a good hydrological information system is needed in the region for managing the available water resources appropriately.>

< Together with the information provided by the maps it will be appropriate to include brief description of salient features of various river basins in the state / region. A sample is given hereunder that can further be expanded to include more relevant information in a crisp manner.>

Godavari Basin (only as an example)

The Godavari river basin is one of the 14 major river basins of India having a catchment area of 3,12,812 km^2 which is nearly 10 percent of the total geographical area of the country. It spreads over Maharashtra (48.7%), Madhya Pradesh (20.8%), Andhra Pradesh (23.4%), Orissa (5.7%) and Karnataka (1.4%). The river traverses a distance of 694 km through Maharashtra and 771 km through Andhra Pradesh, totalling 1,465 km, before discharging into the Bay of Bengal.

The major tributaries of the river Godavari are Pravara, Purna, Bindusara, Manjira, Penganga, Wainganga, Wardha, Pranahita, Indravathi, Maner and Sabari.

3.2 Hydro-meteorological and hydrological observation system

3.2.1 General

<The text in this section would include the background on hydro-meteorological and hydrological observations in the area under consideration and how such observation systems have evolved over a period of time. This may also include how different agencies share the whole task and compliment each others networks. A mention of the various field Divisions of the agency covering the entire area may also come in the text.>

<In case of the State agencies, the whole area may be suitably divided into various River Basins/Zones and the reporting in all the subsequent sections should also follow the same grouping. That means all the sections would have sub-sections for each of the River Basins/Zones of the state.>

<The maps and text included in this section gives complete understanding of the three types of networks, viz. hydro-meteorological network (SRG/ARG/FCS), hydrological network (river gauging, reservoirs and lakes) and WQ network in each of the River Basins/Zones. The text must also specify what has been added or removed from these respective networks in the year of reporting. Improvements in terms of equipment and facilities could also be highlighted. Information about the system's coverage in terms of various types of data to be observed together with the respective monitoring frequencies to be maintained will be helpful to the readers in appreciating the scope and extent of the information that can be available from the system. Similarly, an overview of how the data has been scrutinised at various levels for assuring its quality would be beneficial for readers' understanding of the whole mechanism of collection of data in the field to the presentation of data in the water yearbook. Furthermore, a section on how much of the data of the year under reporting fall short of the target would be appropriate. This section would briefly show what information would not be available though it was expected and would thus clear ambiguity about availability of such data. >

<The subsequent sub-sections cover all issues mentioned above for (a) hydro-meteorological, (b) hydrological and (c) water quality observation networks.

3.3 Hydro-meteorological observation system

3.3.1 Network layout and adaptations in reporting year

<The text should refer to the map showing the meteorological network of SRG, ARG and FCS stations. On the basis of number of the stations of various types, a table could be made about the density of observation stations of various types in every river basin or zone.>

<Highlight what improvements have been effected in the year under consideration in terms of new stations, equipment/procedures etc.>

<A comprehensive listing of the observation stations must be provided for the benefit of the user so that any station can be easily referred. A sample of such table in given as Table 3.1. This table must be put in Annex – A, rather than in this main text of the water yearbook. This will avoid imbalance of the text by putting a huge table in between. Also, availability of such table separately in the Annex would be better for accessing it electronically. Highlight what

has been changed in the network in terms of addition or removal of stations. This could be given in tabular form giving name, location and the period for which the station remained operational. Any such new station could also be highlighted in the tabular presentation of the list of stations in the network. The station listing in Table 3.1 also shows a few key static characteristics along with. It is also important to mention about changes in the frequency of observation introduced in the system, if any, as a result of the systems review in light of emerging user requirements. >

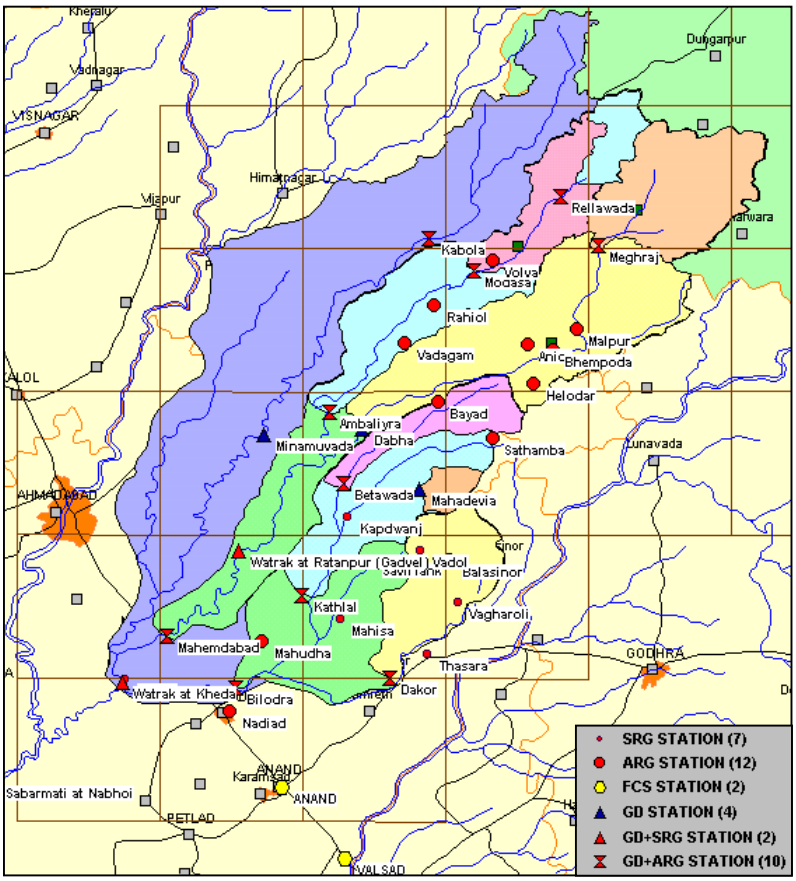


Figure 3.1: Meteorological observation network in ?? River Basin/Zone (full page)

< The map in Figure 4.1 could also simultaneously show agency's jurisdiction together with boundaries of various divisions and locations of SDDPCs/DDPCs/SDPC headquarters and distinct hydrological regions in the state >

S.No.	River	District	Station Name	Station Code	Tehsil	Tributary	Lat.	Long.	Alt. (m)	Date of Establishment	SW - Type
1	Amba	Raigad	Pali	Pali	Sudhagad	-	183152	731205	22.4	01/06/1972	FCS
2			Payarachiwadi	Payarwadi	Sudhagad	Walki	183300	731600	22.4	31/03/1988	SRG
3			Tuksai	Tuksai	Khalapur	-	184149	731800	43.1	31/03/1988	ARG
4	Bharja	Thane	Gonde(Kd)	Gonde(Kd)	Mokhada	Wagh	195522	732200	400.0	01/06/1986	ARG
5	Daman Ganga	Thane	Jamsar	Jamsar	Jawhar	Wagh	195820	731409	395.0	01/06/1986	SRG
6			Juni Jawhar	Juni Jawhar	Jawhar	Jawhar	195348	731358	400.0	01/08/1977	SRG
7			Khadadi	Khadadi	Jawhar	Wagh	195910	731409	300.0	01/06/1986	ARG
8			Shindyachapada	Shindyapada	Mokhada	Wagh	195817	732234	400.0	01/07/1986	ARG
9	Deoghar	Sindudurg	Baparde	Baparde	Deogad	Local nala	162618	732854	19.6	01/06/1991	ARG
10			Deogad	Deogad	Deogad	-	162219	732328	45.7	01/05/1969	SRG
11			Phondaghat	Phondaghat	Kankawali	Kharada	162154	734757	145.1	01/05/1969	SRG
12			Talere	Talere	Kankawali	Kharada	162712	733916	152.4	01/05/1990	SRG
13	Gad	Sindudurg	Digawale	Digawale	Kankawali	-	161415	735000	91.5	01/05/1969	SRG
14			Golvan	Golvan	Malvan	-	160831	733340	76.2	01/05/1990	SRG
15			Kankawali	Kankawali	Kankawali	-	161642	734244	76.2	01/05/1969	SRG
16			Kasal	Kasal	Kudal	Kasal	161003	734139	45.7	01/05/1990	SRG
17			Nardave	Nardave	Kankawali	-	161201	735207	131.0	01/05/1990	SRG
18			Palsamb	Palsamb	Malvan	-	161407	733251	30.5	01/05/1991	SRG
19			Tarandale	Tarandale	Kankawali	-	161811	734224	76.2	01/05/1990	SRG
20	Godavari	Ahmednagar	Adhala	Adhala	Akola	Adhala	193644	740605	626.0	01/07/1995	ARG
21			Bhagur	Bhagur	Shevgaon	Nani	191929	751226	472.0	01/06/1989	ARG
22			Bhavarwadi	Bhavarwadi	Newasa	-	191638	744917	605.0	01/06/1976	SRG
23			Bodhegaon	Bodhegaon	Shevgaon	-	191816	752752	468.0	01/06/1976	SRG
24			Brahmangaon	Brahmangaon	Kopargaon	-	195742	742617	520.0	01/06/1959	SRG
25			Kopargaon	Kopargaon	Kopargaon	-	195210	742746	499.0	01/06/1989	FCS
26			Kotul	Kotul	Akola	Mula	192603	735808	715.0	01/07/1990	ARG
27			Manjur(Handewadi)	Manjur	Kopargaon	-	195445	741650	530.0	01/06/1959	ARG
28			Mhaladevi(Induri)	Mahaldevi	Akola	Pravara	193250	735537	578.0	01/06/1969	ARG
29			Mungi	Mungi	Shevgaon	-	192421	752648	432.0	01/06/1972	ARG
30			Newasa	Newasa	Newasa	Parvara	193308	745543	471.0	01/01/1978	FCS
31			Padhegaon	Padhegaon	Kopargaon	-	195553	743315	515.0	01/06/1959	ARG
32			Panegaon	Panegaon	Newasa	Mula	192850	744738	483.0	01/06/1988	ARG
33	Godavari	Ahmednagar	Rahata	Rahata	Kopargaon	-	194253	742907	512.0	01/06/1959	SRG
34			Samangaon(Male)	Samangaon M	Shevgaon	Godavari	192026	750626	480.0	01/06/1988	ARG
. . .											
. . .											
. . .											

3.3.2 Monitoring and processing

<It would be beneficial to present the salient features of the observation systems being used for various types of stations. Equipment and practices about following type of stations can be outlined, for example:

Hydro-meteorological Observation Network

ARG stations: Brief note on the equipment available – type of ARGs used in the network and observation practices employed

FCS stations: Brief note on the type and range of equipment employed – observation practices

< Together with the above note on the data collection plan, it would be good to briefly define the various primary and secondary validations and data processing carried out while finalising the data. Such a background will create greater awareness among the data users about the type of data processing the data has undergone.

3.3.3 Data collection in reporting year

< This sub-section can bring out the accomplishment in terms of percentage of data collection target achieved. Together with such percentages for various data types it would be appropriate to briefly mention about the reasons of the shortfall in collection of data. It may be due to equipment malfunctioning, maintenance issues, availability of required personnel and consumables required for observation.

3.4 Hydrometry and sediment transport

3.4.1 Network layout and adaptations in report year

<The text to refer to the map showing the network of river gauging / reservoir stations (G/GQ/GD/GDS/GDSQ/GDQ).>

<Highlight what improvements have been effected in the year under consideration in terms of new equipment/procedures, etc.>

<Highlight what has been changed in the network in terms of addition or removal of stations. This could be given in tabular form giving name, location and the period for which the station remained operational. Any such new station could also be highlighted in the tabular presentation of the list of stations in the network. It is also important to mention about changes in the frequency of observation.>

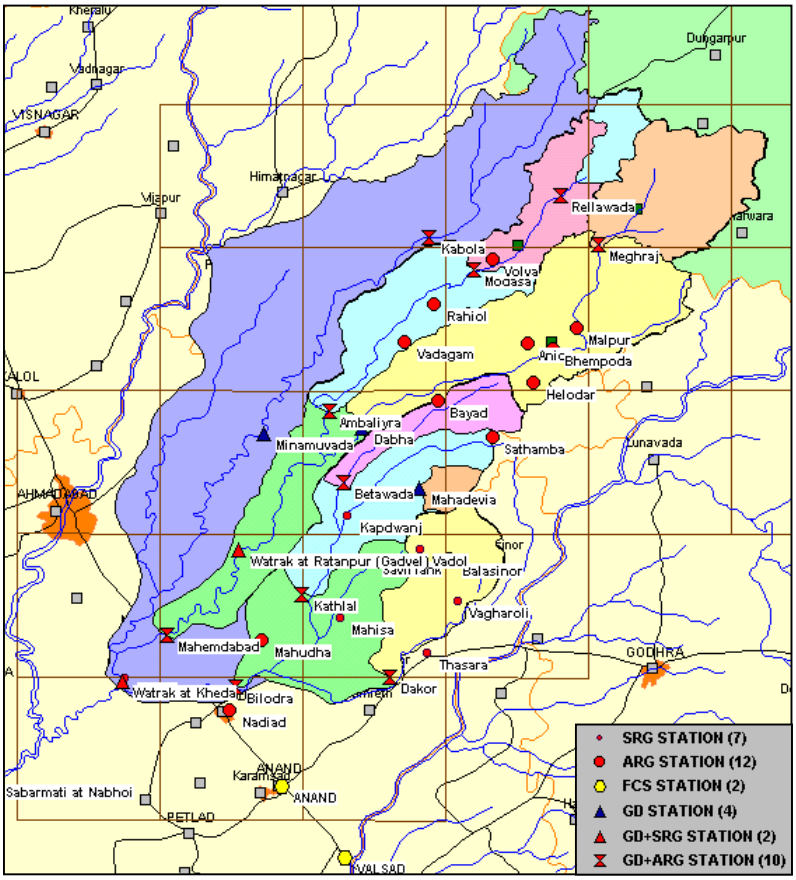


Figure 3.2: Hydrological observation network in ?? River Basin/Zone (full page)

S.No.	River	District	Station Name	Station Code	Tehsil	Tributary	Lat.	Long.	Alt. (m)	Date of Establishment	SW - Type
1	Amba	Raigad	Burmali	Burmali	Sudhagad	Walki	183129	731330	22.6	01/06/1993	GD
2			Pali	Pali	Sudhagad	-	183152	731205	22.4	01/06/1972	GD
3			Salinde	Salinde	Pen	Nigade	183718	730632	20.0	01/06/1994	GDS
4			Tuksai	Tuksai	Khalapur	-	184149	731800	43.1	31/03/1988	GD
5	Bharja	Ratnagiri	Latwan	Latwan	Mandangad	-	175555	732051	121.9	01/12/1983	GDS
6	Daman Ganga	Nashik	Usthale (Hedpada)	Usthale	Peth	Damaganga	201200	733237	378.0	06/06/1982	G
7		Thane	Gaheli	Gaheli	Jawhar	Wagh	200700	731503	90.0	01/06/1999	GD
8			Khadadi	Khadadi	Jawhar	Wagh	195910	731409	300.0	01/06/1986	GD
9			Khadkhad	Khadkhad	Jawhar	Wagh	195654	731634	30.0	01/06/1987	G
10			Shindyachapada	Shindyapada	Mokhada	Wagh	195817	732234	400.0	01/07/1986	GD
11			Ghonsari(L)	Ghonsari(L)	Kankawali	Kharada	162405	734616	111.8	21/09/1965	GDS
12	Godavari	Ahmednagar	Bhagur	Bhagur	Shevgaon	Nani	191929	751226	472.0	01/06/1989	GDS
13			Kopargaon	Kopargaon	Kopargaon	-	195210	742746	499.0	01/06/1989	GD
14			Mhaladevi(Induri)	Mahaldevi	Akola	Pravara	193250	735537	578.0	01/06/1969	GD
15			Newasa	Newasa	Newasa	Parvara	193308	745543	471.0	01/01/1978	GD
16			Panegaon	Panegaon	Newasa	Mula	192850	744738	483.0	01/06/1988	GD
17	Godavari	Ahmednagar	Samangaon(Male)	Samangaon M	Shevgaon	Godavari	192026	750626	480.0	01/06/1988	G
18			Sangamner(Waghapur)	Sangamner	Sangamner	Pravara	193308	741400	551.0	01/07/1989	GD
19		Amravati	Warud Bagaji	WarudBagaji	Tiwasa	Wardha	205230	781544	274.7	06/08/1987	GD
20		Aurangabad	Chinchkhed Bhavan	Chinchkhed	Sillod	Purna	201622	753843	583.0	01/06/1984	GD
21			Nagamthan	Nagamthan	Vaijapur	-	194344	744726	476.0	01/06/1987	GD
22			Solegaon	Solegaon	Gangapur	Shivna	194215	750558	467.0	01/06/1988	G
23		Bhandara	Chichghat	Chichghat	Bhandara	Wainganga	210448	793406	249.0	18/04/1986	GDS
24			Kardha	Kardha	Bhandara	Wainganga	210840	794019	246.0	01/06/1977	GD
25			Lakhandur	Lakhandur	Lakhandur	Wainganga	204406	795232	222.5	28/06/1988	GD
26			Mahalgaon	Mahalgaon	Tumsar	Wainganga	213033	795422	263.1	01/06/1990	GD
27			Sitekasa	Sitekasa	Bhandara	Wainganga	213104	793514	323.0	01/06/1985	GD
28		Buldhana	Fardapur	Fardapur	Mehkar	Painganga	201030	763354	527.5	01/06/1985	GDS
29			Raheri	Raheri	Sindhkhed Raja	Purna	195900	761654	494.0	01/01/1988	GD
30			Dhaba	Dhaba	Gondpipri	Wardha	193146	793520	162.0	01/07/1988	GD
31			Dindora(Soit)	SoitDindora	Warora	Wardha	201644	784912	203.2	01/06/1988	GD
32	Godavari	Chandrapur	Gadbori	Gadbori	Sindewahi	Wainganga	201731	793534	199.3	01/06/1972	GD
33			Nandgur	Nandgur	Chandrapur	Wainganga	200105	793044	187.6	01/06/1978	GDS
. . .											
. . .											
. . .											

3.4.2 Monitoring and processing

<It would be beneficial to present the salient features of the observation systems being used for various types of stations. Equipment and practices about following type of stations can be outlined, for example:>

Hydrological observation Network

Gauge & Discharge stations:	Brief note on available equipment – current meters, water level recorders. Method of observation – single point or multiple point velocities. Mechanism for crossing the river – boats, bridges, cableway (what types)
Sediment stations:	Type of sampler used and analysis procedure employed

< Together with the above note on the data collection plan, it would be good to briefly define the various primary and secondary validations and data processing carried out while finalising the data. Such a background will create greater awareness among the data users about the type of data processing the data has undergone.

3.4.3 Data collection in report year

< This sub-section can bring out the accomplishment in terms of percentage of data collection target achieved. Together with such percentages for various data types it would be appropriate to briefly mention about the reasons of the shortfall in collection of data. It may be due to equipment malfunctioning, maintenance issues, availability of required personnel and consumables required for observation.

3.5 Water quality

3.5.1 Network layout and adaptations in report year

< It is appropriate to indicate which agencies are complementing each others observation network in the region. For example, the water quality of the river Godavari and its tributaries is being monitored by the Central Water Commission (CWC), the Water Resources Departments of Maharashtra and Andhra Pradesh, the Ground Water Survey Division of Madhya Pradesh (SW monitoring as additional activity), and the Central Pollution Control Board (CPCB) through the State Pollution Control Boards (SPCB) of Madhya Pradesh, Maharashtra, and Andhra Pradesh. >

< In Godavari basin, water quality is monitored by CWC at 14 stations out of the 22 hydrological observation stations. Besides, the State Water Resources Department monitors water quality at 13 locations. >

< CPCB has in all 21 Stations (11 on Godavari, 1 on Kalu, 1 on Manjira, 4 on Maner, 1 on Panchaganga, 2 on Ulhas 3 on Wainganga and 1 on Wardha).>

Figure 3.3 shows the monitoring stations of the following type on one map:

- WQ stations of CWC;
- WQ stations of state SW;
- WQ stations of CPCB/SPCBs; and
- Hydrologic discharge stations

<The text to refer to the map showing the network of water quality monitoring stations (GQ/GDQ/GDSQ). Highlighting the various types of WQ stations (baseline, trend, flux, surveillance) would be very useful.>

<Highlight what improvements have been effected in the year under consideration in terms of new equipment/procedures etc.>

<Highlight what has been changed in the network in terms of addition or removal of stations. This could be given in tabular form giving name, location and the period for which the station remained operational. Any such new station could also be highlighted in the tabular presentation of the list of stations in the network. It is also important to mention about changes in the frequency of observation.>

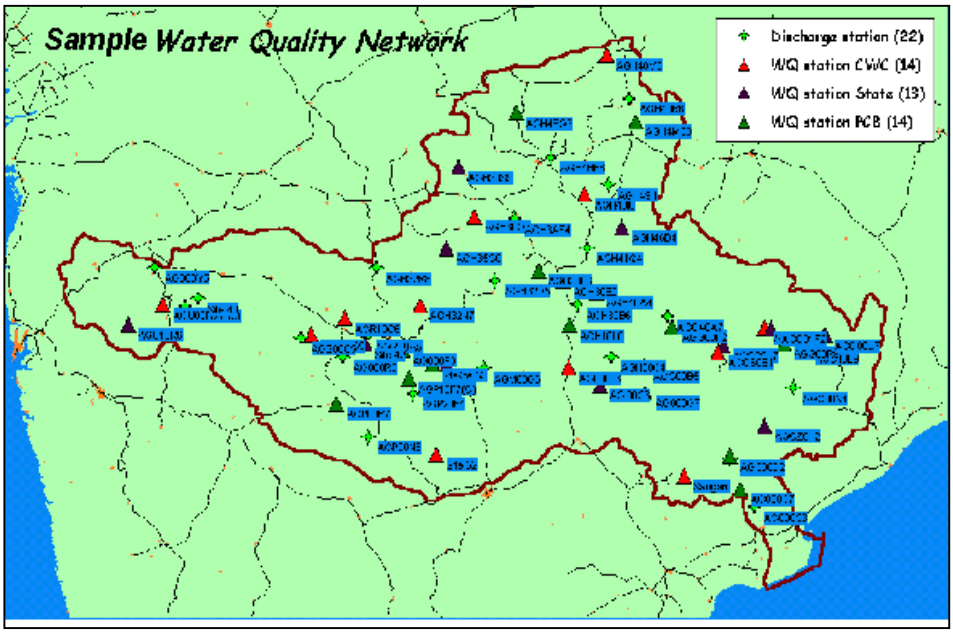


Figure 3.3: Water quality observation network in ?? River Basin/Zone (full page)

Table 3.3 gives the list of WQ stations in the region. Note however that this is a list of example stations only and not the stations shown in Figure 3.3. above.

S.No.	River	District	Station Name	Station Code	Tehsil	Tributary	Lat.	Long.	Alt. (m)	Date of Establishment	SW - Type
1	Amba	Raigad	Pali	Pali	Sudhagad	-	183152	731205	22.4	01/06/1972	Trend
2	Daman Ganga	Thane	Khadadi	Khadadi	Jawhar	Wagh	195910	731409	300.0	01/06/1986	Trend
3			Khadkhad	Khadkhad	Jawhar	Wagh	195654	731634	30.0	01/06/1987	Baseline
4			Shindyachapada	Shindyapada	Mokhada	Wagh	195817	732234	400.0	01/07/1986	Trend
5	Godavari	Ahmednagar	Kopargaon	Kopargaon	Kopargaon	-	195210	742746	499.0	01/06/1989	Trend
6			Newasa	Newasa	Newasa	Parvara	193308	745543	471.0	01/01/1978	Trend
7	Godavari	Bhandara	Kardha	Kardha	Bhandara	Wainganga	210840	794019	246.0	01/06/1977	Trend
8	Godavari	Chandrapur	Wadsa (Chincholi)	WadsaChinch	Bramhapuri	Wainganga	203625	795601	221.2	01/06/1965	Trend
9			Wagholi -Butti	WagholiButi	Saoli	Wainganga	200706	795417	222.1	01/06/1964	Trend
10		Gadchiroli	Bhamragad	Bhamragad	Bhamragad	Indrawati	192500	803510	207.5	20/06/1998	Flux
11			Damrencha	Damrencha	Aheri	Indrawati	191332	792230	175.9	01/03/2000	Baseline
12			Mahagaon	Mahagaon	Aheri	Pranhita	192658	795812	128.3	06/06/1998	Flux
. . .											
. . .											
. . .											

3.5.2 Monitoring and processing

< This section will emphasis on the monitoring program and its objectives together with understanding of various types of data processing which is undertaken.

The different organisations involved in water quality monitoring in Godavari river basin have the following objectives for monitoring:

1. To establish *baseline* quality (all agencies);
2. To observe *trend* in water quality over a period of time (all agencies);
3. To calculate the *load* (or *flux*) of water quality constituents of interest (e.g. silt in reservoirs);
4. To prevent and control water pollution (Central and State PCBs);
5. To have surveillance over pollution threats to water quality for sustenance of various beneficial uses, like irrigation (State Irrigation Departments)

Monitoring Frequency

The samples are collected three times in a month by CWC and once a month by CPCB. Sampling dates for CWC are 1st, 10th and 20th of each month in general.

- A general statement on the target frequency of sampling for the respective agencies according to their monitoring objectives may be given here or a table indicating the targeted sampling frequency for each station.
- Elaborate on sampling frequency of irrigation departments
- Describe the sampling programme for seasonal rivers, if applicable.

Analytical Quality Control

Analytical Quality Control (AQC) program is run among various laboratories for ensuring and monitoring standards maintained with respect to analysis performed in the laboratories. The following parameters are covered under the inter-laboratory AQC exercise (carried out once a year) in which the majority of the laboratories take part.

1. Conductivity
2. Total Dissolved Solids
3. Total Hardness
4. Sodium
5. Fluoride
6. Sulphate
7. Nitrate - N
8. Phosphate-P
9. Boron
10. Chloride

- ***Average accuracy of the participating laboratories for relevant parameters, such as heavy metals, may be given here in addition.***
- ***Newly introduced parameters in the AQC programme, if any, may be mentioned here.***
- ***All parameters associated with the laboratory level may be listed here or in an appendix.***

Parameters

The level of the laboratory is an indication of the analytical capacity of the laboratory.

Level I	Laboratory located in the field, generally analysing Temperature, pH, Conductivity, Dissolved Oxygen, colour and odour
Level II	Laboratory has facilities to analyse basic water quality parameters, nutrients, indicators of organic and bacteriological pollution etc.
Level II^{+}	Laboratory has facilities to analyse basic water quality parameters, nutrients, indicators of organic and bacteriological pollution etc. Laboratory is in possession of advanced equipment, such as Atomic Adsorption Spectrophotometer (AAS), Gas Chromatograph (GC), UV-Visible Spectrophoto-meter etc.

Table 3.4: Classification of laboratories involved in monitoring as used by CWC and other HP-Agencies.

Parameter ID	Parameter Name	Category	Unit	LWL	UWL	Minimum	Maximum	No. of Decimals
FLD Field Determinations								
Colour Code	Colour	Physical	-					
DO	Dissolved oxygen	Chemical	mg/L	0	15	0	30	1
EC_FLD	Electrical Conductivity, Field	Physical	µmho/cm	50	5000	1	10000	0
Odour Code	Odour	Chemical	-					
pH_FLD	pH_Field	Chemical	pH units	5.5	9	2	14	1
Secchi	Secchi Depth	Physical	m	0.01	50	0.005	100	2
Temp	Temperature	Physical	deg C	10	40	0.1	50	1
Laboratory Determinations								
DO_SAT%	Dissolved Oxygen Saturation %	Chemical	%	0	150	0	300	0
EC_GEN	Electrical Conductivity	Physical	µmho/cm	50	5000	1	10000	0
pH_GEN	pH	Chemical	pH units	5.5	9	2	14	1
SS	Solids, Suspended	Physical	mg/L	5	2000	0	3000	0
TDS	Solids, Total Dissolved	Physical	mg/L	50	5000	5	30000	0
TS	Solids, Total	Physical	mg/L	50	5000	10	30000	0
Turb	Turbidity	Physical	NTU	1	2000	0.1	10000	1
NH_3-N	Nitrogen, ammonia	Chemical	mg N/L	0.05	100	0.05	1000	2
NO_2+NO_3	Nitrogen, Total Oxidised	Chemical	mg N/L	0.05	1000	0.05	2000	1
NO_2-N	Nitrogen, Nitrite	Chemical	mgN/L	0	0.5	0	10	1
NO_3-N	Nitrogen, Nitrate	Chemical	mgN/L	0.05	1000	0.01	2000	2
o-PO4-P	Phosphorus, ortho-phosphate	Chemical	mg P/L	0.05	5	0.01	50	3

Parameter ID	Parameter Name	Category	Unit	LWL	UWL	Minimum	Maximum	No. of Decimals
Org-N	Nitrogen, Organic	Chemical	mgN/L	0.1	200	0.01	1000	1
P-Tot	Phosphorus, total	Chemical	mgP/L	0.01	10	0.001	100	3
$BOD_{3\text{-day, }27\,^{\circ}c}$	Biochemical Oxygen demand	Chemical	mg/L	0.5	200	0.1	5000	1
COD	Chemical Oxygen Demand	Chemical	mg/L	5	5000	1	10000	1
Alk-Phen	Alkalinity, phenolphthalein	Chemical	$mgCaCO_3/L$	0	500	0	3000	1
ALK-TOT	Alkalinity, total	Chemical	$mgCaCO_3/L$	10	1000	5	5000	1

Table 3.5: Example of: Details of parameters analysed by various levels of laboratories

Parameter	Parameter group	WQ standard (target)
Temp	General	none
TDS or EC	General	TDS 500 mg/L , (drinking water std.) EC 2250 umho/cm (for irrigation water)
SAR	Major Ions (indirect)	26 (for irrigation)
DO	General	4 mg/L (min value)
BOD	Organic matter	3 mg/L (target)
TotP & NO_3	Nutrients	Nitrate 10 mgN/L (drinking water)
Selected pollutants	trace metals or pesticides	

Table 3.6: CPCB classification system for quality of water

3.5.3 Data collection in report year

< In this sub-section a brief account of what could be achieved in the year under reporting in terms of data collection is to be given. The short summary can bring out certain typical problems that would have hampered the data collection. An overall account of how much percentage of the target data collection could be achieved together with the number of station-samples taken and analysed in the year would be indicative of the system's performance in terms of collection of data.

In this sub-section an overview of the monitoring related to pollution monitoring is given for the year 1996. In Table 3.7 the content of the database with respect to pollution monitoring is summarised: the number of samples for BOD, Total Coliforms (TC) and Faecal Coliforms (FC) and the first and last sampling date are indicated.

☞ ***The targeted number of samples may be added to Table 4 if one wants to indicate the performance of operating the monitoring network with respect to the activities envisaged in the monitoring programme.***

Station characteristics overview					
Godavari Pollution related Monitoring For the year 1996					
Station ID	**Name**	**Parameter ID**	**First Date**	**Last Date**	**Number of Samples**
AG000C3	Polavaram	BOD	09/03/1996	10/11/1996	32
AG000C3	Polavaram	FC			0
AG000C3	Polavaram	TC			0
AG000C3	Polavaram	DO	07/02/1996	12/11/1996	34
AG000G7	Perur	BOD	23/01/1996	03/11/1996	30
AG000G7	Perur	FC			0
AG000G7	Perur	TC			0
AG000G7	Perur	DO	09/11/1996	01/12/1996	35
AG000J3	Mancherial	BOD	01/02/1996	21/11/1996	35
AG000J3	Mancherial	FC			0
AG000J3	Mancherial	TC			0
AG000J3	Mancherial	DO	24/01/1996	13/12/1996	35
AG000P3	Yelli	BOD	09/03/1996	12/07/1996	15
Water Quality Yearbook – HYMOS Example Report 3 (HP 2002)					

Table 3.7: Contents of the database for pollution related monitoring in 1996

Limitations

At present the infrastructure of the laboratories attached to the Krishna Godavari Basin Organisation of CWC in Hyderabad are meeting the requirements for analysing all the above-mentioned parameters. The laboratories have been upgraded to analyse also the pollution-related parameters.

4 Hydrological review of the year <YYYY>

4.1 Summary

<This section on hydrological review tries to summaries all the aspects of the main components of the hydrological cycle (rainfall, evaporation, runoff and water quality) one-by-one. This presentation of information will be in the form of explanatory notes, graphs and data tables. The Summary in the beginning attempts to highlight the salient features of the hydrological scenario for the year under reporting>.

As an example, a short summary about WQ data is presented hereunder. Note that this is only an indicative text and the actual text is to be based on the region and the year at hand and has to bring out the essence of the WQ regime representing the year.

<The water quality of the Godavari River and its tributaries is being monitored by the Central Water Commission (CWC) at 14 stations and by the Central Pollution Control Board (CPCB) at 21 stations. The State Irrigation Departments of Maharashtra and Andhra Pradesh also started water quality monitoring of the Godavari River. During the reporting period only CWC data are analysed for the purpose of preparation of the specimen Water Quality Yearbook.>

<The monitoring is done three times a month by CWC. >

<The CWC analyses major ions, some inorganics, like phosphates, silicates, ammonia, aluminium and irons, and basic parameters, like temperature, conductivity and pH. Pollution related parameters, like BOD, COD and total and fecal coliforms have recently been introduced. >

<Most of the major ions and inorganics are genarally within the limits of drinking and irrigation standards, whereas coliforms are the major problem in the river basin. Most of the stations monitored do not meet the desired water quality criteria for coliforms and in some cases BOD.>

<With respect to organic pollution, i.e. BOD, COD and DO, the Godavari is worst polluted at Nashik, and Nanded. This is mainly due to discharge of untreated domestic wastewater into the river followed by reduced flow in the river due to water abstraction from the river in the upstream. Similarly, the river is heavily polluted at Ramagundam, Bhadrachalam and Rajamundary towns due to discharges of partially treated / untreated industrial wastewater along with the domestic wastewater.>

4.2 Rainfall

<Rainfall of the year in the region could be characterised by the following figures and tables. A good explanation of the important features which may be inferred from these figures and tables must follow in the sub-section. Different types of figures and tables that could be representing the rainfall in the region could be as follows: >

Figure 4.2.1 Spatial variation of the monthly rainfall (monsoon months) in the region

Figure 4.2.2 Spatial variation of the annual rainfall in the region

Figure 4.2.3	Spatial variation of the rainfall as a percentage of long term annual average rainfall
Figure 4.2.4	Monthly rainfall of the year as seen against monthly frequency curves
Table 4.2.1	Station-wise rainfall data summary
Table 4.2.2	District-wise (or basin/sub-basin-wise, if required) rainfall data summary
Table 4.2.3	Daily Rainfall Data and associated monthly and yearly statistics (This table needs to be given in the main text for only few representative stations and not all the stations in the network. Similar tables for all the stations are however to be included in the Appendices to the yearbook. These appendices need to be printed only in required quantity and not in bulk as mentioned in the introduction. The appendices will be readily available as soft copy in the electronic yearbook form.

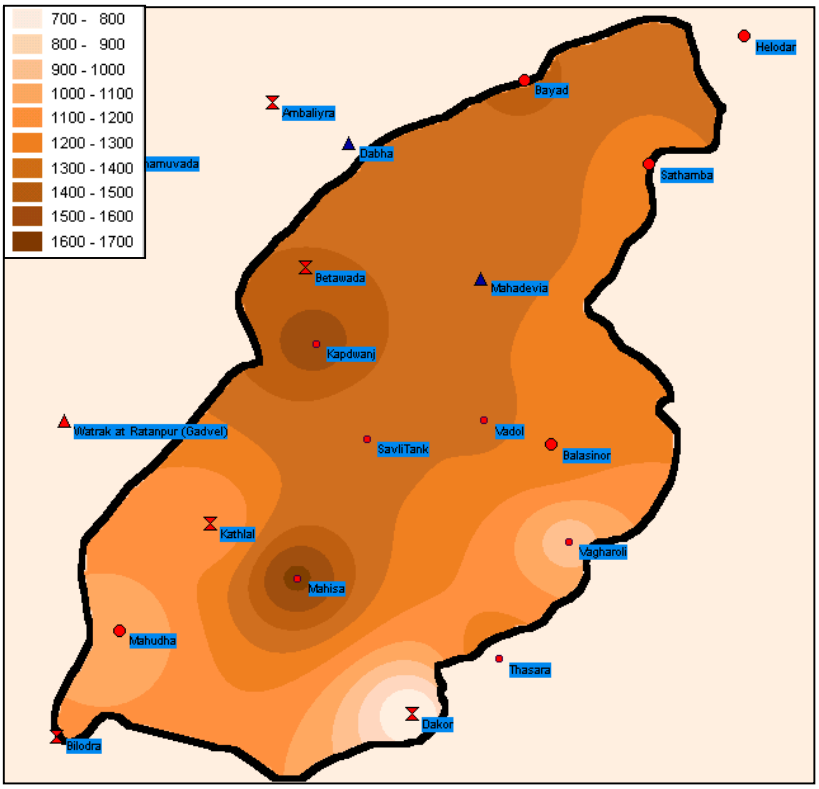


Figure 4.2.2: Annual Rainfall in 1997

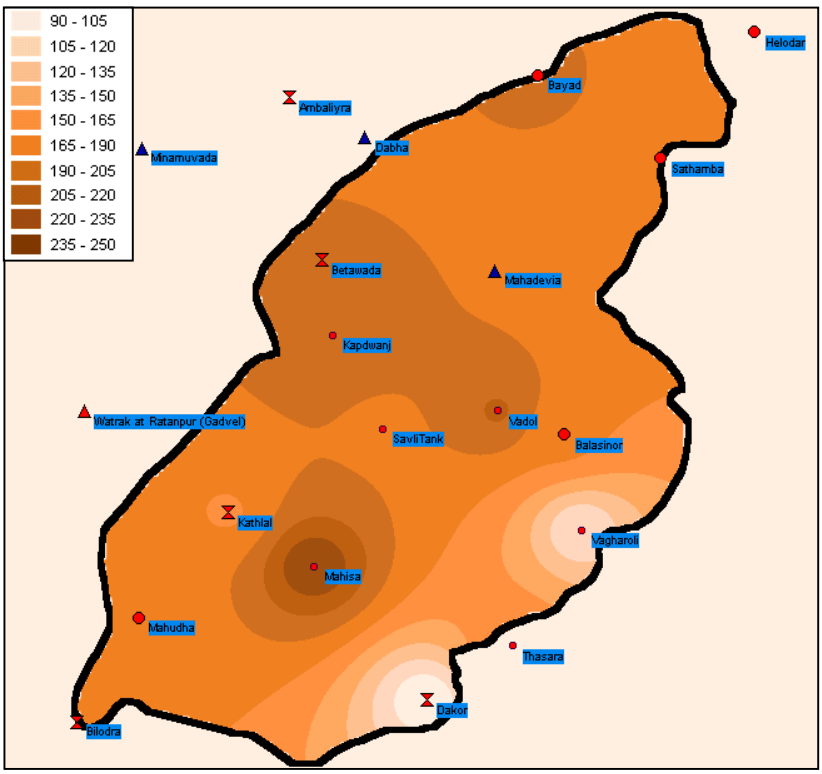


Figure 4.2.3: Annual Rainfall in 1997 as percentage of 1970-2000 average

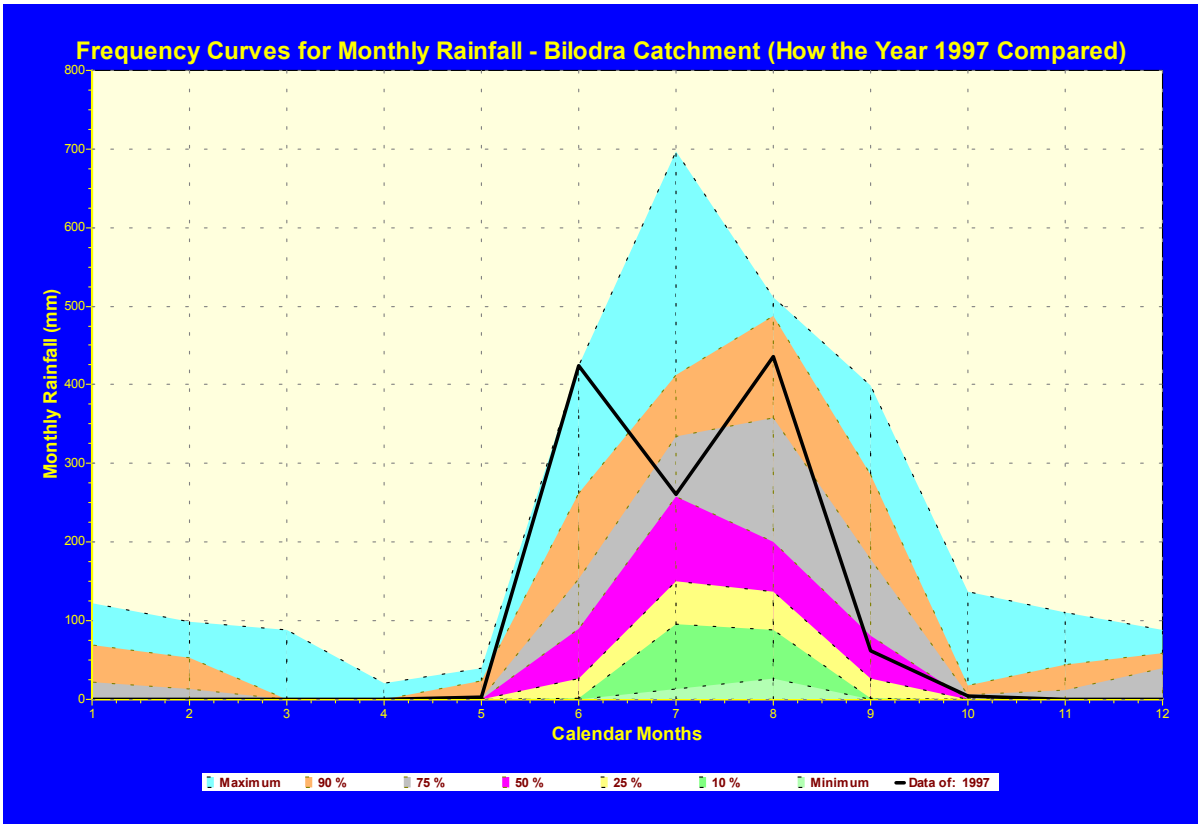


Figure 4.2.4 Monthly rainfall of 1997 as seen against monthly frequency curves ased on 1961-1997 period)

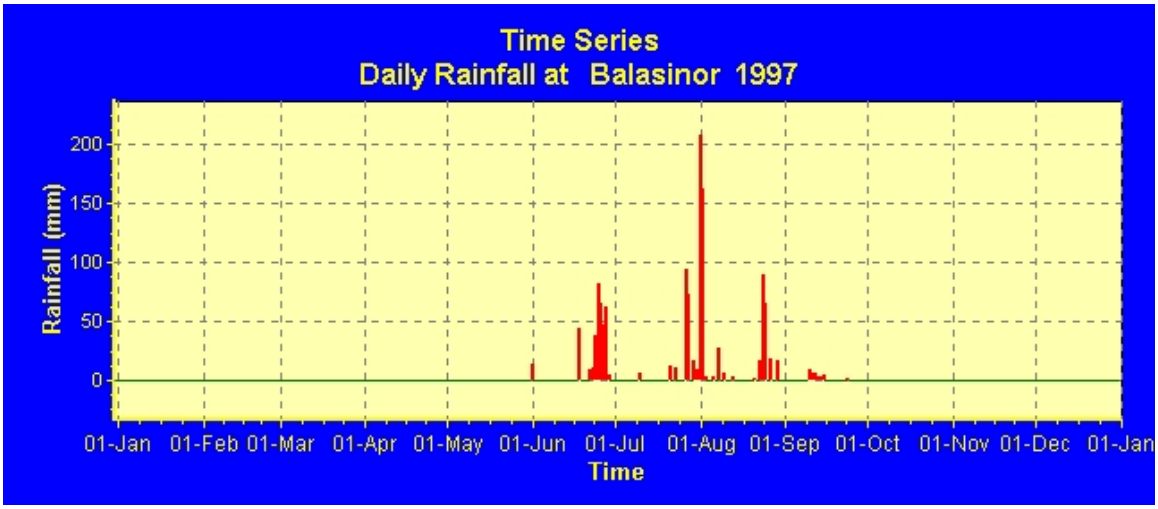
Station ID	Name	Alt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	LTA	Max	Date
Basin A																		
Ambaliyara	Ambaliyara	72	0	0	0	0	0	473	113	279	85	0	0	0	950	900	170.1	25/06/1997
Balasinor	Balasinor	90	0	0	0	0	0	381	226	625	40	0	0	0	1272	750	208.0	01/08/1997
Bayad	Bayad	135	0	0	0	0	0	428	384	526	64	16	0	0	1418	775	257.0	01/08/1997
Dakor	Dakor	55	0	0	0	0	0	315	120	403	0	0	0	0	718	775	127.3	01/08/1997
Helodar	Helodar	180	0	0	0	0	0	338	476	572	3	27	0	0	1416	850	238.0	28/07/1997
Kapadwanj	Kapdwanj	100	0	0	0	0	0	633	197	613	105	0	0	0	1548	800	225.0	28/06/1997
Kathlal	Kathlal	47	0	0	0	0	0	448	108	545	0	0	0	0	1102	675	150.0	01/08/1997
Mahemdabad	Mahemdabad	35	0	0	0	0	0	488	125	425	90	0	0	0	1128	775	130.2	25/06/1997
Mahisa	Mahisa	65	0	0	0	0	0	492	325	642	137	28	0	0	1624	725	200.0	23/08/1997
Mahudha	Mahudha	50	0	0	0	0	0	276	112	500	97	29	0	0	1014	600	132.0	02/08/1997
Sathamba	Sathamba	152	0	0	0	0	0	239	556	468	0	0	0	0	1263	725	275.0	31/07/1997
SavliTank	SavliTank	90	0	0	0	0	0	382	139	687	95	33	0	0	1336	750	245.7	01/08/1997
Thasara	Thasara	65	0	0	0	0	0	428	113	525	59	0	0	0	1125	775	205.0	02/08/1997
Vadol	Vadol	92	0	0	0	0	0	335	233	676	85	0	0	0	1329	675	260.1	01/08/1997
Vagharoli	Vagharoli	72	0	0	0	0	0	473	113	279	85	0	0	0	950	900	170.0	25/06/1997
Basin B																		
…																		…
…																		…
…																		…

District Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	LTA
Ahmedabad	5	0	0	0	0	172	113	279	85	0	0	0	950	900
(% of 1970-2000)	100	-	-	-	-	191	113	112	170	0	-	0	105	
Amreli	0	0	0	0	0	187	190	625	40	0	0	0	1272	750
(% of 1975-2000)	0	-	-	-	-	156	136	208	100	0	-	0	170	
Banaskantha	7	0	0	0	0	148	140	526	64	16	0	0	1418	775
(% of 1975-2000)	88	-	-	-	-	197	147	162	107	80	-	0	180	
Bharuch	0	0	0	0	0	176	130	403	105	0	0	0	718	775
(% of 1970-2000)	0	-	-	-	-	161	118	107	233	0	-	0	92	
Bhavnagar	10	0	0	0	0	129	180	572	90	27	0	0	1416	850
(% of 1975-2000)	250	-	-	-	-	103	138	163	164	180	-	0	166	
Dang	0	0	0	0	0	189	108	613	137	0	0	0	1548	600
(% of 1970-2000)	-	-	-	-	-	126	74	189	228	0	-	0	258	
Gandhinagar	14	0	0	0	0	150	90	545	97	0	0	0	1102	725
(% of 1970-2000)	117	-	-	-	-	176	95	136	176	0	-	0	152	
Jamnagar	6	0	0	0	0	120	205	425	95	0	0	0	1128	750
(% of 1975-2000)	60	-	-	-	-	126	205	118	238	0	-	0	150	
Junagadh	0	0	0	0	0	160	80	642	59	28	0	0	1624	775
(% of 1970-2000)	0	-	-	-	-	152	70	201	197	156	-	0	210	
Kheda	0	0	0	0	0	80	200	500	85	29	0	0	1336	900
(% of 1970-2000)	0	-	-	-	-	145	267	161	243	145	-	0	148	
…														
…														
…														

Daily Rainfall Data **Year – 1997**

Station Code: Balasinor **District:** Kheda **Independent River :** Sabarmati

Station Name: Balasinor **Units :** mm **Tributary:** Watrak



Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	14.0	0.0	208.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	1.0	162.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	7.0	6.0	10.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	4.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	44.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	12.0	2.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	11.0	11.0	17.0	1.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	38.0	0.0	90.0	2.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	83.0	0.0	66.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	48.0	94.0	19.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	63.0	74.0	0.0	0.0	0.0	0.0	0.0
29	0.0		0.0	0.0	0.0	5.0	0.0	17.0	0.0	0.0	0.0	0.0
30	0.0		0.0	0.0	0.0	0.0	17.0	0.0	0.0	0.0	0.0	0.0
31	0.0		0.0		0.0		10.0	0.0		0.0		0.0
Mean	0.0	0.0	0.0	0.0	0.0	12.7	7.3	20.2	1.3	0.0	0.0	0.0
Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max.	0.0	0.0	0.0	0.0	0.0	83.0	94.0	208.0	10.0	0.0	0.0	0.0
Sum	0.0	0.0	0.0	0.0	0.0	381.0	226.0	625.0	40.0	0.0	0.0	0.0

Yearly statistics :

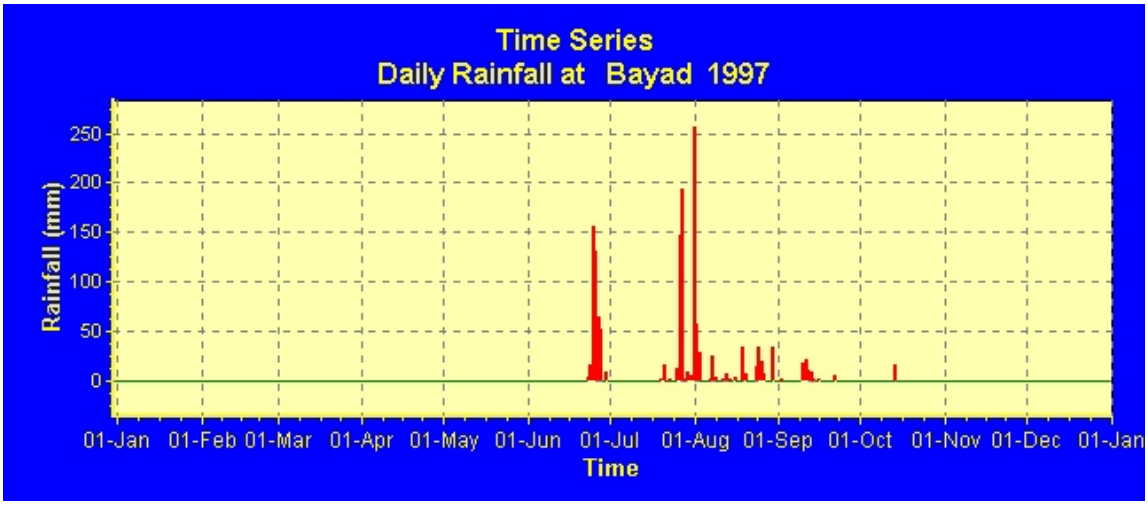
Mean : 3.5 Sum : 1272.0	Minimum : 0.0 Date : 01/01/1997	Maximum : 208.0 Date : 01/08/1997	No. of data : 365 No. of missing data : 0

Table 4.2.3: Daily Rainfall Data

Daily Rainfall Data

Year - 1997

Station Code: Bayad
Station Name: Bayad
District: Sabarkantha
Units : mm
Independent River : Sabarmati
Tributary: Watrak



Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	257.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.5	1.5	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.5	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	10.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	9.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	16.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	14.5	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	2.0	1.5	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	16.0	0.0	13.5	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	156.0	0.0	33.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	130.0	11.0	19.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	64.5	147.5	5.5	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	52.0	194.5	0.0	0.0	0.0	0.0	0.0
29	0.0		0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0
30	0.0		0.0	0.0	0.0	7.5	9.0	33.0	0.0	0.0	0.0	0.0
31	0.0		0.0		0.0		4.0	0.0		0.0		0.0
Mean	0.0	0.0	0.0	0.0	0.0	14.3	12.4	17.0	2.2	0.5	0.0	0.0
Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max.	0.0	0.0	0.0	0.0	0.0	156.0	194.5	257.0	20.0	16.0	0.0	0.0
Sum	0.0	0.0	0.0	0.0	0.0	428.0	384.5	525.5	64.5	16.0	0.0	0.0

Yearly statistics :

Mean : 3.9 Sum : 1418.5	Minimum : 0.0 Date : 01/01/1997	Maximum : 257.0 Date : 01/08/1997	No. of data : 365 No. of missing data : 0

Table 4.2.4: Daily Rainfall Data

4.3 River flows and water levels

<River flows during the year in the region could be characterised by the following figures and tables. A good explanation of the important features which may be inferred from these figures and tables must follow in the sub-sections. Different types of figures and tables that could be representing the runoff in various rivers could be as follows: >

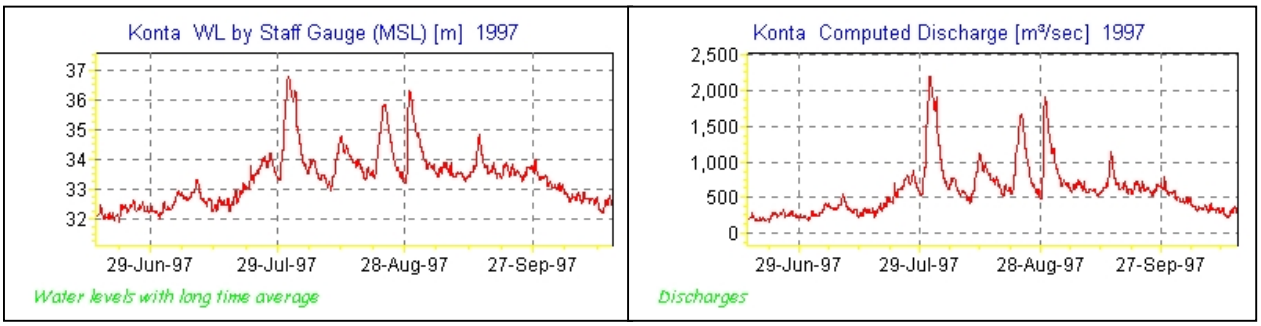
Figure 4.3.1 Water levels and flows observed and available at the least frequency at a few representative stations

Figure 4.3.2 Ten-daily river flows of the year as seen against Ten-daily frequency curves for certain base period. This could be given for few representative river gauging stations

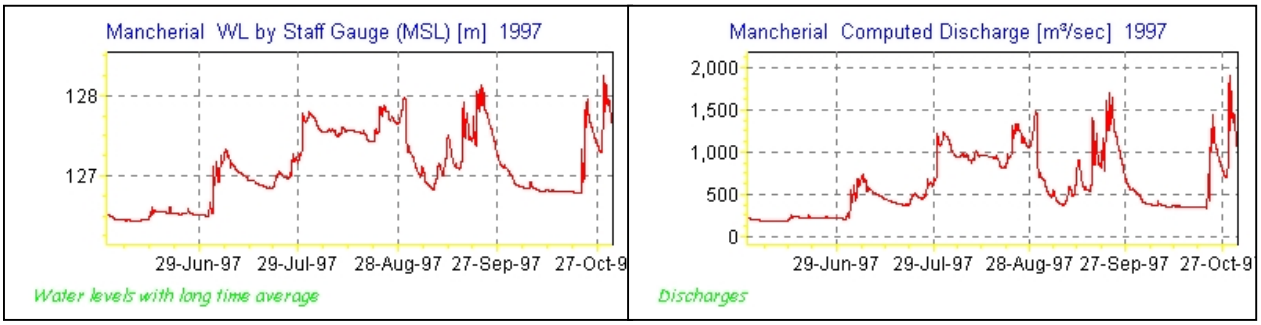
Figure 4.3.3 Flow duration curve for the year under consideration together with the Average duration curve for a certain base period. These curves obtained from daily data could be quite informative of the duration for which certain flow is maintained. This also could be given for few representative stations.

Table 4.3.1 Daily runoff data and associated monthly and yearly statistics. This table needs to be given in the main text for only few representative stations and not all the stations in the network. Similar tables for all the stations are however to be included in the Appendices to the yearbook. These appendices need to be printed only in required quantity and not in bulk as mentioned in the introduction. The appendices will be available as soft copy in the electronic yearbook form.

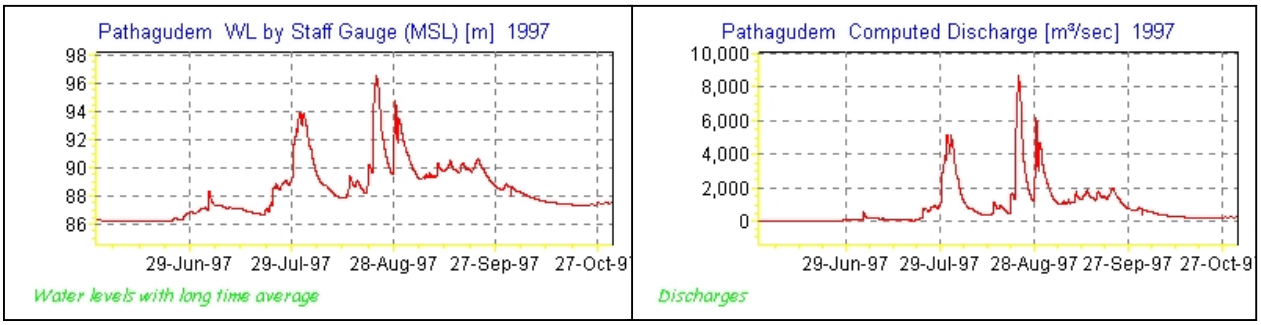
Station: Konta



Station: Mancherial



Station: Pathagudem



Station: Polawaram

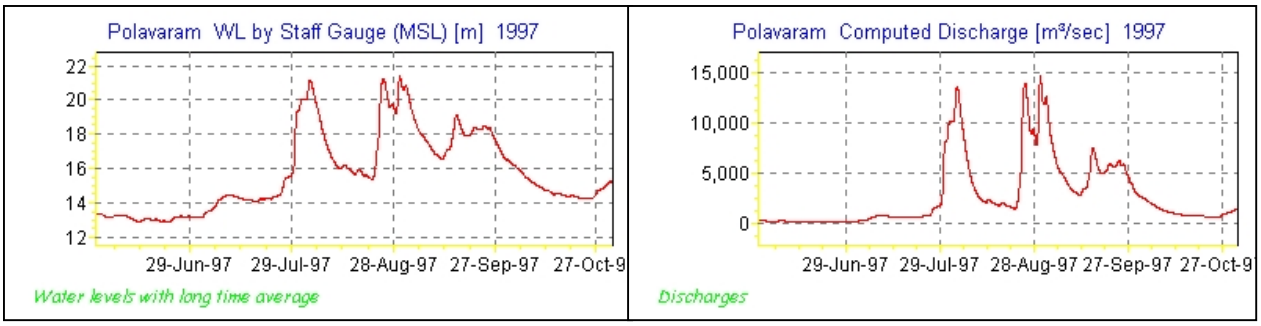


Figure 4.3.1: Hourly water levels and flows during the year at observation stations

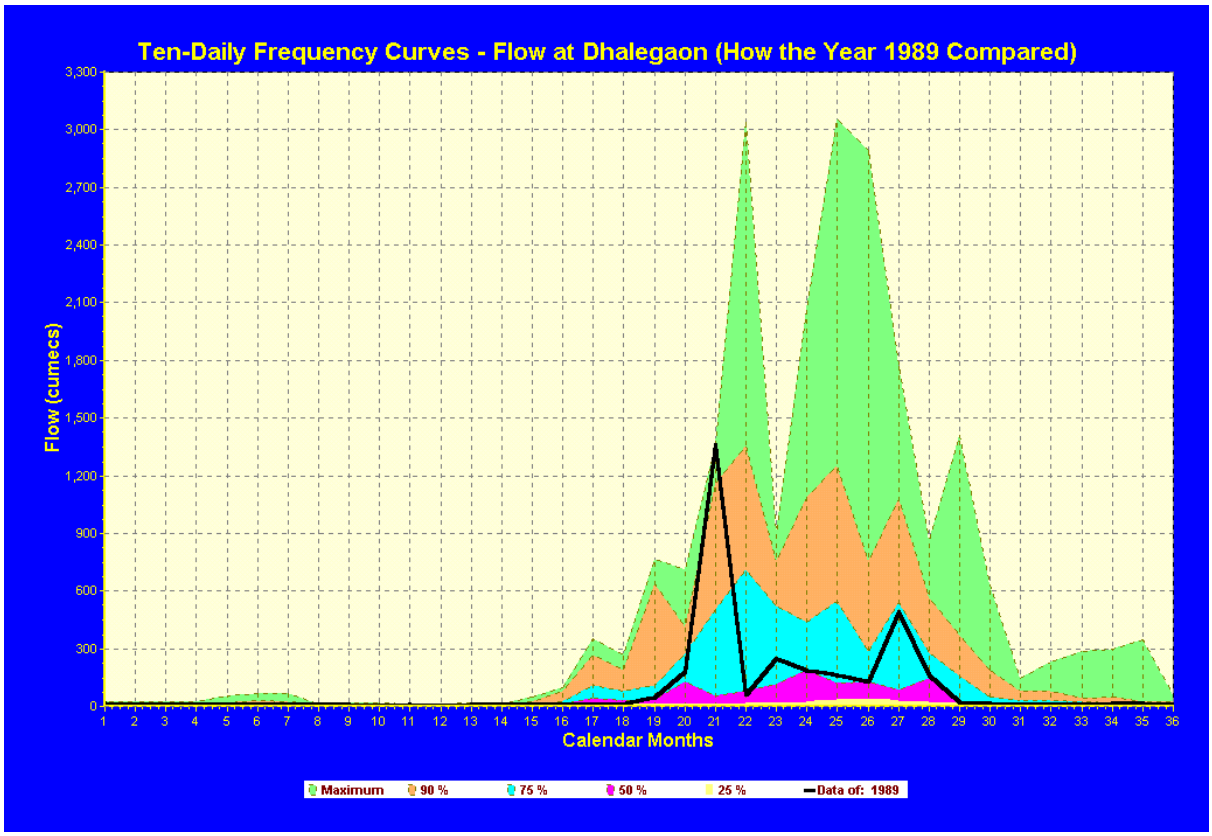


Figure 4.3.2: Ten-daily flows in a river as seen against frequency curves (based on 1970-2000 period)

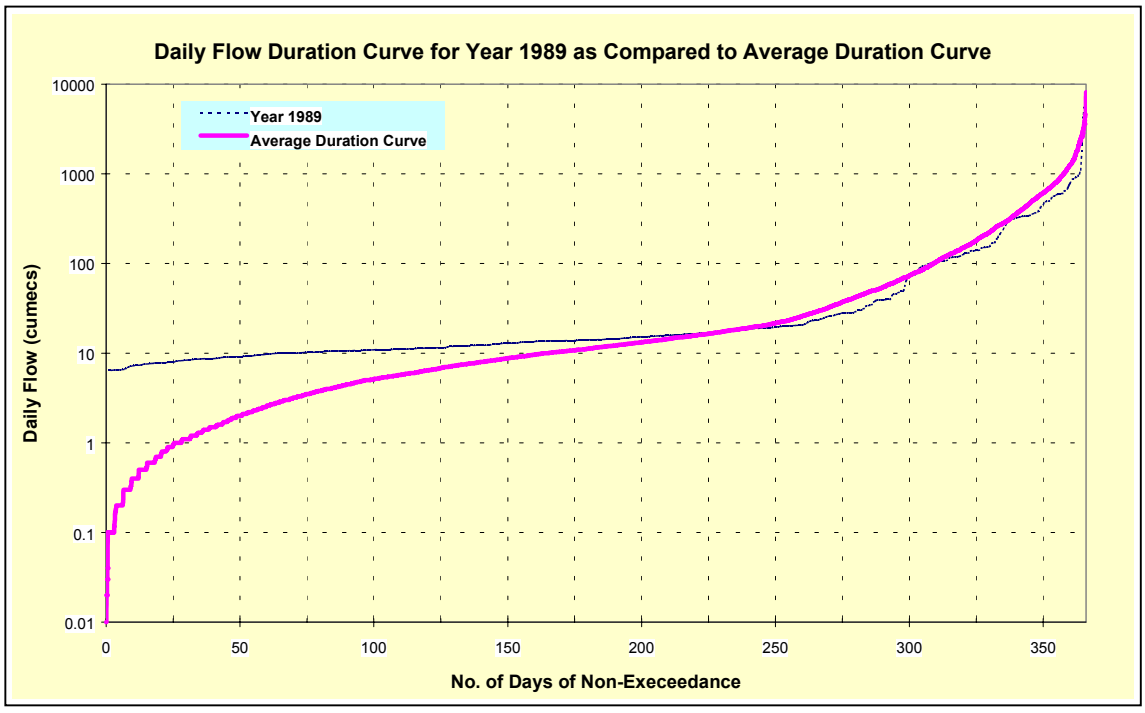
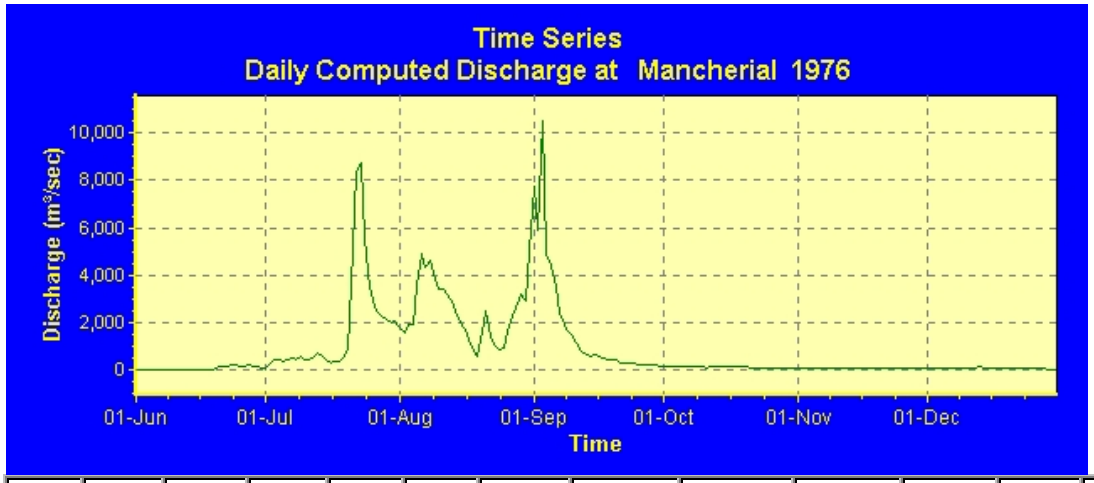


Figure 4.3.3: Average flow duration curve for daily flows in a river (based on 1970-2000 period)

Daily Mean Flow Data

Year - 1976

Station Code: AG000J3 **District:** Adilabad **Independent River :** Godavari
Station Name: Mancherial **Units :** m³/sec **Tributary:** -



Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	103	69.0	52.1	23.8	7.6	7.6	90.1	1760	7730	154	81.9	48.4
2	102	64.5	54.9	24.7	7.5	6.9	277	1580	5920	160	80.7	48.0
3	102	63.7	56.3	24.1	7.0	6.5	411	1890	10520	155	78.8	41.4
4	100	51.3	56.1	24.5	6.8	5.8	459	1890	4900	141	76.0	47.4
5	84.2	54.2	56.3	24.4	7.8	5.5	391	3560	4410	133	74.3	61.0
6	87.1	51.6	53.1	22.7	7.9	4.9	453	4870	3470	123	73.9	75.9
7	130	50.5	53.0	21.5	7.4	5.2	481	4360	2380	129	80.0	76.2
8	125	56.0	51.5	18.5	6.2	5.2	448	4580	1900	123	74.1	80.6
9	115	56.2	41.8	21.0	7.0	5.5	537	3850	1600	121	83.4	76.9
10	112	59.5	34.7	21.7	6.0	5.5	422	3410	1420	115	72.8	78.0
11	86.0	51.3	34.9	21.0	6.7	6.0	433	3410	1120	110	63.0	80.9
12	72.0	50.5	34.7	17.8	6.0	6.0	528	3200	760	122	62.2	104
13	83.2	50.0	32.5	16.5	6.5	6.6	685	2900	609	132	61.2	115
14	91.0	50.7	36.0	15.3	5.8	6.9	568	2450	600	127	60.0	103
15	94.0	52.0	39.0	14.4	5.7	7.3	441	1970	620	124	57.5	111
16	86.2	48.4	38.5	14.5	6.5	8.1	309	1720	575	120	60.0	83.1
17	85.8	46.1	35.9	14.8	7.9	8.4	347	1300	518	115	56.3	61.5
18	80.0	45.1	35.4	14.5	8.5	7.5	356	763	461	122	56.2	47.0
19	74.2	44.4	34.8	16.8	8.5	7.9	497	607	435	121	53.9	44.5
20	68.8	45.5	32.4	15.6	8.5	120	856	1630	398	117	64.8	55.8
21	87.4	41.1	32.0	13.4	8.7	127	5100	2510	322	105	78.0	42.4
22	83.4	41.0	30.5	12.9	8.6	165	8410	1390	310	101	65.0	52.6
23	69.9	41.0	31.2	14.5	7.0	244	8750	969	274	95.0	61.3	50.1
24	67.2	41.2	31.1	13.0	8.2	227	5620	836	275	90.0	61.8	44.9
25	72.0	39.5	30.9	13.0	6.4	182	3470	946	236	90.0	63.9	44.5
26	70.0	31.7	27.7	12.0	5.4	172	2670	1670	220	91.4	58.4	44.0
27	65.3	32.7	26.4	11.1	5.7	204	2420	2240	220	90.9	55.4	43.7
28	65.9	32.6	27.0	10.1	6.6	173	2190	2660	195	89.8	50.0	42.7
29	66.0	35.0	25.4	9.2	6.3	177	2110	3220	190	87.5	52.9	38.6
30	64.1		24.2	8.4	5.0	103	1970	2940	170	84.0	45.0	38.2
31	66.7		24.0		6.3		2050	5060		85.0		33.8
Min.	64.1	31.7	24.0	8.4	5.0	4.9	90.1	607	170	84.0	45.0	33.8
Max.	130	69.0	56.3	24.7	8.7	244	8750	5060	10500	160	83.4	115
Eff.	31	29	31	30	31	30	31	31	30	31	30	31
Miss.	0	0	0	0	0	0	0	0	0	0	0	0
Mean	85.9	48.1	37.9	16.9	7.0	67.4	1735.8	2459.6	1760.5	115.6	65.4	61.8

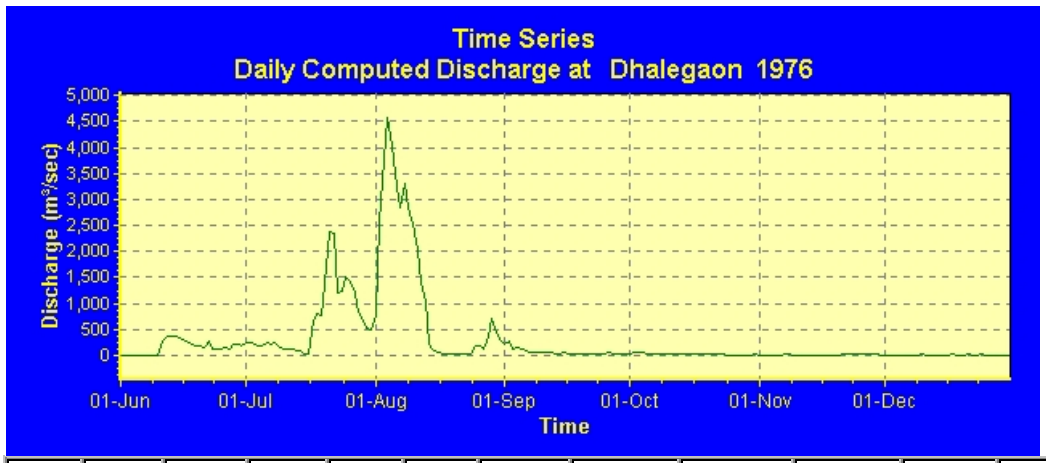
Yearly statistics :

Mean : 541.8	Minimum : 4.9 Date : 06/06/1976	Maximum : 10500.0 Date : 03/09/1976	No. of data : 366 No. of missing data : 0

Table 4.3.1: Daily Mean Flow Data

Daily Mean Flow Data — Year - 1976

Station Code: AG000S9 **District:** Parbhani **Independent River :** Godavari
Station Name: Dhalegaon **Units :** m³/sec **Tributary:** -



Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2.4	18.6	20.2	2.2	1.1	0.4	247	756	223	19.3	11.7	13.6
2	25.2	19.6	22.9	2.3	0.9	0.4	239	2550	286	57.7	11.2	12.5
3	22.9	20.6	18.9	3.0	0.9	0.5	199	3760	124	50.0	12.0	13.5
4	21.8	18.5	10.9	2.8	0.8	0.5	181	4580	141	64.3	10.3	11.9
5	22.7	19.2	8.0	3.2	0.8	0.5	176	4050	125	44.1	10.3	12.2
6	22.6	17.5	12.2	2.9	0.8	0.8	231	3240	89.8	27.6	10.1	9.8
7	22.0	18.6	14.4	2.6	0.8	1.4	230	2830	66.7	22.2	15.0	12.1
8	20.5	18.6	15.6	2.3	0.6	1.6	242	3290	47.0	21.6	14.7	11.7
9	22.0	17.2	16.4	2.0	0.6	1.5	164	2840	54.1	20.8	13.5	13.4
10	20.8	18.2	17.1	1.8	0.6	1.8	134	2520	49.3	20.0	13.0	15.2
11	20.0	18.6	14.3	2.0	0.5	270	110	2030	71.0	15.4	13.4	12.4
12	20.7	18.8	17.6	2.0	0.6	372	109	1400	55.0	17.3	12.9	11.3
13	21.4	20.0	16.0	2.0	0.5	384	100	1050	44.7	18.0	12.3	11.8
14	20.0	21.3	9.6	1.8	0.5	365	87.1	228	43.3	16.6	12.0	11.9
15	19.6	21.4	8.1	1.6	0.5	332	31.7	100	46.5	16.6	11.3	11.6
16	19.6	20.8	6.0	1.8	0.5	300	28.3	50.8	43.3	17.4	11.1	12.2
17	21.3	19.5	5.0	1.6	0.5	246	669	41.0	44.7	17.0	10.3	14.2
18	20.6	19.7	4.2	1.6	0.5	229	794	36.3	33.8	15.4	9.8	11.8
19	21.1	19.2	3.4	1.4	0.5	191	776	30.5	40.0	16.4	9.8	11.3
20	19.0	20.3	3.6	1.3	0.5	194	1400	30.4	29.9	14.8	11.7	13.0
21	19.4	15.8	3.4	1.2	0.4	161	2380	34.1	28.0	15.9	15.0	15.0
22	20.3	13.4	3.3	1.2	0.4	267	2350	40.0	27.9	15.0	21.8	13.0
23	18.9	10.5	3.0	1.2	0.4	127	1200	28.9	29.4	14.0	30.3	11.2
24	19.6	9.6	2.6	1.3	0.4	132	1220	30.0	33.2	12.0	24.2	14.4
25	19.0	7.9	2.9	1.2	0.3	126	1520	198	31.0	12.5	20.8	11.7
26	19.0	7.9	2.7	1.4	0.4	158	1430	171	58.0	10.4	19.6	10.7
27	21.2	6.8	2.6	1.1	0.4	121	1200	125	22.6	11.0	18.2	11.6
28	20.7	5.2	2.4	1.0	0.4	222	842	361	25.0	10.6	16.0	11.3
29	21.0	14.8	2.2	1.0	0.4	200	686	702	23.9	9.6	15.1	11.8
30	18.8		2.2	1.0	0.4	198	533	438	22.2	11.5	13.8	11.2
31	20.6		2.2		0.5		493	267		14.0		11.1
Min.	18.8	5.2	2.2	1.0	0.3	0.4	28.3	28.9	22.2	9.6	9.8	9.8
Max.	25.2	21.4	22.9	3.2	1.1	384	2380	4580	286	64.3	30.3	15.2
Eff.	31	29	31	30	31	30	31	31	30	31	30	31
Miss.	0	0	0	0	0	0	0	0	0	0	0	0
Mean	20.8	16.5	8.8	1.8	0.6	153.8	646.8	1222.2	65.4	20.9	14.4	12.3

Yearly statistics :

Mean : 184.3	Minimum : 0.3 Date : 25/05/1976	Maximum : 4580.0 Date : 04/08/1976	No. of data : 366 No. of missing data : 0

Table 4.3.2: Daily Mean Flow Data

4.4 Surface water quality

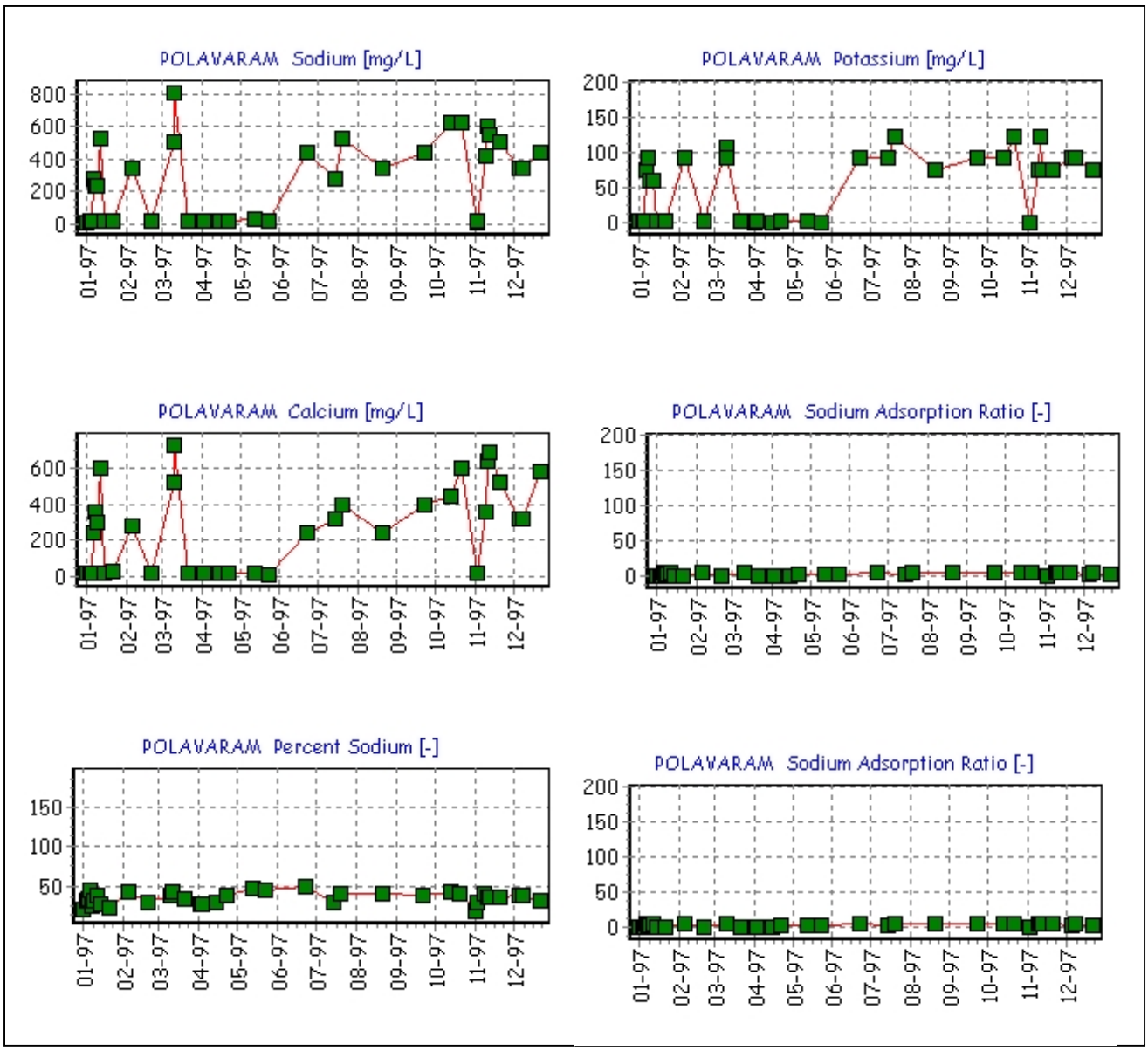
<In order to present the water quantity and quality information in an integrated manner for the user it will be appropriate to include all water quality related summaries, figures and tables as given hereunder, in continuation of the other aspects of the hydrological processes.

On the basis of the sampling and analysis program for any river basin, a summary could be drawn. As an example for an agency that is monitoring only major ions, looking into the data obtained during the reporting period the following inferences are drawn. Hereunder, some inferences for Godawari river are put only as an illustrative example:

- The water of river is generally alkaline in nature mainly due to the presence of bicarbonate. Carbonates were present in the samples of the Godavari river collected from Nashik, Nanded, Mancherial, Bhadrachalam and Pollavaram.
- The conductivity varies between 300 μmhos/cm (Nashik Upstream) to 2000 μmhos/cm (Polavaram).
- Among cations calcium, magnesium and sodium were dominating. Potassium is always low. Maximum calcium (600 mg/L) was observed in Polavaram. Aluminium, iron and ammoniacal nitrogen were present in very small quantity. In general the cations are present in permissible limits of drinking water or irrigation standards of BIS.
- The chloride was the dominant anion followed by bicarbonate and sulphate. The maximum chloride (1000 mg/L) was recorded from Polavaram and bicarbonate (8,000 mg/L) from Polavaram. Silicates were present in significant concentration at all the stations. Nitrates, fluorides and phosphates were present in low concentrations at all the stations throughout the year. In general the anions were within the permissible limit of drinking and irrigation requirements of the Bureau of Indian Standards (BIS).
- Dissolved oxygen was generally at saturation level at all the monitoring stations except the stretch between Nashik to Nanded, where DO was observed as low as zero on many occasions, which may be due to effect of discharge of untreated domestic sewage from Nashik, Aurangabad, Nanded.
- Water quality indices viz. Sodium adsorption ratio (SAR), sodium percentage (%Na) and residual sodium carbonate (RSC) were found within tolerance limits of irrigation standards at all the stations. From salinity classification point of view,the river waters of the basin generally fall under C1S1 and C3S1 classification as per US Salinity diagram.

Overview of water quality for different stations

Station: POLAVARAM



Station: POLAVARAM

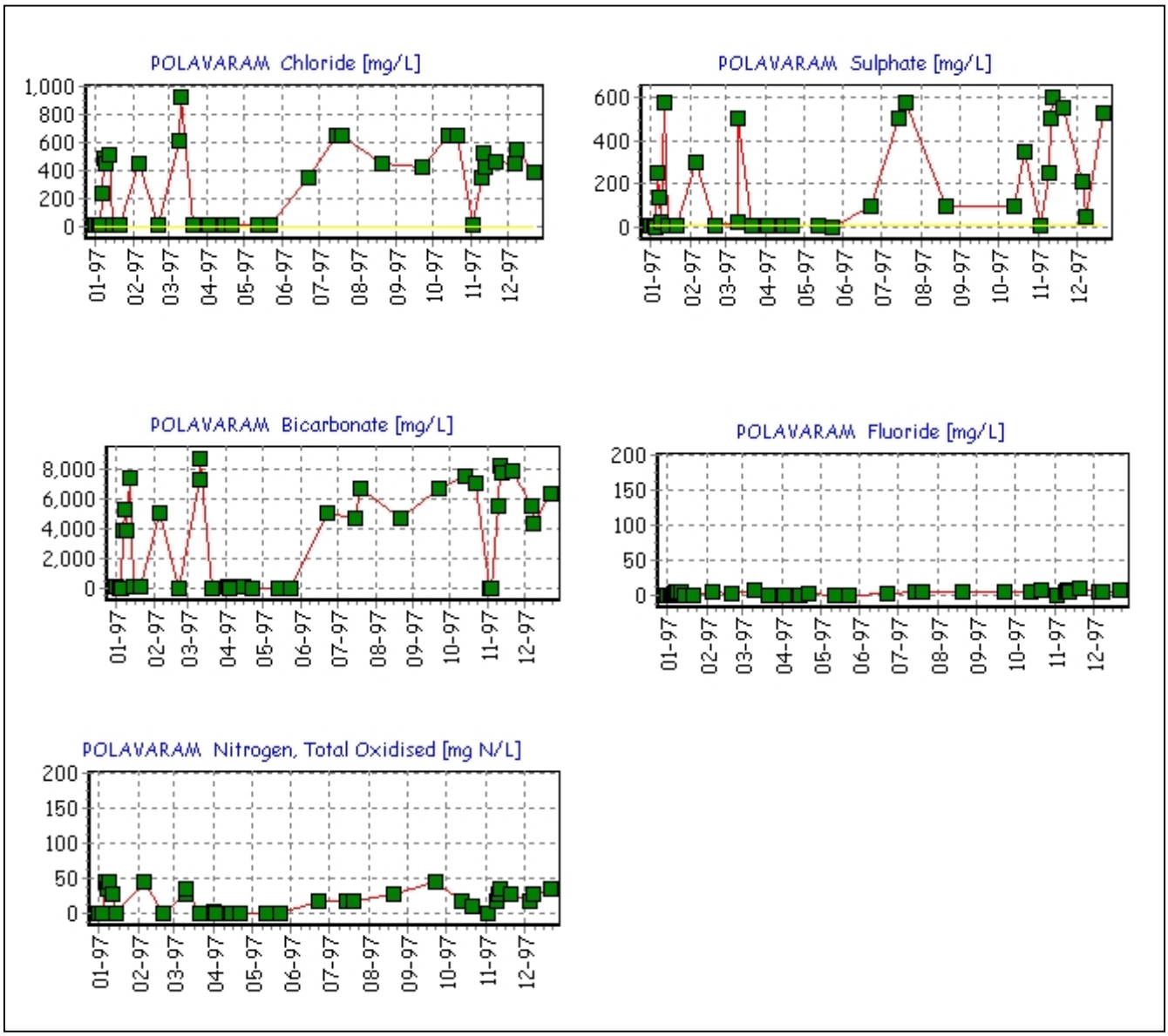


Figure 4.4.2: Major anions for station Polavaram in the year 1997

☞ ***Templates for several parameter groups are available in HYMOS (major cations and anions, general and pollution related parameters), this way Figure 4.4.1 and 4.4.2 can be generated automatically for a desired number of stations best representing a river stretch or a basin.***

Comparing with standards

The CPCB results which contain some of the parameters related to major water quality issues of the river were analysed (Table 7). The main findings are presented as follows:

The Godavari river basin is a relatively clean river in the country.

The major water quality problem in the river basin is mainly due to presence of coliform. A large number of stations are showing coliform values higher than the desired limits identified under "designated best use" criteria of CPCB.

☞ ***The water quality results for the year of interest are compared to water quality standards after summarising the time-series over the year (or season). Normally the 90 percentile value (10% for DO) is used for comparison with standards such as given in Table 4.4.1.***

Fitness for use classification according to CPCB system "ABCDE"

1996	Water for Drinking & Bathing (ABC)				Wildlife (D)		Irrigation (E)			
Station	pH	CTM	BOD	DO	pH	DO	pH		B	SAR
AG000C3	8.2	-	0.4	6.4	8.2	6.4	8.2	212	-	0
AG000C7	-	-	-	-	-	-	-	-	-	-
AG000G7	8.3	-	0.5	6.4	8.3	6.4	8.3	339	-	1
AG000J3	8.4	-	0.7	6.5	8.4	6.5	8.4	468	-	1
AGH00C4	8.1	638.7	1.3	6.8	8.1	6.8	8.1	393	-	1
AGH30E2	8.1	3742.8	3.7	6.0	8.1	6.0	8.1	515	-	1
AGH30F6	-	-	-	-	-	-	-	-	-	-
AGH30Q1	8.2	502.8	1.0	7.2	8.2	7.2	8.2	413	-	1
AGH30S9	8.2	166.5	1.7	6.1	8.2	6.1	8.2	410	-	1
AGH32D5	8.2	1502.9	1.2	7.2	8.2	7.2	8.2	429	-	1

Table 4.4.1: Station-wise water quality problems according to the CPCB classification

Legend

Drinking water (A), Bathing water (B) and Source for drinking water (C)							
pH		Col		BOD		DO	
6	-	50	A	2	A	4	-
6.5	C	500	B	3	B	5	C
8.5	A	5000	C		-	6	B
9	C		-				A
	-						

Wildlife (D)							
pH		DO					
6.5	-	4	-				
8.5	D		D				
	-						

Irrigation (E)							
pH		EC		B		SAR	
6.5	-	2250	E	2	E	26	E
8.5	E		-		-		
	-						

Water Quality Yearbook - HYMOS example Report 4 (HP, 2002)

Trends in water quality

A time series plot for BOD (3years period i.e. from 1996 to 1998), all dates and annual average is plotted as shown in Table 4.4.2 and Figure 4.4.3 below. As reveal from the graph BOD values up to 1997 was vary between 0.1 and 1.1 mg/L with an average of 0.45 mg/L. The observed increase of the maximum and average value in 1998, 1.4 and 0.67 mg/L respectively are very small compared tot the large spread of the data, caused by the sharp decrease in the number of observation in 1998. The data do therefore not indicate an significant increase in BOD at this station.

☞ ***A similar plot as presented in Figure 2 may be included for longitudinal analysis of a river or river stretch: different monitoring stations are presented on the horizontal axis the graph.***

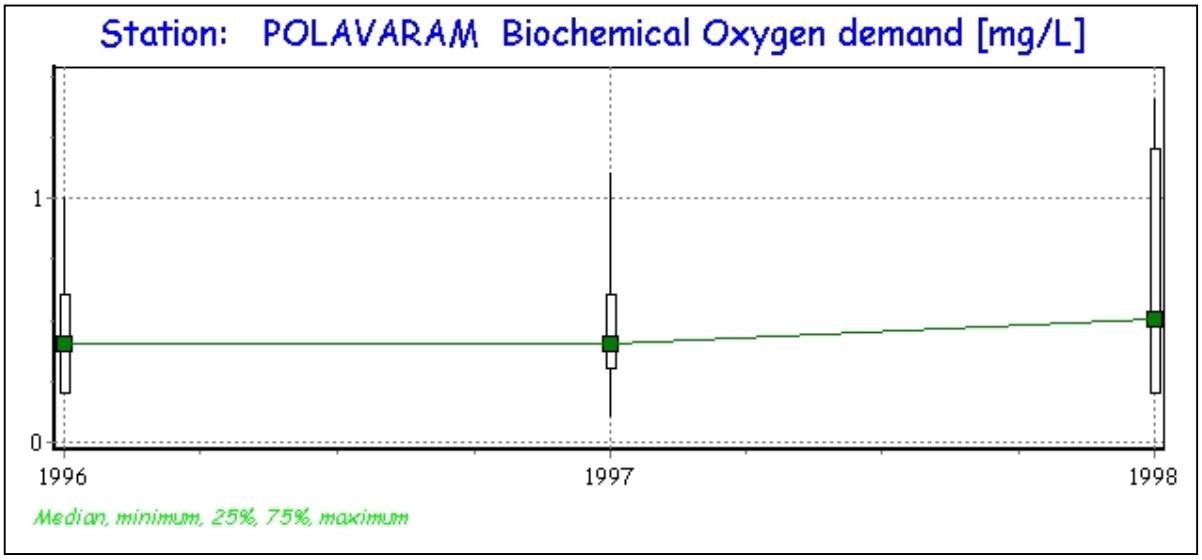


Figure 4.4.3: Box-whisker graph for BOD at station Polavaram

Year	1995	1996	1997	1998	1999	2000
Max	-	1.000	1.100	1.400	-	-
Mean	-	0.444	0.463	0.667	-	-
Min	-	0.200	0.100	0.200	-	-
Median	-	0.400	0.400	0.500	-	-
10%	-	0.200	0.200	0.200	-	-
25%	-	0.200	0.300	0.200	-	-
75%	-	0.600	0.600	1.200	-	-
90%	-	0.900	0.800	1.400	-	-
No. data	0	32	32	6	0	0

Table 4.4.2: Yearly time-series for summary statistics for BOD at station Polavaram

Results of Surveillance Monitoring

Surveillance monitoring will/may not be conducted at the same locations or for the same parameters from year to year. Thus presentation of these results needs to be separate from the above items. Since surveillance monitoring is conducted for problem issues, it is assumed that the results of these studies are relevant for a yearbook. Surveillance monitoring likely will be for pollution parameters such as (e.g. coliforms, heavy metals, pesticides, organic pollutants, ammonia).

- ***Include a map showing location(s) monitored***
- ***Time series plots for 1 year, for the WQ parameters included in the surveillance. The water quality standard must be represented as a horizontal line.***
- ***Comparison of stations for the period of monitoring.***

5 Interpretation of various statistics presented in the yearbook

<It is very important to explain to the readers what the various statistics that are used in the yearbook mean. Some such important terms that need to be explained are as follows;

5.1 Daily rainfall – What time frame does daily rainfall refers to.

5.2 Mean Daily Runoff – How is the mean daily runoff computed.>

6 Options for users for receiving data from the Data Centres

<Now that the dissemination of hydrological data would become very efficient and user-friendly for the data users, it will be useful to give wider publicity to the data retrieval options available to the users. Few aspects which could be put as brief note for this purpose are:

6.1 What major types of hydrological data and information is available in HIS

6.2 What is the extent of data availability in terms of number of stations, length of data on different data types and overall volume of data. This would also incidentally give the

6.3 How a user can request for the data

6.4 What would be the cost of data

6.5 Who would qualify as eligible data users and could get data.>

7 Previous publications of water yearbooks

<It is very important to include a sort of bibliography on the water yearbooks published in the past, highlighting the salient features or the major changes that were introduced from time to time. Such note enlisting what has been published so far by the agency would become a ready reference to anybody seeking to know what type of information is available on hydrological data and how it could be approached for.>