

FLOOD FORECASTING AND WARNING NETWORK PERFORMANCE APPRAISAL 2003



**GOVERNMENT OF INDIA
CENTRAL WATER COMMISSION
FLOOD FORECAST MONITORING DIRECTORATE**

NEW DELHI-110 066

APRIL 2004

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PREFACE

Central Water Commission had made a small beginning in Flood Forecasting & Warning service in India in November 1958 with one forecasting station at Delhi, the national capital, on the river Yamuna. Today, its network of Flood Forecasting and Warning Stations has gradually extended over the years and covers almost all the major inter-state flood prone river basins throughout the country.

During the year 2003, the network comprised of 166 Flood Forecasting Stations including 27 inflow forecast stations, on 62 sub- river basins in 8 major river basins of the country. It covers 14 states besides NCT Delhi and one UT, Dadra & Nagar Haveli. The Flood Forecasting activities of the Commission are being performed every year from May to October through its 19 field divisions who issue flood forecasts and warnings to user Agencies including the civil authorities of the States as well as other organizations of the Central & State Governments, as and when the river water level touches the warning level at the flood forecasting stations. At the end of each flood season, a performance appraisal of the National Flood Forecasting & Warning Network is prepared with a view to analyse the various flood forecasting activities, achievements, shortfalls, and to provide the users related information in compact and ready to use format.

The first edition of this publication was brought out by the Commission in 1986. Since its fourth edition, the report was fully computerized and is being published in its present format. The appraisal reports have been increasingly used by various organizations of the Government of India as well as States and academic bodies etc. on studies and research concerning floods.

The flood season 2003 witnessed some unprecedented flood events in recent history, particularly in the Ganga basin. The year was a drought year in most other parts of the country and hence forecast stations in these areas recorded peaks much lower than their respective warning levels. At 37 stations no forecasts were required to be issued.

Some changes in the format of the report have been made beginning this year. The Chapter on flood events has been divided into two and Chapter 4 describes the events river wise. Chapter 5 gives State wise description of flood events. Chapter 6 has been added which gives comments from various User Agencies.

During the period under report, in all, 6600 flood forecasts were issued i.e., 661 inflow forecasts and 5989 level forecasts. Out of 5989 level forecasts, 5782 forecasts i.e. 96.54% forecasts were found within the permissible limit of accuracy of ± 15 cm. Similarly, out of 661 inflow forecasts, 586 inflow forecasts i.e. 95.91% were found within the permissible limit of accuracy of $\pm 20\%$ cumecs. Thus on the whole, in 2003, out of 6600 forecasts, 6368 forecasts i.e. 96.48% forecasts were found within the permissible limit of accuracy.

The level of performance achieved has been possible as a result of the dedicated team work of the entire field staff and various officers manning the Sub-divisions, Divisions, Circles and the Regional offices of CWC.

The Flood Forecasting & Monitoring (FFM) Directorate plays an important role in compiling the reports from various field offices and issues daily flood bulletins which are sent to various offices of the MOWR, CWC, Central Ministries, and the Disaster Management Division of the Home Ministry. The draft of the report was prepared by Shri Anand Prakash, AD (HM), Shri S.Venkataraman, AD (HM), Shri Krishna Kumar, EAD (HM) and Shri Vijay Pal, Sr. P.A (HM). Other officials of the FFM Directorate including S/Shri Harinder, D'man-Gr-I, Yaseen, LDC, R.L.Gupta, Sr. Computer, Rajbir Singh, Data Entry Operator have provided a strong backup team in the task of the preparation of this report. I wish to place on record my deep appreciations of the efforts put in by these officers and staff in bringing out this report.

It is hoped that the momentum gained in improving performance, innovations in evaluation, modernization as well as computerization, year after year, will be further accelerated to achieve greater accuracy of each and every forecast especially in high and unprecedented flood situations.

Suggestions / comments of the Users of this report with a view to further enhance its usefui' welcome and will be incorporated in the next edition.

New Delhi
June, 2005


(M. K. SHARMA)
Member (RM)
Central Water Commission

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MAP

1	India Showing Flood Forecasting Set Up
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EXECUTIVE SUMMARY

GENERAL

During the flood season 2003, from 1st May 2003 to 31st October 2003, the Flood Forecasting and Warning Network of the Central Water Commission comprised of 129 level forecasting and 27 inflow forecasting sites. Thus, there were 166 flood forecasting sites and all of them were operational i.e. where Hydrological and Hydro-meteorological data were duly observed and collected. However, no forecasts were issued for 37 flood forecasting sites in 2003.

In 2003, flood season 5 new level forecasting sites were added in the network, all in them in the Ganga basin and no forecast were issued for the newly added sites due to times constraint for the preparations of the forecasting tools.

During the period under report, in all 6600 flood forecasts were issued for the benefit of the 14 states, one Union territory and NCT of Delhi, which includes 661 inflow forecasts and 5989 level forecasts. Out of 5989 level forecasts, 5782 forecasts i.e. 96.54% forecasts were found within permissible limit of accuracy of ± 15 cm. Similarly, out of 661 inflow forecasts, 586 inflow forecasts i.e. 95.91% inflow forecasts were found within permissible limit of accuracy of ± 20 % cumecs. Thus on the whole, in 2003, out of 6600 forecasts 6368 forecasts i.e. 96.48% forecasts were found within permissible limit of accuracy.

RIVER-WISE FLOOD FORECASTING PERFORMANCE

In 2003 flood season, the maximum number of flood forecasting sites i.e. 85, were located in the Ganga basin, revealing that 51.2% of the total forecasting sites were in the Ganga basin. Similarly, there were 27 forecasting sites i.e. 16.3% of the total sites which were located in the Brahmaputra basin. In the Godavari basin there were 17 forecasting sites i.e. 10.2% and 9% i.e. 15 sites were in the west flowing rivers. In the remaining 06 rest river systems which are covered under flood forecasting network, the number of sites was only in single digits.

The analysis of river-wise forecasts data reveals that in 2003, the maximum numbers of flood forecasts, 3401, were issued for the Ganga and its tributaries out of which 3292 (96.80%) forecasts were found within permissible limit of accuracy. This is as per normal situation every year. Next highest numbers of forecasts, 2557, were issued for the Brahmaputra and its tributaries, where an accuracy of 96.87% was achieved. The minimum numbers of forecasts were issued for the Barak System where only 44 forecasts were issued for the 02 forecasting sites, which are located in basin, and accuracy was 95.35% i.e. about 01% less than the average All India accuracy level.

The 100% forecasts issued for the West flowing rivers were found within permissible limit of accuracy, where in all 91 forecasts were issued during the flood season 2003.

The minimum accuracy was found in the Godavari basin's forecasts where 116 forecasts were issued and out those only 101 forecasts i.e. 87.07% forecasts, were within permissible limit of accuracy. Thus, in this case the accuracy was less than all India average accuracy by 9.41%.

For the Eastern Rivers 160 forecasts were issued, out of which 146 (i.e. 91.25%) forecasts were within permissible limit of accuracy. Out of 166 forecasts issued for the Mahanadi, 161 (i.e. 96.99%) forecasts were within permissible limit of accuracy and out of 66 forecasts issued for the Krishna basin, 59 (i.e. 89.39%) forecasts were within permissible limit of accuracy.

STATE -WISE FLOOD FORECASTING PERFORMANCE

The analysis of State-wise forecasts data of the flood season 2003, reveals that although maximum number of flood forecasting sites, i.e. 35 sites (21.1% of the total forecasting sites) were located in the state of Uttar Pradesh, yet the maximum number of flood forecasts were issued for the state of Assam where only 23 flood forecasting sites (i.e. 13.9% sites) are located. For the benefit of state of Assam, 2513 forecasts (i.e. 38.08% of the total forecasts issued) were issued in 2003, out of which 2434 (96.86%) forecasts were found within permissible limit of accuracy.

Next highest numbers of forecasts issued during the flood season 2003 were for the benefit of the state of Bihar, where 1997 forecasts (i.e. 19.9% of the total forecasts) were issued during the period under report, out of which 1958 forecasts i.e. 98.05% forecasts were found within permissible limit of accuracy.

100% forecasts issued, during 2003, were found within permissible limit of accuracy for the benefit of the following 04 states.

1. Gujarat
2. Madhya Pradesh
3. Uttaranchal
4. Dadra and Nagar Haveli

In 2003, 82 forecasts were issued for the benefit of the flood affected people of Gajarat state, only 02 forecasts for Madhya Pradesh, 27 forecasts for Uttaranchal and 07 forecasts for the Union Territory of Dadra and Nagar Haveli.

During 2003 flood season, 1017 forecasts (i.e. 15.41% of the total forecasts) were issued for the benefit of Uttar Pradesh, out of which 957 (94.10%) were found within permissible limit of accuracy. Similarly, 304 forecasts (i.e. 4.61% of the total forecasts) were issued for the benefit of Orissa & 287 (94.41%) forecasts were within

permissible limit of accuracy, 266 forecasts (i.e. 4.03% of the total forecasts) for the benefit of West Bengal of which 259 (97.37%) were within accuracy limits. 174 forecasts (i.e. only 2.4% of the total forecasts) were issued for the benefit of Jharkhand, out of which 171 (98.28%) forecasts were within permissible limit of accuracy.

For the remaining states, namely, Andhra Pradesh, Karnataka, Chhatisgarh, Maharashtra and National Capital Territory of Delhi, less than 100 forecasts were issued in 2003.

62 forecasts (i.e. only 0.94% of the total forecasts) were issued for the benefit of Andhra Pradesh out of which 53 (85.48%) forecasts were within permissible limit of accuracy, out of 64 forecasts (i.e. only 0.97% of the total forecasts) issued for the benefit of Karnataka 57 (89.06%) forecasts were within permissible limit of accuracy, out of 47 forecasts (i.e. only 0.71% of the total forecasts) issued for the benefit of Chhatisgarh 44 (93.62%) forecasts were within permissible limit of accuracy. 31 forecasts (i.e. only 0.47% of the total forecasts) were issued for the benefit of Maharashtra, out of which 26 (83.87%) forecasts were within permissible limit of accuracy and out of 7 forecasts (i.e. only 0.11% of the total forecasts) issued for the benefit of National Capital Territory of Delhi, only 04 (57.14%) forecasts were found within permissible limit of accuracy.

No forecast was issued for the lone flood forecasting site Tajewala weir located in the state Haryana. As a matter of fact, no forecast has ever been issued for this site since its inclusion in the Flood Forecasting and warning Network of the Central water commission in 1990 for various reasons. As already mentioned in the earlier chapters, during 2003 flood season even the hydrological data was not collected at this site, instead data of Hathnikund Barrage, which is about 03 km upstream of the site Tajewala weir, was collected from the irrigation department of the Government of Haryana. The decision for inclusion of the new site in the existing Flood Forecasting and Warning Network of CWC is yet to be taken by the concerned authorities.

DIVISION-WISE FLOOD FORECASTING PERFORMANCE

As already mentioned, this "Scientific Flood Forecasting and Warning" work is being done executed by the 20 field divisions of the Central Water Commission under the overall supervision of the Member (River Management).

These divisions have a dedicated team of Hydrologists and Hydro-meteorologists who are observing, collecting and analyzing the data and finally framing the forecasts of an incoming flood wave in the rivers flowing through the 14 flood prone states, Union Territory of Dadra and Nagar Haveli and NCT of Delhi.

During the flood season 2003, the maximum number of flood forecasting sites were within the jurisdiction of the two divisions located in Bihar, namely, MGD-IV

and MGD-V Patna, i.e. 17 each. Next three divisions in this order are UBD Dibrugarh with 13 forecasting sites, DD Asansol and ERD Bhubaneswar with 11 sites each. The LYD Agra and LBD Jalpaiguri maintains 10 forecasting sites each, while there are 9 sites each with MGD-II Lucknow and LGD Hyderabad, 8 sites each with TD Surat, LKD Hyderabad, UGD Hyderabad, 7 sites with MGD-I Lucknow, 6 sites each with MBD Guwahati and MGD-II Varanasi, 5 sites each with UYD Delhi, MD Ahmedabad, 3 sites with HGD Dehradun, 2 sites with ND Bhopal and only one site with MD Burla.

The analysis of forecasts data of the flood season 2003 reveals that though maximum number of forecasts, 1521 were issued by the MGD-IV, Patna, out of which 1485 forecasts (i.e. 97.63%) were found within permissible limit of accuracy.

The minimum numbers of forecasts i.e. only 02 were issued by the ND Bhopal but both were found within permissible limit of accuracy i.e. with 100% performance accuracy. HGD, Dehradun; MD, Ahmedabad and TD, Surat are other three divisions which have issued 27, 06 and 83 number of forecasts, respectively, all of them i.e. 100% were found within permissible limit of accuracy.

Further, analysis of data reveals that lower Yamuna Division, Agra and Upper Yamuna Division, Delhi are touching the bottom line of forecasting performance accuracy among all the 20 field divisions. Their performance accuracies are 74.29% and 78.95%, respectively.

Another study indicates that even in site-wise order of performance of accuracy, the Upper Yamuna Division, Delhi which is considered as mother of all the forecasting Division in India, is at the bottom, as its forecasting performance accuracy for the "oldest" forecasting site, Delhi Railway Bridge, was only 57.14% against the national average accuracy of 96.48% in 2003. It was Delhi division, then known as Flood Forecasting Unit (FFU) Delhi, which was created for issuing "Scientific Flood Forecasts and Warnings" for National Capital Delhi, in 1958. Also two modernization programmes under various projects / schemes have been implemented by the division for achieving better data observation system and communication means i.e. telemetry and, thus, better accuracy level in the forecasts. But it is revealed from the analysis of the forecasts performance data that the targets could not be achieved in 2003. Neither the data of various sites is being received by the division through telemetry system nor are any forecasts being formulated using any computerized hydrological models.

DATA COMMUNICATION SYSTEM

There is a network of more than 450 wireless stations for fast communications of Hydrological and Hydro-meteorological data during the flood season between various base & forecasting sites and their subdivisions; subdivisions and their divisions, where the flood forecasts are being formulated and disseminated to the users and also between the divisions and the Head quarters of the Commissions at Sewa Bhawan, R.K.Puram, New Delhi where "Flood Forecast Monitoring Directorate"

is monitoring the flood situations and forecasts during flood season, May to October, at the National level.

However, the monitoring of floods during the flood season at the Commission's Head Quarters reveals that there was no direct wireless link between the nodal division MBD/ HOC Circle, Guwahati and Delhi for last 4 years. As a result the forecasts and other concerned hydrological and hydro-meteorological data from the Brahmaputra basin, which includes the river Tista and other tributaries, besides Barak system, was not being received directly by Delhi wireless unit, as the 500w HF wireless sets meant for the purpose are out of order. This has resulted into more dependency on other mode of communications, namely, telephone as well as fax for data communication. As a matter of fact, similar condition existed between Mahandi division Burla and Delhi, particularly during high flood situations in 2003. There was problem in having a direct wireless link between the Burla Division and Delhi, particular in late evening hours. During high flood situations, the data was mostly received on telephone / fax or some time on wireless through ERD Bhubaneswar. During the flood season 2003 it was experienced that on the whole, telephone and fax links have ultimately proved to be very useful, reliable and dependable means of communication of flood data, in all important and critical flood situations, between the field divisions and the Head Quarters of the Commission for monitoring severe flood situations and flood forecasts at any time of the day than the wireless link.

Also, the telephone and fax in general, and the fax in particular were found more useful in receiving the vital flood forecasts and hourly river data on short notice when demanded by the senior authorities of the Ministry of Water Resources and the Commission during the flood season which occasionally comes at unscheduled timings. Wirellesses are working on pre-fixed timetables.

The analysis of forecasts data also reveals that both the river systems i.e. the Brahmaputra and Mahanadi systems are more floods prone and the flood season starts earlier and last longer. As a result of longer flood periods, more number of forecasts were issued for the state of Assam.

FORECAST PERFORMANCE ACCURACY- CRITERIA

As per present practice, all the level and inflow forecasts are being judged by the single criteria of accuracy i.e. $\pm 15\text{cm}$ or $\pm 20\%$ cumecs respectively. However, the analysis of the forecasts data of individual sites reveals the application of uniform rule to all sites is misleading or incorrect from quality point of view. This is described as under.

There are mainly two types of sites, one which are located on the flashy rivers i.e. where rate of change in river level / inflow is sudden / abrupt and sharp in magnitudes while others in the rivers where rise or fall in the level or inflow are not so sudden or sharp during the forecast period. For example, applying same criteria of accuracy to all the forecasting sites on the main stream Ganga in Bihar and to the

forecasting site at Hardwar on the Ganga in Uttaranchal is not logically correct. It is observed that in Bihar the rate of rise or fall in the level of the Ganga is very gentle & mostly even during high floods times less than 15 cm only, in 24 hours, which the permissible limit of deviation in the forecast while at Hardwar it is almost always more than 15 cm in less than 12 hours only. Similarly it is observed that net rise or fall in the Sone at Koelwar or Indrapuri sites or Jhanjharpur on the Kamla Balan or Domohini Road Bridge on the Tista, even in the medium flood situations is almost always more than 15 cm during forecast time while at the forecasting site such as Hayaghat on the Bagmati for which 69 forecasts were issued in 2003 flood season with 100 % accuracy, the net rise or fall in the river level in 24 hours was many times only less than 5 cm only. Thus applying the same criteria on both type of sites is not only unfair but technically incorrect also, particularly when permissible limit of deviation of forecast is ± 15 cm. Therefore, there is need of setting different yardsticks for judging flood forecasts performance of both types of sites so that fair judgment could be done in the both cases of sites.

Secondly, the forecast of incoming flood indicates the "forecast level or inflow or peak level" with its "time" of occurrence. It is also observed that in many cases the peak levels attained were found within permissible limit of accuracy but the time of occurrence was not the same, thus in such cases there was an error in time of forecasts or vice versa. This factor is not presently being taken into account while judging the accuracy, which may produces some erratic results.

Also, the analysis of forecasts data reveals that it is not correct to compare the forecasts performance accuracy of statistically insignificant number of forecasts e.g. 02 in case of Namada Division, Bhopal where both were found within permissible limit of accuracy i.e. achieved 100% performance accuracy, with the performance of UBD, Dibrugarh Division which has issued 1215 forecasts for various sites under its jurisdiction in 2003 flood season, with an over all accuracy of 97.53%, which is less than that of 100%. This proves that where the numbers of forecasts issued are statistically insignificant in such cases the concerned division is likely to gain or loose in accuracy level with a large swing from 100% to 0.0% depending on the correct or incorrect number of forecasts it has issued. Out of the 02 forecasts issued, even if one goes out of permissible limit of accuracy then the percentage accuracy will swing immediately from 100% to 50.0%.

The above results of analysis, therefore, suggest that the accuracy percentage must be seen together with related number of forecasts in question i.e. taking into account the various correlated parameters affecting each others in the system, as in the case of regression analysis and not independently.

The study of the forecasts data also reveals that there are two prime reasons of issuing maximum number of forecasts for the state of Assam, where 2513 forecasts were issued in 2003, the first being the higher frequency of the floods and the second being lesser travel time of flood waves from base sites to the forecasting sites as a result of which more than one forecasts were issued for majority of sites on each

flood affected day. To some extent it also indicates that the flood periods in the state of Assam were longer, which is as per normal phenomena in the state.

Similarly, a study of the meteorological report reveals that the state of Orissa is visited more frequently by depression or cyclones from Bay of Bengal than the states in north India and as a result more severe floods occurred in the state, occasionally. This was the prime reason of Mahanadi floods in 2003 flood season, which equaled the highest flood level recorded so far on 17th July 2001 at flood forecasting site Alipingal Devi on the river.

The table showing the number of forecasting sites within jurisdictions of each of the 20 field flood forecasting divisions, number of forecasting sites for which forecasts are issued and their percentage performance accuracy, during the flood season 2003, from 01.05.2003 to 31.10.2003 is given below for study at a glance.

S, No.	Name of Division	Total number of Forecasting sites under the division	Total no. of sites where "no forecasts" were issued in 2003	Total forecasts issued in 2003	Relative no. of forecasts issued, in comparison to all India total of 6600 forecasts	No. of forecasts within accuracy limit of $\pm 15\text{cm}$ or $\pm 20\%$ cumecs	%age accuracy of forecasts
1	HGD Dehradun	3	2	27	0.41	27	100.00
2	MD Ahmedabad	5	3	6	0.09	6	100.00
3	ND Bhopal	2	1	2	0.03	2	100.00
4	TD Surat	8	5	83	1.26	83	100.00
5	LBD Jalpaiguri	10	0	842	12.76	837	99.41
6	MGD-I Lucknow	7	1	317	4.80	313	98.74
7	MGD-II Lucknow	9	4	230	3.48	227	98.70
8	MGD -V Patna	17	0	778	11.79	765	98.33
9	MGD -III Varanasi	6	0	95	1.44	93	97.89
10	MGD-IV Patna	17	0	1521	23.05	1485	97.63
11	UBD Dibrugarh	13	1	1215	18.41	1185	97.53
12	DD Asansol	11	3	255	3.86	248	97.25
13	MD Burla	1	0	85	1.29	81	95.29
14	ERD-Bhubaneswar	11	0	241	3.65	226	93.78
15	MBD Guwahati	6	0	543	8.23	496	91.34
16	LKD Hyderabad	8	3	66	1.00	59	89.39
17	LGD Hyderabad	9	4	46	0.70	41	89.13
18	UGD Hyderabad	8	4	70	1.06	60	85.71
19	UYD Delhi	5	2	38	0.58	30	78.95
20	LYD Agra	10	4	140	2.12	104	74.29
	Total	166	37	6600	100.00	6368	96.48

FLOOD FORECAST MONITORING AT THE CWC'S HEADQUARTERS

The 20 field units of the Central Water Commission located in various flood affected states are responsible for issuing real time daily flood forecasts of the various forecasting sites to the users, however, at the Headquarters of the Commission, the "Flood Forecast Monitoring Directorate (FFM)" is monitoring the All India flood situation as well as daily Flood Forecasts and Warnings issued by the 20 field divisions during the flood season, from May to October every day. The FFM Directorate at the Headquarters is issuing daily two Flood Forecast Monitoring Bulletins, namely, Part-I and Part-II which contain complete analyzed data of each flood forecasting sites showing degree of flood situation and the current as well as forecasts level in respects of "Level Forecasting Sites" and "Inflow Forecasting Sites," respectively. In unprecedented and high flood situations, hourly flood situations / levels of the concerned sites are also being collected through telephone / fax/ wireless and subsequently special "Red" or "Yellow" coloured bulletins on latest flood situations and forecasts are being issued by the FFM Directorate which are being issued daily on unprecedented and high flood situations, if any, to the following authorities.

1. The Hon'ble Minister of Water Resources, Shram Shakti Bhawan, New Delhi-110001.
2. The Secretary, MoWR, Shram Shakti Bhawan, New Delhi-110001.
3. The Chairman, CWC, Sewa Bhawan , R.K. Puram, New Delhi-110066.
4. The Member (RM), CWC, Sewa Bhawan , R.K. Puram, New Delhi-110066.
5. The Commissioner (ER), MoWR, Block No.11, C.G.O. Complex, Lodi Road, New Delhi-110003.
6. The Chief Engineer (FM), CWC, Sewa Bhawan , R.K. Puram, New Delhi-110066.
7. The Director, National Disaster Management (NDM) Cell, Ministry of Home Affairs, Room No. 12, North Block, New Delhi-110001.

The special "Red" or "Yellow" coloured bulletins are being issued for drawing prompt attention of the concerned authorities towards the severe flood situations prevailing at that time in any part of the country.

During the flood season 2003, the FFM Directorate at the CWC's Head Quarters at New Delhi has issued 161 Part-I and 137 Part-II Bulletins besides 58 "Yellow" and 08 "Red" special bulletins.

RESPONSE USER AGENCIES

Since the issuing of the "Flood Forecasts & Warnings"; and the "Flood Protection & Flood Hazard Mitigation" jobs are being done by two different agencies, namely, the Central Water Commission and the various civil and engineering authorities of the flood affected state Governments, respectively, but it is the later

which is the user of the flood forecast & warning and; hence, only they can assess its utilities.

Although, there are always regular interactions between CWC's "Flood Forecasters" and the "Flood Hazard Mitigation Authorities", yet very few agencies are sending their view on the usefulness of the flood forecast issued by CWC. After the flood season 2003, some state Government authorities have sent us letters expressing their views on usefulness of our forecasts. Abstracts of their letters are given in the Chapter-6. The contents of various letters reveals that the correct and timely flood forecasts and warnings of Central Water Commission were found extremely useful by the user agencies in flood loss mitigation, flood protection and reservoirs' operation etc.

The "Salient Features" of Flood Forecasting and Warning Network of the Central Water Commission are given in the Table below.

(As on 01.04.2004)

1.	Establishment of 'First Scientific Flood Forecasting Unit' (F.F.U.) in India	November, 1958 at Delhi
2.	Date of issue of 'first scientific flood forecast'	25 th July, 1959
3.	Name of first forecasting site and river	Delhi Railway Bridge (old) on the Yamuna
4.	Year of commencement of flood forecasting system on the Inter-state rivers i.e. first national level expansion	1969
5.	No. of Chief Engineer's offices including one CE (Flood Management) at CWC' headquarters	9
6.	No. of Superintending Engineer's offices including one Flood Forecasts Management Directorate at CWC' headquarters	12
7.	No. of present Flood Forecasting Divisions.	20
8.	No. of Control Room/Sub-Divisions engaged in flood forecasting work under above divisions.	64
9.	No. of Inter-State rivers (Main/Tributaries) covered by flood forecasting programme.	65
10.	No. of States including Union Territories covered under F.F. Programme.	16
11.	No. of forecasting Sites.	166
12.	No. of Base Stations.	201
13.	No. of gauge and gauge & discharge sites	700 (Approximately)
14.	No. of rain gauge stations (ordinary/Self recording)	500 (Approximately)
15.	No. of wireless stations.	450 (Approximately)
16.	Maximum No. of forecasts issues in any one year	8566 (in 1990)
17.	Average no. of forecasts being issued every years	6000
18.	No. of forecasts issued in 2003	6600

CHAPTER-1

NATIONAL FLOOD FORECASTING NETWORK

1.0 RIVER FORECASTING SERVICES

Flood cause considerable damage to human lives and property almost every year. About one third of total flood prone area (of 40 m.h.a assessed by the Rashtriya Barh Ayog) of the country has been provided with reasonable protection against flood of a low magnitude due to technological and economical constraints but there is no protection from floods of higher magnitude. Since adoption of National Flood Policy by Government of India in 1954 it was realised that a total protection against flood by structural means alone is not possible and that optimum solution would consist of a mixture of structural and non-structural measures. Therefore, stress has been laid on non-structural measures like Flood Forecasting and warning, which is most important among such means to minimize the damage potential from floods. Accurate and timely flood forecasts and advance warning have, therefore, to be aimed for providing valuable time to the people and to civil authorities in taking preventive measures like evacuation, relief and rehabilitation measures, preparedness for flood fighting by engineering authorities etc. and thus mitigating such losses from floods.

1.1 FLOOD FORECASTING NETWORK IN THE COUNTRY

Flood Forecasting has been recognised as the most important, reliable and cost effective non-structural measures for flood mitigation. Recognising the great importance of this measure, flood forecasting of river Yamuna at Delhi was suggested by Reddy Committee set up by Prime Minister, Govt. of India to manage flooding of Delhi. Accordingly in the year 1958 CWC commenced the flood forecasting service in a small way by establishing Flood Forecasting Unit for issuing water level forecasts of the Yamuna for the National Capital, Delhi. On the recommendation of various committees/panels a "Flood Forecast & Warning Organisation" was set up in CWC in 1969 to establish forecasting sites on inter-state rivers at various flood prone places in the country. 41 forecasting sites were added in 1969, making total number of forecasting sites to 43. Extension of the service followed from time to time and now the river forecasting has been expanded over the years to cover 8 major interstate flood prone river basins, which comprises of 65 sub-river basins traversing the country. The year-wise positions of the number of flood forecasting sites till 2003 in the Network of Central Water Commission are as follows:

Year	No. of Flood Forecasting Sites	Year	No. of Flood Forecasting Sites
1958	01	1987	147
1965	02	1990	157
1969	43	2001	159
1977	77	2002	161
1980	84	2003	166
1985	145		

The "National Flood Forecasting and Warning Network" of Central Water Commission, which comprised of 166 Flood Forecasting Sites including 27 inflow forecasting sites in 2003 is shown in Map-1. The number of flood forecasting sites on each of the 08 major inter-state river systems, which constitutes 65 river sub-basins in the country, are as under.

S. No.	Major Interstate River Systems	Type of Forecasting sites in the state		Total Forecasting sites in the river basins
		Level forecasting	Inflow forecasting	
1	Ganga & its Tributaries	76	09	85
2	Brahmaputra & its Tributaries	27	00	27
3	Barak System	02	00	02
4	Eastern Rivers	08	01	09
5	Mahanadi	03	01	03
6	Godavari	13	04	08
7	Krishna	03	05	08
8	West Flowing Rivers	09	06	15
Total Flood Forecasting Sites		139	27	166

The above Flood Forecasting Network covers the following 14 states, one Union Territory and NCT of Delhi.

S. No.	State/ U.T.	Type of Forecasting sites in the state		Total Forecasting sites in the state
		Stage forecasting	Inflow forecasting	
1	Andhra Pradesh	09	6	15
2	Assam	23	0	23
3	Bihar	32	0	32
4	Chhattisgarh	01	0	01
5	Gujarat	06	4	10
6	Haryana	0	01	01
7	Jharkhand	0	04	04
8	Karnataka	01	03	04
9	Madhya Pradesh	02	0	03
10	Maharashtra	06	01	07
11	Orissa	10	01	11
12	Uttaranchal	03	0	03
13	Uttar Pradesh	34	01	35
14	West Bengal	11	03	14
15	Dadra & Nagar Haveli	01	01	02
16	NCT of Delhi	02	0	02
Total forecasting sites			27	166

Out of 166 Flood Forecasting Sites, level forecasts at 139 sites and inflow forecasts to reservoirs at 27 sites were issued by the Central Water Commission through its 20 field flood forecasting divisions to the various user agencies, which includes various civil / Engineering agencies of the States/ Central Governments which includes Irrigation/ Revenue/ Railways/ public undertakings and Dam /Barrage authorities/ District Magistrates/ Sub divisional Officers besides the Defence authorities involved in the flood loss mitigation work. During the flood season the Honourable Minister of Water Resources Government of India, the Chairman and the Member (River Management) of Central Water commission are also being apprised of the latest flood situations in the above river basins in the country.

1.2 CLASSIFICATIONS OF VARIOUS FLOOD SITUATIONS

The Central Water Commissions has categorized various flood situations, for monitoring the floods in the country though its Flood Forecasting Network, into the following 04 different categories, depending upon the severity of floods i.e. based on floods magnitudes.

(i) LOW FLOOD

The river is said to be in "LOW FLOOD" situation at any flood forecasting sites when the water level of the river touches or crosses the warning level, but remains below the danger level of the forecasting site.

(ii) MODERATE FLOOD

If the water level of the river touches or crosses its Danger level, but remains below 0.50m of the Highest Flood Level of the site (commonly known as "HFL") then the flood situation is called the "MODERATE FLOOD" situation.

(iii) HIGH FLOOD

If the water level of the river at the forecasting site is below the Highest Flood Level of the forecasting site but still within 0.50m of the HFL then the flood situation is called "HIGH FLOOD" situation.

In "High Flood Situations" a special "Yellow Bulletin" is being issued by the Central Water Commission to the users agencies which contains the "special flood message" related to the high flood,

(iv) UNPRECEDENTED FLOOD

The flood situation is said to be "UNPRECEDENTED" when the water level of the river surpasses the "HIGHEST FLOOD LEVEL" recorded at any forecasting site so far.

Although, technically such flood situations when the flood level at a forecasting site just touches its previous HFL and does not crosses the same, (i.e. it equals the previous HFL), can not be termed as unprecedented flood situations, yet such flood situation are also given the same importance by the CWC in its flood messages as to the unprecedented flood situations.

In "unprecedented flood situations" which includes the flood situations equal to the previous HFL, a "Special RED Bulletin" containing the flood message of unprecedented situation" is being issued by the Central Water Commission to the users agencies.

1.3 EXPANSION OF THE NETWORK OF FLOOD FORECASTING SITES

The operation and maintenance of existing flood forecasting network is carried out as per budget allotment each year under 'Non-Plan' head and is thus subject to such restrictions and cuts applied to items under 'Non-Plan'. The expansion of the network with a view to cover additional flood prone areas is covered under 'Plan' head. Work on such Plan schemes is subject to approval of specific schemes by the Government and the budget allocation of funds. After 1990 two additional flood forecasting sites namely Kaleswaram and Eturunagaram on the main Godavari, were added to CWC - FF Network in 2000, two more sites viz. Singur Dam and Nizamsagar Dam on the river Manjira, a tributary of the Godavari in the state of Andhra Pradesh were added in 2002 while the following five new stage flood forecasting sites were added in 2003 flood season.

S.No.	New Flood Forecast sites added in 2003	River	State
1	Srinagar	Alaknanda	Uttaranchal
2	Rishikesh	Ganga	Uttaranchal
3	Kannauj	Ganga	Uttar Pradesh
4	Moradabad	Ramganga	Uttar Pradesh
5	Bareilly	Ramganga	Uttar Pradesh

On modernisation/ improvement of flood forecasting and warning, nine schemes as mentioned below, has been provided with a plan outlay for the year 2002-2003 amounting Rs.3.40 crore. The expenditure on these schemes for preceding year 2001-2002 was Rs.4.60 crore.

1. Strengthening & Modernisation of Flood forecasting & Hydrological Observation Network in Brahmaputra & Barak Basin.
2. Hydrological observation and flood forecasting network in Jhelum basin.
3. Establishment of new flood forecasting stations including inflow forecast.
4. Modernisation of Flood Forecasting Network in India.

5. Flood forecasting on rivers common to India & Nepal.
6. Modernisation of existing flood forecasting activities in respect of HO & FFO (North - East).
7. Establishment / Strengthening of FF & Warning centers in Krishna & Godavari Basins.
8. Establishment / Strengthening of FF & Warning in Mahanadi & Coastal rivers in Andhra Pradesh and Orissa.
9. Establishment of FF Stations in rivers other than Krishna and Mahanadi Basins.

1.4 DAMAGE DUE TO FLOODS/ HEAVY RAINS BETWEEN 1953 TO 2003

During 2003 the damage due to floods for the entire country were estimated to be Rs.981.927 crore (tentative) as compared to Rs.1488.786 crore during 2002. The average annual damages to crops, houses and public utilities from 1953 to 2003 as reported by the States/UT's are of the order of Rs.1368.355 crore (tentative), the maximum annual damage being Rs.5845.980 crore during 1998.

1.4.1 COMPARISION OF DAMAGES DUE TO FLOODS/ HEAVY RAINS DURING THE YEAR 2003 WITH AVERAGE DAMAGES FROM 1953 TO 2003 vis-à-vis EVER MAXIMUM DAMAGES OCCURED

A comparative statement showing the details of damages occurred during the "Flood Season 2003" on different accounts, based on the reports (Tentative), received by CWC from the revenue authorities of the State Governments and Union Territories by 10 th December, 2003 with average damages occurred during the period "1953 to 2003" vis-à-vis maximum damage occurred so far with year of occurrence, is given below.

S. No.	Items	Flood Damages during the periods		Maximum Damages occurred so far in any year (Between the period 1953 to 2003)	
		Year 2003*	Average for Year 1953 -2003	Year	Damages
1	Area affected (in mha)	3.610	7.308	1978	17.500
2	Population affected (in million)	30.901	32.926	1978	70.450

Table continued to next page

Table continued from pre-page

S. No.	Items	Flood Damages during the periods		Maximum Damages occurred so far in any year (Between the period 1953 to 2003)	
		Year 2003*	Average for Year 1953 -2003		
3	Damage to Crops (area in mha)	2.672	3.459	1988	10.150
4	Damage to crops (value in Rs Crore)	559.372	596.228	1988	2510.900
5	Damaged to Houses (in numbers)	6,41,652	11,75,513	1978	35,07,542
6	Damaged to Houses (value in Rs. Crore)	163.238	188.595	1988	1307.894
7	Cattle lost (in number)	8697	91,142	1979	6,18,248
8	Human lives lost (in Numbers)	1371	1556	1977	11,316
9	Damage to Public Utilities (in Rs Crore)	259.317	560.218	1998	3171.403
10	Total damages to crops, houses and Public Utilities (in Rs Crore)	981.927	1368.355	1998	5845.980

* Based on reports received in CWC from states revenue authorities till 10.12.2003

1.4.2 CALAMITY RELIEF FUND

The earlier system of providing flood relief as Central assistance to States has been dispensed with as per recommendations of the Ninth Finance Commission. In its place the Commission has recommended a scheme, which is qualitatively different in the sense that specific amount has been allocated to each

State under "Calamity Relief Fund" and the States are expected to look after themselves in any situation created by natural calamities. Thus, the States have now to deal with the natural calamities and manage their affairs themselves with the allocated funds. The Central Government contributes 75% of the amount and the State Governments contribute balance 25% out of its own resources.

1.4.3 PLAN OUTLAY FOR FLOOD FORECASTING NETWORK

Plan outlay for the "Flood Forecasting Network of CWC" as such alone is not available. However, under the head "Flood Control and Drainage", which includes Flood Forecasting and Warning, the outlay for the Tenth Plan Period 2002-2007 is Rs. 132.13 crore. The actual expenditure incurred under Plan heads during 2002-2003 were of the order of Rs. 27.26 crore.

1.4.4 NOMINAL COST OF FLOOD FORECASTING NETWORK

Flood Forecasting and Warning Network has helped in reducing flood damages at a very nominal cost, utilizing water resources in a better way by properly regulating the reservoirs/barrages, ensuring safety of reservoirs, obviating unnecessary dislocation of population, reduction of expenditure on disaster preparedness etc., thus increasing the stability of local economy. The Report of the Working Group on Flood Management for the Eighth Five Year Plan had recommended that, "The Planning Commission and the Ministry of Finance may devise a suitable financial management system under Non-Plan/ Plan sector which could ensure availability of funds for flood forecasting activity considering it as a major thrust area and exempt it from general cuts on Non-Plan expenditure to ensure that this important activity gets the desired boost in its functioning and does not suffer any set-back on account of lack of funds".

1.5 ANALYSIS OF PERFORMANCE OF FLOOD FORECASTING NETWORK:

While the performance of the Flood Forecasting System is satisfactory yet there is constant endeavour for achieving greater accuracy as newer technology and also more and more data become available. For this purpose the CWC has established a procedure of carrying out analysis and appraisal of the Forecasting Work, at the end of monsoon season. Based on this, measures for improvements, if necessary, are identified. A summary of the performance of the work carried out by the Field Divisions during the flood season 2003 and analyzed in Flood Forecast Monitoring Directorate of the River Management Wing of the Commission is presented in the subsequent sections.

1.6 ORGANISATIONAL SET-UP OF FLOOD FORECASTING NETWORK

The present organisational set up of Flood-forecasting & Warning Establishment of Central Water Commission under the Member (River-Management) consists of 8 Chief Engineer's Offices, 11 Circle Offices and 20 Divisions in its field formations and

one Chief Engineer viz. Chief Engineer (Flood Management) and a Directorate, the Flood Forecast Monitoring Directorate to assist him at the CWC Head-Quarters.

The organisational chart of Flood Forecasting and Warning set up of the Central Water Commission is given at Figure-1.

CHAPTER - 2

SOUTHWEST MONSOON ACTIVITIES IN 2003

2.0 GENERAL

India gets about 80% of its Annual rainfall during the South-West monsoon from June to September except some portions of South-Eastern parts of peninsular India where the main rains occur during the period of North-East monsoon from October to December, which overlap with the receding stage of the South-West monsoon in October. Occasionally cyclonic storm develop in the South-West Bay and move into the Peninsula and produces heavy rain during Northeast monsoon season.

Southwest monsoon advances from Malabar in the beginning of June. It produces spell of heavy rainfall along the Western Coast of the Peninsula and on the Southern slopes of Khasi and Jaintia hills in North Eastern region.

In association with the depression which occasionally form in the North Bay of Bengal and move North-Westwards heavy rains are produced in the Central parts of the country, Orissa, Gangetic West Bengal, Southern districts of Bihar, Gujarat region, and East Rajasthan and in the later monsoon months in and around North Deccan.

A very important characteristic of Southwest monsoon is the occurrence of "break". The break situations arise when the monsoon trough shifts to the Himalayas and are very important as they cause floods in the rivers rising from the Eastern Himalayas. Some times, the phenomenon of break sets in immediately after a monsoon depression has occurred. These two causes occurring in succession serve to intensify the floods.

Since 2002, the whole India has been divided by India Meteorological Department (IMD) into the following 36 meteorological sub-divisions for the purpose of studies of rainfall/ monsoon activities. Before 2002, the meteorological sub-division Chhatisgarh was part of the East Madhya Pradesh sub-division. The Uttaranchal and Jharkhand sub-divisions were earlier known as "Western U.P. Hills" and "Bihar Plateau" sub-divisions respectively.

List of Meteorological Sub-divisions

S.No.	Meteorological Sub-Division	S.No.	Meteorological Sub-Division
1	Jammu & Kashmir	19	Tamilnadu & Pondicherry
2	Himachal Pradesh	20	Kerala
3	Punjab	21	South Interior Karnataka
4	Haryana, Chandigarh & Delhi	22	North Interior Karnataka
5	Uttaranchal	23	Coastal Karnataka

Table continued to next page

Table continued from pre-page

S.No.	Meteorological Sub-Division	S.No.	Meteorological Sub-Division
6	West Uttar Pradesh	24	Konkan & Goa
7	East Uttar Pradesh	25	Madhya Maharashtra
8	Bihar	26	Marathawada
9	Jharkhand	27	Vidarbha
10	Gangetic West Bengal	28	Chhatisgarh
11	Sub-Himalayan W.B. & Sikkim	29	East Madhya Pradesh
12	Assam & Meghalaya	30	West Madhya Pradesh
13	Arunachal Pradesh	31	Gujarat region
14	Nagaland, Manipur, Mizoram & Tripura	32	Sourashtra, Kutch & Diu
15	Orissa	33	East Rajasthan
16	Telangana	34	West Rajasthan
17	Coastal Andhra Pradesh	35	Lakshadweep
18	Rayalaseema	36	Andaman & Nicobar Island

The progress of monsoon rainfall over the country is monitored by evaluating the departures of total rainfall from the normal rainfall in respect of meteorological Sub-Divisions and districts. The IMD has classified the rainfall as Excess, Normal, Deficient and Scanty, according to the following criteria.

Excess	:	+ 20% or more than normal
Normal	:	+ 19% to - 19% of the normal
Deficient	:	- 20% to - 59% of the normal
Scanty	:	- 60% to - 99% of the normal
No Rain (N.R.)	:	- 100% of the normal

2.1 HIGHLIGHTS OF SOUTH-WEST MONSOON IN 2003

Cumulative rainfall distribution during monsoon season 2003
(June to September).

* The southwest monsoon of 2003 (from June to September) was marked by near-normal rainfall over the country, distributed equitably over both space and time.

* For the country as a whole, the total rainfall from 1 June to 30 September 2003 was 102% of its Long Period Average.

* Following the drought of 2002, this year's monsoon rains brought welcome relief to most parts of the country that had experienced severe drought conditions last year.

* The June-September rainfall was normal/ excess in 33 out of the 36 meteorological sub-divisions and 75% of the meteorological districts received excess/normal rainfall.

* The main rainfall-deficient area runs from south Maharashtra across Karnataka to Kerala.

* Out of the 267 meteorological districts, which suffered from drought last year (during 2002), as many as 205 districts received good rainfall during 2003 monsoon, but drought has continued in 62 districts.

2.2 ONSET OF SOUTH-WEST MONSOON IN 2003

Climatologically, the southwest monsoon has an onset phase from end of May to end of June and a withdrawal phase from the first week of September continuing up to the middle of October. The Figure No. 2.1 and Figure No.2.2 are showing the "Normal dates on Onset and Withdrawal" of Southwest Monsoon in India, respectively. The intervening months of July and August are the months of peak monsoon activity. However, the rainfall over various parts of the country occurs in association with the movement of low-pressure systems. The monsoon rainfall thus has its active and weak phases. Also the paths traversed by the low-pressure systems determine the spatial rainfall pattern.

During phases of the weak monsoon activity mentioned above, the monsoon trough of low pressure, which normally runs across the northern parts of the country, shifts to the foothills of the Himalayas. This produced heavy rainfall and led to floods in Bihar, West Bengal and northeastern States.

In 2003, the southwest monsoon entered the South Andaman Sea on 16 May and its onset over northeast India was on 5 June, close to the normal date of 3 June. However, the onset of the monsoon over Kerala occurred on 8 June, marking a week's delay beyond its normal date of 1 June.

The onset phase was characterized by a strong Arabian Sea branch of the southwest monsoon, which accelerated its advance northwards as far as South Rajasthan by 19 June. On the other hand, the Bay of Bengal remained comparatively dormant, restraining its further advance from the direction. By 27 June, the monsoon had covered most parts of the country and the remaining was covered by 5 July, 10 days earlier than the normal date.

The initial delay of the onset of the monsoon over Kerala by a week was carried forward into the interior parts of the peninsula, but it was made up in its final stages and the onset over west Rajasthan was earlier than normal. Moreover, there was good pre-monsoon rainfall activity over northwest India in June.

2.3 SYNOPTIC FEATURES ASSOCIATED WITH THE MONSOON 2003

The monsoon trough, which is a characteristic feature of the monsoon circulation, runs from Rajasthan to North Bay of Bengal, when it is in its normal position. The oscillations of the monsoon trough have a vital bearing on monsoon

rains over the country. During the year 2003 the monsoon trough got established on 5 July and remained near to its normal position, except that the western half of the trough was seen close to the foothills of the Himalayas during the first half of August and on a few days during the first half of September. As a result there was no break or break-like situation in rainfall activity during the entire monsoon season. The dry spells that prevailed in different parts of the country were also not prolonged except in interior Karnataka and Kerala and southern parts of Madhya Maharashtra.

During the monsoon season, as many as 9 low pressure areas formed over the Bay of Bengal and 4 over land, which is as per their normal frequency. Fig.2.3 shows the paths of low pressure areas and monsoon depressions in the 2003 monsoon season. However, it is evident that most of these followed almost a normal track along the monsoon trough across central India and adjoining Gangetic plains. These systems resulted in persistent rainfall activity over central India during the second half of the monsoon season that lead to flooding over Orissa, Chhattisgarh, Bihar and Uttar Pradesh.

Out of these low-pressure areas, only two developed in to monsoon depressions over North Bay. The first one crossed the Orissa coast near Balasore on 25 July as a deep depression, and subsequently weakened into a depression over land. It moved further in a west-north-westerly direction all the way to east Rajasthan and persisted until 29 July. Under the influence of this system, active to vigorous monsoon prevailed over Orissa, Jharkhand, Chhattisgarh, Madhya Pradesh, Rajasthan and Gujarat region during that period.

The second monsoon depression formed a month later and crossed the Orissa coast near Paradip on 27 August. It moved further in land over Chhattisgarh and neighbouring areas on 29 August and weakened thereafter.

During an active monsoon situation, an offshore trough is seen over the Arabian Sea off the west coast, on some days. When the trough becomes well marked it gives copious precipitation, at times exceptionally heavy, along the west coast. On such situations, the interior parts of Maharashtra and Karnataka, which are on the lee-side of the Western Ghats, are deprived of rain. During 2003, the offshore trough was present on many days during the first half of the monsoon season. During the second half, the cross-equatorial flow over the Arabian Sea was subdued and led to a reduction in the pressure gradient, a situation not conducive for the formation of an offshore trough. However, the westerlies over the peninsula were also of moderate strength during this period, thus maintaining the deficiency in rainfall over these areas.

2.4 TIME DISTRIBUTION OF THE RAINFALL FOR THE COUNTRY AS A WHOLE DURING THE MONSOON SEASON 2003

The pattern of rainfall during the 2003 monsoon season was characterized by its equitable distribution in both space and time, although the total rainfall was far

short of that in years like 1988 (119% of Long Period Average LPA) in 1994 (110% of LPA). Hence it was described as a good monsoon in non-meteorological parlance and the rains were considered to be plentiful coming in the wake of an all-India drought.

The week-wise cumulative build-up of rainfall over the season, reveals that from the middle of June right up to the end of September, the rainfall for the country as a whole remained well-balanced without any prolonged breaks or continued wet spells, and the cumulative rainfall remained a little on the higher side of the Long Period Average (LPA).

For the country as a whole, the rainfall was very good during the months of June (109% of LPA) and July (107% of LPA), though August and September rainfall were a little subdued (95% and 96% respectively of LPA). For the country as a whole and for the entire 4-month period June to September, the rainfall was 102% of the LPA.

For the 3 broad homogeneous regions of the country, the season's rainfall was as follows:

North-west India	108% of LPA
North-east India	99% of LPA
Peninsular India	102 % of LPA

At the end of the monsoon season, 7 out of the 36 Meteorological sub-divisions registered excess rains, 26 had normal rainfall, and only 3 sub-divisions (North and South Interior Karnataka and Kerala) received deficient rainfall.

The rainfall distribution over the 523 meteorological districts, for the season as a whole, was as follows:

Excess	139 districts
Normal	249 „
Deficient	113 „
Scanty	14 „
No data	8 „

2.5 METEOROLOGICAL DROUGHT OVER SOME AREAS IN 2003

On a sub-divisional and district level, a rainfall deficiency of more than 25% of LPA is defined as a moderate meteorological drought and when the shortfall is more than 50%, it is regarded as a severe meteorological drought.

During the all-India drought year of 2002, it may be recalled that 2 meteorological sub-divisions comprising Rajasthan were under severe drought and there was moderate drought in 10 meteorological sub-divisions covering the states of

Punjab, Haryana, Delhi, the four southern states and Lakshadweep. Out of the 523 meteorological districts of the country, as many as 180 districts had experienced moderate drought and 87 districts had severe drought.

The most positive aspect of the 2003 monsoon was that out of these drought affected districts as many as 184 districts received normal/ excess rainfall, which also came in a timely manner. In particular the entire drought affected districts of Gujarat and Orissa states and most parts of Rajasthan had very good rainfall this year.

There are, however, the following 62 districts, which were drought-affected last year and continue to be under moderate/ severe drought in 2003 also. The main rainfall-deficient area extends from south Maharashtra across Karnataka to Kerala.

List of 62 meteorological districts having drought conditions
(Rainfall deficiency more than 25%) consecutively in 2002 and 2003

STATE	Details of Drought hit Districts	
	No. of Districts	Name of Districts
Andhra Pradesh	2	Anantapur, West Godavari
Arunachal Pradesh	3	Changland, Lower Subansiri, West Siang
Bihar	1	Bhojpur
Haryana	1	Karnal
Himachal Pradesh	3	Kulu, Lahaul Spiti, Solan
Jammu & Kashmir	1	Leh
Jharkhand	1	West Singhbhum
Karnataka	16	Bagalkote, Bijapur, Gadag, Gulbarga, Haveri, Koppal, Raichur, Bellary, Chamarajanagara, Chikmagalur, Chitradurga, Hassan, Mandya, Mysore, Shimoga, Tumkur
Kerala	7	Alapuzha, Kollam, Kozhikode, Palakkad, Thiruvananthapuram, Trissur, Wynad
Madhya Pradesh	2	Gwalior, Nimach
Maharashtra	4	Pune, Sangli, Satara, Osmanabad
Nagaland	2	Phek, Tuensang
Punjab	5	Fatehgarh Sahib, Moga, Muktasar, Nawashahar, Sangrur
Rajasthan	3	Ajmer, Baran and Udaipur
Tamilnadu	9	Coimbatore, Erode, Kanyakumari, Karur, Namakkal, Nilgiris, Theni, Tuticorin, Virudunagar

2.6 WITHDRAWAL OF MONSOON 2003

Unlike the onset of the southwest monsoon, its withdrawal is not a singular event but a gradual process extending from 1 September to 15 October, and the dates of withdrawal vary widely from year to year. The withdrawal of the 2003 Southwest monsoon started from the extreme northwestern parts of the country only on 17 September. As of 30 September, the monsoon has withdrawn from Rajasthan, Punjab, Haryana, Jammu & Kashmir, Himachal Pradesh, Uttaranchal, Delhi and parts of west Uttar Pradesh and North Gujarat. The withdrawal line of the Southwest monsoon extended from Uttaranchal to Saurashtra across west Uttar Pradesh passing through Bareilly, Agra, Nimach, Ahmedabad and Dwarka.

The withdrawal phase of southwest monsoon continued till October 15, 2003 when it withdrew from the entire country. Simultaneously, North-East monsoon rain commenced over Tamilnadu, Kerala and adjoining states of Karnataka and Andhra Pradesh on 19th October 2003.

The relative position of rainfall distribution Sub-Division-wise at the end of monsoon season (June-September) for the year 2003 and its comparison with the past 10 years of rainfall distribution under different categories is given below:

S. No	Category of rainfall	Monsoon Year-Wise									
		No. of Meteorological Sub-divisions under different category of Rainfall									
		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1	Excess	13	7	10	6	13	3	5	1	1	7
2	Normal	14	26	22	26	20	25	23	29	14	26
3	Deficient	8	2	3	3	2	7	7	5	19	3
4	Scanty	0	0	0	0	0	0	0	0	2	0
5	Data-inadequate	0	0	0	0	0	0	0	0	0	0

FORECAST PERFORMANCE IN 2003 FLOOD SEASON

3.0 FLOOD FORECASTING EVALUATION-PRESENT CRITERIA AND PROCEDURE

A number of techniques are being utilised for formulation of river stage and inflow forecasts by Central Water Commission. While inflow forecasts is being provided for assisting in reservoir regulation, the stage forecast was about the predicted water level well ahead of its occurrence. An accurate forecast would be one where the forecast level and corresponding actual observed level exactly synchronize or have such a small difference that it can be taken as reasonably accurate. In an ideal situation, not only the forecast and the corresponding observed value, of river stage/ inflow should be the same but also the time of such occurrence should be the same as that predicted.

3.1 EVALUATION CRITERIA FOR STAGE/INFLOW FORECASTING

According to the present norms of Central Water Commission a forecast of a flood forecasting site is considered to be reasonably accurate if the difference between the forecast and the corresponding actual observed level of river lies within ± 15 cm. In case of inflow forecasts, a variation within $\pm 20\%$ cumecs is considered acceptable.

3.2 FLOOD FORECASTING ACTIVITIES

As already reported, during the flood season 2003 all the 166 flood forecasting sites including 27 inflow forecasting sites were in operational condition i.e. where desired hydrological and hydro-meteorological data was observed / collected.

In 2003, the first river of the Flood Forecasting & Warning Network of Central Water Commission which crossed the warning level was the Beki, a tributary of the Brahmaputra in Assam when it crossed its warning level at the flood forecasting site, Road Bridge, at 2300 hours on 18th May 2003. The main river Brahmaputra crossed its warning level at flood forecasting Dibrugarh, thereafter, the next day. Subsequently, the first flood forecasting bulletin was issued on 19.05.2003 which contained the informations of flood situations of the above sites together with their flood forecasts. Thus, the flood forecasting activities first commenced in the state of Assam on 19 th May 2003, well before the commencement of normal flood season. During May itself the flood forecasting activities spread over the Brahmaputra main stream, its tributaries and the Barak system. The activities gradually extended to the other river systems and continued thereafter up to October 2003.

During the flood season of 2003 (May to October) 6600 forecasts were issued for 129 sites out of 166 Flood Forecasting sites. No forecast was issued for the remaining 37 flood forecasting station where no flood like situation was experienced,

that is maximum water level observed at the sites during 2003 flood season remained below warning stage except at the inflow forecasting site Tajewala Weir in Haryana, where forecast was not issued due to technical reasons. Besides Tajewala Weir on the Yamuna, these sites include 04 more inflow forecasting sites namely Jaikwadi Dam on the Godavari in Maharashtra; 02 sites in Andhra Pradesh viz. Nizamsagar Dam on the Manjira (a tributary of the Godavari) and Prakashan barrage (Vijaywada) on the Krishna; and Dantiwada Dam on the Banas in Gujarat and 32 level forecasting stations namely Rishikesh and Kannauj on the main stream Ganga; Srinagar on the Alaknada, Moradabad and Bareilly on the Ramganga; Etawah, Auraiya, Kalpi, and Hamirpur on the Yamuna; Dhansa regulator on the Sahibi; Lucknow (Hanuman Setu) and Jaunpur on the Gomati; Narayanpur on the Mayurakshi, Harinkhola on the Mundeshwari; Mohanpur on the Kangsawati; Naharkatia on the Buridehing; Gangkhed, Nanded, Kaleswaram, Etturunagaram, Dummagudam and Rajahmundry on the Godavari; Deongaon on the Bhima; Mantralayam Ahmedabad (Shubhash Bridge) on the Sabarmati; Wanakbori on the Mahi; Hoshangabad, Garudeswar and Bharuch on the Narmada, Surat (Nehru Bridge) on the Tapti; Vapi town and Daman on the Damanganga.

3.3 PERFORMANCE OF FLOOD FORECASTS ISSUED IN 2003

During the flood season 2003, in all 6600 flood forecasts were issued for 129 sites, which includes 5989 level forecasts and 611 inflow forecasts. Out of these 6368 forecasts were found within the permissible limit of accuracy. Further, out of 5989 level forecasts 5782 i.e. 96.54% were found within accuracy limit. Similarly, out of 611 inflow forecasts 586 i.e. 95.91% were found within permissible limit of accuracy.

A brief description of flood forecast performance river-wise and state-wise is given the following sub-sections.

3.4 RIVER-WISE FLOOD FORECASTING PERFORMANCE

An analysis of the flood forecasts issued during the flood season 2003, reveals that out of the total 6600 forecasts, 3401 forecasts (i.e. 51.53% of the total forecasts issued in 2003 flood season), were issued for 79 sites (out of 85 sites) located on the main Ganga and its tributaries. No forecast was issued / required for the remaining 16 sites. Out of 3401 forecasts, 3292 forecasts (i.e. 96.80%) were found with in permissible limit of accuracy.

Similarly, 2557 forecasts (i.e. 38.74% of the total number of forecasts issued in 2003), were issued for 26 sites, out of total 27 sites located on the main Brahmaputra and its tributaries. No forecast was issued for the remaining one site as the water level remained below the warning level there. Out of 2557 forecasts, 2477 forecasts (i.e. 96.87%) were found with in permissible limit of accuracy. For the Barak System 43 (i.e. only 0.65% of the total forecasts issued in 2003), 41 (i.e. 95.35%) forecasts were found with in permissible limit of accuracy.

For the Eastern Rivers 160 forecasts (i.e. 2.42% of the total number of forecasts issued in 2003), were issued for all the 09 sites located on the Eastern Rivers. Out of which 146 forecasts (i.e. 91.25%) were found with in permissible limit of accuracy. 166 forecasts (i.e. 2.52% of the total number of forecasts issued in 2003), were issued for all the 03 sites located on the Mahanadi, of which 161 forecasts (i.e. 96.99%) were found with in permissible limit of accuracy.

116 forecasts (i.e. only 01.76% of the total number of forecasts issued in 2003), were issued for 9 sites out of 17 forecasting sites for the Godavari basin, of which 101 forecasts (i.e. 87.07%) were found with in permissible limit of accuracy.

In case of Krishna basin, 66 forecasts (i.e. only 1.00% of the total number of forecasts issued in 2003), were issued for 5 out of 8 forecasting sites located in the basin. Out of 66 forecasts, 59 (89.39%) were found with in permissible limit of accuracy.

For the West-flowing rivers which comprises of the Narmada , The Tapi etc , 91 forecasts (i.e. 1.38% of the total number of forecasts issued in 2003), were issued for 06 sites, out of total 15 sites. Here, 100% forecasts were found within permissible limit of accuracy.

Thus, during the flood season 2003, out of 08 major river systems in the country where "Flood Forecasting & Warning Network" of the Central Water Commission exists, and floods are being monitored, the accuracy of the forecasting performance was 100% only for the "West Flowing Rivers". For the remaining basins it varies from a maximum of 96.99 % for "Eastern Rivers" to a minimum of 87.07% for the Godavari basin". The overall accuracy performance was of the order of 96.48% for the country as a whole.

The further analysis of forecasts performance also reveals that 100% correct forecasts were issued for all the flood forecasting sites located on 18 rivers ,namely, the Betwa, the Rapti, the Kosi, the Mayurakshi, the Ajoy, the Subansiri, the Kopili, the Manas, the Jaldhaka, the Tista, the Barak, the Brahmani, the Rushikuluya, the Sabarmati, the Mahi, the Narmada, the Tapi and the Damnaganga, which were operational and where forecasts were actually issued in 2003.

100% correct forecasts were also issued for 10 flood forecasting sites on the main stream Ganga out of total 19 forecasting sites for which forecasts were issued during the flood season 2003. In all there were 21 forecasting sites on the main stream Ganga in 2003 flood season. In the case of main Brahmaputra, only at 2 sites 100% correct forecast were issued during the period under report.

On the whole there were 59 (i.e. 45.74%) flood forecasting sites with 100% forecast performance accuracy. These sites are Haridwar, Ankinghat, Kanpur, Phaphamau, Allahabad (Chhatnag), Mirzapur, Ballia, Hathidah, Munger, Bhagalpur and Farakka on the Ganga; Mawi on the Yamuna; Mohana and Sahjina on the

Betwa; Darauli, Gangpur Siswan, and Chhapra on the Ghaghra; Balrampur, Bansi and Gorakhpur on the Rapti, Rewaghat and Hazipur on the Gandak; Khagaria on the Burhi Gandak, Hayaghat on Bagmati; Basu, Baltara and kursela on the Kosi; Jhawa on the Mahanada; Massanjore Dam and Tipara barrage on the Mayurakshi; Gheropara on the Ajoy, Tenughat and Durgapur Barrage on the Damodar; Tezpur and Dhubri on the Brahmaputra, Badatighat on the Subansiri, Kampur and Dharmtul on the Kopili; N.H.Crossing on the Manas, N.H. 31 Road Crossing and Mathabhanga on the Jaldhaka; Domohani Road Bridge and Mekhaliganj on the Tista, Silchar (Annpurnaghat) on the Barak; Rajghat on the Subernrekha; Jenapur Express way on the Brahmani; Alipingal Devi on Devi (a bifurcatory of the Mahanadi; Purushottampur on the Rushikuluya; Kunavaram on the Godavari, Bhandra on the Weinganga, Narayanpur dam, Priyadarshni Jurala Project, Srisailam Dam on the on the Krishna; Dharoi Dam on the Sabarmati, Kadana Dam on the Mahi; Mandla on the Narmada; Hatnur Dam and Ukai dam on the Tapi and Madhuban dam on the Damanganga.

There was no site where all the issued forecasts were out of the prescribed limit of accuracy i.e. where all the forecasts issued were incorrect. Site-wise "Forecast Performance" of 129 flood forecasting sites, out of 166 operational sites, where forecasts were actually issued in 2003 is shown in the following table.

S. No.	Details of sites within different range of permissible limit of accuracy (+/-15cm, +/-20%cumec)	No. of Sites in each category	% age of sites out of 129 where forecasts were issued
	Sites with performance accuracy between 0.1 % to 25.0%	Nil	n.a.
2	Sites with performance accuracy between 25.1 % to 50.0%	1	0.77 %
3	Sites with performance accuracy between 50.1 % to 75.0%	9	6.98 %
4	Sites with performance accuracy between 75.1 % to 99.99%	60	46.51 %
5	Sites with 100% performance accuracy i.e. . where all forecasts issued were within permissible limit of accuracy	59	45.74 %
6	Sites with 0.0% performance accuracy i.e. where all forecasts issued were out of permissible limit of accuracy	nil	n.a.
Total sites where forecasts were issued in 2003 = 129			

The complete description of the "Flood Forecasting Performance" of all the 65 rivers which comprises of the 8 major river systems of the country covered under the

"Flood Forecasting & Warning Network of CWC," based on the analysis of forecasts data of 2003 flood season is given in the following paragraphs.

The other details of the forecasting sites, such as their names, warning levels, danger levels, previous highest flood levels and the maximum levels attained during the flood season 2003 together with number of forecasts issued, the number of forecasts within permissible limit of accuracy and the percentage of accuracy, are given in the Table-1.

3.4.1 FLOOD FORECASTING PERFORMANCE OF THE RIVERS OF THE GANGA BASIN

The Ganga basin comprises of the main stream Ganga and 25 its tributaries / sub-tributaries which were covered under the CWC's Flood Forecasting Network during the flood season 2003. During the flood season 2003, there were 85 flood forecasting sites in the whole Ganga Basin, which included 76 stage and 9 inflow forecasting sites. The names of all rivers in the basin, number of forecasting sites located on each of them besides number of sites where no forecasts were issued, total number of forecasts issued, total number of forecasts within permissible limit of accuracy i.e. when actual level attained against the forecast level were within $\pm 15\text{cm}$ or $\pm 20\%$ cumecs variation only, and percentage accuracy achieved in 2003, are given in the following table.

During the flood season 2003, in all 3401 forecasts were issued for 69 sites on the Ganga basin,, for the benefit of the flood affected people, moveable as well as immovable properties. Out of these forecasts 3292 forecasts are found to be within permissible limit of accuracy. Thus an accuracy of the order of 96.80% was achieved, which is higher than that of the average accuracy achieved at All India level which is 96.48%.

S. No.	Rivers of the Ganga basin under FF network	Operational Flood Forecasting sites in 2003		Stage forecasting sites		Inflow forecasting sites		Total forecasts issued in 2003	No. of accurate forecasts	%age of forecast accuracy
		Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued			
1	Ganga	21	2	20	2	1	0	732	721	98.50
2	Alaknanda	1	1	1	1	0	0	0	0	
3	Ramganga	2	2	2	2	0	0	0	0	
4	Yamuna	11	5	10	4	1	1	159	120	75.47
5	Sahibi	1	1	1	1	0	0	0	0	
6	Betwa	2	0	2	0	0	0	3	3	100.00
7	Ken	1	0	1	0	0	0	16	11	68.75
8	Gomti	2	2	2	2	0	0	0	0	
9	Sai	1	0	1	0	0	0	30	29	96.67
10	Ghaghra	6	0	6	0	0	0	451	447	99.11

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S. No.	Rivers of the Ganga basin under FF network	Operational Flood Forecasting sites in 2003		Stage forecasting sites		Inflow forecasting sites		Total forecasts issued in 2003	No. of accurate forecasts	%age of forecast accuracy
		Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued			
11	Rapti	3	0	3	0	0	0	48	48	100.00
12	Sone	3	0	3	0	0	0	75	71	94.67
13	PunPun	1	0	1	0	0	0	51	49	96.08
14	Gandak	4	0	4	0	0	0	315	300	95.24
15	Burhi Gandak	5	0	5	0	0	0	291	281	96.56
16	Bagmati	2	0	2	0	0	0	183	181	98.91
17	Adhwara Group	2	0	2	0	0	0	126	123	97.62
18	Kamla Balan	1	0	1	0	0	0	118	114	96.61
19	Kosi	3	0	3	0	0	0	385	385	100.00
20	Mahananda	2	0	2	0	0	0	163	161	98.77
21	Mayurakshi	3	1	1	1	2	0	12	12	100.00
22	Ajoy	1	0	1	0	0	0	2	2	100.00
23	Damodar	3	0	0	0	3	0	165	164	99.39
24	Barakar	1	0	0	0	1	0	62	60	96.77
25	Mundeshwari	1	1	1	1	0	0	0	0	0.00
26	Kangsabati	2	1	1	1	1	0	14	10	71.43
	Total	85	16	76	15	9	1	3401	3292	96.80

3.4.2 FLOOD FORECASTING PERFORMANCE OF THE RIVERS OF THE BRAHMAPUTRA BASIN

The Flood Forecasting and Warning Network of the Central water Commission comprises of the main river Brahmaputra and 16 of its tributaries / sub-tributaries in the Brahmaputra basin during the flood season 2003.

In 2003, there were 27 flood forecasting sites in the Brahmaputra Basin; all of them are stage forecasting sites i.e. there is no inflow forecasting site in the Brahmaputra basin. The names of all rivers in the basin, number of forecasting sites located on each of them besides number of sites where no forecasts were issued, total number of forecasts issued, total number of correct forecasts within i.e. permissible limit of accuracy and percentage accuracy are given in the following table.

S. No.	Rivers of the Brahmaputra basin under FF network	Operational Flood Forecasting sites in 2003		Total forecasts issued in 2003	No. of accurate forecasts	%age of forecast accuracy
		Total No.	No. of sites Where no forecasts were issued			
1	Brahmaputra	6	0	875	851	97.26
2	Burhi -Dihing	2	1	39	36	92.31
3	Desang	1	0	44	37	84.09
4	Dikhow	1	0	37	33	89.19
5	Subansiri	1	0	54	54	100.00

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S. No.	Rivers of the Brahmaputra basin under FF network	Operational Flood Forecasting sites in 2003		Total forecasts issued in 2003	No. of accurate forecasts	%age of forecast accuracy
		Total No.	No. of sites Where no forecasts were issued			
6	Dhansiri	2	0	277	272	98.19
7	Jiabharali	1	0	244	236	96.72
8	Kopili	2	0	60	60	100.00
9	Puthimari	1	0	260	243	93.46
10	Beki	1	0	291	290	99.66
11	Pagladiya	1	0	58	51	87.93
12	Manas	1	0	26	26	100.00
13	Sankosh	1	0	205	204	99.51
14	Raidak-1	1	0	19	18	94.74
15	Torasa	1	0	11	9	81.82
16	Jaldhaka	2	0	26	26	100.00
17	Tista	2	0	31	31	100.00
Total	27	1	2557	2477	96.87	

On analysis of the data it reveals that for the Brahmaputra basin, in all 2557 forecasts were issued for 26 sites during the flood season 2003, for the benefit of the state of Assam and West Bengal i.e. the states where these forecasting sites on the water shed of the rivers are located. Out of 2557 forecasts, 2477 forecasts are found to be within permissible limit of accuracy i.e. within $\pm 15\text{cm}$ or $\pm 20\%$ cumecs.

Thus, accuracy of the order of 96.87% was achieved, which is higher than that of the All India average accuracy i.e. 96.48% and also greater than the accuracy achieved in the Ganga basin, though only marginally.

3.4.3 FLOOD FORECASTING PERFORMANCE OF THE RIVERS OF THE BARAK SYSTEM

The Barak River System under the Flood Forecasting and Warning Network of the Central water Commission comprises of only two rivers, the Barak and the Katakhal. The river system enters into Bangladesh in the down stream of Silchar in Assam.

In 2003, there were only two stage flood forecasting sites in the Barak system, one each on the Barak and the Katakhal, both located in Assam. There is no inflow forecasting site on either of these rivers. Forecasts were issued for both sites. The total number of forecasts issued, total number of correct forecasts i.e. within permissible limit of accuracy and percentage accuracy are given in the following table.

S. No.	Rivers of the Barak System under FF network	Operational Flood Forecasting sites in 2003		Total forecasts issued in 2003	No. of accurate forecasts	%age of forecast accuracy
		Total No.	No. of sites Where no forecasts were issued			
1	Barak	1	0	11	11	100.00
2	Katakhal	1	0	32	30	93.75
Total		2	0	44	41	95.35

Analysis of the above mentioned forecasts data reveals that for the Barak System, in all 44 forecasts were issued for both sites during the flood season 2003. Out of 44 forecasts, 41 forecasts i.e. 95.35% are found within permissible limit of accuracy, which is marginally lower than that of the All India average accuracy i.e. 96.48% for the year 2003.

3.4.4 FLOOD FORECASTING PERFORMANCE OF THE RIVERS OF THE EASTERN RIVERS

The Eastern Rivers under the Flood Forecasting and Warning Network of the Central water Commission comprises of the following rivers.

1. Subernarekha
2. Burhabalang
3. Baitarni
4. Brahmani
5. Rushikulia
6. Vamsadhara

During the flood season 2003, there were 09 flood forecasting sites including one inflow forecasting site, Gotta Barrage located in the state of Andhra Pradesh. Remaining all the 8 stage forecasting sites are in the state of Orissa. All these sites were operational in 2003 flood season. Flood forecasts were issued during the period under report, at all the 9 forecasting sites of the Eastern Rivers. The total number of forecasts issued for each of these rivers system, total number of correct forecasts i.e. within permissible limit of accuracy and percentage accuracy are given in the following table.

S. No.	Names of the Eastern Rivers under FF network	Operational Flood Forecasting sites in 2003		Stage forecasting sites		Inflow forecasting sites		Total forecasts issued in 2003	No. of accurate forecasts	%age of fore-cast accuracy
		Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued			
1	Subernarekna	1	0	1	0	0	0	3	3	100.00
2	Burhabalang	1	0	1	0	0	0	8	6	75.00
3	Baitarni	2	0	2	0	0	0	25	21	84.00
4	Brahmani	1	0	1	0	0	0	2	2	100.00
5	Rushikuluya	1	0	1	0	0	0	11	11	100.00
6	Vamsadhara	3	0	2	0	1	0	111	103	92.79
Total		9	0	8	0	1	0	160	146	91.25

An analysis of the forecasts data of the Eastern Rivers reveals that in all 160 forecasts were issued for all the 06 rivers i.e. for 09 sites, during the flood season 2003. Out of 060 forecasts, 146 forecasts i.e. 91.25%, are found within permissible limit of accuracy, which is about 5% less than that of the All India average accuracy i.e. 96.48% for the year 2003.

3.4.5 FLOOD FORECASTING PERFORMANCE OF THE RIVERS OF THE MAHANADI BASIN

In the Mahandi basin, the Central water Commission has so far covered only the main stream Mahanadi under its Flood Forecasting and Warning Network setup. There were 03 flood forecasting sites, one being the inflow forecasting site Hirakud Dam in orissa. All the sites were operational in 2003 and forecasts were issued for all of them.

During the flood season 2003, in all 166 forecasts were issued for all the 03 sites located on the river Mahandi during the period under report. An analysis of the forecasts data reveals that out of 166 forecasts, 161 i.e. 96.99% forecasts were found within permissible limit of accuracy. Thus, a better forecast performance accuracy was achieved in 2003 as compared to the average accuracy of forecasts performance on the all India basis, which was 96.48% during the year.

The river-wise total number of forecasts issued, total number of correct forecasts i.e. within permissible limit of accuracy and percentage accuracy are given in the following table.

S. No.	Name of River under FF Network	Operational Flood Forecasting sites in 2003		Stage forecasting sites		Inflow forecasting sites		Total forecasts issued in 2003	No. of accurate forecasts	%age of forecast accuracy
		Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued			
1	Mahanadi	3	0	2	0.00	1	0	166	161	96.99
Total		3	0	2	0.00	1	0	166	161	96.99

3.4.6 FLOOD FORECASTING PERFORMANCE OF THE RIVERS OF THE GODAVARI BASIN

The Godavari Basin, covered under the Flood Forecasting and Warning Network of the Central water Commission, comprises of the main river Godavari and 03 of its main tributaries, namely, the Wainganga, the Manjira and the Indravati. There were 17 flood forecasting sites on these 03 rivers, all of which were operational from flood forecasting point of view. Out of 17 sites, 12 on the main river Godavari which includes 2 inflow forecasting sites, Jaikwadi dam and Sriram Sagar (Pochampad), two each on the Manjira and Wainganga, and one on the Indravati. The 02 sites on Manjira, namely, Singur dam & Nijamsagar Dam are also inflow forecasting sites.

An analysis of the data showed that in 2003 flood season, out of 13 stage forecasting sites forecasts were issued only for 07 sites while out of 04 inflow forecasting sites forecasts were actually issued only for two sites. In all 116 forecasts were issued for all the 09 sites where forecasts were issued during the period under report. Out of 116 forecasts 101 forecasts i.e. 87.07%, were found within permissible limit of accuracy. Thus the accuracy of forecasts performance for the Godavari basin was about 9% less than the All India average of accuracy i.e. 96.48% of 2003.

The river-wise total number of forecasts issued, total number of correct forecasts i.e. within permissible limit of accuracy and percentage accuracy are given in the following table.

S. No.	Rivers of the Ganga basin under FF network	Operational Flood Forecasting sites in 2003		Stage forecasting sites		Inflow forecasting sites		Total forecasts issued in 2003	No. of accurate forecasts	%age of forecast accuracy
		Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued			
1	Godavari	12	7	10	6	2	1	48	39	81.25
2	Wainganga	2	0	2	0	0	0	18	16	88.89
3	Manjira	2	1	0	0	2	1	3	2	66.67
4	Indravati	1	0	1	0	0	0	47	44	93.62
Total		17	8	13	6	4	2	116	101	87.07

3.4.7 FLOOD FORECASTING PERFORMANCE OF THE RIVERS OF THE KRISHNA BASIN

The Krishna Basin, covered under the Flood Forecasting and Warning Network of the Central water Commission, comprises of the main river Krishna, two of its main tributaries, namely, the Tungabhadra, and the Bhima. There were 08 flood forecasting sites on these rivers, all of which were operational in 2003. Out of 08 sites, 05 sites (all inflow forecasting sites) are on the main river Krishna, two on the Tungabhadra (one stage & other inflow forecasting site), and one on the Bhima. Thus on the whole there were 6 inflow forecasting sites and 02 stage forecasting sites

The data analysis reveals that during the flood season 2003, out of 06 inflow forecasting sites, forecasts were issued only for 05 sites while out of 02 stage forecasting sites forecasts were actually issued only for one sites. In all 66 forecasts were issued for all the 06 sites where forecasts were actually issued during the period under report. Out of 66 forecasts, 59 forecasts i.e. 89.39%, were found within permissible limit of accuracy. Thus in case of the Krishna basin, the accuracy of forecasts performance was about 07% less than the All India average of accuracy i.e. 96.48%.

The river-wise total number of forecasts issued, total number of correct forecasts i.e. within permissible limit of accuracy and percentage accuracy are given in the following table.

S. No.	Rivers of the Krishna basin under FF Network	Operational Flood Forecasting sites in 2003		Stage forecasting sites		Inflow forecasting sites		Total forecasts issued in 2003	No. of accurate forecasts	%age of forecast accuracy
		Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued	Total No.	No. of sites Where no forecasts were issued			
1	Krishna	5	1	0	0	5	1	19	17	89.47
2	Bhima	1	1	1	0	0	0	0	0	0.00
3	Tungbhadra	2	1	1	1	1	0	47	42	89.36
	Total	8	3	2	1	6	1	66	59	89.39

3.4.8 FLOOD FORECASTING PERFORMANCE OF THE RIVERS OF THE WEST FLOWING RIVERS

The West Flowing Rivers comprises of the following river system under the Flood forecasting and Warning Network of the Central water Commission.

1. Banas
2. Sabarmati
3. Mahi
4. Narmada
5. Tapi
6. Damanganga

There were 15 flood forecasting sites on the above rivers, including 06 inflow forecasting sites. All the 15 sites, which include 06 inflow forecasting sites, were operational in 2003 from flood forecasting point of view. Out of 15 sites, there is one on the Banas, Dantiwada Dam, which is an inflow forecasting, one stage forecasting and one inflow forecasting site on each river, the Sabarmati and the Mahi, 04 sites (all stage forecasting sites) on the Narmada, two inflow and one stage forecasting site on the Tapi, and one inflow and two stage forecasting site is on the Damanganga.

An analysis of the forecasts data reveals that during the flood season 2003, out of 15 sites, forecasts were actually issued for only 06 sites as the water level at the remaining 09 sites did not cross or touch their warning stages. No forecasts were issued for the one inflow forecasting site viz Dantiwada Dam on Banas, and 08 stage forecasting sites namely, Ahmedabad (Subhash Bridge) on Sabarmati, Wanakbori on the Mahi, Hoshangabad, Garudeswar and Bharuch on the Narmada, Surat (Nehru Bridge) on the Tapi, Vapi Town and Daman on the Damanganga,

In all 99 forecasts were issued for all the 06 sites where forecasts were actually issued during the period under report, and all of them i.e. 100% forecasts, were found within permissible limit of accuracy. Thus, the flood forecasting performance of West Flowing Rivers not only achieved cent percent accuracy but it is the only one, out of 08 major river system covered under flood forecasting Network of CWC in the country, to issue all forecasts during the flood season 2003, 100% of which were within permissible limit of accuracy.

The river-wise total number of forecasts issued, total number of correct forecasts i.e. within permissible limit of accuracy and percentage accuracy are given in the following table.

S. No.	Name of West flowing River under FF Network	FF sites in 2003		Level forecasting sites		Inflow Forecasting site		Total Forecasts issued in 2003	Total Correct Forecasts	%age Accuracy of forecasts
		Total sites	Sites where no forecast issued	Total sites	Sites where no forecast issued	Total sites	Sites where no forecast issued			
1	Banas	1	1	0	0	1	1	0	0	
2	Sabarmati	2	1	1	1	1	0	1	1	100.00
3	Mahi	2	1	1	1	1	0	5	5	100.00
4	Narmada	4	3	4	3	0	0	2	2	100.00
5	Tapi	3	1	1	1	2	0	76	76	100.00
6	Damanganga	3	2	2	2	1	0	7	7	100.00
	Total	15	9	9	8	6	1	91	91	100.00

The forecasting performances at a glance in respect of the 8 major river systems in the country, which are described in the above paragraphs, are given in

the Table-2. Similar statement showing flood forecasting performances of all the 65 river basins/ sub-basins covered under CWC Network are shown in Table-3.

3.5 STATE-WISE FLOOD FORECASTING PERFORMANCE

As mentioned already, 166 flood forecasting sites of CWC FF Network are located in 14 states, one union territory and NCT of Delhi. The total numbers of forecasting sites and type of sites in each state are listed in the table at page 12 of this report.

The "State-wise and site-wise" forecasting performances of the Flood Forecasting and Warning Network are shown in the Table -4.

The state-wise descriptions of the flood forecasting performances during the flood season 2003 are given in the following paragraphs.

3.5.1 FLOOD FORECASTING PERFORMANCE OF THE SITES LOCATED IN THE STATE OF ANDHRA PRADESH

During the flood season 2003, there were 15 forecasting sites, out of which 09 were stage forecasting and the remaining 06 inflow forecasting sites. During the season no forecasts were issued for the following 07 sites.

S.No.	River	Site where no forecast was issued
1	Godavari	Kaleswaram
2	Godavari	Eturunagaram
3	Godavari	Dummagudam
4	Godavari	Rajahmundri
5	Manjira	Nizamsagar*
6	Krishna	Prakashan Barrage (Vijaywada)*
7	Tungabhadra	Mantralayam

* Inflow forecasting sites

During the flood season 2003, in all 62 forecasts were issued for 08 forecasting sites, which include 4 level forecasting, and 4 inflow forecasting sites. Out of 62 forecast 53 forecasts i.e. 85.48%, were found within permissible limit of accuracy i.e. +/- 15cm or +/- 20% cumecs. Thus it reveals that the accuracy limit of forecasts issued for the state of Andhra Pradesh was 11% less than the all India average accuracy, which was 96.48%.

The site-wise as well as river-wise forecast performances of the forecasting sites located in the state of Andhra Pradesh are given in the following table.

S. No.	River	FF site	No. of Forecasts issued	No. of forecasts within accuracy limit	% age Accuracy
1	Vamsadhara	*Gotta Barrage	22	20	90.91
2	Godavari	*Sriram Sagar (Pochampad)	7	4	57.14
3	Godavari	Bhadrachalam	9	7	77.78
4	Godavari	Kunavaram	3	3	100.00
5	Godavari	Dowalaiswaram	16	15	93.75
6	Manjira	*Singur Dam	3	2	66.67
7	Krishna	*Priyadarshini Jurala Prolect	1	1	100.00
8	Krishna	*Srisailam Dam	1	1	100.00
	Total		62	53	85.48

* Inflow forecasting sites

3.5.2 FLOOD FORECASTING PERFORMANCE IN THE STATE OF ASSAM

In 2003 flood season, there were 23 forecasting sites in the state of Assam. All these sites were operational during the season. However forecasts were issued only at 22 sites as the water level at one site i.e. Naharkatia on the Burhi Dihing did not touch the warning stage of the site.

The site-wise as well as river-wise forecast performances of the forecasting sites located in the state of Assam are given in the following table.

S. No.	River	FF site	No. of Forecasts issued	No. of forecasts within accuracy limit	% age Accuracy
1	Brahmaputra	Dibrugarh	284	282	99.30
2	Brahmaputra	Neamatighat	109	108	99.08
3	Brahmaputra	Tejpur	67	67	100.00
4	Brahmaputra	Guwahati	89	75	84.27
5	Brahmaputra	Goalpara	93	86	92.47
6	Brahmaputra	Dhubri	233	233	100.00
7	Burhi -Dihing	Khowang	39	36	92.31
8	Desang	Nanglamoraghat	44	37	84.09
9	Dikhow	Sibsagar	37	33	89.19
10	Subansiri	Badatighat	54	54	100.00
11	Dhansiri	Golaghat	67	65	97.01
12	Dhansiri	Numaligarh	210	207	98.57
13	Jiabharali	N.T. Road Crossing	244	236	96.72
14	Kopili	Kampur	9	9	100.00
15	Kopili	Dharamtul	51	51	100.00
16	Puthimari	N.H. Crossing	260	243	93.46

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17	Beki	Road Bridge	291	290	99.66
18	Pagladiya	N.T. Road Crossing	58	51	87.93
19	Manas	N.H. Crossing	26	26	100.00
20	Sankosh	Golakganj	205	204	99.51
21	Barak	Silchar (Annapurnaghat)	11	11	100.00
22	Katakhal	Matizuri	32	30	93.75
		Total	2513	2434	96.86

The analysis of the forecasts data reveals that for the state of Assam, in all 2513 forecasts were issued for all the 22 forecasting sites, out of which 2434 forecasts i.e. 96.86 %, were found within permissible limit of accuracy i.e. $\pm 15\text{cm}$ or $\pm 20\%$ cumecs. It further reveals that the accuracy limit of forecasts issued for the state of Assam was slightly better than the all India average accuracy of 96.48%.

3.5.3 FLOOD FORECASTING PERFORMANCE IN THE STATE OF BIHAR

In the state of Bihar, there were 32 sites in 2003, all of which are stage flood forecasting. Forecasts were issued for all these sites during the period under report. Out of 166 sites, 32 i.e. 19.28% of the total forecasting sites are located in the state of Bihar, second largest number of forecasting sites in the country, only next to the state of Uttar Pradesh.

The site-wise as well as river-wise forecast performances of the forecasting sites located in the state of Bihar are given in the following table.

S. No.	River	FF site	No. of Forecasts issued	No. of forecasts within accuracy limit	% age Accuracy
1	Ganga	Buxar	28	27	96.43
2	Ganga	Patna (Dighaghat)	39	38	97.44
3	Ganga	Patna (Gandhighat)	58	54	93.10
4	Ganga	Hathidah	52	52	100.00
5	Ganga	Munger	17	17	100.00
6	Ganga	Bhagalpur	44	44	100.00
7	Ganga	Colgong/ Kahalgaon	74	73	98.65
8	Ghaghra	Darauli	79	79	100.00
9	Ghaghra	Gangpur Siwan	79	79	100.00
10	Ghaghra	Chhapra	24	24	100.00
11	Sone	Inderpuri	4	3	75.00
12	Sone	Koelwar	25	23	92.00
13	Sone	Maner	46	45	97.83
14	Punpun	Sripalpur	51	49	96.08
15	Gandak	Chatia	51	46	90.20
16	Gandak	Rewaghat	35	35	100.00
17	Gandak	Hazipur	25	25	100.00
18	Burhi Gandak	Lalbeghiaghat	26	22	84.62
19	Burhi Gandak	Muzaffarpur (Sikandarpur)	53	52	98.11
20	Burhi Gandak	Samastipur	70	68	97.14

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21	Burhi Gandak	Rosera	75	72	96.00
22	Burhi Gandak	Khagaria	67	67	100.00
23	Bagmati	Benibad	114	112	98.25
24	Bagmati	Hayaghat	69	69	100.00
25	Adhwara Group	Kamtaul	64	62	96.88
26	Adhwara Group	Ekmighat	62	61	98.39
27	Kamla Balan	Jhanjharpur	118	114	96.61
28	Kosi	Basua	187	187	100.00
29	Kosi	Baltara	104	104	100.00
30	Kosi	Kursela	94	94	100.00
31	Mahananda	Dhengraghat	63	61	96.83
32	Mahananda	Jhawa	100	100	100.00
		Total	1997	1958	98.05

An analysis of the above cited forecasts data reveals that for the state of Assam, in all 1997 stage forecasts were issued for all the 32 forecasting sites, out of which 1958 forecasts i.e. 98.05%, were found within permissible limit of accuracy i.e. +/- 15cm. It further reveals that the accuracy limit of forecasts issued for the state was even better than the all India average accuracy of 96.48%.

3.5.4 FLOOD FORECASTING PERFORMANCE IN THE STATE OF CHHATISGARH

In the state of Chhatisgarh, there was only one flood forecasting site, namely, Jagdalpur on the Indravati, a tributary of the Godavari during the flood season 2003 and during the period under report the lone stage forecasting site was operational too, for which forecasts were issued.

During the flood season 2003, 47 forecasts were issued, out of which 44 forecasts i.e. 93.62%, were found within permissible limit of accuracy i.e. +/- 15cm or +/- 20% cumecs. The analysis of forecasts data further shows that the accuracy is about 3% less than the all India average accuracy of 96.48%.

3.5.5 FLOOD FORECASTING PERFORMANCE IN THE STATE OF GUJARAT

In the Gujarat state, there were 10 flood forecasting site, which includes 04 inflow forecasting sites and all of them were operational in 2003. During the period under report, out of the 10 sites, no forecasts were issued at the following 07 sites, as water level at the sites did not touch their warning levels.

S.No.	River	FF Sites where no forecasts were issued
1	Banas	Dantiwada Dam*
2	Sabarmati	Ahmedabad (Subhash Bridge)
3	Mahi	Wanakbori
4	Narmada	Garudeshwar
5	Narmada	Bharuch
6	Tapi	Surat (Nehru Bridge)
7	Damanganga	Vapi Town

* Inflow forecasting site

The analysis of data reveals that during the flood season 2003, in all 35 forecasts were issued and all of them i.e. 100 % forecasts were found within permissible limit of accuracy i.e. +/- 15cm or +/- 20% cumecs.

S. No.	River	FF site	No. of Forecasts issued	No. of forecasts within accuracy limit	% age Accuracy
1	Sabarmati	*Dharoi Dam	1	1	100.00
2	Mahi	*Kadana Dam	5	5	100
3	Tapi	*Ukai Dam	29	29	100.00
Total			35	35	100.00

* Inflow forecasting sites

3.5.6 FLOOD FORECASTING PERFORMANCE IN THE STATE OF HARYANA

As already mentioned in earlier chapter there is only one forecasting site in the Haryana state, i.e. Tajewala Weir on the Yamuna.

The site Tajewala weir was not in operation from the flood forecasting activity point of view. During previous years data of this site was basically observed by the staff of Irrigation Department of the Government of Haryana and the same was being collected from their records by the staff of CWC posted at site during the season.

However, in 2003 flood season, the observation of data has been shifted from the Tajewala weir to about 3 km upstream site known as Hathnikund Barrage, by the Government of Haryana. As such no data was observed at Tajewala Weir site by the staff of CWC. Also no forecasts were issued for this inflow forecasting site during the season.

3.5.7 FLOOD FORECASTING PERFORMANCE IN THE STATE OF JHARKHAND

In the state of Jharkhand, there were 04 flood forecasting site, all of which are inflow forecasting sites, and were operational during the flood season 2003. During the period under report, forecasts were issued for all these sites.

The analysis of the forecasts data reveals that during the flood season 2003, in all 174 inflow forecasts were issued for the four sites, out of which 171 forecasts i.e. 98.28% forecasts were found within permissible limit of accuracy +/- 20% cumecs. The forecasting accuracy was therefore higher than the all India average accuracy of 96.48%.

The site-wise flood forecasts performance is given in the following table.

S. No.	River	FF site	No. of Forecasts issued	No. of forecasts within accuracy limit	% age Accuracy
1	Mayurakshi	* Massanjore Dam	6	6	100.00
2	Damodar	*Tenughat Dam	30	30	100.00
3	Damodar	*Panchet Dam	76	75	98.68
4	Barakar	*Maithon Dam	62	60	96.77
Total			174	171	98.28

* Inflow forecasting sites

3.5.8 FLOOD FORECASTING PERFORMANCE IN THE STATE OF KARNATAKA

In the state of Karnataka there were 04 flood forecasting site, 03 of which are inflow forecasting sites, and all were operational during the flood season 2003. During the period under report, forecasts were issued for all the inflow forecasting sites. No forecasts were issued for the stage forecasting sites Deongaon on the river Bhima where water level did not touch the warning stage.

The analysis of the forecasts data reveals that during the flood season 2003, in all 61 inflow forecasts were issued for all the 03 inflow forecasting sites, out of which 57 forecasts i.e. 89.06% forecasts were found within permissible limit of accuracy +/- 20% cumecs. The forecasting accuracy was, therefore, lesser by about 7% than the all India average accuracy of 96.48%.

The site-wise flood forecasts performance issued for the benefit of Karnataka state is given in the following table.

S. No.	River	FF site	No. of Forecasts issued	No. of forecasts within accuracy limit	% age Accuracy
1	Krishna	*Alamati Dam	13	11	84.62
2	Krishna	*Narayanpur Dam	4	4	100.00
3	Tungbhadra	*Tungabhadra Dam	47	42	89.36
Total			64	57	89.06

* Inflow forecasting sites

3.5.9 FLOOD FORECASTING PERFORMANCE IN THE STATE OF MADHYA PRADESH

In the state of Madhya Pradesh, there were only 02 flood forecasting sites during the flood season 2003, both stage forecasting and located on the river Narmada. Both these sites were operational.

In 2003, only two forecasts were issued for one site, Mandla while no forecasts were issued for the other site, Hoshangabad where water level did not

touch the warning level of the site. Thus statistically insignificant numbers of forecast were issued but both were found within permissible limit of accuracy ± 15 cm.

3.5.10 FLOOD FORECASTING PERFORMANCE IN THE STATE OF MAHARASHTRA

In the state of Maharashtra there were 07 flood forecasting site, 02 of which are inflow forecasting sites, and all were operational during the flood season 2003. During the period under report, forecasts were issued only for 04 forecasting sites, one inflow forecasting and 03 stage forecasting sites. No forecasts were issued for the one inflow forecasting site and 2 stage forecasting sites, namely, Jaikwadi Dam, and Gankhed & Nanded respectively, all on the main river Godavari..

The analysis of the forecasts data reveals that during the flood season 2003, in all 78 forecasts were issued for all the 04 forecasting sites, out of which 73 forecasts i.e. 93.59% forecasts were found within permissible limit of accuracy ± 15 cm or ± 20 % cumecs. In case the Maharashtra state, similar to the Karnataka, the forecasting accuracy was found less than about 3% when compared with the all India average accuracy of 96.48%.

The site-wise flood forecasts performance issued for the benefit of Maharashtra state is given in the following table,

S. No.	River	FF site	No. of Forecasts issued	No. of forecasts within accuracy limit	% age Accuracy
1	Godavari	Kopergaon	13	10	76.92
2	Wainganga	Bhandra	9	9	100.00
3	Wainganga	Pauni	9	7	77.78
4	Tapi	Hatnur Dam*	47	47	100.00
Total			78	73	93.59

* Inflow forecasting site

3.5.11 FLOOD FORECASTING PERFORMANCE IN THE STATE OF ORISSA

In the state of Orissa there were 11 flood forecasting site, 01 of which are inflow forecasting sites, namely, the Hirakud Dam on the Mahanadi and all were operational during the flood season 2003. During the period under report, forecasts were also issued for all these sites.

The site-wise flood forecasts performance issued for the benefit of Orissa state is given in the following table,

S. No.	River	FF site	No. of Forecasts issued	No. of forecasts within limit	% age Accuracy
1	Subernarekna	Rajghat	3	3	100.00
2	Burhabalang	N.H.5 Rd Bridge	8	6	75.00
3	Baitarni	Anandpur	14	11	78.57
4	Baitarni	Akhuapada	11	10	90.91
5	Brahmani	Jenapur Exp Way	2	2	100.00
6	Mahanadi	Hirakud Dam*	85	81	95.29
7	Mahanadi	Alipingal Devi	40	40	100.00
8	Mahanadi	Nimapara	41	40	97.56
9	Rushikuluya	Purushottampur	11	11	100.00
10	Vamsadhara	Gunupur	21	16	76.19
11	Vamsadhara	Kashinagar	68	67	98.53
Total			304	287	94.41

* Inflow forecasting site

The analysis of the forecasts data reveals that during the flood season 2003, in all 304 forecasts were issued for all the 11 forecasting sites, out of which 287 forecasts i.e. 94.41% forecasts were found within permissible limit of accuracy +/- 15cm or +/- 20% cumecs. In this case also, similar to the Karnataka, Maharashtra, the forecasting accuracy was found less than the than all India average accuracy of 96.48% by about 3%.

3.5.12 FLOOD FORECASTING PERFORMANCE IN THE STATE OF UTTARANCHAL

In the state of Uttaranchal , there were 03 flood forecasting site, all stage forecasting sites, namely, the Srinagar on the Alaknada, Rishikesh and Haridwar on the Ganga. Although all were operational during the flood season 2003 yet forecasts were issued only for one site viz. Haridwar only. The other two sites were created as flood forecasting sites during the flood season 2003 and as such forecasts could not be issued for technical reason.

An analysis of the forecasts data reveals that during the flood season 2003, in all 27 stage forecasts were issued for the site Haridwar located on the main stream Ganga. All the 27 forecasts i.e. 100.00% forecasts were found within permissible limit of accuracy ± 15 cm.

3.5.13 FLOOD FORECASTING PERFORMANCE IN THE STATE OF UTTAR PRADESH

In the state of Uttar Pradesh, there were 35 flood forecasting site, which includes 01 inflow forecasting site, Narora on the Ganga and all these sites were operational during the flood season 2003. The state of Uttar Pradesh has maximum number flood forecasting sites in the country. Out of 166 sites, 35 i.e. 21.08% of the total forecasting sites are located in the state of Uttar Pradesh. During the period under report, out of 35 sites forecasts were issued for 26 forecasting sites including the lone inflow forecasting Narora. For 09 stage forecasting sites no forecasts were issued. These sites are Kannauj on the Ganga, Moradabad and Bareilly on the Ramganga, Etawa, Auraiya, Kalpi and Hamirpur on the Yamuna, Lucknow (Hanuman Setu) and Jaunpur on the Gomati where rivers' stages remained below the warning levels of the sites during the season. However, forecast was issued for the site Kanpur where water level remained below warning level on the request of the user agencies, as in the previous years.

The analysis of the forecasts data reveals that during the flood season 2003, in all 1017 forecasts were issued for all the 26 forecasting sites where forecast were issued, out of which 957 forecasts i.e. 94.10% forecasts were found within permissible limit of accuracy ± 15 cm or ± 20 cumecs. Thus the forecasting accuracy was less than the all India average accuracy of 96.48% by about 2%.

The site-wise as well as river-wise forecast performances of the forecasting sites located in the state of Uttar Pradesh are given in the following table.

S. No.	River	FF site	No. of Forecasts issued	No. of forecasts within accuracy limit	% age Accuracy
1	Ganga	*Narora Barrage (U/S)	86	85	98.84
2	Ganga	Ankinghat	30	30	100.00
3	Ganga	Kanpur	45	45	100.00
4	Ganga	Dalmu	39	38	97.44
5	Ganga	Phaphamau	5	5	100.00
6	Ganga	Allahabad (Chhatnag)	4	4	100.00
7	Ganga	Mirzapur	4	4	100.00
8	Ganga	Varanasi	6	5	83.33

* Inflow forecasting site

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9	Ganga	Ghazipur	27	26	96.30
10	Ganga	Ballia	49	49	100.00
11	Yamuna	Mawi	5	5	100.00
12	Yamuna	Mathura	26	21	80.77
13	Yamuna	Agra	111	84	75.68
14	Yamuna	Chilaghat	3	1	33.33
15	Yamuna	Naini	7	5	71.43
16	Betwa	Mohana	2	2	100.00
17	Betwa	Sahjina	1	1	100.00
18	Ken	Banda	16	11	68.75
19	SAI	Rae- Bareilly	30	29	96.67
20	Ghaghra	Elgin Bridge	88	87	98.86
21	Ghaghra	Ayodhya	90	89	98.89
22	Ghaghra	Turtipar	91	89	97.80
23	Rapti	Balrampur	17	17	100.00
24	Rapti	Bansi	16	16	100.00
25	Rapti	Gorakhpur (Birdghat)	15	15	100.00
26	Gandak	Khadda	204	194	95.10
Total			1017	957	94.10

3.5.14 FLOOD FORECASTING PERFORMANCE IN THE STATE OF WEST BENGAL

In the state of West Bengal, there were 14 flood forecasting site, 12 stage forecasting sites and 02 inflow forecasting sites, namely, the Tippiara Barrage on the Mayurakshi and Kangsawati Dam on the Kangsawati. Although all sites were operational during the flood season 2003, yet forecasts were issued only for 11 sites, which includes the inflow forecasting sites cited above. Forecasts for remaining 03 stage forecasting sites were not issued as the water levels did not touch the warning level of these sites namely, Narayanpur on Mayurakshi, Harinkhola on Mundeshwari, Mohanpur on the Kangsawati.

The site-wise as well as river-wise forecast performances of the forecasting sites located in the state of West Bengal are given in the following table.

S. No.	River	FF site	No. of Forecasts issued	No. of forecasts within limit	% age Accuracy
1	Ganga	Farakka	98	98	100.00
2	Mayurakshi	*Tilpara Barrage	6	6	100.00
3	Ajoy	Gheropara	2	2	100.00
4	Damodar	*Durgapur Barrage	59	59	100.00
5	Kangsabati	*Kangsabati Dam	14	10	71.43
6	Raidak-1	Tufanganj	19	18	94.74
7	Torasa	Ghughumari	11	9	81.82
8	Jaldhaka	N.H.31 Road Bridge	9	9	100.00
9	Jaldhaka	Mathabhanga	17	17	100.00
10	Tista	Domohani Rd. Bridge	14	14	100.00
11	Tista	Mekhliganj	17	17	100.00
Total			266	259	97.37

An analysis of the forecasts data of the flood season 2003 reveals that during the flood season 2003, in all 266 forecasts were issued for all the 11 sites where forecasts were issued, out of which 259 (i.e. 97.37%) forecasts were found within permissible limit of accuracy $\pm 15\text{cm}$ or $\pm 20\%$ cumecs. It further shows that this performance was better than the all India average accuracy of 96.48% by about 01%.

3.5.15 FLOOD FORECASTING PERFORMANCE IN THE STATE OF DADRA & NAGAR HAVELI

In the Union Territory of Dadra & Nagar Haveli, during the flood season 2003 there were 02 flood forecasting site, which includes 01 inflow forecasting site, Madhuban Dam and other stage forecasting site Daman on the Damanganga. Though both the sites were operational in 2003 yet no forecasts were issued for the site Daman as water level at the site did not touch the warning stage of the site during the period under report.

An analysis of the forecasts data reveals that in 2003, only 7 inflow forecasts were issued for the inflow forecasting site Madhuban Dam and all of them are found within permissible limit of accuracy i.e. $\pm 20\%$ cumecs better than the all India average accuracy of 96.48%.

3.5.16 FLOOD FORECASTING PERFORMANCE IN THE STATE OF NATIONAL CAPITAL OF DELHI

In the NCT of Delhi, during the flood season 2003 there were 02 flood forecasting site, both stage forecasting, namely, the Old Delhi Railway Bridge on the Yamuna, the oldest flood forecasting site of CWC's Flood Forecasting & Warning Network for which first scientific flood forecast was started and issued during the flood season 1958, on was issued on 25 th July 1959, and the Dhansa Regulator on the Delhi - Haryana boarder on the river Sahibi, a seasonal i.e. a rain fed, tributary of the Yamuna. Both thses sites were operational during the flood season 2003. However forecasts were issued only for the Railway Bridge site as the water level at the other site i.e. Dhansa Regulator did not touch the warning level of site. As a matter of fact no forecast was issued for this site since 1979 for the same reason.

An analysis of the forecasts data reveals that in 2003, only 7 forecasts were issued for the site Delhi Railway Bridge and of which only 4 forecasts i.e. 57.14% forecasts were found within permissible limit of accuracy i.e. $\pm 15\text{cm}$. Thus, it further reveals that the performance accuracy of the forecasts issued for the National Capital Delhi was the poorest amongst all the states so far cover under the Flood Forecasting and Warning Network of the Central Water Commission. This performance is less by 39.34%, than the all India average accuracy of 96.48%.

The "State-wise" Flood Forecasting Performance of the flood season 2003 between 01.05.2003 and 31.10.2003, at various forecasting sites located in 14 states,

one Union Territory namely Dadra & Nagar Haveli and NCT of Delhi are shown in Table-5.

The Broad Features of the Flood forecasting Performances of Flood Forecasting and Warning Network of CWC during the flood season 2003 (from 01.05.2003 to 31.10.2003) are also shown in the Table -6.

A bar chart and a statement showing "The number of forecasts issued with number of accurate forecasts" i.e. Flood Forecasting Performance for the period 1978 to 2003 are given in Figure-3.1 and Table-7, respectively. Another bar chart showing "Percentage of Accurate Forecasts" from 1978 to 2003 is given in the Figure-3.2.

CHAPTER - 4

RIVER-WISE APPRAISAL OF FLOOD EVENTS

4.0 GENERAL

As already reported, out of 166 flood forecasting sites including 27 inflow forecasting sites, 165 forecasting sites were operational i.e. where desired hydrological data was observed / collected, during the flood season 2003. Only at one site namely Tajewala Weir in Haryana neither data was collected nor any forecast was issued by CWC. Instead, during the flood season 2003, the CWC field staff collected gauge and discharge data from the irrigation department of Haryana located at an upstream site Hathnikund Barrage on the Yamuna.

Out of 129 stage forecasting sites where forecasts were issued in 2003, water levels at 126 equalled or exceeded their warning levels and 88 sites also exceeded the danger levels. Unprecedented floods, exceeding previous Highest Flood Levels (HFL), were experienced at 03 sites, all located on the main stream Ganga and while at 23 stations, levels were recorded within 0.5m of their respective H.F.L

Although the maximum water levels attained at the stage forecasting sites Kanpur on the main Ganga and Sahjina on the Betwa and inflow forecasting site Dharoi Dam on the Sabarmati did not exceeded or touch their warning level during the flood season yet 45 forecasts for the site Kanpur, only one forecast for the site Sahjina and one forecast for the inflow forecasting site Dharoi Dam were issued on request of the user agencies. All these forecasts were within prescribed limit of accuracy.

Details of flood events in the various River Systems covered under the Flood Forecasting & Warning Network are discussed in succeeding sections.

4.1 FLOOD EVENTS IN THE GANGA BASIN

During the flood season 2003, there were 85 flood forecasting sites in the Ganga Basin, which included 76 stage and 9 inflow forecasting sites. The details of these sites are given in the table-1. The description of flood situations i.e. Unprecedented Flood, High Flood, Moderate Flood and Low Flood situations as monitored by the CWC Flood Forecasting Network is given following paragraphs. In the Ganga Basin, out of the 76 stage forecasting sites, forecasts were issued at 61 sites only, water level only at 03 stage forecasting sites surpassed the previous Highest Flood Level.

At 05 stage forecasting sites, the Ganga approached levels within 0.5m of their respective Highest Flood Levels during the flood season 2003 i.e. high flood situations were experienced. Moderate floods were experienced at 51 stage

forecasting sites on the Ganga and its tributaries where water level remained above danger levels for varying periods.

Of the 9 inflow forecasting sites in the Ganga Basin, no inflow forecast was issued for the site Tajewala on the Yamuna, as mentioned already. Out of the remaining 08 inflow forecasting sites on the Ganga & its tributaries, the Pond Level was crossed only at one inflow forecasting site, viz Durgapur Barrage on the Damodar.

Details of flood events on the stage forecasting sites in the Ganga Basin are described as under:

4.1.1 UNPRECEDENTED FLOOD EVENTS IN THE MAINSTREAM GANGA

During 2003 flood season unprecedented flood event were experienced at three stage flood-forecasting sites, namely Ballia in Ballia district of Uttar Pradesh and Bhagalpur & Colgong (Kahalgaon) in district Bhagalpur of Bihar state, on the mainstream Ganga. Water Level at the remaining 21 stage forecasting sites on the main mainstream Ganga did not cross their Highest Flood Level.

The details of the periods of Unprecedented Flood Situations at the above mentioned sites are given in the following table.

S. No.	State	River	F.F. Sites	Periods of Unprecedented Floods				Total period in Hours
				From		To		
				Date	Hour	Date	Hour	
1	Uttar Pradesh	Ganga	Ballia	11.9.2003	2000	16.09.03	1300	113
2	Bihar	Ganga	Bhagalpur	16.9.2003	2200	17.09.03	2300	25
3	Bihar	Ganga	Kahalgaon (Colgong)	16.9.2003	0100	19.09.03	0400	75

4.1.2. FLOOD EVENTS EQUAL TO "HIGHEST FLOOD LEVEL" IN THE MAINSTREAM GANGA

In addition to the unprecedented flood situations cited above in the main stream Ganga, no flood event equal to HFL was witnessed during the flood season 2003.

4.1.3 HIGH FLOOD EVENTS IN THE MAINSTREAM GANGA

High floods i.e. where the river level approached within 0.5m of their respective Highest Flood Levels were also experienced at 5 out of 20 stage forecasting sites located on the mainstream Ganga, which includes 03 sites where unprecedented flood situation were witnessed, during the flood season 2003.

The details of the varying periods of high flood situations (i.e. within 0.50m of previous HFL) at various sites are given below:

S. No.	State	River	F.F. Sites	Periods of High Floods				Total period in Hours
				From		To		
				Date	Hour	Date	Hour	
1	U.P.	GANGA	BALLIA	10.09.03	1300	11.09.03	1900	30
				16.09.03	1400	17.09.03	2200	32
2	Bihar	GANGA	PATNA (GANDHIGHAT)	09.09.03	2300	18.09.03	0300	196
3	Bihar	GANGA	HATHIDAH	11.09.03	1700	17.09.03	0100	128
4	Bihar	GANGA	BHAGALPUR	11.09.03	0100	21.09.03	2400	263
5	Bihar	GANGA	KAHALGAON	09.09.03	0100	23.09.03	1900	354

4.1.4 MODERATE FLOOD EVENTS IN THE MAINSTREAM GANGA

The moderate floods events, i.e. where river water level equaled/ exceeded the respective danger levels were monitored at 15 out of 20 stage forecasting sites on the main stream Ganga for varying periods, which includes 5 sites where unprecedented/ high flood situation were also observed during the flood season 2003.

The site-wise details of periods of moderate flood events, cited above in the mainstream Ganga, are given below:

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Uttaranchal	GANGA	HARIDWAR	06.07.03	1700	-	-	1
				27.08.03	1800	27.08.03	1900	1
2	U.P.	GANGA	PHAPHAMUA	11.09.03	1200	14.09.03	0600	78
3	U.P.	GANGA	ALLAHABAD (CHHATNAG)	12.09.03	0300	13.09.03	1900	40
4	U.P.	GANGA	MIRZAPUR	12.09.03	0600	14.09.03	0400	46
5	U.P.	GANGA	VARANASI	11.09.03	1700	15.09.03	0700	86
6	U.P.	GANGA	GAZIPUR	10.09.03	0200	17.09.03	0300	169
7	Bihar	GANGA	BUXAR	10.09.03	0900	17.09.03	0500	164
8	U.P.	GANGA	BALLIA	24.08.03	2400	25.08.03	0500	5
				04.09.03	1400	10.09.03	1200	142
				17.09.03	2300	06.10.03	1300	446

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
9	Bihar	GANGA	PATNA (DIGHAGHAT)	04.09.03	1800	22.09.03	0100	271
10	Bihar	GANGA	PATNA (GANDHIGHAT)	21.08.03	2300	26.08.03	0900	106
				04.09.03	0600	04.10.03	0600	720
11	Bihar	GANGA	HATHIDAH	05.09.03	0900	28.09.03	1000	553
12	Bihar	GANGA	MUNGER	-	-	-	-	-
13	Bihar	GANGA	BHAGALPUR	11.09.03	0100	21.09.03	2400	263
14	Bihar	GANGA	KAHALGAON	20.08.03	0600	07.10.03	2400	1170
15	Wet Bengal	GANGA	FARAKKA	03.08.03	2200	11.08.03	1900	189
				17.08.03	1100	12.10.03	1700	1350

4.1.5 LOW FLOOD EVENTS IN THE MAINSTREAM GANGA

The "Low Flood Events" i.e. the water level of the river equalled or exceeded the warning stage of the flood forecasting sites, were experienced at 19 sites out of the 20 stage forecasting sites on the main stream Ganga in 2003. Out of these 19 sites, 3 sites have also experienced unprecedented flood situations, 2 sites high floods and 10 sites moderate flood situations, which have already been described above.

The site-wise details of the periods of low flood events in the main stream Ganga are given below:

S. No.	State	River	F.F. Site	Periods of low Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Uttaranchal	GANGA	HARIDWAR	05.07.03	1200	05.07.03	2400	12
				01.08.03	0900	01.08.03	1400	05
				03.08.03	0700	03.08.03	2400	17
				04.08.03	0300	04.08.03	2000	17
				05.08.03	1300	05.08.03	1400	01
				06.08.03	1200	06.08.03	2200	10
				07.08.03	0900	07.08.03	2400	15
				08.08.03	0600	10.08.03	0300	45
				10.08.03	1000	11.08.03	1500	29
				11.08.03	1800	11.08.03	1900	01
				19.08.03	1600	19.08.03	2100	05
				20.08.03	0400	20.08.03	1500	11
				26.08.03	1900	-	-	01
				27.08.03	1100	28.03.03	2400	37
				29.08.03	0700	29.08.03	2100	14
				30.08.03	1600	-	-	01
				03.09.03	2300	04.09.03	0800	09

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S. No.	State	River	F.F. Site	Periods of low Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
2	U.P.	GANGA	KANNAUJ	14.08.03	0300	20.08.03	0700	148
				22.08.03	1900	28.08.03	1700	142
				02.09.03	1100	24.09.03	0500	522
				27.09.03	0700	02.10.03	1600	129
3	U.P.	GANGA	ANKINGHAT	14.08.03	0500	17.08.03	2200	89
				23.08.03	0700	27.08.03	2000	109
				02.09.03	2100	14.09.03	2400	291
				16.09.03	1600	23.09.03	0800	160
				29.09.03	1100	30.09.03	2000	33
4	U.P.	GANGA	KANPUR	12.08.03	2000	21.08.03	1900	215
				23.08.03	0400	28.08.03	1600	132
				02.09.03	1700	02.10.03	2400	727
5	U.P.	GANGA	DALMAU	15.08.03	2100	21.08.03	1500	138
				24.08.03	0700	28.08.03	2000	109
				03.09.03	2300	14.09.03	2200	335
				15.09.03	0100	26.09.03	1300	276
				28.09.03	0700	02.10.03	1800	107
6	U.P.	GANGA	PHAPHAMUA	10.09.03	1800	11.09.03	1100	17
				14.09.03	0700	14.09.03	2300	16
7	U.P.	GANGA	ALLAHABAD (CHHATNAG)	11.09.03	0800	12.09.03	0200	18
				13.09.03	2000	14.09.03	1100	15
8	U.P.	GANGA	MIRZAPUR	11.09.03	0600	12.09.03	0500	23
				14.09.03	0500	14.09.03	2300	18
9	U.P.	GANGA	VARANASI	10.09.03	1000	11.09.03	1600	30
				15.09.03	0800	16.09.03	0600	22
10	U.P.	GANGA	GAZIPUR	05.09.03	1900	10.09.03	0100	102
				17.09.03	0400	29.09.03	0600	290
				01.10.03	0200	04.10.03	2400	94
11	Bihar	GANGA	BUXAR	05.09.03	1800	29.09.03	0800	566
				01.10.03	1100	04.10.03	2100	82
12	U.P.	GANGA	BALLIA	18.08.03	0500	20.08.03	2300	66
				25.08.03	0600	30.08.03	1300	127
				03.09.03	0900	04.09.03	1300	28
				06.10.03	1400	09.10.03	0600	64
13	Bihar	GANGA	PATNA (DIGHAGHAT)	21.08.03	0900	28.08.03	0300	162
				03.09.03	2400	05.10.03	2000	764
14	Bihar	GANGA	PATNA (GANDHIGHAT)	03.08.03	1800	07.08.03	0800	83
				16.08.03	0300	08.10.03	0700	1276
15	Bihar	GANGA	HATHIDAH	17.08.03	2300	07.10.03	0900	1209
16	Bihar	GANGA	MUNGER	06.09.03	0800	22.09.03	0400	393
17	Bihar	GANGA	BHAGALPUR	22.08.03	0300	02.09.03	0400	273
				04.09.03	1900	06.10.03	1900	768
18	Bihar	GANGA	KAHALGAON	26.07.03	2100	27.07.03	1900	22
				01.08.03	1600	12.10.03	2300	271
19	Bihar	GANGA	FARAKKA	11.07.03	1300	16.10.03	1200	2327

4.2 FLOOD EVENTS IN THE TRIBUTARIES OF THE GANGA

There are 64 forecasting stations including 07 inflow forecasting stations on its 25 tributaries/ sub-tributaries, which are covered under flood forecasting network. However, during 2003 flood season, out of 57 stage forecasting sites on the tributaries of the Ganga, water levels did not equal or exceed the warning stages at the following 10 sites, namely, Dhansa Regulator on the Sahibi, Etawa, Auraiya, Kalpi and Hamirpur on the Yamuna, Jaunpur and Luchnow (Hanuman Setu) on the Gomati, Narayanpur on the Mayaurashi, Harinkhola on the Mundeswari and Mohannagar on Kangsabati as such no forecast were issued for these sites. Forecasts for the newly created 03 sites, Srinagar on the Alaknada, Moradabad and Bareilly on the Ramganga could not also be issued as these sites were converted into forecasting sites only during the flood season 2003.

Thus, forecasts were issued at 44 out of the 57 stage forecasting sites located on the tributaries/ sub-tributaries of the Ganga. The flood events at these stations are described in the following paragraphs.

4.2.1 UNPRECEDENTED FLOOD EVENTS IN THE TRIBUTARIES OF THE GANGA

During the flood season 2003, at none of the 44 stage forecasting sites where forecasts were issued on the tributaries/ sub-tributaries of the Ganga, the river stages did not surpassed their previous highest flood levels at any of these sites i.e. no unprecedented flood situation was witnessed in any of the tributaries of the Ganga.

4.2.2 HIGH FLOOD EVENTS IN THE TRIBUTARIES OF THE GANGA

High flood situation i.e. where the river stage attained a level within 0.5m of the Highest Flood Level, were experienced at 08 forecasting site on the various tributaries of the Ganga, for varying time periods.

The details of the periods of "High Floods" events at various sites in the tributaries of the Ganga are given below:

S. No.	State	River	F.F. Site	Periods of High Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Bihar	GHAGHRA	GANGPUR-SISWAN	08.09.03	2100	12.09.03	2200	97
				22.09.03	0700	30.09.03	0600	191
2	Bihar	GHAGHRA	CHHAPRA	12.09.03	1200	12.09.03	2400	12
3	U.P.	GANDAK	KHADDA	31.07.03	1900	01.08.03	0900	14
4	Bihar	GANDAK	CHATIA	02.08.03	0900	04.08.03	0300	42
5	Bihar	GANDAK	HAZIPUR	10.09.03	2000	11.09.03	2400	28

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S. No.	State	River	F.F. Site	Periods of High Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
6	Bihar	BAGMATI	BENIBAD	04.07.03	2100	08.07.03	0800	83
				10.07.03	2200	22.07.03	1900	285
				02.08.03	0400	05.08.03	0300	71
7	Bihar	KOSI	BASUA	29.06.03	0100	29.06.03	1700	16
				09.07.03	1600	11.07.03	0800	40
				01.08.03	0300	01.08.03	0800	7
8	Bihar	KOSI	KURSELA	13.09.03	0400	21.09.03	0700	195

4.2.3 MODERATE FLOOD EVENTS IN THE TRIBUTARIES OF THE GANGA

Moderate flood events with levels equalled or exceeded respective danger levels were experienced at 36 stage forecasting sites on the tributaries of the Ganga, which includes 8 sites cited above where high flood situations were also witnessed.

The details of the periods of "Moderate Floods" events at various sites in the tributaries of the Ganga are given below:

S. No.	State	River	F.F. Site	Periods of High Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	U.P.	RAMGANGA	MORADABAD	13.07.03	0300	14.07.03	1000	31
2	U.P.	YAMUNA	CHILLAGHAT	11.09.03	1800	12.09.03	1200	18
3	U.P.	YAMUNA	NAINI	11.09.03	1500	14.09.03	0200	59
4	U.P.	BETWA	MOHANA	10.09.03	2000	11.09.03	1100	15
5	U.P.	KEN	BANDA	30.08.03	2200	31.08.03	2400	26
				08.09.03	1800	12.09.03	0800	86
				16.09.03	1400	17.09.03	0400	14
6	U.P.	SAI	RAE-BAREILLY	15.09.03	15	03.10.03	03	420
7	U.P.	GHAGHRA	ELGIN BRIDGE	12.07.03	1200	14.07.03	1700	53
				19.08.03	1900	01.09.03	2000	313
				03.09.03	2100	08.09.03	1500	114
				17.09.03	0300	21.09.03	1900	112
				24.09.03	1100	28.09.03	1700	102
8	U.P.	GHAGHRA	AYODHYA	13.07.03	1000	15.07.03	2400	62
				22.07.03	0100	23.07.03	1700	40
				2.08.03	0100	08.08.03	1900	162
				08.08.03	2000	14.08.03	1700	69
				18.08.03	1800	10.09.03	0500	491
				17.09.03	1300	30.09.03	0500	904

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
9	U.P.	GHAGHRA	TURTIPAR	14.07.03	1300	17.07.03	0800	67
				22.07.03	1300	25.07.03	2000	79
				03.08.00	1500	07.08.03	1800	99
				14.08.03	0100	16.08.03	2000	67
				19.08.03	2300	13.09.030	1300	590
				18.09.03	0600	2.10.03	2200	304
10	Bihar	GHAGHRA	DARAU LI	21.08.03	2000	31.08.03	1300	233
				06.09.03	1600	11.09.03	2400	128
				21.09.03	2300	28.09.03	0200	147
11	Bihar	GHAGHRA	GANGPUR-SISWAN	04.08.03	1500	07.08.03	2000	77
				15.08.03	0800	01.09.03	0700	407
				06.09.03	0900	15.09.03	0700	214
				20.09.03	1200	02.10.03	1400	290
12	Bihar	GHAGHRA	CHHAPRA	09.09.03	2300	17.09.03	0400	173
13	Bihar	RAPTI	BANSI	22.08.03	1600	25.08.03	0300	59
14	Bihar	RAPTI	GORAKHPUR (BIRGDHAT)	22.08.03	0600	29.08.03	1400	176
15	Bihar	SONE	KOELWAR	04.09.03	0200	08.09.03	0700	101
				09.09.03	0900	14.09.03	1000	121
				15.09.03	0600	15.09.03	1400	8
				16.09.03	1300	17.09.03	0700	18
16	Bihar	SONE	MANER	04.09.03	0900	22.09.03	1200	435
17	Bihar	PUNPUN	SRIPALPUR	01.08.03	1500	05.08.03	2400	105
				13.08.03	0500	25.08.03	1300	296
				30.08.03	0500	30.08.03	1300	8
				01.09.03	2200	08.09.03	1700	163
18	U.P.	GANDAK	KHADDA	30.06.03	0500	30.06.03	0900	4
				30.06.03	2000	01.07.03	2300	27
				04.07.03	0300	05.07.03	0600	27
				08.07.03	2100	11.07.03	1600	67
				20.07.03	0500	25.07.03	2200	137
				31.07.03	0200	02.08.03	0700	53
				16.08.03	1400	16.08.03	1800	4
				18.08.03	1000	21.08.03	2300	85
				02.09.03	1600	03.09.03	0200	10
				19	Bihar	GANDAK	CHATIA	11.07.03
21.07.03	2200	06.08.03	2400					386
20.08.03	1200	23.08.03	2100					81
20	Bihar	GANDAK	REWAGHAT	03.08.03	0900	05.08.03	1000	49
				21.08.03	2400	24.08.03	0300	51
21	Bihar	GANDAK	HAZIPUR	04.09.03	1300	29.09.03	0200	589
22	Bihar	BURHI GANDAK	LALBEGHIA-GHAT	05.07.03	1700	14.07.03	0300	202
23	Bihar	BURHI GANDAK	MUZAFFARPUR (SIKANDARPUR)	07.07.03	1600	18.07.03	2200	270
				03.08.03	0400	10.08.03	0100	165
				20.08.03	2400	28.08.03	1400	182
24	Bihar	BURHI GANDAK	SAMASTIPUR	04.07.03	1400	22.07.03	2400	442
				03.08.03	1400	14.08.03	0800	258
				21.08.03	0400	03.09.03	1200	320

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
25	Bihar	BURHI GANDAK	ROSERA	05.07.03	1700	23.07.03	1000	425
				03.08.03	0500	16.08.03	0600	313
				20.08.03	1500	05.09.03	0800	377
26	Bihar	BURHI GANDAK	KHAGARIA	21.08.03	1700	05.10.03	0700	1070
27	Bihar	BAGMATI	BENIBAD	28.06.03	2100	30.07.03	0400	752
				30.07.03	2000	05.09.03	1500	883
				24.09.03	0600	29.09.03	0600	120
				01.10.03	0500	03.10.03	0500	48
28	Bihar	BAGMATI	HAYAGHAT	13.07.03	0900	27.07.03	0700	334
				04.08.03	0900	08.08.03	2300	110
29	Bihar	ADHWARA GROUP	KAMTAUL	25.06.03	0100	26.07.03	0900	752
				31.07.03	1200	31.07.03	2400	12
				01.08.03	1000	07.08.03	2000	154
				19.08.03	2100	27.08.03	0500	176
30	Bihar	ADHWARA GROUP	EKMIGHAT	08.07.03	1800	29.07.03	1000	496
				02.08.03	2400	13.08.03	0600	246
31	Bihar	KAMLA BALAN	JHANJHARPUR	28.06.03	0900	30.06.03	2400	63
				01.07.03	0100	01.07.03	0600	5
				01.07.03	1800	03.07.03	0400	34
				06.07.03	0600	06.07.03	1100	5
				09.07.03	0800	12.07.03	2100	85
				13.07.03	0200	13.07.03	2200	20
				20.07.03	0500	20.07.03	2300	18
				30.07.03	1500	03.08.03	1200	93
				09.08.03	2200	10.08.03	0200	4
				18.08.03	1800	19.08.03	1300	19
				32	Bihar	KOSI	BASUA	28.06.03
01.07.03	0100	02.07.03	2200					45
08.07.03	2400	12.07.03	1800					90
15.07.03	1400	15.07.03	2100					7
22.07.03	2100	24.07.03	0400					31
31.07.03	1100	02.08.03	1300					50
19.08.03	1600	21.08.03	0900					41
33	Bihar	KOSI	BALTARA	30.06.03	0400	01.07.03	0700	27
				03.07.03	0900	04.07.03	1800	33
				06.07.03	0400	07.07.03	2000	40
				09.07.03	0200	29.09.03	1000	488
34	Bihar	KOSI	KURSELA	03.08.03	2200	10.08.03	1300	159
				17.08.03	0300	08.10.03	0100	1246
35	Bihar	MAHANANDA	DHENGRAGHAT	01.07.03	0300	14.07.03	0300	312
				31.07.03	0500	02.08.03	0900	52
				12.08.03	0500	12.08.03	1600	11
				10.10.03	1600	11.10.03	1900	27
36	Bihar	MAHANANDA	JHAWA	02.07.03	0500	03.07.03	1400	33
				04.07.03	0800	15.07.03	1800	274
				01.08.03	0400	02.08.03	0300	23

4.2.4 LOW FLOOD EVENTS IN THE TRIBUTARIES OF THE GANGA

At the following 41 stages forecasting sites including the sites already listed in medium and high flood situations above, flood levels remained between their respective warning and danger levels during the 2003 flood season.

S. No	State	River	F.F. Site	Periods of Low Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	U.P.	YAMUNA	MAWI	04.08.03 09.08.03	0500 0300	07.08.03 10.08.03	0100 1900	68 40
2	NCT Delhi	YAMUNA	DELHI RLY BRIDGE	05.08.03 09.08.03	0200 2200	08.08.03 11.08.03	2000 1500	90 41
3	U.P.	YAMUNA	MATHURA	06.08.03 23.08.03 07.09.03	2000 2400 0800	22.08.03 25.08.03 20.09.03	0500 1200 0800	369 36 312
4	Bihar	YAMUNA	CHILLAGHAT	11.09.03 12.09.03	0900 1300	11.09.03 12.09.03	1700 2300	9 10
	Bihar	YAMUNA	NAINI	10.09.03 14.09.03	2100 0300	11.09.03 14.09.03	1400 1800	17 15
5	Bihar	BETWA	MOHANA	10.09.03 11.09.03	1700 1200	10.09.03 11.09.03	1900 1600	2 4
6	Bihar	KEN	BANDA	30.08.03 01.09.03 08.09.03 12.09.03 16.09.03 17.09.03	1900 0100 0700 0900 0300 0500	30.08.03 01.09.03 08.09.03 12.09.03 16.09.03 17.09.03	2100 0500 1700 1300 1300 1500	2 4 10 04 10 10
7	Bihar	SAI	RAE-BAREILLY	06.09.03	13	05.10.03	24	707
8	Bihar	GHAGHRA	ELGIN BRIDGE	07.07.03 10.07.03	0700 2200	09.07.03 05.10.03	0800 0100	49 2067
9	Bihar	GHAGHRA	AYODHYA	07.07.03	2000	06.10.03	1400	2178
10	Bihar	GHAGHRA	TURTIPAR	09.07.03	1700	08.10.03	1500	2182
11	Bihar	GHAGHRA	DARAULI	13.07.03 21.07.03 02.08.03	1900 2100 0800	18.07.03 29.07.03 05.10.03	1300 2400 0400	117 195 68
12	Bihar	GHAGHRA	GANGPUR-SISWAN	15.07.03 22.07.03 31.07.03 02.08.03	0200 1000 0900 1400	18.07.03 30.07.03 01.08.03 05.10.03	1800 0200 1600 2400	88 184 31 82
13	Bihar	GHAGHRA	CHHAPRA	04.09.03	1200	27.09.03	1800	558
14	Bihar	RAPTI	BALRAM PUR	22.07.03 02.08.03 13.08.03 19.08.03 06.09.03 23.09.03	0600 0200 1600 1600 2100 0900	22.07.03 04.08.03 15.08.03 25.08.03 08.09.03 26.09.03	2300 1500 1200 0300 1200 2400	17 61 44 131 39 87
15	Bihar	RAPTI	BANSI	04.08.03 20.08.03 07.09.03 24.09.03	0500 0200 1800 0600	04.08.03 27.08.03 09.09.03 28.09.03	2200 1100 1500 1900	17 177 45 109
16	Bihar	RAPTI	GORAKHPUR (BIRDEGHAT)	07.07.03 23.07.03 20.08.03	0200 1400 1100	08.07.03 25.07.03 31.08.03	1300 0300 2000	35 37 273

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S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in Hour-
				From		To		
				Date	Hour	Date	Hour	
17	Bihar	SONE	INDERPURI	03.09.03	1800	04.09.03	0300	9
				09.09.03	0100	10.09.03	2300	46
				11.09.03	1200	11.09.03	1400	2
18	Bihar	SONE	KOELWAR	03.09.03	1300	19.09.03	1400	385
				20.09.03	1400	21.09.03	1300	23
				24.09.03	1400	26.09.03	1500	49
				27.09.03	0300	27.09.03	1100	8
				02.10.03	0100	05.10.03	0600	77
19	Bihar	SONE	MANER	20.08.03	1400	31.08.03	1500	265
				03.09.03	1300	05.10.03	1800	53
20	Bihar	PUNPUN	SRIPALPUR	01.08.03	0300	06.08.03	1300	130
				12.08.03	2100	26.08.03	1100	326
				28.08.03	2200	31.08.03	1900	69
				01.09.03	0100	18.09.03	1600	423
				25.09.03	1800	28.09.03	0300	57
				29.09.03	2300	04.10.03	0600	103
21	Bihar	GANDAK	KHADDA	22.06.03	0900	02.10.03	1400	2453
22	Bihar	GANDAK	CHATIA	01.07.03	2000	03.07.03	1900	47
				04.07.03	2100	06.07.03	0300	30
				09.07.03	1700	17.07.03	1400	189
				21.07.03	0100	26.07.03	0800	127
				01.08.03	0100	08.08.03	1800	185
				09.08.03	0400	10.08.03	2200	42
				17.08.03	1200	30.08.03	0400	204
				30.08.03	1700	01.09.03	0100	32
				02.09.03	0900	10.09.03	2300	206
23	Bihar	GANDAK	REWAGHAT	06.07.03	0500	08.07.03	0100	44
				10.07.03	1600	15.07.03	1100	115
				22.07.03	1700	24.07.03	2000	51
				01.08.03	1500	07.08.03	0700	136
				19.08.03	2000	27.08.03	0200	174
				03.09.03	1900	10.09.03	1700	166
				17.09.03	0600	19.09.03	1800	60
24	Bihar	GANDAK	HAZIPUR	04.09.03	1300	29.09.03	0200	587
25	Bihar	BURHI GANDAK	LALBEGHIAGHAT	01.07.03	0200	18.07.03	1000	416
				03.08.03	1800	07.08.03	2400	114
				23.08.03	0100	26.08.03	1400	85
26	Bihar	BURHI GANDAK	MUZAFFARPUR (Sikandarpur)	30.06.03	2000	22.07.03	2400	532
				01.08.03	2100	14.08.03	1800	309
				19.08.03	2200	02.09.03	2000	332
				23.09.03	2300	27.09.03	2300	96
27	Bihar	BURHI GANDAK	SAMASTIPUR	27.06.03	1400	25.07.03	2100	679
				02.08.03	0100	17.08.03	1000	369
				01.09.03	0100	06.09.03	1100	130
				23.09.03	2700	30.09.03	1100	157
				02.10.03	2100	05.10.03	1400	65
28	Bihar	BURHI GANDAK	ROSERA	02.07.03	0800	26.07.03	0500	589
				02.08.03	0700	08.09.03	1800	899
				23.09.03	1900	08.10.03	0100	342
29	Bihar	BURHI GANDAK	KHAGARIA	03.08.03	0700	08.10.03	1300	290
30	Bihar	BAGMATI	BENIBAD	17.06.03	1600	18.06.03	0600	14
				23.06.03	1600	15.10.03	1300	2733

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S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
31	Bihar	BAGMATI	HAYAGHAT	30.06.03	1200	07.09.03	1200	1656
32	Bihar	ADHWARA GROUP	KAMTAUL	24.06.03	1400	28.07.03	2400	826
				30.07.03	2400	31.07.03	0600	6
				19.08.03	0300	31.08.03	1600	301
				25.09.03	0900	27.09.03	1100	50
				01.10.03	1100	03.10.03	2300	60
33	Bihar	ADHWARA GROUP	EKMIGHAT	26.06.03	1300	06.09.03	2200	1737
34	Bihar	KAMLA BALAN	JHANJHARPUR	16.06.03	2200	17.06.03	2000	22
				20.06.03	2200	21.06.03	1300	15
				25.06.03	0100	25.06.03	2400	23
				27.06.03	1700	25.07.03	2300	678
				30.07.03	0200	14.08.03	1400	379
				15.08.03	0200	15.08.03	2200	20
				18.08.03	1000	25.08.03	0300	161
				25.08.03	1800	27.08.03	0400	34
				29.08.03	0100	30.08.03	1400	37
				15.09.08	1800	16.09.03	0300	9
				21.09.03	0800	22.09.03	0100	25
				22.09.03	1700	23.09.03	0700	14
				24.09.03	0100	25.09.03	1300	36
				30.09.03	1700	01.10.03	0700	14
35	Bihar	KOSI	BASUA	22.06.03	0400	10.09.03	0400	1920
				14.09.03	0100	19.09.03	0400	123
				19.09.03	2200	27.09.03	2100	191
36	Bihar	KOSI	BALTARA	28.06.03	2400	12.10.03	0900	2509
37	Bihar	KOSI	KURSELA	12.07.03	1000	14.10.03	0300	2249
39	Bihar	MAHANANDA	DHENGRAGHAT	25.06.03	0600	25.06.03	1400	8
				28.06.03	0500	17.07.03	0900	436
				16.07.03	0900	24.07.03	0700	190
				30.07.03	0800	05.08.03	1800	161
				10.08.03	0100	15.08.03	0800	127
				17.08.03	2000	23.08.03	1700	141
				24.08.03	1300	25.08.03	0300	14
				15.09.03	2400	27.09.03	0100	265
				28.09.03	1200	30.09.03	0800	44
				01.10.03	0100	01.10.03	1000	9
				10.10.03	1300	14.10.03	110	94
40	Bihar	MAHANANDA	JHAWA	28.06.03	2300	24.07.03	1600	615
				31.07.03	0100	06.08.03	0800	151
				10.08.03	2000	14.08.03	2000	96
				19.08.03	1000	23.08.03	1500	101
				18.09.03	1800	26.09.03	1700	191
				10.10.03	1200	13.10.03	0900	69
41	Bihar	AJOY	GHEROPARA	10.10.03	0800	10.10.03	2100	13

4.3 FLOOD EVENTS IN THE BRAHMAPUTRA BASIN

The Brahmaputra, mightiest (4325km long) river of India, is known by the name of Dibang in its upper reaches in state of Arunachal Pradesh till the Lohit in Assam joins it. Before entering into India from Tibet where it originates, it is known by the name of Tsangpo or Yalutsangpo while after it enters in to the Bangladesh it is known by the name of Jamuna.

In the Brahmaputra basin there are 14 tributaries/ sub-tributaries, which were covered under the flood forecasting network of CWC in 2003. In all there were 27 level forecasting sites, which include 06 on the main Brahmaputra & 21 on the tributaries, all located in the state of Assam. There is no inflow forecasting site in this river system. The floods of different intensity & duration viz. high, moderate and low floods (except unprecedented floods) were experienced at various sites. Flood forecasts were issued at 20 forecasting sites on the tributaries and 6 on the main Brahmaputra, during the flood season of 2003.

Only at one site, Naharkatia on the Burhi Dihing, the water level did not approach the warning level. Thus no forecast was issued for this site.

Details of various flood events on the stage forecasting sites in the Brahmaputra Basin are described as under.

4.3.1 UNPRECEDENTED FLOOD EVENTS IN THE BRAHMAPUTRA

No unprecedented flood event was experienced at any of the 6 flood forecasting sites on the mainstream Brahmaputra i.e. the river stage did not cross the previous HFL at any of the 6 stage forecasting stations. Also, at none of the sites the flood level of the river equalled the HFL.

4.3.2 HIGH FLOOD EVENTS IN THE BRAHMAPUTRA

The Brahmaputra mainstream experienced high flood situations, only at two out of the 6 flood forecasting sites, where the flood level approached between the heights of half a metre below the HFL of the sites. The site-wise details of the high flood periods are given in the following table.

S. No.	State	River	F.F. Site	Periods of High Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Assam	BRAHMAPUTRA	TEZPUR	10.07.03	0900	11.07.03	1800	33
2	Assam	BRAHMAPUTRA	GUWAHATI	11.07.03	1100	14.07.03	1500	76

4.3.3 MODERATE FLOOD EVENTS IN THE BRAHMAPUTRA

The Brahmaputra experienced moderate floods for varying periods at all the 06 flood forecasting sites where the water levels equalled or exceeded its danger mark

but did not approach within 0.50m of the highest flood level. These sites include the sites where high flood events were also witnessed. The details of the moderate flood situations/ periods are specified below:

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Assam	BRAHMAPUTRA	DIBRUGARH	27.05.03	1700	24.10.03	1500	3598
2	Assam	BRAHMAPUTRA	NEAMATIGHAT	26.06.03	1400	28.09.03	0800	2250
3	Assam	BRAHMAPUTRA	TEZPUR	27.06.03	1100	24.07.03	2300	660
4	Assam	BRAHMAPUTRA	GUWAHATI	01.07.03	0100	04.07.03	2300	94
				07.07.03	0100	17.07.03	2200	261
5	Assam	BRAHMAPUTRA	GOALPARA	02.07.03	1100	05.07.03	1600	77
				07.07.03	2100	18.07.03	0200	245
6	Assam	BRAHMAPUTRA	DHUBRI	29.06.03	2000	26.07.03	2000	648
				03.08.03	1100	05.08.03	0300	40

4.3.4 LOW FLOOD EVENTS IN THE BRAHMAPUTRA

As already reported above, since the flood levels at all the flood forecasting sites on the main Brahmaputra touched / crossed their respective danger levels, which is 1.0 m above the warning stage, therefore, all the sites witnessed the low flood situations too i.e. when the flood level crossed / touched the warning levels. The low flood periods are described in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Assam	BRAHMAPUTRA	DIBRUGARH	19.05.03	0600	20.05.03	1100	5
2	Assam	BRAHMAPUTRA	NEAMATIGHAT	15.06.03	1700	16.06.03	1100	18
				28.09.03	1900	08.10.03	1500	236
				12.10.03	0800	14.10.03	1200	59
3	Assam	BRAHMAPUTRA	TEZPUR	15.06.03	2000	18.06.03	2200	74
				31.07.03	0900	05.08.00	0800	119
				18.08.03	1200	20.08.03	0600	42
				02.09.03	1100	24.09.03	1900	536
				05.10.03	0800	06.10.03	0500	21
4	Assam	BRAHMAPUTRA	GUWAHATI	17.06.03	0200	18.06.03	2400	46
				28.06.03	0400	25.07.03	1600	660
				01.08.03	1100	05.08.03	1300	98
				20.08.03	0100	24.08.03	2300	118
				04.09.03	0400	10.09.03	0300	143
				22.09.03	0400	22.09.03	1700	13
5	Assam	BRAHMAPUTRA	GOALPARA	29.06.03	0100	27.07.03	1800	689
				01.08.03	0100	07.08.03	0400	147
				20.08.03	1900	26.08.03	1100	136
				05.09.03	0600	11.09.03	1000	148
6	Assam	BRAHMAPUTRA	DHUBRI	15.06.03	0200	29.09.03	0300	2545
				05.10.03	0100	15.10.03	2400	263

4.4.1 UNPRECEDENTED FLOOD EVENTS IN THE TRIBUTARIES OF THE BRAHMAPUTRA

No unprecedented flood event or equivalent to that was experienced at any of the 21 flood forecasting sites on the tributaries of the Brahmaputra i.e. the river stage neither crossed the previous HFL at any of the sites nor it touched the same in 2003 flood season,

4.4.2 HIGH FLOOD EVENTS IN THE TRIBUTARIES OF THE BRAHMAPUTRA

In 2003 flood season, high flood events were observed only at the 5 flood forecasting sites on the tributaries of the Brahmaputra in Assam and West Bengal states.

The site-wise details of the high flood periods in the tributaries of the Brahmaputra are given below.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Assam	DESANG	NANGLAMORA-GHAT	05.07.03	2200	08.07.03	1900	69
				23.07.03	0300	24.07.03	0200	23
2	Assam	JIABHARALI	N.T. ROAD CROSSING	30.06.03	0900	01.07.03	0500	20
				30.07.03	1400	31.07.03	0600	16
				18.08.03	1500	18.08.03	1900	4
				20.08.03	0800	20.08.03	1000	2
				21.09.03	0600	21.09.03	2200	16
3	Assam	KOPILI	KAMPUR	01.07.03	1700	02.07.03	1300	20
				12.10.03	0300	12.10.03	1400	11
4	West Benagl	JALDHAKA	MATHABHANGA	01.07.03	1400	01.07.03	2200	8
				08.07.03	2100	08.07.03	2300	2
5	West Benagl	TISTA	MEKHLIGANJ	08.07.03	1700	09.07.03	0600	13

4.4.3 MODERATE FLOOD EVENTS IN THE TRIBUTARIES OF THE BRAHMAPUTRA

The moderate flood situations were observed at 18 forecasting sites, out of 21 on the tributaries of the Brahmaputra. These sites also include 06 above cited sites where high flood situations were experienced in 2003.

The site-wise details of the moderate flood periods in the tributaries of the Brahmaputra are given below.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Assam	DESANG	NANGLAMORA-GHAT	28.06.03	0800	26.07.03	0700	671

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour				
				From		To						
				Date	Hour	Date	Hour					
2	Assam	DIKHOW	SIBSAGAR	30.06.03	1200	01.07.03	2200	34				
				14.07.03	1300	16.07.03	2100	56				
				05.08.03	0500	16.08.03	2400	43				
				01.09.03	1500	06.09.03	0900	114				
3	Assam	SUBANSIRI	BADATIGHAT	07.06.03	1000	24.07.03	1300	1124				
4	Assam	DHANSIRI	GOLAGHAT	15.08.03	2000	12.09.03	1600	668				
				11.10.03	0700	18.10.03	0600	167				
5	Assam	DHANSIRI	NUMALIGARH	27.06.03	1400	24.07.03	1100	624				
6	Assam	JIABHARALI	N.T. ROAD CROSSING	28.07.03	1600	19.10.03	1200	1988				
				09.06.03	0700	18.06.03	1500	224				
				19.06.03	0600	27.07.03	1100	917				
				08.08.03	1300	07.10.03	2400	1451				
				09.10.03	1900	13.10.03	1300	90				
7	Assam	KOPILI	KAMPUR	30.06.03	0700	05.07.03	0700	120				
				11.10.03	0600	15.10.03	2400	114				
8	Assam	KOPILI	DHARAMTUL	30.06.03	1800	21.07.03	1400	500				
				11.10.03	1000	20.10.03	2100	227				
9	Assam	PUTHIMARI	N.H. CROSSING	13.06.03	1000	17.06.03	1600	102				
				27.06.03	1700	9.06.03	0400	59				
				29.06.03	1300	30.06.03	0500	16				
				30.06.03	0800	21.07.03	1400	510				
				22.07.03	0800	22.07.03	1400	7				
				27.07.03	1200	27.07.03	1700	5				
				30.07.03	2000	05.08.03	1900	143				
				19.08.03	0600	19.08.03	0800	2				
				21.08.03	0300	21.08.03	1800	15				
				06.09.03	1300	06.09.03	2200	9				
				10.10.03	0900	11.10.03	1300	28				
				10	Assam	BEKI	ROAD BRIDGE	11.06.03	1600	11.06.03	2300	7
								12.06.03	1300	12.06.03	1500	2
								13.06.03	0900	16.06.03	0400	67
16.06.03	1900	16.06.03	2200					3				
20.06.03	1500	21.06.03	0400					13				
21.06.03	1000	22.06.03	0300					17				
22.06.03	1100	24.07.03	1400					51				
27.07.03	1300	28.07.03	0200					13				
28.07.03	1400	28.07.03	1900					5				
30.07.03	0400	06.08.03	0600					170				
06.08.03	1500	06.08.03	2400					9				
09.08.03	2100	09.08.03	2200					1				
11.08.03	0300	12.08.03	0300					24				
17.08.03	1000	21.08.03	2200					108				
22.08.03	1100	30.08.03	0600					187				
30.08.03	1300	31.08.03	0600					17				
31.08.03	1400	22.09.03	1900					533				
01.10.03	1300	01.10.03	1900					6				
02.10.03	1800	02.10.03	2200					4				
10.10.03	0800	11.10.03	0200					18				
11	Assam	PAGLADIYA	N.T. ROAD CROSSING	13.06.03	0900	14.06.03	2100	36				
				15.06.03	0800	16.06.03	0800	24				
				30.06.03	1500	01.07.03	1500	24				
				02.07.03	0800	02.07.03	1600	8				
				08.07.03	1200	09.07.03	1600	28				

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
12	Assam	MANAS	N.H. CROSSING	13.06.03	1000	14.06.03	1200	26
				30.06.03	1300	30.06.03	1400	1
				07.07.03	1600	08.07.03	1200	20
13	Assam	SANKOSH	GOLAKGANJ	01.07.03	1600	15.07.03	1300	330
				16.07.03	0100	16.07.03	0900	8
				18.07.03	0300	18.07.03	0900	6
				18.07.03	2100	22.07.03	0600	81
				30.07.03	2100	01.08.03	0900	36
				18.08.03	2300	20.08.03	0100	26
				16.09.03	0400	16.09.03	1500	11
				14	West Bengal	TORSA	GHUGHUMARI	01.07.03
15	West Bengal	JALDHAKA	MATHABHANGA	01.07.03	1300	01.07.03	2400	11
				04.07.03	1400	05.07.03	0500	15
				08.07.03	1600	09.07.03	0400	12
				09.07.03	1700	10.07.03	0700	14
17	West Bengal	TISTA	DOMOHANI RD. BRIDGE	01.07.03	1100	01.07.03	1800	7
				08.07.03	1200	08.07.03	2300	11
18	West Bengal	TISTA	MEKHLIGANJ	08.07.03	1700	09.07.03	0600	13

4.4.4 LOW FLOOD EVENTS IN THE TRIBUTARIES OF THE BRAHMAPUTRA

In addition to the above mentioned flood situations, the Low flood situations were also observed at 18 forecasting sites, out of 21 on the tributaries of the Brahmaputra for varying time periods. These sites also include 06 above cited sites where high flood situations were experienced in 2003.

The site-wise details of the Low flood periods are cited in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Assam	DESANG	NANGLAMORA-GHAT	31.07.03	1100	04.08.03	1100	96
				15.08.03	1500	21.08.03	1400	143
				03.09.03	0300	06.09.03	0200	71
				08.09.03	0600	09.04.03	0700	25
2	Assam	DIKHOW	SIBSAGAR	28.06.03	1000	29.06.03	0900	23
				05.07.03	1300	07.07.03	0800	43
				08.07.03	1800	10.07.03	1200	42
3	Assam	SUBANSIRI	BADATIGHAT	31.07.03	0200	04.08.03	1300	107
				17.08.03	2300	25.08.03	0900	178
				02.09.03	0700	09.09.03	1700	178
				10.09.03	0100	11.09.03	0600	29
4	Assam	DHANSIRI	GOLAGHAT	07.08.03	2100	08.08.03	1500	18
				09.08.03	0400	10.08.03	1900	39
5	Assam	JIA BHARALI	NT Rd. X	27.05.03	1200	30.05.03	0500	65
				06.06.03	1500	09.06.03	0400	61

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
6	Assam	PUTHIMARI	N.H. CROSSING	27.05.03	1900	29.05.03	1200	41
				06.06.03	0300	08.06.03	0100	46
				09.06.03	1300	11.06.03	0200	37
				11.06.03	2200	08.10.03	1700	2851
				09.10.03	1600	15.10.03	2400	152
7	Assam	BEKI	ROAD BRIDGE	18.05.03	2300	20.05.03	2300	48
				25.05.03	1200	15.10.03	2400	3444
8	Assam	PAGLADIYA	N.T. ROAD CROSSING	13.06.03	0600	18.06.03	1200	126
				27.06.03	0900	27.06.03	1300	4
				27.06.03	2100	28.06.03	0200	5
				29.06.03	1300	29.06.03	2000	7
				30.06.03	0900	12.07.03	1000	289
				12.07.03	1300	14.07.03	1400	25
				14.07.03	2400	16.07.03	2000	44
				17.07.03	0300	17.07.03	1700	14
				17.07.03	2200	18.07.03	1700	19
				30.07.03	1600	01.08.03	1200	44
				02.08.03	0700	02.08.03	1100	4
				10.10.03	0700	10.10.03	2200	15
				9	Assam	MANAS	N.H. CROSSING	13.06.03
15.06.03	1200	16.06.03	0300					15
30.06.03	0100	01.07.03	0400					27
01.07.03	1500	02.07.03	0100					10
04.07.03	0900	05.07.03	1100					16
07.07.03	1300	11.07.03	0300					86
12.07.03	2300	14.07.03	0500					29
27.07.03	1100	27.07.03	2400					13
30.07.03	1900	31.07.03	1600					21
10.10.03	0400	11.10.03	0500					15
10	Assam	SANKOSH	GOLAKGANJ	23.06.03	0700	29.09.03	1800	155
				10.10.03	1100	13.10.03	0700	68
11	Assam	RAIDAK – I	TUFANGANJ	04.07.03	0600	06.07.03	0700	49
				07.07.03	1200	11.07.03	2300	107
				13.07.03	0600	14.07.03	2100	39
12	Assam	Torsa	GHUGHUMARI	01.07.03	1000	02.07.03	2100	35
				04.07.03	0900	05.07.03	0400	19
				08.07.03	1300	10.07.03	1500	50
13	Assam	SANKOSH	GOLAKGANJ	23.06.03	0700	29.09.03	1800	155
				10.10.03	1100	13.10.03	0700	68
14	West Bengal	RAIDAK – I	TUFANGANJ	04.07.03	0600	06.07.03	0700	49
				07.07.03	1200	11.07.03	2300	107
				13.07.03	0600	14.07.03	2100	39
15	West Bengal	JALDHAKA	N.H. 31 ROAD BRIDGE	01.07.03	0700	01.07.03	1900	12
				08.07.03	1000	09.07.03	0500	17
				09.07.03	0700	09.07.03	1900	12
16	West Bengal	JALDHAKA	MATHABHANGA	01.07.03	1200	02.07.03	0300	15
				04.07.01	1100	05.07.03	1200	25
				08.07.03	1500	10.07.03	1900	51

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
17	West Bengal	TISTA	DOMOHANI RD. BRIDGE	23.06.03	2400	24.06.03	0300	3
				27.06.03	1200	27.06.03	1500	3
				30.06.03	0600	30.06.03	2100	15
				01.07.03	0700	01.07.03	2400	17
				04.07.03	1100	04.07.03	1900	8
				08.07.03	1000	09.07.03	0500	19
				09.07.03	2000	10.07.03	0400	8
18	West Bengal	TISTA	MEKHLIGANJ	27.06.03	1800	27.06.03	1800	1
				30.06.03	1600	30.06.03	2100	5
				01.07.03	1200	02.07.03	0600	18
				04.07.03	1200	04.07.03	2100	9
				08.07.03	1300	09.07.03	1100	22
				09.07.03	1300	10.07.03	1300	24

4.5 FLOOD EVENTS IN THE BARAK RIVER SYSTEM

The Barak river system has two rivers, namely, the main river Barak itself and its tributary, the Katakhal which are so far covered by the Flood Forecasting Network of the Central water Commission. There were only forecasting sites, one each on these rivers, during the flood season 2003.

The flood events of these rivers are described in the following paragraphs.

4.5.1 UNPRECEDENTED FLOOD EVENTS IN THE BARAK RIVER SYSTEM

During 2003 no unprecedented flood events were witnessed in the Barak river system.

However, at one site namely, Matizuri on the Katakhal the flood level did touched the highest flood level stage, i.e. it equaled the HFL during 2003.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Assam	KATAKHAL	MATIZURI	12.06.03	2200	13.06.03	1300	15

4.5.2 HIGH FLOOD EVENTS IN THE BARAK RIVER SYSTEM

During the year under report, high flood situations were also witnessed at the site Matizuri on Katakhal in two spells as cited in the flowing table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Assam	KATAKHAL	MATIZURI	11.06.03	2100	14.06.03	2000	71
				29.06.03	1800	02.07.03	0500	59

4.5.3 MODERATE FLOOD EVENTS IN THE BARAK RIVER SYSTEM

The moderate flood waves were observed at both the sites in the Barak river system, as detailed below.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Assam	BARAK	SILCHAR (ANNAPURNA GHAT)	14.06.03	1500	15.06.03	0400	13
2	Assam	KATAKHAL	MATIZURI	08.06.03	2200	10.06.03	0300	29
				11.06.03	0300	15.06.03	2000	113
				28.06.03	1500	03.07.03	0700	112

4.5.4 LOW FLOOD EVENTS IN THE BARAK RIVER SYSTEM

The low flood waves were witnessed at both the sites of the river system, as per following varying period, during the flood season 2003.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Assam	BARAK	SILCHAR (ANNAPURNA GHAT)	13.06.03	0700	16.06.03	0600	71
				30.06.03	1300	02.07.03	0700	42
2	Assam	KATAKHAL	MATIZURI	08.06.03	0700	16.06.03	0900	194
				28.06.03	0400	03.07.03	2000	136
				20.09.03	0700	21.09.03	1300	30

4.6 FLOOD EVENTS IN THE EASTERN RIVERS SYSTEM

As already mentioned in the chapter- 2, there were 09 flood forecasting sites in the Eastern River system, mainly comprised of the following rivers excluding the Mahandi, which were covered under the flood forecasting Network of the Central Water Commission in 2003 flood season.

1. Subernarekha
2. Burhabalang
3. Baitarni
5. Brahamani
6. Rushikuliya
7. Vamsadhara

There are 09 flood forecasting sites on these rivers and forecasts were issued at all the sites since at every site the river stage crossed the warning levels during the period under report.

Details of flood situations as observed at the above sites are described in the following sub-paragraphs.

4.6.1 UNPRECEDENTED FLOOD EVENTS IN THE EASTERN RIVERS

Neither any unprecedented flood events nor equal to the highest flood level at any of the 09 flood forecasting sites, were observed in the any Eastern Rivers system, cited above.

4.6.2 HIGH FLOOD EVENTS IN THE EASTERN RIVERS

No high flood events were either experienced at any of the forecasting site of Eastern Rivers during 2003.

4.6.3 MODERATE FLOOD EVENTS IN THE EASTERN RIVERS

The Eastern Rivers experienced moderate floods at 06 sites on the 4 rivers mentioned below excluding the Subernarekha, in 2003 flood season.

The site-wise details of periods of moderate floods are given below.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Orissa	BURHABALANG	N.H.-5 RD.BRIDGE	08.10.03	0100	08.10.03	1300	12
2	Orissa	BAITARANI	ANANDPUR	08.10.03	1800	08.10.03	2000	2
3	Orissa	BAITARANI	AKHUAPADA	21.06.03 31.07.03 07.10.03	100 1600 2200	21.06.03 02.08.03 10.10.03	1600 1000 2200	6 42 72
4	Orissa	RUSHIKULIYA	PURUSHOTTAM-PUR	07.10.03	0100	09.10.03	1000	57
5	Orissa	VAMSADHARA	GUNUPUR	06.09.03 07.10.03	0500 0300	06.09.03 07.10.03	2400 2000	19 17
6	Orissa	VAMSADHARA	KASHINAGAR	28.08.03 06.09.03 07.10.03	0600 0600 0200	28.08.03 07.09.03 08.10.03	0900 0700 0800	03 25 30

4.6.4 LOW FLOOD EVENTS IN THE EASTERN RIVERS

The low flood situations were experienced at 07 level forecasting sites where water level touched or crossed the warning levels, which includes the 6 sites where moderate flood events were also experienced in 2003. The site-wise details of periods of low floods are given in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Orissa	SUBERNAREKHA	RAJGHAT	09.10.03	0800	10.10.03	1700	33
2	Orissa	BURHABALANG	N.H.-5 RD.BRIDGE	07.10.03	1200	11.10.03	0200	86
3	Orissa	BAITARANI	ANANDPUR	20.06.03	2400	21.06.03	0800	08
				31.07.03	1000	31.07.03	2200	12
				01.08.03	0400	01.08.03	1400	10
				08.10.03	0100	10.10.03	0400	51
4	Orissa	BRAHMANI	JENAPUR EXP WAY	11.10.03	1000	12.10.03	0900	23
5	Orissa	RUSHIKULIYA	PURUSHOTTAM-PUR	28.08.03	2000	29.08.03	1600	20
				06.10.03	2000	10.10.03	2300	99
6	Orissa	VAMSADHARA	GUNUPUR	28.08.03	0100	28.08.03	2100	20
				06.09.03	0300	07.09.03	1000	31
				06.10.03	2000	08.10.03	1200	40
7	Orissa	VAMSADHARA	KASHINAGAR	28.08.03	0400	31.08.03	1700	85
				02.09.03	1200	03.09.03	1700	29
				06.09.03	0300	09.09.03	2000	89
				14.09.03	0600	15.09.03	0100	19
				18.09.03	1800	19.09.03	1000	16
				20.09.03	2200	21.09.03	1000	12
				06.10.03	1600	13.10.03	2200	174

4.7 FLOOD EVENTS IN THE RIVER MAHANADI

As already mentioned, there are only 03 flood forecasting sites on the mainstream Mahanadi including 01 inflow forecasting site, Hirakud Dam. All these sites are located in the state of Orissa.

Both the level forecasting sites namely the Nimapara and Alipingal Devi, are in the delta region. The Nimapara site is on the main channel of the Mahandi while the Alipingal Devi is located on one of the bifurcatory of the Mahandi, called Devi.

The different flood events observed at level forecasting sites located on the river Mahandi are disused below.

4.7.1 UNPRECEDENTED FLOOD EVENTS IN THE RIVER MAHANADI

During the flood season 2003, there was no unprecedented situation was experienced at any site in the Mahandi. However, only at one site, namely, Alipingal

Devi, a flood of the magnitude equal to the highest flood level of the site was observed in 2003. The period of this flood peak is described in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Orissa	Mahanadi (Devi)	Alipingal Devi	30.08.03	1400	30.08.03	1700	3

4.7.2 HIGH FLOOD EVENTS IN THE RIVER MAHANADI

High flood events i.e. within 0.50m of HFL were experienced at 02 flood forecasting site in 2003, which includes the site where flood of magnitude equal to the HFL was also witnessed. The period of these floods are described in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Orissa	MAHANADI	ALIPINGAL DEVI	30.08.03	0400	02.09.03	0800	76
2	Orissa	MAHANADI	NIMAPARA	30.08.03	1400	31.08.03	1300	23
				01.09.03	0300	02.09.03	1200	33

4.7.3 MODERATE FLOOD EVENTS IN THE MAHANADI

The moderate flood events were witnessed at both the stage forecasting sites on the Mahanadi. The details of the flood periods are given below.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Orissa	MAHANADI	ALIPINGAL DEVI	29.08.03	2100	05.09.03	1700	164
				09.09.03	1200	10.09.03	1900	31
2	Orissa	MAHANADI	NIMAPARA	30.08.03	0600	05.09.03	1800	156

4.7.4 LOW FLOOD EVENTS IN THE MAHANADI

The low flood events were observed at both the two stage forecasting sites in the main stream Mahanadi, in addition to flood equal to the magnitude of HFL or high, which are already discussed earlier.

The river Mahanadi remained above the warning stage i.e. in low flood situations at the above sites for the varying periods as detailed in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Orissa	MAHANADI	ALIPINGAL DEVI	29.08.03	1400	11.09.03	2300	321
2	Orissa	MAHANADI	NIMAPARA	29.08.03	2000	12.09.03	0300	319

4.8 FLOOD EVENTS IN THE GODAVARI

In the Godavari basin there were 17 flood forecasting sites which includes the 4 inflow forecasting sites, Jaikwadi Dam, Sriram Sagar (Pochampad), Singur Dam and the Nizamsagar Dam. 12 sites are on the main Godavari, two sites each on the Wainganga and Manjira, the tributaries of the Godavari, and one site, namely, Jagadapur is on the third tributary called Indravati. Out of the remaining 13 stage forecasting sites, flood forecasts were not issued for the following 06 sites, all located on the main Godavari, since water level at these sites did not touch their warning levels during the period under report.

1. Gangkhed
2. Nanded
3. Eturunagaram
4. Kaleswaram
5. Dumagudam
6. Rajahmundri

Floods of varying intensities were observed at the 7 stage forecasting sites where forecasts were issued in 2003 flood season. The descriptions of these flood periods, magnitude-wise, are given below.

4.8.1 UNPRECEDENTED FLOOD EVENTS IN THE GODAVARI BASIN

During the flood season 2003 neither any unprecedented flood nor equal to unprecedented was observed at any of the sites located in the Godavari basin. The water level did not cross or touch the highest flood levels of any of the stage forecasting sites.

4.8.2 HIGH FLOOD EVENTS IN THE RIVER GODAVARI BASIN

No high flood situation i.e. level within 0.50m of HFL was experienced at any of the 7 stage forecasting sites where forecasts were issued in 2003 in the Godavari basin.

4.8.3 MODERATE FLOOD EVENTS IN THE GODAVARI BASIN

Moderate flood events were experienced at 03 out of the 07 level forecasting sites where forecasts were issued in 2003. Out of three stage forecasting sites, two are located on the Wainganga, viz Bhandara & Pauni and Jagdalpur on the Indravati.

The flood stage at the above cited sites remained either above the danger level or just touching the red mark for the varying periods, which are described in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Maharashtra	WAINGANGA	BHANDARA	27.07.03	2300	29.07.03	0200	27
2	Maharashtra	WAINGANGA	PAUNI	28.07.03	0300	29.07.03	0400	25
3	Chhatisgarh	INDRAVATI	JAGDALPUR	28.08.03	1300	29.08.03	2400	35
				08.10.03	0400	09.10.03	1500	35

4.8.4 LOW FLOOD EVENTS IN THE GODAVARI BASIN

The water level of the main stream Godavari touched or crossed at 04 stage forecasting sites, namely, Kopergaon, Bhadrachalam, Kunavaram, Dowalaiswaram, while at Bhandara & Pauni on Weinganga and Jagdalpur on the Indravati during the period under report. Accordingly forecasts were issued only for these 07 stage forecasting sites in 2003 in the Godavari basin.

The river water level cited sites remained either above the warning level or just touched the same for the varying periods, which are described in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Maharashtra	GODAVARI	KOPERGAON	28.07.03	1800	30.07.03	0300	33
2	Andhra Pradesh	GODAVARI	BHADRACHALAM	27.07.03	0900	28.07.03	1200	27
3	Andhra Pradesh	GODAVARI	KUNAVARAM	27.07.03	2200	28.07.03	0900	11
4	Andhra Pradesh	GODAVARI	DOWALAI SWARAM	27.07.03	1700	29.07.03	1300	44
5	Maharashtra	WAINGANGA	BHANDARA	27.07.03	2100	29.07.03	0600	33
6	Maharashtra	WAINGANGA	PAUNI	27.07.03	2400	29.07.03	0800	32
7	Andhra Pradesh	INDRAVATI	JAGDALPUR	06.08.03	2000	06.08.03	2300	3
				27.08.03	2400	30.08.03	1000	58
				07.09.03	1200	09.09.03	0300	39
				07.10.03	2400	10.10.03	0100	49

4.9 FLOOD EVENTS IN THE KRISHNA BASIN

The Krishana basin's flood forecasting network of the Central Water Commission consists of the main river Krishna and two of its main tributaries viz the Tungbhadra and the Bhima. During the flood season 2003, in all there were 08 flood forecasting sites in the Krishna which includes the 5 inflow forecasting sites viz Alamati Dam, Narayanpur Dam, Priyadarshani Jurala Project, Srisailem Dam and Prakashan Barrage on the main stream Krishna, stage forecasting site Mantralayam & one inflow forecasting site Tungbhadra Dam on the river Tungbhadra and level forecasting site Deongaon, on the Bhima.

Like the Godavari basin, in 2003 flood season there was no much of the flood problem in the Krishna basin as well. At two stage forecasting sites namely, Deongaon and Mantralayam as well as one inflow forecasting sites Prakashan Barrage (Vijaywada), the river stage did not touch the warning level fixed for the purpose and as such no forecasts were issued for these three sites in 2003. Similarly, only at one occasion each, forecasts were issued for the site Srisailem Dam and Priyadarshani Jurala Project on the main Krishna.

The various flood events observed in the Krishna basin are described in the following paragraphs.

4.9.1 UNPRECEDENTED FLOOD EVENTS IN THE KRISHNA BASIN

In 2003, neither any unprecedented flood nor equal to the highest flood level was observed any site in the Krishna basin.

4.9.2 HIGH FLOOD EVENTS IN THE KRISHNA BASIN

No high flood event was witnessed in the basin at any of the 8 flood forecasting sites in 2003 flood season.

4.9.3 MODERATE FLOOD EVENTS IN THE KRISHNA BASIN

No moderate flood events were either experienced at any stage forecasting site in the Krishna or in its tributaries at any time during the period under report.

4.9.4 LOW FLOOD EVENTS IN THE KRISHNA BASIN

Although no low flood events were observed at any of the two stage forecasting sites in the Krishna basin, yet low flood like situations were experienced at 4 out of the total 5 inflow forecasting sites on the main river Krishna (in which all the forecasting sites are only inflow forecasting sites) and at one inflow forecasting site on the Tungabhadra.

Since the pond levels or reservoir levels at any inflow forecasting sites are always under human /manual control as such the level of the reservoir / pond don't indicate the real magnitude of the natural flood in that sense. However, period of so called low floods as observed at the above five sites are described in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Karnataka	KRISHNA	ALAMATTI DAM	25.06.03	0600	26.06.03	1800	36
				27.07.03	1500	01.08.03	1200	117
2	Karnataka	KRISHNA	NARAYANPUR DAM	31.07.03	0400	01.08.03	2200	42

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
3	Andhra Pradesh	KRISHNA	PRIYADARSHINI JURALA PROJECT	24.08.03	2300	25.08.03	1800	19
4	Andhra Pradesh	KRISHNA	SRISAILAM DAM	26.08.03	0100	26.08.03	1000	9
5	Karnataka	TUNGA-BHADRA	TUNGABHADRA DAM	09.07.03	0100	12.07.03	1300	84
				19.07.03	0200	23.07.03	0600	100
				26.07.03	1000	03.08.03	1500	197
				09.08.03	0900	13.08.03	0900	96
				21.08.03	1500	29.08.03	1100	188
				05.10.03	1300	09.10.03	1800	101

4.10 FLOOD EVENTS IN THE WEST FLOWING RIVERS

In the Central Water Commission's Flood Forecasting Network, the following 6 rivers are covered so far.

1. The Narmada
2. The Tapi
3. The Mahi
4. The Sabarmati
5. The Banas
6. Damanganga

During 2003 flood season, there were 15 flood forecasting sites on the above rivers, which includes 06 inflow forecasting sites viz Dantiwada Dam on the Banas, Kadana Dam on Mahi, Hatnur Dam and Ukai dam on the Tapi and Madhuban Dam on the Damanganga and the rest 9 sites are level forecasting site in. In 2003, out the 9 level forecasting sites forecasts were issued only for one stage forecasting site namely Mandla on the Narmada for which only 02 forecasts were issued. At all the remaining sites water level did not touch the warning level during the period under report.

Similarly, out of 06 inflow forecasting sites, forecasts were issued for 05 sites. No forecast was issued for the inflow forecasting site, Dantiwada dam on the river Banas.

Details of periods of various magnitude of flood situations observed on the above cited West Flowing Rivers are given in following paragraphs.

4.10.1 UNPRECEDENTED FLOOD EVENTS IN THE WEST FLOWING RIVERS

In the flood season 2003, neither any unprecedented floods nor equivalent to the magnitude of previous highest flood level were experienced at any site during the period under report.

4.10.2 HIGH FLOOD EVENTS IN THE WEST FLOWING RIVERS

No high flood situation i.e. where the river stage approached within 0.50m of the HFL, was observed at any of the level forecasting sites in the West Flowing River System, during the flood season in the 2003.

4.10.3 MODERATE FLOOD EVENTS IN THE WEST FLOWING RIVERS

Only at one stage forecasting site, river crossed or touched the danger level of the site. At the forecasting site Mandla on the Narmada, in the West Flowing Rivers, moderate flood event was observed, where the water level exceeded the danger mark in the flood season 2003.

The details of the flood periods are given in the table below.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Madhya Pradesh	NARAMADA	MANDLA	29.08.03	1900	29.08.03	2100	03

4.10.4 LOW FLOOD EVENTS IN THE WEST FLOWING RIVERS

During the flood season 2003, the river stage crossed the warning level only at one level forecasting site in the West Flowing Rivers. It was the site Mandla on the Narmada where moderate flood was also experienced. Only 2 forecasts were issued for this site during the period under report.

The details of the flood periods are given in the table below.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Madhya Pradesh	NARAMADA	MANDLA	29.08.03	1400	30.08.03	0100	11

4.11 AN OVERVIEW OF FORECAST PERFORMANCE

During the flood season 2003 an average number of flood forecasts issued per forecasting site were 57. The number of forecasting sites where the performance accuracy of the issued forecasts were found above 96.48 % i.e. the overall percentage accuracy of the forecasts issued during 2003 flood season, were 83 (67.5%) which includes 55 (44.7%) flood forecasting stations where 100% forecasts issued were found within permissible limit of accuracy. There was no station where 100% incorrect forecasts were issued.

The broad features of the flood forecasting performance between 01.05.2003 to 31.10.2003 are given in Table-6.

The comparative year-wise flood forecasting performance from 1978 to 2003 showing total number of flood forecasts issued each year, number of forecasts within permissible limit of accuracy and percentage of accurate forecast are given in Table-7. The above informations in bar-chart forms are also shown in Figure 3.1 and corresponding correct number of forecast during each the year.

The flood forecasting performance of the level forecasting as well as inflow forecasting sites from 1986 to 2003 is in Table-8.

CHAPTER - 5

STATE-WISE APPRAISAL OF FLOOD EVENTS

5.0 GENERAL

As reported already, there are 14 states, one union territory, the Dadra & Nagar Haveli, and National Capital Territory of Delhi so far covered under the Flood Forecast and Warning Network of the Central Water Commission.

The flood situations as monitored in the above cited 14 states, Dadra & Nagar Haveli and NCT of Delhi through observations at 139 level forecasting sites of the Flood Forecasting and Warning Network of CWC, during the flood season 2003 are described in the following paragraphs, since the pond levels or the reservoir levels of the inflow forecasting sites are manually controlled and hence do not reflect the actual flood situations experienced in any of the river systems. As such only flood situations as observed at the level forecasting sites in the various states / U.T. and NCT of Delhi, are described in the subsequent paragraphs.

5.1 ANDHRA PRADESH

In the state of Andhra Pradesh there were 15 forecasting sites, 9 of them were level forecasting sites. Forecasts were issued only for 8 sites which i4level forecasting and 4 inflow forecasting sites during the period under report.

5.1.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

During the flood season 2003, no unprecedented flood situation was experienced at any of the 8 level forecasting sites located in the state of Andhra Pradesh.

5.1.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS

High flood situation was not experienced at any level forecasting sites, i.e. the rivers stages did not tough a level within 0.50m of their HFL during the flood season 2003.

5.1.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

The moderate flood situation i.e. where water level touched or crossed the danger level of any level forecasting sites, was not observed in 2003 flood season at any sites in the state.

5.1.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

During the flood season 2003, low flood events i.e. where water level of the rivers touched or crossed the warning levels of he forecasting sites, were xperienced at the 04 out of 08 level forecasting sites in Andhra Pradesh.

The low flood periods as observed at various sites in the states are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in Hours
				From		To		
				Date	Hour	Date	Hour	
1	Andhra Pradesh	GODAVARI	BHADRACHALAM	27.07.03	0900	28.07.03	1200	27
2	Andhra Pradesh	GODAVARI	KUNAVARAM	27.07.03	2200	28.07.03	0900	11
3	Andhra Pradesh	GODAVARI	DOWALAISWARAM	27.07.03	1700	29.07.03	1300	44
4	Andhra Pradesh	INDRAVATI	JAGDALPUR	06.08.03	2000	06.08.03	2300	3
				27.08.03	2400	30.08.03	1000	58
				07.09.03	1200	09.09.03	0300	39
				07.10.03	2400	10.10.03	0100	49

The "Maximum Water Levels attained and Forecasting Performance of each forecasting site located in the state of Andhra Pradesh, during the flood season 2003" are shown in the Table-9.1.

5.2 ASSAM

In the state of Assam there were in all 23 forecasting sites, all of them are level Forecasting sites. Forecasts were issued for all the sites in the state during the period under report.

5.2.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

No unprecedented flood event was observed at any of the 23 sites located in the state of Assam during the period under report.

However, at one site, namely, the Matizuri on the Katakhal in Assam, the water level of the river did touch the highest flood level recorded so far i.e. flood of the magnitude equivalent to the HFL was experienced. The flood periods as observed at this site is shown in the following table.

S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in Hours
				From		To		
				Date	Hour	Date	Hour	
1	Assam	KATAKHAL	MATIZURI	12.06.03	2200	13.06.03	1300	15

5.2.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS

High flood situations were observed at 05 sites in the state where level was attained within 0.50m of their highest flood levels (HFL).

S. No.	State	River	F.F. Site	Periods of Floods equal to HFL				Total Period in Hours
				From		To		
				Date	Hour	Date	Hour	
1	Assam	BRAHMAPUTRA	TEZPUR	10.07.03	0900	11.07.03	1800	33
2	Assam	BRAHMAPUTRA	GUWAHATI	11.07.03	1100	14.07.03	1500	76
3	Assam	DESANG	NANGLAM ORAGHAT	05.07.03 23.07.03	2200 0300	08.07.03 24.07.03	1900 0200	69 23
4	Assam	JIABHAR-ALI	N.T. ROAD CROSSING	30.06.03 30.07.03 18.08.03 20.08.03 21.09.03	0900 1400 1500 0800 0600	01.07.03 31.07.03 18.08.03 20.08.03 21.09.03	0500 0600 1900 1000 2200	20 16 4 2 16
5	Assam	KOPI LI	KAMPUR	01.07.03 12.10.03	1700 0300	02.07.03 12.10.03	1300 1400	20 11

5.2.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

The Moderate flood situations were experienced at 19 level forecasting sites in the state of Assam, in 2003. The moderate flood periods at these sites are described in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Assam	BRAHMAPUTRA	DIBRUGARH	27.05.03	1700	24.10.03	1500	3598
2	Assam	BRAHMAPUTRA	NEAMATIGHAT	26.06.03	1400	28.09.03	0800	2250
3	Assam	BRAHMAPUTRA	TEZPUR	27.06.03	1100	24.07.03	2300	660
4	Assam	BRAHMAPUTRA	GUWAHATI	01.07.03 07.07.03	0100 0100	04.07.03 17.07.03	2300 2200	94 261
5	Assam	BRAHMAPUTRA	GOALPARA	02.07.03 07.07.03	1100 2100	05.07.03 18.07.03	1600 0200	77 245
6	Assam	BRAHMAPUTRA	DHUBARI	29.06.03 03.08.03	2000 1100	26.07.03 05.08.03	2000 0300	648 40
7	Assam	DESANG	NANGLAMORA GHAT	28.06.03	0800	26.07.03	0700	671
8	Assam	DIKHOW	SIBSAGAR	30.06.03 14.07.03 15.08.03 01.09.03	1200 1300 0500 1500	01.07.03 16.07.03 16.08.03 06.09.03	2200 2100 2400 0900	34 56 43 114
9	Assam	SUBANSIRI	BADATIGHAT	07.06.03	1000	24.07.03	1300	1124
10	Assam	DHANSIRI	GOLAGHAT	15.08.03 11.10.03	2000 0700	12.09.03 18.10.03	1600 0600	668 167

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hours
				From		To		
				Date	Hour	Date	Hour	
11	Assam	DHANSIRI	NUMALIGARH	27.06.03 28.07.03	1400 1600	24.07.03 19.10.03	1100 1200	624 1988
12	Assam	JIABHARALI	N.T. ROAD CROSSING	09.06.03 19.06.03 08.08.03 09.10.03	0700 0600 1300 1900	18.06.03 27.07.03 07.10.03 13.10.03	1500 1100 2400 1300	224 917 1451 90
13	Assam	KOPILI	KAMPUR	30.06.03 11.10.03	0700 0600	05.07.03 15.10.03	0700 2400	120 114
14	Assam	KOPILI	DHARAMTUL	30.06.03 11.10.03	1800 1000	21.07.03 20.10.03	1400 2100	500 227
15	Assam	PUTHIMARI	N.H. CROSSING	13.06.03 27.06.03 29.06.03 30.06.03 22.07.03 27.07.03 30.07.03 19.08.03 21.08.03 06.09.03 10.10.03	1000 1700 1300 0800 0800 1200 2000 0600 0300 1300 0900	17.06.03 29.06.03 30.06.03 21.07.03 22.07.03 27.07.03 05.08.03 19.08.03 21.08.03 06.09.03 11.10.03	1600 0400 0500 1400 1400 1700 1900 0800 1800 2200 1300	102 59 16 510 7 5 143 2 15 9 28
16	Assam	BEKI	ROAD BRIDGE	11.06.03 12.06.03 13.06.03 16.06.03 20.06.03 21.06.03 22.06.03 27.07.03 28.07.03 30.07.03 06.08.03 09.08.03 11.08.03 17.08.03 22.08.03 30.08.03 31.08.03 01.10.03 02.10.03 10.10.03	1600 1300 0900 1900 1500 1000 1100 1300 1400 0400 1500 2100 0300 1000 1100 1300 1400 1300 1800 0800	11.06.03 12.06.03 16.06.03 16.06.03 21.06.03 22.06.03 24.07.03 28.07.03 28.07.03 06.08.03 06.08.03 09.08.03 12.08.03 21.08.03 30.08.03 31.08.03 22.09.03 01.10.03 02.10.03 11.10.03	2300 1500 0400 2200 0400 0300 1400 0200 1900 0600 2400 2200 0300 2200 0600 0600 1900 2200 0200	7 2 67 3 13 17 51 13 5 170 9 1 24 108 187 17 533 6 4 18
17	Assam	PAGLADIYA	N.T. ROAD CROSSING	13.06.03 15.06.03 30.06.03 02.07.03 08.07.03	0900 0800 1500 0800 1200	14.06.03 16.06.03 01.07.03 02.07.03 09.07.03	2100 0800 1500 1600 1600	36 24 24 8 28
18	Assam	MANAS	N.H. CROSSING	13.06.03 30.06.03 07.07.03	1000 1300 1600	14.06.03 30.06.03 08.07.03	1200 1400 1200	26 1 20

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hours
				From	To	From	To	
				Date	Hour	Date	Hour	
19	Assam	SANKOSH	GOLAKGANJ	01.07.03	1600	15.07.03	1300	330
				16.07.03	0100	16.07.03	0900	8
				18.07.03	0300	18.07.03	0900	6
				18.07.03	2100	22.07.03	0600	81
				30.07.03	2100	01.08.03	0900	36
				18.08.03	2300	20.08.03	0100	26
				16.09.03	0400	16.09.03	1500	11

5.2.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

The low floods were observed at 18 sites during the period under report in 2003. The descriptions of low flood periods as monitored at the above sites are as under.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hours
				From	To	From	To	
				Date	Hour	Date	Hour	
1	Assam	BRAHMAPUTRA	DIBRUGARH	19.05.03	0600	20.05.03	1100	5
2	Assam	BRAHMAPUTRA	NEAMATI-GHAT	15.06.03	1700	16.06.03	1100	18
				28.09.03	1900	08.10.03	1500	236
				12.10.03	0800	14.10.03	1200	59
3	Assam	BRAHMAPUTRA	TEZPUR	15.06.03	2000	18.06.03	2200	74
				31.07.03	0900	05.08.00	0800	119
				18.08.03	1200	20.08.03	0600	42
				02.09.03	1100	24.09.03	1900	536
				05.10.03	0800	06.10.03	0500	21
4	Assam	BRAHMAPUTRA	GUWAHATI	17.06.03	0200	18.06.03	2400	46
				28.06.03	0400	25.07.03	1600	660
				01.08.03	1100	05.08.03	1300	98
				20.08.03	0100	24.08.03	2300	118
				04.09.03	0400	10.09.03	0300	143
				22.09.03	0400	22.09.03	1700	13
5	Assam	BRAHMAPUTRA	GOALPARA	29.06.03	0100	27.07.03	1800	689
				01.08.03	0100	07.08.03	0400	147
				20.08.03	1900	26.08.03	1100	136
				05.09.03	0600	11.09.03	1000	148
6	Assam	BRAHMAPUTRA	DHUBARI	15.06.03	0200	29.09.03	0300	2545
				05.10.03	0100	15.10.03	2400	263
7	Assam	DESANG	NANGLAMORA GHAT	31.07.03	1100	04.08.03	1100	96
				15.08.03	1500	21.08.03	1400	143
				03.09.03	0300	06.09.03	0200	71
				08.09.03	0600	09.04.03	0700	25

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hours
				From Date	To Hour	From Date	To Hour	
8	Assam	DIKHOW	SIBSAGAR	28.06.03	1000	29.06.03	0900	23
				05.07.03	1300	07.07.03	0800	43
				08.07.03	1800	10.07.03	1200	42
9	Assam	SUBANSIRI	BADATI-GHAT	31.07.03	0200	04.08.03	1300	107
				17.08.03	2300	25.08.03	0900	178
				02.09.03	0700	09.09.03	1700	178
				10.09.03	0100	11.09.03	0600	29
10	Assam	DHANSIRI	GOLAGHAT	07.08.03	2100	08.08.03	1500	18
				09.08.03	0400	10.08.03	1900	39
11	Assam	JIA BHARALI	NT Rd. X	27.05.03	1200	30.05.03	0500	65
				06.06.03	1500	09.06.03	0400	61
12	Assam	PUTHIMARI	N.H. CROSSING	27.05.03	1900	29.05.03	1200	41
				06.06.03	0300	08.06.03	0100	46
				09.06.03	1300	11.06.03	0200	37
				11.06.03	2200	08.10.03	1700	2851
				09.10.03	1600	15.10.03	2400	152
13	Assam	BEKI	ROAD BRIDGE	18.05.03	2300	20.05.03	2300	48
				25.05.03	1200	15.10.03	2400	3444
14	Assam	PAGLADIYA	N.T. ROAD CROSSING	13.06.03	0600	18.06.03	1200	126
				27.06.03	0900	27.06.03	1300	4
				27.06.03	2100	28.06.03	0200	5
				29.06.03	1300	29.06.03	2000	7
				30.06.03	0900	12.07.03	1000	289
				12.07.03	1300	14.07.03	1400	25
				14.07.03	2400	16.07.03	2000	44
				17.07.03	0300	17.07.03	1700	14
				17.07.03	2200	18.07.03	1700	19
				30.07.03	1600	01.08.03	1200	44
				02.08.03	0700	02.08.03	1100	4
				10.10.03	0700	10.10.03	2200	15
15	Assam	MANAS	N.H. CROSSING	13.06.03	0700	15.06.03	0400	45
				15.06.03	1200	16.06.03	0300	15
				30.06.03	0100	01.07.03	0400	27
				01.07.03	1500	05.07.03	0100	10
				04.07.03	0900	07.03	1100	16
				07.07.03	1300	11.07.03	0300	86
				12.07.03	2300	14.07.03	0500	29
				27.07.03	1100	27.07.03	2400	13
				30.07.03	1900	31.07.03	1600	21
				10.10.03	0400	11.10.03	0500	15
16	Assam	SANKOSH	GOLAKGANJ	23.06.03	0700	29.09.03	1800	155
				10.10.03	1100	13.10.03	0700	68
17	Assam	BARAK	SILCHAR (ANNAPURNA GHAT)	13.06.03	0700	16.06.03	0600	71
				30.06.03	1300	02.07.03	0700	42
18	Assam	KATAKHAL	MATIZURI	08.06.03	0700	16.06.03	0900	194
				28.06.03	0400	03.07.03	2000	136
				20.09.03	0700	21.09.03	1300	30

The "Maximum Water Levels attained and Forecasting Performance of each forecasting site located in the state of Assam, during the flood season 2003" are shown in the Table-9.2.

5.3 BIHAR

In the state of Bihar there were 32 level forecasting sites during the period under report.

5.3.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

The unprecedented flood events were experienced at two sites, both on the main river Ganga, in the state. The unprecedented flood periods as observed at both these sites are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Unprecedented Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
1	Bihar	GANGA	BHAGALPUR	16.09.03	2200	17.09.03	2300	25
2	Bihar	GANGA	KAHALGAON	16.09.03	0100	19.09.03	0400	75

5.3.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS

The high flood events were experienced at 11 sites, 4 on the Ganga and 7 sites on its tributaries in the state. The high flood periods as observed at these 11 sites are shown in the following table.

S. No.	State	River	F.F. Site	Periods of High Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
1	Bihar	GANGA	PATNA (GANDHIGHAT)	09.09.03	2300	18.09.03	0300	196
2	Bihar	GANGA	HATHIDAH	11.09.03	1700	17.09.03	0100	128
3	Bihar	GANGA	BHAGALPUR	11.09.03	0100	21.09.03	2400	263
4	Bihar	GANGA	KAHALGAON	09.09.03	0100	23.09.03	1900	354
5	Bihar	GHAGHRA	GANGPUR-SISWAN	08.09.03	2100	12.09.03	2200	97
				22.09.03	0700	30.09.03	0600	191
6	Bihar	GHAGHRA	CHHAPRA	12.09.03	1200	12.09.03	2400	12
7	Bihar	GANDAK	CHATIA	02.08.03	0900	04.08.03	0300	42
8	Bihar	GANDAK	HAZIPUR	10.09.03	2000	11.09.03	2400	28
9	Bihar	BAGMATI	BENIBAD	04.07.03	2100	08.07.03	0800	83
				10.07.03	2200	22.07.03	1900	285
				02.08.03	0400	05.08.03	0300	71
10	Bihar	KOSI	BASUA	29.06.03	0100	29.06.03	1700	16
				09.07.03	1600	11.07.03	0800	40
				01.08.03	0300	01.08.03	0800	7
11	Bihar	KOSI	KURSELA	13.09.03	0400	21.09.03	0700	195

5.3.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

The moderate flood events were experienced at 30 sites, 06 sites on the main Ganga and remaining sites on its tributaries in the state. The moderate flood periods as observed at these 30 sites are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
1	Bihar	GANGA	BUXAR	10.09.03	0900	17.09.03	0500	164
2	Bihar	GANGA	PATNA (DIGHAGHAT)	04.09.03	1800	22.09.03	0100	271
3	Bihar	GANGA	PATNA (GANDHIGHAT)	21.08.03	2300	26.08.03	0900	106
				04.09.03	0600	04.10.03	0600	720
4		GANGA	HATHIDAH	05.09.03	0900	28.09.03	1000	553
5	Bihar	GANGA	BHAGALPUR	11.09.03	0100	21.09.03	2400	263
6	Bihar	GANGA	KAHALGAON	20.08.03	0600	07.10.03	2400	1170
7	Bihar	GHAGHRA	DARALI	21.08.03	2000	31.08.03	1300	233
				06.09.03	1600	11.09.03	2400	128
				21.09.03	2300	28.09.03	0200	147
8	Bihar	GHAGHRA	GANGPUR-SISWAN	04.08.03	1500	07.08.03	2000	77
				15.08.03	0800	01.09.03	0700	407
				06.09.03	0900	15.09.03	0700	214
				20.09.03	1200	02.10.03	1400	290
9	Bihar	GHAGHRA	CHHAPRA	09.09.03	2300	17.09.03	0400	173
10	Bihar	SONE	KOELWAR	04.09.03	0200	08.09.03	0700	101
				09.09.03	0900	14.09.03	1000	121
				15.09.03	0600	15.09.03	1400	8
				16.09.03	1300	17.09.03	0700	18
11	Bihar	SONE	MANER	04.09.03	0900	22.09.03	1200	435
12	Bihar	PUNPUN	SRIPALPUR	01.08.03	1500	05.08.03	2400	105
				13.08.03	0500	25.08.03	1300	296
				30.08.03	0500	30.08.03	1300	8
				01.09.03	2200	08.09.03	1700	163
13	Bihar	GANDAK	CHATIA	11.07.03	1700	13.07.03	1400	45
				21.07.03	2200	06.08.03	2400	386
				20.08.03	1200	23.08.03	2100	81
14	Bihar	GANDAK	REWAGHAT	03.08.03	0900	05.08.03	1000	49
				21.08.03	2400	24.08.03	0300	51
15	Bihar	GANDAK	HAZIPUR	04.09.03	1300	29.09.03	0200	589
16	Bihar	BURHI GANDAK	LALBEGHIAGHAT	05.07.03	1700	14.07.03	0300	202
17	Bihar	BURHI GANDAK	MUZAFFARPUR (SIKANDARPUR)	07.07.03	1600	18.07.03	2200	270
				03.08.03	0400	10.08.03	0100	165
				20.08.03	2400	28.08.03	1400	182
18	Bihar	BURHI GANDAK	SAMASTIPUR	04.07.03	1400	22.07.03	2400	442
				03.08.03	1400	14.08.03	0800	258
				21.08.03	0400	03.09.03	1200	320
19	Bihar	BURHI GANDAK	ROSERA	05.07.03	1700	23.07.03	1000	425
				03.08.03	0500	16.08.03	0600	313
				20.08.03	1500	05.09.03	0800	377
20	Bihar	BURHI GANDAK	KHAGARIA	21.08.03	1700	05.10.03	0700	1070
21	Bihar	BAGMATI	BENIBAD	28.06.03	2100	30.07.03	0400	752
				30.07.03	2000	05.09.03	1500	883
				24.09.03	0600	29.09.03	0600	120
				01.10.03	0500	03.10.03	0500	48

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S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
22	Bihar	BAGMATI	HAYAGHAT	13.07.03	0900	27.07.03	0700	334
				04.08.03	0900	08.08.03	2300	110
23	Bihar	ADHWARA GROUP	KAMTAUL	25.06.03	0100	26.07.03	0900	752
				31.07.03	1200	31.07.03	2400	12
				01.08.03	1000	07.08.03	2000	154
				19.08.03	2100	27.08.03	0500	176
24	Bihar	ADHWARA GROUP	EKMIGHAT	08.07.03	1800	29.07.03	1000	496
				02.08.03	2400	13.08.03	0600	246
25	Bihar	KAMLA BALAN	JHANJHARPUR	28.06.03	0900	30.06.03	2400	63
				01.07.03	0100	01.07.03	0600	5
				01.07.03	1800	03.07.03	0400	34
				06.07.03	0600	06.07.03	1100	5
				09.07.03	0800	12.07.03	2100	85
				13.07.03	0200	13.07.03	2200	20
				20.07.03	0500	20.07.03	2300	18
				30.07.03	1500	03.08.03	1200	93
				09.08.03	2200	10.08.03	0200	4
				18.08.03	1800	19.08.03	1300	19
26	Bihar	KOSI	BASUA	28.06.03	0800	30.06.03	0900	49
				01.07.03	0100	02.07.03	2200	45
				08.07.03	2400	12.07.03	1800	90
				15.07.03	1400	15.07.03	2100	7
				22.07.03	2100	24.07.03	0400	31
				31.07.03	1100	02.08.03	1300	50
				19.08.03	1600	21.08.03	0900	41
27	Bihar	KOSI	BALTARA	30.06.03	0400	01.07.03	0700	27
				03.07.03	0900	04.07.03	1800	33
				06.07.03	0400	07.07.03	2000	40
				09.07.03	0200	29.09.03	1000	488
28	Bihar	KOSI	KURSELA	03.08.03	2200	10.08.03	1300	159
				17.08.03	0300	08.10.03	0100	1246
29	Bihar	MAHANANDA	DHENGGRAGHAT	01.07.03	0300	14.07.03	0300	312
				31.07.03	0500	02.08.03	0900	52
				12.08.03	0500	12.08.03	1600	11
				10.10.03	1600	11.10.03	1900	27
30	Bihar	MAHANANDA	JHAWA	02.07.03	0500	03.07.03	1400	33
				04.07.03	0800	15.07.03	1800	274
				01.08.03	0400	02.08.03	0300	23

5.3.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

The low flood events were experienced at all the 32 sites located in the state of Bihar. The low flood periods as observed at these 30 sites are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Bihar	GANGA	BUXAR	05.09.03	1800	29.09.03	0800	566
				01.10.03	1100	04.10.03	2100	82
2	Bihar	GANGA	PATNA (DIGHAGHAT)	21.08.03	0900	28.08.03	0300	162
				03.09.03	2400	05.10.03	2000	764

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S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
3	Bihar	GANGA	PATNA (GANDHIGHAT)	03.08.03 16.08.03	1800 0300	07.08.03 08.10.03	0800 0700	83 1276
4	Bihar	GANGA	HATHIDAH	17.08.03	2300	07.10.03	0900	1209
5	Bihar	GANGA	MUNGER	06.09.03	0800	22.09.03	0400	393
6	Bihar	GANGA	BHAGALPUR	22.08.03 04.09.03	0300 1900	02.09.03 06.10.03	0400 1900	273 768
7	Bihar	GANGA	KAHALGAON	26.07.03 01.08.03	2100 1600	27.07.03 12.10.03	1900 2300	22 271
8	Bihar	GHAGHRA	DARAU LI	13.07.03 21.07.03 02.08.03	1900 2100 0800	18.07.03 29.07.03 05.10.03	1300 2400 0400	117 195 68
9	Bihar	GHAGHRA	GANGPUR-SISWAN	15.07.03 22.07.03 31.07.03 02.08.03	0200 1000 0900 1400	18.07.03 30.07.03 01.08.03 05.10.03	1800 0200 1600 2400	88 184 31 82
10	Bihar	GHAGHRA	CHHAPRA	04.09.03	1200	27.09.03	1800	558
11	Bihar	SONE	INDERPURI	03.09.03 09.09.03 11.09.03	1800 0100 1200	04.09.03 10.09.03 11.09.03	0300 2300 1400	9 46 2
12	Bihar	SONE	KOELWAR	03.09.03 20.09.03 24.09.03 27.09.03 02.10.03	1300 1400 1400 0300 0100	19.09.03 21.09.03 26.09.03 27.09.03 05.10.03	1400 1300 1500 1100 0600	385 23 49 8 77
13	Bihar	SONE	MANER	20.08.03 03.09.03	1400 1300	31.08.03 05.10.03	1500 1800	265 53
14	Bihar	PUNPUN	SRIPALPUR	01.08.03 12.08.03 28.08.03 01.09.03 25.09.03 29.09.03	0300 2100 2200 0100 1800 2300	06.08.03 26.08.03 31.08.03 18.09.03 28.09.03 04.10.03	1300 1100 1900 1600 0300 0600	130 326 69 423 57 103
15	Bihar	GANDAK	CHATIA	01.07.03 04.07.03 09.07.03 21.07.03 01.08.03 09.08.03 17.08.03 30.08.03 02.09.03	2000 2100 1700 0100 0100 0400 1200 1700 0900	03.07.03 06.07.03 17.07.03 26.07.03 08.08.03 10.08.03 30.08.03 01.09.03 10.09.03	1900 0300 1400 0800 1800 2200 0400 0100 2300	47 30 189 127 185 42 204 32 206
16	Bihar	GANDAK	REWAGHAT	06.07.03 10.07.03 22.07.03 01.08.03 19.08.03 03.09.03 17.09.03	0500 1600 1700 1500 2000 1900 0600	08.07.03 15.07.03 24.07.03 07.08.03 27.08.03 10.09.03 19.09.03	0100 1100 2000 0700 0200 1700 1800	44 115 51 136 174 166 60
17	Bihar	GANDAK	HAZIPUR	04.09.03	1300	29.09.03	0200	587
18	Bihar	BURHI GANDAK	LALBEGHIAGHAT	01.07.03 03.08.03 23.08.03	0200 1800 0100	18.07.03 07.08.03 26.08.03	1000 2400 1400	416 114 85

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S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
19	Bihar	BURHI GANDAK	MUZAFFARPUR (SIKANDARPUR)	30.06.03	2000	22.07.03	2400	532
				01.08.03	2100	14.08.03	1800	309
				19.08.03	2200	02.09.03	2000	332
				23.09.03	2300	27.09.03	2300	96
20	Bihar	BURHI GANDAK	SAMASTIPUR	27.06.03	1400	25.07.03	2100	679
				02.08.03	0100	17.08.03	1000	369
				01.09.03	0100	06.09.03	1100	130
				23.09.03	2700	30.09.03	1100	157
				02.10.03	2100	05.10.03	1400	65
21	Bihar	BURHI GANDAK	ROSERA	02.07.03	0800	26.07.03	0500	589
				02.08.03	0700	08.09.03	1800	899
				23.09.03	1900	08.10.03	0100	342
22	Bihar	BURHI GANDAK	KHAGARIA	03.08.03	0700	08.10.03	1300	290
23	Bihar	BAGMATI	BENIBAD	17.06.03	1600	18.06.03	0600	14
				23.06.03	1600	15.10.03	1300	2733
24	Bihar	BAGMATI	HAYAGHAT	30.06.03	1200	07.09.03	1200	1656
25	Bihar	ADHWAR A GROUP	KAMTAUL	24.06.03	1400	28.07.03	2400	826
				30.07.03	2400	31.07.03	0600	6
				19.08.03	0300	31.08.03	1600	301
				25.09.03	0900	27.09.03	1100	50
				01.10.03	1100	03.10.03	2300	60
26	Bihar	ADHWAR A GROUP	EKMIGHAT	26.06.03	1300	06.09.03	2200	1737
27	Bihar	KAMLA BALAN	JHANJHARPUR	16.06.03	2200	17.06.03	2000	22
				20.06.03	2200	21.06.03	1300	15
				25.06.03	0100	25.06.03	2400	23
				27.06.03	1700	25.07.03	2300	678
				30.07.03	0200	14.08.03	1400	379
				15.08.03	0200	15.08.03	2200	20
				18.08.03	1000	25.08.03	0300	161
				25.08.03	1800	27.08.03	0400	34
				29.08.03	0100	30.08.03	1400	37
				15.09.03	1800	16.09.03	0300	9
				21.09.03	0800	22.09.03	0100	25
				22.09.03	1700	23.09.03	0700	14
				24.09.03	0100	25.09.03	1300	36
				30.09.03	1700	01.10.03	0700	14
28	Bihar	KOSI	BASUA	22.06.03	0400	10.09.03	0400	1920
				14.09.03	0100	19.09.03	0400	123
				19.09.03	2200	27.09.03	2100	191
29	Bihar	KOSI	BALTARA	28.06.03	2400	12.10.03	0900	2509
30	Bihar	KOSI	KURSELA	12.07.03	1000	14.10.03	0300	2249
31	Bihar	MAHANA-NDA	JHAWA	28.06.03	2300	24.07.03	1600	615
				31.07.03	0100	06.08.03	0800	151
				10.08.03	2000	14.08.03	2000	96
				19.08.03	1000	23.08.03	1500	101
				18.09.03	1800	26.09.03	1700	191
				10.10.03	1200	13.10.03	0900	69

The maximum water levels attained and Forecasting Performance of each forecasting site located in the state of Bihar, during the flood season 2003" are shown in the Table-9.3.

5.4 CHHATISGARH

In the state of Chhatisgarh there was only one flood forecasting site during the period under report i.e. Jagdalpur , a level forecasting site on the Indravati, a tributary of the Godavari.

5.4.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

No unprecedented flood event was observed at the lone level forecasting site in the state in 2003.

5.4.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS OBSERVED IN THE STATE OF CHHATISGARH

No high flood event was observed in the state during 2003 flood season.

5.4.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

During the flood season 2003, moderate flood situation was experienced at the site for the period shown in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
1	Chhatisgarh	INDRAVATI	JAGDALPUR	28.08.03	1300	29.08.03	2400	35
				08.10.03	0400	09.10.03	1500	35

5.4.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

Low flood peaks were observed at the site Jagdalpur in chhatisgarh for varying periods in 2003, as shown in the following table.

S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
1	Chhatisgarh	INDRAVATI	JAGDALPUR	06.08.03	2000	06.08.03	2300	3
				27.08.03	2400	30.08.03	1000	58
				07.09.03	1200	09.09.03	0300	39
				07.10.03	2400	10.10.03	0100	49

The "Maximum Water Levels attained and Forecasting Performance of each forecasting site located in the state of Chhatisgarh, during the flood season 2003" are shown in the Table-9.4.

5.5 GUJARAT

* In the state of Gujarat, there were 10 flood forecasting sites, including 04 inflow forecasting sites, but forecasts were issued only for the 03 inflow forecasting sites during 2003 flood season.

Out of 06 level forecasting sites, forecasts were not issued for any site as the water level did not touch their warning level, during the period under report.

5.5.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

No unprecedented flood situation was observed in the state in 2003.

5.5.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS

No high flood situation was observed in the state during the flood season 2003.

5.5.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

At none of the level forecasting site the water level of any river in the state touched the danger level in 2003 i.e. no moderate flood events was witnessed.

5.5.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

No low flood situation was observed in the state during the flood season 2003.

The maximum water levels attained and Forecasting Performance of each forecasting site located in the state of Gujarat, during the flood season 2003" are shown in the Table-9.5.

5.6 HARYANA

As mentioned earlier, neither any hydrological data was collected nor any forecast was issued for the lone site Tajewala weir on the Yamuna in the state of Haryana during the period under report. Instead data from an upstream site, namely, Hathni Kund Barrage was collected in 2003. Consequently, the analysis of the forecasts data did not explain / reveals any flood situations of the state.

However, the "Highest Flood Level" attained so far at the forecasting site Tajewala Weir located in the state of Haryana, together with danger level are shown in the Table-9.6, for reference only.

5.7 JHARKHAND

In the state of Jharkhand, there were 04 flood forecasting sites during the flood season 2003. All these sites are inflow forecasting sites and flood forecasts were also issued for all of them during the period under report.

The "Maximum Water Levels attained and Forecasting Performance of each forecasting site located in the state of Jharkhand, during the flood season 2003" are shown in the Table-9.7.

5.8 KARNATAKA

In the state of Karnataka, there were 04 flood forecasting sites, which includes 03 inflow forecasting sites and one level forecasting site, namely, Devangaon on the Bhima, tributary of the Krishna in flood season 2003. However no forecasts were issued for this site as the water level at the site did not touch the warning level during the period under report.

The "Maximum Water Levels attained and Forecasting Performance of each forecasting site located in the state of Karnataka, during the flood season 2003" are shown in the Table-9.8.

5.9 MADHYA PRADESH

In the state of Madhya Pradesh, there were 02 sites, both level forecasting sites on the Narmada. During the flood season 2003 both the forecasting sites were operational too. But forecasts were issued only for one site viz. Madla, as water level at the other site namely, Hoshngabad did not touch the warning level in 2003..

The flood situations as experienced in 2003 flood season are described below.

5.9.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

No unprecedented flood situation was experienced during the period under report.

5.9.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS

No high flood situation was experienced in Madhya Pradesh, during the period under report.

5.9.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

Moderate flood situation was experienced at the forecasting site Mandla when the river Narmada crossed the danger level, during 2003 for the period shown in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	
1	M.P.	NARAMADA	MANDLA	29.08.03	1900	29.08.03	2100	03

5.9.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

Low flood situation was also experienced at the forecasting site Mandla on the Narmada during the following period in flood season 2003, which includes period of moderate flood as well.

S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	
1	M.P.	NARAMADA	MANDLA	29.08.03	1400	30.08.03	0100	11

The "Maximum Water Levels attained and Forecasting Performance of each forecasting site located in the state of Madhya Pradesh, during the flood season 2003" are shown in the Table-9.9.

5.10 MAHARASHTRA

During the flood season 2003, there were 07 forecasting sites including 02 inflow forecasting sites, in the state of Maharashtra. Forecasts were not issued for 02 level forecasting sites out of the total 05 such sites.

5.10.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

No unprecedented flood events were observed at any of the flood forecasting sites in 2003, in the state of Maharashtra.

5.10.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS

No high flood events were observed at any flood forecasting sites located in the state of Maharashtra, in 2003.

5.10.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

The moderate flood events were observed at 02 flood forecasting sites located on the river Weinganga , a tributary of the Godavari, in the state of Maharashtra, in 2003,. The periods of high flood situations are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Maharashtra	WAINGANGA	BHANDARA	27.07.03	2300	29.07.03	0200	27
2	Maharashtra	WAINGANGA	PAUNI	28.07.03	0300	29.07.03	0400	25

5.10.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

In 2003, the low flood events were observed at 03 level flood forecasting sites, 01 located on the main Godavari and 02 sites located on the river Weinganga , a tributary of the Godavari, in the state of Maharashtra. The periods of high flood situations are shown in the following table.

S. No.	State	River	F.F. Site	Periods of low Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
1	Maharashtra	GODAVARI	KOPERGAON	28.07.03	1800	30.07.03	0300	33
2	Maharashtra	WAINGANGA	BHANDARA	27.07.03	2100	29.07.03	0600	33
3	Maharashtra	WAINGANGA	PAUNI	27.07.03	2400	29.07.03	0800	32

The "Maximum Water Levels attained and Forecasting Performance of each forecasting site located in the state of Maharashtra, during the flood season 2003" are shown in the Table-9.10.

5.11 ORISSA

In the state of Orissa, there were 11 flood forecasting sites in 2003, which includes 01 inflow forecasting site i.e. Hirakud Dam on the main river Mahanadi.

5.11.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

No unprecedented flood events were observed at any flood forecasting sites located on any river in the state of Orissa, during the period under report.

However, at one site, namely, Alipingal Devi on the Devi, a major bifurcatory of the Mahanada in the delta region, a flood of magnitude equal to the highest flood level (HFL) recorded so far was experienced in 2003.

The period of the flood equal to the HFL is shown in the following table.

S. No.	State	River	F.F. Site	Periods of Flood equal to HFL				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Orissa	MAHANADI	ALIPINGAL DEVI	30.08.03	1400	30.08.03	1700	3

5.11.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS

The high flood events were observed at 02 level flood forecasting sites, both located on the Mahanadi (one on the main channel and other on bifurcatory, the Devi, in the delta region) in the state of Orissa, during the period under report.

The periods of the high floods are shown in the following table.

S. No.	State	River	F.F. Site	Periods of high Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	
1	Orissa	MAHANADI	ALIPINGAL DEVI	30.08.03	0400	02.09.03	0800	76
2	Orissa	MAHANADI	NIMAPARA	30.08.03	1400	31.08.03	1300	23
				01.09.03	0300	02.09.03	1200	33

5.11.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

The moderate flood events were observed at 08 level flood forecasting sites, both located on the Mahanadi (one on the main channel and other on bifurcatory, the Devi, in the delta region) in the state of Orissa, during the period under report.

The periods of the moderate floods are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Orissa	BURHABALANG	N.H.-5 RD.BRIDGE	08.10.03	0100	08.10.03	1300	12
2	Orissa	BAITARANI	ANANDPUR	08.10.03	1800	08.10.03	2000	2
3	Orissa	BAITARANI	AKHUAPADA	21.06.03	100	21.06.03	1600	6
				31.07.03	1600	02.08.03	1000	42
				07.10.03	2200	10.10.03	2200	72
4	Orissa	MAHANADI	ALIPINGAL DEVI	29.08.03	2100	05.09.03	1700	164
				09.09.03	1200	10.09.03	1900	31
5	Orissa	MAHANADI	NIMAPARA	30.08.03	0600	05.09.03	1800	156
6	Orissa	RUSHIKULIYA	PURUSHOTTAMPUR	07.10.03	0100	09.10.03	1000	57
7	Orissa	VAMSADHARA	GUNUPUR	06.09.03	0500	06.09.03	2400	19
				07.10.03	0300	07.10.03	2000	17
8	Orissa	VAMSADHARA	KASHINAGAR	28.08.03	0600	28.08.03	0900	03
				06.09.03	0600	07.09.03	0700	25
				07.10.03	0200	08.10.03	0800	30

5.11.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

The low flood events, where river waters either touched or crossed the warning levels of the forecasting sites, were observed at 09 level flood forecasting sites in the state of Orissa, during the floods season 2003.

The periods of the low floods are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Orissa	SUBERNAREKHA	RAJGHAT	09.10.03	0800	10.10.03	1700	33
2	Orissa	BURHABALANG	N.H.-5 RD. BRIDGE	07.10.03	1200	11.10.03	0200	86
3	Orissa	BAITARANI	ANANDPUR	20.06.03	2400	21.06.03	0800	08
				31.07.03	1000	31.07.03	2200	12
				01.08.03	0400	01.08.03	1400	10
				08.10.03	0100	10.10.03	0400	51
4	Orissa	BRAHMANI	JENAPUR EXP. WAY	11.10.03	1000	12.10.03	0900	23
5	Orissa	MAHANADI	ALIPINGAL DEVI	29.08.03	1400	11.09.03	2300	321
6	Orissa	MAHANADI	NIMAPARA	29.08.03	2000	12.09.03	0300	319
7	Orissa	RUSHIKULIYA	PURUSHOTTAM -PUR	28.08.03	2000	29.08.03	1600	20
				06.10.03	2000	10.10.03	2300	99
8	Orissa	VAMSADHARA	GUNUPUR	28.08.03	0100	28.08.03	2100	20
				06.09.03	0300	07.09.03	1000	31
				06.10.03	2000	08.10.03	1200	40
9	Orissa	VAMSADHARA	KASHINAGAR	28.08.03	0400	31.08.03	1700	85
				02.09.03	1200	03.09.03	1700	29
				06.09.03	0300	09.09.03	2000	89
				14.09.03	0600	15.09.03	0100	19
				18.09.03	1800	19.09.03	1000	16
				20.09.03	2200	21.09.03	1000	12
				06.10.03	1600	13.10.03	2200	174

The maximum water levels attained and Forecasting Performance of each forecasting site located in the state of Orissa during the flood season 2003" are shown in the Table-9.11.

5.12 UTTARANCHAL

As already mentioned there were 03 forecasting sites during the flood season 2003, in the state of Uttaranchal, namely, Srinagar on the Alaknada, Rishikesh and Haridwar on the main Ganga. However, forecasts could not be issued for the first two sites as these sites were converted into forecasting sites during the 2003 flood season only. Forecasts were issued for the remaining site, Haridwar.

5.12.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

No unprecedented flood events were observed at the flood forecasting site Haridwar located on the Ganga in the state of Uttaranchal, during the period under report.

5.12.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS

No high flood event was observed at the flood forecasting Hardwar during the period under report in the state of Uttaranchal.

5.12.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

The moderate flood events were observed at the flood forecasting Hardwar during the period under report in the state of Uttaranchal.

The periods of the moderate floods are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	
1	Uttaranchal	GANGA	HARIDWAR	06.07.03	17	-	-	1
				27.08.03	18	27.08.03	19	1

5.12.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

The periods of low flood events were observed a number of times at the flood forecasting Hardwar located in the state of Uttaranchal, during the flood season 2003.

The "Maximum Water Levels attained and Forecasting Performance of each forecasting site located in the state of Uttaranchal during the flood season 2003" are shown in the Table-9.12.

The periods of the low floods are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Uttaranchal	GANGA	HARIDWAR	05.07.03	1200	05.07.03	2400	12
				01.08.03	0900	01.08.03	1400	05
				03.08.03	0700	03.08.03	2400	17
				04.08.03	0300	04.08.03	2000	17
				05.08.03	1300	05.08.03	1400	01
				06.08.03	1200	06.08.03	2200	10
				07.08.03	0900	07.08.03	2400	15
				08.08.03	0600	10.08.03	0300	45
				10.08.03	1000	11.08.03	1500	29
				11.08.03	1800	11.08.03	1900	01
				19.08.03	1600	19.08.03	2100	05
				20.08.03	0400	20.08.03	1500	11

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S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	Uttaranchal	GANGA	HARIDWAR	26.08.03	1900	-	-	01
				27.08.03	1100	28.03.03	2400	37
				29.08.03	0700	29.08.03	2100	14
				30.08.03	1600	-	-	01
				03.09.03	2300	04.09.03	0800	09

5.13 UTTAR PRADESH

There were 35 flood forecasting sites in the state of Uttar Pradesh, which includes one inflow forecasting sites. The flood situations as observed at the 34 level forecasting sites during the flood season 2003 is described as under. Out of 34 level forecasting sites, forecasts were issued only for 25 sites. No forecasts were issued for 9 sites as already reported earlier.

5.13.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

In Uttar Pradesh, the unprecedented flood events were observed only at one forecasting site, namely, Ballia on the main river Ganga during the period under report. The unprecedented flood period as monitored at these sites is shown in the table given below.

S. No.	State	River	F.F. Site	Periods of Unprecedented Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	U.P.	GANGA	BALLIA	11.09.03	2000	16.09.03	1300	113

5.13.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS

In Uttar Pradesh, the high flood events were observed only at 02 forecasting site, namely, Ballia on the main river Ganga and Khadda on the Gandak during the period under report. The high flood periods as monitored at these sites are shown in the table given below.

S. No.	State	River	F.F. Site	Periods of High Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	U.P.	GANGA	BALLIA	10.09.03	1300	11.09.03	1900	30
				16.09.03	1400	17.09.03	2200	32
2	U.P.	GANDAK	KHADDA	31.07.03	1900	01.08.03	0900	14

5.13.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

During the flood season 2003, the moderate flood events were experienced at 18 level forecasting sites located in Uttar Pradesh. The moderate flood periods as monitored at these sites are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in Hour
				From		To		
				Date	Hour	Date	Hour	
1	U.P.	GANGA	PHAPHAMUA	11.09.03	1200	14.09.03	0600	78
2	U.P.	GANGA	ALLAHABAD (CHHATNAG)	12.09.03	0300	13.09.03	1900	40
3	U.P.	GANGA	MIRZAP UR	12.09.03	0600	14.09.03	0400	46
4	U.P.	GANGA	VARANASI	11.09.03	1700	15.09.03	0700	86
5	U.P.	GANGA	GAZIPUR	10.09.03	0200	17.09.03	0300	169
6	U.P.	GANGA	BALLIA	24.08.03	2400	25.08.03	0500	5
				04.09.03	1400	10.09.03	1200	142
				17.09.03	2300	06.10.03	1300	446
7	U.P.	RAMGANGA	MURADABAD	13.07.03	0300	14.07.03	1000	31
8	U.P.	YAMUNA	CHILLAGHAT	11.09.03	1800	12.09.03	1200	18
9	U.P.	YAMUNA	NAINI	11.09.03	1500	14.09.03	0200	59
10	U.P.	BETWA	MOHANA	10.09.03	2000	11.09.03	1100	15
11	U.P.	KEN	BANDA	30.08.03	2200	31.08.03	2400	26
				08.09.03	1800	12.09.03	0800	86
				16.09.03	1400	17.09.03	0400	14
12	U.P.	SAI	RAE-BAREILLY	15.09.03	15	03.10.03	0300	420
13	U.P.	GHAGHRA	ELGIN BRIDGE	12.07.03	1200	14.07.03	1700	53
				19.08.03	1900	01.09.03	2000	313
				03.09.03	2100	08.09.03	1500	114
				17.09.03	0300	21.09.03	1900	112
				24.09.03	1100	28.09.03	1700	102
14	U.P.	GHAGHRA	AYODHYA	13.07.03	1000	15.07.03	2400	62
				22.07.03	0100	23.07.03	1700	40
				02.08.03	0100	08.08.03	1900	162
				11.08.03	2000	14.08.03	1700	69
				18.08.03	1800	10.09.03	0500	491
				17.09.03	1300	30.09.03	0500	904
15	U.P.	GHAGHRA	TURTIPAR	14.07.03	1300	17.07.03	0800	67
				22.07.03	1300	25.07.03	2000	79
				03.08.00	1500	07.08.03	1800	99
				14.08.03	0100	16.08.03	2000	67
				19.08.03	2300	13.09.03	1300	590
				18.09.03	0600	02.10.03	2200	304
16	U.P.	RAPTI	BANSI	22.08.03	1600	25.08.03	0300	59
17	U.P.	RAPTI	GORAKHPUR (BIRGDHAT)	22.08.03	0600	29.08.03	1400	176
18	U.P.	GANDAK	KHADDA	30.06.03	0500	30.06.03	0900	4
				30.06.03	2000	01.07.03	2300	27
				04.07.03	0300	05.07.03	0600	27
				08.07.03	2100	11.07.03	1600	67
				20.07.03	0500	25.07.03	2200	137
				31.07.03	0200	02.08.03	0700	53
				16.08.03	1400	16.08.03	1800	4
				18.08.03	1000	21.08.03	2300	85
				02.09.03	1600	03.09.03	0200	10

5.13.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

During the flood season 2003, the low flood events i.e. touching or crossing the warning level at the forecasting sites, were experienced at 18 level forecasting sites in the state. The low flood periods as observed at these sites are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
1	U.P.	GANGA	KANNAUJ **	14.08.03	0300	20.08.03	0700	148
				22.08.03	1900	28.08.03	1700	142
				02.09.03	1100	24.09.03	0500	522
				27.09.03	0700	02.10.03	1600	129
2	U.P.	GANGA	ANKINGHAT	14.08.03	0500	17.08.03	2200	89
				23.08.03	0700	27.08.03	2000	109
				02.09.03	2100	14.09.03	2400	291
				16.09.03	1600	23.09.03	0800	160
3	U.P.	GANGA	KANPUR	29.09.03	1100	30.09.03	2000	33
				12.08.03	2000	21.08.03	1900	215
				23.08.03	0400	28.08.03	1600	132
				02.09.03	1700	02.10.03	2400	727
4	U.P.	GANGA	DALMAU	24.08.03	0700	28.08.03	2000	109
				03.09.03	2300	14.09.03	2200	335
				15.09.03	0100	26.09.03	1300	276
				28.09.03	0700	02.10.03	1800	107
5	U.P.	GANGA	PHAPHAMUA	10.09.03	1800	11.09.03	1100	17
				14.09.03	0700	14.09.03	2300	16
6	U.P.	GANGA	ALLAHABAD (CHHATNAG)	11.09.03	0800	12.09.03	0200	18
				13.09.03	2000	14.09.03	1100	15
7	U.P.	GANGA	MIRZAPUR	11.09.03	0600	12.09.03	0500	23
				14.09.03	0500	14.09.03	2300	18
8	U.P.	GANGA	VARANASI	10.09.03	1000	11.09.03	1600	30
				15.09.03	0800	16.09.03	0600	22
9	U.P.	GANGA	GAZIPUR	05.09.03	1900	10.09.03	0100	102
				17.09.03	0400	29.09.03	0600	290
				01.10.03	0200	04.10.03	2400	94
10	U.P.	GANGA	BALLIA	18.08.03	0500	20.08.03	2300	66
				25.08.03	0600	30.08.03	1300	127
				03.09.03	0900	04.09.03	1300	28
				06.10.03	1400	09.10.03	0600	64
11	U.P.	RAMGANGA	MURADABAD	12.07.03	1000	15.07.03	1900	81
				01.08.03	2000	03.08.03	0300	31
				21.08.03	0200	21.08.03	2400	22
				24.09.03	1600	26.09.03	2200	54
12	U.P.	YAMUNA	MAWI	04.08.03	0500	07.08.03	0100	68
				09.08.03	0300	10.08.03	1900	40
13	U.P.	YAMUNA	MATHURA	06.08.03	2000	22.08.03	0500	369
				23.08.03	2400	25.08.03	1200	36
				07.09.03	0800	20.09.03	0800	312
14	U.P.	YAMUNA	CHILLAGHAT	11.09.03	0900	11.09.03	1700	9
				12.09.03	1300	12.09.03	2300	10
15	U.P.	YAMUNA	NAINI	10.09.03	2100	11.09.03	1400	17
				14.09.03	0300	14.09.03	1800	15

Table continued to next page

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S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
16	U.P.	BETWA	MOHANA	10.09.03	1700	10.09.03	1900	2
				11.09.03	1200	11.09.03	1600	4
17	U.P.	KEN	BANDA	30.08.03	1900	30.08.03	2100	2
				01.09.03	0100	01.09.03	0500	4
				08.09.03	0700	08.09.03	1700	10
				12.09.03	0900	12.09.03	1300	04
				16.09.03	0300	16.09.03	1300	10
				17.09.03	0500	17.09.03	1500	10
18	U.P.	SAI	RAE-BAREILLY	06.09.03	13	05.10.03	24	707
19	U.P.	GHAGHRA	ELGIN BRIDGE	07.07.03	0700	09.07.03	0800	49
				10.07.03	2200	05.10.03	0100	2067
20	U.P.	GHAGHRA	AYODHYA	07.07.03	2000	06.10.03	1400	2178
21	U.P.	GHAGHRA	TURTIPAR	09.07.03	1700	08.10.03	1500	2182
22	U.P.	RAPTI	BALRAM PUR	22.07.03	0600	22.07.03	2300	17
				02.08.03	0200	04.08.03	1500	61
				13.08.03	1600	15.08.03	1200	44
				19.08.03	1600	25.08.03	0300	131
				06.09.03	2100	08.09.03	1200	39
				23.09.03	0900	26.09.03	2400	87
23	U.P.	RAPTI	BANSI	04.08.03	0500	04.08.03	2200	17
				20.08.03	0200	27.08.03	1100	177
				07.09.03	1800	09.09.03	1500	45
				24.09.03	0600	28.09.03	1900	109
24	U.P.	RAPTI	GORAKHPUR (BIRGHAT)	07.07.03	0200	08.07.03	1300	35
				23.07.03	1400	25.07.03	0300	37
				20.08.03	1100	31.08.03	2000	273
25	U.P.	GANDAK	KHADDA	22.06.03	0900	02.10.03	1400	2453

As mentioned already, no forecasts were issued for the sites Moradabad and Bareilly since these sites were converted into new forecasting sites during the flood season 2003 itself. However, on the other hand, though no low flood situation was experienced at the site Kanpur i.e. water level did not touch the warning stage of this site, yet forecasts were issued on demand of the state agencies. In all forecasts were issued for 24 sites in the state including one inflow forecasting site, the Narora barrage on the main Ganga.

The "Maximum Water Levels attained and Forecasting Performance of each forecasting site located in the state of Uttar Pradesh, during the flood season 2003" are shown in the Table-9.13.

5.14 WEST BENGAL

In the state of West Bengal, there were 14 flood forecasting sites, which include 03 inflow forecasting sites during the flood season 2003. No forecasts were issued at 03 sites during the period under report.

5.14.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

No unprecedented flood events were observed at any flood forecasting in the state of West Bengal in 2003 flood season.

5.14.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS

High flood events were observed at 02 flood forecasting sites in the state of West Bengal during the flood season 2003.

The periods of the high floods are shown in the following table.

S. No.	State	River	F.F. Site	Periods of High Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
1	West Bengal	JALDHAKA	MATHABHANGA	01.07.03	1400	01.07.03	2200	8
				08.07.03	2100	08.07.03	2300	2
2	West Bengal	TISTA	MEKHLIGANJ	08.07.03	1700	09.07.03	0600	13

5.14.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

During 2003 flood season, moderate flood events were experienced at 05 level forecasting sites, one on the main Ganga and remaining on the tributaries/ sub-tributaries of the Brahmaputra, in the state of West Bengal.

The periods of the moderate floods are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Moderate Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
1	West Bengal	GANGA	FARAKKA	03.08.03	2200	11.08.03	1900	189
				17.08.03	1100	12.10.03	1700	1350
2	West Bengal	TORSA	GHUGHUMARI	01.07.03	1900	02.07.03	0100	6
3	West Bengal	JALDHAKA	MATHABHANGA	01.07.03	1300	01.07.03	2400	11
				04.07.03	1400	05.07.03	0500	15
				08.07.03	1600	09.07.03	0400	12
				09.07.03	1700	10.07.03	0700	14
4	West Bengal	TISTA	DOMOHANI RD. BRIDGE	01.07.03	1100	01.07.03	1800	7
				08.07.03	1200	08.07.03	2300	11
5	West Bengal	TISTA	MEKHLIGANJ	08.07.03	1700	09.07.03	0600	13

5.14.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

During 2003 flood season, low flood events were experienced at 09 level forecasting sites, one each on the main Ganga and its tributary and remaining on the tributaries/ sub-tributaries of the Brahmaputra, in the state of West Bengal.

The periods of the low floods are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
1	West Bengal	GANGA	FARAKKA	11.07.03	1300	16.10.03	1200	2327
2	West Bengal	AJOY	GHEROPARA	10.10.03	0800	10.10.03	2100	13
3	West Bengal	RAIDAK – I	TUFANGANJ	04.07.03	0600	06.07.03	0700	49
				07.07.03	1200	11.07.03	2300	107
				13.07.03	0600	14.07.03	2100	39
4	West Bengal	TORSA	GHUGHUMARI	01.07.03	1000	02.07.03	2100	35
				04.07.03	0900	05.07.03	0400	19
				08.07.03	1300	10.07.03	1500	50
5	West Bengal	JALDHAKA	N.H. 31 ROAD BRIDGE	01.07.03	0700	01.07.03	1900	12
				08.07.03	1000	09.07.03	0500	17
				09.07.03	0700	09.07.03	1900	12
6	West Bengal	JALDHAKA	MATHABHANGA	01.07.03	1200	02.07.03	0300	15
				04.07.01	1100	05.07.03	1200	25
				08.07.03	1500	10.07.03	1900	51
7	West Bengal	TISTA	DOMOHANI RD. BRIDGE	23.06.03	2400	24.06.03	0300	3
				27.06.03	1200	27.06.03	1500	3
				30.06.03	0600	30.06.03	2100	15
				01.07.03	0700	01.07.03	2400	17
				04.07.03	1100	04.07.03	1900	8
				08.07.03	1000	09.07.03	0500	19
				09.07.03	2000	10.07.03	0400	8
8	West Bengal	TISTA	MEKHLIGANJ	27.06.03	1800	27.06.03	1800	1
				30.06.03	1600	30.06.03	2100	5
				01.07.03	1200	02.07.03	0600	18
				04.07.03	1200	04.07.03	2100	9
				08.07.03	1300	09.07.03	1100	22
				09.07.03	1300	10.07.03	1300	24

The maximum water levels attained and Forecasting Performance of each forecasting site located in the state of West Bengal, during the flood season 2003" are shown in the Table-9.14.

5.15 DADRA & NAGAR HAVELI

In the Union territory of Dadra and Nagar Haveli, there were 02 flood forecasting sites, one level forecasting site and other inflow forecasting site, in 2003 flood season.

No flood forecasts were issued for the lone level forecasting sites during the flood season 2003. in the Union Territory of Dadra and Nagar Haveli.

The maximum water levels attained and Forecasting Performance of each forecasting site located in the state of Dadra & Nagar Haveli, during the flood season 2003" are shown in the Table-9.15.

5.16 NCT OF DELHI

There are 02 flood forecasting sites in the National Capital Territory of Delhi (NCT of Delhi), namely, Delhi Railway Bridge on the Yamuna and Dhansa Regulator at Delhi and Haryana boarder on the Sahibi, a tributary of Yamuna which is commonly known by name of Nazafgarh drain within Delhi town.

Both the sites cited above are level forecasting sites. Forecasts were issued only for the first site during the flood season 2003. For Dhansa Regulator no forecasts have been issued during the period under report. As a matter of fact, no forecast has been issued for this site since 1998. Delhi Railway Bridge is the oldest flood forecasting site of the Flood Forecasting and warning Network of CWC.

5.16.1 DETAILS OF THE PERIODS OF UNPRECEDENTED FLOOD EVENTS

During 2003 flood season, no unprecedented flood event was experienced at Delhi Railway Bridge site in the NCT of Delhi:

5.16.2 DETAILS OF THE PERIODS OF HIGH FLOOD EVENTS

In 2003 flood season, no high flood event was experienced in the NCT of Delhi:

5.16.3 DETAILS OF THE PERIODS OF MODERATE FLOOD EVENTS

In 2003, no moderate flood event was experienced at Delhi Railway Bridge site in the NCT of Delhi.

5.16.4 DETAILS OF THE PERIODS OF LOW FLOOD EVENTS

During the flood season 2003, only low flood situations were experienced at Delhi Railway Bridge located in the NCT of Delhi.

The low flood periods observed in NCT of Delhi are shown in the following table.

S. No.	State	River	F.F. Site	Periods of Low Floods				Total Period in
				From		To		
				Date	Hour	Date	Hour	Hour
1	NCT of Delhi	YAMUNA	DELHI RLY BRIDGE	05.08.03	0200	08.08.03	2000	90
				09.08.03	2200	11.08.03	1500	41

The maximum water levels attained and Forecasting Performance of each forecasting site located in NCT of Delhi, during the flood season 2003" are shown in the Table-9.16.

5.17 SUMMARY

A state-wise summary showing the total flood forecasting sites which were operational during the flood season 2003, number of sites where no forecasts were issued during the period under report, their relative percentage value compared with all India total and their forecasts performances are given in the following table.

State Codes/ S.No.	Name of State / Union Territory	Total No. of FF sites in the state/UT	No. of FF sites where no forecast was issued	Total no. of forecasts issued	Relative %age of forecasts issued with respect to All India Total	No. of forecasts within +/- 15 cm or +/- 20% cumecs	%age Accuracy
1	Andhra Pradesh	15	7	62	0.94	53	85.48
2	Assam	23	1	2513	38.08	2434	96.86
3	Bihar	32	0	1997	30.26	1958	98.05
4	Chhatisgarh	1	0	47	0.71	44	93.62
5	Gujarat	10	7	82	1.24	82	100.00
6	Haryana	1	1	0	0.00	0	--
7	Jharkhand	4	0	174	2.64	171	98.28
8	Karnataka	4	1	64	0.97	57	89.06
9	Madhya Pradesh	2	1	2	0.03	2	100.00
10	Maharashtra	7	3	31	0.47	26	83.87
11	Orissa	11	0	304	4.61	287	94.41
12	Uttaranchal	3	2	27	0.41	27	100.00
13	Uttar Pradesh	35	9	1017	15.41	957	94.10
14	West Bengal	14	3	266	4.03	259	97.37
15	Dadra & Nagar Haveli	2	1	7	0.11	7	100.00
16	NCT Delhi	2	1	7	0.11	4	57.14
	Total	166	37	6600	100.00	6368	96.48

A state-wise comparative statement showing flood forecasting performance from 1996 to 2003 is given in Table-10.

CHAPTER - 6

RESPONSE FROM USER AGENCIES

6.0 GENERAL

As already mentioned, the Central Water Commission basically does the Flood Forecasting and Warning job on flood prone inter-state river basins in the country. It issues the forecast to its users such as various departments of the state and Central Governments including Civil and Engineering authorities, Railway, Defence, Revenues authorities, Private Sector Undertakings besides National Disaster Management Cell in the Ministry of Home Affairs, who are responsible for taking timely flood fighting measures, rescue operations including shifting of flood affected people to safer places etc.

The various State Government agencies in-charge of the Flood Management and Relief operations continue to write to the Central Water Commission conveying their views on the usefulness of the flood forecasts received during the flood season by them.

Abstract of some of the messages received by our field unit during the flood season 2003 are given below.

6.1

O/o The Chief Engineer and Basin Manager,
Lower Mahanadi Basin,
Water Resources Department,
Bhubaneswar, Orissa

"I feel great to mention here that the availability of forecast for different rivers of the state in the form of hydro-meteorological information and flood forecast etc. (round the clock) from pioneer organization CWC has made it possible time and again to overcome successfully the flood exigencies in time with better preparedness. As an active user of online data and forecasts of CWC. I do express my deep thanks and gratitude to the CWC organization".

Sd/
Chief Engineer and Basin Manager

6.2

O/o the Executive Engineer,
Irrigation Division, Balasore

"This division was able to keep inform the people of lower areas as well as the field staff associated with flood protection. As a result of which the field officer were able to take flood relief measures before flood, as and when required."

Sd/
Executive Engineer

6.3

O/o the Collector and District magistrate,
Mayurbhanj, Orissa.

"The flood forecasting reports have been received in time from the site in-charge, Podaastia and communicated to the subordinate officers for taking appropriate flood fighting measures and for arranging adequate relief measures to the affected area of the district. The usefulness of these forecast reports can hardly be overstated."

Sd/
Collector and District magistrate,

6.4

Office of the Engineer-in-Chief (Irrigation),
I& CAD Department,
Errum Manzil, Hyderabad

"The information published by Central Water Commission (Krishna Basin) Hyderabad Unit in respect of real time and forecast in Krishna Basin is every useful in monitoring the floods and water resources of the various reservoirs and also very helpful during review meetings of high level coordination Committee of Flood Management being held by Principal Secretary to Government during flood season".

Sd/
Engineer-in-Chief (Irrigation)

6.5

Office of the Superintending Engineer,
Mahi Irrigation Circle, Nadiad:

"During monsoon period, CWC has rendered excellent service by conveying very useful information and forecast about the levels, storage, inflow and outflow through their wireless station situated at Nadiad which enable the focal officer to send information to the people through local authority (revenue and other local Government authorities) for taking necessary action in time".

Sd/
Superintending Engineer

6.6

Office of the Superintending Engineer,
Irrigation Project Circle, Ahmedabad,

"Based on the advance messages/warnings it becomes possible for us, who are in-charge of controlling system, to make advanced arrangements for reservoir operation, advance warning to the people likely to be effected etc. particularly in Ahmedabad city and downstream of low lying areas".

Sd/
Superintending Engineer

6.7

Office of the Superintending Engineer,
Irrigation Project Circle, Palanpur

"The flood forecasting system is required to be continued in the interest of Dam Safety"

Sd/
Superintending Engineer

6.8

Office of the collector,
Valsad

"During the monsoon period of year 2003 no damage is occurred to Valsad district, due to timely forecast, preventive measures suggested by your office and constant touch has resulted in keeping the district floodless".

Sd/
Collector, Valsad

6.9

O/o the Executive Engineer,
Irrigation Division, Jalgaon

"Information regarding inflow forecast of Hatnur Dam is regularly supplied by CWC's unit. On this basis we can pass flood gradually through the weir during monsoon 2003. Due to this forecast gate operation can be done in time, so as to release moderate flood or to maintain inflow and outflow as required. Hence no damage are observed during monsoon 2003".

Sd/
Executive Engineer

6.10

O/o the Executive Engineer,
Ukai Division No. 1, Ukai

"The flood forecast service rendered by Tapi Division CWC Surat in respect of Ukai Project was very much useful for reservoir operation during monsoon 2003. The forecasts were found well in time with 95% accuracy. Accordingly it helped us considerably in planning of reservoir storage and hence optimum utilization of water in hydropower generation and irrigation requirements"

Sd/
Executive Engineer

6.11

Office of the Superintending Engineer,
Surat Irrigation Circle, Surat
(Focal Officer for Tapi Basin)

"This year every district of Gujarat experienced timely and sufficient rainfall. This year in first week of September the situation of flood arose for short duration. During the critical period the CWC authority communicated the flood forecasts/ flood warning well in time to every concerned department. So that it become possible to tackle the situation amicably by releasing moderate flow from Ukai reservoir. Severe flood situation was averted. Thus the flood forecast delivered by CWC Division Surat during recent monsoon 2003 found timely, satisfactory and useful".

Sd/
Superintending Engineer

6.12

O/o The Collectorate,
Bharuch

"The flood forecasting services rendered by CWC were very much useful to us for taking precautionary measures in minimizing the damage to the public and private properties, live stock and human lives, even though there were no heavy floods in river Narmada during 2003."

Sd/
Collector, Bharuch

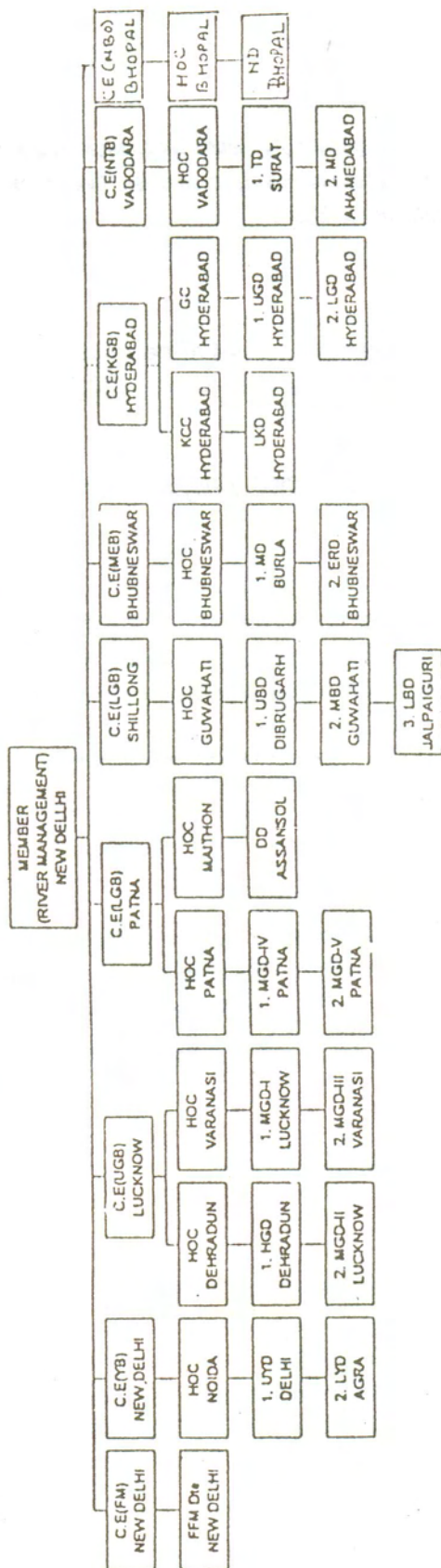
6.13

Office of the Superintending Engineer,
Damanganga Project Circle,
Valsad.

"The flood forecasting services rendered by CWC during monsoon 2003, was very much useful to the Damanganga Reservoir Project."

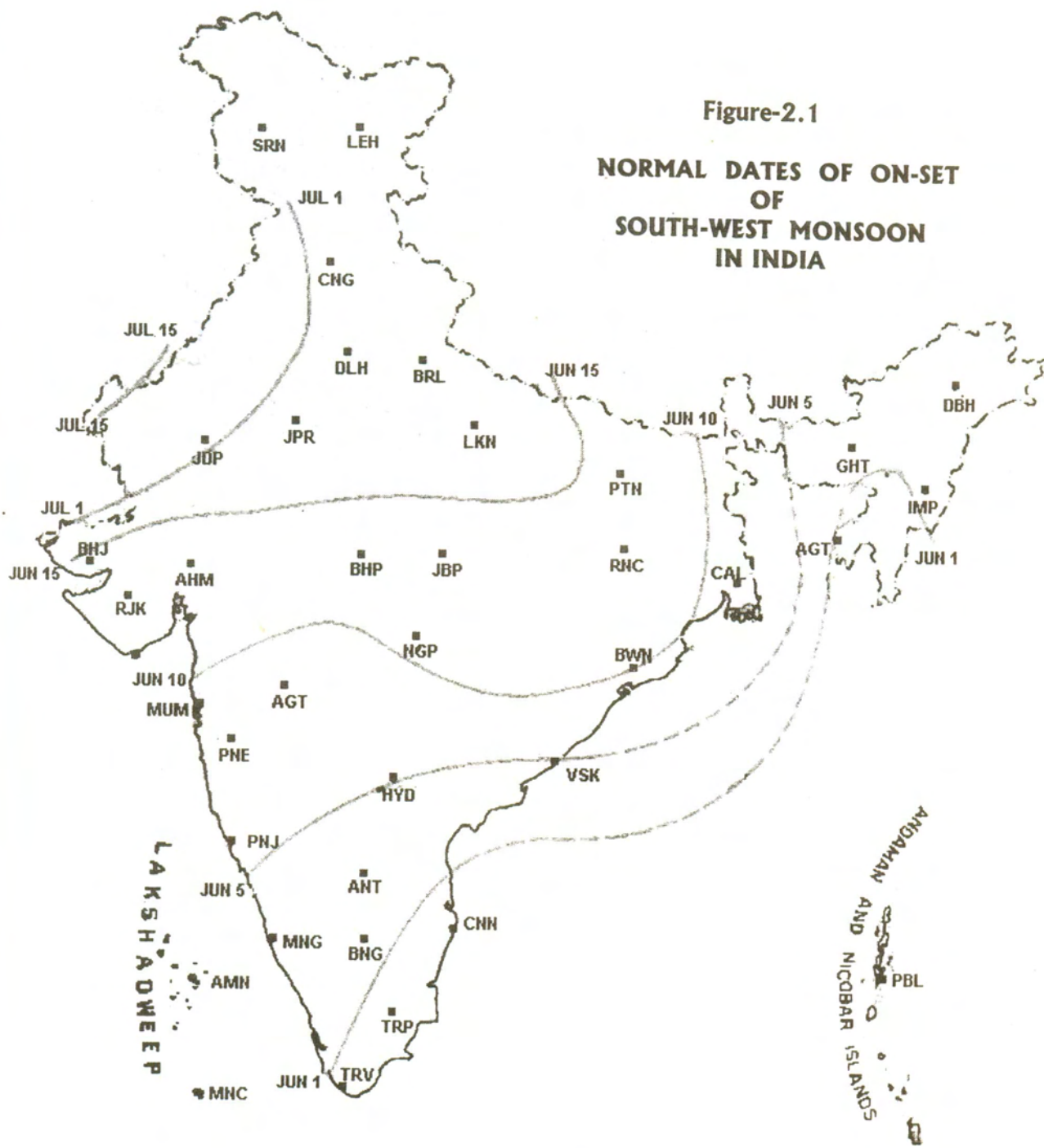
Sd/
Superintending Engineer

ORGANISATIONAL CHART OF FLOOD FORECASTING & WARNING SET UP
OF
CENTRAL WATER COMMISSION



CHIEF ENGG. OFFICES	= 9
DIRECTORATE	= 1
CIRCLE OFFICES	= 11
DIVISION OFFICES	= 20

Figure-2.1
**NORMAL DATES OF ON-SET
 OF
 SOUTH-WEST MONSOON
 IN INDIA**



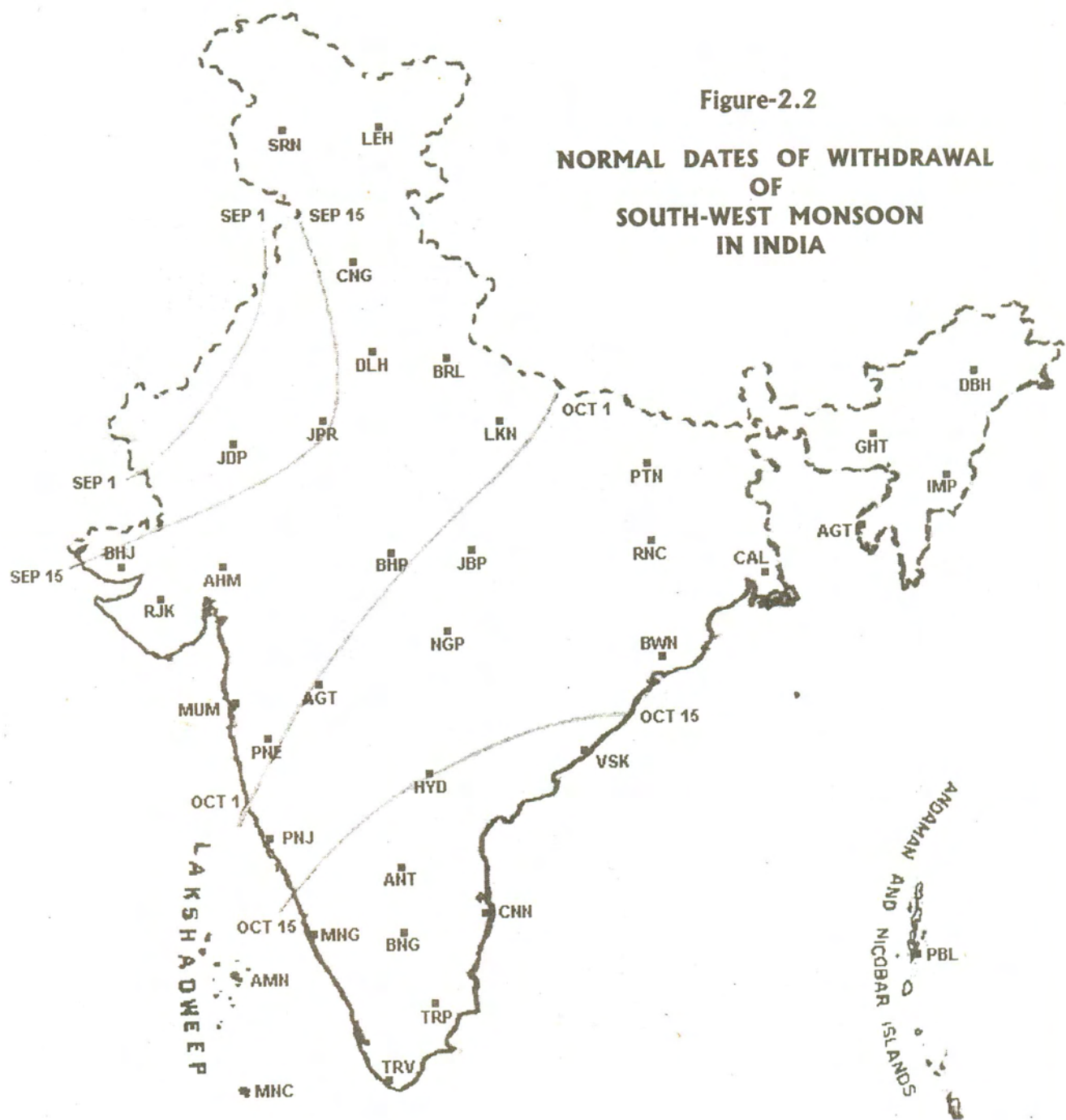
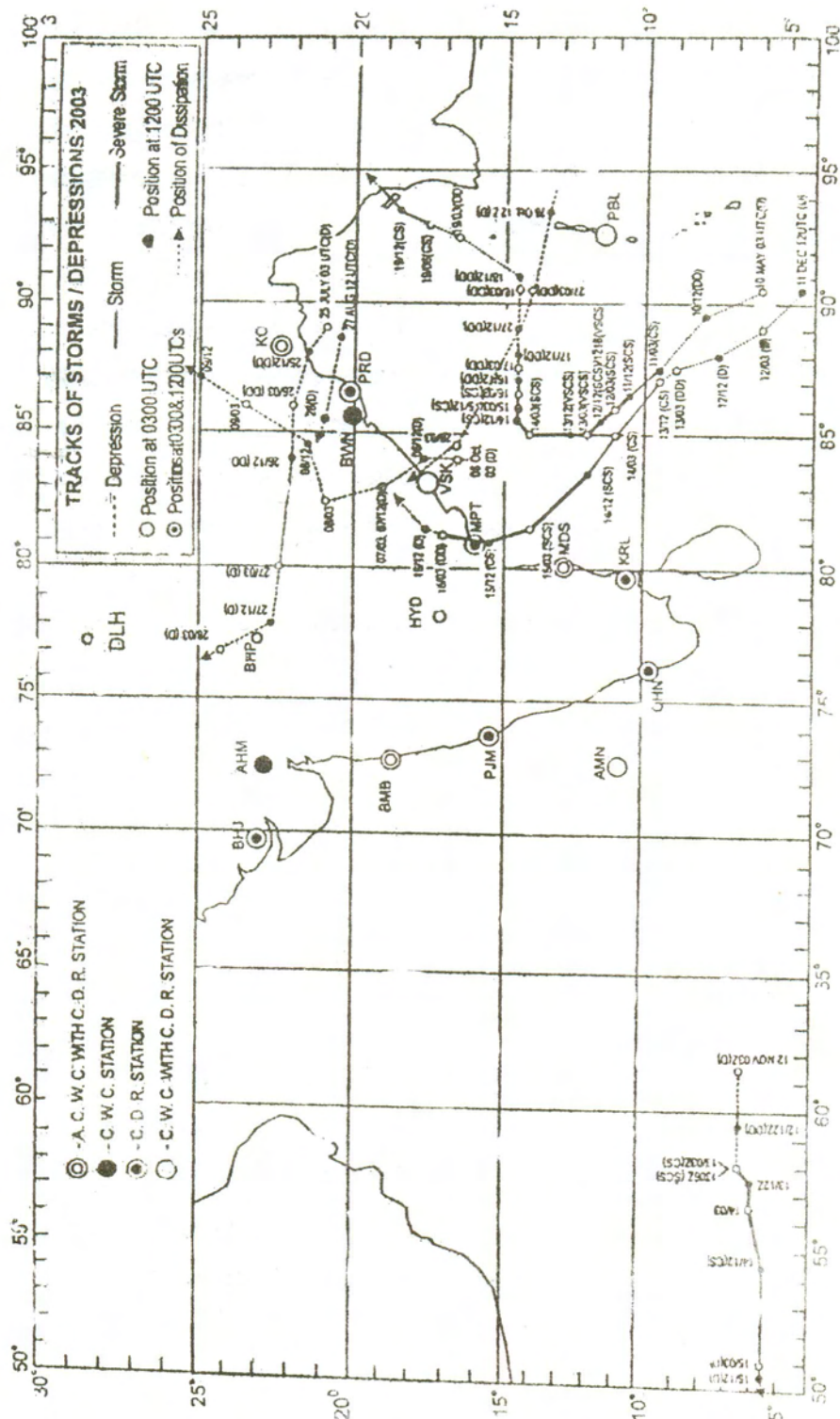


Figure No.2.3



Courtesy: India Meteorological Department

Fig. 3.1

FLOOD FORECASTING PERFORMANCE (FROM 1978 - 2003)

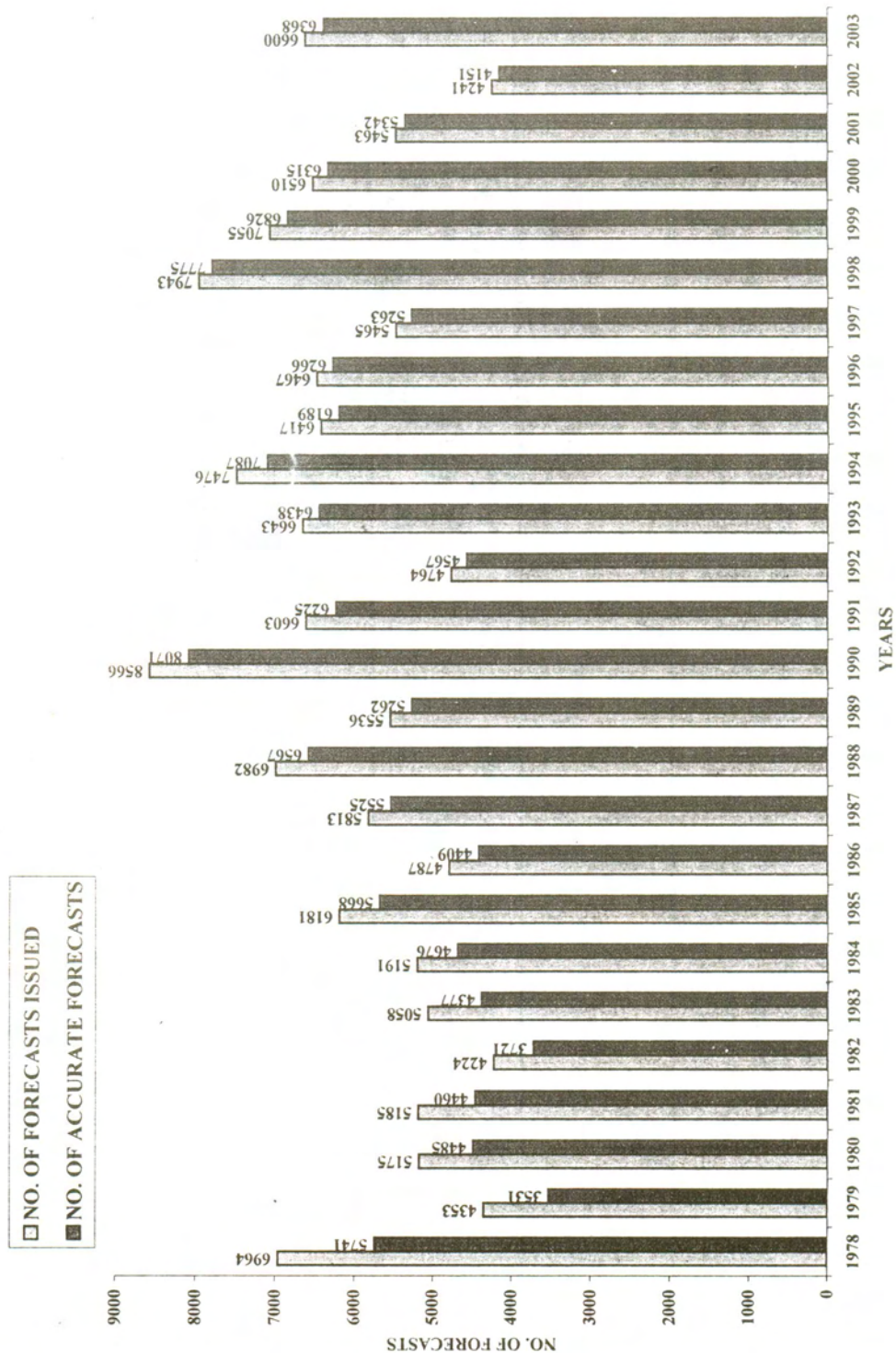


Fig. 3.2

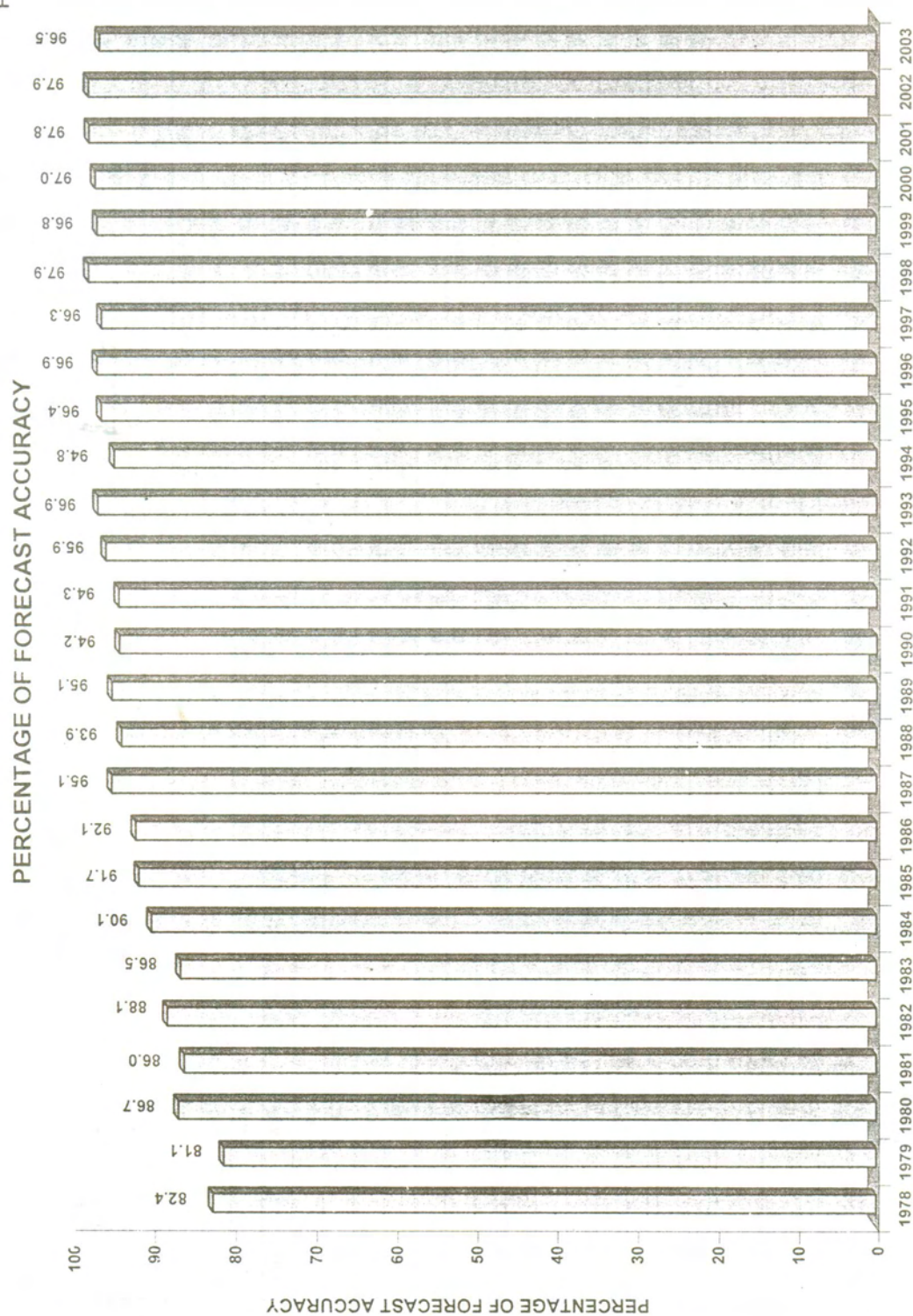


TABLE-1 Flood Forecasting Performance (River-wise) at various Forecasting Stations between 01.5.2003 and 31.10.2003 during the Flood Season 2003

S.No.	Name of Rivers	Name of FF sites	Name of State	Warning Level in m	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level (m)	Date	No of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Ganga	Rishikesh	Uttaranchal	339.50	340.50	341.72	1995			0	0	0.00
2	Ganga	Haridwar	Uttaranchal	293.00	294.00	296.23	3.9.78	294.22	5.7.03	27	27	100.00
3	Ganga	*Narora Barrage (U/S)	Uttar Pradesh	PL	180.79	180.18	1978	179.08	15.06.03 to 08.10.03	86	85	98.84
4	Ganga	Kannauj	Uttar Pradesh	124.90	125.97	126.24	29.8.98			0	0	0.00
5	Ganga	Aunghat	Uttar Pradesh	123.00	124.00	124.31	09.09.1978	123.50	17.09.03	30	30	100.00
6	Ganga	Kanpur	Uttar Pradesh	113.00	114.00	113.47	02.09.1987	112.96	18.09.03	45	45	100.00
7	Ganga	Dalmai	Uttar Pradesh	98.36	99.36	99.84	03.08.1973	99.18	22.09.03	39	38	97.44
8	Ganga	Piphamau	Uttar Pradesh	83.73	84.73	87.98	08.09.1978	85.98	12.09.03	5	5	100.00
9	Ganga	Allahabad (Chhatnag)	Uttar Pradesh	83.73	84.73	88.39	1948	85.18	12.09.03	4	4	100.00
10	Ganga	Mirzapur	Uttar Pradesh	76.72	77.72	80.34	09.09.1978	78.26	13.09.03	4	4	100.00
11	Ganga	Varanasi	Uttar Pradesh	70.26	71.26	73.90	09.09.1978	72.13	13.09.03	6	5	83.33
12	Ganga	Ghazipur	Uttar Pradesh	62.11	63.11	65.22	09.09.1978	64.75	14.09.03	27	26	96.30
13	Ganga	Buxar	Bihar	59.32	60.32	62.09	1948	61.12	14.09.03	28	27	96.43
14	Ganga	Ballia	Uttar Pradesh	56.62	57.62	59.92	03.09.1982	60.25	14.09.03	49	49	100.00
15	Ganga	Patna (Dighaghat)	Bihar	49.45	50.45	52.52	23.08.1975	51.33	11.09.03	39	38	97.44
16	Ganga	Patna (Gandhighat)	Bihar	47.60	48.60	50.27	14.08.1994	50.12	11.09.03	58	54	93.10
17	Ganga	Hathidah	Bihar	40.76	41.76	43.15	07.08.1971	42.71	11/15.09.03	52	52	100.00
18	Ganga	Munger	Bihar	38.33	39.33	40.99	19.09.1976	39.14	14/17.09.03	17	17	100.00
19	Ganga	Bhagalpur	Bihar	32.68	33.68	34.18	19.08.1978	34.20	17.09.03	44	44	100.00
20	Ganga	Colgong/ Kahalgaon	Bihar	30.09	31.09	32.84	06.09.1998	32.87	17/18.09.03	74	73	98.65
21	Ganga	Farakka	West Bengal	21.25	22.25	25.14	07.09.1998	24.52	18/19.09.03	98	98	100.00
22	Alaknanda	Srinagar	Uttaranchal	539.00	540.00	536.85	1995			0	0	0.00
23	Ramganga	Moradabad	Uttar Pradesh	189.60	190.60	192.68	3.9.78			0	0	0.00
24	Ramganga	Bareilly	Uttar Pradesh	162.70	163.70	162.88	6.8.78			0	0	0.00
25	Yamuna	*Tajewala Weir	Haryana	PL	323.70	328.27	03.09.1978	n.a.	n.a.	0	0	0
26	Yamuna	Mawi	Uttar Pradesh	230.00	230.85	232.45	1988	230.42	5.8.03	5	5	100.00
27	Yamuna	Delhi Rly Bridge	NCT Delhi	204.00	204.83	207.49	1978	204.60	6.8.03	7	4	57.14

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1	2	3	4	5	6	7	8	9	10	11	12	13
28	Yamuna	Mathura	Uttar Pradesh	164.20	165.20	169.73	1978	164.84	8.8.03	26	21	80.77
29	Yamuna	Agra	Uttar Pradesh	151.40	152.40	154.76	09.09.1978	149.71	11.09.03	111	84	75.68
30	Yamuna	Etawa	Uttar Pradesh	120.92	121.92	126.13	11.09.1978	119.21	07.09.03	0	0	0
31	Yamuna	Auraiya	Uttar Pradesh	112.00	113.00	118.19	25.08.1996	106.25	12.09.03	0	0	0
32	Yamuna	Kalpi	Uttar Pradesh	107.00	108.00	112.98	25.08.1990	103.55	12.09.03	0	0	0
33	Yamuna	Hamirpur	Uttar Pradesh	102.63	103.63	108.59	12.09.1983	102.19	12.09.03	0	0	0
34	Yamuna	Chilghat	Uttar Pradesh	99.00	100.00	105.16	06.09.1978	100.35	11.09.03	3	1	33.33
35	Yamuna	Naini	Uttar Pradesh	83.73	84.74	87.99	08.09.1978	85.64	12.09.03	7	5	71.43
36	Sahibi	Dhansa Regulator	NCT Delhi	211.44	212.44	213.58	1977	209.90	4.8.03	0	0	0.00
37	Betwa	Mohana	Uttar Pradesh	121.66	122.66	133.69	11.09.1983	123.34	11.09.03	2	2	100.00
38	Betwa	Sahjina	Uttar Pradesh	103.54	104.54	108.67	12.09.1983	103.33	11.09.03	1	1	100.00
39	Ken	Banda	Uttar Pradesh	103.00	104.00	113.28	14.09.1992	109.17	11.09.03	16	11	68.75
40	Gomati	Lucknow	Uttar Pradesh	108.50	109.50	110.85	10.09.1971	107.43	29.09.03	0	0	0
41	Gomati	(Hanuman setu)	Uttar Pradesh	73.07	74.07	77.74	22.09.1971	72.65	30.09.03	0	0	0
42	SAI	Rae- Bareilly	Uttar Pradesh	100.00	101.00	104.81	17.09.1982	101.72	29.06.03	30	29	96.67
43	Ghaghra	Elgin Bridge	Uttar Pradesh	105.07	106.07	107.18	14.09.1983	106.58	22.8.03	88	87	98.86
44	Ghaghra	Ayodhya	Uttar Pradesh	91.73	92.73	93.65	19.08.1998	93.35	24.8.03	90	89	98.89
45	Ghaghra	Turtipar	Uttar Pradesh	63.01	64.01	66.00	28.08.1998	65.01	25.8.03	91	89	97.80
46	Ghaghra	Darauli	Bihar	59.82	60.82	61.74	29.08.1998	61.20	26/27.08.03	79	79	100.00
47	Ghaghra	Gangpur Siwan	Bihar	56.04	57.04	58.01	18.09.1983	57.98	25/26.08.03	79	79	100.00
48	Ghaghra	Chhapra	Bihar	52.68	53.68	54.59	03.09.1982	54.15	10.09.03	24	24	100.00
49	Rapti	Balrampur	Uttar Pradesh	103.62	104.62	105.25	11.09.2000	104.31	22.08.03	17	17	100.00
50	Rapti	Bansi	Uttar Pradesh	83.90	84.90	85.82	21.08.1998	84.95	23.08.03	16	16	100.00
51	Rapti	Gorakhpur (Birdghat)	Uttar Pradesh	73.98	74.98	77.54	23.08.1998	75.89	25.08.03	15	15	100.00
52	Sone	Inderpuri	Bihar	107.20	108.20	108.85	23.08.1975	108.10	09.09.03	4	3	75.00
53	Sone	Kochwar	Bihar	54.52	55.52	58.88	20.07.1971	57.91	09.09.03	25	23	92.00
54	Sone	Maner	Bihar	51.00	52.00	53.79	10.09.1976	53.14	12/14.09.03	46	45	97.83
55	Punpun	Sripalpur	Bihar	49.60	50.60	53.91	18.09.1976	53.05	19.08.03	51	49	96.08

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1	2	3	4	5	6	7	8	9	10	11	12	13
56	Gandak	Khadda	Uttar Pradesh	95.00	96.00	97.50	23.07.2002	97.22	31.07.03	204	194	95.10
57	Gandak	Chatia	Bihar	68.15	69.15	70.04	06.07.2002	69.15	02.08.03	51	46	90.20
58	Gandak	Rewaghat	Bihar	53.41	54.41	55.41	17.09.1986	54.71	03/04.08.03	35	35	100.00
59	Gandak	Hazipur	Bihar	49.32	50.32	50.93	1948	50.50	10/11.09.03	25	25	100.00
60	Burhi Gandak	Lalbeghiaghat	Bihar	62.20	63.20	67.09	30.07.1975	63.43	07.07.03	26	22	84.62
61	Burhi Gandak	Muzaffarpur (Sikandarpur)	Bihar	51.53	52.53	54.29	15.08.1987	52.95	23.08.03	53	52	98.11
62	Burhi Gandak	Samastipur	Bihar	45.02	46.02	49.38	15.08.1987	47.26	25.08.03	70	68	97.14
63	Burhi Gandak	Rosera	Bihar	41.63	42.63	46.35	16.08.1987	44.47	25.08.03	75	72	96.00
64	Burhi Gandak	Khagaria	Bihar	35.58	36.58	39.22	1976	37.97	15.09.03	67	67	100.00
65	Bagmati	Benibad	Bihar	47.68	48.68	49.72	26.07.2002	49.35	03.08.03	114	112	98.25
66	Bagmati	Hayaghat	Bihar	44.72	45.72	48.96	14.08.1987	45.98	22.07.03	69	69	100.00
67	Adhwara Group	Kamtaul	Bihar	49.00	50.00	52.99	12.08.1987	50.70	30.06.03	64	62	96.88
68	Adhwara Group	Ekmighat	Bihar	45.94	46.94	49.27	14.08.1987	47.42	23.07.03	62	61	98.39
69	Kamia Balan	Jhanjharpur	Bihar	49.00	50.00	52.73	11.08.1987	52.00	10.07.03	118	114	96.61
70	Kosi	Basua	Bihar	46.75	47.75	48.76	21.07.1996	48.69	10.07.03	187	187	100.00
71	Kosi	Baltara	Bihar	32.85	33.85	36.40	15.08.1987	34.89	22.07.03	104	104	100.00
72	Kosi	Kursela	Bihar	29.00	30.00	32.04	06.09.1988	31.80	17.09.03	94	94	100.00
73	Mahananda	Dhengraghat	Bihar	34.65	35.65	38.09	1968	36.97	10.07.03	63	61	96.83
74	Mahananda	Jhawa	Bihar	30.40	31.40	33.51	14.08.1987	32.72	11.07.03	100	100	100.00
75	Mayurakshi	* Massanjore Dam	Jharkhand	FRL	121.31	122.71	21.09.2000	117.64	15.10.03	6	6	100.00
76	Mayurakshi	*Tilpara Barrage	West Bengal	PL	62.79	67.05	27.09.1978	62.76	11.10.03	6	6	100.00
77	Mayurakshi	Narayanpur	West Bengal	26.99	27.99	29.69	27.09.1995	25.80	10.10.03	0	0	0
78	Ajoy	Gheropara	West Bengal	38.42	39.42	43.94	27.09.1978	38.79	10.10.03	2	2	100.00
79	Damodar	*Tenughat Dam	Jharkhand	FRL	268.83	265.56	17.09.1989	261.70	09.10.03	30	30	100.00
80	Damodar	*Panchet Dam	Jharkhand	FRL	132.59	132.89	02.10.1959	128.45	11.10.03	76	75	98.68
81	Damodar	*Durgapur Barrage	West Bengal	PL	64.47	64.47	31.10.2002	64.47	Several	59	59	100.00
82	Barakar	*Maithon Dam	Jharkhand	FRL	150.88	151.79	02.10.1959	149.21	12.10.03	62	60	96.77
83	Mundeshwari	Harinkhola	West Bengal	11.80	12.80	14.58	20.09.1978	11.10	12.10.03	0	0	

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1	2	3	4	5	6	7	8	9	10	11	12	13
84	Kangsabati	*Kangsabati Dam	West Bengal	FRL	134.11	134.71	02.09.1978	127.37	15.10.03	14	10	71.43
85	Kangsabati	Mohanpur	West Bengal	24.73	25.73	29.87	02.09.1978	24.02	09.10.03	0	0	0
86	Brahmaputra	Dibrugarh	Assam	103.24	104.24	106.48	03.09.1998	105.95	08.07.03	284	282	99.30
87	Brahmaputra	Neamatighat	Assam	84.04	85.04	87.37	11.07.1991	86.60	09.07.03	109	108	99.08
88	Brahmaputra	Tejpur	Assam	64.23	65.23	66.59	27.08.1988	66.11	10.07.03	67	67	100.00
89	Brahmaputra	Guwahati	Assam	48.68	49.68	51.37	29.08.1988	50.99	13.07.03	89	75	84.27
90	Brahmaputra	Goalpara	Assam	35.27	36.27	37.43	31.07.1954	36.86	13.07.03	93	86	92.47
91	Brahmaputra	Dhubri	Assam	27.50	28.50	30.36	28.08.1988	29.77	14.07.03	233	233	100.00
92	Burhi -Dihing	Naharkatia	Assam	119.40	120.40	122.69	17.06.1973	119.36	10.07.03	0	0	0
93	Burhi -Dihing	Khowang	Assam	101.11	102.11	103.92	25.08.1988	103.88	10/11.07.03	39	36	92.31
94	Desang	Nanglamoraghat	Assam	93.46	94.46	96.49	06.09.1998	96.32	06/07.07.03	44	37	84.09
95	Dikhow	Sibsagar	Assam	91.40	92.40	95.62	08.07.1974	93.00	02/03.09.03	37	33	89.19
96	Subansiri	Badatighat	Assam	81.53	82.53	86.84	28.06.1972	83.30	10.07.03	54	54	100.00
97	Dhansiri	Golaghat	Assam	88.50	89.50	91.30	11.10.1986	90.10	13.10.03	67	65	97.01
98	Dhansiri	Numaligarh	Assam	76.42	77.42	79.87	24.09.1985	79.01	25.08.03	210	207	98.57
99	Jiabharali	N.T. Road Crossing	Assam	76.00	77.00	78.25	26.06.1998	78.10	30.06.03 to 01.07.03	244	236	96.72
100	Kopili	Kampur	Assam	59.50	60.50	61.86	16.06.1973	61.47	12.10.03	9	9	100.00
101	Kopili	Dharamtul	Assam	55.00	56.00	57.68	24.05.1988	56.25	03.07.03	51	51	100.00
102	Puthimari	N.H. Crossing	Assam	50.81	51.81	54.92	20.06.1993	54.40	01.07.03	260	243	93.46
103	Beki	Road Bridge	Assam	43.38	44.38	46.20	04.08.2000	45.64	08.07.03	291	290	99.66
104	Pagladiya	N.T. Road Crossing	Assam	51.75	52.75	55.38	15.09.1984	54.04	01.07.03	58	51	87.93
105	Manas	N.H. Crossing	Assam	46.95	47.56	50.08	15.09.1984	48.10	13.06.03	26	26	100.00
106	Sankosh	Golakganj	Assam	28.51	29.51	30.91	21.07.1991	30.30	08.07.03	205	204	99.51
107	Raidak-1	Tufanganj	West Bengal	34.22	35.30	36.36	21.07.1993	35.15	10.07.03	19	18	94.74
108	Torsa	Ghughumari	West Bengal	39.80	40.41	41.46	03.08.2000	40.50	01.07.03	11	9	81.82
109	Jaldhaka	N.H.31 Road Bridge	West Bengal	80.00	80.90	81.33	28.07.1972	80.24	01.07.03	9	9	100.00
110	Jaldhaka	Mathabhanga	West Bengal	48.20	48.70	49.60	29.07.1972	49.35	01.07.03	17	17	100.00
111	Tista	Domohani Rd. Bridge	West Bengal	85.65	85.95	86.78	13.06.1971	86.20	08.07.03	14	14	100.00
112	Tista	Mekhliganj	West Bengal	65.45	65.95	66.45	13.07.1996	66.18	09.07.03	17	17	100.00

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1	2	3	4	5	6	7	8	9	10	11	12	13
113	Barak	Silchar(Annapurnghat)	Assam	18.83	19.83	21.84	01.08.1989	19.86	14.06.03	11	11	100.00
114	Katakhal	Matizuri	Assam	19.27	20.27	22.58	09.08.2002	22.58	12/13.06.03	32	30	93.75
115	Subernarekna	Rajghat	Orissa	9.45	10.36	12.20	07.08.1997	9.78	10.10.03	3	3	100.00
116	Burhabalang	N.H.5 Rd Bridge	Orissa	7.21	8.13	9.50	12.10.1973	8.72	08.10.03	8	6	75.00
117	Baitarni	Anandpur	Orissa	37.44	38.36	41.20	19.08.1975	38.40	08.10.03	14	11	78.57
118	Baitarni	Akhuapada	Orissa	18.29	19.20	21.95	16.08.1960	18.60	09.10.03	11	10	90.91
119	Brahmani	Jenapur Exp Way	Orissa	22.00	23.00	24.78	20.08.1975	22.46	11.10.03	2	2	100.00
120	Mahanadi	Hirakud Dam	Orissa	FRL	192.02	192.08	25.09.1994	192.04	15.10.03	85	81	95.29
121	Mahanadi	Alipingal Devi	Orissa	10.85	11.76	12.90	17.07.2001	12.90	30.08.03	40	40	100.00
122	Mahanadi	Nimpara	Orissa	9.85	10.76	11.60	31.08.1982	11.17	30.08.03	41	40	97.56
123	Rushikuluya	Purushottampur	Orissa	15.83	16.83	19.65	04.11.1990	18.15	08.10.03	11	11	100.00
124	Vamsadhara	Gunupur	Orissa	83.00	84.00	88.75	17.09.1980	84.97	07.10.03	21	16	76.19
125	Vamsadhara	Kashinagar	Orissa	53.60	54.60	58.93	18.09.1980	55.78	07.10.03	68	67	98.53
126	Vamsadhara	Gotta Barrage	Andhra Pradesh	FRL	38.40	39.92	07.10.1999	38.12	19.07.03	22	20	90.91
127	Godavari	Kopergaon	Maharashtra	490.90	493.68	499.17	1969	492.19	29.7.03	13	10	76.92
128	Godavari	Jaikwadi Dam	Maharashtra	FRL	465.50	464.69	12.10.1990	457.83	10.6.03	0	0	0
129	Godavari	Gankhed	Maharashtra	374.00	375.00	377.57	1947	367.00	20.7.03	0	0	0
130	Godavari	Nanded	Maharashtra	353.00	354.00	355.65	1983	344.80	20.7.03	0	0	0
131	Godavari	Sriram Sagar (Pochampad)	Andhra Pradesh	FRL	333.15	332.72	13.10.1990	330.89	27.8.03	7	4	57.14
132	Godavari	Kaleswaram	Andhra Pradesh	103.50	104.75	107.05	1986	101.19	30.7.03	0	0	0
133	Godavari	Eturunagaram	Andhra Pradesh	73.29	75.79	77.66	1990	73.01	24.8.03	0	0	0
134	Godavari	Dummagudam	Andhra Pradesh	53.00	55.00	60.25	1986	52.55	27.7.03	0	0	0
135	Godavari	Bhadrachalam	Andhra Pradesh	45.72	48.77	55.66	1986	46.57	27.7.03	9	7	77.78
136	Godavari	Kunavaram	Andhra Pradesh	37.54	40.32	51.30	1986	37.88	28.7.03	3	3	100.00
137	Godavari	Rajamundri	Andhra Pradesh	17.68	19.51	20.48	1986	17.22	28.7.03	0	0	0
138	Godavari	Dowalaiswaram	Andhra Pradesh	14.25	16.08	18.36	1986	10.09	28.703	16	15	93.75
139	Wainganga	Bhand.	Maharashtra	244.00	244.50	246.82	1986	246.30	28.7.03	9	9	100.00
140	Wainganga	Pauni	Maharashtra	not fixed	232.50	235.80	1979	233.97	28.7.03	9	7	77.78

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1	2	3	4	5	6	7	8	9	10	11	12	13
141	Manjira	*Singur Dam	Andhra Pradesh	FRL	523.60	523.60	1999	522.31	10.8.03	3	2	66.67
142	Manjira	*Nizamsagar Dam	Andhra Pradesh	FRL	428.24	428.24	1999	422.68	9.10.03	0	0	0
143	Indravati	Jagdulpur	Chhattisgarh	539.50	540.80	544.68	1973	541.47	29.8.03	47	44	93.62
144	Krishna	*Alamati Dam	Karnataka	FRL	500.00	494.70	12.08.79	519.60	05.09.03	13	11	84.62
145	Krishna	*Narayanpur Dam	Karnataka	FRL	492.25	491.98	17.10.91	492.11	07.09.03	4	4	100.00
146	Krishna	*Priyadarshini Jurala Project	Andhra Pradesh	FRL	318.52	309.85	21.10.93	316.50	22.09.03	1	1	100.00
147	Krishna	*Srisailem Dam	Andhra Pradesh	FRL	269.75	269.93	13.10.90	259.73	31.10.03	1	1	100.00
148	Krishna	*Prakashan Barrage (Vijayawada)	Andhra Pradesh	FRL	18.30	21.50	07.10.1903	17.62	08.08.03	0	0	0
149	Bhima	Deongaon	Karnataka	400.00	407.00	406.30	29.08.1997	398.77	24.09.03	0	0	0
150	Tungbhadra	*Tungabhadra Dam	Karnataka	FRL	497.74	497.74	28.10.2000	494.67	11.10.03	47	42	89.36
151	Tungbhadra	Mantralayam	Andhra Pradesh	310.00	312.00	315.60	19.11.1992	308.69	24.10.03	0	0	0
152	Banas	*Dantiwada Dam	Gujarat	182.88	185.06	186.04	01.09.1973	174.09	19.9.03	0	0	0
153	Sabarmati	*Dharoi Dam	Gujarat	187.45	192.25	189.63	03.09.1990	185.02	10.10.03	1	1	100.00
154	Sabarmati	Ahmedabad (Shubhash Bridge)	Gujarat	44.09	45.34	46.85	18.07.1993	42.00	24.8.03	0	0	0
155	Mahi	*Kadana Dam	Gujarat	126.18	127.71	127.74	09.09.1989	127.71	21.09.03	5	5	100
156	Mahi	Wanakbori	Gujarat	71.00	72.54	74.77	24.08.1990	70.72	25.9.03	0	0	0
157	Narmada	Mandla	Madhya Pradesh	437.20	437.80	439.40	13.08.1974	437.83	29.8.03	2	2	100.00
158	Narmada	Hoshangabad	Madhya Pradesh	292.83	293.83	300.90	30.08.1973	292.10	28.7.03	0	0	0
159	Narmada	Garudesar	Gujarat	30.48	31.09	41.65	06.09.1970	22.54	30.07.03	0	0	0
160	Narmada	Bharuch	Gujarat	6.71	7.31	12.65	07.09.1970	6.35	30.07.03	0	0	0
161	Tapi	*Hatnur Dam	Gujarat	212.02	214.00	214.00	30.09.2002	214.00	10.03 to 15.10	47	47	100.00
162	Tapi	*Ukai Dam	Gujarat	102.41	105.16	105.51	08.10.1990	104.79	03.10.03	29	29	100.00
163	Tapi	Surat (Nehru Bridge)	Gujarat	8.50	9.50	12.01	1968	4.80	16.06.03	0	0	0
164	Damanganga	Madhuban dam	Dadra & Nagar Haveli	79.86	79.86	80.60	27.09.1993	80.00	08.10.03	7	7	100.00
165	Damanganga	Vapi Town	Gujarat	18.20	19.20	20.72	1976	17.57	28.07.03	0	0	0.00

S.No.	Name of Rivers	Name of FF sites	Name of State	Warning Level in m	Danger Level (m)	Previous Highest Flood Level (m)	Previous Highest Flood Date/Year	Maximum Level Level (m)	Date	No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
1	2	3	4	5	6	7	8	9	10	11	12	13
166	Damanganga	Daman	Dadra & Nagar Haveli	2.60	3.40	2.40	02.07.1981	2.10	16.06.03	0	0	0.00
Total forecast										6600	6368	96.48
Level forecast										5989	5782	96.54
Infow forecast										611	586	95.91

Table-2 "major River - Basinwise" Flood Forecasting Performance of CWC's Flood Forecasting & Warning Network during the Flood season 2003 (from 01.05.2003 to 31.10.2003)

S.No	Name of the Major river Basin	Total No. of FF sites in the River basin	No. of FF sites where no forecast was issued	Total No. of Forecasts issued	Relative %age of forecasts issued w.r.t All India Total	No. of forecasts within +/- 15 cm or +/- 20% in cumec	%age of accuracy
1	2	3	4	5	6	7	8
1	Ganga & Tributaries	85	16	3401	51.53	3292	49.88
2	Brahmaputra & Tributaries	27	1	2557	38.74	2477	37.53
3	Barak System	2	0	43	0.65	41	0.62
4	Eastern Rivers	9	0	166	2.52	161	2.44
5	Mahanadi	3	0	160	2.42	146	2.21
6	Godavari	17	8	116	1.76	101	1.53
7	Krishna	8	3	66	1	59	0.89
8	West Flowing Rivers	15	9	91	1.38	91	1.38
	Total	166	37	6600	100	6368	96.48

TABLE-3 "Sub-Riverwise" Flood Forecasting Performance of CWC's Flood Forecasting & Warning Network
During the Flood Season 2003 (From 01.05.2003 to 30.10.2003)

S. No.	Name of River	Total No. of FF sites on the River	No. of FF sites where no forecast was issued	Total no. of forecasts issued	Relative %age of forecasts issued w.r.t All India Total	No. of forecasts within +/- 15cm or +/- 20% cumecs	%age Accuracy
1	Ganga	21	2	732	11.09	721	98.50
2	Alaknanda	1	1	0	0.00	0	n.a.
3	Ramganga	2	2	0	0.00	0	n.a.
4	Yamuna	11	5	159	2.41	120	75.47
5	Sahibi	1	1	0	0.00	0	n.a.
6	Betwa	2	0	3	0.05	3	100.00
7	Ken	1	0	16	0.24	11	68.75
8	Gomti	2	2	0	0.00	0	n.a.
9	SAI	1	0	30	0.45	29	96.67
10	Ghaghra	6	0	451	6.83	447	99.11
11	Rapti	3	0	48	0.73	48	100.00
12	Sone	3	0	75	1.14	71	94.67
13	PunPun	1	0	51	0.77	49	96.08
14	Gandak	4	0	315	4.77	300	95.24
15	Burhi Gandak	5	0	291	4.41	281	96.56
16	Bagmati	2	0	183	2.77	181	98.91
17	Adhwara Group	2	0	126	1.91	123	97.62
18	Kamla Balan	1	0	118	1.79	114	96.61
19	Kosi	3	0	385	5.83	385	100.00
20	Mahananda	2	0	163	2.47	161	98.77
21	Mayurakshi	3	1	12	0.18	12	100.00
22	Ajoy	1	0	2	0.03	2	100.00
23	Damodar	3	0	165	2.50	164	99.39
24	Barakar	1	0	62	0.94	60	96.77
25	Mundeshwari	1	1	0	0.00	0	n.a.
26	Kangsabati	2	1	14	0.21	10	71.43
27	Brahmaputra	6	0	875	13.26	851	97.26
28	Burhi -Dihing	2	1	39	0.59	36	92.31
29	Desang	1	0	44	0.67	37	84.09
30	Dikhow	1	0	37	0.56	33	89.19
31	Subansiri	1	0	54	0.82	54	100.00
32	Dhansiri	2	0	277	4.20	272	98.19
33	Jiabharali	1	0	244	3.70	236	96.72
34	Kopili	2	0	60	0.91	60	100.00
35	Puthimari	1	0	260	3.94	243	93.46
36	Beki	1	0	291	4.41	290	99.66
37	Pagladiya	1	0	58	0.88	51	87.93
38	Manas	1	0	26	0.39	26	100.00
39	Sankosh	1	0	205	3.11	204	99.51
40	Raidak-1	1	0	19	0.29	18	94.74
41	Torasa	1	0	11	0.17	9	81.82
42	Jaldhaka	2	0	26	0.39	26	100.00

TABLE-3 "Sub-Riverwise" Flood Forecasting Performance of CWC's Flood Forecasting & Warning Network
During the Flood Season 2003 (From 01.05.2003 to 30.10.2003)

S. No.	Name of River	Total No. of FF sites on the River	No. of FF sites where no forecast was issued	Total no. of forecasts issued	Relative %age of forecasts issued w.r.t All India Total	No. of forecasts within +/- 15cm or +/- 20% cumecs	%age Accuracy
43	Tista	2	0	31	0.47	31	100.00
44	Barak	1	0	11	0.17	11	100.00
45	Katahal	1	0	32	0.48	30	93.75
46	Subernarekna	1	0	3	0.05	3	100.00
47	Burhabalang	1	0	8	0.12	6	75.00
48	Baitarni	2	0	25	0.38	21	84.00
49	Brahmani	1	0	2	0.03	2	100.00
50	Mahanadi	3	0	166	2.52	161	96.99
51	Rushikuluya	1	0	11	0.17	11	100.00
52	Vamsadhara	3	0	111	1.68	103	92.79
53	Godavari	12	7	48	0.73	39	81.25
54	Wainganga	2	0	18	0.27	16	88.89
55	Manjira	2	1	3	0.05	2	66.67
56	Indravati	1	0	47	0.71	44	93.62
57	Krishna	5	1	19	0.29	17	89.47
58	Bhima	1	1	0	0.00	0	n.a.
59	Tungbhadra	2	1	47	0.71	42	89.36
60	Banas	1	1	0	0.00	0	n.a.
61	Sabarmati	2	1	1	0.02	1	100.00
62	Mahi	2	1	5	0.08	5	100.00
63	Narmada	4	3	2	0.03	2	100.00
64	Tapi	3	1	76	1.15	76	100.00
65	Damanganga	3	2	7	0.11	7	100.00
	Total	166	37	6600	100.00	6368	96.48

Note: n.a = Not Applicable

Table-4 Flood Forecasting Performance (Statewise-Sitewise) at various Forecasting Stations during the Flood Season 2003 (01.05.2003 to 31.10.2003)

Sl.No	Name of State	Name of Rivers	Name of FF sites	Name of Divisions	Warning Level (m)	Danger Level (m)	Previous Highest Flood		Maximum Level	No. of Forecasts issued	No. of forecasts within	% age accuracy	
							Level (m)	Date/Year	Level (m)	Date			
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Andhra Pradesh	Vamsadhara	Gotta Barrage	ERD-Bhubaneswar	FRL	38.40	39.92	07.10.1999	38.12	19.07.03	22	20	90.91
2	Andhra Pradesh	Godavari	Sriram Sagar (Pochampad)	UGD Hyderabad	FRL	333.15	332.72	13.10.1990	330.89	27.8.03	7	4	57.14
3	Andhra Pradesh	Godavari	Kaleswaram	LGD Hyderabad	103.50	104.75	107.05	1986	101.19	30.7.03	0	0	0
4	Andhra Pradesh	Godavari	Eturunagaram	LGD Hyderabad	73.29	75.79	77.66	1990	73.01	24.8.03	0	0	0
5	Andhra Pradesh	Godavari	Dummagudam	LGD Hyderabad	53.00	55.00	60.25	1986	52.55	27.7.03	0	0	0
6	Andhra Pradesh	Godavari	Bhadrachalam	LGD Hyderabad	45.72	48.77	55.66	1986	46.57	27.7.03	9	7	77.78
7	Andhra Pradesh	Godavari	Kunavaram	LGD Hyderabad	37.54	40.32	51.30	1986	37.88	28.7.03	3	3	100.00
8	Andhra Pradesh	Godavari	Rajamundri	LGD Hyderabad	17.68	19.51	20.48	1986	17.22	28.7.03	0	0	0
9	Andhra Pradesh	Godavari	Dowalalswaram	LGD Hyderabad	14.25	16.08	18.36	1986	10.09	28.7.03	16	15	93.75
10	Andhra Pradesh	Manjira	*Singur Dam	UGD Hyderabad	FRL	523.60	523.60	1999	522.31	10.8.03	3	2	66.67
11	Andhra Pradesh	Manjira	*Nizamsagar Dam	UGD Hyderabad	FRL	428.24	428.24	1999	422.68	9.10.03	0	0	0
12	Andhra Pradesh	Krishna	*Priyadarshini Jurala Project	LKD Hyderabad	FRL	318.52	309.85	21.10.93	316.50	22.09.03	1	1	100.00
13	Andhra Pradesh	Krishna	*Srisailem Dam	LKD Hyderabad	FRL	269.75	269.93	13.10.90	259.73	31.10.03	1	1	100.00
14	Andhra Pradesh	Krishna	*Prakashan Barrage (Vijayawada)	LKD Hyderabad	FRL	18.30	21.50	07.10.1903	17.62	08.08.03	0	0	0
15	Andhra Pradesh	Tungbhadra	Mantralayam	LKD Hyderabad	310.00	312.00	315.60	19.11.1992	308.69	24.10.03	0	0	0
16	Assam	Brahmaputra	Dibrugarh	UBD Dibrugarh	103.24	104.24	106.48	03.09.1998	105.95	08.07.03	284	282	99.30
17	Assam	Brahmaputra	Neamatighat	UBD Dibrugarh	84.04	85.04	87.37	11.07.1991	86.60	09.07.03	109	108	99.08
18	Assam	Brahmaputra	Tejpur	UBD Dibrugarh	64.23	65.23	66.59	27.08.1988	66.11	10.07.03	67	67	100.00
19	Assam	Brahmaputra	Guwahati	MBD Guwahati	48.68	49.68	51.37	29.08.1988	50.99	13.07.03	89	75	84.27
20	Assam	Brahmaputra	Goalpara	MBD Guwahati	35.27	36.27	37.43	31.07.1954	36.86	13.07.03	93	86	92.47
21	Assam	Brahmaputra	Dhubri	LBD Jalpaiguri	27.50	28.50	30.36	28.08.1988	29.77	14.07.03	233	233	100.00
22	Assam	Burhi -Dihing	Naharkatia	UBD Dibrugarh	119.40	120.40	122.69	17.06.1973	119.36	10.07.03	0	0	0
23	Assam	Burhi -Dihing	Khawang	UBD Dibrugarh	101.11	102.11	103.92	25.08.1988	103.88	10/11.07.03	39	36	92.31
24	Assam	Desang	Nanglamoraghat	UBD Dibrugarh	93.46	94.46	96.49	06.09.1998	96.32	06/07.07.03	44	37	84.09
25	Assam	Dikhow	Sibsagar	UBD Dibrugarh	91.40	92.40	95.62	08.07.1974	93.00	02/03.09.03	37	33	89.19
26	Assam	Subansiri	Badatighat	UBD Dibrugarh	81.53	82.53	86.84	28.06.1972	83.30	10.07.03	54	54	100.00
27	Assam	Dhansiri	Golaghat	UBD Dibrugarh	88.50	89.50	91.30	11.10.1986	90.10	13.10.03	67	65	97.01
28	Assam	Dhansiri	Numaligarh	UBD Dibrugarh	76.42	77.42	79.87	24.09.1985	79.01	25.08.03	210	207	98.57
29	Assam	Jiabharali	N.T. Road Crossing	UBD Dibrugarh	76.00	77.00	78.25	26.06.1998	78.10	30.06.03 to 24.10.03	244	236	96.72
30	Assam	Kopili	Kampur	UBD Dibrugarh	59.50	60.50	61.86	16.06.1973	61.47	12.10.03	9	9	100.00
31	Assam	Kopili	Dharamtul	UBD Dibrugarh	55.00	56.00	57.68	24.05.1988	56.25	03.07.03	51	51	100.00
32	Assam	Puthimari	N.H. Crossing	MBD Guwahati	50.81	51.81	54.92	20.06.1993	54.40	01.07.03	260	243	93.46
33	Assam	Beki	Road Bridge	LBD Jalpaiguri	43.38	44.38	46.20	04.08.2000	45.64	08.07.03	291	290	99.66

Sl.No	Name of State	Name of Rivers	Name of FF sites	Name of Divisions	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level (m)	Date	No. of Forecasts Issued	No. of forecasts within	% age accuracy
34	Assam	Pagladia	N.T. Road Crossing	MBD Guwahati	51.75	52.75	55.38	15.09.1984	54.04	01.07.03	58	51	87.93
35	Assam	Manas	N.H. Crossing	LBD Jalpaiguri	46.95	47.56	50.08	15.09.1984	48.10	13.06.03	26	26	100.00
36	Assam	Sankosh	Golakganj	LBD Jalpaiguri	28.51	29.51	30.91	21.07.1991	30.30	08.07.03	205	204	99.51
37	Assam	Barak	Silchar(Annapurnghat)	MBD Guwahati	18.83	19.83	21.84	01.08.1989	19.86	14.06.03	11	11	100.00
38	Assam	Katakhal	Matizuri	MBD Guwahati	19.27	20.27	22.58	09.08.2002	22.58	12/13.06.03	32	30	93.75
39	Bihar	Ganga	Buxar	MGD -V Patna	59.32	60.32	62.09	1948	61.12	14.09.03	28	27	96.43
40	Bihar	Ganga	Patna (Dighaghat)	MGD -V Patna	49.45	50.45	52.52	23.08.1975	51.33	11.09.03	39	38	97.44
41	Bihar	Ganga	Patna (Gandhighat)	MGD -V Patna	47.60	48.60	50.27	14.08.1994	50.12	11.09.03	58	54	93.10
42	Bihar	Ganga	Hathidah	MGD -V Patna	40.76	41.76	43.15	07.08.1971	42.71	11/15.09.03	52	52	100.00
43	Bihar	Ganga	Munger	MGD -V Patna	38.33	39.33	40.99	19.09.1976	39.14	14/17.09.03	17	17	100.00
44	Bihar	Ganga	Bhagalpur	MGD -V Patna	32.68	33.68	34.18	19.08.1978	34.20	17.09.03	44	44	100.00
45	Bihar	Ganga	Colgong/ Kahalgao	MGD -V Patna	30.09	31.09	32.84	06.09.1998	32.87	17/18.09.03	74	73	98.65
46	Bihar	Chaghra	Darauli	MGD -V Patna	59.82	60.82	61.74	29.08.1998	61.20	26/27.08.03	79	79	100.00
47	Bihar	Chaghra	Gangpur Siwan	MGD -V Patna	56.04	57.04	58.01	18.09.1983	57.98	25/26.08.03	79	79	100.00
48	Bihar	Chaghra	Chhapra	MGD -V Patna	52.68	53.68	54.59	03.09.1982	54.15	10.09.03	24	24	100.00
49	Bihar	Gandak	Chatia	MGD-IV Patna	68.15	69.15	70.04	06.07.2002	69.15	02.08.03	51	46	90.20
50	Bihar	Gandak	Rewaghat	MGD -V Patna	53.41	54.41	55.41	17.09.1986	54.71	03/04.08.03	35	35	100.00
51	Bihar	Gandak	Hazipur	MGD -V Patna	49.32	50.32	50.93	1948	50.50	10/11.09.03	25	25	100.00
52	Bihar	Burhi Gandak	Lalbeghiaghat	MGD-IV Patna	62.20	63.20	67.09	30.07.1975	63.43	07.07.03	26	22	84.62
53	Bihar	Burhi Gandak	Muzaffarpur (Sikandarpur)	MGD-IV Patna	51.53	52.53	54.29	15.08.1987	52.95	23.08.03	53	52	98.11
54	Bihar	Burhi Gandak	Samastipur	MGD-IV Patna	45.02	46.02	49.38	15.08.1987	47.26	25.08.03	70	68	97.14
55	Bihar	Burhi Gandak	Rosera	MGD-IV Patna	41.63	42.63	46.35	16.08.1987	44.47	25.08.03	75	72	96.00
56	Bihar	Burhi Gandak	Khagaria	MGD-IV Patna	35.58	36.58	39.22	1976	37.97	15.09.03	67	67	100.00
57	Bihar	Bagmati	Benibad	MGD-IV Patna	47.68	48.68	49.72	26.07.2002	49.35	03.08.03	114	112	98.25
58	Bihar	Bagmati	Hayaghat	MGD-IV Patna	44.72	45.72	48.96	14.08.1987	45.98	22.07.03	69	69	100.00
59	Bihar	Adhwara Group	Kamtaul	MGD-IV Patna	49.00	50.00	52.99	12.08.1987	50.70	30.06.03	64	62	96.88
60	Bihar	Adhwara Group	Ekmighat	MGD-IV Patna	45.94	46.94	49.27	14.08.1987	47.42	23.07.03	62	61	98.39
61	Bihar	Kamia Balan	Jhanjharpur	MGD-IV Patna	49.00	50.00	52.73	11.08.1987	52.00	10.07.03	118	114	96.61
62	Bihar	Kosi	Basua	MGD-IV Patna	46.75	47.75	48.76	21.07.1996	48.69	10.07.03	187	187	100.00
63	Bihar	Kosi	Baltara	MGD-IV Patna	32.85	33.85	36.40	15.08.1987	34.89	22.07.03	104	104	100.00
64	Bihar	Kosi	Kursela	MGD-IV Patna	29.00	30.00	32.04	06.09.1998	31.80	17.09.03	94	94	100.00
65	Bihar	Mahananda	Dhengahat	MGD-IV Patna	34.65	35.65	38.09	1968	36.97	10.07.03	63	61	96.83
66	Bihar	Mahananda	Jhawa	MGD-IV Patna	30.40	31.40	33.51	14.08.1987	32.72	11.07.03	100	100	100.00
67	Bihar	Sone	Inderpuri	MGD -V Patna	107.20	108.20	108.85	23.08.1976	108.10	09.09.03	4	3	75.00
68	Bihar	Sone	Kochwar	MGD -V Patna	54.52	55.52	58.88	20.07.1971	57.91	09.09.03	25	23	92.00
69	Bihar	Sone	Maner	MGD -V Patna	51.00	52.00	53.79	10.09.1976	53.14	12/14.09.03	46	45	97.83
70	Bihar	PunPun	Sripalpur	MGD -V Patna	49.60	50.60	53.91	18.09.1976	53.05	19.08.03	51	49	96.08

Sl.No	Name of State	Name of Rivers	Name of FF sites	Name of Divisions	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Maximum Level Level (m)	Date	No. of forecasts issued within	% age accuracy
71	Chhatisgarh	Indravati	Jagdalpur	UGD Hyderabad	539.50	540.80	544.58	541.47	29.8.03	47	44
72	Dadra & Nagar Haveli	Damanganga	Madhuban dam	TD Surat	79.86	79.86	80.60	80.00	08.10.03	7	7
73	Dadra & Nagar Haveli	Damanganga	Daman	TD Surat	2.60	3.40	2.40	2.10	16.06.03	0	0
74	Gujarat	Banas	*Dantiwada Dam	MD Ahmedabad	182.88	185.06	186.04	174.09	19.9.03	0	0
75	Gujarat	Sabarmati	*Dharol Dam	MD Ahmedabad	187.45	192.25	189.63	185.02	10.10.03	1	1
76	Gujarat	Sabarmati	Ahmedabad (Shubhash Bridge)	MD Ahmedabad	44.09	45.34	46.85	42.00	24.8.03	0	0
77	Gujarat	Mahi	*Kadana Dam	MD Ahmedabad	126.18	127.71	127.74	127.71	21.09.03	5	5
78	Gujarat	Mahi	Wanakbori	MD Ahmedabad	71.00	72.54	74.77	70.72	25.9.03	0	0
79	Gujarat	Narmada	Garudesar	TD Surat	30.48	31.09	41.65	22.54	30.07.03	0	0
80	Gujarat	Narmada	Bharuch	TD Surat	6.71	7.31	12.65	6.35	30.07.03	0	0
81	Gujarat	Tapi	*Hatnur Dam	TD Surat	212.02	214.00	214.00	214.00	10.03to 15.10	47	47
82	Gujarat	Tapi	*Ukai Dam	TD Surat	102.41	105.16	105.51	104.79	03.10.03	29	29
83	Gujarat	Tapi	(Nehru Bridge)	TD Surat	8.50	9.50	12.01	4.80	16.06.03	0	0
84	Gujarat	Damanganga	Vapi Town	TD Surat	18.20	19.20	20.72	17.57	28.07.03	0	0
85	Haryana	Yamuna	*Tajewala Weir	UYD Delhi	PL	323.70	328.27	n.a.	n.a.	0	0
86	Jharkhand	Mayurakshi	*Massanjore Dam	DD Asansol	FRL	121.31	122.71	117.64	15.10.03	6	6
87	Jharkhand	Damodar	*Tenughat Dam	DD Asansol	FRL	268.83	265.56	261.70	09.10.03	30	30
88	Jharkhand	Damodar	*Panchet Dam	DD Asansol	FRL	132.59	132.89	128.45	11.10.03	76	75
89	Jharkhand	Barakar	*Maiton Dam	DD Asansol	FRL	150.88	151.79	149.21	12.10.03	62	60
90	Karnataka	Krishna	*Alamati Dam	LKD Hyderabad	FRL	500.00	494.70	519.60	05.09.03	13	11
91	Karnataka	Krishna	*Narayanpur Dam	LKD Hyderabad	FRL	492.25	491.98	492.11	07.09.03	4	4
92	Karnataka	Bhima	Deogaon ?	LKD Hyderabad	400.00	407.00	406.30	398.77	24.09.03	0	0
93	Karnataka	Tungbhadra	*Tungbhadra Dam	LKD Bhopal	FRL	497.74	497.74	494.67	11.10.03	47	42
94	Madhya Pradesh	Narmada	Mandla	ND Bhopal	437.20	437.80	439.40	437.83	29.8.03	2	2
95	Madhya Pradesh	Narmada	Hoshangabad	ND Bhopal	292.83	293.83	300.90	292.10	28.7.03	0	0
96	Maharashtra	Godavari	Kopergaon	UGD Hyderabad	490.90	493.68	499.17	492.19	29.7.03	13	10
97	Maharashtra	Godavari	Jaikwadi Dam	UGD Hyderabad	FRL	465.50	464.69	457.83	10.6.03	0	0
98	Maharashtra	Godavari	Gankhed	UGD Hyderabad	374.00	375.00	377.57	367.00	20.7.03	0	0
99	Maharashtra	Godavari	Nanded	UGD Hyderabad	353.00	354.00	355.65	344.80	20.7.03	0	0
100	Maharashtra	Wainganga	Bhandra	LGD Hyderabad	244.00	244.50	246.82	246.30	28.7.03	9	9
101	Maharashtra	Wainganga	Pauni	LGD Hyderabad	not fixed	232.50	235.80	233.97	28.7.03	9	7
102	NCT Delhi	Yamuna	Delhi Rly Bridge	UYD Delhi	204.00	204.83	207.49	204.60	6.8.03	7	4
103	NCT Delhi	Sahibi	Dhansa Regulator	UYD Delhi	211.44	212.44	213.58	209.90	4.8.03	0	0
104	Orissa	Subernarekna	Rajghat	ERD-Bhubaneswar	9.45	10.36	12.20	9.78	10.10.03	3	3
105	Orissa	Burhabalang	N.H.5 Rd Bridge	ERD-Bhubaneswar	7.21	8.13	9.50	8.72	08.10.03	8	6

Sl.No	Name of State	Name of Rivers	Name of FF sites	Name of Divisions	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level (m)	No. of Forecasts Issued	No. of forecasts within	% age accuracy
106	Orissa	Baitarni	Anandpur	ERD-Bhubaneswar	37.44	38.36	41.20	19.08.1975	38.40	14	11	78.57
107	Orissa	Baitarni	Akhuapada	ERD-Bhubaneswar	18.29	19.20	21.95	16.08.1960	18.60	11	10	90.91
108	Orissa	Brahmani	Jenapur Exp Way	ERD-Bhubaneswar	22.00	23.00	24.78	20.08.1975	22.46	2	2	100.00
109	Orissa	Mahanadi	Hirakud Dam	MD Ahmedabad	FRL	192.02	192.08	25.09.1994	192.04	85	81	95.29
110	Orissa	Mahanadi	Alipingal Devi	ERD-Bhubaneswar	10.85	11.76	12.90	17.07.2001	12.90	40	40	100.00
111	Orissa	Mahanadi	Nimapara	ERD-Bhubaneswar	9.85	10.76	11.60	31.08.1982	11.17	41	40	97.56
112	Orissa	Rushikuluya	Purushottampur	ERD-Bhubaneswar	15.83	16.83	19.65	04.11.1990	18.15	11	11	100.00
113	Orissa	Vamsadhara	Gunupur	ERD-Bhubaneswar	83.00	84.00	88.75	17.09.1980	84.97	21	16	76.19
114	Orissa	Vamsadhara	Kashinagar	ERD-Bhubaneswar	53.60	54.60	58.93	18.09.1980	55.78	68	67	98.53
115	Uttar Pradesh	Ganga	*Narora Barrage (U/S)	MGD-II Lucknow	PL	180.79	180.18	1978	179.08	86	85	98.84
116	Uttar Pradesh	Ganga	Kannauj	MGD-II Lucknow	124.90	125.97	126.24	29.8.98		0	0	0.00
117	Uttar Pradesh	Ganga	Aunghat	MGD-II Lucknow	123.00	124.00	124.31	09.09.1978	123.50	30	30	100.00
118	Uttar Pradesh	Ganga	Kanpur	MGD-II Lucknow	113.00	114.00	113.47	02.09.1987	112.96	45	45	100.00
119	Uttar Pradesh	Ganga	Dalmau	MGD-II Lucknow	98.36	99.36	99.84	03.08.1973	99.18	39	38	97.44
120	Uttar Pradesh	Ganga	Phaphamau	MGD-III Varanasi	83.73	84.73	87.98	08.09.1978	85.98	5	5	100.00
121	Uttar Pradesh	Ganga	Allahabad (Chhatnag)	MGD-III Varanasi	83.73	84.73	88.39	1948	85.18	4	4	100.00
122	Uttar Pradesh	Ganga	Mirzapur	MGD-III Varanasi	76.72	77.72	80.34	09.09.1978	78.26	4	4	100.00
123	Uttar Pradesh	Ganga	Varanasi	MGD-III Varanasi	70.26	71.26	73.90	09.09.1978	72.13	6	5	83.33
124	Uttar Pradesh	Ganga	Ghazipur	MGD-III Varanasi	62.11	63.11	65.22	09.09.1978	64.75	27	26	96.30
125	Uttar Pradesh	Ganga	Ballia	MGD-III Varanasi	56.62	57.62	59.92	03.09.1982	60.25	49	49	100.00
126	Uttar Pradesh	Ranganga	Moradabad	MGD-II Lucknow	189.60	190.60	192.68	3.9.78		0	0	0.00
127	Uttar Pradesh	Ranganga	Bareilly	MGD-II Lucknow	162.70	163.70	162.88	6.8.78		0	0	0.00
128	Uttar Pradesh	Yamuna	Mauji	LYD Delhi	230.00	230.85	232.45	1988	230.42	5	5	100.00
129	Uttar Pradesh	Yamuna	Mathura	LYD Delhi	164.20	165.20	169.73	1978	164.84	26	21	80.77
130	Uttar Pradesh	Yamuna	Agra	LYD Agra	151.40	152.40	154.76	09.09.1978	149.71	111	84	75.68
131	Uttar Pradesh	Yamuna	Etawa	LYD Agra	120.92	121.92	126.13	11.09.1978	119.21	0	0	
132	Uttar Pradesh	Yamuna	Auraiya	LYD Agra	112.00	113.00	118.19	25.08.1996	106.25	0	0	0
133	Uttar Pradesh	Yamuna	Kalpi	LYD Agra	107.00	108.00	112.98	25.08.1990	103.55	0	0	0
134	Uttar Pradesh	Yamuna	Hamirpur	LYD Agra	102.63	103.63	108.59	12.09.1983	102.19	0	0	0
135	Uttar Pradesh	Yamuna	Chilghat	LYD Agra	99.00	100.00	105.16	06.09.1978	100.35	3	1	33.33
136	Uttar Pradesh	Yamuna	Naini	LYD Agra	83.73	84.74	87.99	08.09.1978	85.64	7	5	71.43
137	Uttar Pradesh	Betwa	Mohana	LYD Agra	121.66	122.66	133.69	11.09.1983	123.34	2	2	100.00
138	Uttar Pradesh	Ken	Banda	LYD Agra	103.00	104.00	113.28	14.09.1992	109.17	16	11	68.75
139	Uttar Pradesh	Gomati	Lucknow (Hanuman setu)	MGD-II Lucknow	108.50	109.50	110.85	10.09.1971	107.43	0	0	0
140	Uttar Pradesh	Gomati	Jaunpur	MGD-I Lucknow	73.07	74.07	77.74	22.09.1971	72.65	0	0	0
141	Uttar Pradesh	SAI	Rae Bareilly	MGD-II Lucknow	100.00	101.00	104.81	17.09.1982	101.72	30	29	96.67

Sl.No	Name of State	Name of Rivers	Name of FF sites	Name of Divisions	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level Level (m)	Date	No. of Forecasts issued	No. of forecasts within	% age accuracy
142	Uttar Pradesh	Ghaghra	Elgin Bridge	MGD-I Lucknow	105.07	106.07	107.18	14.09.1983	106.58	22.8.03	88	87	98.86
143	Uttar Pradesh	Ghaghra	Ayodhya	MGD-I Lucknow	91.73	92.73	93.65	19.08.1998	93.35	24.8.03	90	89	98.89
144	Uttar Pradesh	Ghaghra	Turtipar	MGD-I Lucknow	63.01	64.01	66.00	28.08.1998	65.01	25.8.03	91	89	97.80
145	Uttar Pradesh	Rapti	Balrampur	MGD-I Lucknow	103.62	104.62	105.25	11.09.2000	104.31	22.08.03	17	17	100.00
146	Uttar Pradesh	Rapti	Bansi	MGD-I Lucknow	83.90	84.90	85.82	21.08.1998	84.95	23.08.03	16	16	100.00
147	Uttar Pradesh	Rapti	Gorakhpur (Birdghat)	MGD-I Lucknow	73.98	74.98	77.54	23.08.1998	75.89	25.08.03	15	15	100.00
148	Uttar Pradesh	Gandak	Khadda	MGD-IV Patna	95.00	96.00	97.50	23.07.2002	97.22	31.07.03	204	194	95.10
149	Uttar Pradesh	Betwa	Sahjina	LYD Agra	103.54	104.54	108.67	12.09.1983	103.33	11.09.03	1	1	100.00
150	Uttaranchal	Ganga	Rishikesh	HGD Dehradun	339.50	340.50	341.72	1995			0	0	0.00
151	Uttaranchal	Ganga	Haridwar	HGD Dehradun	293.00	294.00	296.23	3.9.78	294.22	5.7.03	27	27	100.00
152	Uttaranchal	Alaknanda	Srinagar	HGD Dehradun	539.00	540.00	536.85	1995			0	0	
153	West Bengal	Ganga	Farakka	MGD-V Patna	21.25	22.25	25.14	27.09.1998	24.52	18/19.09.03	98	98	100.00
154	West Bengal	Mayurakshi	*Tilpara Barrage	DD Asansol	PL	62.79	67.05	27.09.1978	62.76	11.10.03	6	6	100.00
155	West Bengal	Mayurakshi	Narayanpur	DD Asansol	26.99	27.99	29.69	27.09.1995	25.80	10.10.03	0	0	0
156	West Bengal	Ajoy	Gheropara	DD Asansol	38.42	39.42	43.94	27.09.1978	38.79	10.10.03	2	2	100.00
157	West Bengal	Damodar	*Durgapur Barrage	DD Asansol	PL	64.47	64.47	31.10.2002	64.47	Several Times	59	59	100.00
158	West Bengal	Mundeshwari	Harinkhola	DD Asansol	11.80	12.80	14.58	20.09.1978	11.10	12.10.03	0	0	
159	West Bengal	Kangsabati	*Kangsabati Dam	DD Asansol	FRL	134.11	134.71	02.09.1978	127.37	15.10.03	14	10	71.43
160	West Bengal	Kangsabati	Mohanpur	DD Asansol	24.73	25.73	29.87	02.09.1978	24.02	09.10.03	0	0	0
161	West Bengal	Raidak-1	Tufanganj	LBD Jalpaiguri	34.22	35.30	36.36	21.07.1993	35.15	10.07.03	19	18	94.74
162	West Bengal	Torsa	Ghughumari	LBD Jalpaiguri	39.80	40.41	41.46	03.08.2000	40.50	01.07.03	11	9	81.82
163	West Bengal	Jaldhaka	N.H.31 Road Bridge	LBD Jalpaiguri	80.00	80.90	81.33	28.07.1972	80.24	01.07.03	9	9	100.00
164	West Bengal	Jaldhaka	Mathabhanga	LBD Jalpaiguri	48.20	48.70	49.60	29.07.1972	49.35	01.07.03	17	17	100.00
165	West Bengal	Tista	Domohani Rd.Bridge	LBD Jalpaiguri	85.65	85.95	86.78	13.06.1971	86.20	08.07.03	14	14	100.00
166	West Bengal	Tista	Mekhliganj	LBD Jalpaiguri	65.45	65.95	66.45	13.07.1996	66.18	09.07.03	17	17	100.00
Total forecast											6600	6368	96.48
Level forecast											5989	5782	96.54
Infow forecast											611	586	95.91

TABLE-5 "State-wise" Flood Forecasting Performance of CWC's Flood Forecasting & Warning Network
During the Flood Season 2003 (From 01.05.2003 to 30.10.2003)

S.No.	Name of State / Union Territory	Total No. of FF sites in the state/UT	No. of FF sites where no forecast was issued	Total no. of forecasts issued	Relative %age of forecast issued w.r.t All India Total	No. of forecasts within +/- 15cm or +/- 20% cumecs	%age Accuracy
1	Andhra Pradesh	15	7	62	0.94	53	85.48
2	Assam	23	1	2513	38.08	2434	96.86
3	Bihar	32	0	1997	30.26	1958	98.05
4	Chhatisgarh	1	0	47	0.71	44	93.62
5	Gujarat	11	7	82	1.24	82	100.00
6	Haryana	1	1	0	0.00	0	not applicable
7	Jharkhand	4	0	174	2.64	171	98.28
8	Karnataka	4	1	64	0.97	57	89.06
9	Madhya Pradesh	2	1	2	0.03	2	100.00
10	Maharashtra	6	3	31	0.47	26	83.87
11	Orissa	11	0	304	4.61	287	94.41
12	Uttaranchal	3	2	27	0.41	27	100.00
13	Uttar Pradesh	35	9	1017	15.41	957	94.10
14	West Bengal	14	3	266	4.03	259	97.37
15	Dadra & Nagar Haveli	2	1	7	0.11	7	100.00
16	NCT Delhi	2	1	7	0.11	4	57.14
	Total	166	37	6600	100.00	6368	96.48

TABLE-6: Broad Features of Flood Forecasting Performance of F.F & W Network of CWC during the Flood season 2003 (i.e from 01.05.2003 to 31.10.2003)

Details of Flood Forecasting Performance during the Flood season 2003		No.Of FF Sites	Percentage of FF sites	
1	Number of Operational Flood Forecasting stations during the Flood season	166	100	
2	Flood Forecasting sites where "No Forecast" was issued / required because water level at those sites were below warning stages during the flood season.	37	22.3	
3	Flood Forecasting sites where forecasts were actually issued.	129	77.7	
4	Flood Forecasting sites where forecasting accuracy was 100% (out of 129 sites)	59	45.74	
5	Number of Flood Forecasting sites where forecasting accuracy was Nil i.e where all issued forecasts were out of prescribed limits of accuracy (+/- 15cm, +/-20% cumec)	Nil	Not Applicable	
6	Total number of forecasts issued during the flood season	6600		
7	Total number of correct forecasts issued during the flood season within prescribed limit of accuracy of +/-15 cm or +/- 20% cumec	6368 (96.48%)		
8	Total number of flood forecasting sites where the accuracy of forecasts issued were equal to or more than the percentage of accuracy of item 7 cited above	86 (66.67 %)		
9	Average number of flood forecasts issued per site (i.e the sites where forecasts are actually issued during the flood season)	51.16		
10	Details of Flood Forecasting sites where river stages crossed their previous HFL (i.e) where unprecedented flood situation were experienced).			
SL.No	River	F.F.Sites	Station code	State
1	Ganga	Ballia	14	Uttar Pradesh
2	Ganga	Bhagalpur	19	Bihar
3	Ganga	Khalgaon (Colgong)	20	Bihar
11	Details of Flood Forecasting sites where river stages just touched their previous HFL			
SL.No	River	F.F.Sites	Station code	State
1	Khatakhali	Matizuri	114	Assam
2	Mahanadi	Alipingal Devi	121	Orissa
12	Details of Flood Forecasting sites where river stages were within 0.5 m of their previous HFL (i.e., where High Flood situations were observed)			
SL.No	River	F.F.Sites	Station code	State
1	Ganga	Kannauj	4	Uttar Pradesh
2	Ganga	Ghazipur	12	Uttar Pradesh
3	Ganga	Patna (Gandhighat)	16	Bihar
4	Ganga	Hathidah	17	Bihar
5	Ghagra	Ayodhya	44	Uttar Pradesh
6	Ghagra	Gangapur Siwan	47	Bihar
7	Ghagra	Chhapra	48	Bihar
8	Gandak	Khadda	56	Uttar Pradesh
9	Gandak	Hazipur	59	Bihar
10	Bagmati	Benibda	65	Bihar
11	Kosi	Basua	70	Bihar
12	Kosi	Kursela	72	Bihar

[illegible]

TABLE-7: Comparative Flood Forecast Performance from 1978 to 2004				
Year	Total Number of Forecasts issued during the flood season	No. of Forecasts within +/-15 cm or +/-20% cumec of deviation from actual	Percentage of forecasts within +/-15 cm or +/-20% cumec of deviation from actual	Remarks
1978	6964	5741	82.4	Exclu. IF f/C
1979	4353	3531	81.1	
1980	5175	4485	86.7	
1981	5185	4480	86.4	
1982	4224	3721	88.1	
1983	5058	4377	86.5	
1984	5191	4676	90.1	
1985	6181	5668	91.7	
1986	4787	4409	92.1	
1987	5813	5525	95.0	
1988	6982	6554	93.9	
1989	5536	5262	95.1	
1990	8566	8071	94.2	Maximum no. of forecasts issued in a year
1991	6603	6225	94.3	
1992	4764	4567	95.9	
1993	6643	6438	96.9	
1994	7476	7086	94.8	
1995	6417	6189	96.4	
1996	6467	6266	96.9	
1997	5465	5263	96.3	
1998	7943	7775	97.9	
1999	7055	6826	96.8	
2000	6510	6315	97.0	
2001	5463	5343	97.8	
2002	4241	4151	97.9	
2003	6600	6368	96.5	

TABLE 8: FLOOD FORECASTING PERFORMANCE FROM 1986 TO 2003									
Year	No. of Level Forecasts issued			No. of Inflow Forecasts issued			Total No. of Forecasts issued		
	Total	Within +/- 15 cm of deviation from actual	Percentage of accuracy	Total	Within +/- 20% cumec of deviation from actual	Percentage of accuracy	Total	Within +/- 15 cm or +/- 20% cumec of deviation from actual	Percentage of accuracy
1986	3956	3635	91.89	831	744	89.53	4787	4379	91.48
1987	4793	4560	95.14	1021	965	94.52	5814	5525	95.03
1988	5472	5131	93.77	1510	1425	94.37	6982	6556	93.90
1989	4323	4081	94.40	1213	1181	97.36	5536	5262	95.05
1990	6578	6124	93.10	1988	1947	97.94	8566	8071	94.22
1991	5234	4890	93.43	1369	1335	97.52	6603	6225	94.28
1992	3588	3418	95.26	1176	1149	97.70	4764	4567	95.86
1993	5226	5066	96.94	1417	1372	96.82	6643	6438	96.91
1994	5472	5158	94.26	2004	1929	96.26	7476	7087	94.80
1995	5393	5201	96.44	1024	988	96.48	6417	6189	96.45
1996	5104	4945	96.88	1363	1321	96.92	6467	6266	96.89
1997	4059	3895	95.96	1406	1368	97.30	5465	5263	96.30
1998	6401	5264	82.24	1542	1511	97.99	7943	6775	85.30
1999	5550	5428	97.80	1505	1398	92.89	7055	6826	96.75
2000	5622	5504	97.90	821	747	90.99	6443	6251	97.02
2001	4606	4533	98.42	857	809	94.40	5463	5342	97.79
2002	3618	3549	98.09	623	602	96.63	4241	4151	97.88
2003	5989	5789	96.66	611	586	95.91	6600	6375	96.59

Table 9.1 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003 located in the State of Andhra Pradesh

Sl.No	Name of Rivers	FF sites codes	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood		Maximum Level Attained		No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
						Level (m)	Date/Year	Level (m)	Date			
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Vamsadhara	126	Gotta Barrage	FRL	38.40	39.92	07.10.1999	38.12	19.07.03	22	20	90.91
	Godavari	131	Sriram Sagar (Pochampad)	FRL	333.15	332.72	13.10.1990	330.89	27.8.03	7	4	57.14
2	Godavari	132	Kaleswaram	103.50	104.75	107.05	1986	101.19	30.7.03	0	0	0
3	Godavari	133	Eturunagaram	73.29	75.79	77.66	1990	73.01	24.8.03	0	0	0
4	Godavari	134	Dummagudam	53.00	55.00	60.25	1986	52.55	27.7.03	0	0	0
5	Godavari	135	Bhadrachalam	45.72	48.77	55.66	1986	46.57	27.7.03	9	7	77.78
6	Godavari	136	Kunavaram	37.54	40.32	51.30	1986	37.88	28.7.03	3	3	100.00
7	Godavari	137	Rajamundri	17.68	19.51	20.48	1986	17.22	28.7.03	0	0	0
8	Godavari	138	Dowalaishwaram	14.25	16.08	18.36	1986	10.09	28.7.03	16	15	93.75
9	Manjira	141	*Singur Dam	FRL	523.60	523.60	1999	522.31	10.8.03	3	2	66.67
10	Manjira	142	*Nizamsagar Dam	FRL	428.24	428.24	1999	422.68	9.10.03	0	0	0
11	Krishna	146	*Priyadarshini	FRL	318.52	309.85	21.10.93	316.50	22.09.03	1	1	100.00
12			Jurala Prolect									
13	Krishna	147	*Srisaillam Dam	FRL	269.75	269.93	13.10.90	259.73	31.10.03	1	1	100.00
14	Krishna	148	*Prakashan Barrage (Vijayawada)	FRL	18.30	21.50	07.10.1903	17.62	08.08.03	0	0	0
15	Tungbhadra	151	Mantralayam	310.00	312.00	315.60	19.11.1992	308.69	24.10.03	0	0	0
Total:										62	53	85.48

Table 9.2 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003 located in the State of Assam

Sl.No	Name of Rivers	FF sites codes	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood		Maximum Level Attained		No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
						Level (m)	Date/Year	Level (m)	Date			
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Brahmaputra	86	Dibrugarh	103.24	104.24	106.48	03.09.1998	105.95	08.07.03	284	282	99.30
2	Brahmaputra	87	Neamatighat	84.04	85.04	87.37	11.07.1991	86.60	09.07.03	109	108	99.08
3	Brahmaputra	88	Tejpur	64.23	65.23	66.59	27.08.1988	66.11	10.07.03	67	67	100.00
4	Brahmaputra	89	Guwahati	48.68	49.68	51.37	29.08.1988	50.99	13.07.03	89	75	84.27
5	Brahmaputra	90	Goalpara	35.27	36.27	37.43	31.07.1954	36.86	13.07.03	93	86	92.47
6	Brahmaputra	91	Dhubri	27.50	28.50	30.36	28.08.1988	29.77	14.07.03	233	233	100.00
7	Burhi -Dihing	92	Naharkatia	119.40	120.40	122.69	17.06.1973	119.36	10.07.03	0	0	0
8	Burhi -Dihing	93	Khowang	101.11	102.11	103.92	25.08.1988	103.88	10/11.07.03	39	36	92.31
9	Desang	94	Nanglamoraghat	93.46	94.46	96.49	06.09.1998	96.32	06/07.07.03	44	37	84.09
10	Dikhow	95	Sibsagar	91.40	92.40	95.62	08.07.1974	93.00	02/03.09.03	37	33	89.19
11	Subansiri	96	Badatighat	81.53	82.53	86.84	28.06.1972	83.30	10.07.03	54	54	100.00
12	Dhansiri	97	Golaghat	88.50	89.50	91.30	11.10.1986	90.10	13.10.03	67	65	97.01
13	Dhansiri	98	Numaligarh	76.42	77.42	79.87	24.09.1985	79.01	25.08.03	210	207	98.57
14	Jiabharali	99	N.T. Road Crossing	76.00	77.00	78.25	26.06.1998	78.10	30.06.03 to 01.07.03	44	236	96.72
15	Kopili	100	Kampur	59.50	60.50	61.86	16.06.1973	61.47	12.10.03	9	9	100.00
16	Kopili	101	Dharamtul	55.00	56.00	57.68	24.05.1988	56.25	03.07.03	51	51	100.00
17	Puthimari	102	N.H. Crossing	50.81	51.81	54.92	20.06.1993	54.40 *	01.07.03	260	243	93.46
18	Beki	103	Road Bridge	43.38	44.38	46.20	04.08.2000	45.64	08.07.03	291	290	99.66
19	Pagladiya	104	N.T. Road Crossing	51.75	52.75	55.38	15.09.1984	54.04	01.07.03	58	51	87.93
20	Manas	105	N.H. Crossing	46.95	47.56	50.08	15.09.1984	48.10	13.06.03	26	26	100.00
21	Sankosh	106	Golakganj	28.51	29.51	30.91	21.07.1991	30.30	08.07.03	205	204	99.51
22	Barak	113	Silchar/Annapurngh	18.83	19.83	21.84	01.08.1989	19.86	14.06.03	11	11	100.00
23	Katakhal	114	Matizuri	19.27	20.27	22.58	09.08.2002	22.58	12/13.06.03	32	30	93.75
Total:									2513	2434	96.86	

Table 9.3 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003 located in the State of Bihar

Sl.No	Name of Rivers	FF sites codes	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level Attained Level (m)	Date	No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Ganga	13	Buxar	59.32	60.32	62.09	1948	61.12	14.09.03	28	27	96.43
2	Ganga	15	Patna (Dighaghat)	49.45	50.45	52.52	23.08.1975	51.33	11.09.03	39	38	97.44
3	Ganga	16	Patna (Gandhighat)	47.60	48.60	50.27	14.08.1994	50.12	11.09.03	58	54	93.10
4	Ganga	17	Hathidah	40.76	41.76	43.15	07.08.1971	42.71	11/15.09.03	52	52	100.00
5	Ganga	18	Munger	38.33	39.33	40.99	19.09.1976	39.14	14/17.09.03	17	17	100.00
6	Ganga	19	Bhagalpur	32.68	33.68	34.18	19.08.1978	34.20	17.09.03	44	44	100.00
7	Ganga	20	Colgong/ Kahalgaur	30.09	31.09	32.84	06.09.1998	32.87	17/18.09.03	74	73	98.65
8	Ghaghra	46	Darauli	59.82	60.82	61.74	29.08.1998	61.20	26/27.08.03	79	79	100.00
9	Ghaghra	47	Gangpur Siwan	56.04	57.04	58.01	18.09.1983	57.98	25/26.08.03	79	79	100.00
10	Ghaghra	48	Chhapra	52.68	53.68	54.59	03.09.1982	54.15	10.09.03	24	24	100.00
11	Candak	57	Chatia	68.15	69.15	70.04	06.07.2002	69.15	02.08.03	51	46	90.20
12	Candak	58	Rewaghat	53.41	54.41	55.41	17.09.1986	54.71	03/04.08.03	35	35	100.00
13	Candak	59	Hazipur	49.32	50.32	50.93	1948	50.50	10/11.09.03	25	25	100.00
14	Burhi Candak	60	Lalbeghiaghat	62.20	63.20	67.09	30.07.1975	63.43	07.07.03	26	22	84.62
15	Burhi Candak	61	Muzaffarpur (Sikandarpur)	51.53	52.53	54.29	15.08.1987	52.95	23.08.03	53	52	98.11
16	Burhi Candak	62	Samastipur	45.02	46.02	49.38	15.08.1987	47.26	25.08.03	70	68	97.14
17	Burhi Candak	63	Rosera	41.63	42.63	46.35	16.08.1987	44.47	25.08.03	75	72	96.00
18	Burhi Candak	64	Khagaria	35.58	36.58	39.22	1976	37.97	15.09.03	67	67	100.00
19	Bagnmati	65	Benibad	47.68	48.68	49.72	26.07.2002	49.35	03.08.03	114	112	98.25
20	Bagnmati	66	Hayaghat	44.72	45.72	48.96	14.08.1987	45.98	22.07.03	69	69	100.00
21	Adhwara Group	67	Kamtaul	49.00	50.00	52.99	12.08.1987	50.70	30.06.03	64	62	96.88
22	Adhwara Group	68	Ekmighat	45.94	46.94	49.27	14.08.1987	47.42	23.07.03	62	61	98.39
23	Kamia Balan	69	Jhanjharpur	49.00	50.00	52.73	11.08.1987	52.00	10.07.03	118	114	96.61
24	Kosi	70	Basua	46.75	47.75	48.76	21.07.1996	48.69	10.07.03	187	187	100.00
25	Kosi	71	Baitara	32.85	33.85	36.40	15.08.1987	34.89	22.07.03	104	104	100.00
26	Kosi	72	Kursela	29.00	30.00	32.04	06.09.1998	31.80	17.09.03	94	94	100.00
27	Mahananda	73	Dhengraghat	34.65	35.65	38.09	1968	36.97	10.07.03	63	61	96.83
28	Mahananda	74	Jhawa	30.40	31.40	33.51	14.08.1987	32.72	11.07.03	100	100	100.00
29	Sone	52	Inderpuri	107.20	108.20	108.85	23.08.1975	108.10	09.09.03	4	3	75.00
30	Sone	53	Koelwar	54.52	55.52	58.88	20.07.1971	57.91	09.09.03	25	23	92.00
31	Sone	54	Maner	51.00	52.00	53.79	10.09.1976	53.14	12/14.09.03	46	45	97.83
32	Punpun	55	Sripalpur	49.60	50.60	53.91	18.09.1976	53.05	19.08.03	51	49	96.08
Total:										1997	1958	98.05

Table 9.4 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003 located in the State of Chattisgarh

Sl.No	Name of Rivers	FF sites codes	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level Attained Level (m)	No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
1	2	3	4	5	6	7	8	9	10	11	13
1	Indravati	143	Jagdalpur	539.50	540.80	544.68	1973	541.47	29.8.03	47	44
Total:									47	44	93.62

Table 9.5 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003 located in the UT of Dadra & Nagar haveli

Sl.No	Name of Rivers	FF sites codes	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level Attained Level (m)	No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
1	2	3	4	5	6	7	8	9	10	11	13
1	Damanganga	164	Madhuban dam	79.86	79.86	80.60	27.09.1993	80.00	08.10.03	7	7
2	Damanganga	166	Daman	2.60	3.40	2.40	02.07.1981	2.10	16.06.03	0	0
Total:									7	7	100.00

Table 9.6 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003 located in the State of Gujarat

Sl.No	Name of Rivers	FF sites codes	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level Attained Level (m)	No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
1	2	3	4	5	6	7	8	9	10	11	13
1	Banas	152	*Dantiwada Dam	182.88	185.06	186.04	01.09.1973	174.09	19.9.03	0	0
2	Sabarmati	153	*Dharoi Dam	187.45	192.25	189.63	03.09.1990	185.02	10.10.03	1	1
3	Sabarmati	154	Ahmedabad	44.09	45.34	46.85	18.07.1993	42.00	24.8.03	0	0
(Shubhash Bridge)											
4	Mahi	155	*Kadana Dam	126.18	127.71	127.74	09.09.1989	127.71	21.09.03	5	5
5	Mahi	156	Wanakbori	71.00	72.54	74.77	24.08.1990	70.72	25.9.03	0	0
6	Narmada	159	Garudesar	30.48	31.09	41.55	06.09.1970	22.54	30.07.03	0	0
7	Narmada	160	Bharuch	6.71	7.31	12.65	07.09.1970	6.35	30.07.03	0	0
8	Tapi	161	*Hatrur Dam	212.02	214.00	214.00	30.09.2002	214.00	10.03to 15.10	47	47
9	Tapi	162	*Ukal Dam	102.41	105.16	105.51	08.10.1990	104.79	03.10.03	29	29
10	Tapi	163	Surat	8.50	9.50	12.01	1968	4.80	16.06.03	0	0
(Nehru Bridge)											
11	Damanganga	165	Vapi Town	18.20	19.20	20.72	1976	17.57	28.07.03	0	0
Total:									82	82	100.00

Table 9.7 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003 located in the State of Haryana

Sl.No	Name of Rivers	FF sites codes	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood		Maximum Level Attained		No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
						Level (m)	Date/Year	Level (m)	Date			
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Yamuna	25	*Tajewala Weir	PL	323.70	328.27	03.09.1978	n.a.	n.a.	0	0	0
Total:									0	0	0	0

Table 9.8 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003 located in the State of Jharkhand

Sl.No	Name of Rivers	FF sites codes	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood		Maximum Level Attained		No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
						Level (m)	Date/Year	Level (m)	Date			
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Mayurakshi	75	* Massanjore Dam	FRL	121.31	122.71	21.09.2000	117.64	15.10.03	6	6	100.00
2	Damodar	79	*Tenughat Dam	FRL	268.83	265.56	17.09.1989	261.70	09.10.03	30	30	100.00
3	Damodar	80	*Panchet Dam	FRL	132.59	132.89	02.10.1959	128.45	11.10.03	76	75	98.68
4	Barakar	82	*Malthon Dam	FRL	150.88	151.79	02.10.1959	149.21	12.10.03	62	60	96.77
Total:									174	171	98.28	

Table 9.9 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003 located in the State of Karnataka

Sl.No	Name of Rivers	FF sites codes	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood		Maximum Level Attained		No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
						Level (m)	Date/Year	Level (m)	Date			
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Krishna	144	*Alamatti Dam	FRL	500.00	494.70	12.08.79	519.60	05.09.03	13	11	84.62
2	Krishna	145	*Narayanpur Dam	FRL	492.25	491.98	17.10.91	492.11	07.09.03	4	4	100.00
3	Bhima	149	Deongaon	400.00	407.00	406.30	29.08.1997	398.77	24.09.03	0	0	0
4	Tungbhadra	150	*Tungabhadra Dam	FRL	497.74	497.74	28.10.2000	494.67	11.10.03	47	42	89.36
Total:									64	57	89.06	

Table 9.10 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003, located in the State of Madhya Pradesh

2003 , located in the State of Madhya Pradesh.												
Sl.No	Name of Rivers	FF sites	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood		Maximum Level Attained		No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
						Level (m)	Date/Year	Level (m)	Date			
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Naramada	157	Mandla	437.20	437.80	439.40	13.08.1974	437.83	29.8.03	2	2	100.00
2	Naramada	158	Hoshangabad	292.83	293.83	300.90	30.08.1973	292.10	28.7.03	0	0	0
Total:										2	2	100.00

Table 9.11 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003, located in the State of Maharashtra

2003, located in the State of Maharashtra												
Sl.No	Name of Rivers	FF sites	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood		Maximum Level Attained	No.of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy	
						Level (m)	Date/Year					
		codes										
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Godavari	127	Kopergaon	490.90	493.68	499.17	1969	492.19	29.7.03	13	10	76.92
2	Godavari	128	Jalkwadi Dam	FRL	465.50	464.69	12.10.1990	457.83	10.6.03	0	0	0
3	Godavari	129	Gankhed	374.00	375.00	377.57	1947	367.00	20.7.03	0	0	0
4	Godavari	130	Nanded	353.00	354.00	355.65	1983	344.80	20.7.03	0	0	0
5	Wainganga	139	Bhandra	244.00	244.50	246.82	1986	246.30	28.7.03	9	9	100.00
6	Wainganga	140	Pauni	not fixed	232.50	235.80	1979	233.97	28.7.03	9	7	77.78
Total:										31	26	83.87

Table 9.12 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003, located in the NCT of Delhi

2003 , located in the No.1 of Delhi.												
Sl.No	Name of Rivers	FF sites	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level Attained	No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy	
		</										

Table 9.13 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003 , located in the State of Orissa												
Sl.No	Name of Rivers	FF sites codes	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood		Maximum Level Attained		No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
						Level (m)	Date/Year	Level (m)	Date			
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Subernarekna	115	Rajghat	9.45	10.36	12.20	07.08.1997	9.78	10.10.03	3	3	100.00
2	Burhabalang	116	N.H.5 Rd Bridge	7.21	8.13	9.50	12.10.1973	8.72	08.10.03	8	6	75.00
3	Baitarni	117	Anandpur	37.44	38.36	41.20	19.08.1975	38.40	08.10.03	14	11	78.57
4	Baitarni	118	Akhuapada	18.29	19.20	21.95	16.08.1960	18.60	09.10.03	11	10	90.91
5	Brahmani	119	Jenapur Exp Way	22.00	23.00	24.78	20.08.1975	22.46	11.10.03	2	2	100.00
6	Mahanadi	120	Hirakud Dam	FRL	192.02	192.08	25.09.1994	192.04	15.10.03	85	81	95.29
7	Mahanadi	121	Alipingal Devi	10.85	11.76	12.90	17.07.2001	12.90	30.08.03	40	40	100.00
8	Mahanadi	122	Nimapara	9.85	10.76	11.60	31.08.1982	11.17	30.08.03	41	40	97.56
9	Rushikuluya	123	Purushottampur	15.83	16.83	19.65	04.11.1990	18.15	08.10.03	11	11	100.00
10	Vamsadhara	124	Gunupur	83.00	84.00	88.75	17.09.1980	84.97	07.10.03	21	16	76.19
11	Vamsadhara	125	Kashinagar	53.60	54.60	58.93	18.09.1980	55.78	07.10.03	68	67	98.53
Total:									304		287	94.41

Table 9.14 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003, located in the State of Uttar Pradesh

Sl.No	Name of Rivers	FF sites codes	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level Attained		No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Ganga	3	*Narora Barrage (U/S)	PL	180.79	180.18	1978	179.05	15.06.03 to 08.10.03	86	85	98.84
2	Ganga	4	Kannauj	124.90	125.97	126.24	29.8.98			0	0	0.00
3	Ganga	5	Ankinghat	123.00	124.00	124.31	09.09.1978	123.50	17.09.03	30	30	100.00
4	Ganga	6	Kanpur	113.00	114.00	113.47	02.09.1987	112.96	10.09.03	45	45	100.00
5	Ganga	7	Dalmau	98.36	99.36	99.84	03.08.1973	99.18	22.09.03	39	38	97.44
6	Ganga	8	Phphamau	83.73	84.73	87.98	08.09.1978	85.98	12.09.03	5	5	100.00
7	Ganga	9	Allahabad (Chhatnag)	83.73	84.73	88.39	1948	85.18	12.09.03	4	4	100.00
8	Ganga	10	Mirzapur	76.72	77.72	80.34	09.09.1978	78.26	13.09.03	4	4	100.00
9	Ganga	11	Varanasi	70.26	71.26	73.90	09.09.1978	72.13	13.09.03	6	5	83.33
10	Ganga	12	Ghazipur	62.11	63.11	65.22	09.09.1978	64.75	14.09.03	27	26	96.30
11	Ganga	14	Ballia	56.62	57.62	59.92	03.09.1982	60.25	14.09.03	49	49	100.00
12	Ramganga	23	Moradabad	189.60	190.60	192.68	3.9.78			0	0	0.00
13	Ramganga	24	Bareilly	162.70	163.70	162.88	6.8.78			0	0	0.00
14	Yamuna	26	Mawi	230.00	230.85	232.45	1988	230.42	5.8.03	5	5	100.00
15	Yamuna	28	Mathura	164.20	165.20	169.73	1978	164.84	8.8.03	26	21	80.77
16	Yamuna	29	Agra	151.40	152.40	154.76	09.09.1978	149.71	11.09.03	111	84	75.68
17	Yamuna	30	Etawa	120.92	121.92	126.13	11.09.1978	119.21	07.09.03	0	0	0
18	Yamuna	31	Auraiya	112.00	113.00	118.19	25.08.1996	106.25	12.09.03	0	0	0
19	Yamuna	32	Kalpi	107.00	108.00	112.98	25.08.1990	103.55	12.09.03	0	0	0
20	Yamuna	33	Hamirpur	102.63	103.63	108.59	12.09.1983	102.19	12.09.03	0	0	0
21	Yamuna	34	Chilaghat	99.00	100.00	105.16	06.09.1978	100.35	11.09.03	3	1	33.33
22	Yamuna	35	Naini	83.73	84.74	87.99	08.09.1978	85.64	12.09.03	7	5	71.43
23	Betwa	37	Mohana	121.66	122.66	133.69	11.09.1983	123.34	11.09.03	2	2	100.00
24	Ken	39	Banda	103.00	104.00	113.28	14.09.1992	109.17	11.09.03	16	11	68.75
25	Gomati	40	Lucknow (Hanuman setu)	108.50	109.50	110.85	10.09.1971	107.43	29.09.03	0	0	0
26	Gomati	41	Jaunpur	73.07	74.07	77.74	22.09.1971	72.65	30.09.03	0	0	0
27	Sai	42	Rae- Bareilly	100.00	101.00	104.81	17.09.1982	101.72	29.06.03	30	29	96.67
28	Ghaghra	43	Elgin Bridge	105.07	106.07	107.18	14.09.1983	106.58	22.8.03	88	87	98.86
29	Ghaghra	44	Ayodhya	91.73	92.73	93.65	19.08.1998	93.35	24.8.03	90	89	98.89
30	Ghaghra	45	Turtipar	63.01	64.01	66.00	28.08.1998	65.01	25.8.03	91	89	97.80
31	Rapti	49	Balrampur	103.62	104.62	105.25	11.09.2000	104.31	22.08.03	17	17	100.00
32	Rapti	50	Bansi	83.90	84.90	85.82	21.08.1998	84.95	23.08.03	16	16	100.00
33	Rapti	51	Gorakhpur (Birdghat)	73.98	74.98	77.54	23.08.1998	75.89	25.08.03	15	15	100.00
34	Gandak	56	Khadda	95.00	96.00	97.50	23.07.2002	97.22	31.07.03	204	194	95.10
35	Betwa	38	Sahjina	103.54	104.54	108.67	12.09.1983	103.33	11.09.03	1	1	100.00
Total:										931	872	93.66

Table 9.15 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003, located in the State of Uttaranchal

Sl.No	Name of Rivers	FF sites	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level Attained	No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
								Level (m)	Date		
1	2	3	4	5	6	7	8	9	10	11	12
1	Ganga	1	Rishikesh	339.50	340.50	341.72	1995			0	0
2	Ganga	2	Haridwar	293.00	294.00	296.23	3.9.78	294.22	5.7.03	27	27
3	Alaknanda	22	Srinagar	539.00	540.00	536.85	1995			0	0
Total:										27	27
											100.00
											100.00

Table 9.16 Statement showing Maximum Water level attained, Forecasting Performance of each Forecasting Site during the flood season 2003, located in the State of West Bengal

Sl.No	Name of Rivers	FF sites	Name of FF sites	Warning Level (m)	Danger Level (m)	Previous Highest Flood Level (m)	Date/Year	Maximum Level Attained	No. of Forecasts issued during 2003	No. of forecasts within accuracy limit	% age accuracy
								Level (m)	Date		
1	2	3	4	5	6	7	8	9	10	11	12
1	Ganga	21	Farakka	21.25	22.25	25.14	07.09.1998	24.52	18/19.09.03	98	98
2	Mayurakshi	76	*Tippara Barrage	PL	62.79	67.05	27.09.1978	62.76	11.10.03	6	6
3	Mayurakshi	77	Narayanpur	26.99	27.99	29.69	27.09.1995	25.80	10.10.03	0	0
4	Ajoy	78	Gheropara	38.42	39.42	43.94	27.09.1978	38.79	10.10.03	2	2
5	Damodar	81	*Durgapur Barrage	PL	64.47	64.47	31.10.2002	64.47	Several	59	59
6	Mundeshwari	83	Harinkhola	11.80	12.80	14.58	20.09.1978	11.10	12.10.03	0	0
7	Kangsabati	84	*Kangsabati Dam	FRL	134.11	134.71	02.09.1978	127.37	15.10.03	14	10
8	Kangsabati	85	Mohanpur	24.73	25.73	29.87	02.09.1978	24.02	09.10.03	0	0
9	Raidak-1	107	Tufanganj	34.22	35.30	36.36	21.07.1993	35.15	10.07.03	19	18
10	Torsa	108	Ghughumari	39.80	40.41	41.46	03.08.2000	40.50	01.07.03	11	9
11	Jaldhaka	109	N.H.31 Road Bridge	80.00	80.90	81.33	28.07.1972	80.24	01.07.03	9	9
12	Jaldhaka	110	Mathabhanga	48.20	48.70	49.60	29.07.1972	49.35	01.07.03	17	17
13	Tista	111	Domohani Rd. Bridge	85.65	85.95	86.78	13.06.1971	86.20	08.07.03	14	14
14	Tista	112	Mekhliganj	65.45	65.95	66.45	13.07.1996	66.18	09.07.03	17	17
Total:										266	259
											97.37

TABLE-10: STATTE-WISE PERFORMANCE OF FLOOD FORECASTING & WARNING NETWORK OF CWC										
S.No	State/ Union Territory	Forecasts	Years							
			1996	1997	1998	1999	2000	2001	2002	2003
1	Andhra Pradesh	Issued	471	340	502	331	508	281	113	62
		Within limits	458	340	492	302	463	250	105	53
		% accuracy	97.2	100.0	98.0	91.2	91.1	89.0	92.9	85.5
2	Assam	Issued	2155	1862	2760	2422	2716	1779	1967	2513
		Within limits	2068	1765	2686	2366	2667	1754	1939	2434
		% accuracy	96.0	94.8	97.3	97.7	98.2	98.6	98.6	96.6
3	Bihar	Issued	1952	1567	2281	2329	1700	1764	966	1997
		Within limits	1917	1536	2247	2297	1687	1753	951	1958
		% accuracy	98.2	98.0	98.5	98.6	99.2	99.4	98.4	98.0
4	Chattisgarh (created from M.P.)	Issued	Not Applicable					49	10	47
		Within limits						42	9	44
		% accuracy						85.7	90.0	93.6
5	Gujarat	Issued	102	92	100	61	11	34	44	35
		Within limits	95	77	88	60	11	33	43	35
		% accuracy	93.1	83.7	88.0	98.4	100.0	97.1	97.7	100.0
6	Haryana	Issued	0	0	0	0	0	0	0	0
		Within limits	0	0	0	0	0	0	0	0
		% accuracy								
7	Jharkhand (created from Bihar)	Issued	Not Applicable					268	140	174
		Within limits						264	139	171
		% accuracy						98.5	99.3	98.3
8	Karnataka	Issued	284	366	421	347	212	87	98	64
		Within limits	282	365	418	297	179	74	91	57
		% accuracy	99.3	99.7	99.3	85.6	84.4	85.1	92.9	89.1
9	Madhya Pradesh	Issued	18	5	5	27	30	6	1	2
		Within limits	15	4	4	26	26	6	1	2
		% accuracy	83.3	80.0	80.0	96.3	86.7	100.0	100.0	100.0
10	Maharashtra	Issued	65	92	141	160	35	57	116	78
		Within limits	50	84	132	150	30	53	106	73
		% accuracy	76.9	91.3	93.6	93.8	85.7	93.0	91.4	93.6
11	Orissa	Issued	114	176	96	118	48	263	55	304
		Within limits	112	172	92	109	44	256	53	287
		% accuracy	98.2	97.7	95.8	92.4	91.7	97.3	96.4	94.4
12	Uttaranchal (created from U.P.)	Issued	Not Applicable					31	19	27
		Within limits						29	19	27
		% accuracy						93.5	100.0	100.0
13	Uttar Pradesh	Issued	899	570	1009	789	921	587	456	1017
		Within limits	874	553	1000	770	909	581	446	957
		% accuracy	97.2	97.0	99.1	97.6	98.7	99.0	97.8	94.1
14	West Bengal	Issued	385	377	584	454	311	238	243	266
		Within limits	363	351	574	433	292	228	237	259
		% accuracy	94.3	93.1	98.3	95.4	93.9	95.8	97.5	97.4
15	Dadra & Nagar Haveli	Issued	7	12	9	9	5	3	7	7
		Within limits	7	11	8	8	5	3	7	7
		% accuracy	100.0	91.7	88.9	88.9	100.0	100.0	100.0	100.0
16	N.C.T Delhi	Issued	25	6	35	8	13	16	6	7
		Within limits	25	5	34	8	12	16	5	4
		% accuracy	100.0	83.3	97.1	100.0	92.3	100.0	83.3	57.1
Country's Performance		Issued	6467	5465	7943	7055	6510	5463	4241	6600
		Within limits	6266	5263	7775	6826	6315	5342	4151	6368
		% accuracy	96.9	96.3	97.9	96.8	97.0	97.8	97.9	96.5

INDIA

SHOWING

FLOOD FORECASTING SET-UP IN 2003

