Assessment and Development of River
Basin Series: ADSORBS/41/2006-07

WATER QUALITY STATUS OF YAMUNA RIVER

(1999 – 2005)

CENTRAL POLLUTION CONTROL BOARD
(MINISTRY OF ENVIRONMENT & FORESTS)

November, 2006
e-mail: cpcb@nic.in; Website: www.cpcb.nic.in

Assessment and Development of River
Basin Series: ADSORBS/41/2006-07

WATER QUALITY STATUS OF YAMUNA RIVER

(1999 – 2005)

CENTRAL POLLUTION CONTROL BOARD
(Ministry of Environment & Forests, Govt. of India)
Parivesh Bhawan, East Arjun Nagar
Delhi – 110 032
Website : www.cpcb.nic.in e-mail : cpcb@nic.in

CPCB 200 Copies, 2006

Published By : Dr. B. Sengupta, Member Secretary, Central Pollution Control Board, Delhi - 32
Printing Supervision & Layout : P.K. Mahendru and Mrs. Anamika Sagar
Composing & Laser Typesetting : Mohd. Javed
Printed at : National Institute of Science Communication and Information Resources, CSIR, Dr. K.S. Krishnan Marg, New Delhi - 12

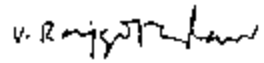
FOREWORD

The River Yamuna, the largest tributary of River Ganga has been one of the most prominent & important rivers of India. Unfortunately, certain stretches of River Yamuna are very polluted. Various urban centers e.g. Delhi, Mathura, Agra etc., which are located on the banks of Yamuna river, draw fresh river water for various activities. In return, almost the entire wastewater generated by these centers is disposed off into the river. This is the prime reason for deterioration of Yamuna River water quality from urban agglomeration of Delhi up to Chambal River Confluence.

The objectives of the monitoring studies undertaken for water bodies are to assess variation in water quality with time, significance of various outfalls into water bodies, effectiveness of various steps undertaken for pollution abatement etc. With these objectives, Central Pollution Control Board is regularly monitoring the entire Yamuna river stretch alongwith major polluting sources since 1976. Several reports had already been published based on these monitoring studies.

A project related with monitoring of Yamuna water quality under Yamuna action plan has been assigned to CPCB by National River Conservation Directorate (NRCD), Ministry of Environment & Forests. The present report covers the findings of studies under NRCD project and National Water Quality Monitoring Programme of CPCB. The water quality status of River Yamuna presented in this report is for the period 1999-2005.

It is believed that this report would be useful to various agencies engaged in the work of restoring and preserving the water quality of Yamuna River.



(V. Rajagopalan)
Chairman, CPCB

CONTRIBUTION

Overall Guidance & Supervision	:	Dr. B. Sengupta
Project Coordinator	:	Dr. S. D. Makhijani Dr. C. S. Sharma
Assistant Project Coordinator	:	Sh. N. C. Durgapal
Sampling & Analysis	:	Sh. A. Manoharan Sh. S. K. Arora Sh. N. C. Durgapal Sh. B. K. Jakhmola Sh. Vinay Gangal Sh. R. K. Rustagi Sh. G. K. Ahuja Dr. S. S. Raghav Sh. J. K. Bhatia Sh. Y. D. Pandey Sh. Satvir Singh Sh. Mirajuddin Ms. Meenu Mishra Ms. Gargi Gurtu Sh. Lakhmi Chand Sh. Ram Kishan Sh. B. L. Meena Sh. R. C. Mishra Sh. R. S. Sharma Ms. Kavita Yadav Ms. Tuhina Tripathi Ms Chetna Anand Ms. Pratibha Nair Ms. Shashi Devi Ms. Vineeta Sh. Mahavir Singh Sh. Rameshwar Sh. Ramesh Kumar Manjhi Sh. Suresh Sahu
Data Compilation, Interpretation and Report Writing	:	Sh. N. C. Durgapal
Report Editing	:	Dr. C. S. Sharma
Computer Typing, Graphics presentation & Layout setting	:	Sh. K. P. Srivastava Sh. N. C. Durgapal
Drawing	:	Sh. Ramesh Sahi

CONTENTS

EXECUTIVE SUMMARY

- Total length of the River Yamuna from its origin near Yamunotri to its confluence with Ganga River at Allahabad is 1376 kilometer. The total basin area of the river is 366223 km^2 which covers part of geographical area in the states of Uttaranchal, Uttar Pradesh, Himachal Pradesh, Haryana, Rajasthan, Madhya Pradesh & NCT – Delhi.

- The flow of the Yamuna River varies significantly during monsoon and non-monsoon seasons. The river constitutes maximum flow i.e. around 80% of the total annual flow during monsoon period. During non-monsoon period the Yamuna cannot be designated as a continuous river but segregated into four independent segments due to the presence of three barrages from where almost the entire water is being diverted for various human activities.

- The river water is used for both abstractive and in stream uses. Irrigation is the important use of Yamuna Water followed by domestic water supply, industrial and other uses.

- The sources contributing pollution are both point & non-point type. Urban agglomeration at NCT – Delhi is the major contributor of pollution in the Yamuna River followed by Agra and Mathura. About 85% of the total pollution in the river is contributed by domestic sources. The condition of river deteriorate further due to abstraction of significant amount of river water, leaving almost no fresh water in the river, which is essential to maintain the assimilation capacity of the river.

- About 580 km long river stretch in between Wazirabad barrage and Chambal river confluence is critically polluted. This stretch is characterized by high organic contents, high nutrients, significant depletion or increase in dissolved oxygen, severe odours etc. The 22 km long Delhi stretch is polluted severely.

- Central Pollution Control Board is regularly monitoring River Yamuna at 19 locations alongwith its main tributary, the Chambal River at Udi. Twenty eight major drains outfalls into Yamuna are also being monitored to measure the pollution load contributed by these drains into the river.

- This report covers the findings of monitoring studies undertaken between the periods from 1999 to 2005.

- Though, there was gradual increase in organic pollution from origin till the river reaches Delhi, but the water quality is quite good in this stretch of river. The organic pollution level increase significantly at Delhi and BOD level does not confirm the standard till the confluence of river Chambal.

- In the critically, polluted stretch of Yamuna river from Delhi to Chambal confluence, there was significant fluctuations in dissolved oxygen level from Nil to well above saturation level. This reflects presence of organic pollution load and persistence of eutrophic conditions in the river.

- Bacteriological contamination is significantly high in the entire Yamuna River stretch. Total Coliforms are generally well above the prescribed water quality standard even sometimes at Yamunotri also. The microbiological analysis confirms that the bacteriological contamination was predominantly contributed by human beings.

- Micro-pollutants were studied in the stretch between Delhi and Agra. Cadmium, Nickel and Lead were rarely present in the river, whereas zinc and iron were generally present. Among pesticides, BHC was generally present in studied stretch, whereas other monitored pesticides e.g. Aldrin, Dieldrin, endosulfan, & DDT were present rarely. The micro-pollutants were generally observed during dry seasons. Study of micro-pollutants reflects gradual decrease in the level of micro-pollutants.

- Seasonal variation in BOD reflects that upto Palla generally BOD meets the limits during both monsoon and non-monsoon period. After Delhi, BOD exceeds the limit till Chambal confluence during non-monsoon period, however, during monsoon after Agra the BOD generally meets the standard. At Delhi except at Palla, the DO generally violate the standard even during monsoon period. The Total and Faecal coliform reduced significantly during monsoon but was much higher than water quality standard.

- Standard deviation (SD) of the seven years data reflects the SD was less for those parameters representing lower values e.g. pH, Ammonia, TKN, DO, BOD etc. and was high for parameters having higher values e.g. Coliforms, Conductivity etc. Further, the values of SD increased for various parameters at those locations, which are highly polluted. The parametric correlation analysis reflects significant or highly significant correlation coefficient in almost all the locations for four pair of parameters i.e. COD-BOD, BOD-TC, TC-FC and Ammonia-TKN. The correlation of determination was poor at all the locations in case of Ammonia & TKN.

- The physico-chemical parameters such as ammonia, TKN, DO, pH etc. represent lower values having low standard deviation, whereas bacteriological parameter e.g. coliforms represent high values significantly high standard deviation. Higher standard deviation in case of coliform and conductivity reflects that these parameters are not predictable in the river Yamuna.

- Based on the water quality, the entire Yamuna river stretches may be segregated into five distinguished stretches i.e. Himalayan stretch, upper stretch, Delhi stretch, mixed stretch and diluted stretch.

- Water quality trend indicated increase in the number of coliform bacteria, TKN, ammonia concentration upstream of Delhi. After Delhi, the organic pollution and microbial contamination reflect increasing trend upto Allahabad. At Allahabad increase in total coliform and TKN leads to increasing trend.

- The aggregate discharge from 22 major drains joining river Yamuna and canals at NCT – Delhi was 49.57 m^3/sec during the year 2000, which has been reduced

to 42.65 m^3/sec during the year 2005. Correspondingly there was reduction of about 25% in BOD load contributed by these drains during year 2003.

- As per estimation, the Total BOD load generation at NCT – Delhi during the year 2003 was 443 tonnes/day (TPD). The sewage treatment facility was available for 355 TPD of BOD load, however, treatment facility of 265 TPD of BOD load was utilized. Because of which, there was reduction of about 43% in the total BOD load generated during the year 2003 by NCT – Delhi.

- Najafgarh drain of NCT – Delhi is the biggest polluter of River Yamuna, which contributes about 26% (year 2001) to 33% 22 (year 2000) of total BOD load and 48% (year 2003) to 52% (year 2001) of total discharge that joins Yamuna river and canal at Delhi by various drains. There are 70 sub drains that join main Najafgarh Drain. The study indicated that the total BOD load received by Najafgarh Drain through sub-drains was 136 TPD, whereas the BOD load at the terminal end of the Najafgarh Drain was 83 TPD only. This reduction may be contributed by biodegradation, deposition of setllable material at the bottom and diversion of drain water for irrigation etc.

- For abatement of domestic source of pollution in Yamuna river various steps are required to be undertaken, which includes – reduction of gap between wastewater generation and its treatment; maximum utilization of sewage treatment facilities; decentralization of sewage treatment plants; segregation of industrial and domestic waste; the treated sewage must be used for irrigation; aqua culture etc.

- To control industrial pollution, careful planning for the development of industrial areas based on environmental impact assessment is necessary. All the small scale industries should be connected with Combined Effluent Treatment Plant (CETP's). All the rules as specified under various acts should be followed strictly.

- The significant measure to be undertaken for abatement of pollution in river Yamuna areas below:

  - Industries should treat their effluents so as to confirm the specified requirements.
  - To reduce over exploitation of river water for various human activities, adoption of water harvesting system on large scale becoming necessary.
  - Construction of small barrages in the entire Yamuna river stretch will also solve the water scarcity problem.
  - Disposal of garbage, solid, semi-solid, waste into river, its tributaries and drains should be restricted.
  - Community participation in various Yamuna water quality restoration programme should be encouraged.

CHAPTER 1

INTRODUCTION

1.1 The Yamuna

The River Yamuna is the largest tributary of River Ganga (Fig. 1.1). This river is as prominent and sacred as the great River Ganga itself. It has been acclaimed as a holy river in Indian mythology and various pilgrimage centers e.g. Yamunotri (Uttaranchal), Paonta Sahib (Himachal Pradesh), Mathura, Vrindavan, Bateshwar & Allahabad (all in Uttar Pradesh) are located at the banks of this river. Large urban centers e.g. Yamuna Nagar, Sonepat, Delhi, the political nucleus of India, Gautam Budh Nagar, Faridabad, Mathura, Agra and Etawah are also established on its banks. Large industrial centers have also been developed either on banks or in its basin. In agriculture front also the Yamuna basin is one of the highly fertile and high food grain yielding basin, especially areas in Haryana and Western district in Uttar Pradesh. All this reflects that the River Yamuna not only flows in the hearts of Indian but also plays a significant role in the economy of the country. This river Yamuna is also influenced by the problems imparted by industrialization, urbanization and rapid agricultural developments similar to other riverine system.

The total length of Yamuna River from origin at Saptrishi Kund to its confluence with Ganga at Allahabad is 1376 km traversing through five states. The main stream of river originates from the Yamunotri glacier (Saptrishi Kund) near Bander punch peaks (38^0 59' N $78^0$27'E) in the Mussoorie range of the lower Himalayas at an elevation of about 6320 meter above mean sea level in Uttarkashi district of Uttaranchal. The head waters of Yamuna river are formed by several melt streams, the chief of then gushing out of the morainic smooth at an altitude of 3250 m, 8 km North West of Yamunotri, hot springs at the latitude 31^0 2'12" N and longitude 78^0 26' 10". Arising from the source, the river flows through series of curves and rapids for about 120 km to emerge into Indo-Gangetic plains at Dak Patthar in Uttaranchal. At Dak Patthar the river water discharge is regulated through a weir & diverted into a canal for irrigation and power generation. From Dak Patthar it flows down through famous Sikh religious center Paonta Sahib (Himachal Pradesh) and reaches Hathnikund in Haryana district where the major part of river water is diverted again into Eastern & Western Yamuna canals for irrigation. In dry season, no water is allowed to flow in the river, downstream to Hathnikund barrage. The river is almost dry in some stretches between Hathnikund and Delhi. Downstream of Hathnikund the river regain water from ground water accrual and contributions of feeding canals and small tributaries etc. From Hathnikund the river sluggishly meanders and reaches Delhi at Palla after travelling a distance of about 224 km. At Wazirabad the river is trapped again through a barrage for drinking water supply to urban aglameration at Delhi. From Wazirabad barrage no water is allowed to flow down particularly during summer, as the available water in the river is not adequate to fulfill the water supply demand of Delhi. The water flows in the Yamuna River down stream of Wazirabad is the treated, partially

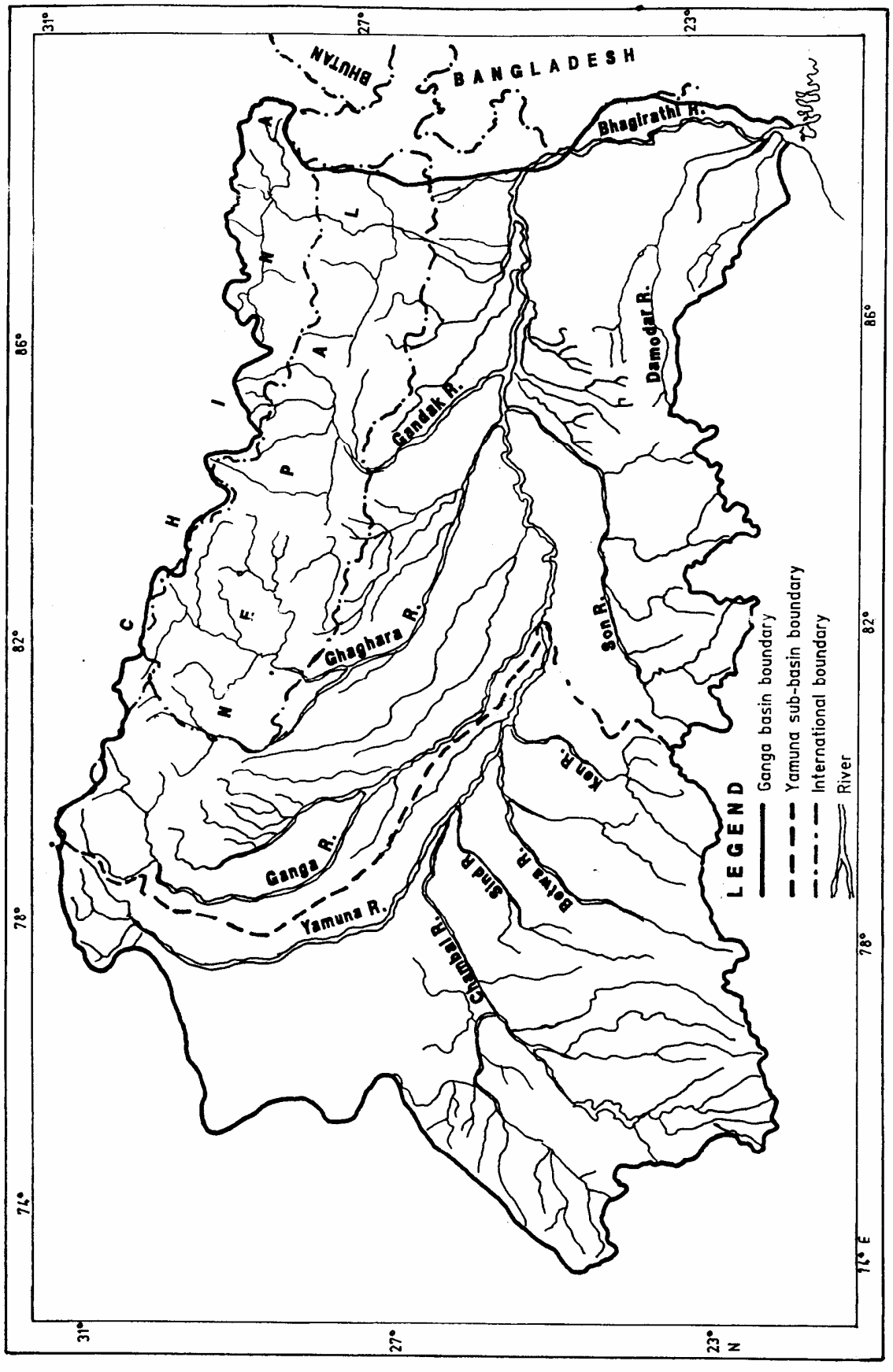


Fig. 1.1: The Ganga Basin

Yamuna at Yamunotri

Yamuna at Delhi

Yamuna behind Taj Mahal

treated or untreated domestic & industrial wastewater contributed by various drains joining river Yamuna and canal water. After 22 km downstream from Wazirabad barrage the Yamuna water is again blocked and diverted into Agra Canal for irrigation through another barrage at Okhla. Similar to downstream of Wazirabad, at downstream Okhla barrage the water flows in the river is the drain water of domestic & industrial origin contributed mainly by Shahdara drain. After travelling a distance of around 166 km, the river reaches at Mathura from where again a major part of water is diverted for drinking water supply through Gokul barrage. The Yamuna from Gokul barrage after receiving water through other important tributaries and city drains joins river Ganga at Allahabad after traversing about 790 km via cities of Agra, Bateshwar, Etawah, Hamirpur and Pratapgarh.

1.2 Tributaries of River Yamuna

In the upper reaches of River Yamuna, there are several hill streams join together to form the main stream. There are four main rivers that joins Yamuna in the higher Himalayan ranges, these are Rishi Ganga, which joins on the right bank of Yamuna, where as Unta and Hanuman Ganga joins on left bank. In the lower Himalayan ranges the Yamuna River receives Kamal, Tons, Giri & Bata on its right bank and on left banks receives Aglag & Asan. The Chambal, Betwa, Sindh & Ken are the important tributaries joining Yamuna on right bank in plain & on left bank Hindon river joins River Yamuna. Among all these tributaries, Tons at hills and Chambal at plains are the most important tributaries in terms of their discharges. The Tons is the principal source of water in mountainous range and generally carries more water than mainstream. In plains, during non-monsoon period, River Chambal contributes about 5-10 times more water to the Yamuna than its own flow. However, since the year 2003, there is a significant reduction in the water quantity that River Chambal discharges into the Yamuna River. The main tributaries of Yamuna along with location of major cities are depicted in Fig. 1.2.

1.3 River Flow Characteristics

India is one of the wettest countries in the world with about 1170 mm rains per year. But the average rainy days in a year is about 40 only and confined to only three months i.e. July, August & September (Monsoon period). The impact of this precipitation is mostly influencing the water flow in the rivers through flooding. During the non-monsoon period (October to June) the river flow reduced significantly and some rivers stretches become dry. Just opposite of this, during monsoon period the rivers receives significant amount of water, which is beyond their capacity and resulting in flood. The River Yamuna also experiences such periods of drought and floods. Yamuna River carries almost 80% of total annual flow during monsoon period. The water flow reduces significantly during non-monsoon period (Fig. 1.3) and that too diverted from river and extensively used for irrigation and drinking purpose, leaving very little or no water flow in the river.

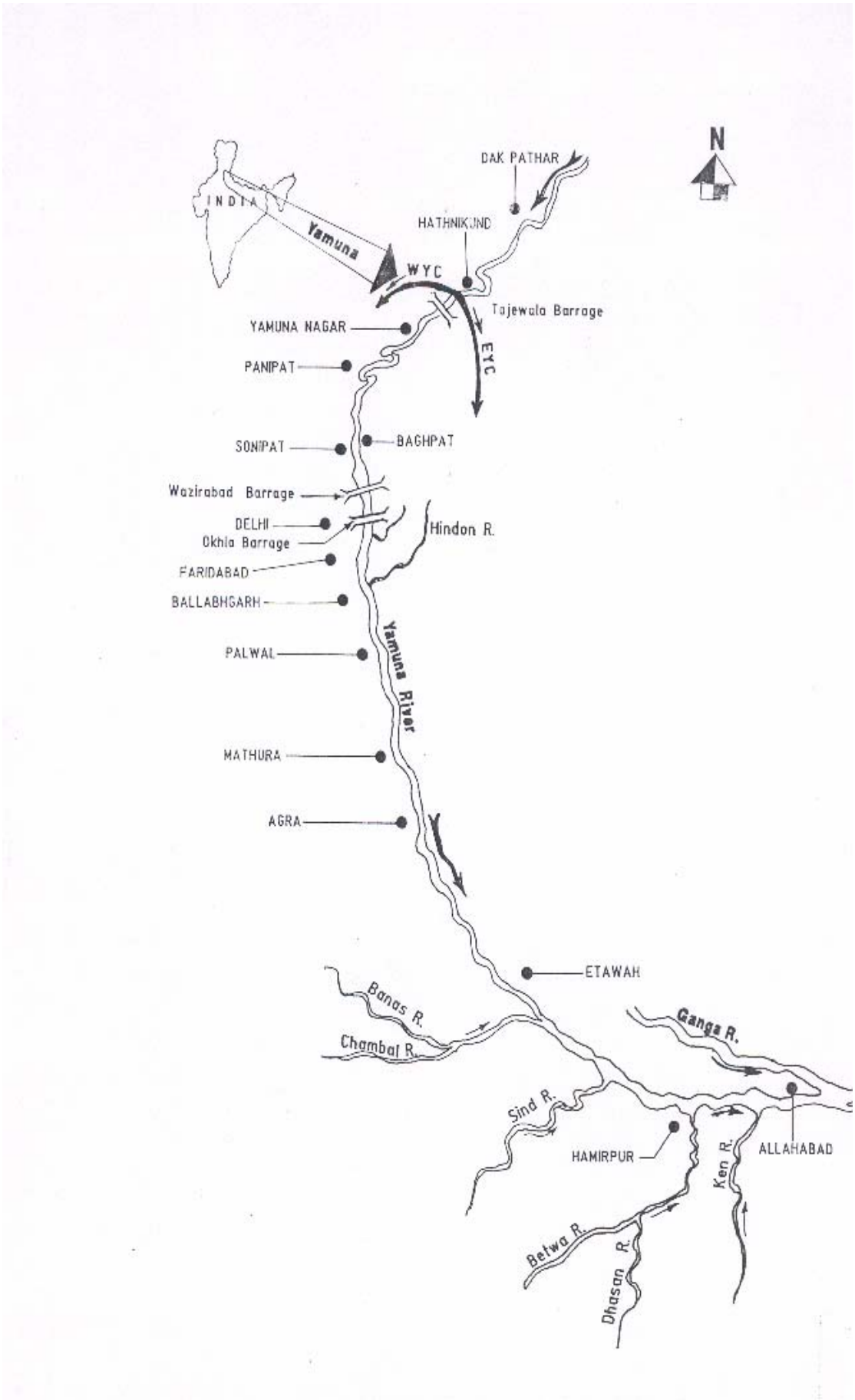


Fig. 1.2: Location of Major Cities along Yamuna River

Monsoon phase (Yamuna D/s Okhla Barrage)

Non-Monsoon Phase (Yamuna Behind Taj Mahal)

The points of abstraction and addition in water of Yamuna River are presented in Fig. 1.4. As evident, the Yamuna river is trapped through 5 barrages during its total course of flow i.e. At Dak Patthar (about 160 km from origin in Uttaranchal) at Hathnikund (172 km distance from origin, just at foothills in Haryana) at Wazirabad (in National Capital Territory of Delhi, 396 km distance from origin) at Okhla (in NCT – Delhi, 418 km distance from origin & at Mathura (Near Gokul village in Uttar Pradesh about 570 km distance from origin). These barrages are the major water abstraction locations on the river. The water is contributed into the Yamuna River, not only through its tributaries but also by the canals & drains originating from various urban centers.

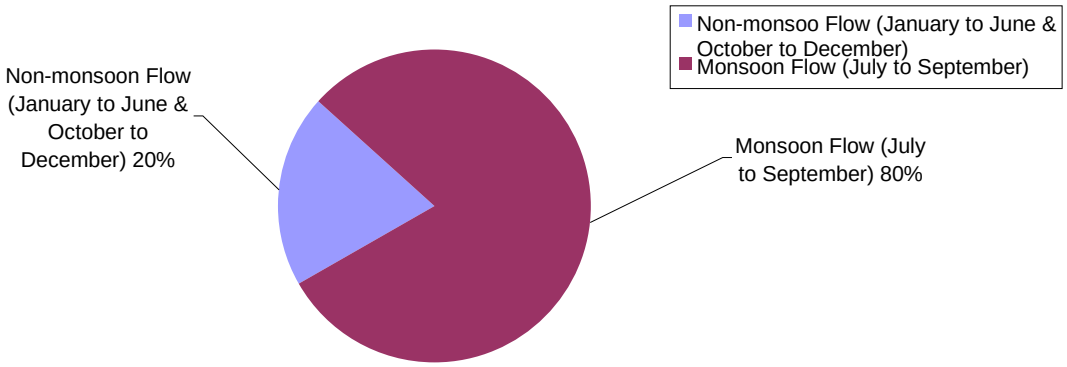


Fig. 1.3: Water Flow Estimation in Yamuna River

1.4 Segmentation of Yamuna River

The water flow characteristics of Yamuna River changes significantly from monsoon to non-monsoon seasons. This change in water flow alongwith the construction of various barrages hampers the continuous flow of the river. Thus, in dry season (almost nine months), the river becomes segmented in four distinguished independent segments.

Segment I:

This segments (length 157 km) is identified from Yamunotri and terminate at Hathnikund / Tajewala barrage. The major source of water in this segment is the melting of glaciers. The water flow in this segment terminates into Western Yamuna canal (WJC) and Eastern Yamuna Canal (EJC) for irrigation and drinking water purposes in command areas.

Segment II:

This segment (about 224 km) lies between Hathnikund / Tajewala barrage and Wazirabad barrage. The main source of water in this segment is ground

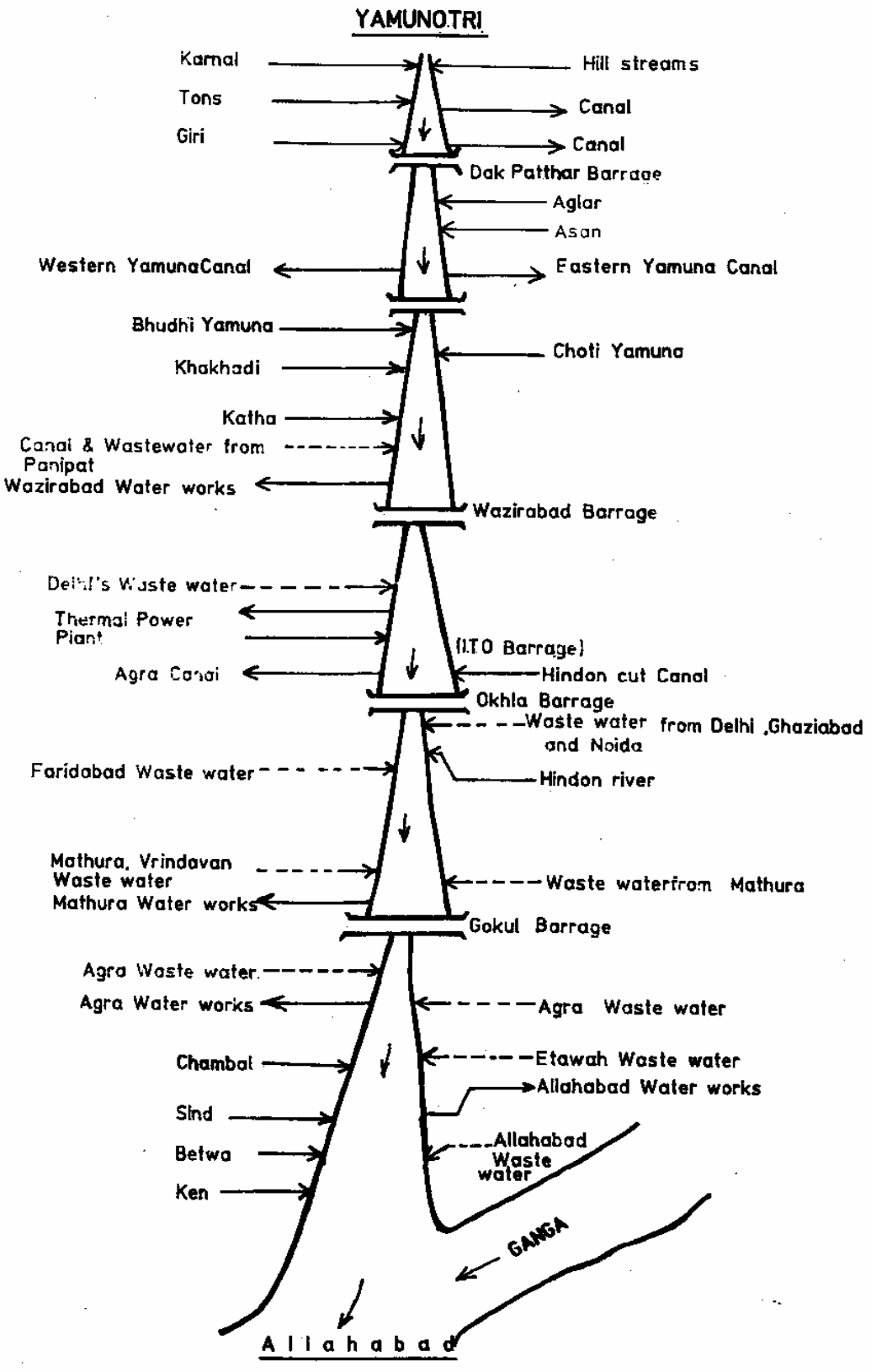


Fig. 1.4: Points of Water Abstraction & Additions in Yamuna River

water accrual. Few small tributaries also contribute water in this segment. The water is diverted in this segment from WJC through drain No. 2 to fulfill the raw water demand for drinking water supply in Delhi. The water segment is terminated into Wazirabad reservoir formed due to stagnation of water at Wazirabad barrage. The reservoir water is pumped to the various water works as raw water for treatment to met drinking water demand of the capital city. No or very little water is allowed to flow downstream Wazirabad barrage during lean seasons.

Segment III:

This 22 km segment of Yamuna River is located in between Wazirabad barrage and Okhla barrage. This segment receives water from seventeen sewage drains of Delhi and also from WJC and Upper Ganga Canal via Najafgarh drain and Hindon cut canal respectively. Little contribution of water is also made in this segment by Surghat, where Ganga and Yamuna water is provided for bathing purposes. This river segment terminates into Agra Canal, which is used to augment its flow for irrigation in the states of Haryana and Uttar Pradesh.

Segment IV:

This Segment of Yamuna River is about 973 km long initiate immediately downstream to Okhla barrage and extends upto confluence to Ganga River at Allahabad. The source of water in this segment are ground water accrual, its tributaries like Hindon, Chambal, Sindh, Ken, Betwa etc. and waste water carrying drains of Delhi, Mathura-Vrindavan, Agra and Etawah. The water of this segment is used for drinking and industrial uses at Mathura & Agra.

At Mathura, recently Gokul barrage has been constructed to trap the Yamuna river water for drinking purposes. Due to low drinking water demand only part of water is pumped out and rest flows downstream. As the water demand will increase in future. It is likely that no water will be allowed to flow down stream like Wazirabad and Okhla barrage. This may create further segmentation of segment IV into two segments of 154 & 804 km. With the construction of another barrage near Sikandara at Agra the river would be further segmented.

1.5 Rate of Fall

In the Himalayan stretch, the Yamuna River has a steep fall with an average of 19.1 metre/km. In plain stretch the river flattened gradually with an average of 0.2 metre/km. The rate of fall in various stretches of river is presented in Table 1.1. As reflected from Table 1.1 there is remarkable difference in rate of fall in valley profile of the Himalaya and Plain stretch. The maximum rate of fall i.e. 59 metres per km is in the first 25 km of river from its origin, while it is minimum (0.08 metres per km) in the 768 km long tail end starting from Agra.

Table 1.1: Rate of fall in Yamuna River Stretches

S. No.	Stretch	Length of stretch (in km)	Rate of Fall (m/km)
1.	Upper Himalaya Stretch	25	59.0
2.	Himalaya Stretch	152	19.1
3.	Total Plain Stretch	1224	0.2
4.	Lower Plain Stretch	768	0.08

1.6 Yamuna River Catchment Area

The total catchment basin of the Yamuna River is 3,66,223 km^2 (catchment basin area in various states = 3,45,848 km^2; Yamuna river area = 20,375 km^2), which is 42.5% of the Total Ganga basin area and 10.7% of the total geographical landmass of the country. The catchment of the Yamuna river system covers parts of Uttaranchal, Uttar Pradesh, Himachal Pradesh, Haryana, Rajasthan, Madhya Pradesh & National Capital Territory – Delhi. The state-wise details of catchment areas are presented in Table 1.2.

Table 1.2: Catchment Area Details of Yamuna River

State/Territory	Total area in the Yamuna River Catchment (km^2)	Area in the major sub-basin (km^2)					
		River Hindon	River Chambal	River Sind	River Betwa	River Ken	Other Sub basin
Uttaranchal	3771	-	-	-	-	-	3771
Uttar Pradesh	70437	7083	452	748	14438	3336	44380
Himachal Pradesh	5799	-	-	-	-	-	5799
Haryana	21265	-	-	-	-	-	21265
Rajasthan	102883	-	79495	-	-	-	23388
Madhya Pradesh	140208	-	59838	25131	33502	21090	647
NCT – Delhi	1485	-	-	-	-	-	1485
Total	**345848 (100%)**	**7083 (2.0%)**	**139785 (40.5%)**	**25879 (7.5%)**	**47940 (13.9%)**	**24426 (7.1%)**	**100735 (29.1%)**

The percentage contribution of the various states to the catchment area of Yamuna River are Uttaranchal 1.1%; Uttar Pradesh 20.4%; Himachal Pradesh 1.7%; Haryana 6.1%; Rajasthan 29.7%; Madhya Pradesh 40.6% & NCT – Delhi 0.4%. The sub basin tributaries of Yamuna contributes 70.9% of catchment area and remaining 29.1% account for direct drainage into the Yamuna river through other small tributaries.

The ground elevation in the Yamuna River basin varies from about 6320 meters above mean sea level (MSL) near Yamunotri Glacier to around 100 mtrs above MSL near the confluence of Yamuna River with River Ganga at

Allahabad. The topography of the Yamuna basin can be classified into three groups i.e. Hilly Region – more than 600 m above MSL; Foot hills and Plateau region – 300 m to 600 m; Plains and valleys 100 m to 300 m above MSL. On the basis of this topographic classification 11700 km^2 basin area (about 3.19%) can be classified as hilly, while remaining equally divided between plains and plateau regions with 161,231 km^2 & 172,917 km^2 respectively.

On the basis of soil types there are eight types of soils present in the entire Yamuna River basin as depicted in Table 1.3. The majority of soil type is alluvial and covers about 42% of the basin area, whereas calcareous Seirozemic soils contribute minimum with about 0.5% of the basin area.

Table 1.3: Soil Types in the Yamuna River Basin

Types of Soil	% of Total Basin Area covered	Locations
Red Sandy	2.5	Along UP-MP border in districts of Jhansi, Hamirpur, Chhattarpur etc.
Red and Yellow	5.0	Parts of Jaipur, Alwar, Sawai Madhopur, Banda, Panna districts and along western boundary of basin in Rajasthan
Calcareous Seirozemic	0.5	Parts of Mohindergarh and Bhiwani districts in Haryana
Deep Black	5.5	On the southern boundary of the basin in Sehore, Bhopal, Raisen, Vidisha, Sagar & Damoh districts
Medium Black	25.5	Most of the basin in MP and strips north of river Chambal in Rajasthan
Mixed Red and Black	15.0	Chittaurgarh, Bhilwara, Banda, Mandasaur, Shivpur, Lalitpur, Tikamgarh, Panna and Chattarpur districts
Brown Hill	4.0	Hills and foot hills in the north
Alluvial	42.0	Plains and valleys

The land use pattern in the Yamuna river catchment is presented in Table 1.4. The cultivable land in catchment is more than 60%, however, the land actually cultivated is about 52% (Table 1.4). The forest land is only 12.5% in the catchment and pertains mainly to Uttaranchal, Himachal Pradesh & Madhya Pradesh.

Table 1.4: State-wise land use pattern in Yamuna River Catchment

State	Area (% of total catchment)	Land use pattern			Land actually cultivated %	Land under habitational use %
		Non-arable land %	Forest land %	Cultivable land %		
Himachal Pradesh	1.6	25.0	59.4	15.6	14.2	1.5
Haryana	6.1	18.1	2.4	79.5	59.9	3.6
NCT – Delhi	0.4	51.0	1.0	48.0	46.5	43.7
Uttaranchal	1.1	5.0	22.0	23.0	14.3	1.6
Uttar Pradesh	20.4	14.5	3.9	81.1	68.0	5.1
Rajasthan	29.8	40.8	8.8	50.4	43.9	2.2
Madhya Pradesh	40.6	26.0	18.0	56	50.7	1.8
Total	**100.0**	**27.5**	**12.5**	**60.0**	**51.9**	**2.9**

Source: Comprehensive plan of flood control for Ganga sub-basin and tributary River System, Ganga Flood Control Committee, Ministry of Water Resources, Govt of India

1.7 Uses of Yamuna River Water

Water is one of the essential requirements of life. In the modern age it also plays a significant role in various economic activities. The higher growth rate is reflected during good monsoon period and availability of good amount of water in the river. The various uses of river water can be kept into two major groups. In one group the water is abstracted and transported away from the natural water bodies for beneficial uses and is called abstractive uses or uses involving collection and transportation. The other is just opposite of the first, in which withdrawal and transportation of water is not required but the water is utilized. It is known as non-abstractive or in-situ water uses.

1.7.1 Abstractive Uses

The river water is abstracted at different locations for varied uses. At two places i.e. Hathnikund / Tajewala & Okhla, the water abstraction is significant. The annual abstraction at various locations is presented in Table 1.5 and percent use of abstracted water for various purposes is presented in Fig. 1.5, whereas, the sharing of Yamuna river water by various states is depicted in Fig. 1.6. The various abstractive uses of river water are as below:

Domestic Water Supplies

The large urban centres located on river banks and where suitable ground water is not available, water is abstracted for drinking water supplies after suitable treatment. The urban agglomerations like Delhi, Mathura, Agra and Allahabad use the Yamuna water significantly for domestic water supplies. The water abstracted for domestic water supply at various locations is presented in Table 1.5. At Wazirabad, Delhi the entire river water is diverted for this purpose alongwith the increase in demand of water for drinking purposes. Alongwith the population increase, there are plans at various locations to withdraw more and more water from the river.

Irrigation

Irrigation is an important use of Yamuna river water. It is estimated that about 92% of Yamuna river water is used for irrigation. In the entire Yamuna basin the irrigated land is about 12.3 million hectares and approximately half of it (about 49%) is irrigated exclusively from surface water.

At present there are four irrigation canals transporting the Yamuna river water to the command areas.

Western Yamuna Canal (WJC)

This canal originate from the right bank of Yamuna River at Hathnikund / Tajewala barrage. The capacity of main canal is 163 m^3/sec and irrigates an area of about 486,000 hectares annually in Haryana State. This irrigation system is more than 100 years.

Eastern Yamuna Canal (EJC)

This canal takes off from the left bank of the River Yamuna at Hathnikund / Tajewala barrage. The canal is about 206 km long and having capacity of 85 m^3/sec. It irrigates an area of about 191,000 hectares annually in Uttar Pradesh.

Agra Canal

Agra canal originates from right bank of Yamuna River at Okhla barrage. The canal is 163 km long and carries discharge of about 63.5 m^3/sec. It irrigates about 138,000 hectares of land mainly in two districts of Mathura and Agra in Uttar Pradesh.

Gurgaon Canal

This canal is a interstate project between Rajasthan & Haryana and takes off from Agra canal at a distance of around 8 km from its off take at Okhla barrage. The water flow capacity of this canal is 14.15 m^3/sec and land irrigated by this canal is about 40,000 hectares.

Table 1.5: Water Abstraction from Yamuna River

S. No.	Location	River Water Abstraction Approx. MLD	Abstraction Use
1.	Hathnikund	20,000	Irrigation, Drinking water supply and others
2.	Wazirabad	1,100	Drinking water supply
3.	Wazirabad to Okhla Stretch	5,000	Irrigation and others
4.	Okhla to Etawah Stretch	400	Irrigation, Drinking water supply and others
5.	Etawah to Allahabad Stretch	475	Irrigation, Drinking water supply and others

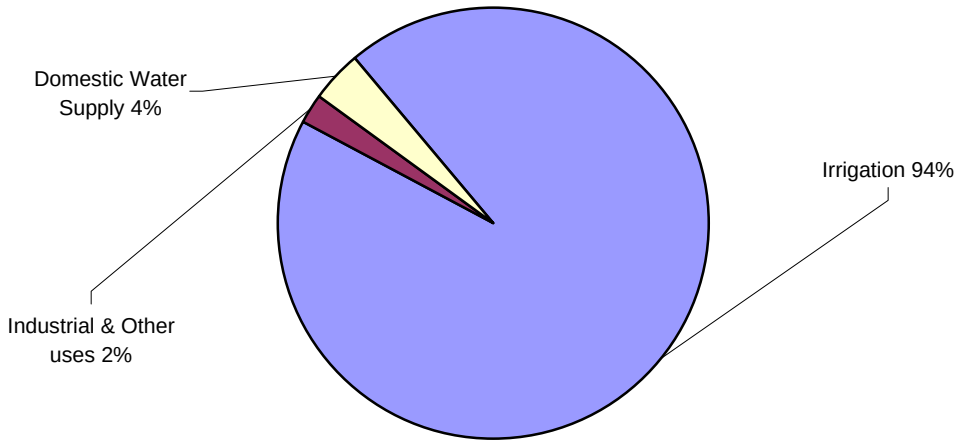


Fig. 1.5: Percentage of water abstracted from River Yamuna for various uses

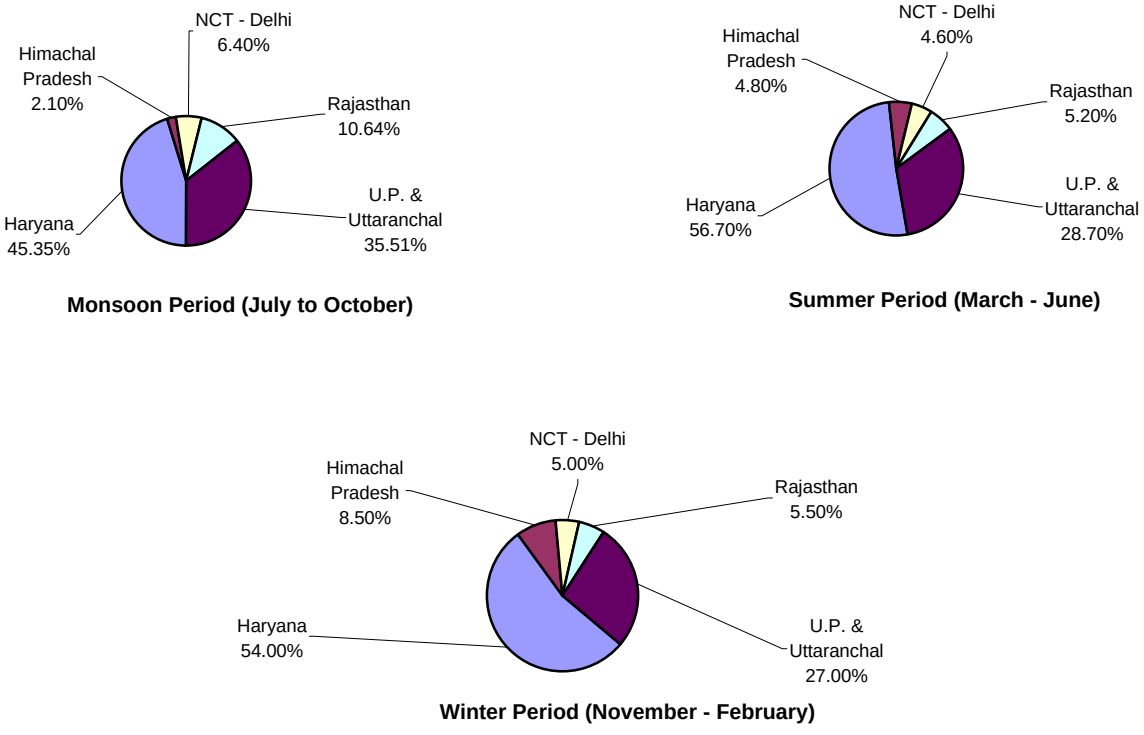


Fig. 1.6: Sharing of Yamuna River Water among various States

Bathing Activities at Yamunotri

Cloth Washing Activities at Delhi

1.7.2 In Stream Uses

Hydropower

The total potential for hydropower development in the entire Yamuna basin is about 1300 MW. The present utilization is only one third of total potential. There are few new schemes, which are at various stages of construction:

Fisheries

Fish is not popular traditional food for the people residing in Yamuna basin area except in some tribes and castes and collectively called fishing community. This is the reason that the pisciculture is neither practiced on large scale nor undertaken in organized manner in the area. However, the entire river stretch and tributaries is being utilized for fishing in unorganized manner. There is a large scope of farming for fish and other aquatic animals in stretches of River Yamuna.

Growing Aquatic Plants

The most prevalent aquatic plants in River Yamuna is the water hyacinth. In West Bengal this plant is used as cattle fodder and composted an-aerobically on large scale. In Kerala too there are various schemes to generate biogas from water hyacinth. Unfortunately, these practices are yet to be undertaken in Yamuna basin.

Navigation

The most of the river channel of river Yamuna and its tributaries are not suitable for Navigation. Low flow of river further restricts this activity. At few locations the boats are plying on need based basis, mainly for crossing the river. Earlier, the timber logs and sleepers were floated down from the Upper Himalayan areas but now this practices is also replaced by road transportation. There is a scope to use the Yamuna River stretch between Agra and Allahabad for navigation.

River Bathing & Washing

River bathing and washing is one of the most important use of river water in the country. The Hindu culture and the other cultures of Indian origin are generally considered as river oriented. Bathing is an essential part of various Hindu rituals. Bathing in flowing water and that too on rivers like Ganga, Yamuna, Narmada, Godawari etc. is considered more superior than bathing in house with well or tap water. On religious and cultural occasions millions of people take bath especially near religious towns in a congested stretch of the river within the span of a few hours. The river water is also used for washing clothes and utensils by nearby communities, particularly by the poor inhabitants.

Some of the prominent bathing centers at River Yamuna are Yamunotri, Kalpi, Paonta Sahib, Delhi, Mathura-Vrindavan, Agra, Bateshwar, Etawah and Allahabad on Yamuna River, Kota on Chambal, Orcha on Betwa and Ujjain on Shipra River.

Recreational Uses

In Yamuna basin the river are used very little for recreational value due to unsuitable conditions like rocky river bed, low water depth etc. water sports like boating have a vast potential in future specially at urban centers and at various barrage sites in the reservoir formed by the barrages.

Cattle bathing and Washing

The cattles at most of the towns & villages along the rivers are regularly taken toward the river for drinking and bathing. It is estimated that about 70% of the total cattle population in the Yamuna basin uses flowing water of river and canals for bathing and watering purposes directly. These cattle activities impart substantial impact on water quality. This occurs not only through direct discharge of urine, dung and washed off organic inorganic materials but the bottom sediments are also churn up because of cattle wading.

Besides these uses, the river Channel of Yamuna River, particularly in Delhi stretch is also used for the transportation of water for irrigation from one water body to another or from one place to another. Yamuna water is being transported from Western Yamuna Canal to Gurgaon canal via Najafgarh drain, Yamuna River and Agra canal. Similarly, River Ganga water from upper Ganga canal is transported to Agra canal for irrigation in district of Mathura and Agra via Hindon River, Hindon Cut Canal and Yamuna River. The dilution that the rivers received through this means of water transportation affects significantly the water quality of drain, canal and river.

1.8 Pollution Sources of River Yamuna

The entire stretch of Yamuna River from origin to confluence with Ganga is used for various human activities. The results of these activities are the generation of wastewater. The various sources of pollution are categorized in two groups.

1.8.1 Point Source of Pollution

When the source of pollution is single, well specified and generate significant amount of pollutants such source is known as point source. Urban centers located along or near the bank of Yamuna River are the major pollution sources of River Yamuna as detailed in Fig.1.7. The point source of pollution covers two major categories.

Riverbed farming in Yamuna River (D/s Okhla Barrage)

Cattle Wading in Yamuna River (Palwal)

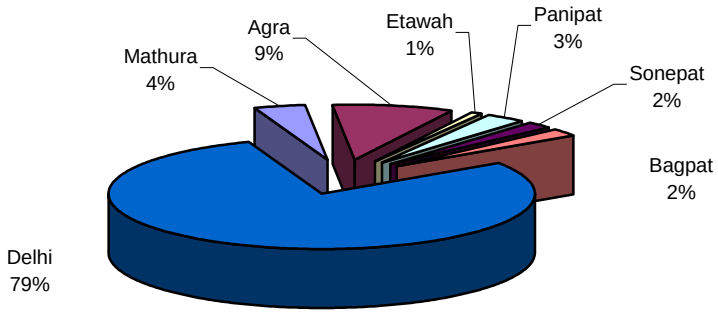


Fig. 1.7: City-wise Contribution of Pollution Load in Yamuna River

A. Domestic Pollution

The domestic pollution is the major source of pollution in Yamuna River. About 85% of the total pollution in the river is caused by the domestic sources. The domestic pollution is mainly caused by the urban centers. The major urban centres dumping domestic waste into Yamuna River are Panipat, Sonepat, Delhi, Ghaziabad, Mathura-Vrindavan, Agra, Etawah and Allahabad. The intensity of impact of domestic pollution on river depends on the efficiency of the wastewater collection system, type and length of the waste transportation system. If wastewater gets more retention time within urban premises before reaching to receiving water bodies, in such case the pollution load will reduce due to biodegradation and settling. The organic matters and micro-organisms are the main constituents of the domestic waste. Besides these, total salts, chlorides, nutrients, detergents, oil & grease etc. are also contributed by the domestic sources. There are numerous unauthorized colonies exist in various urban centres. Due to non-availability of sewerage system in these colonies, the night soil is collected, transported and dumped either in drains, tributaries or directly into river without any treatment. During last few years because of proliferation of Jhuggi Jhonpri settlement this activity increased significantly and now become a major non-point source of river water pollution.

B. Industrial Pollution

After independence, rapid industrialization occurred in the Yamuna river basin. There are large clusters of industries established at Kota, Gwalior, Indore, Nagda, Khetri, Yamuna Nagar, Panipat, Sonepat, Delhi, Baghpat, Ghaziabad, Gautam Budha Nagar, Faridabad, Mathura & other places. The categories of industries discharging wastewater into Yamuna river includes Pulp & paper, Sugar, Distilleries, Textiles, Leather, Chemical, Pharmaceuticals, Oil Refineries, Thermal Power Plants, food etc. In order to compliance to the environment laws, it is compulsory for these industries to treat the effluent to achieve prescribed standards before discharging effluent into the environment.

1.8.2 Non Point or Diffused Sources of Pollution

Just opposite to the point source the diffused sources are unspecified, numerous in numbers and contribution of each is of less significance. Though, in combination the resultant contribution is significant. This pollution is original in the catchment area of the river and transported regularly or occasionally by leaching, drainage and surface water off during monsoon. The pollutants originated from diffused sources are topsoil, organic matter, plant residues, nutrients, organic chemicals, toxicants, microorganisms etc. The important diffused pollution sources contributing to river Yamuna are:

- Agricultural pollution sources
- Dumping of garbage and dead bodies
- Immersion of idols
- Pollution due to in-stream uses of water

Agricultural Pollution

There are three major sources that contribute agricultural pollution in the river:

- Agricultural residues
- Fertilizer and Pesticides
- Animal husbandry
- Excess Salts from applied irrigation water

The various types of agricultural residues generated in the river basin are degraded naturally as it is a part of saprophytic food chain and thus not contributing much to the river pollution.

In the Yamuna basin the application rate of fertilizer is still low, moreover, due to marginal irrigation in the basin there is little chance of leftover nutrients from fertilizer application to leach, drain or wash away except during monsoon. The nutrients and pesticides are generally adsorbed by the sediment particles and reach to the river alongwith run off sediments particularly during early floods. These chemicals geo accumulate in riverbeds, which is not stable due to sandy nature of river bottom. Hence, with the flushing of riverbed by water current these chemicals mixed slowly with the supernatant river water.

The solid waste generated from animal husbandry is generally collected dry and rarely washed. Major part of this solid waste is used as organic manure. In rural areas the animal husbandry solid waste particularly animal dung is formed into cakes and dried for burning as dung cakes. Because of this, there is no significant water pollution caused from animal husbandry. However, with the change in cooking style with more and more use of cooking gas, urbanization of rural areas, modernized cattle farming, illegal and unorganized dairy farming in urban centers etc. increasing the organic pollution from these sources.

The plants consume water only through transpiration and the salts present in the applied irrigation water accumulated in the soil and ultimately leached or washed off to adjoining water bodies. The build up of salinity is frequently observed in parts of Haryana.

In almost entire stretch of Yamuna River that lies in the plain area, riverbed is extensively used for farming during the lean period when the river stream shrinks to minimum. The riverbed farming, which mainly includes vegetables, melons, cucumbers starts after monsoon season and continued till the end of summer season. During farming, there is frequent use of pesticide, washing of vegetables, disposal of farming residues etc., which provides direct impact on river water quality.

Dumping of Garbage and Dead bodies

A large portion of the solid waste generated by the unauthorized inhabitants all along the bank of Yamuna River or its tributaries finds its way into the river. The waste includes domestic waste, waste from dairies, unauthorized slaughtering, flowers and other material used during worships caracase of animals etc. The dumping of human and animal dead bodies are also sometimes observed in the Yamuna river. Disposal of infants dead bodies in the river water is practiced in the entire Yamuna stretch. Floating of human dead bodies partially eaten by animals and in rotten state are generally observed in the lower part of the river. Such disposal of dead bodies increases the risk of pathogenic contamination besides other negative impact.

Immersion of Idols

Immersion of idols, especially during Durga Puja, Ganesh Puja takes place all along the bank of river. Flowers, Straw, Bamboo, Clay / Plaster of Paris, harmful chemicals used for paints, plastic bags are finds its way into the river. As the Durga Puja festival is also getting popularity in Northern India the rate of idols immersion is also increasing every year.

1.8.3 Pollution Due to In-stream use of Water

The various sources of pollution caused by the stream use of water are:

- Bathing and clothes washing
- Cattle wading
- Open defaecation

Because of spiritual faith the bathing in River Yamuna is very common. Bathing, especially mass bathing, significantly contributes disease causing pathogens in the river water and enhance the bacterial load. The religious activities e.g. offering flowers, milk, sweets etc. into the river water further increase organic loading in the river. Since, the food items are not consumed by aquatic animals due to their limited availability. The other activities associated with bathing are clothes washing. This activity contributes

inorganic, organic and biological contaminants in the river water besides detergents. Excessive presence of detergent caused significant foaming at the site of turbulence. Foaming not only hamper the oxygen diffusion rate in the river water, essential for self-purification but also affect various biological activities.

The Yamuna basin is one of the densely populated river basins in the country. In the basin, due to non-existence of sanitary facilities in rural areas and urban areas, especially in slum clusters, a large section of population use either catchment area or directly to the river for open defecation. The activity contributes organic pollution and pathogens in the river water.

1.9 Water Quality Issues in Yamuna River

Most of the rivers including River Yamuna are spiritually regarded as mother. People from all over the country visit various stretches of this river especially at Yamunotri, Paonta Sahib, Mathura-Vrindavan and Bateshwar to take holy dip in river water to purge away their sins. Thus, the river portrays Indian culture and traditions. Deteriorate water quality and quantity of Yamuna River hurts the sentiments of Indian masses besides having several adverse impacts on life process in the river.

The issues related with water quality of Yamuna River are described as follows:

HIGH ORGANIC CONTENTS

River Yamuna receives significantly high amount of organic matter, which is generally, originates from domestic sources. For biodegradation, this organic waste requires oxygen, causing significant depletion of dissolved oxygen in river water. The oxygen depletion not only affects biotic community of the river but also affects its self-purification capacity. This problem is critical in the river stretch between Delhi and confluences of river with Chambal. In Delhi stretch, the load of organic matter is so high that it consumes the entire dissolved oxygen available in river water.

HIGH NUTRIENTS

The organic matter after biodegradation release nutrients in the water. High nutrients concentration leads to Eutrophication, a condition characterized by significant diurnal variation in dissolved oxygen concentration and excessive algal grown.

EXCESSIVE PRESENCE OF PATHOGENS

Continuous flow of sewage waste, dumping of animal dead bodies etc. and instream uses of water like bathing, cattle wading etc. contribute significant load of pathogens in the river water making it unsuitable for drinking and bathing purposes.

ACCUMULATION OF POLLUTANTS IN THE CATCHMENT AREA

Organic, inorganic and toxic pollutants generated from agricultural and industrial sources are accumulated near the source during dry seasons and get mixed with river water posing threat to aquatic life during monsoon or percolated to ground water and making water unfit for human consumption.

AESTHETIC VALUE

Yamuna river loosing its aesthetic value, glory due to severe odour that releases to the surrounding environment from the anaerobic activities occurring in the river strata and the ugly surface look contributed by blackish water, floating of garbage, plastic bags, dead bodies of animals. The religious activities and tourism are greatly affected because of these transformed characteristics of river water.

DEFORESTATIN IN THE CATCHMENT AREA

Forest cover in the catchment area of Yamuna is vanishing rapidly. This leads to soil erosion with the rainfall. This result mixing of high amount of silt, mud etc. in the river water, which in tern increases the turbidity. The turbidity of river water is also increased due to direct influx of domestic and industrial wastewater. Increased turbidity has an impact on the productivity of water body besides affecting biotic life of aquatic system.

REDUCTION IN THE QUANTITY OF WATER

The fresh water of Yamuna River is over exploited for irrigation use, drinking and industrial uses resulting very little or sometimes no water in the river at certain locations during summer season. The water scarce condition is so severe that to avoid percolation and evaporation losses, the Delhi's share of Yamuna water transported through WJC and added back into the river through Drain No. 2. All this leads to stagnation of water and formation of dry zones in the drainage area of the river. Non-availability of fresh water hampers the purification capacity of the river and causes increase in concentration of pollutants in the river water.

USE OF RIVER STREAM FOR TRANSPORTATION OF WATER

The Delhi stretch of Yamuna River is being used for transportation of water from one water body to another for irrigation purpose by Haryana and Uttar Pradesh. This transportation activity may dilute or add the pollutants affecting the water quality of river.

DISCHARGES FROM SEWAGE TREATMENT PLANTS INTO THE RIVER

Sewage treatment plants (STP's) have been constructed at various urban centers to conserve the water quality of Yamuna River. The treated, untreated or partially treated sewage from these STP's generally discharged directly or

through carrier drain into the river. Prior to installation of STP's the sewage of urban centers was discharged and get mixed with river water at various locations in the wide stretch of river through long & slow transportation system. After installation of STP alongwith swift collection and transport system, the sewage from urban centers concentrated at few places, where STP's are located. The connection of STP with the river sometimes poses great threat to water quality during non-operation of STP due to unavoidable reasons e.g. power failure, mechanical problems or maintenance of plants. In such cases the collected sewage is generally bypassed and discharged into the river at few locations with out any treatment. Such problem is very significant in those stretches of river where the STP's are located upstream of the river e.g. Mathura-Vrindavan and Agra. The discharges from these STP's located upstream from water abstraction point have impact on the water quality making it unsuitable for various human activities occurring down stream of these STP's.

ROLE OF BARRAGES

Presently there are six barrages in the Yamuna River and some other are in planning stage. The barrages have impact on characteristics of Yamuna River:

- Blocking the continuity of the river, which is a prominent characteristic of lotic (flowing) environment.

- Less demand of irrigation water or rainfall in the catchment area leads to intermittent release of water form the barrages and thus affecting the river water quality.

- Sludge containing inorganic, organic, toxic matters are generally get deposited at upstream of barrage. This settled material flushes to downstream along with sudden release of water from the barrages. Thus, pollutants mixed further with the river water at downstream, deteriorating its quality.

- The water generally releases from barrages during monsoon after a gap of 6-9 months. The water releases from the barrage after a considerable gap period, significant amount of deposited sludge in downstream reaches, which is dominantly organic in nature also flushes with it and flow in the river downstream. This sludge after mixing with the water at downstream consumes the available dissolved oxygen rapidly resulting into fish mortality and killing of other fauna of the river.

- Besides the negative impact of barrages on river characteristics, barrages also have one positive impact. Barrage forms some sort of reservoir towards upstream. This reservoir acts as oxidation pond to treat the river water.

CHAPTER 2

WATER QUALITY MONITORING NETWORK FOR RIVER YAMUNA AND METHODOLOGY

Several research studies had been carried out at River Yamuna between 1947-1976 by various organizations. However, these studies were irregular, unsystematic and limited in the scope. There had been rapid urbanization, industrialization and agricultural development in Yamuna basin after 70's, which is still ongoing. All these developments are water dependable and the water requirement is met from the River Yamuna. Alongwith the developmental activities in the catchment area, the River Yamuna water influenced greatly both in term of quantity and quality because it is well known fact that human activities requires fresh water and generates wastewater generally having final destination into river. Necessity of a well-developed water quality monitoring network for the riverine system of the country including River Yamuna that provides water quality status regularly and systematically was considered necessary for water and wastewater management, development of rational pollution control programme etc. With this in view, regular Yamuna water quality monitoring was initiated by the Central Pollution Control Board during year 1977.

Based on River Water quality monitoring studies conducted by CPCB "Ganga Action Plan" (GAP) was launched by the Government of India during 1985 for cleaning of the river Ganga. After the launching of first phase of GAP, it had been realized that launching of pollution prevention plan for main stream of river alone can not be sufficient to achieve the target unless implementation is undertaken in river tributaries such as River Gomti and River Yamuna. Therefore, during second phase of GAP two new action plans for Gomti and Yamuna River had launched. In the Yamuna Action Plan, it has been made necessary to monitor water quality of river frequently to assess the present status in the critical stretch of river and to evaluate the effectiveness of various plans undertaken for abatement of pollution. The responsibility of Yamuna River water quality monitoring was assigned to CPCB, by National River Conservation Directorate (NRCD/MoEF), the nodal agency at Ministry of Environment & Forests for planning and implementation of various rivers cleaning programme. The monitoring studies assigned by NRCD is continuously being undertaken since December, 1994 at 14 locations about 638 km long critical stretch of river Yamuna between Hathnikund to downstream of Chambal confluence at Yamuna Bridge, Sher Gharh Ghat, Aruaiya, at one location in Chambal river and 12 major wastewater outfalls in the river. Besides this, monitoring of 16 additional drains of NCT – Delhi are also undertaken since August, 1999 as a follow up action of Hon'ble Supreme Court direction in the case on news item on "Maili Yamuna" Writ Petition (Civil) No. 725 of 1994.

The Central Pollution Control Board is operating water quality network under National Water Quality Monitoring Programme (NWQMP) at 784 locations represented by 26 states and 5 Union Territories in collaboration with State Pollution Control Boards. The classification of location under NWQMP is presented in Table 2.1.

The 784 locations under NWQMP also includes the locations identified under Yamuna Action Plan. To cover the entire Yamuna River stretch five additional locations in 738 km long stretch between Yamunotri to Hathnikund and Auraiya to Allahabad and on Tons River at one location each are also being monitored regularly.

The monitoring of Yamuna River alongwith major wastewater outfall is being carried out with following objectives:

- To continuously monitor the water quality of River Yamuna on monthly to annual basis in the various stretches in order to assess water quality trend over a period of time.
- To assess the impact of tributaries or other out falls e.g. drains etc.
- To evaluate effectiveness of pollution control measures already in existence and to assess nature and extent of requirement of additional pollution control measures.
- To assess the improvement in water quality as a result of implementation of Yamuna Action Plan.
- To assess pollution loads in terms of important pollutants, joining the river by regularly monitoring major drains on monthly basis.
- To assess micro-pollutants load in the river water and sediment at critical stretch of Yamuna river through monthly (heavy metals measured in river water) and seasonal monitoring.
- To assess water quality of the river in terms of important water quality parameters (42 parameters) once a year in the river stretch. Identified under Yamuna Action Plan.

Table 2.1: Classification of Water Quality Monitoring Locations Identified under National Water Quality Monitoring Programme

S. No.	Water Body	No. of water bodies covered	Total no. of locations
1.	River	200	592
2.	Lake	61	65
3.	Pond	3	3
4.	Drain	17	17
5.	Canal	4	13
6.	Creek	3	3
7.	Tanks	5	5
8.	Well	321	321
Total		**614**	**1019**

The present report deals with the water quality data of Yamuna river locations and major outfalls that join the river selected under various projects as discussed earlier.

2.1 Sampling Locations

The sampling stations for river and major drains joining River Yamuna were selected on the basis of the need and potential of water quality impact or pollution load transported respectively. The sampling at Tons River has been initiated at the later stage under NWQMP.

The sampling locations of Yamuna and Chambal River alongwith major outfalls of drains are depicted in Fig. 2.1. The details of locations are presented below:

2.1.1 River Sampling Locations

(i) Yamunotri

The sampling site is situated just upstream of Yamunotri Temple. This location is approximately 2 km downstream from origin (Saptrishi Kund) of mainstream of Yamuna River. This reference station provides water quality of river near the source.

(ii) Shyana Chatti

Approximately 18 km from Yamunotri at Yamuna Bridge at Shyana Chatti. This location provides information about the impact of various tributaries that joins mainstream at High reaches.

(iii) Lakhwar Dam

Approximately 96 km from Yamunotri at Yamuna Bridge upstream of Lakhwar dam construction site.

(iv) Dak Patthar

Approximately 119 km from Yamunotri at Yamuna Bridge at Dak Patthar Chakrata Road, near Haripur Village. This location provides water quality prior to the confluence with Tons River and before receiving any significant pollution from urban centers.

(v) Hathnikund

Approximately 38 km downstream from Dak Patthar and 2 km upstream from Tajewala barrage, just upstream of newly constructed barrage. This location provides water quality after the tributaries e.g. Tons, Giri, Asan etc. of lower Himalaya region joins River Yamuna.

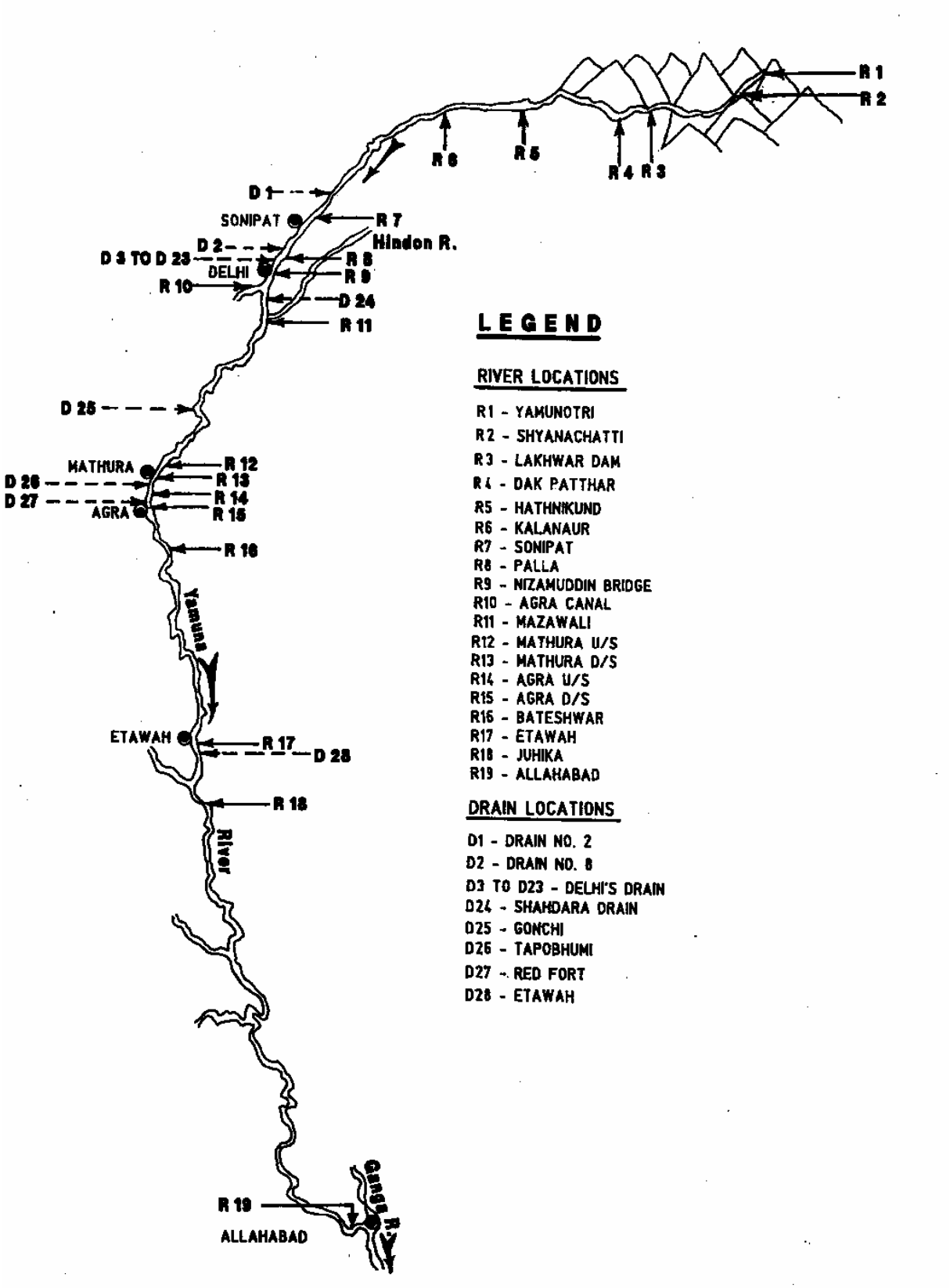


Fig. 2.1: Location Map of Sampling Stations on Yamuna River

This location also provides information about the impact of drain outfalls at Paonta Sahib.

(vi) Kalanaur

Located downstream of Hathnikund / Tajewala barrage 7 km east of Yamuna Nagar at Yamuna Bridge on Yamuna Nagar – Saharanpur Road near Kalanaur village. This location provides quality of Yamuna water mainly contributed by ground water accrual and some river tributaries like Son etc.

(vii) Sonepat

12 km East from National Highway No. 2 and 20 km East of Sonepat City at Yamuna Bridge on Sonepat-Baghpat Road. The water quality at this location reflects impact of discharges from Karnal and Panipat Cities.

(viii) Palla

About 15 km upstream from Wazirabad barrage near Cremation ground. Sampling at this location reflects the water quality before receiving the wastewater discharges from Delhi and raw water quality for Delhi's water supply. During monsoon period the river receives Drain No. 2. Upstream of this location and thus during this period, the water quality at this location also reflects the impact of domestic and industrial discharges from Sonepat District of Haryana.

(ix) Nizamuddin Bridge

14 km downstream from Wazirabad barrage (near Sarai Kale Khan bus stand) at Delhi – Ghaziabad (Noida) road bridge on Yamuna River. The water quality at this location reflects the impact of wastewater discharge.

(x) Agra Canal

24 km downstream from Wazirabad barrage and East of Delhi-Agra National highway near Madanpur Khadar village. The water quality at this location reflects the impact of discharge of treated, partially treated effluents from Okhla Sewage treatment Plant, other drains joining the river/canal and Hindon-cut.

(xi) Mazawali / Palwal

About 84 km downstream from Wazirabad barrage and approximately 16 km from Palwal at Palwal Aligarh Road bridge on Yamuna River. The location depicts the impact of wastewater discharged through Shahdara drain and Hindon River.

(xii) Mathura Upstream

At Vrindavan near Chirharan Ghat about 188 km downstream from Wazirabad barrage. The sampling location shifts to Pantoon Bridge in case river flow changes to other side of the ghat. This location of river is being monitored to assess the water quality of Yamuna before it enters Vrindavan – Mathura.

(xiii) Mathura Downstream

About 204 km from Wazirabad barrage at Gokul Barrage. The site depicts the impact of wastewater discharges from Mathura-Vrindavan city.

(xiv) Agra upstream

At Poia Ghat, about 272 Km downstream from Wazirabad barrage towards Dayalbagh near Central Water Commission's gauge station. The site presents the water quality of river Yamuna before it enters Agra city.

(xv) Agra downstream

Near temple at West Burzi of Tajmahal monument (Behind the monument) about 310 km downstream from Wazirabad Barrage. The location depicts the impact of wastewater discharges from Agra city.

(xvi) Bateshwar

5 km east of Bah Road near famous Bateshwar Temple at Yamuna Bridge, about 422 Km from Wazirabad barrage. The location depicts the water quality of the river at religious place to ensure its suitability for bathing.

(xvii) Etawah

Near Etawah-Bhind road bridge on River Yamuna, about 501 Km downstream from Wazirabad Barrage. The location provides assessment of water quality of river Yamuna before its joining with the Chambal River.

(xviii) Juhikha/Auraiya

Monitored about 9 km south of Auraiya town at Jalaun Road bridge on Yamuna river near Sher Garh Ghat about 613 km downstream from Wazirabad barrage. To assess the impact of River Chambal confluence on River Yamuna.

(xviii) Allahabad

About 3 km upstream from confluence with Ganga river at Grand Trunk Road Bridge called Naini Bridge near Gau Ghat. This location depicts the Yamuna river water quality before its confluence with river Ganga.

(xix) Udi

Near Udi village at Bhind Road bridge on Chambal River, about 330 Km via Fatehabad/Bah downstream from Wazirabad barrage. The location depicts the water quality of Chambal river before it joins Yamuna river.

The impact stations referred in the report represent four sampling location viz. Nizamuddin Bridge, Agra canal, Mathura downstream and Agra downstream.

2.1.2 Drain Sampling Locations

(i) Panipat Drain (Drain No. 2)

Around 80 km upstream from Wazirabad barrage opposite to National Fertilizers Limited (NFL) on National Highway No. 2 at Panipat (Haryana).

(ii) Sonepat Drain (Drain No. 8)

Around 25 km upstream from Wazirabad barrage at National Highway No. 2 near Piao Manihari village (Haryana). Water from Western Yamuna Canal (WJC) was also diverted through this drain (especially in summer) into Yamuna. Monitoring in this location is discontinued since 2000 as its water diverted completely into Najafgarh Drain via Drain No. 6 and Supplementary drain. This drain carries water during monsoon period only.

(iii) Najafgarh Drain

0.3 km downstream from Wazirabad Barrage near MCD garbage incinerator, Delhi. This drain also receives irrigation water from Western Yamuna Canal.

(iv) Magazine Road Drain

1.3 km from Wazirabad Barrage behind and just upstream of Gurudwara at Majnu Ka Tilla.

(v) Sweeper Colony Drain

1.4 km from Wazirabad Barrage behind and just downstream of Gurudwara at Majnu Ka Tilla.

(vi) Khyber Pass Drain

About 2.4 km from Wazirabad Barrage on outer Ring Road.

(vii) Metcalf House Drain

About 3.4 km from Wazirabad Barrage on outer Ring Road near Metcalf House.

(viii) ISBT Drain

About 4.4 km from Wazirabad barrage near ISBT Kashmere Gate, close to the Metro Rail Power feeder station.

(ix) Tonga Stand Drain

About 5.4 km from Wazirabad Barrage at Yamuna Bazar

(x) Moat Drain

About 6.9 km downstream from Wazirabad Barrage, near Vijay Ghat, Ring Road. The water is stagnant at this drain and there is no flow in the drain since November, 2001.

(xi) Civil Mill Drain

7.4 km downstream from Wazirabad barrage, near Shantivan, Ring Road, Delhi.

(xii) Power House Drain

9.2 km downstream from Wazirabad Barrage, near Rajghat Power House at Rajghat, Delhi.

(xiii) Sen Nursing Home drain

10.6 km downstream from Wazirabad barrage, near Indra Prasth (I.P.) Power Station, Opposite World Health Organization (WHO) Office, Delhi.

(xiv) Drain No. 12 A

About 0.2 km downstream of Sen Nursing Home Drain flow parallel to Sen Nursing Home Drain. No flow was observed in this drain during the year 2005.

(xv) Drain No. 14

About 8.1 km downstream of Wazirabad Barrage, near Ash Pond of Indra Prastha Thermal Power Plant.

(xvi) Barapulla Drain

14.2 km downstream from Wazirabad barrage, near Sarai Kale Khan Bus Stand, Delhi.

(xvii) Maharani Bagh Drain

About 17.7 km from Wazirabad Barrage, near Gurudwara at Taimur Nagar (Maharani Bagh).

(xviii) Kalkaji Drain

About 19.7 km downstream of Wazirabad barrage on Delhi Mathura Road near Sukhdev Vihar Bus Depot. This drain terminates into Agra Canal.

(xix) Sarita Vihar Drain

About 4 km from Kalkaji Drain on Delhi Mathura Road, near Peer Baba Majar after Sarita Vihar. This drain confluence with Agra Canal.

(xx) Tuglakabad Drain

About 6 km downstream of Okhla Barrage, behind Badarpur Thermal Power Plants water intake point.

(xxi) Shahdara Drain

24 km downstream from Wazirabad barrage, near East of Okhla barrage on the road bridge near Film City (NOIDA).

(xxii) Drain Near LPG Bottling Plant

About 2 km from Okhla Barrage, near LPG Bottling Plant.

(xxiii) Drain Near Sarita Vihar Bridge

About 1 km from Okhla Barrage. It is also known as Old Agra Canal, which receives treated / partially treated wastewater from Okhla STP.

(xxiv) Tehkhand Drain

About 4 km down stream from Sarita Vihar drain on Delhi-Mathura Road at Jaitpur Crossing. This drain terminates into Gurgaon Canal.

(xxv) Gaunchi Drain

Carrying effluents from Faridabad and Palwal. Sampling point located near Hodal (Haryana) on Road Bridge at National Highway No. 2. The water at this drain is generally used for irrigation purpose.

(xxvi) Tapobhoomi / Masani Drain

Also known as Raal drain, near a temple about 165 km downstream from Wazirabad Barrage. Raal Drain located between Vrindavan and Mathura near Tapobhoomi area. Monitoring of this drain has been discontinued since August, 2001 as the drain water diverted into oxidation pond based STP.

(xxvii) Redfort Drain

Near Red Fort in Agra city and 2 km upstream of Tajmahal monument about 212 km from Wazirabad Barrage.

(xxviii) Etawah Drain

Near Crematoria and 3 km downstream from Bhind road, about 333 km downstream from Wazirabad Barrage. Monitoring at this drain has been discontinued since November, 2001 as the drain water is diverted into oxidation pond based STP.

River Locations e.g. Yamunotri, Shyana Chatti, Lakhwar Dam, Dak Patthar and Allahabad are monitored under NWQMP, while other locations are monitored under NRCD – Yamuna water quality monitoring project. Among the drain locations Najafgarh Drain, Civil Mill Drain, Power House Drain, Sen Nursing Home Drain, Barapulla Drain and Shahdara Drain and drains of Haryana and Uttar Pradesh are monitored under NRCD Project and others are being monitored as per direction of Hon'ble Supreme Court.

2.2 Monitoring Methodology

Grab river water samples were collected form the midstream (½ width of river) or from the well mixed zone at all the river locations from a depth of about 0.3 meters. Additional samples were also collected at four impact locations from one-fourth (¼) width of the river towards out fall side. Grab samples were also collected from the drain locations before their merger with river or canal. Details of frequency of monitoring, type and number of parameters studied are briefed in Table 2.2.

Table 2.2: Water Quality Samples Collected from Yamuna River and Drains

S. No.	Locations	Monitoring Frequency	Parameters analyzed	No. of parameters covered
1.	River Locations except Yamunotri, Shyana Chatti, Lakhwar Dam, Dak Patthar and Allahabad	Monthly	General Physico-chemical	7
2.	River Locations except Yamunotri, Shyana Chatti, Lakhwar Dam, Dak Patthar and Allahabad	Yearly	General Physico-chemical	15

S. No.	Locations	Monitoring Frequency	Parameters analyzed	No. of parameters covered
3.	Lakhwar Dam, Dak Patthar and Allahabad	Quarterly	General Physico-chemical	20
4.	Yamunotri and Shyana Chatti	Yearly	General Physico-chemical	20
5.	River Locations except Yamunotri, Shyana Chatti, Lakhwar Dam, Dak Patthar and Allahabad	Monthly	Biological	3
6.	River Locations except Yamunotri, Shyana Chatti, Lakhwar Dam, Dak Patthar and Allahabad	Yearly	Biological	2
7.	Lakhwar Dam, Dak Patthar and Allahabad	Quarterly	Biological	2
8.	Yamunotri & Shyana Chatti	Yearly	Biological	2
9.	All river locations except Yamunotri, Shyana Chatti, Lakhwar Dam, Dak Patthar and Allahabad	Yearly	Heavy Metal in water	9
10.	Palla (Delhi) and impact locations	Monthly	Heavy Metals in water and sediment	7
11.	All river locations except Yamunotri, Shyana Chatti, Lakhwar Dam, Dak Patthar and Allahabad	Yearly	Pesticide in water	7
12.	Palla (Delhi) and impact locations	Quarterly	Pesticide in water and sediments, heavy metals in sediment	5
Drain Locations				
13.	All major drains joining the river	Monthly	General physico-chemical	4
14.	Drains except 16 drains of Delhi monitored as per Hon'ble Supreme Court direction	Quarterly	Heavy metal in water and sediment	7
15.	Drains except 16 drains of Delhi monitored as per Hon'ble Supreme Court direction	Quarterly	Pesticide in water and sediment	5

The collected samples are preserved either in ice or by chemicals, depending upon the parameters and transported to the laboratories as early as possible for the analysis. Measurement of few parameters like temperature and dissolved oxygen at river location and discharges at drain locations have been carried out at the monitoring site itself.

Analyses of most of the parameters have been carried out using Standard Method (APHA, 2000) as presented in Table 2.3.

Table 2.3: Analytical method used in water quality monitoring of Yamuna river & drains

S. No.	Parameter	Analysis Method	Reference
1.	Water temperature	Thermometer	APHA, 2000
2.	Discharge	Cross section - velocity method	D. de Zewart & R. C. Trivedi, 1995. Manual on integrated matter quality evaluation
3.	Turbidity	Nephelometric	APHA, 2000
4.	Total dissolved solids	Gravimetric	- do -
5.	Conductivity	Conductivity meter	- do -
6.	pH value	pH meter	- do -
7.	Chloride	Titrimetric (Argentometric)	- do -
8.	Sulphate	Turbidimetric	- do -
9.	Sodium	Flame photometric method	- do -
10.	Calcium	Titrimetric (EDTA)	- do -
11.	Magnesium	By difference between total hardness & calcium	- do -
12.	Total hardness	Titrimetric (EDTA)	- do -
13.	Alkalinity	Potentiometric titration/colour indicator titration	- do -
14.	Total coliforms	Membrane filtration technique	- do -
15.	Faecal coliforms	Membrane filtration technique	- do -
16.	Total plate count	Agar method	- do -
17.	Enterococcus	Membrane filtration technique	- do -
18.	Faecal Streptococcus	Membrane filtration technique	- do -
19.	BOD	Three day BOD at 27 degree celsius	BIS (IS:3025 part 44) 1993
20.	COD	Dichromate reflux	APHA, 2000
21.	Nitrate	Colorimetric (NEDA method)	- do -
22.	Nitrite	Colorimetric (chromotropic acid)	- do -
23.	TKN	Digestion, distillation followed by acidimetric titration	- do -
24.	Ammonia	Distillation followed by colorimetric method (Nesselerization)	- do -
25.	Dissolved oxygen	Winkler method	- do -
26.	Phosphate	Orthophosphate - pre-treatment followed by colorimetric (Stannous-chloride)	- do -
27.	Trace metals (except mercury)	Atomic absorption spectrophotometer	- do -
28.	Mercury	Flameless (cold vapour) atomic absorption (mercury analyzer)	- do -
29.	Pesticides	Gas chromatograph	- do -

APHA, 2000: Standard methods for the examination of water and wastewater 20thEdition; APHA, AWWA, USA.

CHAPTER 3

WATER QUALITY STATUS OF YAMUNA RIVER

Water quality studies of River Yamuna is being undertaken by Central Pollution Control Board since 1977. The findings of these studies are available in various reports viz:

- The Ganga Basin, Part-I: The Yamuna sub-basin (ADSORBS/2/1980-81).
- Quality and Trend of River Yamuna (ADSORBS/10/1982-83).
- Assimilation Capacity of point pollution load – The River Yamuna in UT – Delhi (CUPS/12/1982-83).
- Water Quality Status of Yamuna River (ADSORBS-32/1999-2000).

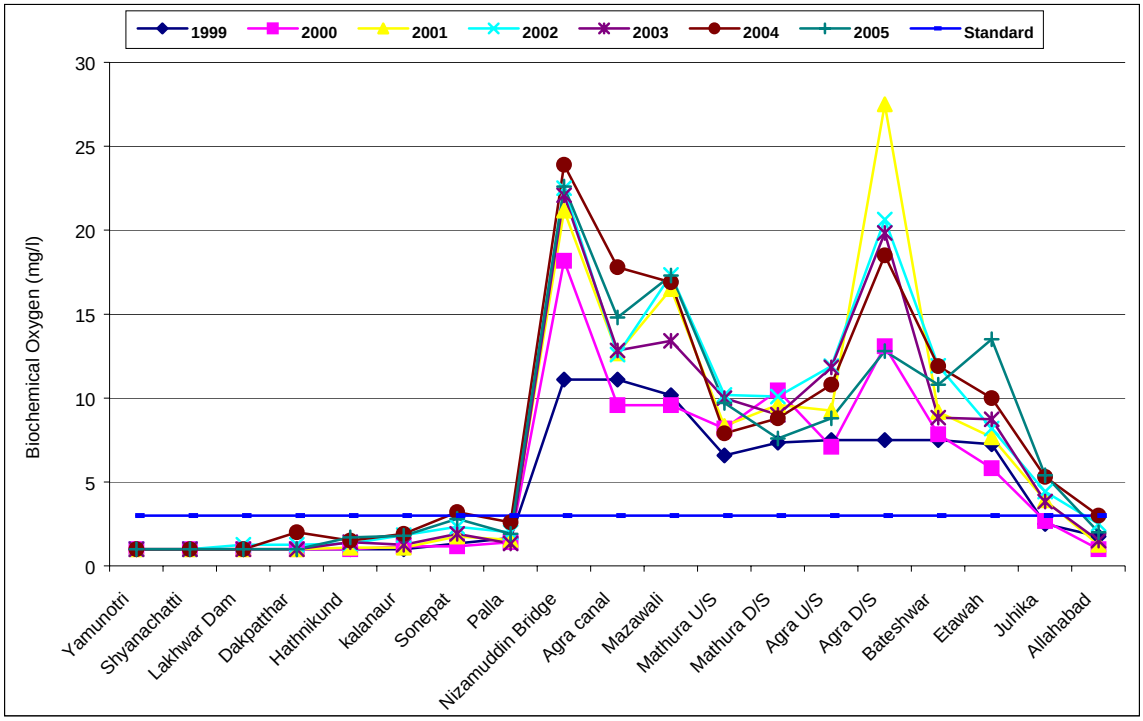
Besides these reports, year-wise water quality status of National Water Quality Monitoring Programme (NWQMP) locations data is also collated in Water quality statistics of India, published regularly by CPCB.

Water quality characteristic of River Yamuna and River Chambal (main tributary at Yamuna) in term of various characteristics is discussed ahead.

3.1 Physico-Chemical Characteristics of Yamuna River Water

The water quality status representing general physico-chemical parameters for the period January, 1999 to December, 2005 are appended in Annexure-I & II, whereas annual average of important water quality parameters is presented in Fig. 3.1 & 3.2.

The water quality of River Yamuna in terms of organic pollution had been quite good from origin till Palla as evident from Fig. 3.1. Though, there was a gradual increase in BOD from river stretch between origin to upstream Delhi. However, the average BOD values have been well below the designated best use criteria in this stretch. The BOD level increased significantly afterwards and average BOD values were not confirming the standard till the confluence of river Chambal.



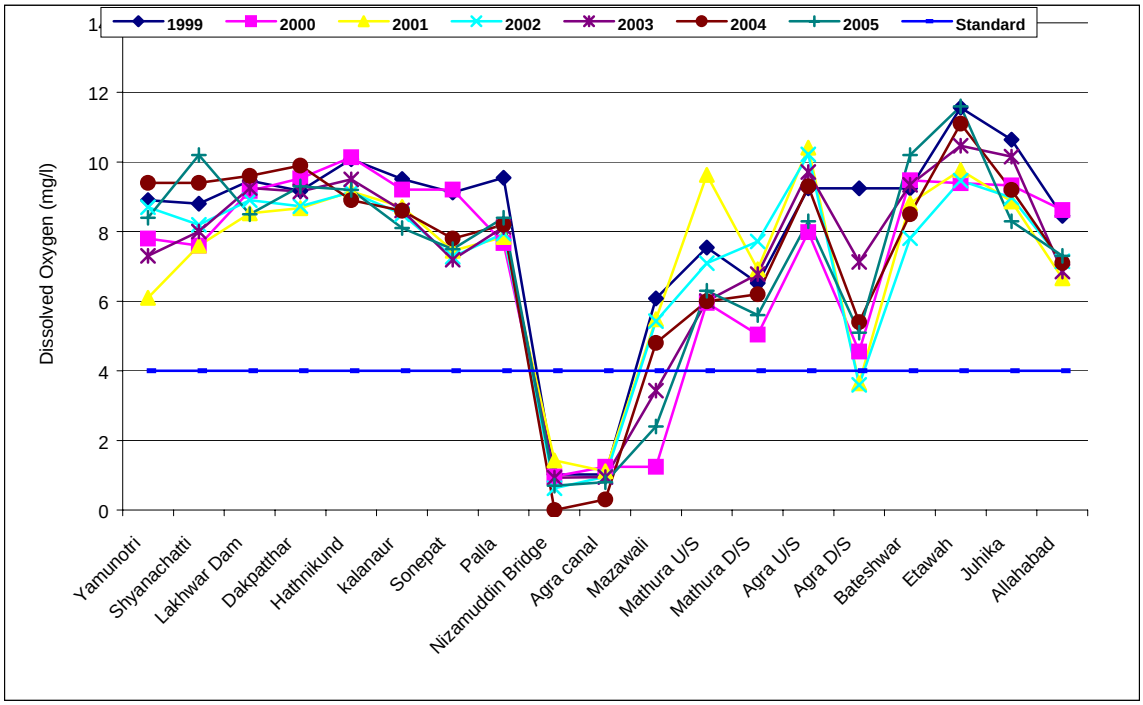
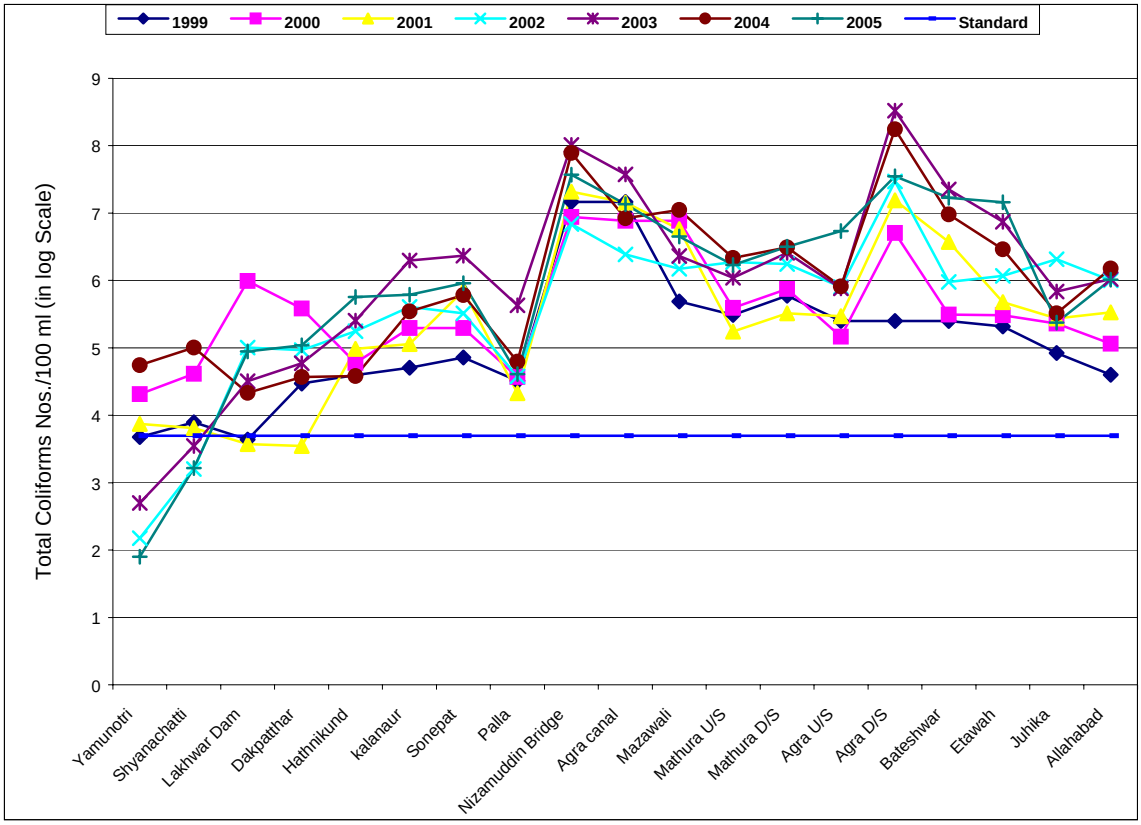


Fig. 3.1: Longitudinal Profile of Biochemical Oxygen Demand and Dissolved Oxygen in Yamuna river



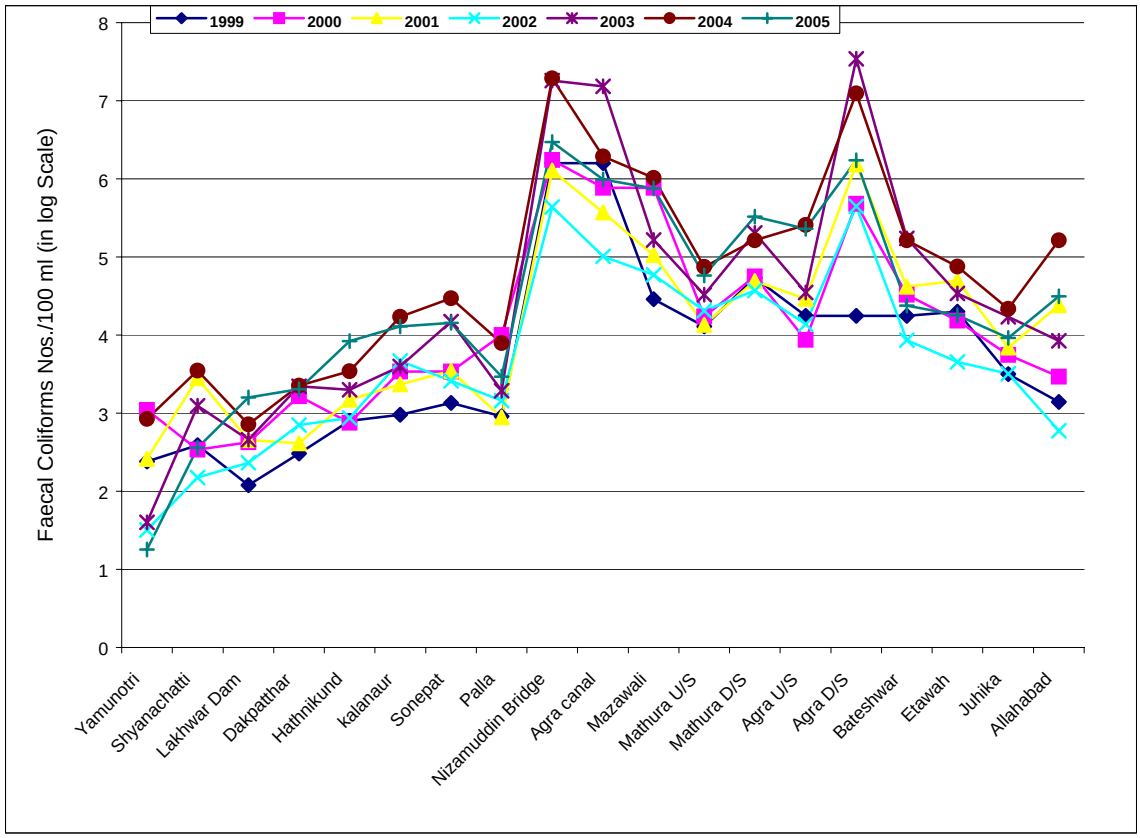


Fig. 3.2: Longitudinal profile of Total And Faecal Coliform in Yamuna river

3.1.1 Bio-chemical Oxygen Demand (BOD)

The BOD level in the Yamuna from its origin till Palla has been observed generally between in the rage of 1-3 mg/l with annual average not exceeding 3 mg/l. This is due to the fact that there is no significant wastewater outfall in the river and adequate fresh water available in this river stretch. However, the BOD concentration rises beyond the desired standard i.e. from 3.0 mg/l to 6.0 mg/l between Kalanaur to Palla. This may be either due to accidental discharges of wastewater from urban agglomerations located upstream to these locations or due to human / animal activities in the river e.g. washing, defecation etc. There has been significant increase in the BOD level downstream Wazirabad barrage at Delhi immediately after the biggest drain i.e. Najafgarh Drain joins river Yamuna. The BOD has been found exceeding the standards even after Chambal Confluence at Juhika. However, BOD standard has been complied by river water quality at Allahabad after getting sufficient dilution from the tributaries and assimilation of the pollution load. At Nizamuddin Bridge, Delhi the BOD level in the Yamuna River has been in the range of 3 to 51 mg/l with annual average varying from 11 mg/l to 24 mg/l. During year 1999 and 2000 the BOD concentration was comparatively low at all the sampling locations may be due to rainfall throughout the year in the river catchment area, frequent release of water form barrages and irrigation canal that joins Yamuna River and contribution of low BOD load from various STP, significant application of drain water for irrigation etc. At Agra Canal the BOD level varied from 3 to 34 mg/l with annual average in the range of 9 – 18 mg/l. At Agra Canal the BOD level has been observed low in comparison to Nizamuddin Bridge, inspite of the fact that the river receives many drains downstream to this location. The possible reason for this trend may be that Okhla Barrage converts river into a big reservoir, which also act as and act as an oxidation pond. Another reason may be that this reservoir gets fresh water from Hindon Cut Canal.

At Mazawali the BOD level was high and found in the range of 3 – 39 mg/l with annual average of 10 – 17 mg/l. Downstream to Okhla barrages till Etawah, the river having both septic and eutrophicated patches. The abundant algal mass from eutrophicated patches generally flushed down and mixes with septic part of river, which might have interfered in the BOD measurement. Filtration of sample to remove algal contamination also removes organic materials and as such could not be practiced. At Mathura there is not much variation in BOD level at upstream and downstream locations. At upstream and downstream BOD level was in the range of 3 – 25 mg/l and 3 - 21 mg/l respectively with similar annual average. The reasons for high BOD level at upstream may be contribution of high BOD load by Vrindavan Oxidation Pond located upstream to river sampling location. Almost same BOD concentration at down stream location is due to Gokul barrage, which transform river again into an oxidation pond similar to Okhla Barrage.

At Agra upstream the BOD concentration was even higher than Mathura and has been in the range of 2-25 mg/l with annual average of 8 – 12 mg/l between year 1999 and 2005. The reason for higher BOD may be contribution of BOD load from Buria Ka Nagla STP and other wastewater discharges, garbage disposal etc. After river location Nizamuddin Bridge, Agra downstream is worst polluted. At this location BOD ranged from 4 – 43 mg/l with annual average of 12-28 mg/l. During the year 2001 the average BOD value at Agra downstream was more than the value at Nizamuddin Bridge. The possible reason for this may be due to significantly low dilution in the river because of prolonged dry season or incomplete diversion of wastewater from source to STP. After Agra downstream there was fall in the BOD concentration though it was higher than the desirable limit except at Allahabad. At Bateshwar BOD has been found in the range of 1 – 31 mg/l with annual average of 8-12 mg/l and at Etawah it was in the range of 1 – 24 with annual average of 6-14 mg/l. At Juhika after getting dilution from River Chambal the BOD levels drop significantly and varied between 1 – 10 mg/l with annual average of 3 - 5 mg/l. At Allahabad the BOD level ranged between 1 to 3 mg/l with similar annual average.

At impact locations (downstream of city), where two samples were drawn from mid and quarter stream, there has been some variations in the BOD concentration range between mid and quarter stream. However, the annual average range has been found almost same at all the four impact locations.

3.1.2 Chemical Oxygen Demand (COD)

It has been observed that besides the wastewater discharges that Yamuna River receives at various places, excessive presence of algal mass (due to Eutrophication) also contributes significantly to COD. Upto Palla the COD was in the range of 1 - 49 mg/l. The COD was observed lowest at places located either in hilly stretch or near foothill. From Lakhwar dam till Kalanaur the annual average of COD was never exceeded 10 mg/l and was in the range of 2-10 mg/l. At Sonepat and Palla the annual average of COD was 9-17 mg/l.

From downstream Wazirabad the COD level increased drastically and remained on higher side at Juhika even after receiving Chambal River. The range of COD at this portion of river varied from 3-155 mg/l. The maximum COD values observed at stretch between Nizamuddin Bridge to Juhika was more than 60 mg/l. At Allahabad it ranged between 5-18 mg/l. At Nizamuddin bridge the annual average of COD was 50-76 mg/l, which reduced slightly at Agra Canal after getting higher retention time and also dilution from Hindon cut canal and was in the range of 40-64 mg/l. At Mazawali (Palwal) COD exceeded again with annual average in the range of 44-68 mg/l due to persistence of septic or eutrophic condition or the combination of both the COD level. At Mathura upstream, downstream and Agra upstream there has been no significant variation in the annual average of COD and it has been observed in the range of 30 to 53 mg/l. The location at Agra downstream is again the highly polluted in terms of COD location, where it ranged between 11-155 mg/l with annual average of 45-86 mg/l.

At Bateshwar, the river water quality has been almost similar to that of Mazawali and here the annual average varied from 32 – 55 mg/l. The annual average of COD at Etawah was ranged between 32 – 52 mg/l. At Juhika after receiving water from Chambal river, annual average of COD reduced and it was in the range of 15-25 mg/l. At Allahabad the annual average values of COD got reduced may be due to effect of dilution and it varied between 7-14 mg/l. There was no significant variation in the COD values at mid and quarter stream at impact locations.

3.1.3 Dissolved Oxygen (DO)

The availability of dissolved oxygen (DO) in river depends on rate and period of photosynthesis, its consumption by aquatic flora, fauna and microorganisms, water temperature etc. The variations in dissolved oxygen observed may also be because of time of the day when it is measured. In aquatic ecosystems, the DO usually occur maximum in the afternoon and minimum during night or when the sunlight is less. Therefore, changes in DO concentration observed during the study may also be due to variation in the sampling time. In Yamuna River low BOD and low DO was observed more oftenly may be due to consumption of oxygen by settled sludge in the riverbed. The annual DO values at various locations are presented at Fig.3.1. From origin to Palla the DO level has been found normal. The higher DO level at some locations may be due to low water temperature or Eutrophication. After Wazirabad the DO level fall significantly. Most of the times the DO has been found nil at both Delhi downstream locations, however, the DO level was observed meeting the standard at these locations once during the monsoon season, when there is flood of water in the river. The annual average of dissolved oxygen was not meeting the standard during the entire study period. From Okhla barrages till Allahabad the annual average of DO meets the standard except during the year 2003 at Mazawali and during year 2001 and 2002 at Agra. The fluctuations in DO level from Nizamuddin Bridge, Agra Canal and Mazawali Nil to as high as 23.1 mg/l (Bateshwar) reflects the persistence of septic and eutrophic conditions at these locations.

3.1.4 pH

The pH in the entire Yamuna stretch varied from 6.11 (Yamunotri) to 9.39 (Bateshwar). The pH in the Yamuna River has remained within prescribed limit. Slightly low pH at Yamunotri might be due to presence of various sulphur springs that joins the river.

At all the locations upstream of Mathura, the value of pH meets the higher limit i.e. 9.00 in all other locations (except Allahabad) the pH values are occasionally slightly exceeding the range. The possible reason of the same may be either industrial discharge or contributed by soil or the formation of bicarbonates ions.

3.1.5 Ammonia and TKN

Ammonia and Total Kjeldahl nitrogen follows almost the same trend as it was for BOD. The values in relatively clean stretches of river was low whereas severely polluted stretch from downstream Wazirabad till Bateshwar both ammonia and TKN concentration were significantly high. The values of ammonia in the entire Yamuna stretch were varies from beyond traceable limit (at various locations especially during monsoon period) to 43.34 mg/l at Mazawali with annual average ranged from BDL (Yamunotri and Lakhwar Dam u/s, year 1999 and Yamunotri to Dak Patthar, year 2004) to 20.66 mg/l (Nizamuddin bridge year 2004). Significantly, high concentration of ammonia might be due to contribution from industrial sources. The TKN values varied between BDL (various locations similar to that of ammonia) to 46.20 mg/l (at Nizamuddin bridge) with annual average ranged between BDL at Yamunotri, Shyana Chetti and Lakhwar Dam u/s during the year 2004 to 31.78 mg/l at Mazawali during the year 2002. The monitoring was performed at Yamunotri & Shyana Chatti once in a year (June month only when maximum pilgrims occur and the river flow slightly less. This may be the reason that the values of both TKN and ammonia has often been observed high at these locations as compared to other locations where the pollution level is less.

3.1.6 Conductivity

The conductivity in the entire Yamuna river stretch varied greatly from 45 µmhos/cm (Yamunotri) to 2290 µmhos/cm (Agra d/s). Upto Dak Patthar the conductivity was in the range of about 300 µmhos/cm and exceeds gradually at downstream locations. Conductivity was at its maximum level in the entire river stretch during dry seasons and was decreased significantly after getting dilution during rainy seasons. On the basis of annual average the conductivity was below 300 µmhos/cm upto Hathnikund and exceeded to a level of about 500 µmhos/cm upto Palla. In between Wazirabad and Okhla barrage the annual average of conductivity was in the range of about 650 to 1000 µmhos/cm. Maximum conductivity was observed from down stream Okhla barrage till upstream of Chambal confluence and the annual average was in the range of about 650 to 1450 µmhos/cm. Maximum conductivity was observed at Agra downstream, where it ranged from 431 to 2290 µmhos/cm with annual average of 1135 to 1440 µmhos/cm. After getting dilution from Chambal river the conductivity was lower down with annual average of 578 to 704 µmhos/cm, which decreased further at Allahabad with average conductivity range of 292 to 600 µmhos/cm. At impact monitoring locations, slight to significant increase has been observed in the values of conductivity.

3.1.7 Other Physico-chemical Characteristics

About a dozen parameters were also monitored once in a year (June month) in the Yamuna river stretch between Hathnikund to Juhika. The values of these additional parameters are appended at Annexure-III. The nitrite was generally not traceable in the study stretch and often observed as high as 1.54 mg/l (Mathura u/s, 2001). The nitrate concentration also varied from below traceable level to 12.83 mg/l (Mazawali, 1999). Fluoride was not

monitored in the year 2000 and 2001 and in remaining years its value varied from 0.02 mg/l (Hathnikund, 2005) to 1.42 mg/l (Nizamuddin Bridge – quarter stream, 2005). Boron was generally observed below traceable limit, its highest concentration i.e. 2.00 mg/l was observed in the year 2001 at Kalanaur, Palla and Nizamuddin Bridge ½. This parameter was not monitored in the year 2005. Fix dissolved solids (FDS) was monitored in the year 2001 and 2003 only and its value ranged between 74 mg/l (Hathnikund, 2001) to 1012 mg/l (Mathura d/s, midstream, 2003). The summary of the other observations is presented at Table 3.3.

Table 3.3: Range of values of additional Parameters in River Yamuna

S. No.	Parameters	Minimum			Maximum		
		Value (mg/l)	Location	Year	Value (mg/l)	Location	Year
1.	Total Dissolved Solids	83	Hathnikund	2000	1357	Etawah	2002
2.	Chloride	2	Hathnikund Sonepat Kalanaur	2001	424	Agra d/s (½)	2005
3.	Sulphate	7	Etawah	2005	217	Nizamuddin Bridge	1999
4.	Sodium	6	Hathnikund Sonepat	2001 2003 2004	406	Agra d/s (¼)	2004
5.	Calcium	7	Kalanaur	2001	291	Agra d/s (½)	2005
6.	Magnesium	0.4	Sonepat	2004	77	Agra canal (½)	2004
7.	Total Hardness	46	Hathnikund	2005	792	Agra u/s	2005
8.	Alkalinity	40	Hathnikund	2000	425	Mazawali	2004 2005
9.	Phosphate	0.02	Palla	2005	2.00	Mathura u/s	2004
10.	Potassium	1.0	Hathnikund	2000	48	Agra D/s	1999

3.1.8 Physico-Chemical Characteristics of River Chambal at Udi

River Chambal is the largest tributary of Yamuna River and during non-monsoon period contributes more water than Yamuna itself having. Though, significant reduction in the quantity of water in Chambal River has been noticed since 2003. The water quality of Chambal is also much better than the Yamuna. Thus after confluence with Chambal River the water quality of Yamuna improves. The water quality of the Chambal River was monitored before its confluence with Yamuna at Udi. The pH of the Chambal River was in the range of 7.11 to 9.32, the value exceeded the limit of 9.0 occasionally. The BOD ranged from 1 to 11 mg/l with annual average of 2 to 3 mg/l. Though the BOD was always below the limit of 3 mg/l for `C' class of water, however, like pH some times i.e. one time every year upto 2003, it exceeded the limit due to significant human and cattle activities. After 2003, with the reduction in water quantity BOD violated the limit more frequently. In terms of dissolved oxygen the river always matched with the standard at Udi with its concentration varied between 4.3 to 14.3 mg/l with annual average of 8.1 to 10.0 mg/l. High DO levels on maximum occasions indicate eutrophic

conditions in the river, which is also an indication of organic pollution at upstream location of the river pollution. The detailed physico-chemical characteristic of Chambal River is appended at Annexure-I & III.

3.2 Bacteriological Characteristics

The analytical data related with various groups of bacteria are appended in Annexure 1 to 3, while the annual average of Total and Faecal coliforms depicted in Fig. 3.2. In general, the total coliform numbers were not meeting the designated best use criteria i.e. 5000 nos./100 ml in Yamuna River. Total coliform numbers was below the limit at the locations near the source in the year 1999, 2002, 2003 &2005 and rarely observed meeting the standard at Palla, Mathura u/s and Agra u/s. After Palla till Allahabad the number always exceeded the limit at Yamunotri and Shyana Chetti. Near the source at Yamunotri and Shyana Chatti, the range of Total and Faecal coliform (TC & FC) varied between 80-101000 nos./100 ml and 18-3500 Nos./100 ml respectively, where as from Lakhwar dam to Palla these values ranged between 50 to 218 x 10^5 and 0 to 139000 nos./100 ml with annual average of 3513 to 2328645 and 120 to 29678 nos./100 ml for TC & FC respectively. The minimum bacterial contamination was observed not at source of the river but at the location in the foot hills of Himalaya. The monitoring at Yamunotri and Shyana Chetti was done once in a year in the month of June, when pilgrimage in its peak and bacterial contamination in the river may be contributed by this activity.

As depicted in Fig. 3.2, there was gradual increase in the numbers of both TC & FC from source to Palla. Two peaks of very high values, one in Delhi stretch and another at Agra stretch of Total and Faecal coliforms were observed. After Agra Yamuna River restore its bacteriological quality, though still not suitable for its designated best use.

After Palla the number of total and faecal coliforms varied from 1300 to 171x10^7 nos./100 ml and 50 to 203 x 10^6 nos./100 ml respectively. At Agra downstream maximum bacterial contamination was observed followed by Nizamuddin Bridge and Agra Canal. At Agra downstream the range of total coliforms and faecal coliforms varied from 58000 to 171 x 10^7 nos/100 ml and 2800 to 203 x 10^6 nos./100 ml with annual average of 1952083 – 332341667 and 442899 to 34578167 nos./100 ml respectively. At Nizamuddin bridge it was in the range of 15500 to 89 x 10^7 nos./100 ml and 2540 x 199 10^6 nos./100 ml with annual average of 88 x 10^5 to 10250883 and 437917 to 1836333 nos./100 ml in terms of total and faecal coliform respectively.

The total and faecal coliform in Chambal River at Udi varied from 60 to 145 x 10^5 and 0 - 220000 nos./100 ml with annual average of 97836 to 2542583 nos./100 ml and 280 to 20476 nos./100 ml respectively.

The faecal streptococci (FS) in the river water was monitored since 2001. The faecal streptococci have been used with faecal coliforms to differentiate human faecal contamination from that of other warm blooded animals. The

ratio of FC & FS could provide information, though not accurately, about the source of contamination. A ratio of greater than 4 is considered indicative of human faecal contamination whereas a ratio of less than 0.7 indicative of non-human contamination. In the river Yamuna and its biggest tributary i.e. in River Chambal at Udi this ratio was always above the 0.7 and generally much higher than 4 only at few locations, sometimes this ratio ranged between 1 to 4. This indicates that the bacteriological contamination in the Yamuna River was predominantly contributed by the human beings.

The Entrococcus group of bacteria was monitored once during the month of June, 1991 in the entire river stretch from Hathnikund to Juhika (Annexure-III). The Entrococcus is considered as the most efficient bacterial indicator of water quality generally used for bathing or recreational purpose. A count of 33 enterococcus / 100 ml (APHA, Standard Method for examination of water and wastewater, 20^{th} edition) in river water is considered fit for recreational uses. On the basis of Enterococcus standard, Yamuna River in the year 1999 (Enterococcus ranged between 3-26 nos./100 ml) upto Palla and at Juhika, in the year 2000 from Mathura upstream to Agra upstream (10 to 30 nos./100 ml) and in the year 2005 at Hathnikund (Enterococcus 10 nos./100 ml) was fit for bathing purpose. The Yamuna River water quality with these exceptions one not matched with the enterococcus standard during the study period because the count varies between 50 to 870000 nos./100 ml. The Chambal River water having very low count of this bacteria i.e. 2 to 16 nos./100 ml.

To estimate the number of live hetrotrophic bacteria in river water, the total plate counts was also done once in a year in the Yamuna stretch from Hathnikund to Juhika. The total plate count varies from 6000 (Hathnikund – 1999) to 198 x 10^7 nos./100 ml (Agra downstream – quarter stream; 2003) in the selected stretch of Yamuna. In Chambal at Udi this count varies from 25000 (1999) to 23 x 10^5 (2001).

3.3 Micro-pollutants Characteristics of Yamuna River Water

Micro pollutants were monitored at Palla and impact locations i.e. Nizamuddin Bridge, Agra Canal, Mathura D/s and Agra D/s. Micro pollutants, which were studied regularly includes both heavy metals and pesticides (organo chlorine)

3.3.1 Heavy Metals

Seven heavy metals were monitored on quarterly basis till June, 2000 and afterwards monitored on monthly basis at Palla and impact locations and once in a year (June month) at other locations except Allahabad and locations upstream of Hathnikund. The heavy metals characteristics of Yamuna at selected locations are appended at Annexure-IV. Cadmium & nickel were rarely present in the Yamuna River during study period. Cadmium was observed only twice with a concentration of 0.02 mg/l (at Agra downstream June, 1999) and 0.11 mg/l (at Agra downstream – quarter-stream in March, 2004) whereas nickel was present at all the impact locations during the year 2001, at Mathura (midstream & quarter-stream) and Agra (quarter-stream) in

the year 1999 & at Agra (midstream & quarter-stream) in 2002. In the year 2005, this metal was present at all the location except Nizamuddin bridge midstream. Maximum concentration i.e. 0.21 mg/l of nickel was observed during the month of March, 1999 at Mathura. Both cadmium and nickel were observed in the river either during lean flow period or during early monsoon period. Till the year 2004, the lead was not traceable in Yamuna River. However, during the year 2005, it was observed at Nizamuddin Bridge, Agra Canal and Agra downstream locations. Its maximum concentration i.e. 0.20 mg/l was observed at Nizamuddin bridge quarter stream in August, 2005.

Chromium & copper were observed more frequently in River Yamuna at studied locations. Chromium was not traceable at Palla during the year 1999 and 2003 to 2005, whereas at other locations this metal was not traceable during the year 2000 & 2004. Maximum concentration of Chromium 7.91 mg/l was observed in the month of January, 2001 at Agra D/s (midstream). At Palla copper was absent during the year 2003 to 2005 and at Agra d/s (quarter-stream) maximum concentration of copper (1.43 mg/l) was observed in February, 2002. During the same year this metal was present in maximum concentration at all the studied locations of Yamuna River.

Iron and zinc were generally observed at all the studied locations. Maximum concentration of iron i.e. 78.3 mg/l was observed at Nizamuddin Bridge (quarter-stream) in July, 2001. Iron (on the basis of annual average) concentration from Palla to Agra d/s was varied from 1.79 mg/l (Palla, 2004) to around 12.00 mg/l (Palla 2000 & Nizamuddin bridge (quarter stream), 2001). The maximum concentration of zinc 1.37 mg/l was observed in June, 2003 at Palla. The average of zinc concentration was in the range of 0.01 (Nizamuddin Bridge Midstream, 2005) to 0.54 mg/l (Nizamuddin bridge quarter-stream, 1999). Significant concentration of heavy metals in the Yamuna was generally observed either during the lean flow period or at the onset of monsoon period. These metals generally reached upto the river through flushing from various point and non-point sources. At Palla, which is relatively clean location on the basis of organic pollution, sometimes high concentration of few metals may contributed by various large scale electroplating industries located at Sonepat, upstream town of Palla. At Palla, the riverbed is silty as compared to other locations, which are having organic sludge deposition at riverbed. Silt have very less affinity to adsorb the metals as compared to sludge. This may also be a reason that the metals remain in the water, if flushed into river instead of their deposition at the riverbed along with the sludge. The mercury, which was studied once in a year (June month) at all the locations, was not traceable in the entire Yamuna stretch during the study period.

At all the non-impact locations from Hathnikund to Juhika lead and cadmium was not traceable whereas nickel was traceable once (2005) only at Sonepat with a concentration of 0.04 mg/l. Chromium was also present rarely and observed at Agra upstream and Etawah in the month of June, 2005; at Kalanaur in June, 2002 and at Sonepat in the month of June, 2005. Copper was observed at Etawah in the year 1999 and 2000 and in the locations from

Agra upstream to Juhika in the year 2001. This metal in the year 2005 was present at all the non-impact locations except Hathnikund and Juhika. Iron and zinc were present at all the locations. The range of iron at non-impact locations was 0.27 mg/l (Mazawali, 2003 & 2005) to 14.90 (Sonepat 2001).

The concentration of zinc metal was observed in the range of 0.01 mg/l (Agra u/s 1999 and Etawah 2002) to 3.61 mg/l (Etawah 1999). The presence of these metals at non-impact locations may be transportation by the early monsoon showers from the non point sources.

3.3.2 Pesticides

Pesticides characteristics of River Yamuna at Palla & impact locations in terms of five organo-chlorine pesticides are appended at Annexure-V. The sources of pesticides in Yamuna River are generally non-points in nature. Agriculture is the main source of pesticide contamination in the river, which is not only very common in the catchment area of the Yamuna River but also all along the bank of the river also. During non-monsoon period, when the main river stream shrinks significantly the riverbed itself used for farming and thus directly contributing pesticides residue in the river. The BHC (benzene hexa chloride) is widely used pesticides and its concentration generally present in the study area. The maximum concentration of BHC 5517.79 ng/l was observed at Agra downstream (quarter-stream) in September, 2005. The remaining four pesticides i.e. Dieldrin, Aldrin, Endosulfan & DDT (Dichloro, Diphenyl, Trichloroethane) were generally not traceable. Maximum concentration of Aldrin 231.41 ng/l was observed at Nizamuddin bridge (midstream) in December, 2001 whereas the maximum level of Dieldrin 50.85 ng/l was observed at Mathura downstream (quarter stream) in March, 2005. The level of endosulfan was on its peak with 4591.08 ng/l at Mathura d/s (midstream) in the month of June, 2002. The maximum concentration of DDT i.e. 1789.53 ng/l was observed in the month of September, 2005 at Agra downstream (quarter stream). The pesticides are contributed in the river by the surface run off of agricultural land through non-monsoon/ monsoon showers and seepage of irrigation water. Though, DDT is not presently in use for agricultural purpose, however, it is used to protect the public health by control of vectors. Moreover, the persistence of DDT in the environment is quite high & it remains in the environment for quite a long period of time. The gradual decrease in the level of studied pesticides as depicted at Annexure V may be attributed by the more and more use of less persistence pesticides in the catchment area of river Yamuna.

The organo chlorine pesticides (OCP) were also monitored at all non-impact locations during June month. BHC and Aldrin in the year 2000, 2001 and 2003; Endosulfan in the year 2000 & 2001, Dieldrin in the year 2000, 2001 and 2003 and DDT in the year 2003 were found not traceable. The range of BHC at non-impact locations varied from 4.37 µg/l (Kalanaur, 2002) to 980.34 µg/l (Mathura u/s, 2000). The range of Aldrin observed at non impact location varied from 17.33 µg/l (Hathnikund, 1999) to 111.85 (Mathura u/s, 2002). The concentration range of Endosulfan was observed from 4.29 µg/l (Bateshwar,

1999) to 1394.83 µg/l (Mathura u/s, 2002). Dieldrin in the year 1999 was observed at only two locations i.e. Hathnikund (10.20 µg/l) and Kalanaur (2.87 µg/l). In the year 2002 again this pesticide was observed at two locations only i.e. Agra upstream (6.11 µg/l) and Bateshwar (4.33 µg/l). DDT was observed at few locations only with the range of 1.59 µg/l (Kalanaur, 1999) to 848.05 (Mazawali, 1999). In the year 2001 DDT was observed at Bateshwar only with the concentration of 28.22 µg/l.

Organo-phosphorous pesticide i.e. Malathion & Methyl parathion were simultaneously studied once in a year (June month) in the Yamuna river stretch from Hathnikund to Juhika. The Malathion was not traceable whereas Methyl parathion was observed upto the year 2000 with maximum concentration of 520.95 ng/l at Kalanaur during the year 1999.

3.3.3 Micro-pollutants Characteristics of Chambal River at Udi

7 heavy metals and 7 pesticides (5 OCP and 2 OPP) were monitored once in a year in Chambal River at Udi. The concentration range of Iron was 0.26 mg/l (2002) to 17.8 mg/l (2001) and zinc between 0.01 mg/l (1999) to 0.27 mg/l (2005), while other studied metals were not traceable. Among pesticides Dieldrin was observed once (2001) with the concentration of 10.9 µg/l.

3.4 Micro Pollutant Characteristics of Yamuna River Sediment

Seven heavy metals & five pesticides were monitored on quarterly basis at Palla and impact locations. The micro-pollutants adsorbed by the organic matters present in the river water and settled down at the river bottom as sludge. Flushing of sludge again slowly released them in the water. The settlement of the micro pollutants in the riverbed is not uniform, therefore, it is difficult to find out the co-relation of micro pollutants concentration in water & sludge. This is also a reason that accurate sludge sampling to find out true picture of micro-pollutant in sludge is often not possible. The micro pollutants characteristics of river sediment at selected location are appended at Annexure-VI.

Except iron, the concentration of all other studied heavy metals are either not traceable or present with very low concentration. In the month of June, 2004 the lead and chromium concentration in March, 2001 was as high as 0.233 mg/g and 0.099 mg/gm at Agra downstream & Mathura d/s respectively. Nickel in June, 2002 & zinc in June, 2004 was high with a concentration of 0.793 mg/g & 3.408 mg/g at Agra d/s. The concentration of cadmium was at maximum with 0.232 mg/g in December, 2002 at Agra D/s whereas copper with 1.229 mg/g was at the peak at Agra d/s in June, 2004. Maximum concentration of iron i.e. 57.172 mg/g was observed at Mathura D/s in September, 2002. Those metals, which were not traceable or having very low concentration in river water e.g. cadmium, nickel and lead were observed in sediment may be due to their build up concentration at the bottom deposited sludge.

Among pesticides, Aldrin was not traceable in the year 1999 & 2003 to 2005 and its maximum concentration as 21.13 ng/g was observed in March, 2001 at Mathura d/s. Maximum level of BHC (801.19 ng/g) was observed at Agra downstream (June, 2005), whereas Dieldrin with concentration of 234.07 ng/g was at maximum at Agra D/s (March, 2003). Endosulfan was generally not traceable and its maximum concentration (612.18 ng/g) was observed at Agra Canal (December, 2002) DDT reflects its persistence with maximum concentration peak of 79.97 mg/g at Nizamuddin Bridge (September, 2002).

3.5 Statistical Evaluation of Yamuna Water Quality Data

Yamuna river water quality data are evaluated statistically in terms of nine prominent parameters by clubbing together all the data generated during the seven years of study from 1999 to 2005. The summary of water quality statistics is depicted in Table 3.4. The various data evaluations are detailed below:

Table 3.4: Summary of Water Quality Statistics for Yamuna River

Year : 1999 - 2005

pH

	Min	Max	SD	90 Percentile	10 Pecentile
Yamunotri	6.11	7.75	0.55	7.74	6.70
Shyanachatti	7.06	7.90	0.31	7.82	7.12
Lakhwar dam	6.94	8.62	0.49	8.40	7.17
Dak Patthar	6.95	8.61	0.47	8.28	7.18
Hathnikund	6.83	9.00	0.47	8.32	7.21
Kalanaur	6.56	8.81	0.39	8.30	7.36
Sonepat	7.00	8.80	0.36	8.23	7.35
Palla	6.83	8.91	0.45	8.40	7.25
Nizamuddin Bridge	6.81	8.54	0.35	7.90	7.00
Agra Canal	6.87	8.82	0.37	7.94	7.05
Mazawali	6.89	8.41	0.32	8.13	7.33
Mathura U/S	6.97	9.33	0.41	8.42	7.44
Mathura D/S	6.77	9.14	0.46	8.50	7.39
Agra U/S	6.77	9.23	0.53	8.73	7.52
Agra D/S	6.73	8.92	0.43	8.45	7.38
Bateshwar	7.00	9.39	0.54	8.83	7.45
Etawah	7.26	9.30	0.54	8.96	7.49
Juhika	6.43	9.13	0.47	8.61	7.50
Allahabad	7.01	8.65	0.47	8.45	7.32

CHEMICAL OXYGEN DEMAND (COD), mg/l

	Non	Mon	Min	Max	Avg	SD	90 Percentile	10 Pecentile
Yamunotri	**-**	**-**	**1**	**10**	**3**	**3.15**	**6**	**1**
Shyanachatti	-	-	2	20	7	6.50	13	2
Lakhwar dam	4	4	1	11	4	2.93	9	1
Dak Patthar	5	6	1	13	5	3.71	11	2
Hathnikund	6	8	1	29	6	4.41	11	2
Kalanaur	8	11	1	34	8	5.94	16	3
Sonepat	11	17	2	49	13	8.46	23	5
Palla	11	14	2	34	11	6.05	20	4
Nizamuddin Bridge	71	33	14	113	62	24.73	88	27
Agra Canal	55	29	10	119	49	20.78	73	27
Mazawali	61	36	16	102	55	22.03	85	29
Mathura U/S	40	27	13	81	37	14.32	55	21
Mathura D/S	40	30	13	94	38	14.02	56	20
Agra U/S	44	29	9	93	41	19.76	71	19
Agra D/S	68	42	11	155	61	33.25	107	24
Bateshwar	50	28	9	113	44	21.39	73	21
Etawah	47	26	6	91	42	18.63	64	18
Juhika	24	15	3	65	21	10.97	36	9
Allahabad	9	10	5	18	11	4.31	18	7

BIO CHEMICAL OXYGEN DEMAND (BOD), mg/l

	Non	Mon	Min	Max	Avg	SD	90 Percentile	10 Pecentile
Yamunotri	-	-	1	1	1.0	0.00	1	1
Shyanachatti	-	-	1	1	1.0	0.00	1	1
Lakhwar dam	1	1	1	2	1.0	0.19	1	1
Dak Patthar	1	1	1	2	1.1	0.31	1	1
Hathnikund	1	1	1	4	1.3	0.61	2	1
Kalanaur	1	1	1	7	1.4	1.00	2	1
Sonepat	2	2	1	8	2.1	1.27	3	1
Palla	2	1	1	6	1.8	1.01	3	1
Nizamuddin Bridge	24	9	3	51	20.2	10.57	33	6
Agra Canal	15	7	3	34	13.1	6.32	22	5
Mazawali	17	8	3	39	14.5	8.58	27	5
Mathura U/S	9	6	3	25	8.7	4.42	14	4
Mathura D/S	9	8	3	21	8.9	3.96	15	5
Agra U/S	10	7	2	25	9.6	4.98	17	4
Agra D/S	19	14	4	43	17.7	9.72	34	7
Bateshwar	11	5	1	31	9.7	5.61	17	3
Etawah	10	5	1	24	8.7	5.06	16	3
Juhika	4	3	1	10	4.0	2.28	7	2
Allahabad	2	2	1	3	1.8	0.86	3	1

AMMONIA, mg/l

	Non	Mon	Min	Max	Avg	SD	90 Percentile	10 Pecentile
Yamunotri	-	-	BDL	1.58	0.40	0.57	0.97	BDL
Shyanachatti	-	-	BDL	1.50	0.40	0.53	1.00	BDL
Lakhwar dam	0.33	0.38	BDL	1.99	0.31	0.50	0.80	BDL
Dak Patthar	0.36	0.17	BDL	1.51	0.32	0.43	1.07	BDL
Hathnikund	0.23	0.35	BDL	1.33	0.26	0.32	0.74	BDL
Kalanaur	0.24	0.40	BDL	1.96	0.28	0.38	0.80	BDL
Sonepat	0.54	0.58	BDL	2.80	0.55	0.57	1.21	BDL
Palla	0.39	0.39	BDL	3.55	0.39	0.52	0.86	BDL
Nizamuddin Bridge	17.15	5.28	0.30	33.30	14.26	8.25	25.59	2.85
Agra Canal	11.23	5.13	0.30	27.47	9.68	5.73	15.64	3.82
Mazawali	16.66	6.99	0.46	43.34	14.21	10.19	27.26	2.60
Mathura U/S	8.11	1.98	BDL	27.80	6.57	6.91	17.42	0.46
Mathura D/S	7.52	1.90	BDL	36.60	6.10	6.65	15.03	0.49
Agra U/S	3.84	1.23	BDL	19.70	3.21	4.17	9.66	0.22
Agra D/S	7.34	3.66	0.2	21.60	6.46	5.38	13.81	1.04
Bateshwar	2.53	0.61	0.02	14.80	2.05	3.30	5.54	0.16
Etawah	1.52	0.58	BDL	10.05	1.29	1.89	3.05	0.10
Juhika	0.73	0.44	BDL	5.94	0.66	0.85	1.58	0.08
Allahabad	0.80	0.69	BDL	3.71	0.77	0.95	2.11	BDL

TOTAL KJELDAHL NITROGEN (TKN), mg/l

	Non	Mon	Min	Max	Avg	SD	90 Percentile	10 Pecentile
Yamunotri	-	-	BDL	5.00	1.29	1.85	2.98	0.16
Shyanachatti	-	-	BDL	3.08	1.27	1.16	2.66	0.27
Lakhwar dam	1.19	1.18	BDL	2.24	1.17	0.81	2.21	0.29
Dak patthar	1.52	1.40	0.28	3.21	1.49	0.79	2.53	0.67
Hathnikund	1.14	1.50	BDL	6.16	1.23	0.92	2.01	0.31
Kalanaur	1.56	1.40	BDL	8.00	1.52	1.13	2.54	0.63
Sonepat	1.86	1.82	0.28	10.00	1.85	1.36	3.05	0.64
Palla	1.85	2.12	BDL	7.28	1.92	1.36	3.95	0.68
Nizamuddin Bridge	22.68	11.39	2.15	39.20	19.93	9.00	31.41	7.02
Agra Canal	16.37	10.65	1.05	40.60	14.92	7.82	26.18	7.06
Mazawali	22.86	12.77	1.05	46.20	20.30	11.06	34.68	6.70
Mathura U/S	11.36	4.48	0.60	41.41	9.62	8.59	22.49	1.61
Mathura D/S	11.37	5.30	1.12	41.30	9.83	7.34	19.09	2.22
Agra U/S	7.02	3.68	0.56	23.70	6.18	5.63	15.82	1.28
Agra D/S	11.11	8.19	0.66	29.30	10.37	6.09	19.37	3.26
Bateshwar	4.80	2.18	0.53	19.39	4.15	3.96	10.43	1.15
Etawah	3.66	1.91	0.28	17.17	3.22	2.92	7.13	0.93
Juhika	2.67	2.16	BDL	13.94	2.54	1.98	5.01	0.62
Allahabad	2.42	2.31	BDL	8.00	2.39	1.92	4.74	0.61

DISSOLVED OXYGEN (DO), mg/l

	Non	Mon	Min	Max	Avg	SD	90 Percentile	10 Pecentile
Yamunotri	-	-	6.1	9.4	8.1	1.1	9.1	6.8
Shyanachatti	-	-	7.6	10.2	8.5	1.0	9.7	7.6
Lakhwar dam	9.2	7.3	6.6	11.4	9.0	1.3	10.7	7.2
Dak Patthar	9.5	8.4	6.7	12.9	9.2	1.4	10.7	7.8
Hathnikund	9.7	8.6	6.7	12.7	9.5	1.3	11.0	7.8
Kalanaur	9.1	7.9	6.1	11.4	8.8	1.3	10.3	7.1
Sonepat	8.2	7.3	5.2	12.0	7.9	1.5	10.2	6.3
Palla	8.5	7.4	5.2	12.8	8.3	1.7	10.6	6.3
Nizamuddin Bridge	0.4	2.3	0.0	7.8	0.8	1.6	3.1	0.0
Agra Canal	0.5	2.2	0.0	7.8	0.9	1.4	2.6	0.0
Mazawali	4.1	4.3	0.0	14.0	4.1	3.4	8.1	0.0
Mathura U/S	7.2	6.1	1.0	17.2	6.9	3.0	10.4	3.8
Mathura D/S	6.7	5.4	0.8	18.5	6.4	3.2	9.2	2.9
Agra U/S	10.2	6.8	3.6	22.8	9.3	4.2	15.6	4.7
Agra D/S	5.4	4.0	0.0	14.8	5.0	3.3	8.4	1.6
Bateshwar	10.5	6.7	2.9	23.1	9.5	4.0	14.6	5.3
Etawah	11.6	7.2	2.7	19.5	10.5	3.8	15.9	5.7
Juhika	10.2	7.0	4.9	17.5	9.4	2.6	12.2	5.9
Allahabad	7.6	6.9	4.8	12.0	7.4	1.5	9.0	6.0

CONDUCTIVITY, µ mhos/cm

	Non	Mon	Min	Max	Avg	SD	90 Percentile	10 Pecentile
Yamunotri	-	-	45	249	89	72	154	45
Shyanachatti	-	-	71	280	122	71	183	78
Lakhwar dam	208	175	126	272	195	47	263	141
Dak patthar	220	166	127	302	207	51	269	145
Hathnikund	253	184	110	1030	236	122	317	153
Kalanaur	369	238	114	963	336	120	420	188
Sonepat	420	262	185	960	380	146	517	206
Palla	446	293	174	850	408	146	573	241
Nizamuddin Bridge	1022	499	132	1650	899	340	1255	376
Agra Canal	795	469	242	1400	714	231	1037	424
Mazawali	1331	655	221	2090	1162	463	1681	458
Mathura U/S	1332	824	292	2040	1211	411	1705	717
Mathura D/S	1280	699	12	1954	1132	488	1720	419
Agra U/S	1283	678	233	2040	1132	445	1655	499
Agra D/S	1403	801	413	2290	1252	486	1846	506
Bateshwar	1334	694	128	2220	1174	533	1810	446
Etawah	1204	566	293	2110	1044	485	1661	370
Juhika	734	365	9	1280	640	279	969	287
Allahabad	525	287	170	775	470	177	665	254

TOTAL COLIFORM (TC), No./100 ml

	Non	Mon	Min	Max	Avg	SD	90 Percentile	10 Pecentile
Yamunotri	-	-	80	55000	12669	20038	34420	122
Shyanachatti	-	-	1600	101000	23307	36972	65000	1630
Lakhwar dam	45634	34375	50	3800000	181858	727655	177600	708
Dak patthar	50853	256043	400	1430000	102151	272772	161900	1155
Hathnikund	85140	437547	100	4300000	177647	550034	272200	890
Kalanaur	151729	1559578	510	20100000	525967	2360362	670000	3980
Sonepat	350514	1813165	110	21800000	734460	2673536	1390000	5180
Palla	36479	267019	400	4350000	94114	472886	98100	3330
Nizamuddin Bridge	46502542	2650611	15500	890000000	36382865	110794783	74500000	491000
Agra Canal	18066500	2106476	14000	262000000	14076494	35813382	29490000	193000
Mazawali	5951803	1132250	7000	70000000	4790465	10555158	15420000	40560
Mathura U/S	1217469	839190	1300	17600000	1120593	2651468	2585000	23000
Mathura D/S	1827195	1644819	13200	26100000	1780489	3663910	4050000	100500
Agra U/S	512339	3342386	1600	57000000	1237107	6278978	1480000	21630
Agra D/S	107330131	25777905	58000	1710000000	86444805	285335755	136300000	469000
Bateshwar	6003278	12947310	8000	180000000	7739286	28657213	10260000	49300
Etawah	4188459	3240629	3000	161000000	3945722	18658996	3880000	21580
Juhika	621959	311814	2900	20300000	542532	2276765	1017000	15020
Allahabad	871086	291143	6800	4800000	726100	1259255	2962000	14700

FAECAL COLIFORM (FC), No./100 ml)

	Non	Mon	Min	Max	Avg	SD	90 Percentile	10 Pecentile
Yamunotri	-	-	18	1100	361	434	944	26
Shyanachatti	-	-	150	3500	1254	1356	3080	264
Lakhwar dam	471	713	10	4100	587	879	1402	52
Dak patthar	1301	1564	10	8200	1367	2087	4630	87
Hathnikund	1531	5633	0	69000	2621	8231	5440	58
Kalanaur	6302	7737	70	116000	6684	17294	11420	158
Sonepat	8148	16002	0	139000	10236	24287	22600	216
Palla	3807	3231	34	88000	3660	10345	7360	123
Nizamuddin Bridge	7613687	600479	2540	199000000	5974236	24026177	7440000	40600
Agra Canal	3906009	459696	2540	97000000	3034050	12547113	2768000	18400
Mazawali	497752	130129	300	5400000	408088	927294	1260000	1820
Mathura U/S	33472	31554	50	250000	32987	46933	88200	1720
Mathura D/S	113576	174419	900	2820000	129158	368321	141300	9360
Agra U/S	99929	45664	100	2300000	86032	302838	129000	1900
Agra D/S	8603593	4380300	2800	203000000	7522018	30431844	8820000	18740
Bateshwar	99565	45471	400	1500000	85878	207923	218000	1420
Etawah	28247	40561	110	550000	31401	78059	60800	912
Juhika	9517	9262	50	170000	9451	22003	17900	504
Allahabad	17867	79000	130	510000	33150	97783	68400	388

Legends:

1. Non = Average of Non monsoon period (January to June and October to December
2. Mon = Average of Monsoon period (July to September)
3. SD = Standard deviation
4. BDL = Below traceable limit
5. Traceable Limit for Ammonia and TKN is 0.04 mg/l till 2003 afterwards 0.02 mg/l

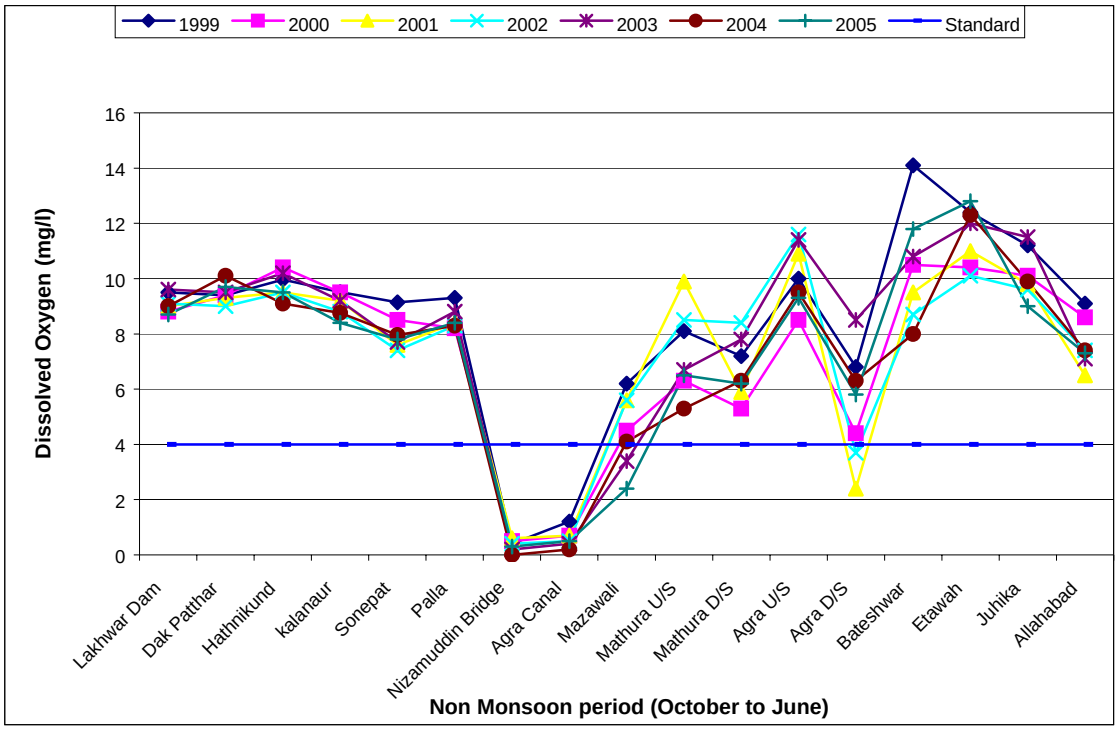
Note: For the calculation BDL is considered as half of the Traceable limit

3.5.1 Seasonal Variations in Water Quality

The physical characteristics i.e. discharge and drainage area of Yamuna river varies significantly during non monsoon (January to June & October to December) and monsoon period (July to September). Therefore, an attempt is made to find out the variation in river water quality during these two seasons. For four parameters i.e. dissolved oxygen, Biochemical oxygen demand, Total and Faecal coliform, seasonal variations was also analysed year-wise and are depicted in Fig. 3.3 to 3.6. The seasonal variations indicate that in Delhi stretch the DO level was always below the prescribed limit during both the seasons except during the year 2001 when the value just touches the limit at Nizamuddin Bridge. After Delhi, the dissolved oxygen generally dropped down slightly during monsoon period, may be due to vanishing of eutrophic condition. The BOD concentration upto Palla was generally below the standards both in monsoon and non-monsoon periods during all the seven years. The value of BOD exceeded the limit afterwards and again meets the standards only at Allahabad. However, during monsoon period BOD levels generally reduced & often to meet the prescribed limit after Agra. Though, the values of total and faecal coliforms reduced significantly during monsoon

period in the entire Yamuna stretch, but the values were generally high than the prescribed standards. In general it was observed that DO, BOD levels reduced during monsoon period. The total & faecal coliforms reduced in the most polluted stretch i.e. between Delhi and Agra and generally increased at relatively less polluted or clean locations. This may be due to flushing of faecal materials into the river from the catchment areas.

There was slight decline in the pH value at majority of locations during monsoon seasons. Though from Hathnikund the Nizamuddin Bridge and Mathura down stream there was slight increase in pH values. COD which was observed in the range of 4 mg/l (Lakhwar dam) to 68 mg/l during non monsoon period reduced (Agra d/s) during monsoon period with a range of 4 mg/l (Lakhwar dam) to 42 mg/l (Agra d/s). In most of the locations the ammonia and total kjehldal nitrogen were reduced during monsoon. On the basis of non-monsoon average the ammonia and TKN was in the range of 0.23 mg/l (Hathnikund) to 16.66 mg/l (Mazawali) & 1.14 mg/l (Hathnikund) to 22.86 mg/l (Mazawali) respectively. During monsoon period same were in the range of 0.17 mg/l (Dak Pathar) to 6.99 mg/l (Mazawali) and 1.40 mg/l (Lakhwar Dam & Kalanaur) to 12.77 mg/l (Mazawali) for ammonia and TKN respectively. The conductivity was also fallen down at all locations with a range of 208 (Mathura u/s) to 1403 (Agra D/s) µmhos/cm and 175 (Lakhwar Dam) to 824 (Agra d/s) during non-monsoon and monsoon period respectively.



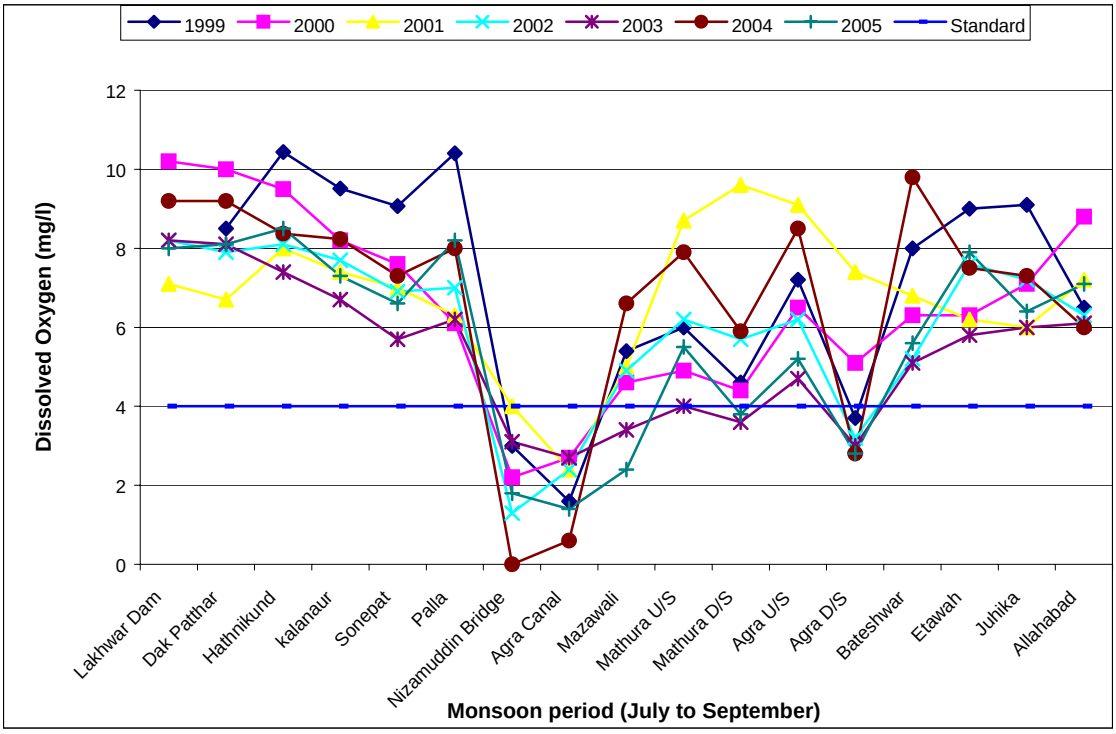
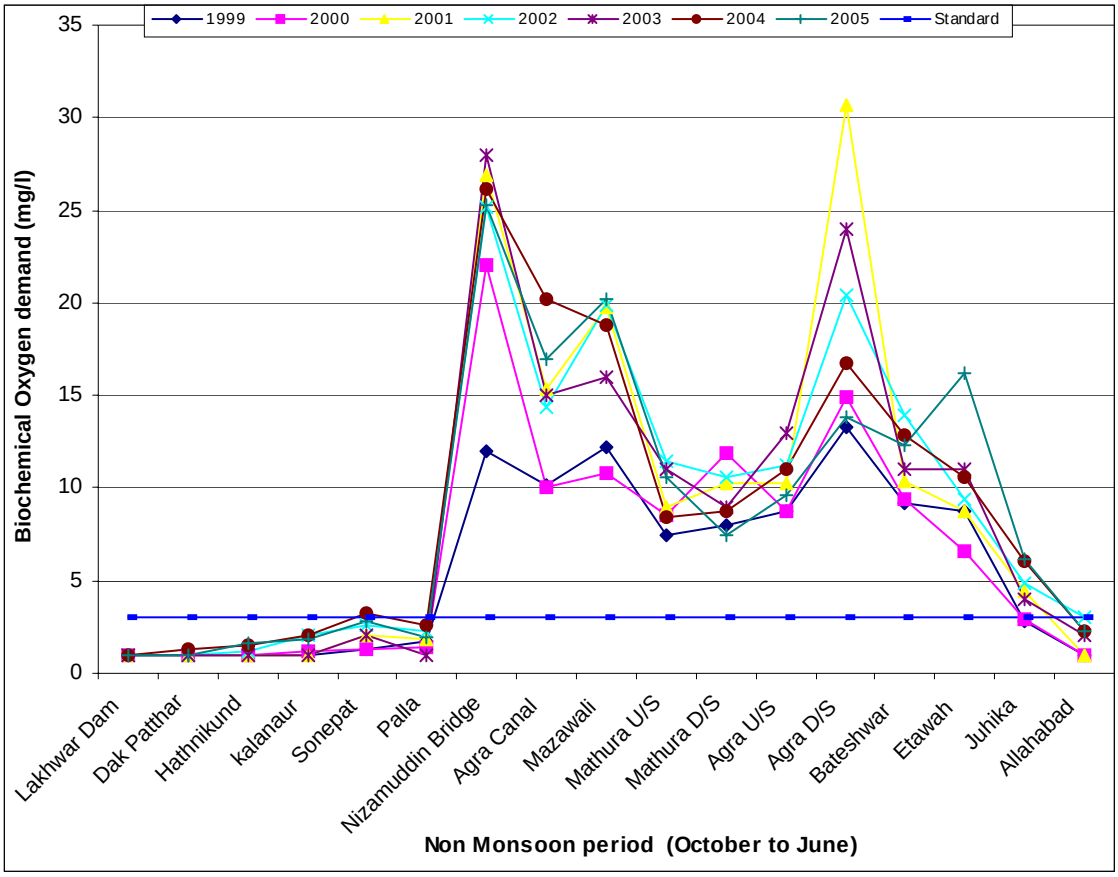


Fig. 3.3: Seasonal Variation in Dissolved Oxygen in Yamuna River



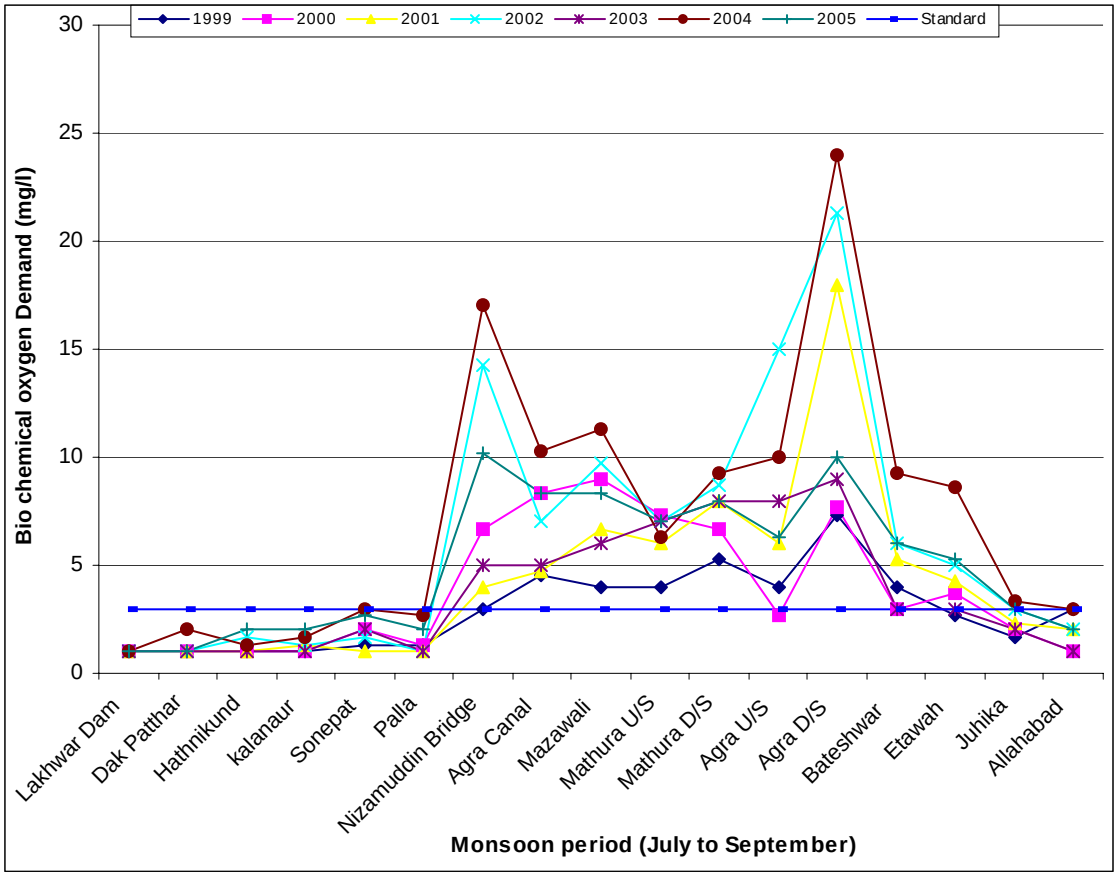
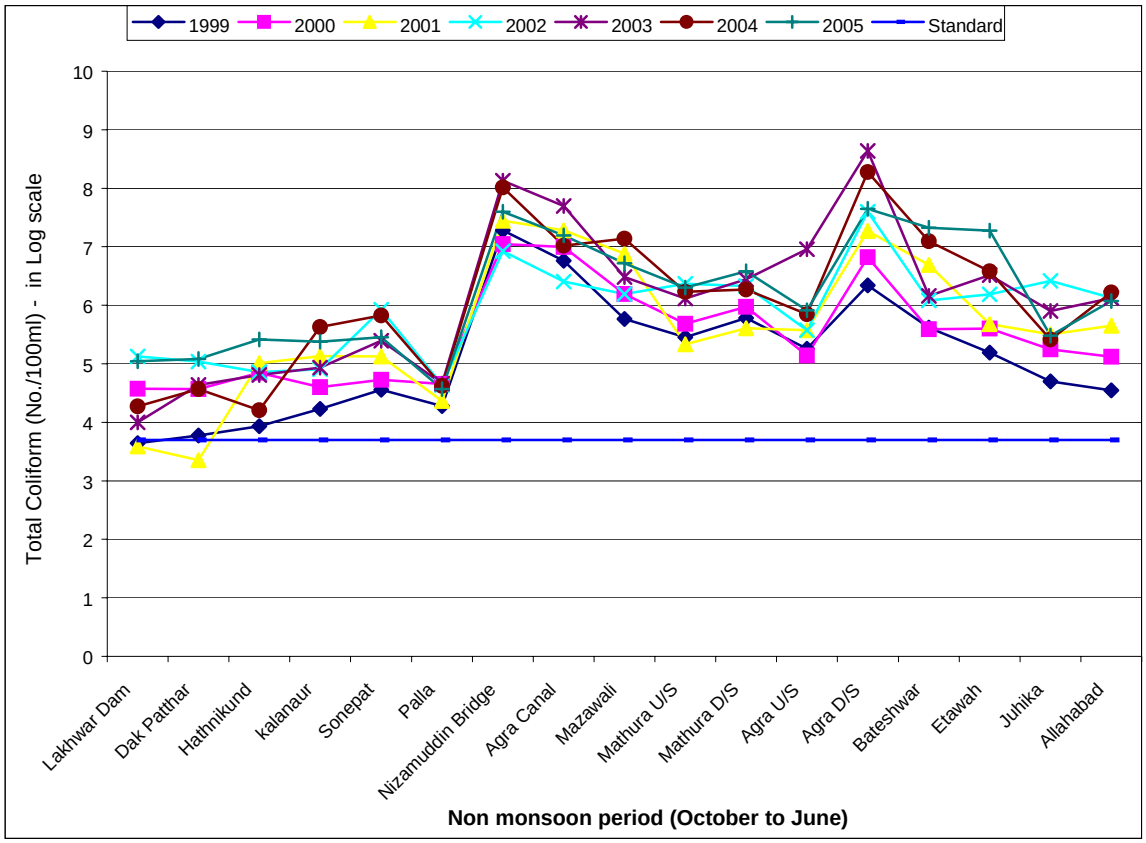


Fig. 3.4: Seasonal Variation in Bio-chemical Oxygen in Yamuna River



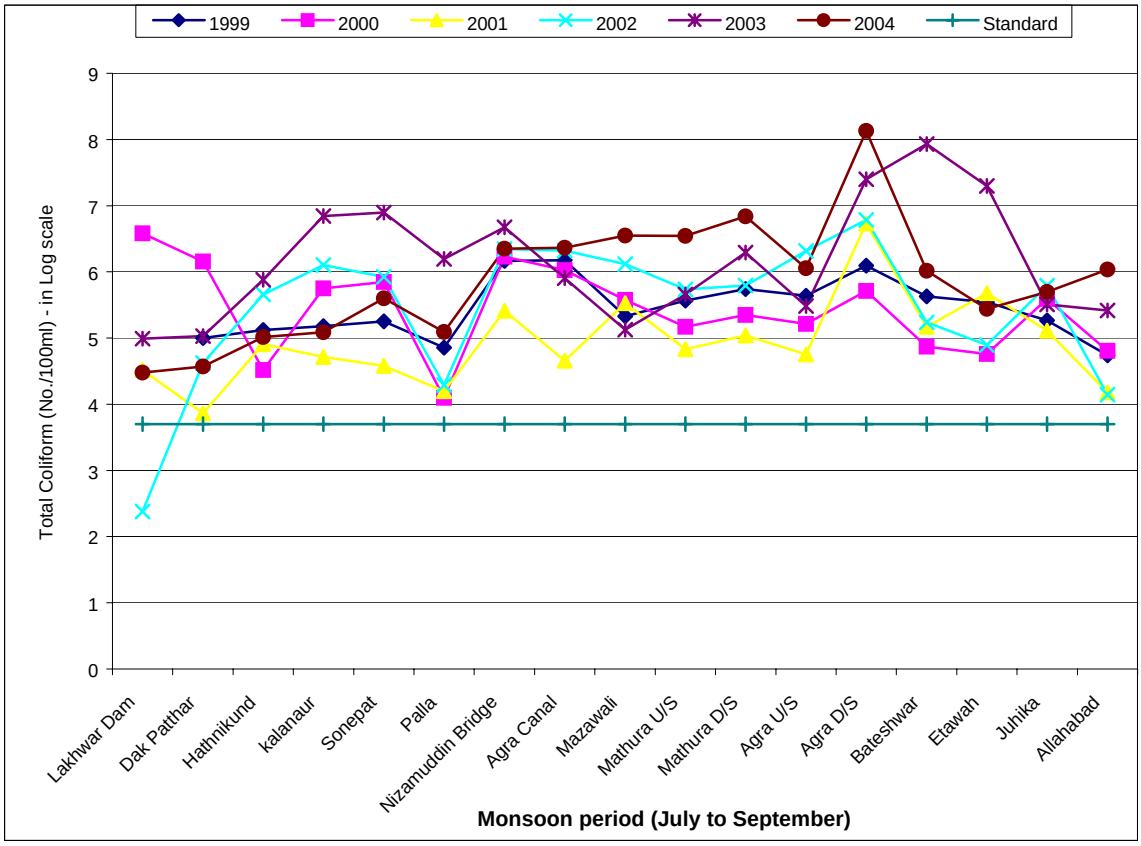
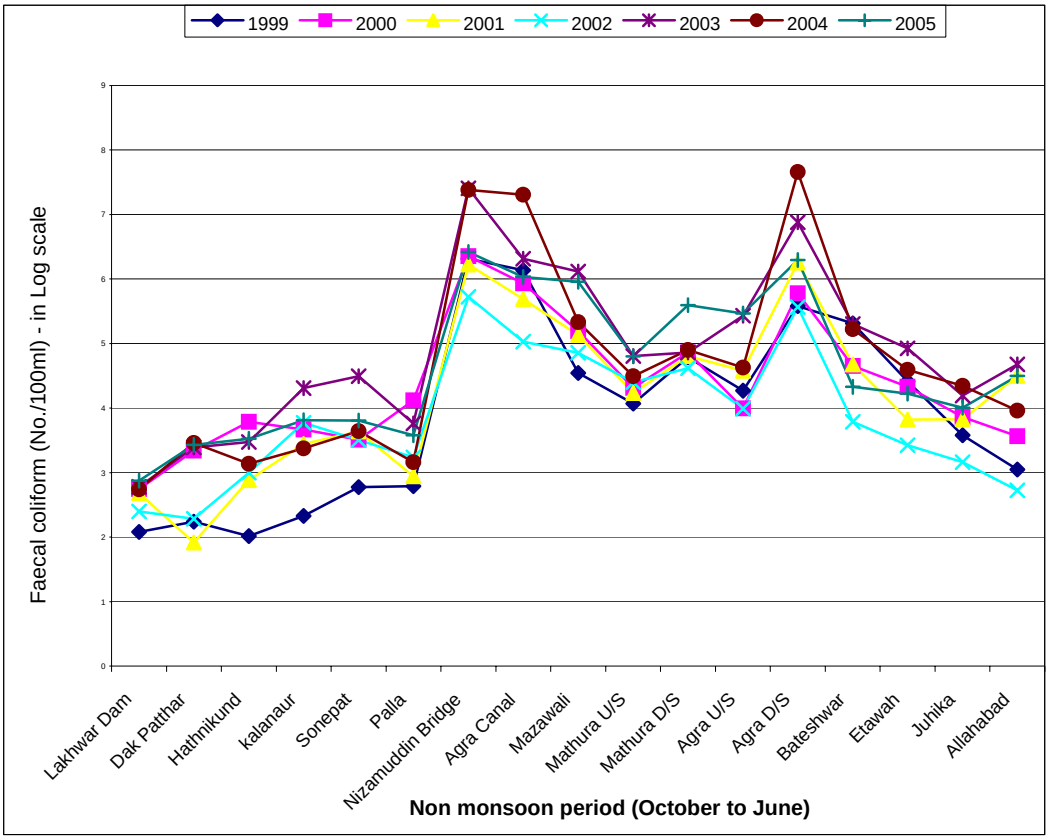


Fig. 3.5: Seasonal Variation in Total Coliform in Yamuna River



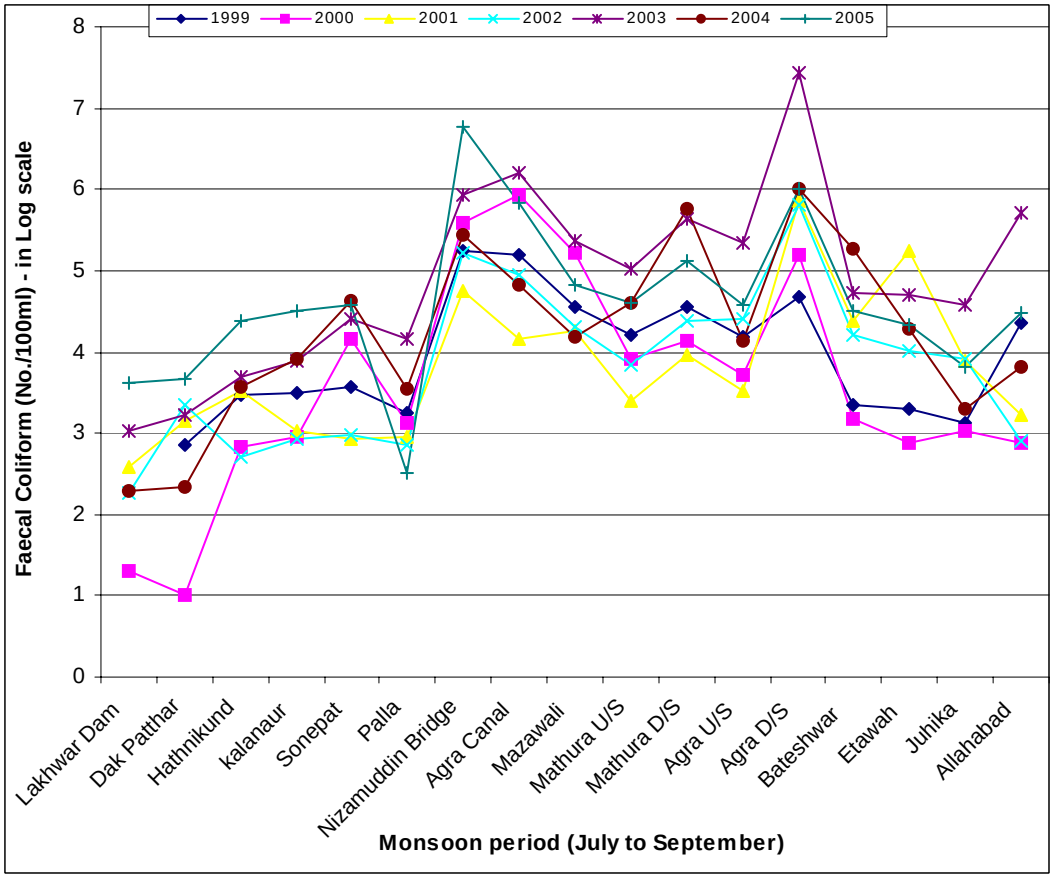


Fig. 3.6: Seasonal Variation in Faecal Coliform in Yamuna River

3.5.2 Seven Years Average (1999 – 2005) Water Quality Status

The seven years (1999-2005) average values for COD in entire Yamuna stretch varied from 3 (Yamunotri) to 62 mg/l (Nizamuddin Bridge). The BOD average from origin upto Palla and at Allahabad was well within the prescribed limit. The maximum average BOD value of about 20.0 mg/l was observed at Nizamuddin Bridge. The ammonia and TKN varied in the entire stretch from 0.26 to 14.26 mg/l and 1.17 to 20.30 mg/l respectively. The minimum values of both ammonia and TKN were observed at Hathnikund and Lakhwar dam, whereas maximum was observed at Nizamuddin Bridge & Mazawali respectively. Dissolved oxygen average was about 0.8 mg/l at Nizamuddin bridge and Agra canal and at all other places DO matched with the standard with the range of 4.1 mg/l (Mazawali) to 10.5 mg/l (Etawah). DO level at many locations exceeded saturation level may be due to eutrophic conditions. At few locations DO was high even after high BOD concentration, this may be due to persistence of both eutrophic and septic conditions. The level of conductivity was minimum at Yamunotri (89 µmhos/cm) and maximum at Agra D/s (1252 µmhos/cm).

The average of entire study period reveals that in the entire Yamuna stretch the Total coliforms violated the limit and varied between 12669 nos./100 ml (Yamunotri) to 86444805 nos./100 ml (Agra D/s). The average value of faecal coliform in the entire Yamuna stretch ranged between 361 to 7522018 nos./100 ml at Yamunotri and Agra D/s respectively.

3.5.3 Standard Deviation for various parameters

Calculation of Standard deviation reveals that there was minimum variation in the pH values whereas significantly high variation was in coliforms values. It was also observed that those parameters e.g. ammonia, TKN, DO etc. represents lower values having low standard deviation and parameters representing higher value e.g. coliforms and conductivity the standard deviation is very-very high. It was also noticed that except pH for all other parameters the standard deviation was high at severely polluted locations e.g. Nizamuddin Bridge, Agra D/s etc.

The standard deviation for pH varied from 0.31 (Shyana Chetti) to 0.55 (Yamunotri). At Yamunotri higher deviation in pH values may be due to presence of sulphur spring and occasionally significant dilution through rainfall. The COD (SD ranged between 3.15 to 33.25), BOD (SD ranged between 0.00 to 10.57), Ammonia (SD ranged between 0.32 to 10.19) and TKN (SD varies from 0.79 to 11.06) having low standard deviation at those places which were relatively clean and high at those locations reflecting significant impact of pollution discharges. The standard deviations for DO ranged from 1.0 (Shyana Chetti) to 4.2 (Agra u/s) the higher fluctuations at Agra upstream may be due to persistence of eutrophic and septic conditions.

Higher standard deviation values of conductivity (ranged between 47 to 533), Total coliform (always in five to nine figures) and faecal coliforms (always in three to eight figures reflect that these parameters are not predictable. The contribution of these parameters in the entire Yamuna stretch varied significantly with the, space and weather conditions mainly characterized by rainfall.

3.5.4 Percentile for various parameters

The data for each monitoring location was categorized into two on the basis of percentile viz 90 percentile and 10 percentile. The 90 percent values for pH were between 7.74 to 8.96 whereas, 10 percent values were between 6.70 to 7.52. For COD and BOD, 90 percent was in the range of 6 to 107 mg/l and 1 to 34 mg/l. Maximum value of 90 percentile for both COD and BOD was observed at Agra downstream. The value of 10 percentile for these two parameters varied for 1 to 29 mg/l and 1 to 7 mg/l respectively. In terms of ammonia and TKN, 90 percentile values varied from 0.80 to 27.26 mg/l and 2.01 to 34.68 mg/l. 10 percentile of ammonia and TKN data was in the range of BDL (below detection limit) to 3.82 and 0.16 to 7.06 mg/l. At Nizamuddin Bridge and Agra Canal 90 percent data were not confirming with the standard in terms of DO and at three locations, 10 percent data reflecting nil. Further, at another three locations 10 percent data not meeting the prescribed limit. For conductivity the 90 and 10 percent values in the entire river stretch were below 154 to 1846 µmhos/cm and 45 to 506 µmhos/cm. In the entire Yamuna river stretch 90 percent total coliforms values were lying between 34420 to 136300000 nos./100 ml and 10 percentile values were between 122 to 491000 nos./100 ml. For faecal coliform data 90 and 10 percentile values were between 944 to 8820000 nos./100 ml and 26 to 40600 nos./100 ml respectively.

3.5.5 Parametric Correlations

An attempt was made to correlate some of the important water quality parameters observed during 1999 to 2005. The values of correlation coefficient (r) and correlation determination (R^2) were derived for four pairs of parameters i.e. BOD - COD, TC - FC, BOD – FC and Ammonia - TKN. Except at Yamunotri and Shyana Chetti, where the sampling frequency was once a year (June) at all other locations the r & R^2 were calculated on seasonal basis i.e. considering data of all seasons, data of non monsoon season (October to June) and monsoon seasons (July to September).

3.5.5.1 Correlation between Chemical Oxygen Demand & Bio-chemical Oxygen Demand

The correlation analysis between COD and BOD at various locations in different seasons is depicted in Table 3.5 and Figs. 3.7 to 3.9. At two upstream locations of Yamuna River viz. Yamunotri & Shyana Chetti, there was no correlation between COD & BOD, this was because slight fluctuation was observed in the COD values during study period, but the BOD values

remain unchanged i.e. 1 mg/l. At upstream location viz. Lakhwar Dam also the value of r for COD – BOD was not significant (P >5%). From Dak Patthar to Juhika the correlation coefficient was highly significant (P <1%) in all the seasons, however at Allahabad it was significant (P <5%). In non-monsoon period the r was same as for all seasons. In monsoon season there was no correlation between COD and BOD at Dak Patthar, while the correlation was not significant at Hathnikund, Sonepat, Juhika and Allahabad. At other locations it was either significant or highly significant. The R^2 was significant (< 0.500) at Nizamuddin bridge to Mazawali and at Agra up and downstream locations during all seasons and in non-monsoon period it was significant at Agra canal only. In monsoon the R2 was significant at Mazawali and Agra u/s to Etawah.

In general, COD-BOD correlation reflects that the correlation coefficient and correlation were significant at those locations where river generally receives organic waste (BOD). In monsoon period the number of location having insignificant r were determinations more may be due to dilution of bio-degradable organic pollution, which was already low at all these locations. At one location i.e. Hathnikund the R^2 values depicted negative sign in monsoon period may be due to increase in COD from various sources i.e. flushing of forest soil and vegetation residue (containing cellulose or lignin etc.) and very low or no biodegradable organic component.

3.5.5.2 Correlation between Total and Faecal Coliform

The correlation-coefficient and correlation of determination at various locations in different season between TC & FC is presented in Table 3.6 and Figs. 3.10 to 3.12. During all the seasons the correlation coefficient was highly significant at all the location except from Shyama Chetti to Dak Patthar and closeness of values (R^2) were observed significant (above 0.500) at Yamunotri and Nizamuddin Bridge to Mathura and at Agra downstream. In non monsoon season, at all the locations the r values were highly significant except at Lakhwar dam. The correlation coefficient in monsoon season was not significant at Lakhwar Dam, Etawah and Juhika and it was significant at Kalanaur, Palla and Bateshwar, while highly significant at all other locations. Correlation of determination was significant at three locations only i.e. Mathura upstream, Agra downstream and Allahabad.

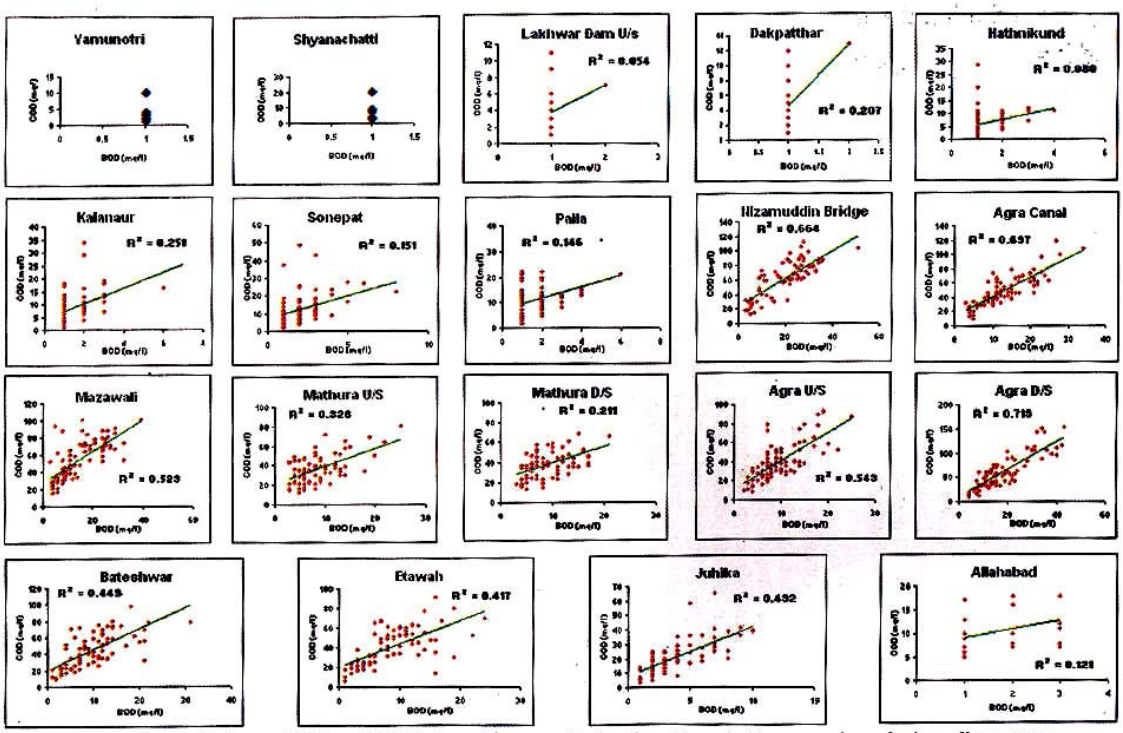


Fig. 3.7: Correlation between BOD and COD at various monitoring locations in Yamuna river during all seasons (Year:1999 to 2005)

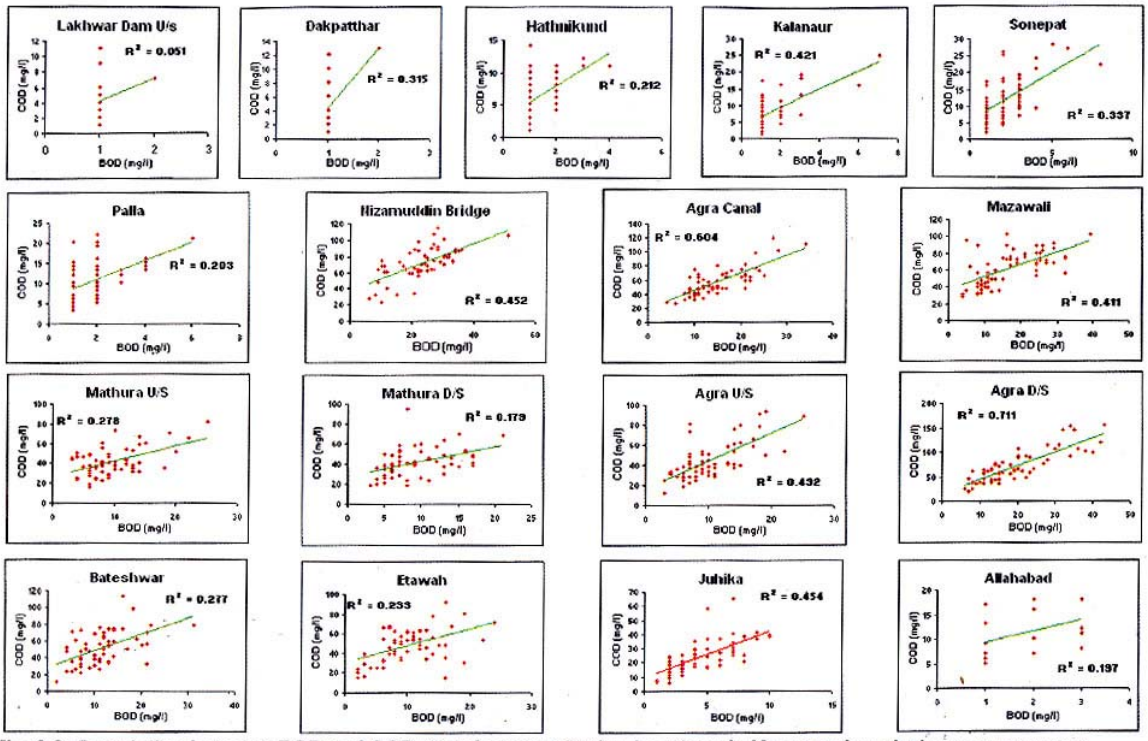


Fig. 3.8: Correlation between BOD and COD at various monitoring locations in Yamuna river during non monsoon seasons (Year-1999 to 2005)

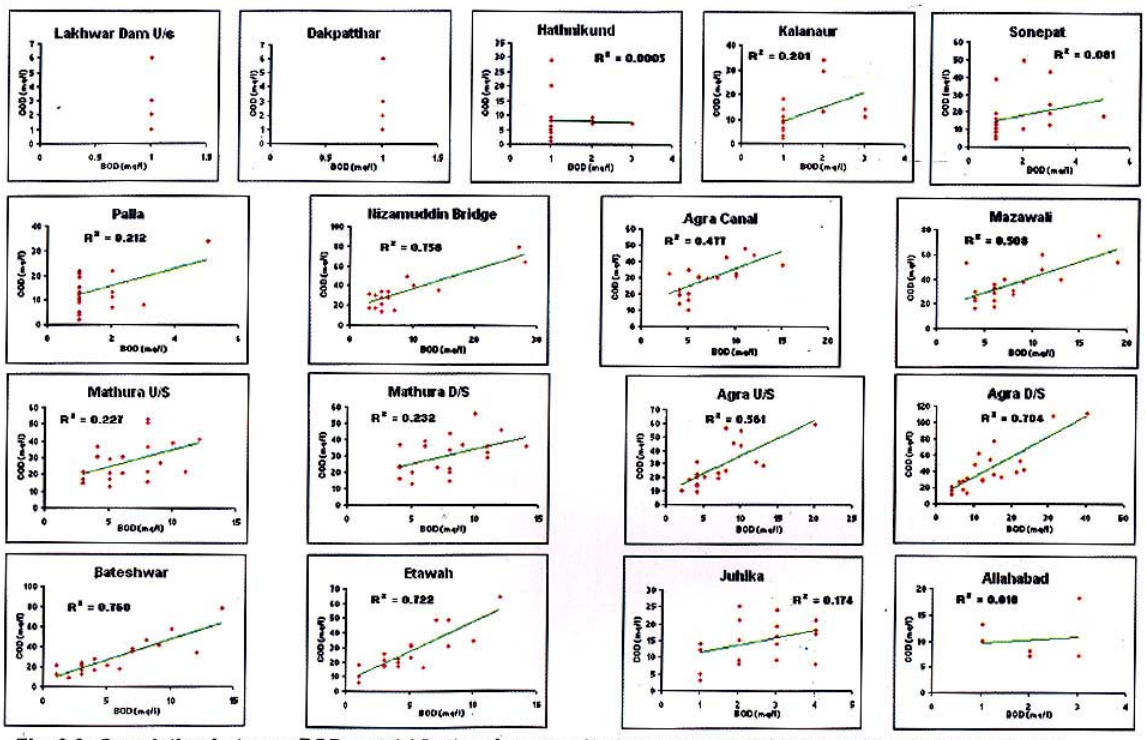


Fig. 3.9: Correlation between BOD and COD at various monitoring locations in Yamuna river during monsoon seasons (Year-1999 to 2005)

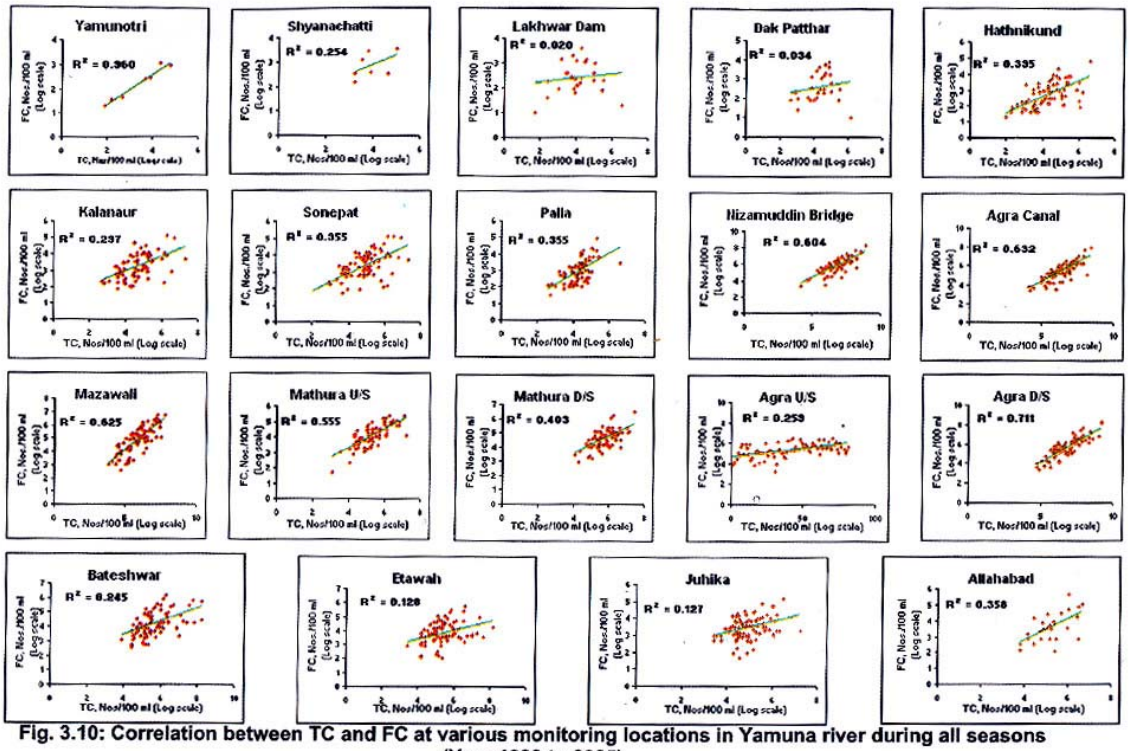


Fig. 3.10: Correlation between TC and FC at various monitoring locations in Yamuna river during all seasons (Year:1999 to 2005)

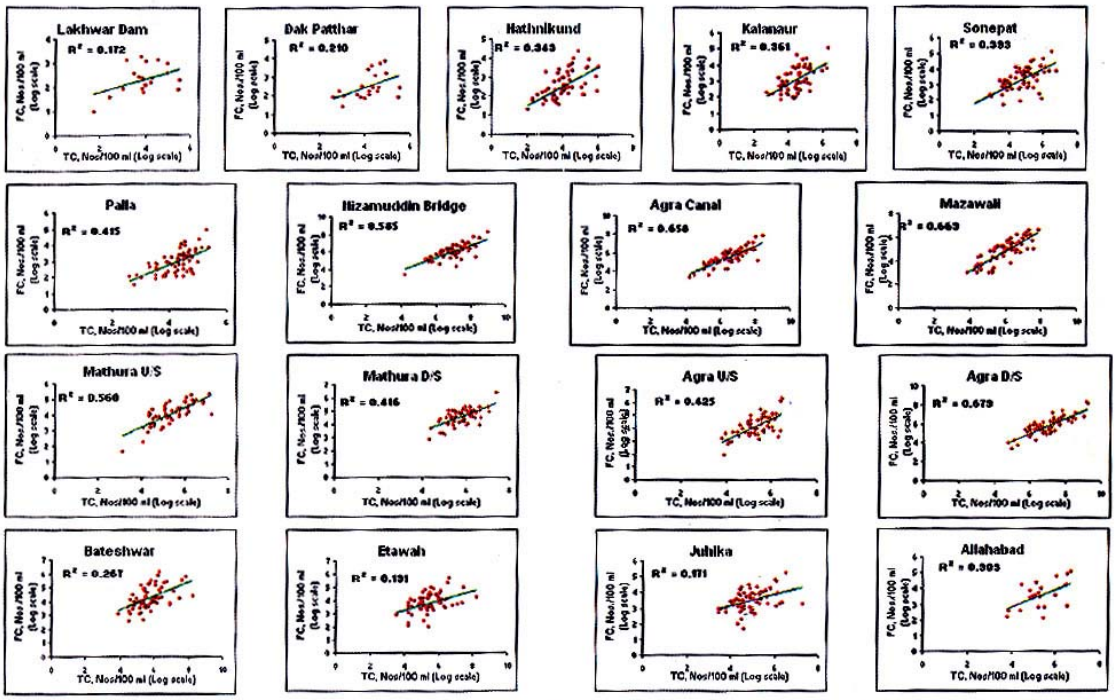


Fig. 3.11: Correlation between TC and FC at various monitoring locations in Yamuna river during non monsoon seasons (Year-1999 to 2005)

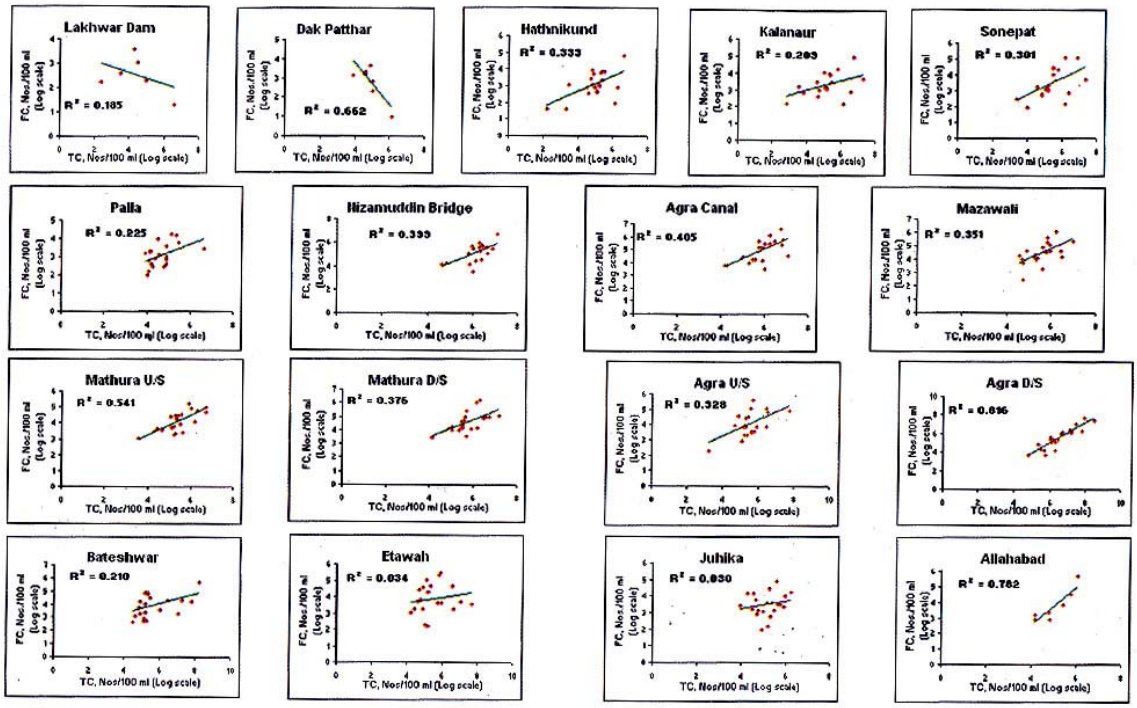


Fig. 3.12: Correlation between TC and FC at various monitoring locations in Yamuna river during monsoon seasons (Year-1999 to 2005)

In general, the correlation coefficient between TC & FC was significant or highly significant at those locations where river receives significant faecal matter / sewage. The correlation of determination was significant (above 0.500) at those locations, which are polluted by direct input of sewage. At Yamunotri the highly significant values of r & R^2 may be due to the contamination from one major source i.e. Pilgrimage and contaminant having almost fixed relation of TC & FC. At Lakhwar dam and Dak Patthar which were having less human population in the vicinity, the r values showing negative sign during monsoon period may be due to flushing of higher number of Total coliform from various sources i.e. soil, forest, residences etc. and reduction in the Faecal coliform number due to dilution caused by increased quantity of river water. At Allahabad during monsoon period the R^2 value was significant, may be due to flushing of such waste into the river in which the fluctuation of TC & FC concentration was identical.

3.5.5.3 Correlation between Bio-chemical Oxygen Demand and Faecal Coliform

Considering the fact that in Yamuna river, the major sources of BOD is sewage and origin of Faecal coliform is mainly from faecal matter of human beings (sewage), an attempt had been made to find the correlation between BOD & FC. As reflected from Table 3.7 and Fig. 3.13 to 3.15 the correlation determination was very poor at all the sampling location in different seasons. There was no correlation at upper most two locations i.e. Yamunotri and Shyana Chetti due to constant value of BOD (1.0 mg/l). The correlation coefficient was highly significant from Sonepat to Agra Canal, Agra upstream to Bateshwar in all the seasons. It was significant at Kalanaur and non significant at all other locations. During non-monsoon seasons r is highly significant at Sonepat Nizamuddin Bridge, Agra Canal and Agra downstream. It was significant at Palla, Agra upstream & Bateshwar. The correlation was highly significant during monsoon season at Sonepat and from Agra downstream to Etawah. The correlation analysis results reflect that correlation coefficient was not significant at those locations, which were less polluted or where the chances of elimination of Faecal coliform are high. During monsoon season the correlation was highly significant not only at Agra downstream but at two locations situated further downstream may be due to persistence of almost identical composition of BOD and FC, caused by flushing of sludge etc. and less retention time in the river.

3.5.5.4 Correlation between Ammonia & Total Kjeldahl Nitrogen

The correlation coefficient and correlation determination between ammonia and TKN at various locations of River Yamuna in different seasons are depicted in Table 3.8 and Figs. 3.16 to 3.18. Except at Shyama Chetti in the entire river stretch in all the seasons the correlation coefficient between ammonia and TKN was highly significant. Whereas, in non monsoon season the r was significant at locations situated in upper stretch i.e. Lakhwar Dam to Kalanaur afterwards it is highly significant. In monsoon period r was not significant at Lakhwar dam and Hathnikund and from Bateshwar to Juhika, whereas at remaining locations, it was either significant or highly significant.

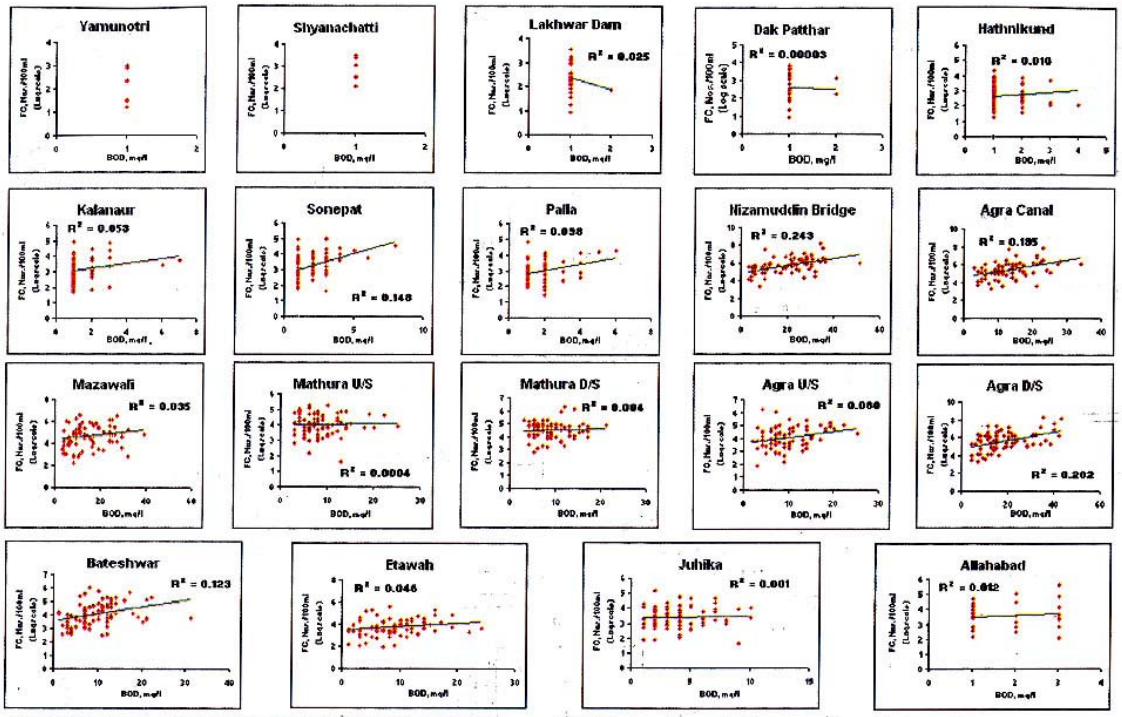


Fig. 3.13: Correlation between BOD and FC at various monitoring locations in Yamuna river during all seasons (Year:1999 to 2005)

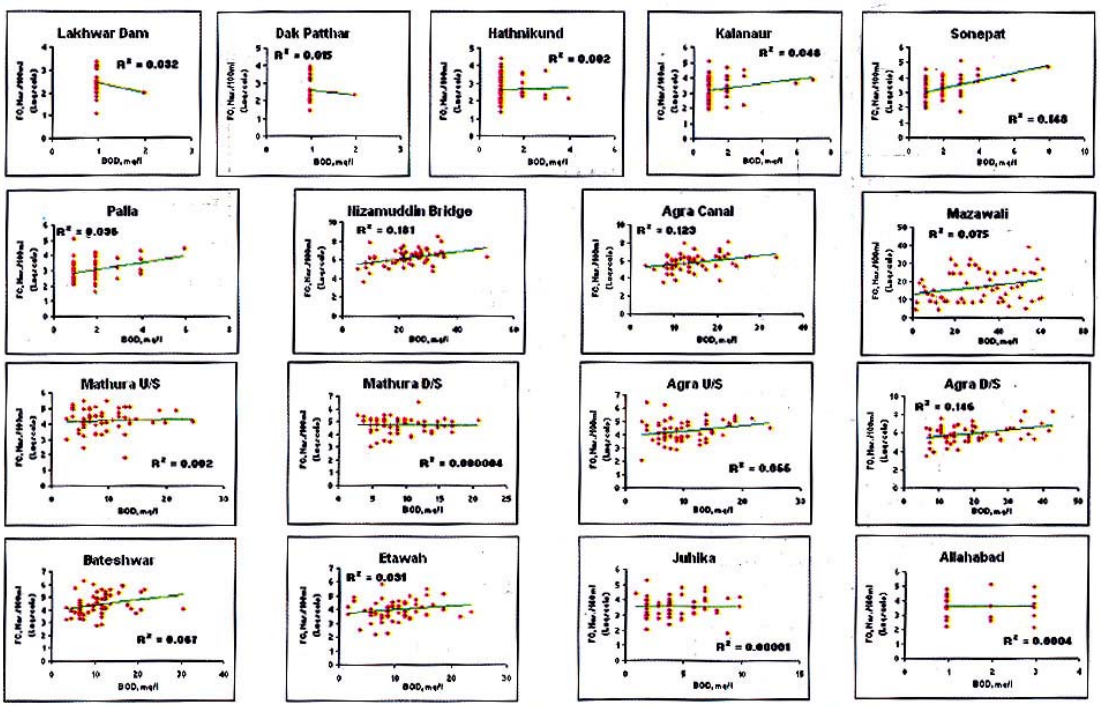


Fig. 3.14: Correlation between BOD and FC at various monitoring locations in Yamuna river during non monsoon seasons (Year-1999 to 2005)

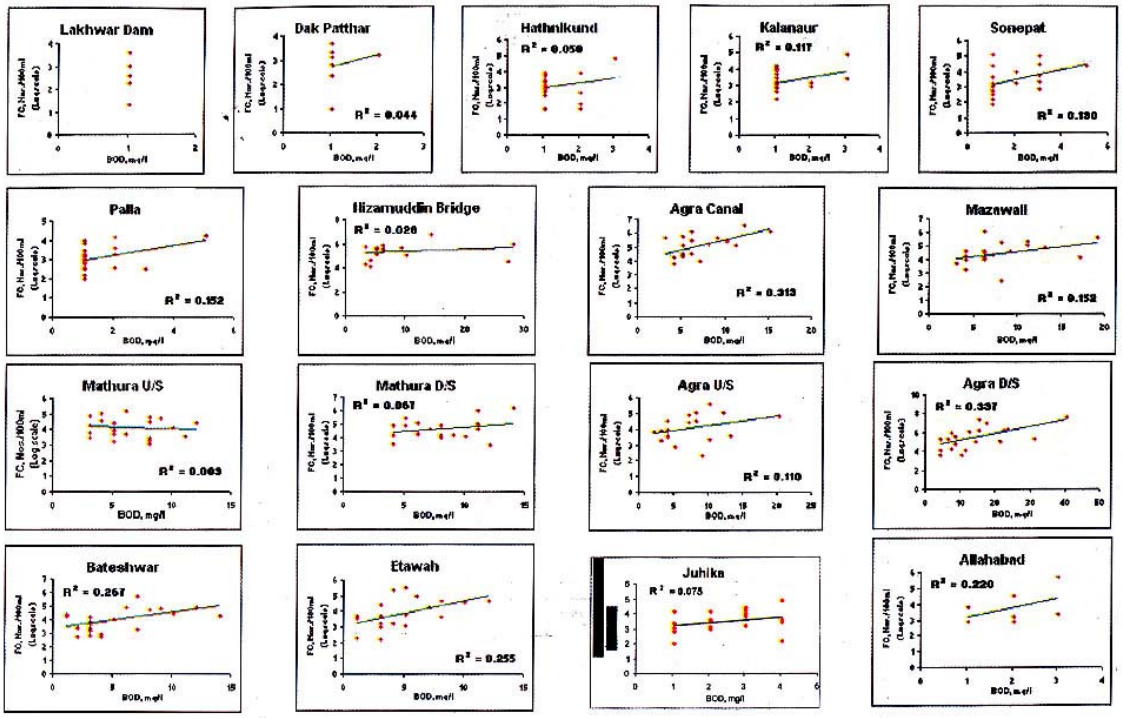


Fig. 3.15: Correlation between BOD and FC at various monitoring locations in Yamuna river during monsoon seasons (Year-1999 to 2005)

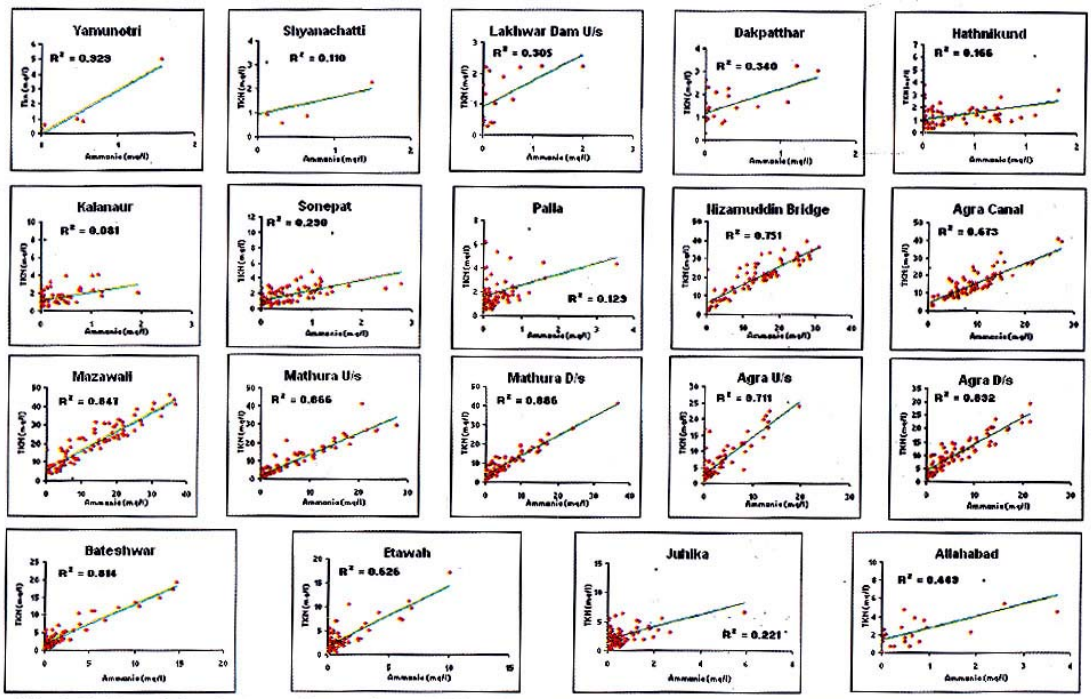


Fig. 3.16: Correlation between Ammonia and TKN at various monitoring locations in Yamuna river during all seasons (Year:1999 to 2005)

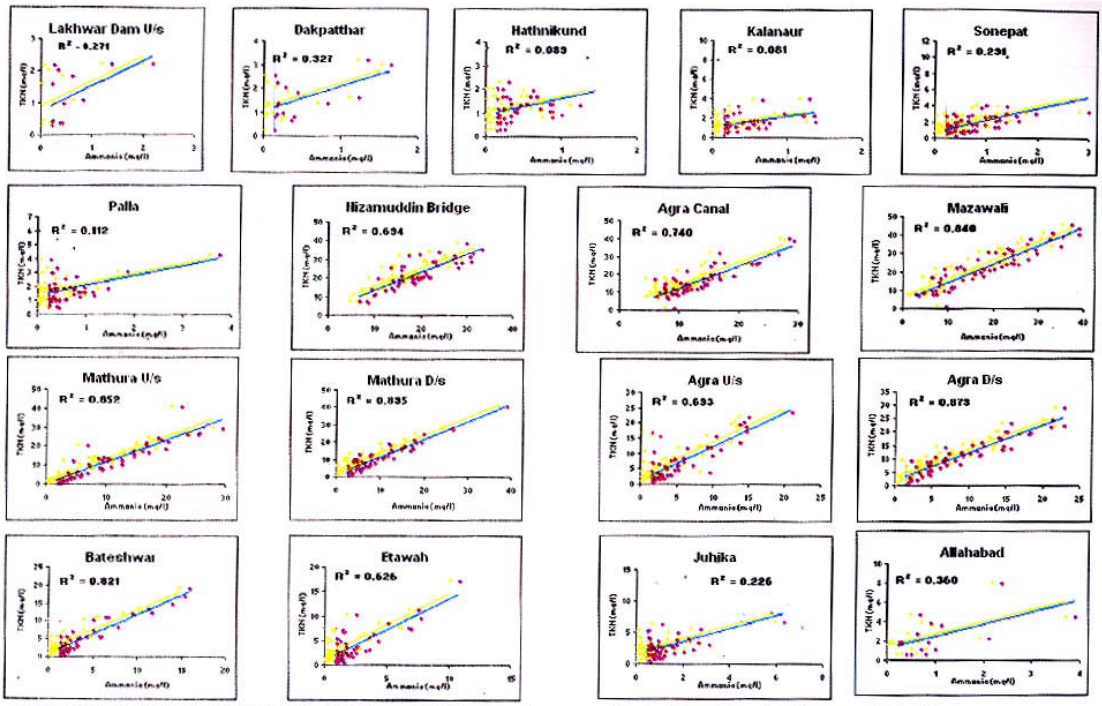


Fig.3.17: Correlation between Ammonia and TKN at various monitoring locations in Yamuna river during non monsoon seasons (Year-1999 to 2005)

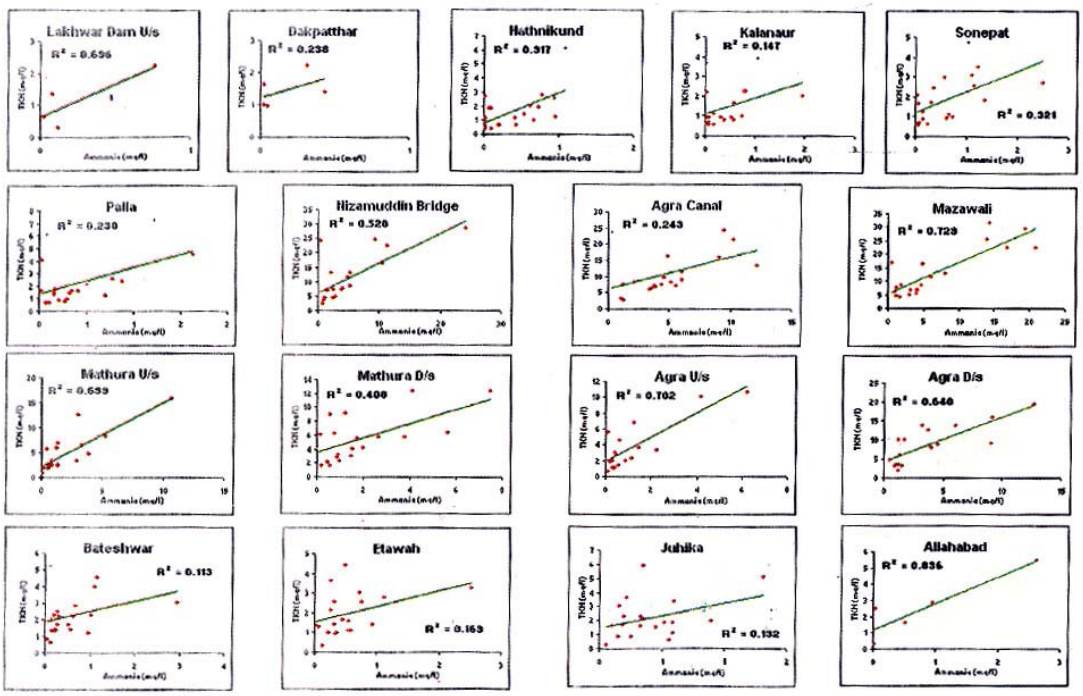


Fig. 3.18: Correlation between Ammonia and TKN at various monitoring locations in Yamuna river during monsoon seasons (Year-1999 to 2005)

The correlation of determination was significant (<0.500) at Yamunotri and from Nizamuddin Bridge till Etawah during all season, almost same was applicable in non-monsoon also including Palla and excluding Nizamuddin Bridge. In monsoon R^2 was significant at Nizamuddin Bridge, Mazawali, Mathura u/s, Agra up and downstream and Allahabad. Ammonia & TKN, which are contributed generally through the breakdown of organic matter showing good correlation almost in the entire stretch except at the locations, where dilution in the river was high, less organic contamination in the upstream and liberation of Ammonia from river water due to slight increase in pH etc.

Table 3.5: Correlation Coefficient (r) and Correlation Determination (R^2) between COD & BOD at various locations of River Yamuna during different seasons (Year 1999 – 2005)

S. No.	Location	All The Seasons			Non Monsoon Seasons			Monsoon Seasons		
		No. of Paired Variables	r	R2	No. of Paired Variables	r	R2	No. of Paired Variables	r	R2
1	Yamunotri	7	NC	NC	7	NC	NC	-	-	-
2	Shyanachatti	7	NC	NC	7	NC	NC	-	-	-
3	Lakhwar dam	23	0.232^{NS}	0.054	18	0.226^{NS}	0.051	5	NC	NC
4	Dak Patthar	24	0.455**	0.207	18	0.561**	0.315	6	NC	NC
5	Hathnikund	83	0.283**	0.080	63	0.460**	0.212	20	-0.022^{NS}	0.0005
6	Kalanaur	84	0.501**	0.251	63	0.649**	0.421	21	0.448*	0.201
7	Sonepat	84	0.389**	0.151	63	0.581**	0.337	21	0.285^{NS}	0.081
8	Palla	83	0.382**	0.146	62	0.451**	0.203	21	0.460*	0.212
9	Nizamuddin Bridge	77	0.815**	0.664	60	0.672**	0.452	17	0.871**	0.758
10	Agra Canal	82	0.835**	0.697	63	0.777**	0.604	19	0.691**	0.477
11	Mazawali	84	0.723**	0.523	63	0.641**	0.411	21	0.713**	0.508
12	Mathura U/S	82	0.573**	0.328	61	0.527**	0.278	21	0.476*	0.227
13	Mathura D/S	80	0.459**	0.211	59	0.423**	0.179	21	0.482*	0.232
14	Agra U/S	83	0.737**	0.543	63	0.701**	0.492	20	0.749**	0.561
15	Agra D/S	84	0.848**	0.719	63	0.843**	0.711	21	0.839**	0.704
16	Bateshwar	82	0.670**	0.449	62	0.526**	0.277	21	0.872**	0.760
17	Etawah	79	0.646**	0.417	58	0.483**	0.233	21	0.850**	0.722
18	Juhika	83	0.701**	0.492	62	0.674**	0.454	21	0.417^{NS}	0.174
19	Allahabad	27	0.348*	0.121	20	0.444*	0.197	7	0.100^{NS}	0.010

** = Highly significant at <1% level
* = significant at <5% level
NS = Not significant, P>5%
NC = No correlation

Note: AT Yamunotri and Shyanachatti monitoring was done once in a year during the month of June

Table 3.6: Correlation Coefficient (r) and Correlation Determination (R^2) between TC and FC at various locations of River Yamuna during different seasons (Year 1999 – 2005)

S. No.	Location	All The Seasons			Non Monsoon Seasons			Monsoon Seasons		
		No. of Paired Variables	r	R2	No. of Paired Variables	r	R2	No. of Paired Variables	r	R2
1	Yamunotri	7	0.980**	0.960	7	0.980**	0.960	-	-	-
2	Shyanachatti	7	0.504^{NS}	0.254	7	0.504^{NS}	0.254	-	-	-
3	Lakhwar dam	27	0.141^{NS}	0.020	21	0.415*	0.172	6	-0.430^{NS}	0.185
4	Dak Patthar	28	0.184^{NS}	0.034	21	0.458**	0.210	7	-0.814**	0.662
5	Hathnikund	78	0.628**	0.395	57	0.586**	0.343	21	0.577**	0.333
6	Kalanaur	78	0.545**	0.297	57	0.601**	0.361	21	0.457*	0.209
7	Sonepat	79	0.596**	0.355	58	0.627**	0.393	21	0.549*	0.301
8	Palla	82	0.596**	0.355	61	0.644**	0.415	21	0.474*	0.225
9	Nizamuddin Bridge	77	0.777**	0.604	59	0.765**	0.585	18	0.632**	0.399
10	Agra Canal	83	0.795**	0.632	62	0.811**	0.658	21	0.636**	0.405
11	Mazawali	82	0.791**	0.625	62	0.818**	0.669	20	0.592**	0.351
12	Mathura U/S	82	0.745**	0.555	61	0.748**	0.560	21	0.736**	0.541
13	Mathura D/S	82	0.635**	0.403	61	0.645**	0.416	21	0.613**	0.376
14	Agra U/S	82	0.509**	0.259	61	0.652**	0.425	21	0.573**	0.328
15	Agra D/S	81	0.843**	0.711	60	0.824**	0.679	21	0.903**	0.816
16	Bateshwar	83	0.495**	0.245	62	0.517**	0.267	21	0.458*	0.210
17	Etawah	81	0.358**	0.128	60	0.437**	0.191	21	0.184^{NS}	0.034
18	Juhika	81	0.356**	0.127	60	0.414**	0.171	21	0.173^{NS}	0.030
19	Allahabad	28	0.598**	0.358	21	0.550**	0.303	7	0.884**	0.782

** = Highly significant at <1% level
* = significant at <5% level
NS = Not significant, P>5%

Note: AT Yamunotri and Shyanachatti monitoring was done once in a year during the month of June

Table 3.7: Correlation Coefficient (r) and Correlation Determination (R^2) between BOD and FC at various locations of River Yamuna during different seasons (Year 1999 – 2005)

S. No.	Location	All The Seasons			Non Monsoon Seasons			Monsoon Seasons		
		No. of Paired Variables	r	R2	No. of Paired Variables	r	R2	No. of Paired Variables	r	R2
1	Yamunotri	7	NC	NC	7	NC	NC	-	-	-
2	Shyanachatti	7	NC	NC	7	NC	NC	-	-	-
3	Lakhwar dam	27	0.158^{NS}	0.025	21	0.179^{NS}	0.032	6	NC	NC
4	Dak Patthar	28	0.005^{NS}	0.00003	21	0.122^{NS}	0.015	7	0.210^{NS}	0.044
5	Hathnikund	79	0.100^{NS}	0.010	58	0.045^{NS}	0.002	21	0.224^{NS}	0.050
6	Kalanaur	79	0.230*	0.053	58	0.219^{NS}	0.048	21	0.342^{NS}	0.117
7	Sonepat	79	0.385**	0.148	58	0.385**	0.148	21	0.436**	0.190
8	Palla	80	0.313**	0.098	59	0.310*	0.096	21	0.390^{NS}	0.152
9	Nizamuddin Bridge	74	0.493**	0.243	58	0.425**	0.181	16	0.167^{NS}	0.028
10	Agra Canal	81	0.442**	0.195	62	0.351**	0.123	19	0.559**	0.313
11	Mazawali	82	0.187^{NS}	0.035	62	0.274^{NS}	0.075	20	0.390^{NS}	0.152
12	Mathura U/S	82	0.020^{NS}	0.0004	61	0.045^{NS}	0.002	21	0.095^{NS}	0.009
13	Mathura D/S	80	0.063^{NS}	0.004	59	0.002^{NS}	0.000004	21	0.259^{NS}	0.067
14	Agra U/S	80	0.283**	0.080	60	0.257*	0.066	20	$.332^{NS}$	0.110
15	Agra D/S	80	0.449**	0.202	59	0.382**	0.146	21	0.581**	0.337
16	Bateshwar	81	0.351**	0.123	60	0.259*	0.067	21	0.517**	0.267
17	Etawah	77	0.214^{NS}	0.046	56	0.176^{NS}	0.031	21	0.505**	0.255
18	Juhika	82	0.032^{NS}	0.001	61	0.003^{NS}	0.00001	21	0.274^{NS}	0.075
19	Allahabad	28	0.110^{NS}	0.012	21	0.020^{NS}	0.0004	7	0.469^{NS}	0.220

** = Highly significant at <1% level
* = significant at <5% level
NS = Not significant, P>5%

Note: AT Yamunotri and Shyanachatti monitoring was done once in a year during the month of June

Table 3.8: Correlation Coefficient (r) and Correlation Determination (R^2) between Ammonia and TKN at various locations of River Yamuna during different seasons (Year 1999 – 2005)

S. No.	Location	All The Seasons			Non Monsoon Seasons			Monsoon Seasons		
		No. of Paired Variables	r	R2	No. of Paired Variables	r	R2	No. of Paired Variables	r	R2
1	Yamunotri	6	0.964**	0.929	6	0.964**	0.929	-	-	-
2	Shyanachatti	6	0.332^{NS}	0.110	6	0.332^{NS}	0.110	-	-	-
3	Lakhwar dam	19	0.552**	0.305	15	0.521*	0.271	4	0.834*	0.696
4	Dak Patthar	22	0.583**	0.340	17	0.572*	0.327	5	0.488^{NS}	0.238
5	Hathnikund	78	0.407**	0.166	59	0.298*	0.089	19	0.563**	0.317
6	Kalanaur	80	0.285**	0.081	60	0.285*	0.081	20	0.383^{NS}	0.147
7	Sonepat	80	0.539**	0.290	60	0.539**	0.291	20	0.567**	0.321
8	Palla	79	0.359**	0.129	59	0.833**	0.694	20	0.480*	0.230
9	Nizamuddin Bridge	74	0.867**	0.751	56	0.335**	0.112	18	0.727**	0.528
10	Agra Canal	79	0.820**	0.673	59	0.860**	0.740	20	0.493*	0.243
11	Mazawali	79	0.920**	0.847	59	0.917**	0.840	20	0.854**	0.729
12	Mathura U/S	80	0.931**	0.866	60	0.923**	0.852	20	0.836**	0.699
13	Mathura D/S	79	0.941**	0.886	59	0.946**	0.895	20	0.639**	0.408
14	Agra U/S	79	0.843**	0.711	60	0.832**	0.693	19	0.838**	0.702
15	Agra D/S	78	0.912**	0.832	59	0.934**	0.873	19	0.800**	0.640
16	Bateshwar	80	0.902**	0.814	60	0.906**	0.821	20	0.336^{NS}	0.113
17	Etawah	80	0.791**	0.626	60	0.791**	0.626	20	0.411^{NS}	0.169
18	Juhika	78	0.470**	0.221	58	0.475**	0.226	20	0.363^{NS}	0.132
19	Allahabad	23	0.670**	0.449	17	0.600**	0.360	6	0.914**	0.836

** = Highly significant at <1% level
* = significant at <5% level
NS = Not significant, P>5%

Note: AT Yamunotri and Shyanachatti monitoring was done once in a year during the month of June

Continued

ANNEXURE - I: PHYSICO CHEMICAL CHARACTERISTICS OF RIVER YAMUNA

YEAR - 1999

HATHNIKUND

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.72	7.70	8.40	8.27	8.18	8.18	8.46	7.97	8.33	7.43	7.25	7.12	7.12	8.46	-
COD	11	10	10	6	6	10	4	2	1	2	5	3	1	11	6
BOD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
AMM.	BDL	BDL	0.04	BDL	0.05	0.33	0.73	0.66	0.10	BDL	BDL	BDL	BDL	0.73	0.17
TKN	0.92	1.20	0.92	0.56	0.80	1.34	1.91	0.91	1.82	0.97	0.97	0.97	0.56	1.91	1.11
DO	8.6	10.8	8.6	12.5	8.7	9.6	11.0	10.0	10.3	10.4	9.7	10.8	8.6	12.5	10.1
WT	14.0	14.5	23.0	22.0	22.0	24.0	28.0	22.0	27.0	27.0	20.5	11.0	11.0	28.0	21.3
TC	210	3700	400	4600	23000	1150	237000	42000	118000	34000	6000	4000	210	237000	39505
FC	85	50	120	80	140	60	7800	340	500	300	40	60	40	7800	798

KALANAUR

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.20	7.40	7.61	8.3	8.09	8.27	8.02	7.19	8.33	7.61	7.35	7.61	7.19	8.33	-
COD	13	10	10	7	8	8	5	11	6	2	9	6	2	13	8
BOD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
AMM.	0.05	BDL	BDL	BDL	0.08	0.05	0.52	0.30	BDL	0.09	BDL	0.07	BDL	0.52	0.11
TKN	1.54	0.92	1.86	0.87	1.17	1.34	0.91	0.91	0.91	1.30	1.30	2.30	0.87	2.30	1.28
DO	7.9	10.1	8.2	11.4	8.2	8.9	9.7	9.0	9.8	9.6	10.4	10.9	7.9	11.4	9.5
WT	14.5	14.5	24.0	26.0	24.0	25.0	26.0	24.0	28.0	28.0	21.0	12.0	12.0	28.0	22.3
TC	510	3900	700	19100	25000	1250	248000	48000	158000	50000	30000	21000	510	248000	50455
FC	205	70	150	100	450	184	8000	400	1100	300	360	90	70	8000	951

SONEPAT

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.40	7.00	8.23	8.07	8.12	8.24	7.65	7.96	8.3	7.91	7.36	7.98	7.00	8.40	-
COD	17	16	10	9	12	11	10	14	10	4	18	9	4	18	12
BOD	1	1	1	1	1	1	2	1	1	1	3	2	1	3	1
AMM.	0.04	BDL	0.05	0.12	0.11	0.22	0.60	0.14	1.34	0.04	BDL	0.23	BDL	1.34	0.24
TKN	1.86	1.54	1.54	1.45	0.80	2.64	0.91	1.21	1.82	1.63	0.65	1.95	0.65	2.64	1.50
DO	8.4	9.0	6.9	11.2	7.0	7.8	10.6	7.2	9.4	9.0	11.6	11.4	6.9	11.6	9.1
WT	12.0	14.0	24.0	24.0	24.0	27.0	32.0	26.0	29.0	26.0	21.5	16.0	12.0	32.0	23.0
TC	900	4200	1000	7300	111000	42700	295000	74000	169000	74000	46000	37000	900	295000	71842
FC	220	200	170	1800	620	89	9300	500	1050	1100	600	550	89	9300	1350

PALLA

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.00	7.10	8.19	7.81	7.86	8.7	8.61	7.79	7.89	7.53	7.25	7.83	7.00	8.70	-
COD	5	20	19	12	20	12	22	11	15	10	19	9	5	22	15
BOD	1	1	2	1	2	2	2	1	1	3	2	2	1	3	2
AMM.	BDL	0.07	BDL	0.34	0.21	0.21	0.42	0.17	BDL	0.68	3.55	0.37	BDL	3.55	0.67
TKN	1.23	1.84	2.16	1.90	1.76	3.36	1.51	1.21	1.51	1.3	4.28	2.6	1.21	4.28	2.06
DO	8.2	8.4	8.5	5.2	8.3	9.5	12.2	8.3	10.0	12.5	10.7	12.8	5.2	12.8	9.6
WT	14.0	18.0	25.0	27.0	29.0	30.5	36.0	27.0	32.0	29.0	30.0	16.0	14.0	36.0	26.1
TC	2050	1050	15000	11500	32000	3200	80000	64000	71000	21400	54000	31000	1050	80000	32183
FC	480	100	200	660	2150	400	4000	360	1000	1100	340	110	100	4000	908

NIZAMUDDIN BRIDGE - MID STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.41	7.90	8.07	7.38	7.51	8.15	7.4	8.54	7.02	7.45	7.22	7.45	7.02	8.54	-
COD	31	46	67	60	74	63	32	20	ND	26	64	63	20	74	50
BOD	8	9	11	12	10	9	3	ND	ND	6	21	22	3	22	11
AMM.	6.46	6.24	7.82	17.37	13.62	15.09	9.42	0.30	3.80	4.70	13.16	14.18	0.30	17.37	9.35
TKN	7.08	7.70	11.30	19.60	24.90	32.28	24.31	23.69	6.98	7.82	17.82	26.70	6.98	32.28	17.52
DO	0.3	1.5	0.0	0.0	0.0	0.0	0.0	7.8	1.2	1.5	0.0	0.0	0.0	7.8	1.0
WT	13.5	20.0	23.0	27.0	35.0	30.0	29.0	30.0	29.0	31.0	24.0	19.0	13.5	35.0	25.9
TC	15500	364000	544000	2370000	1950000	2110000	2650000	1005000	755000	615000	78000000	85000000	15500	85000000	14614875
FC	2540	102000	262000	1290000	1030000	356000	500000	3120	15500	84000	13000000	2400000	2540	13000000	1587097

NIZAMUDDIN BRIDGE - QUARTER STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.21	7.80	7.61	7.32	7.55	7.76	7.7	8.41	7.02	7.96	7.21	7.51	7.02	8.41	-
COD	31	31	69	59	83	62	40	29	ND	27	62	64	27	83	51
BOD	7	7	12	9	17	9	4	ND	ND	8	21	23	4	23	12
AMM.	9.64	7.95	11.21	16.31	13.24	16.45	12.54	0.30	3.99	5.21	13.62	14.42	0.30	16.45	10.41
TKN	10.47	8.31	11.70	20.16	14.70	24.10	30.38	26.12	7.29	6.52	18.47	28.30	6.52	30.38	17.21
DO	0.5	1.0	0.0	0	0.0	0.0	0.0	7.8	1.0	1.5	0.0	0.0	0.0	7.8	1.0
WT	13.5	20.0	23.0	28.00	35.0	30.0	29.0	30.0	29.0	31.0	24.0	19.0	13.5	35.0	26.0
TC	15500	366000	570000	2500000	2010000	2250000	2810000	1075000	860000	985000	97000000	214000000	15500	214000000	27036792
FC	2600	93000	270000	1370000	1170000	374000	502000	3180	13000	106000	17000000	2800000	2600	17000000	1975315

AGRA CANAL - MID STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.14	8.02	7.46	7.67	7.62	8.51	7.92	8.41	7.21	8.01	7.1	7.51	7.10	8.51	-
COD	27	36	53	53	61	30	41	17	ND	36	48	35	17	61	40
BOD	5	8	5	10	13	9	7	2	ND	10	20	12	2	20	9
AMM.	7.57	3.64	8.57	10.80	6.51	5.51	23.02	0.48	4.31	4.70	10.72	6.84	0.48	23.02	7.72
TKN	17.94	6.16	12.32	12.60	9.70	20.17	28.25	25.21	7.89	8.14	18.80	24.00	6.16	28.25	15.93
DO	0.1	0.0	0.0	3.8	1.5	2.0	0.0	3.0	1.7	3.0	0.7	0.0	0.0	3.8	1.3
WT	16.0	20.0	24.0	28.0	29.0	32.0	28.5	31.0	30.0	30.0	23.0	18.0	16.0	32.0	25.8
TC	12500	474000	474000	155000	440000	1790000	2780000	890000	820000	890000	37000000	10500000	12500	37000000	4685458
FC	1120	115000	174000	120000	380000	254000	458000	3200	19500	196000	9000000	2000000	1120	9000000	1060068

AGRA CANAL - QUARTER STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.73	8.1	7.61	7.65	7.57	7.86	8.01	8.36	7.07	7.63	7.22	7.36	7.07	8.36	-
COD	31	38	64	51	61	33	42	17	ND	36	50	38	17	64	42
BOD	5	8	7	9	12	8	7	4	ND	9	13	11	4	13	8
AMM.	6.46	6.78	11.21	11.56	5.78	5.43	20.60	0.52	4.12	5.50	10.50	5.72	0.52	20.60	7.85
TKN	18.56	7.08	14.16	15.40	8.82	21.52	29.77	24.91	7.51	8.42	16.84	23.10	7.08	29.77	16.34
DO	0.4	0.0	0.0	3.9	1.0	2.0	0.0	3.0	1.5	3.0	0.7	0.0	0.0	3.9	1.3
WT	16.0	20.0	24.0	28.0	29.0	32.0	28.5	31.0	30.0	30.0	23.0	18.0	16.0	32.0	25.8
TC	12000	484000	502000	124000	400000	1850000	2800000	915000	920000	1000000	39000000	14300000	12000	39000000	5192250
FC	1200	135000	188000	100000	370000	380000	470000	3420	23500	214000	10000000	3000000	1200	10000000	1240427

MAZAWALI

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.63	7.61	7.66	8.14	7.77	8.28	7.7	7.64	7.27	7.94	7.15	7.43	7.15	8.28	-
COD	35	30	55	72	78	72	24	22	16	35	48	41	16	78	44
BOD	5	4	8	19	21	17	4	4	4	14	13	9	4	21	10
AMM.	8.04	5.40	0.87	2.51	10.50	16.69	19.33	0.46	1.92	1.22	15.58	14.15	0.46	19.33	8.06
TKN	9.28	8.04	7.70	8.40	22.90	30.93	29.16	16.70	8.20	7.17	17.49	27.30	7.17	30.93	16.11
DO	2.1	3.6	3.9	13.5	8.7	14.0	ND	7.3	3.4	7.0	2.6	0.8	0.8	14.0	6.1
WT	14.0	21.0	23.0	28.0	26.0	36.0	28.0	31.0	28.0	31.0	24.0	18.0	14.0	36.0	25.7
TC	14400	40200	126000	30000	22000	232000	37000	390000	215000	130000	600000	4025000	14400	4025000	488467
FC	1600	2000	1000	5000	3550	72000	19000	1780	9500	80000	50000	100000	1000	100000	28786

MATHURA - U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.41	7.5	7.71	7.97	7.91	8.50	7.94	8.63	7.48	7.46	7.99	7.89	7.41	8.63	-
COD	27	44	54	47	35	42	31	15	17	22	33	31	15	54	33
BOD	6	3	8	6	5	7	4	3	5	8	11	13	3	13	7
AMM.	2.77	6.76	5.54	0.60	0.24	0.27	3.96	0.46	0.06	0.79	4.09	7.77	0.06	7.77	2.78
TKN	3.40	7.39	6.16	1.96	0.88	5,38	4.55	5.46	2.12	2.6	4.56	8.15	0.88	8.15	4.29
DO	5.7	7.9	17.2	9.7	8.2	4.3	3.8	7.5	6.7	9.0	4.2	6.4	3.8	17.2	7.5
WT	14.5	20.0	25.0	31.0	30.0	30.0	28.0	30.0	28.0	27.0	27.0	16.5	14.5	31.0	25.6
TC	73000	18600	24000	356000	37000	120000	350000	430000	325000	555000	1150000	236000	18600	1150000	306217
FC	1200	800	1600	17000	2000	29500	37000	2740	9500	22000	12500	19000	800	37000	12903

MATHURA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.82	7.02	7.73	7.93	7.93	8.55	8.41	8.56	7.54	7.7	7.64	7.94	7.02	8.56	-
COD	25	37	51	49	34	41	37	16	22	38	36	36	16	51	35
BOD	6	5	7	5	5	7	4	4	8	9	15	13	4	15	7
AMM.	3.25	6.73	5.16	0.60	0.30	0.30	5.64	0.58	BDL	0.14	2.38	8.31	BDL	8.31	2.78
TKN	3.40	8.00	6.40	2.80	1.47	6.72	6.34	8.81	4.25	6.52	10.10	11.08	1.47	11.08	6.32
DO	5.6	8.7	15.7	2.7	7.9	3.5	2.1	7.6	4.0	6.60	9.3	4.6	2.1	15.7	6.5
WT	14.5	20.0	26.0	31.0	29.5	32.0	28.0	32.0	27.0	27.0	26.0	17.0	14.5	32.0	25.8
TC	111000	20200	126000	1770000	57000	165000	400000	440000	815000	645000	2110000	474000	20200	2110000	594433
FC	1720	900	37000	125000	17500	122000	89000	3300	13000	76000	91500	75000	900	125000	54327

MATHURA - D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.90	7.10	7.69	7.95	7.89	8.78	8.32	8.49	7.56	7.45	7.89	8.01	7.10	8.78	-
COD	25	38	52	51	34	41	36	17	17	38	32	34	17	52	35
BOD	6	4	8	6	5	7	4	3	6	9	11	13	3	13	7
AMM.	3.05	6.24	5.84	0.65	0.35	0.14	5.62	0.52	BDL	0.46	3.42	7.14	BDL	7.14	2.79
TKN	3.09	8.00	7.39	3.08	1.76	8.07	6.34	8.50	3.64	5.87	9.78	10.78	1.76	10.78	6.36
DO	5.5	8.6	12.4	2.5	7.8	3.2	2.0	7.6	4.1	6.5	9.4	4.2	2.0	12.4	6.1
WT	15.0	20.0	26.0	31.0	29.5	32.0	28.0	32.0	27.00	27.0	26.0	17.0	15.0	32.0	25.9
TC	119000	20600	130000	1800000	368000	173000	420000	442000	885000	700000	2290000	484000	20600	2290000	652633
FC	2100	900	40000	130000	28000	120000	92000	3300	14000	78000	106000	79000	900	130000	57775

AGRA - U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.10	8.30	8.15	8.81	7.74	8.54	7.89	8.69	7.92	7.09	7.45	7.9	7.09	8.81	-
COD	26	37	40	48	35	38	31	22	9	38	61	36	9	61	35
BOD	6	8	7	7	5	6	4	4	4	10	15	14	4	15	8
AMM.	1.84	2.92	0.64	0.38	0.43	0.30	0.21	1.28	BDL	0.01	1.46	2.39	BDL	2.92	0.99
TKN	2.16	3.08	1.84	1.12	1.17	2.69	1.82	6.68	2.12	4.80	3.58	3.28	1.12	6.68	2.86
DO	5.8	ND	8.1	9.2	8.4	18.5	6.9	8.5	6.3	7.2	16.4	6.3	5.8	18.5	9.2
WT	15.5	22.0	23.0	30.0	30.0	34.0	28.0	29.0	27.0	29.0	27.0	17.0	15.5	34.0	26.0
TC	6700	14200	13000	30000	ND	118000	68500	424000	815000	100000	770000	386000	6700	815000	249582
FC	1900	800	1000	5000	ND	42000	35000	2940	7500	30000	11500	56000	800	56000	17604

AGRA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.45	8.11	7.7	8.23	7.84	8.45	8.44	8.52	7.88	8.04	7.63	7.99	7.63	8.52	-
COD	34	56	60	62	56	64	54	20	11	43	54	46	11	64	47
BOD	9	16	8	11	11	13	14	4	4	15	15	22	4	22	12
AMM.	3.06	3.50	2.32	0.54	0.84	0.90	9.04	1.22	0.55	1.40	3.01	10.64	0.54	10.64	3.09
TKN	4.33	4.00	3.38	1.40	2.35	9.41	9.11	10.02	4.55	7.17	8.80	14.67	1.40	14.67	6.60
DO	5.6	ND	6.5	8.4	6.2	5.2	0.0	6.5	4.7	6.0	9.5	5.6	0.0	9.5	5.8
WT	15.50	22.0	24.0	30.0	29.0	33.0	28.5	28.0	29.0	30.0	27.0	17.0	15.5	33.0	26.1
TC	195000	58000	134000	1780000	1990000	1710000	1225000	550000	1950000	1075000	12200000	558000	58000	12200000	1952083
FC	6800	11000	18000	1560000	850000	278000	127000	4200	14500	96000	325000	270000	4200	1560000	296708

AGRA - D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.12	8.00	7.75	8.13	7.82	7.93	8.04	8.49	8.01	7.68	7.91	7.96	7.68	8.49	-
COD	34	56	58	66	57	64	39	18	15	39	41	44	15	66	44
BOD	9	17	7	11	12	12	8	4	4	14	13	20	4	20	11
AMM.	3.04	3.48	2.05	0.81	0.43	0.49	9.55	1.87	1.60	1.28	3.58	8.55	0.43	9.55	3.06
TKN	3.71	4.31	2.77	1.40	3.70	12.10	10.63	10.93	5.16	5.81	9.12	12.38	1.40	12.38	6.84
DO	5.5	ND	5.5	8.2	6.4	5.0	0.0	6.5	4.6	6.1	9.4	3.3	0.0	9.4	5.5
WT	15.5	22.0	24.0	30.5	29.0	33.5	28.5	28.0	29.0	30.0	27.0	17.0	15.5	33.5	26.2
TC	201000	82000	148000	1870000	2110000	1750000	1255000	562000	2120000	1135000	12900000	598000	82000	12900000	2060917
FC	7300	11000	23000	1700000	1030000	280000	133000	4440	19000	110000	355000	280000	4440	1700000	329395

BATESHWAR

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.21	7.61	8.9	8.72	8.31	8.2	8.11	8.01	8.39	7.91	7.65	7.51	7.21	8.90	-
COD	23	46	55	50	46	60	37	9	13	31	50	32	9	60	38
BOD	5	9	8	8	7	6	7	2	3	7	12	21	2	21	8
AMM.	0.33	1.00	1.09	0.16	0.73	0.25	2.97	0.11	0.29	0.31	0.46	4.83	0.11	4.83	1.04
TKN	1.54	1.84	1.23	0.84	0.80	4.03	3.03	5.20	2.43	2.28	2.60	5.77	0.80	5.77	2.63
DO	8.0	9.0	14.7	17.9	22.5	6.5	10.5	7.1	6.5	11.2	23.1	14.2	6.5	23.1	12.6
WT	18.0	23.0	25.0	30.0	32.0	38.0	33.0	31.0	31.0	29.0	22.0	21.0	18.0	38.0	27.8
TC	98000	62000	8000	1810000	288000	318000	85000	170000	1022500	370000	272000	498000	8000	1810000	416792
FC	9000	5000	1200	1500000	19000	5000	2020	550	4025	47000	53000	205000	550	1500000	154233

ETAWAH

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.69	7.60	8.99	8.97	8.11	7.8	7.64	8.64	8.24	7.93	7.63	7.63	7.60	8.99	-
COD	25	38	50	52	61	23	22	10	18	16	38	30	10	61	32
BOD	5	7	8	11	10	2	4	1	3	3	14	19	1	19	7
AMM.	1.75	1.76	0.65	0.62	0.52	0.16	0.34	0.49	0.26	0.26	0.48	0.16	0.16	1.76	0.62
TKN	2.47	10.47	2.46	1.12	1.47	5.38	0.91	4.40	2.12	1.95	1.95	4.56	0.91	10.47	3.27
DO	10.9	7.9	17.8	13.5	18.3	9.0	12.5	7.4	7.0	7.6	17.1	9.8	7.0	18.3	11.6
WT	18.0	23.0	24.0	30.0	34.0	34.0	33.0	30.0	31.5	28.0	22.0	21.0	18.0	34.0	27.4
TC	90000	27000	3000	ND	254000	126000	83000	115000	852500	280000	106000	352000	3000	852500	208045
FC	7000	3800	900	12000	15000	4000	1860	200	4025	39000	42000	110000	200	110000	19982

JUHIKA

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.39	7.23	8.01	8.34	8.02	7.6	7.97	7.69	7.89	7.56	7.7	7.43	7.23	8.34	-
COD	25	20	19	24	19	23	25	5	15	6	21	11	5	25	18
BOD	4	2	3	2	2	2	2	1	2	1	6	3	1	6	3
AMM.	2.23	BDL	0.64	0.09	0.30	0.15	0.59	0.35	0.16	BDL	0.54	0.08	BDL	2.23	0.51
TKN	3.40	1.54	2.77	2.24	1.17	4.03	1.82	5.90	3.03	2.93	2.93	4.17	1.17	5.90	2.99
DO	11.9	9.3	17.1	8.4	12.4	10.4	12.0	8.1	7.2	8.6	10.3	12.0	7.2	17.1	10.6
WT	18.0	22.5	20.0	31.0	32.0	37.0	27.0	31.0	29.5	28.0	21.5	19.0	18.0	37.0	26.4
TC	31000	21000	3000	20800	115000	26000	53000	85000	417500	160000	42000	34000	3000	417500	84025
FC	200	1200	1000	100	4050	500	840	100	3050	23000	1000	3000	100	23000	3170

UDI (Chambal River)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.43	7.40	8.73	8.5	8.04	7.7	7.62	7.53	7.73	7.64	7.94	7.71	7.40	8.73	-
COD	8	7	15	8	14	6	21	3	12	4	15	10	3	21	10
BOD	2	1	3	1	1	1	1	1	1	1	1	11	1	11	2
AMM.	0.15	0.16	0.20	0.08	0.24	0.10	1.48	0.19	0.27	0.04	0.09	0.07	0.04	1.48	0.26
TKN	1.86	2.77	1.54	1.40	1.17	4.03	2.12	4.90	2.73	2.60	2.28	3.91	1.17	4.90	2.61
DO	12.2	9.7	11.3	8.6	12.2	7.9	9.5	8.4	7.2	10.0	10.7	12.6	7.2	12.6	10.0
WT	18.0	23.0	25.0	31.0	31.5	32.0	28.0	29.0	31.5	27.0	23.0	21.0	18.0	32.0	26.7
TC	800	19000	400	ND	31500	12000	69000	35000	852500	12000	26000	18000	400	852500	97836
FC	100	290	80	ND	100	20	740	50	4025	2000	1000	300	20	4025	791

YEAR - 2000

HATHNIKUND

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.51	7.32	7.36	7.29	7.81	7.93	7.7	7.98	8.22	7.94	7.45	8.13	7.29	8.22	-
COD	5	8	2	2	3	4	5	8	9	3	5	9	2	9	5.25
BOD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
AMM.	BDL	BDL	BDL	BDL	BDL	0.20	0.43	0.09	BDL	0.06	BDL	0.07	BDL	0.43	0.08
TKN	0.96	0.96	0.64	0.64	0.64	0.64	0.64	0.32	0.31	0.31	0.63	0.63	0.31	0.96	0.61
DO	10.9	10.2	11.6	9.9	11.3	8.0	9.6	9.0	9.8	10.6	9.8	10.9	8.0	11.6	10.1
WT	11.0	13.0	14.0	20.0	21.0	22.5	21.0	26.5	25.5	19.0	22.0	13.0	11.0	26.5	19.0
TC	8700	268000	12550	4400	ND	257000	31000	65000	2200	100	1600	6500	100	268000	59732
FC	ND	38000	385	45	ND	3400	830	1110	40	20	250	700	20	38000	4478

KALANAUR

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.43	7.78	7.44	7.39	7.84	8.09	7.8	8.02	8.13	7.88	7.49	8.24	7.39	8.24	-
COD	7	5	3	19	7	8	11	9	6	17	8	10	3	19	9
BOD	1	1	1	3	1	1	1	1	1	1	1	1	1	3	1
AMM.	BDL	0.07	0.08	0.58	BDL	BDL	0.73	0.07	BDL	0.35	BDL	BDL	BDL	0.73	0.17
TKN	0.64	0.96	0.64	0.96	0.64	0.64	0.96	0.64	0.63	0.95	0.94	0.63	0.63	0.96	0.77
DO	10.8	9.7	9.4	8.1	11.1	7.8	7.5	8.4	8.7	9.7	9.0	10.3	7.5	11.1	9.2
WT	11.0	14.0	15.5	27.0	26.0	27.0	26.0	28.0	26.0	23.0	24.0	18.0	11.0	28.0	22.1
TC	6250	41000	13550	ND	ND	176000	117000	159000	1420000	27700	7600	5600	5600	1420000	197370
FC	ND	11400	3100	ND	ND	5600	1300	1200	150	6800	470	740	150	11400	3418

SONEPAT

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.62	7.69	7.50	7.5	7.89	8.06	7.73	7.94	8.06	7.82	7.83	8.35	7.50	8.35	-
COD	6	10	8	5	8	7	19	19	11	20	15	14	5	20	12
BOD	1	1	2	1	2	1	2	2	2	1	1	2	1	2	2
AMM.	0.42	0.38	0.19	0.16	BDL	0.22	0.40	0.26	BDL	0.48	0.59	1.06	BDL	1.06	0.35
TKN	0.96	0.65	0.97	0.96	0.64	1.61	0.96	0.64	0.63	0.95	1.26	1.89	0.63	1.89	1.01
DO	11.0	8.3	8.2	6.9	10.0	6.8	6.5	7.9	8.4	8.5	7.0	9.8	6.5	11	8.3
WT	18.0	12.0	15.0	25.0	30.0	26.5	26.0	28.5	30.5	25.0	26.0	14.0	12.0	30.5	23.0
TC	11500	38000	15250	13250	ND	295000	1480000	229000	410000	2200	1900	47000	1900	1480000	231191
FC	ND	11000	1370	1070	ND	8800	39000	3700	360	100	150	250	100	39000	6580

PALLA

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.66	7.56	7.41	6.83	7.8	8.08	7.82	7.8	8.19	8.25	7.59	7.92	6.83	8.25	-
COD	14	10	5	4	7	7	7	19	13	12	7	13	4	19	10
BOD	2	1	2	1	2	1	2	1	1	2	1	1	1	2	1
AMM.	0.54	0.19	0.16	0.16	BDL	BDL	0.33	0.16	0.17	0.07	BDL	0.12	BDL	0.54	0.16
TKN	1.92	1.92	1.62	2.24	1.93	1.93	1.28	1.28	1.59	0.95	0.94	1.26	0.94	2.24	1.57
DO	8.7	8.6	12.0	8.0	7.8	6.9	5.6	6.2	6.7	5.8	5.8	10.2	5.6	12.0	7.7
WT	13.8	14.0	18.0	25.0	27.0	29.0	30.0	26.5	31.0	25.0	25.0	15.0	13.8	31.0	23.3
TC	89000	20600	32800	22550	26300	201000	13900	13100	10300	3300	8400	3300	3300	201000	37046
FC	ND	2750	10100	1205	2400	88000	1810	2000	100	750	220	150	100	88000	9953

NIZAMUDDIN BRIDGE - MID STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.49	7.39	7.30	7.9	7.91	7.71	7.13	7.97	8.04	7.43	7.51	7.34	7.13	8.04	-
COD	77	39	32	97	54	62	29	28	49	71	61	78	28	97	56
BOD	25	12	21	22	22	27	6	5	9	16	23	30	5	30	18
AMM.	13.17	8.71	11.91	17.78	11.81	13.57	2.22	1.55	5.29	18.29	19.05	15.90	1.55	19.05	11.60
TKN	19.26	19.90	13.60	19.96	18.67	26.72	12.84	6.44	12.72	21.62	22.26	20.16	6.44	26.72	17.85
DO	0.0	0.0	0.0	0.5	3.6	ND	2.1	4.4	0.0	0.0	0.0	0.0	0.0	4.4	1.0
WT	20.0	19.0	23.0	32.0	33.0	32.0	30.0	30.0	30.0	30.0	20.5	20.0	19.0	33.0	26.6
TC	21000000	21500000	11000000	390000	2540000	1870000	2230000	860000	2010000	1900000	25200000	15100000	390000	25200000	8800000
FC	ND	990000	855000	100000	1260000	1370000	210000	480000	440000	610000	4700000	8100000	100000	8100000	1737727

NIZAMUDDIN BRIDGE - QUARTER STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.44	7.42	7.49	7.88	7.86	7.57	7.20	7.92	8.09	7.3	7.53	7.46	7.20	8.09	-
COD	77	42	42	103	60	65	27	32	46	66	62	86	27	103	59
BOD	23	11	18	24	18	30	6	6	9	19	27	22	6	30	18
AMM.	14.28	9.64	10.61	17.37	12.86	14.90	2.79	1.16	4.85	11.83	18.35	18.51	1.16	18.51	11.43
TKN	21.82	20.22	15.87	20.23	19.96	28.33	13.48	8.05	9.54	15.90	23.85	22.36	8.05	28.33	18.30
DO	0.0	0.0	0.0	0.5	4.5	ND	1.9	4.5	0.0	0.0	0.0	0.0	0.0	4.5	1.0
WT	20.0	19.0	23.0	32.0	33.0	32.5	30.0	30.0	30.0	30.0	20.5	20.5	19.0	33.0	26.7
TC	26500000	31500000	29300000	900000	2700000	4400000	1210000	1200000	2130000	2200000	40000000	12300000	900000	40000000	12861667
FC	ND	2180000	1020000	690000	1920000	1430000	50000	500000	520000	270000	5300000	5600000	50000	5600000	1770909

AGRA CANAL - MID STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.91	7.43	7.59	7.81	7.64	8	7.01	7.84	7.48	7.34	7.45	7.41	7.01	8.00	-
COD	55	33	48	39	27	45	30	31	48	66	42	35	27	66	42
BOD	11	12	15	8	4	11	8	6	11	11	9	9	4	15	10
AMM.	7.35	4.32	9.14	7.03	5.86	9.55	4.85	1.22	6.05	7.60	5.81	5.04	1.22	9.55	6.15
TKN	18.20	17.33	11.70	9.70	14.61	22.50	16.05	7.40	11.44	1.05	12.72	10.08	1.05	22.5	12.73
DO	0.0	0.0	0.0	2.5	ND	0.0	0.4	5.3	2.3	1.2	1.1	0.8	0.0	5.3	1.2
WT	17.0	20.0	22.0	31.0	31.0	28.0	31.0	31.0	31.0	29.5	19.0	16.0	16.0	31.0	25.5
TC	28300000	27300000	14300000	260000	520000	1770000	680000	1600000	900000	310000	15700000	900000	260000	28300000	7711667
FC	ND	1360000	1390000	160000	190000	700000	170000	1300000	130000	160000	2810000	110000	110000	2810000	770909

AGRA CANAL - QUARTER STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.63	7.47	7.61	7.69	7.86	8	7.01	7.68	7.55	7.49	7.49	7.41	7.01	8.00	-
COD	53	36	46	34	33	47	34	39	48	47	43	32	32	53	41
BOD	10	10	19	8	6	12	8	9	9	9	9	9	6	19	10
AMM.	8.44	4.83	8.31	6.62	7.03	9.23	5.37	1.26	5.72	8.41	5.70	4.45	1.26	9.23	6.28
TKN	17.01	16.05	12.30	10.27	14.81	24.15	15.40	7.08	10.17	11.44	11.13	10.71	7.08	24.15	13.38
DO	0.0	0.0	0.0	2.9	ND	0.0	ND	5.5	12.0	4.1	1.0	0.70	0.0	12.0	2.6
WT	17.0	20.0	22.0	31.0	31.0	28.0	31.0	31.0	31.0	29.5	19.0	16.0	16.0	31.0	25.5
TC	29700000	27800000	20100000	210000	530000	1220000	1140000	1700000	940000	280000	17800000	380000	210000	29700000	8483333
FC	ND	765000	2250000	120000	140000	650000	300000	1400000	270000	130000	4000000	70000	70000	4000000	917727

MAZAWALI

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.68	7.51	7.49	7.79	7.92	7.91	7.1	7.9	7.89	7.43	7.64	7.59	7.10	7.92	-
COD	65	42	67	50	61	39	42	27	50	44	46	44	27	67	48
BOD	9	7	21	11	9	12	12	6	ND	9	11	8	6	21	10
AMM.	16.67	5.18	16.67	14.85	17.40	15.33	4.80	1.59	5.29	7.11	20.03	12.48	1.59	20.03	11.45
TKN	22.47	15.72	22.70	16.10	24.15	29.94	17.33	8.69	14.31	12.72	25.44	16.06	8.69	29.94	18.80
DO	1.0	1.9	2.0	8.6	10.4	ND	2.6	5.5	5.8	4.4	4.0	3.6	1.0	10.4	4.5
WT	18.0	19.0	21.0	32.0	33.0	27.0	31.0	30.0	30.0	29.0	20.0	18.5	18.0	33.0	25.7
TC	7200000	805000	1285000	1330000	187000	175000	64000	950000	119000	155000	2810000	108000	64000	7200000	1265667
FC	ND	360000	416000	19000	39000	29000	1000	500000	6000	2500	370000	17000	1000	500000	159955

MATHURA - U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.91	7.63	7.71	7.68	7.75	8.14	7.48	7.73	7.94	8.01	7.92	7.82	7.48	8.14	-
COD	ND	18	43	46	23	15	22	22	37	41	37	39	15	46	31
BOD	ND	6	12	9	7	6	11	3	8	10	10	8	3	12	8
AMM.	1.31	9.09	14.44	2.36	1.92	2.95	2.93	1.33	BDL	0.58	0.24	1.10	BDL	14.44	3.19
TKN	2.24	9.63	17.60	3.21	2.57	3.86	3.21	2.25	1.27	1.27	1.59	11.02	1.27	17.6	4.98
DO	7.5	2.8	14.0	4.4	5.7	4.4	1.0	4.1	9.5	6.9	8.3	2.8	1.0	14.0	5.9
WT	17.5	15.0	25.0	32.0	30.0	36.0	29.5	31.0	32	30.0	23.0	18.0	15.0	36.0	26.6
TC	ND	47000	1020000	25200	2450000	12000	43000	216000	185000	23000	198000	102000	12000	2450000	392836
FC	ND	8700	85000	1600	62000	200	3700	19000	2100	2700	2800	1600	200	85000	17218

MATHURA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.82	7.56	7.70	7.61	7.8	8.12	7.88	7.65	8.18	8.05	8.01	7.77	7.56	8.18	-
COD	ND	46	47	51	27	18	20	23	44	48	40	47	18	51	37.4
BOD	ND	17	17	10	7	8	8	4	8	13	17	6	4	17	10.45
AMM.	1.76	8.59	12.35	2.71	2.57	2.03	1.24	0.76	0.17	3.50	9.77	12.43	0.17	12.43	4.82
TKN	9.30	11.50	16.50	7.06	6.44	10.62	8.98	6.11	6.04	5.08	19.31	16.08	5.08	19.31	10.25
DO	5.1	3.1	6.9	8.7	5.3	3.8	0.8	4.2	8.1	4.0	7.6	2.9	0.8	8.7	5.0
WT	18.0	15.5	24.0	32.0	35.0	34.0	29.0	31.0	31.0	30.0	24.0	20.0	15.5	35.0	27.0
TC	ND	289000	1350000	231000	2800000	70000	100000	300000	268000	265000	1750000	760000	70000	2800000	743909
FC	ND	37000	89000	121000	75000	2100	10000	16000	14200	32000	81000	142000	2100	142000	56300

MATHURA - D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.86	7.69	7.68	7.51	7.88	8.1	7.73	7.69	8.08	8.19	8.04	8.3	7.51	8.30	-
COD	ND	42	47	45	31	19	26	22	40	45	38	38	19	47	36
BOD	ND	18	16	9	11	7	9	4	8	12	15	8	4	18	11
AMM.	1.45	9.14	12.54	2.25	3.63	1.38	1.92	0.84	0.35	3.63	11.29	12.97	0.35	12.97	5.12
TKN	8.02	12.84	17.80	8.02	8.37	11.50	8.66	5.15	5.40	5.72	16.85	15.12	5.15	17.8	10.29
DO	5.0	3.4	6.9	8.6	5.0	3.9	0.8	4.1	8.5	4.1	7.5	2.8	0.8	8.6	5.0
WT	18.0	16.0	24.0	32.0	35.0	34.0	29.0	31.0	31.0	30.0	24.0	20.0	16.0	35.0	27.0
TC	ND	231000	1440000	265000	2820000	78000	105000	305000	660000	180000	1810000	400000	78000	2820000	754000
FC	ND	37000	88000	140000	80000	2700	11500	19500	23000	34000	85000	70000	2700	140000	53700

AGRA - U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.51	7.74	7.8	7.76	7.76	8.11	7.85	7.72	8.03	8	7.73	7.69	7.51	8.11	-
COD	ND	28	31	50	35	11	18	18	10	53	40	40	10	53	30
BOD	ND	8	9	9	9	3	3	3	2	9	14	9	2	14	7
AMM.	0.11	5.94	3.36	1.02	0.49	0.21	1.16	0.59	0.32	0.14	1.88	8.63	0.11	8.63	1.99
TKN	2.56	6.42	4.91	2.56	1.93	4.18	2.24	1.28	1.90	1.27	2.54	9.45	1.27	9.45	3.44
DO	7.7	5.8	9.0	14.4	12.0	3.9	4.6	4.8	10.1	6.7	7.6	9.3	3.9	14.4	8.0
WT	16.5	17.0	25.0	31.0	32.0	35.0	29.5	31.0	30.0	32.0	22.5	23.0	16.5	35.0	27.0
TC	ND	95000	705000	20700	35000	8000	155000	200000	135000	11400	115000	122000	8000	705000	145645
FC	ND	26500	15725	5100	2600	100	1900	7300	6800	600	4500	24000	100	26500	8648

AGRA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.64	7.81	7.44	7.81	7.81	8.05	7.49	7.52	7.99	7.93	7.64	7.75	7.44	8.05	-
COD	22	23	64	86	71	18	31	27	13	75	57	57	13	86	45
BOD	6	8	24	23	14	7	8	7	8	14	23	15	6	24	13
AMM.	3.31	8.71	7.46	9.69	5.45	5.45	1.76	3.93	0.86	7.60	5.15	13.00	0.86	13.0	6.03
TKN	7.06	12.19	8.28	13.16	10.30	14.16	9.95	8.05	3.18	12.72	9.54	17.32	3.18	17.32	10.49
DO	3.5	3.9	3.7	5.9	6.1	2.1	3.5	3.7	8.2	3.4	6.6	4.1	2.1	8.2	4.6
WT	17.0	17.5	26.0	31.5	33.0	37.0	29.5	31.0	30.0	32.0	23.0	22.0	17.0	37.0	27.5
TC	166000	20300000	16400000	1460000	3550000	92000	1010000	310000	221000	1000000	12500000	4000000	92000	20300000	5084083
FC	ND	1780000	486000	860000	620000	2800	370000	20000	68000	52000	270000	740000	2800	1780000	478982

AGRA - D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.71	7.69	7.74	7.69	7.89	8.09	7.45	7.61	8.01	7.89	7.75	7.69	7.45	8.09	-
COD	23	24	61	84	60	19	57	26	15	81	67	62	15	84	48
BOD	6	9	24	22	11	7	14	7	7	15	26	17	6	26	14
AMM.	2.93	9.39	5.84	8.95	5.70	4.15	1.73	3.42	10.00	8.41	5.94	12.54	1.73	12.54	6.58
TKN	8.02	10.50	7.97	11.23	9.66	13.20	11.55	9.01	4.45	13.03	11.13	14.80	4.45	14.80	10.38
DO	3.4	4.1	3.7	5.7	4.2	1.8	1.5	3.8	8.7	3.5	6.3	4.0	1.5	8.7	4.2
WT	17.0	17.5	26.0	32.0	33.0	37.0	29.5	31.0	30.0	32.0	23.0	22.0	17.0	37.0	27.5
TC	22500	20800000	17100000	1970000	4300000	101000	1940000	320000	240000	1040000	13600000	4080000	22500	20800000	5459458
FC	ND	1850000	515000	1030000	750000	3200	400000	28000	71000	56000	300000	770000	3200	1850000	524836

BATESHWAR

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.00	7.38	7.29	7.31	7.71	8.15	7.82	7.82	7.82	7.94	7.98	7.7	7.00	8.15	-
COD	11	33	72	42	49	22	21	9	27	38	54	25	9	72	34
BOD	2	13	14	10	8	4	3	2	4	10	13	11	2	14	8
AMM.	0.37	2.47	0.24	2.06	0.70	BDL	0.17	0.17	0.20	0.07	0.42	0.18	BDL	2.47	0.59
TKN	2.27	5.40	5.83	2.88	2.89	5.79	1.92	1.28	2.22	2.22	2.22	2.20	1.28	5.83	3.09
DO	9.8	15.5	5.6	11.6	10.6	6.9	3.0	7.7	8.3	9.9	17.0	7.9	3.0	17.0	9.5
WT	21.0	25.0	23.5	32.0	34.0	33.0	27.0	31.0	31.0	27.0	22.0	22.0	21.0	34.0	27.4
TC	66500	36000	2430000	82000	49000	132000	41000	151000	31000	226000	470000	30000	30000	2430000	312042
FC	ND	13000	22000	16300	3000	1400	1500	2500	500	92000	210000	400	400	210000	32964

ETAWAH

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.44	7.36	7.26	7.45	7.59	8.18	7.65	7.7	8.24	7.84	7.61	7.38	7.26	8.24	-
COD	14	48	ND	66	45	25	23	17	21	28	47	38	14	66	34
BOD	2	15	ND	7	7	4	5	3	3	3	12	3	2	15	6
AMM.	0.64	0.29	0.04	2.81	0.99	0.92	0.32	0.36	0.07	0.13	0.14	1.52	0.04	2.81	0.69
TKN	2.56	1.92	1.62	3.21	2.25	4.50	2.56	0.96	1.27	1.59	1.27	3.15	0.96	4.5	2.24
DO	8.3	13.2	7.6	12.10	14.3	8.9	3.1	8.6	7.1	2.7	14.0	12.9	2.7	14.3	9.4
WT	21.0	22.0	23.5	29.0	35.0	32.5	27.0	33.0	29.0	28.0	21.0	16.0	16.0	35.0	26.4
TC	35800	21200	2220000	234000.0	66000	121000	15200	16500	141000	152000	340000	ND	15200	2220000	305700
FC	ND	12200	13250	26200	5100	300	1110	1020	170	62000	31000	ND	170	62000	15235

JUHIKA

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG

pH	6.94	7.51	7.5	7.39	7.65	8.21	7.75	7.89	8.35	7.78	7.92	8.26	6.94	8.35	-
COD	7	18	12	13	9	18	21	3	14	22	25	16	3	25	15
BOD	1	6	2	2	2	2	4	1	1	4	4	3	1	6	3
AMM.	0.20	0.67	0.04	0.65	0.11	0.10	0.33	0.20	0.33	0.10	0.24	0.22	0.04	0.67	0.27
TKN	3.26	6.42	5.18	2.56	2.89	5.47	2.24	2.25	1.59	2.22	2.54	2.52	1.59	6.42	3.26
DO	12.3	9.2	9.9	6.6	9.2	9.0	4.93	9.0	7.5	10.3	10.0	14.0	4.9	14.0	9.3
WT	21.0	20.0	23.0	27.0	32.0	31.0	27.00	31.0	29.0	27.5	19.0	12.0	12.0	32.0	25.0
TC	22400	15200	1450000	28800	23100	10600	157000	800000	213000	5700	30600	6200	5700	1450000	230217
FC	ND	2850	8200	14500	8000	2800	150	2400	600	540	20000	1040	150	20000	5553

UDI (Chambal River)

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
pH	7.31	7.11	7.17	7.21	7.61	8.31	7.74	7.93	8.35	7.89	7.45	8.13	7.11	8.35	-
COD	6	7	5	7	4	12	32	2	11	4	13	5	2	32	9
BOD	1	1	1	1	1	1	7	1	2	1	2	1	1	7	2
AMM.	0.49	0.11	BDL	0.33	0.12	0.15	0.52	0.16	BDL	0.11	0.04	0.07	BDL	0.52	0.18
TKN	1.60	2.24	3.24	1.92	1.93	3.86	2.88	1.61	0.95	1.27	1.59	1.57	0.95	3.86	2.06
DO	11.5	12.3	8.9	8.2	7.6	7.1	5.4	9.1	6.5	6.7	9.0	13.3	5.4	13.3	8.8
WT	26.0	20.0	23.0	30.0	33.0	31.0	25.0	32.0	31.0	27.5	20.0	20.0	20.0	33.0	26.5
TC	37400	20100	7300	24200	15000	6800	284000	1360000	2300	3400.0	15200	ND	2300	1360000	161427
FC	ND	5100	180	12000	520	98	190	2800	300	2600	3500	ND	98	12000	2729

YEAR - 2001

HATHNIKUND

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.25	7.64	7.69	8.06	7.38	7.09	7.28	7.35	7.47	7.7	7.95	7.5	7.09	8.25	-
COD	6	2	7	7	5	1	6	9	4	2	3	5	1	9	5
BOD	1.00	1	2	1	1	1	1	1	1	1	1	1	1	2	1
AMM.	BDL	0.75	BDL	BDL	1.33	0.10	BDL	BDL	BDL	BDL	BDL	0.11	BDL	1.33	0.20
TKN	3.76	0.82	2.00	3.00	3.34	2.00	1.07	0.53	2.67	0.85	1.60	0.77	0.53	3.76	1.87
DO	12.6	10.5	8.8	10.8	8.6	9.0	8.3	8.0	7.8	7.6	7.8	10.0	7.6	12.6	9.2
WT	12.5	17.0	20.3	22.5	24.0	22.0	24.5	24.0	23.0	26.0	27	14.5	12.5	27.0	21.4
COND.	288	359	276	210	144	140	160	141	205	237	234	246	140	359	220
TC	23000	200	750	900	400	5500	58000	182000	3100	6000	ND	780000	200	780000	96350
FC	290	60	170	80	0	1650	2700	6400	1100	2760	ND	1100	0	6400	1483
FS	40	14	10	16	0	98	460	14	196	108	ND	30	0	460	90

KALANAUR

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.22	8.07	7.84	7.7	7.85	7.6	7.23	7.53	7.53	7.88	7.82	7.74	7.23	8.22	-
COD	8	3	4	7	5	9	29	18	3	3	5	3	3	29	8
BOD	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1
AMM.	0.10	0.39	BDL	0.06	1.16	BDL	0.07	0.16	BDL	BDL	0.55	BDL	BDL	1.16	0.22
TKN	1.35	1.64	2.00	8.00	4.00	1.00	0.53	1.07	2.14	2.84	1.57	0.77	0.53	8.00	2.24
DO	9.5	10.1	9.2	9.8	7.3	7.4	7.7	7.6	6.9	9.8	9.3	10.0	6.9	10.1	8.7
WT	13.0	17.0	19.5	28.5	31.0	29.0	27.0	28.0	26.5	29.0	28.5	16.5	13.0	31.0	24.5
COND.	393	363	388	358	343	282	169	183	248	381	377	347	169	393	319
TC	49000	3100	20400	8800	44000	6900	98000	52000	6300	6200	ND	950000	3100	950000	113155
FC	3500	530	7800	180	2500	2600	1700	860	700	600	ND	4700	180	7800	2334
FS	62	78	24	24	158	74	530	22	340	10	ND	90	10	530	128

SONEPAT

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.23	8.08	7.59	7.61	7.99	7.63	7.37	7.53	7.73	8.02	7.62	7.5	7.37	8.23	-
COD	14	8	7	8	25	24	12	19	4	18	6	5	4	25	13
BOD	2	1	2	1	2	4	1	1	1	3	1	2	1	4	2
AMM.	0.31	0.96	0.20	0.17	1.40	0.80	0.04	0.04	0.36	0.71	BDL	1.04	BDL	1.40	0.50
TKN	2.21	1.37	2.00	3.00	10.00	4.00	1.61	0.53	2.40	3.69	0.94	1.39	0.53	10.00	2.76
DO	5.8	8.6	8.6	8.1	6.8	5.2	6.7	7.6	6.6	7.5	10.2	7.7	5.2	10.2	7.4
WT	12.0	14.0	20.0	24.5	26.0	27.0	30.0	29.0	30.5	26.0	29.0	15.5	12.0	30.5	23.6
COND.	429	380	447	335	559	312	205	193	368	368	355	415	193	559	364
TC	108000	110	80000	860000	271000	24600	36000	69000	9300	5200	6000000	1060000	110	6000000	710268
FC	6200	0	1840	120	3400	13000	1800	610	80	50	7700	7000	0	13000	3483
FS	304	0	72	28	740	610	228	68	32	4	10	170	0	740	189

PALLA

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.97	8.02	8.08	7.63	7.7	7.46	7.18	7.64	7.67	8.18	7.89	7.59	7.18	8.18	-
COD	19	8	14	10	13	15	4	22	2	22	6	7	2	22	12
BOD	2	2	1	1	3	1	1	1	1	ND	2	2	1	3	2
AMM.	0.24	BDL	BDL	BDL	0.10	0.08	0.18	0.11	0.07	0.58	1.25	BDL	BDL	1.25	0.22
TKN	1.1	1.09	6	2	3	4	1.61	0.53	6.15	1.99	1.88	1.08	0.53	6.15	2.54
DO	9.4	9.8	9.8	8.0	6.9	6.6	5.9	6.6	6.3	8.9	6.4	9.6	5.9	9.8	7.8
WT	12.0	15.0	19.5	24.5	31.0	29.0	30.5	30.0	32.0	29.5	24.0	17.5	12.0	32.0	24.5
COND.	430	343	392	331	279	288	216	189	263	482	573	437	189	573	352
TC	3400	600	6000	69000	48000	1800	16000	23000	8500	7600	30000	43000	600	69000	21408
FC	80	34	110	170	5000	830	370	850	1500	110	1310	230	34	5000	883
FS	18	0	32	30	160	98	24	90	88	16	8	12	0	160	48

NIZAMUDDIN BRIDGE - MID STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.47	7.09	7.17	7.39	7.01	7.22	7.72	7.46	7.40	6.99	7.84	6.97	6.97	7.84	-
COD	84	104	71	83	69	59	18	34	18	67	57	73	18	104	61
BOD	34	51	33	19	23	11	3	5	4	25	19	27	3	51	21
AMM.	16.44	16.12	17.40	15.83	31.00	11.13	2.60	0.74	4.03	13.59	7.98	19.74	0.74	31.00	13.05
TKN	17.70	20.00	33.00	21.00	36.00	26.00	6.99	2.15	7.22	21.66	11.39	20.68	2.15	36.00	18.65
DO	0.0	0.0	0.0	0.0	0.0	0.0	1.9	4.0	6.1	5.1	0.0	0.0	0.0	6.1	1.4
WT	15.5	19.5	25.0	29.5	31.5	30.5	35.0	30.0	32.0	30.0	22.0	19.0	15.5	35.0	26.6
COND.	1334	1050	861	920	891	771	252	219	467	882	910	933	219	1334	791
TC	30600000	4900000	4300000	8600000	7400000	470000	68000	660000	43000	234000	179000000	14000000	43000	179000000	20856250
FC	1930000	1320000	2400000	6600000	860000	340000	20000	133000	13000	178000	350000	1210000	13000	6600000	1279500
FS	12200	10000	28000	73000	70000	27000	4200	3100	1500	2600	18900	13900	1500	73000	22033

NIZAMUDDIN BRIDGE - QUARTER STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.35	7.14	7.21	7.26	7.08	7.02	7.68	7.52	7.45	7.09	7.85	7.01	7.01	7.85	-
COD	92	108	72	72	68	55	11	38	17	61	49	71	11	108	60
BOD	35	43	30	19	21	20	4	4	4	26	17	25	4	43	21
AMM.	17.25	14.67	18.79	16.47	31.00	9.86	1.54	1.02	3.90	11.32	7.78	23.47	1.02	31.00	13.09
TKN	21.53	21.96	23.60	20.00	37.00	18.00	5.92	2.15	7.22	20.70	12.56	25.03	2.15	37.00	17.97
DO	0.0	0.0	0.0	0.0	0.0	0.0	2.4	3.6	7.7	5.6	0.0	0.0	0.0	7.7	1.6
WT	15.0	19.5	25.0	29.5	31.5	30.5	35.0	30.0	32.0	30.0	22.0	19.0	15.0	35.0	26.6
COND.	1175	1090	848	963	932	917	252	220	464	881	908	937	220	1175	799
TC	42000000	3600000	5100000	7500000	11500000	150000	43000	1120000	31000	156000	185000000	15500000	31000	185000000	22641667
FC	3080000	1300000	4100000	2380000	1010000	30000	13000	206000	12000	18000	390000	1360000	12000	4100000	1158250
FS	14200	8000	28000	36000	68000	18000	3000	4200	1400	1700	20300	14500	1400	68000	18108

AGRA CANAL - MID STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.47	7.38	7.31	7.77	7.14	7.64	7.25	7.33	6.9	7.07	7.94	7.05	6.90	7.94	-
COD	48	46	69	80	67	71	14	31	19	38	47	38	14	80	47
BOD	14	17	17	21	16	18	4	6	4	11	14	10	4	21	13
AMM.	7.07	11.39	12.23	15.02	25.00	7.71	6.06	1.28	4.60	6.15	6.04	8.01	1.28	25.00	9.21
TKN	10.45	12.07	13.00	21.00	32.00	17.00	8.61	2.69	9.63	14.75	10.36	9.02	2.69	32.00	13.38
DO	0.0	0.0	0.8	0.0	0.0	1.3	1.3	3.3	2.6	3.1	0.0	1.1	0.0	3.3	1.1
WT	14.0	17.5	25.5	27.5	31.5	34.5	32.0	31.0	32.0	29.0	24.0	18.0	14.0	34.5	26.4
COND.	683	695	692	849	870	738	411	242	494	655	797	579	242	870	642
TC	18600000	670000	1360000	2840000	1640000	110000	14000	102000	20000	30000	142000000	5000000	14000	142000000	14365500
FC	550000	180000	970000	1380000	340000	80000	6000	31000	6000	5000	150000	750000	5000	1380000	370667
FS	3700	16400	25000	62000	54000	9500	1500	2300	200	1100	5900	3700	200	62000	15442

AGRA CANAL - QUARTER STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.49	7.26	7.32	7.4	7.2	7.24	7.32	7.44	7.07	7.07	7.98	7.12	7.07	7.98	-
COD	45	46	63	76	62	63	15	24	18	45	46	39	15	76	45
BOD	15	25	19	20	17	20	5	5	5	12	13	9	5	25	14
AMM.	7.68	11.90	12.20	15.25	23.00	7.04	7.90	1.14	4.36	6.61	7.03	8.11	1.14	23.00	9.35
TKN	25.50	12.07	20.00	21.00	29.00	14.00	12.92	3.23	7.49	16.32	13.16	8.86	3.23	29.00	15.30
DO	0.0	0.0	0.9	0.0	0.0	1.8	1.5	2.9	2.9	2.2	0.0	1.1	0.0	2.9	1.1
WT	14.0	17.5	25.5	27.5	31.5	34.5	32.0	31.0	32.0	29.0	24.0	18.0	14.0	34.5	26.4
COND.	665	690	658	865	874	744	438	233	502	685	815	585	233	874	646
TC	18900000	10200000	1220000	2790000	6200000	150000	670000	108000	27000	16000	151000000	7100000	16000	151000000	16531750
FC	630000	300000	980000	1250000	410000	77000	44000	43000	8000	4000	160000	990000	4000	1250000	408000
FS	40000	20600	27000	69000	80000	12500	2100	5800	100	800	6200	5500	100	80000	22467

MAZAWALI

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.58	7.55	7.74	8.13	7.83	7.1	7.41	7.45	7.88	7.75	8.10	7.55	7.10	8.13	-
COD	80	74	58	92	89	53	53	37	27	44	44	67	27	92	60
BOD	24	32	24	29	8	24	3	9	8	10	8	19	3	32	17
AMM.	19.14	26.10	25.40	19.48	21.00	6.93	4.21	1.09	4.73	6.28	8.47	23.36	1.09	26.10	13.85
TKN	25.65	38.40	27.10	23.00	33.00	22.00	6.46	5.92	8.29	16.32	11.30	24.25	5.92	38.40	20.14
DO	2.8	1.1	6.9	13.0	3.5	7.4	3.6	3.8	7.8	8.2	5.0	2.9	1.1	13.0	5.5
WT	15.0	19.0	25.0	29.0	31.0	32.0	34.0	30.0	29.0	29.0	23.0	21.0	15.0	34.0	26.4
COND.	1137	1290	1311	1470	1572	840	418	222	726	880	1135	1330	222	1572	1028
TC	30000000	26000	29000	47000	189000	40000	51000	910000	52000	7000	37000000	1370000	7000	37000000	5810083
FC	600000	1000	23000	6000	1200	27000	5200	48000	300	1000	110000	450000	300	600000	106058
FS	1000	30	690	2000	400	2600	300	1400	100	10	1330	2430	10	2600	1024

MATHURA - U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8	7.41	7.87	7.83	8.14	7.72	6.97	7.78	8.65	7.96	7.86	7.63	6.97	8.65	-
COD	55	34	39	53	50	45	13	21	51	39	26	34	13	55	38
BOD	8	13	14	12	4	5	5	6	8	9	9	7	4	14	8
AMM.	12.96	18.67	15.37	5.36	3.36	4.18	0.89	0.17	0.72	2.83	5.35	10.85	0.17	18.67	6.73
TKN	15.2	22.7	17	21	7	6	2.15	1.61	2.1	12.87	6.59	12.44	1.61	22.70	10.56
DO	9.5	8.7	12.5	12.4	7.5	11.7	5.7	4.3	16.0	13.1	6.5	7.6	4.3	16.0	9.6
WT	14.0	18.0	27.0	28.0	28.0	28.5	28.0	29.0	32.0	26.0	20.5	17.5	14.0	32.0	24.7
COND.	911	1380	1209	1356	1573	745	292	321	736	939	1146	1266	292	1573	990
TC	33000	1300	40000	ND	950000	34000	174000	26000	4000	21500	111000	530000	1300	950000	174982
FC	6200	50	7700	23000	66000	3000	1800	4700	1100	9700	28000	11000	50	66000	13521
FS	330	5	980	8200	300	300	300	250	310	1410	4800	170	5	8200	1446

MATHURA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.67	7.49	8.13	7.66	8.28	7.68	6.95	7.79	8.6	7.47	ND	7.6	6.95	8.60	-
COD	41	39	56	51	46	39	15	24	46	44	ND	43	15	56	40
BOD	9	8	12	16	7	9	8	4	12	11	ND	ND	4	16	10
AMM.	13.19	17.17	14.50	3.16	3.56	3.03	0.87	0.18	1.76	2.55	ND	10.65	0.18	17.17	6.42
TKN	18.30	20.00	15.48	5.00	9.00	13.00	2.69	1.61	5.40	9.10	ND	11.19	1.61	20.00	10.07
DO	4.6	4.7	9.0	6.6	8.6	4.7	6.1	4.3	18.5	1.1	ND	7.9	1.1	18.5	6.9
WT	14.5	18.0	27.0	28.5	28.0	29.0	30.0	30.0	32.0	27.0	ND	18.0	14.5	32.0	25.6
COND.	934	1190	1304	1406	1539	773	247	304	653	1007	ND	1280	247	1539	967
TC	314000	202000	155000	320000	1350000	70000	210000	105000	13200	23700	ND	810000	13200	1350000	324809
FC	135000	40000	61000	130000	93000	31000	9300	16200	2800	5600	ND	17000	2800	135000	49173
FS	680	1440	560	6100	6600	770	880	440	560	2150	ND	230	230	6600	1855

MATHURA - D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.37	7.38	7.88	7.76	8.28	7.64	6.98	7.76	8.58	7.54	8.52	7.54	6.98	8.58	-
COD	38	53	41	54	55	24	14	33	55	49	38	55	14	55	42
BOD	11	15	13	14	5	8	8	5	12	11	11	27	5	27	12
AMM.	12.70	16.12	14.47	3.94	4.00	4.40	0.99	0.16	2.05	1.96	9.71	10.80	0.16	16.12	6.78
TKN	15.83	20.30	18.00	7.00	11.00	6.00	3.76	1.07	3.90	10.04	10.99	11.50	1.07	20.30	9.95
DO	4.8	4.6	8.5	7.0	7.7	4.9	5.2	4.5	19.2	6.6	7.2	7.8	4.5	19.2	7.3
WT	14.5	18.0	27.0	28.5	28.0	29.0	31.0	30.0	32.0	27.0	21.0	18.0	14.5	32.0	25.3
COND.	920	1232	1329	1382	1515	786	299	299	638	1009	1275	1291	299	1515	998
TC	480000	266000	139000	328000	690000	93000	500000	180000	15100	15100	1360000	1200000	15100	1360000	438850
FC	84000	48000	71000	204000	44000	46000	15200	19000	1800	8000	25700	18000	1800	204000	48725
FS	720	1580	690	6700	2800	3100	930	5100	610	1750	4100	250	250	6700	2361

AGRA - U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.97	7.83	7.96	8.69	8.93	8.66	7.19	7.74	8.74	8.5	8.3	7.65	7.19	8.93	-
COD	50	32	52	50	73	36	20	14	45	43	53	27	14	73	41
BOD	7	10	14	10	7	7	5	4	9	9	22	7	4	22	9
AMM.	0.17	13.22	3.74	8.30	2.20	0.28	0.35	ND	0.62	1.10	0.56	3.82	0.17	13.22	3.12
TKN	16.78	17.20	6.00	4.00	5.00	7.00	1.07	8.21	4.50	6.59	10.83	4.66	1.07	17.20	7.65
DO	8.7	6.8	12.6	13.0	13.9	7.8	5.2	4.4	17.6	16.2	10.4	8.3	4.4	17.6	10.4
WT	14.0	21.0	27.5	29.0	29.0	28.5	32.0	30.5	31.0	29.0	21.5	18.0	14.0	32.0	25.9
COND.	903	1375	1365	1366	1388	628	233	288	562	1127	1315	1338	233	1388	991
TC	16800	1020000	121000	66000	202000	211000	121000	48000	1600	9900	1490000	234000	1600	1490000	295108
FC	940	63000	102000	5300	8000	3700	800	8800	200	4600	140000	11000	200	140000	29028
FS	180	960	1230	2100	200	770	90	1210	80	20	1900	150	20	2100	741

AGRA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.43	7.48	7.38	7.76	7.79	7.77	6.9	7.57	8.35	7.43	7.92	7.21	6.90	8.35	-
COD	106	89	106	104	144	71	38	42	48	83	100	97	38	144	86
BOD	30	34	36	20	32	18	21	23	10	28	38	40	10	40	28
AMM.	13.39	21.51	13.89	5.60	13.51	3.45	3.70	ND	3.24	14.37	8.71	13.13	3.24	21.51	10.41
TKN	14.80	22.50	20.00	8.00	20.00	6.00	12.36	6.46	13.80	23.33	12.25	13.68	6.00	23.33	14.43
DO	3.1	1.6	0.0	3.0	0.5	0.0	5.9	2.0	14.2	4.4	7.1	2.0	0.0	14.2	3.6
WT	15.0	22.0	27.5	31.0	31.0	30.0	31.0	31.0	32.0	28.0	22.0	19.5	15.0	32.0	26.7
COND.	1049	1565	1607	1575	1714	859	431	443	612	1469	1456	1556	431	1714	1195
TC	5800000	5200000	890000	23800000	22000000	1050000	2100000	14100000	60000	1050000	24700000	84000000	60000	84000000	15395833
FC	1830000	190000	560000	1360000	2700000	86000	134000	2040000	4400	132000	210000	9100000	4400	9100000	1528867
FS	32200	30000	21200	27000	31500	7500	17600	21800	2500	12000	23900	1580	1580	32200	19065

AGRA - D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.39	7.54	7.34	7.82	8.11	7.25	6.9	7.55	8.27	7.68	7.81	7.2	6.90	8.27	-
COD	103	94	96	111	167	63	47	45	50	103	94	87	45	167	88
BOD	35	31	38	21	41	21	21	26	13	31	38	37	13	41	29
AMM.	11.80	20.76	18.90	5.80	16.06	6.80	4.30	ND	3.22	13.57	7.10	12.35	3.22	20.76	10.97
TKN	19.31	22.77	18.96	13.00	23.00	12.00	12.36	5.92	17.40	25.20	13.50	13.06	5.92	25.20	16.37
DO	2.7	1.5	0.0	2.9	0.4	0.0	5.1	2.1	14.6	4.0	6.0	2.0	0.0	14.6	3.4
WT	15.0	21.5	27.5	31.0	31.0	30.0	31.0	31.0	32.5	28.0	22.0	19.0	15.0	32.5	26.6
COND.	1025	1590	1628	1574	1684	867	423	453	575	1424	1490	1550	423	1684	1190
TC	6100000	777777	1800000	32500000	18400000	430000	2930000	17600000	480000	1570000	32400000	94000000	430000	94000000	17415648
FC	1910000	230000	780000	2240000	1740000	45000	217000	2420000	24000	350000	790000	9900000	24000	9900000	1720500
FS	33700	32000	32400	29500	32300	8600	19000	23400	4700	13700	31100	1660	1660	33700	21838

BATESHWAR

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.52	7.33	8.24	8.98	8.45	8.09	7.74	7.53	8.32	8.23	8.6	7.45	7.33	8.98	-
COD	27	43	74	74	70	31	16	16	41	32	64	58	16	74	46
BOD	9	12	16	13	5	7	3	4	9	7	12	13	3	16	9
AMM.	BDL	10.58	1.33	2.20	1.65	0.37	0.33	0.04	1.16	1.42	0.81	4.00	BDL	10.58	1.99
TKN	10.13	12.62	4.69	3.00	7.00	3.00	2.15	0.80	4.50	2.82	2.51	7.46	0.80	12.62	5.06
DO	8.5	8.5	9.0	13.2	7.7	7.1	4.5	5.4	10.5	9.6	12.2	9.6	4.5	13.2	8.8
WT	18.0	22.0	26.0	28.0	29.5	26.0	32.0	31.5	31.0	26.0	18.0	16.0	16.0	32.0	25.3
COND.	932	1032	1522	1442	1659	675	289	310	599	1017	1323	1380	289	1659	1015
TC	1030000	34000	155000	1090000	590000	50000	126000	118000	200000	600000	28100000	12500000	34000	28100000	3716083
FC	17500	2000	150000	140000	1800	31000	600	800	70000	8000	18000	58000	600	150000	41475
FS	450	120	1380	1760	200	1580	80	70	190	240	2700	1780	70	2700	879

ETAWAH

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.87	7.98	8.49	8.86	8.92	7.96	7.89	7.41	7.79	8.14	8.8	8.46	7.41	8.92	-
COD	34	32	49	57	67	19	20	17	32	38	62	63	17	67	41
BOD	9	9	9	11	7	2	4	4	5	8	12	12	2	12	8
AMM.	BDL	2.58	0.92	1.86	0.82	0.24	0.56	BDL	0.26	0.69	0.38	0.55	BDL	2.58	0.74
TKN	7.60	3.01	2.70	4.00	7.00	3.00	1.07	1.33	3.60	6.90	2.83	0.93	0.93	7.60	3.66
DO	6.2	9.0	11.0	10.5	14.8	6.2	4.0	5.6	9.0	13.3	16.9	10.8	4.0	16.9	9.8
WT	18.0	21.5	26.5	29.0	32.0	30.0	32.0	31.5	30.0	27.0	19.0	17.0	17.0	32.0	26.1
COND.	849	925	1402	1475	1534	668	293	323	582	976	1055	1092	293	1534	931
TC	960000	16000	37000	103000	15000	73000	650000	25000	760000	470000	2430000	180000	15000	2430000	476583
FC	12600	170	10000	15000	130	14000	224000	1700	310000	2000	2700	3100	130	310000	49617
FS	300	70	120	160	40	1030	470	50	100	80	520	460	40	1030	283

JUHIKA

XX

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.98	7.84	8.55	8.72	8.21	6.43	7.75	7.54	7.68	8.08	8.35	8.22	6.43	8.72	-
COD	15	35	19	29	17	58	8	14	18	15	34	27	8	58	24
BOD	2	4	4	5	4	5	2	1	4	3	7	6	1	7	4
AMM.	1.60	0.62	0.58	1.37	0.54	1.03	0.59	0.10	0.22	2.35	0.26	0.24	0.10	2.35	0.79
TKN	1.90	2.47	1.00	5.00	2.00	3.00	1.07	1.60	3.60	5.65	1.57	1.24	1.00	5.65	2.51
DO	8.5	9.3	12.0	9.1	9.5	7.7	5.7	6.0	6.4	10.2	12.2	9.9	5.7	12.2	8.9
WT	16.0	20.5	27.0	27.0	31.0	22.0	30.0	31.0	32.0	26.5	18.0	16.0	16.0	32.0	24.8
COND.	688	720	858	965	915	552	229	247	406	481	685	697	229	965	620
TC	40000	2900	3700	72000	213000	620000	224000	18600	145000	84000	1690000	154000	2900	1690000	272267
FC	9700	550	1000	18000	9200	17000	3700	15500	4000	500	1900	2300	500	18000	6946
FS	210	50	140	140	90	1800	550	90	80	20	330	120	20	1800	302

UDI (Chambal River)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.29	8.26	8.41	8.54	8.25	7.99	7.83	7.53	7.77	8.12	8.1	7.9	7.53	8.54	-
COD	9	3	2	3	17	4	7	6	8	11	15	12	2	17	8
BOD	1	1	1	1	1	1	1	1	2	2	5	1	1	5	2
AMM.	BDL	0.55	0.49	0.08	0.08	0.35	0.63	0.03	BDL	1.39	0.16	BDL	BDL	1.39	0.32
TKN	13.80	1.92	1.94	2.00	3.00	2.00	1.61	1.87	3.00	5.34	2.83	0.62	0.62	13.80	3.33
DO	10.1	10.5	10.0	8.8	8.4	5.3	6.0	6.9	4.3	9.5	8.8	8.8	4.3	10.5	8.1
WT	17.0	20.0	27.0	28.0	30.0	29.0	31.0	31.5	33.0	27.0	19.0	15.0	15.0	33.0	25.6
COND.	591	490	556	605	640	341	184	205	316	357	457	505	184	640	437
TC	3500	700	1900	17600	162000	188000	180000	5100	115000	25000	5200000	57000	700	5200000	496317
FC	320	60	850	5300	790	2800	5300	3700	2700	80	2100	3700	60	5300	2308
FS	10	6	20	210	60	200	830	10	20	0	100	90	0	830	130

YEAR - 2002

HATHNIKUND

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.48	7.52	7.09	7.39	7.19	7.58	8.23	7.65	7.62	7.84	7.40	7.79	7.09	8.23	-
COD	2	2	6	6	4	2	8	9	8	5	3	8	2	9	5
BOD	1	1	1	1	2	1	2	2	1	1	1	2	1	2	1
AMM.	0.10	0.12	1.11	0.59	0.20	0.87	0.54	0.96	BDL	0.73	0.29	0.19	BDL	1.11	0.52
TKN	1.67	0.31	1.31	1.19	1.40	0.90	1.37	1.19	0.91	1.37	1.03	1.58	0.31	1.67	1.19
DO	10.5	9.6	10.5	9.3	9.8	9.4	8.2	7.7	8.5	8.1	9.6	8.4	7.7	10.5	9.1
WT	13.0	13.0	18.0	20.5	20.0	27.0	25.5	26.0	21.0	28.0	22	16.0	13.0	28.0	20.8
COND.	262	260	195	154	128	156	156	167	160	317	244	276	128	317	206
TC	3000	24000	ND	20000	210000	132000	180	1230000	142000	3200	800	180000	180	1230000	176835
FC	100	700	1700	2000	3200	120	40	92	1370	620	40	450	40	3200	869
FS	20	160	120	350	30	16	8	24	130	80	0	30	0	350	81

KALANAUR

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.07	7.66	7.16	7.70	7.76	7.27	8.48	7.46	7.51	7.73	7.64	7.88	7.16	8.48	-
COD	3	4	6	11	16	4	3	13	14	4	4	7	3	16	7
BOD	1	1	1	2	6	1	1	2	1	2	2	2	1	6	2
AMM.	BDL	BDL	1.24	BDL	0.25	0.63	0.58	1.96	0.06	0.49	0.42	0.09	BDL	1.96	0.48
TKN	1.19	0.31	1.63	0.89	1.45	1.51	0.76	2.01	0.91	1.03	1.70	1.29	0.31	2.01	1.22
DO	9.8	9.4	8.33	8.9	9.0	8.9	8.6	7.1	7.5	7.1	9.4	8.0	7.1	9.8	8.5
WT	14.0	16.0	19.0	27.0	30.5	31.0	31.0	30.0	23.0	25.0	25.5	18.5	14.0	31.0	24.2
COND.	404	397	198.0	345	338	350	258	177	188	368	402	340	177	404	314
TC	4000	79000	ND	30000	290000	172000	630	3820000	3200	7900	27000	36000	630	3820000	406339
FC	300	1000	3100	41000	3800	250	144	810	1610	2700	100	1070	100	41000	4657
FS	90	150	330	790	180	16	24	52	460	770	30	210	16	790	259

SONEPAT

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.12	7.55	7.24	7.61	7.47	7.63	7.93	7.51	7.63	7.75	7.79	7.88	7.24	8.12	-
COD	5	6	28	12	9	4	9	19	10	11	4	12	4	28	11
BOD	2	1	5	3	4	2	1	3	1	2	2	2	1	5	2
AMM.	1.44	0.52	2.80	1.00	0.20	1.20	0.65	2.49	0.24	0.62	0.88	1.40	0.20	2.80	1.12
TKN	2.15	0.93	3.27	2.08	1.16	3.92	1.06	2.69	0.60	1.71	2.73	2.73	0.60	3.92	2.09
DO	7.4	8.0	7.4	6.7	8.6	7.7	7.6	6.2	7.0	6.5	7.0	7.2	6.2	8.6	7.3
WT	14.0	13.0	18.0	24.0	28.0	31.0	30.0	29.0	25.0	26.0	25.0	19.0	13.0	31.0	23.5
COND.	465	416	200	401	318	251	255	253	228	331	373	383	200	465	323
TC	5000	74000	ND	70000	440000	460000	2170	2490000	36000	8200	4300	5600	2170	2490000	326843
FC	1300	5500	ND	8000	5000	1780	310	720	1780	1290	800	1920	310	8000	2582
FS	260	200	400	1400	280	80	72	64	480	420	60	900	60	1400	385

PALLA

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG

pH	7.66	7.77	7.05	7.68	8.38	7.03	7.54	7.97	7.56	7.70	7.71	7.57	7.03	8.38	-
COD	9	8	9	16	14	4	9	5	12	8	12	3	3	16	9
BOD	2	2	2	4	4	1	1	1	1	2	3	1	1	4	2
AMM.	BDL	0.26	0.18	0.04	0.2	0.56	0.88	0.35	0.79	0.05	0.18	0.25	BDL	0.88	0.34
TKN	1.54	0.49	1.81	0.65	0.58	1.81	2.28	1.49	2.43	0.68	1.02	1	0.49	2.43	1.32
DO	9.9	9.8	7.9	7.7	7.6	7.2	6.8	6.7	7.6	7.0	8.8	8.4	6.7	9.9	8.0
WT	11.0	15.0	18.0	25.0	28.5	30.0	31.5	29.0	29.0	28.0	24.0	16.0	11.0	31.5	23.8
COND.	431	420	408	290	329	318	315	233	174	328	514	397	174	514	346
TC	9800	82000	29800	31000	102000	59000	12300	34000	12400	3700	58000	16600	3700	102000	37550
FC	750	6400	2900	ND	900	1900	150	1330	620	630	240	120	120	6400	1449
FS	12	60	310	120	20	88	20	28	8	80	70	20	8	310	70

NIZAMUDDIN BRIDGE - MID STREAM

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
pH	6.82	6.86	6.89	6.81	7.54	7.43	7.40	7.24	6.92	7.13	7.17	7.36	6.81	7.54	-
COD	81	88	31	68	61	78	80	41	34	59	58	63	31	88	62
BOD	32	36	15	30	22	32	27	10	6	22	20	18	6	36	23
AMM.	16.31	25.30	13.95	28.84	26.78	10.32	24.12	10.60	1.00	11.61	12.93	19.50	1.00	28.84	16.77
TKN	19.26	28.88	18.90	29.18	28.78	13.63	28.60	16.00	3.31	14.75	16.43	20.59	3.31	29.18	19.86
DO	0.0	0.0	0.8	0.0	0.4	1.2	1.8	0.1	2.1	0.0	1.1	0.0	0.0	2.1	0.6
WT	19.0	23.0	17.0	33.0	31.0	31.0	30.0	28.0	20.0	33.0	29.0	15.0	15.0	33.0	25.8
COND.	1000	1053	643	959	963	829	903	554	203	820	795	904	203	1053	802
TC	300000	10100000	26100000	11200000	2000000	1610000	1350000	4300000	980000	970000	10200000	13800000	300000	26100000	6909167
FC	150000	1570000	140000	550000	810000	41000	31000	113000	340000	570000	630000	310000	31000	1570000	437917
FS	66000	12700	9500	1400	1500	4200	2060	39000	19000	12100	150000	5300	1400	150000	26897

NIZAMUDDIN BRIDGE - QUARTER STREAM

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
pH	6.85	6.88	7.16	6.82	7.5	7.34	7.36	7.15	6.72	6.98	7.11	7.46	6.72	7.50	-
COD	78	92	39	63	59	79	78	42	31	57	62	63	31	92	62
BOD	37	27	16	27	20	34	28	11	5	22	20	21	5	37	22
AMM.	16.23	22.20	12.30	23.52	25.05	12.26	26.52	10.48	0.83	12.93	13.62	17.73	0.83	26.52	16.14
TKN	19.02	27.56	15.40	24.41	29.39	14.84	27.39	15.60	2.98	15.78	17.00	20.02	2.98	29.39	19.12
DO	0.0	0.0	0.4	0.0	0.2	1.1	2.2	0.5	2.3	0.0	1.1	0.0	0.0	2.3	0.7
WT	19.0	23.0	17.0	33.0	31.0	31.0	30.0	28.0	20.0	33.0	29.0	15.0	15.0	33.0	25.8
COND.	977	1057	650	949	985	848	937	565	207	819	783	936	207	1057	809
TC	340000	12200000	26300000	11700000	2700000	2540000	1770000	3600000	870000	1030000	12800000	15100000	340000	26300000	7579167
FC	130000	1980000	310000	650000	850000	49000	38000	90000	380000	630000	650000	490000	38000	1980000	520583
FS	68000	17500	10000	1700	1900	6300	2050	38000	18900	14000	170000	6200	1700	170000	29546

AGRA CANAL - MID STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.01	6.99	7.07	7.17	7.1	7.54	7.64	7.22	6.87	7.07	7.08	7.36	6.87	7.64	-
COD	63	63	30	39	50	46	29	22	32	44	36	62	22	63	43
BOD	20	11	10	15	12	21	7	4	10	14	10	17	4	21	13
AMM.	10.02	15.30	7.75	12.96	12.52	6.31	12.19	3.65	4.36	12.44	7.22	11.90	3.65	15.30	9.72
TKN	14.39	17.66	9.31	14.59	14.28	8.18	13.30	6.33	7.29	16.12	9.35	13.68	6.33	17.66	12.04
DO	1.1	0.0	0.3	0.0	0.0	1.3	1.3	1.2	4.7	0.0	0.9	0.7	0.0	4.7	1.0
WT	17.0	17.0	17.0	26.0	31.0	29.0	29.0	30.0	19.0	33.0	28.0	17.0	17.0	33.0	24.4
COND.	801	800	605	720	744	557	523	391	353	835	570	679	353	835	632
TC	10000000	7700000	1900000	400000	200000	220000	190000	380000	5700000	130000	820000	1580000	130000	10000000	2435000
FC	160000	260000	20000	20000	80000	5000	9000	18000	240000	45000	169000	200000	5000	260000	102167
FS	81000	19300	3200	2000	1600	1100	1400	11300	9900	2300	15400	12500	1100	81000	13417

AGRA CANAL - QUARTER STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.05	6.91	6.95	6.79	7.3	7.67	7.29	7.24	6.85	7.58	7.24	7.39	6.79	7.67	-
COD	66	62	35	39	49	48	30	22	33	43	38	64	22	66	44
BOD	21	10	9	14	13	17	9	5	10	13	10	16	5	21	12
AMM.	10.44	13.80	10.45	12.48	14.00	7.03	10.51	4.70	5.90	11.90	13.62	11.41	4.70	14.00	10.52
TKN	15.36	15.34	13.12	14.00	14.54	9.69	13.90	8.14	11.94	14.75	16.72	13.10	8.14	16.72	13.38
DO	1.2	0.0	0.3	0.0	0.0	1.2	2.2	1.4	5.2	0.0	0.8	1.0	0.0	5.2	1.1
WT	17.0	17.0	17.0	26.0	31.0	29.0	29.0	30.0	19.0	33.0	28.0	17.0	17.0	33.0	24.4
COND.	795	793	587	680	636	563	547	384	354	832	575	668	354	832	618
TC	12300000	13800000	5700000	1100000	800000	310000	130000	280000	5300000	190000	350000	1850000	130000	13800000	3509167
FC	140000	280000	30000	10000	100000	13000	10000	20000	153000	50000	186000	152000	10000	280000	95333
FS	85000	19900	3400	1700	1700	300	1800	9200	9700	2600	18300	14900	300	85000	14042

MAZAWALI

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.47	7.44	7.75	7.61	8.41	8.11	8.05	7.75	6.93	7.44	7.75	7.76	6.93	8.41	-
COD	86	75	31	67	72	68	75	31	28	32	48	64	28	86	56
BOD	29	32	8	29	16	27	17	6	6	9	12	17	6	32	17
AMM.	27.29	32.75	16.85	25.13	27.16	14.97	20.83	7.98	3.23	4.26	8.62	22.34	3.23	32.75	17.62
TKN	30.00	34.49	20.88	35.43	32.11	20.00	22.50	12.67	6.63	9.95	11.76	24.60	6.63	35.43	21.75
DO	3.1	1.8	6.8	6.5	12.0	2.9	6.6	3.4	4.7	5.6	10.3	1.6	1.6	12.0	5.4
WT	19.0	20.0	18.5	28.0	34.0	29.0	30.0	28.0	17.0	31.0	ND	17.0	17.0	34.0	24.7
COND.	1665	1517	917	1429	1607	1395	1598	754	247	640	1381	1297	247	1665	1204
TC	6500000	1940000	2100000	1800000	800000	290000	3110000	250000	570000	130000	230000	194000	130000	6500000	1492833
FC	60000	310000	90000	120000	30000	20000	15000	12000	33000	12000	2800	1700	1700	310000	58875
FS	4000	520	690	330	290	1010	2040	590	3200	1100	300	490	290	4000	1213

MATHURA - U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.54	7.34	7.72	7.72	9.33	8.81	8.96	8.02	7.04	7.46	7.90	8.02	7.04	9.33	-
COD	39	32	24	42	58	66	53	39	17	31	34	29	17	66	39
BOD	ND	6	7	12	14	14	8	10	3	14	18	6	3	18	10
AMM.	18.3	10.9	1.17	2.67	0.96	2.02	0.1	10.65	0.882	5.51	0.91	12.93	0.10	18.30	5.58
TKN	19.26	13.37	1.6	3.57	3.03	6.06	0.6	15.67	2.32	10.63	2.83	16.28	0.60	19.26	7.94
DO	4.2	7.1	9.5	4.7	10.3	8.7	6.0	6.9	4.2	6.5	10.4	6.5	4.2	10.4	7.1
WT	16.0	20.0	25.0	30.0	32.0	32.0	33.0	30.0	30.0	30.0	23.0	23.0	16.0	33.0	27.0
COND.	1519	1485	826	1340	1313	1133	1139	1410	ND	822	885	1343	822	1519	1201
TC	129000	23000	1350000	1410000	200000	17600000	20000	1450000	160000	140000	40000	60000	20000	17600000	1881833
FC	13000	12000	30000	40000	90000	13000	3000	12000	6000	9000	9000	8000	3000	90000	20417
FS	1080	190	1500	1100	700	5000	180	1400	1400	1000	800	200	180	5000	1213

MATHURA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.64	7.59	7.33	8.41	8.98	9.02	9.14	8.52	7.1	7.52	7.84	7.94	7.10	9.14	-
COD	32	27	24	67	33	62	56	37	23	29	37	31	23	67	38
BOD	ND	5	4	21	6	13	10	9	7	13	17	6	4	21	10
AMM.	15.09	14.65	2.30	5.40	1.48	2.64	0.47	2.00	1.49	3.82	4.63	10.38	0.47	15.09	5.36
TKN	16.34	15.55	3.85	7.44	3.04	6.96	2.13	4.10	2.98	5.83	5.95	15.59	2.13	16.34	7.48
DO	4.6	6.4	7.0	17.2	7.6	8.3	7.8	7.3	2.0	7.1	8.8	8.5	2.0	17.2	7.7
WT	16.0	20.0	25.0	31.0	31.3	34.0	35.0	30.0	32.0	30.0	24	24.0	16.0	35.0	27.7
COND.	1503	1560	555	1476	1382	1253	1080	1547	278	797	1014	1315	278	1560	1147
TC	151000	140000	1510000	12400000	360000	2600000	70000	1440000	360000	280000	1160000	660000	70000	12400000	1760917
FC	13000	13000	90000	100000	80000	32000	12000	14000	47000	14000	12000	17000	12000	100000	37000
FS	100	450	2000	160	710	20	510	200	1900	2100	1200	1500	20	2100	904

MATHURA – D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.59	7.68	7.38	8.37	9.00	9.01	9.16	8.51	7.09	7.64	7.85	7.94	7.09	9.16	-
COD	30	26	21	64	38	63	57	36	31	26	32	31	21	64	38
BOD	ND	6	4	22	8	15	11	6	8	12	18	6	4	22	11
AMM.	15.87	14.70	2.32	6.87	0.37	2.00	0.36	2.18	0.74	4.64	3.03	12.20	0.36	15.87	5.44
TKN	16.58	16.17	3.53	6.25	1.22	6.06	1.52	4.71	2.32	10.29	5.10	13.16	1.22	16.58	7.24
DO	4.1	4.5	7.5	12.5	7.0	8.3	7.3	7.3	1.8	5.9	8.7	8.6	1.8	12.5	7.0
WT	17.0	20.0	25.0	31.0	31.0	34.0	35.0	30.0	32.0	30.0	24.0	24.0	17.0	35.0	27.8
COND.	1497	1537	581	1484	1452	1283	1063	1558	287	790	1036	1283	287	1558	1154
TC	144000	180000	1640000	29500000	600000	930000	90000	1550000	440000	230000	1190000	700000	90000	29500000	3099500
FC	12000	15000	100000	170000	100000	43000	10000	13000	47000	12000	17000	18000	10000	170000	46417
FS	190	520	2300	180	780	50	590	180	2200	1700	1500	1400	50	2300	966

AGRA - U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.75	8.07	7.8	9.21	9.18	9.16	8.55	7.67	6.77	8.54	8.70	8.22	6.77	9.21	-
COD	33	24	17	79	58	60	54	52	59	40	57	41	17	79	48
BOD	4	6	6	15	13	14	10	ND	20	13	17	13	4	20	12
AMM.	12.35	8.37	0.36	0.63	0.52	0.54	0.41	1.48	0.89	1.08	1.41	9.80	0.36	12.35	3.15
TKN	13.90	12.39	1.28	1.78	1.82	1.81	3.04	3.65	1.99	3.77	1.84	11.43	1.28	13.90	4.89
DO	5.5	9.9	8.0	22.7	9.8	10.1	5.2	6.4	7.1	12.7	15.0	10.2	5.2	22.7	10.2
WT	18.0	18.0	26.5	28.0	33.0	30.5	32.0	30.0	30.0	21.0	ND	20.0	18.0	33.0	26.1
COND.	1576	1473	651	1359	1536	1136	1408	858	463	705	923	1216	463	1576	1109
TC	105000	129000	50000	40000	170000	1930000	222000	2690000	3330000	211000	460000	270000	40000	3330000	800583
FC	19000	13000	10000	20000	10000	2200	2100	7100	68000	3700	8800	1400	1400	68000	13775
FS	1800	420	130	250	120	20	160	900	3400	800	1200	300	20	3400	792

AGRA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.52	7.65	7.22	8.22	8.88	8.56	8.02	7.59	6.74	7.96	8.50	7.81	6.74	8.88	-
COD	ND	40	23	112	62	65	107	62	53	44	74	117	23	117	69
BOD	ND	13	8	28	13	13	31	11	22	19	27	42	8	42	21
AMM.	16.75	10.10	3.25	10.15	1.90	3.07	1.17	1.01	4.51	3.16	1.64	17.00	1.01	17.00	6.14
TKN	19.26	11.05	5.77	11.61	ND	5.15	3.34	3.34	8.62	8.06	2.41	19.64	2.41	19.64	8.93
DO	2.2	4.8	5.7	3.9	3.4	3.1	0.0	2.7	6.8	5.6	1.4	3.5	0.0	6.8	3.6
WT	18.5	19.0	27.0	31.0	33.0	31.0	32.0	30.5	29.0	21.0	ND	20.0	18.5	33.0	26.5
COND.	1830	1503	690	1550	1698	1250	1842	977	452	825	1020	1416	452	1842	1254
TC	ND	ND	9200000	16100000	5300000	2210000	1040000	460000	16700000	740000	1030000	243000000	460000	243000000	29578000
FC	ND	78000	80000	170000	110000	18600	209000	15200	1720000	161000	590000	1720000	15200	1720000	442891
FS	ND	15800	1290	7600	2600	1120	7800	1700	8900	19000	7600	14000	1120	19000	7946

AGRA - D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.55	7.57	7.1	8.32	8.85	8.65	8.11	7.82	6.9	7.99	8.40	7.83	6.90	8.85	-
COD	ND	98	72	109	72	85	103	64	53	83	78	95	53	109	83
BOD	ND	39	25	29	15	20	28	14	18	39	29	43	14	43	27
AMM.	20.99	15.65	9.45	9.45	1.74	2.95	1.14	1.03	2.82	4.04	2.86	16.56	1.03	20.99	7.39
TKN	22.43	18.75	11.55	12.21	3.04	5.45	3.65	2.73	5.30	12.00	4.11	20.71	2.73	22.43	10.16
DO	2.0	3.2	4.0	4.1	3.4	4.2	0.0	3.0	6.8	4.7	0.9	3.2	0.0	6.8	3.3
WT	18.5	19.0	27.5	30.0	33.0	31.0	32.0	30.5	29.0	21.0	ND	20.0	18.5	33.0	26.5
COND.	1886	1644	882	1607	1682	1235	1839	982	448	836	1025	1443	448	1886	1292
TC	ND	1410000	ND	16400000	8700000	2880000	17000000	520000	18100000	770000	1120000	183000000	520000	183000000	24990000
FC	ND	108000	ND	220000	130000	49000	311000	19000	1890000	173000	630000	1430000	19000	1890000	496000
FS	ND	25900	13700	8100	3900	1180	8300	2100	9800	22000	8000	12000	1180	25900	10453

BATESHWAR

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.90	7.79	8.23	8.50	9.39	8.49	8.70	7.56	7.64	8.50	8.64	8.68	7.56	9.39	-
COD	34	29	39	63	98	65	58	21	24	54	53	78	21.0	98.0	51.3
BOD	5	7	7	12	18	12	10	5	3	20	13	31	3.0	31.0	11.9
AMM.	NT	12.90	0.50	0.44	1.30	2.17	0.64	1.03	0.23	0.66	3.30	4.65	0.23	12.90	2.53
TKN	1.46	14.73	1.92	2.08	2.13	5.15	2.13	2.22	1.32	1.89	5.83	5.89	1.32	14.73	3.90
DO	7.2	11.9	8.2	10.0	3.8	7.6	5.6	5.5	4.6	8.3	11.0	10.1	3.8	11.9	7.8
WT	16.5	27.0	27.0	30.0	30.5	32.0	30.5	31.0	30.0	27.0	20.0	18.0	16.5	32.0	26.6
COND.	1707	1545	710	1560	1959	1257	1796	369	320	755	992	1318	320	1959	1191
TC	150000	176000	289000	250000	1460000	231000	292000	160000	65000	29000	58000	8300000	29000	8300000	955000
FC	6500	1600	3300	4200	17000	500	31000	11000	6600	4300	9000	8500	500	31000	8625
FS	1000	400	1200	340	1760	100	100	790	1300	1300	1100	900	100	1760	858

ETAWAH

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.13	8.11	8.35	8.47	9.12	9.23	9.08	7.65	7.4	8.28	8.14	8.75	7.40	9.23	-
COD	34	31	45	57	51	ND	49	31	18	41	52	54	18	57	42
BOD	9	6	13	9	9	ND	7	5	3	10	8	11	3	13	8
AMM.	2.87	6.17	0.60	0.05	1.43	0.97	0.72	0.56	0.23	0.52	1.37	0.54	0.05	6.17	1.34
TKN	5.60	7.36	1.60	0.89	1.82	3.63	3.04	1.59	0.99	1.20	2.42	2.07	0.89	7.36	2.68
DO	11.5	10.2	9.9	10.6	8.6	11.3	10.4	7.4	5.0	8.8	7.8	12.1	5.0	12.1	9.5
WT	18.0	26.0	28.0	31.0	28.0	33.0	30.5	31.5	30.5	27.0	20.5	21.0	18.0	33.0	27.1
COND.	1354	1243	708	1308	1756	1357	1655	370	310	703	817	1211	310	1756	1066
TC	16000	214000	93000	74000	1040000	254000	142000	55000	39000	16000	390000	11700000	16000	11700000	1169417
FC	3300	800	2300	2500	6000	110	19000	6600	4900	1200	2900	4900	110	19000	4543
FS	20	360	500	240	670	40	36	560	780	110	900	800	20	900	418

JUHIKA

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.00	8.07	8.23	7.84	8.54	8.54	8.88	7.77	7.58	8.06	8.09	8.59	7.58	8.88	-
COD	9	11	23	30	17	41	24	16	14	24	13	28	9	41	21
BOD	2	2	4	7	5	9	3	3	3	5	3	7	2	9	4
AMM.	0.29	1.82	0.64	1.21	2.72	0.36	0.46	0.56	0.35	0.59	0.85	0.44	0.29	2.72	0.86
TKN	2.43	4.02	1.92	1.78	3.04	1.51	1.52	0.63	2.15	1.55	2.13	2.17	0.63	4.02	2.07
DO	9.4	10.8	7.41	9.2	9.1	9.1	10.1	5.9	5.5	7.3	11.2	12.8	5.5	12.8	9.0
WT	18.5	24.0	24	30.0	30.0	31.0	30.5	31.0	30.0	27.0	22.0	21.0	18.5	31.0	26.6
COND.	629	847	592	823	864	855	939	296	295	546	662	883	295	939	686
TC	30000	100000	241000	ND	120000	42000	1790000	32000	47000	126000	15000	20300000	15000	20300000	2076636
FC	700	800	3600	2000	400	50	17000	1660	6600	480	3100	2000	50	17000	3199
FS	130	110	300	170	30	32	32	220	400	90	400	800	30	800	226

UDI (Chambal River)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.98	8.07	8.19	7.84	8.58	9.17	8.73	7.85	7.68	7.95	8.06	7.98	7.68	9.17	-
COD	15	10	11	13	14	ND	16	13	4	8	12	9	4	16	11
BOD	2	2	1	3	4	ND	1	1	1	1	1	2	1	4	2
AMM.	0.15	0.04	0.22	1.43	0.97	0.25	0.34	0.84	BDL	0.70	0.27	0.36	BDL	1.43	0.51
TKN	0.48	1.67	0.96	2.97	1.21	0.90	1.82	0.95	1.65	1.20	1.28	1.38	0.48	2.97	1.37
DO	10.2	10.4	8.0	9.2	7.3	10.0	9.1	5.3	7.3	11.1	9.7	10.2	5.3	11.1	9.0
WT	17.0	25.0	25.0	30.0	29.0	34.0	31.0	31.0	30.5	29.0	23.0	20.0	17.0	34.0	27.0
COND.	545	466	493	569	622	ND	525	208	222	427	492	499	208	622	461
TC	13000	23000	5000	91000	20000	7600	7700	51000	37000	1400	1200	900000	1200	900000	96492
FC	800	100	600	50	280	32	192	128	396	32	500	250	32	800	280
FS	170	10	16	12	20	12	12	30	90	0	8	36	0	170	35

YEAR - 2003

HATHNIKUND

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.46	7.60	7.28	8.19	7.7	7.64	8.27	8.42	7.83	7.88	7.67	6.84	6.84	8.42	-
COD	11	6	3	2	10	11	ND	20	2	1	7	14	1	20	8
BOD	3	2	1	1	2	1	2	1	1	1	1	1	1	3	1
AMM.	0.17	0.29	BDL	0.11	0.71	0.26	ND	0.06	0.41	0.72	0.49	0.21	BDL	0.72	0.31
TKN	2.32	1.17	2.06	1.20	1.36	1.09	ND	1.77	1.08	1.08	1.96	0.86	0.86	2.32	1.45
DO	11.6	11.3	10.6	8.8	9.9	9.0	7.0	6.7	8.5	8.6	9.3	12.7	6.7	12.7	9.5
WT	17.0	15.5	13.0	21.5	21.0	24.0	25.0	25.0	22.5	22.0	22	16.0	13.0	25.0	20.4
COND.	264	258	165	208	212	184	176	144	173	1030	238	286	144	1030	278
TC	3500	12000	15100	8400	ND	330000	310000	1750000	210000	21000	115000	10000	3500	1750000	253182
FC	130	1000	360	150	ND	8000	7800	830	2300	140	310	910	130	8000	1994
FS	40	40	30	30	90	1300	150	350	150	10	80	20	10	1300	191

KALANAUR

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.74	7.75	7.71	8.34	8.06	8.24	8.31	8.36	7.92	7.70	7.97	6.56	6.56	8.36	-
COD	2	6	2	4	1	11	2	18	3	8	11	16	1	18	7
BOD	1	2	1	1	1	2	1	1	1	1	1	2	1	2	1
AMM.	0.22	0.37	0.21	0.20	0.46	0.33	0.37	BDL	0.58	0.42	0.53	0.07	BDL	0.58	0.32
TKN	2.61	1.75	3.24	0.60	1.70	1.04	0.80	3.67	1.62	1.35	3.92	1.14	0.60	3.92	1.95
DO	10.7	10.5	9.20	9.0	10.0	9.6	6.2	6.1	7.8	7.2	7.6	9.4	6.1	10.7	8.6
WT	15.0	17.0	14.0	25.5	28.0	28.0	31.0	25.0	23.0	28.0	24.0	16.0	14.0	31.0	22.9
COND.	253	375	339.0	435	414	292	259	157	206	963	325	398	157	963	368
TC	4100	42000	31000	180000	ND	140000	600000	20100000	300000	38000	140000	110000	4100	20100000	1971373
FC	160	7900	650	770	ND	7000	17200	4500	2900	180	790	1500	160	17200	3959
FS	40	120	90	50	120	800	350	510	220	20	170	50	20	800	212

SONEPAT

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.78	7.40	7.35	8.01	7.86	7.81	8.29	8.20	7.64	7.90	8.14	7.15	7.15	8.29	-
COD	4	11	2	13	5	17	38	43	16	18	8	26	2	43	17
BOD	2	3	1	2	2	2	1	3	1	2	2	2	1	3	2
AMM.	0.44	0.96	BDL	0.44	1.20	0.30	0.56	BDL	1.22	0.47	0.53	0.22	BDL	1.22	0.63
TKN	2.03	2.69	2.65	2.70	3.07	0.82	2.96	2.04	3.52	0.81	2.80	1.43	0.81	3.52	2.29
DO	8.5	7.1	8.4	5.6	7.7	7.7	5.4	5.2	6.5	7.0	9.2	8.0	5.2	9.2	7.2
WT	14.0	15.0	16.0	24.0	25.0	29.0	30.5	30.0	25.5	28.5	16.0	18.0	14.0	30.5	22.6
COND.	418	345	400	422	435	343	225	185	205	960	391	502	185	960	403
TC	7200	10900	144000	143000	ND	140000	1390000	21800000	440000	620000	250000	670000	7200	21800000	2328645
FC	790	780	820	1200	ND	13000	119000	5200	4300	270	660	17600	270	119000	14875
FS	100	140	120	90	170	1600	470	570	330	50	220	210	50	1600	339

PALLA

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.39	7.47	7.58	8.32	8.23	8.4	8.49	8.22	7.78	8.36	8.64	7.62	7.39	8.64	-
COD	3	6	5	9	16	10	10	21	19	14	22	4	3	22	12
BOD	1	2	1	1	2	2	1	1	1	1	2	1	1	2	1
AMM.	0.17	0.54	BDL	0.09	1.65	0.95	0.07	BDL	0.28	0.97	0.74	0.37	BDL	1.65	0.58
TKN	1.16	1.46	2.06	1.2	3.07	1.64	0.53	3.94	0.68	1.35	4.76	1.15	0.53	4.76	1.92
DO	9.6	7.8	7.4	7.4	7.6	7.5	6.7	5.6	6.5	12.0	12.3	7.2	5.6	12.3	8.1
WT	13.5	16.0	21.5	22.5	26.0	29.5	32.0	28.5	30.0	28.5	21.5	16.0	13.5	32.0	23.8
COND.	352	325	411	324	391	406	273	184	242	413	510	518	184	518	362
TC	4000	41000	31000	48000	48000	230000	290000	4350000	79000	7000	400	700	400	4350000	427425
FC	350	1730	350	1070	2100	7000	6700	2800	780	160	120	150	120	7000	1943
FS	100	40	40	80	170	230	210	110	410	30	10	40	10	410	123

NIZAMUDDIN BRIDGE - MID STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.02	6.83	7.16	7.51	7.81	7.96	7.89	7.17	7.65	7.35	7.44	7.16	6.83	7.96	-
COD	70	80	91	61	88	113	22	14	31	67	72	87	14	113	66
BOD	24	30	28	25	34	28	5	5	4	17	29	36	4	36	22
AMM.	15.83	15.82	20.83	17.67	16.89	28.38	2.59	2.95	1.19	7.36	15.99	21.30	1.19	28.38	13.90
TKN	21.19	21.46	29.00	21.00	21.00	31.52	4.02	4.64	3.93	13.97	18.03	26.97	3.93	31.52	18.06
DO	0.0	0.0	0.0	0.0	0.0	0.0	1.3	3.5	4.6	1.7	0.0	0.0	0.0	4.6	0.9
WT	13.5	23.0	26.0	26.0	27.0	30.0	29.0	28.0	29.5	26.0	26.0	22.0	13.5	30.0	25.5
COND.	1136	870	1185	1090	1240	1190	368	389	245	960	992	1090	245	1240	896
TC	6500000	14500000	73000000	27000000	890000000	170000000	3800000	7800000	2600000	500000	2400000	32000000	500000	890000000	102508333
FC	230000	820000	1590000	2900000	199000000	7000000	440000	340000	40000	86000	290000	3700000	40000	199000000	18036333
FS	32000	42000	220000	200000	90000	140000	80000	10000	14000	15000	43000	95000	10000	220000	81750

NIZAMUDDIN BRIDGE - QUARTER STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.01	6.82	7.27	7.58	7.66	7.90	7.94	7.01	7.60	6.85	7.56	7.25	6.82	7.94	-
COD	69	84	79	67	85	109	21	15	31	69	68	85	15	109	65
BOD	21	37	21	25	37	33	4	4	4	18	25	31	4	37	22
AMM.	17.41	15.70	21.95	16.94	16.50	27.63	2.44	3.54	1.15	8.20	16.80	20.52	1.15	27.63	14.07
TKN	20.61	19.69	26.00	20.00	24.00	30.45	4.02	5.46	3.66	15.60	18.93	27.54	3.66	30.45	18.00
DO	0.0	0.0	0.0	0.0	0.0	0.0	1.3	3.4	5.3	1.7	0.0	0.0	0.0	5.3	1.0
WT	13.5	23.0	26.0	26.0	27.0	30.0	29.0	32.0	29.5	26.0	26.0	22.0	13.5	32.0	25.8
COND.	1114	863	1168	1080	1270	1150	378	395	246	957	1005	1100	246	1270	894
TC	7200000	13300000	93000000	22000000	930000000	185000000	6800000	8000000	3100000	820000	2600000	38000000	820000	930000000	109151667
FC	340000	840000	3200000	2500000	205000000	8200000	6500000	370000	47000	93000	320000	4600000	47000	205000000	19334167
FS	38000	39000	180000	210000	140000	260000	100000	10000	16000	21000	47000	99000	10000	260000	96667

AGRA CANAL - MID STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.06	7.01	7.28	7.83	7.84	7.94	7.89	7.56	7.66	7.45	7.52	7.24	7.01	7.94	-
COD	51	47	79	67	97	56	30	20	16	51	46	42	16	97	50
BOD	13	14	15	21	23	13	6	5	5	15	11	13	5	23	13
AMM.	9.06	9.73	12.32	21.73	14.97	10.26	3.41	5.53	1.05	6.13	9.36	8.88	1.05	21.73	9.37
TKN	11.61	11.17	18.00	27.00	19.00	12.28	5.90	6.83	2.98	11.80	14.92	13.19	2.98	27.00	12.89
DO	0.0	1.0	0.0	0.0	1.0	0.0	0.3	3.7	3.9	1.0	0.0	0.4	0.0	3.9	0.9
WT	13.0	19.5	26.0	28.0	28.0	31.0	29.0	32.0	29.5	24.0	22.0	19.5	13.0	32.0	25.1
COND.	778	574	796	1070	1150	571	472	425	276	957	693	664	276	1150	702
TC	1560000	6600000	39000000	27000000	262000000	96000000	1580000	550000	280000	101000	3900000	11700000	101000	262000000	37522583
FC	330000	1430000	13900000	7700000	97000000	61000000	330000	150000	20000	21000	210000	1450000	20000	97000000	15295083
FS	17300	13000	310000	950000	110000	210000	20000	10000	9000	1800	14000	84000	1800	950000	145758

AGRA CANAL - QUARTER STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.12	6.98	7.09	8.08	7.78	7.90	7.88	7.08	7.53	7.4	7.48	7.41	6.98	8.08	-
COD	48	49	71	67	101	53	28	17	24	50	45	44	17	101	50
BOD	12	14	13	21	27	13	6	5	4	16	13	13	4	27	13
AMM.	7.77	9.34	15.48	20.54	15.48	10.38	3.10	3.63	1.28	8.20	9.39	8.84	1.28	20.54	9.45
TKN	12.19	10.87	19.00	25.00	18.00	12.82	5.36	4.92	3.66	16.96	13.77	14.06	3.66	25.00	13.05
DO	0.0	0.2	0.0	0.0	0.9	0.0	0.6	1.4	4.1	1.5	0.0	0.4	0.0	4.1	0.8
WT	13.0	19.5	26.0	28.0	28.0	31.0	29.0	29.0	29.5	24.0	22.0	19.5	13.0	31.0	24.9
COND.	717	588	803	1070	1130	590	430	440	279	967	678	659	279	1130	696
TC	1730000	2010000	61000000	17800000	303000000	101000000	1650000	660000	290000	112000	4400000	13500000	112000	303000000	42262667
FC	267000	168000	17200000	530000	10500000	850000	185000	135000	23000	24000	320000	1590000	23000	17200000	2649333
FS	16800	38000	340000	86000	12000	250000	19000	10000	9000	1900	16000	86000	1900	340000	73725

MAZAWALI

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.53	7.29	7.61	8.37	8.17	8.40	8.32	6.89	7.67	8.03	7.62	7.61	6.89	8.40	-
COD	71	75	73	89	88	30	39	22	35	38	36	58	22	89	55
BOD	25	21	15	24	16	8	7	6	6	11	9	13	6	25	13
AMM.	20.60	17.03	22.18	21.84	18.12	11.13	4.06	2.95	1.75	4.47	13.05	15.52	1.75	22.18	12.73
TKN	24.39	20.94	27.20	25.00	22.00	15.49	5.40	4.64	3.79	7.73	16.64	21.80	3.79	27.20	16.25
DO	1.1	1.70	4.5	6.8	4.4	4.2	4.5	1.7	4.1	3.3	2.4	2.5	1.1	6.8	3.4
WT	13.0	19.0	27.0	28.0	30.0	33.0	30.0	29.0	29.0	25.0	22.0	20.0	13.0	33.0	25.4
COND.	1379	985	1615	1680	1530	1010	460	443	278	965	1001	965	278	1680	1026
TC	17200000	810000	800000	2100000	1800000	1100000	180000	50000	170000	42000	1100000	2400000	42000	17200000	2312667
FC	105000	173000	52000	170000	880000	90000	21000	11000	14800	1800	120000	340000	1800	880000	164883
FS	17800	46000	8000	7000	7000	1000	9000	2000	4500	700	1200	6500	700	46000	9225

XXX

MATHURA U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.56	7.70	7.57	8.44	8.48	8.38	7.57	8.25	7.45	8.22	7.82	7.28	7.28	8.48	-
COD	34	36	59	65	37	60	41	29	15	38	37	28	15	65	40
BOD	6	7	15	22	8	8	12	5	3	12	13	9	3	22	10
AMM.	7.63	15.03	12.72	23.9	0.41	0.46	0.63	1.35	0.85	0.78	8.46	15.1	0.41	23.90	7.28
TKN	12.92	22.44	18	27	2.83	0.82	1.61	2.46	2.99	1.49	13.77	20.65	0.82	27.00	10.58
DO	5.6	5.4	5.7	5.8	7.8	8.1	3.3	4.7	3.9	7.7	7.8	6.3	3.3	8.1	6.0
WT	10.0	18.0	25.0	28.0	26.0	35.0	30.5	31.5	26.5	26.0	22.5	24.0	10.0	35.0	25.3
COND.	1455	1114	1234	1890	1540	1620	455	766	670	968	1080	1260	455	1890	1171
TC	150000	120000	1430000	7200000	600000	2100000	190000	130000	1040000	78000	12000	110000	12000	7200000	1096667
FC	7000	19000	16000	56000	30000	100000	28000	5000	84000	5500	1700	43000	1700	100000	32933
FS	600	700	900	300	100	700	1500	700	7500	400	80	650	80	7500	1178

MATHURA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.53	7.72	7.97	8.34	8.37	8.68	7.79	8.17	7.38	8.10	7.96	7.21	7.21	8.68	-
COD	37	40	53	58	34	94	36	39	20	39	27	25	20	94	42
BOD	7	8	16	7	6	8	14	6	5	14	7	10	5	16	9
AMM.	5.58	14.80	5.68	2.70	0.20	1.51	0.58	0.96	0.94	4.36	4.39	10.26	0.20	14.80	4.33
TKN	12.63	17.95	13.00	6.00	2.20	2.22	1.61	2.18	2.99	8.00	7.21	16.06	1.61	17.95	7.67
DO	5.1	6.8	13.5	4.7	9.6	9.4	3.9	3.0	3.8	9.2	7.3	5.0	3.0	13.5	6.8
WT	13.0	19.0	21.0	27.5	29.5	35.0	29.0	31.5	27.0	26.5	22.5	23.5	13.0	35.0	25.4
COND.	1362	1090	1182	1940	1470	1700	365	432	495	985	846	1070	365	1940	1078
TC	2080000	220000	4900000	10400000	1500000	4100000	1950000	300000	3600000	1070000	90000	580000	90000	10400000	2565833
FC	46000	31000	34000	240000	50000	230000	1610000	20000	85000	9900	2300	67000	2300	1610000	202100
FS	3100	900	1700	500	300	5400	4700	1000	7800	570	110	790	110	7800	2239

MATHURA - D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.64	7.74	8	8.47	8.36	8.68	7.89	8.11	7.41	7.58	8.08	7.60	7.41	8.68	-
COD	36	36	56	53	28	75	33	39	20	34	29	25	20	75	39
BOD	7	5	17	9	7	8	13	9	5	10	9	10	5	17	9
AMM.	6.39	13.56	4.67	0.62	0.22	1.14	0.45	1.13	1.14	6.89	5.09	10.52	0.22	13.56	4.32
TKN	10.45	17.35	10.00	4.00	2.40	1.38	1.34	1.95	3.54	11.80	8.31	14.63	1.34	17.35	7.26
DO	4.8	6.9	13.4	4.0	9.2	9.4	3.9	3.1	3.6	9.5	7.2	5.0	3.1	13.4	6.7
WT	13.0	19.0	21.0	27.5	29.0	35.0	29.0	31.5	27.0	26.5	22.5	23.5	13.0	35.0	25.4
COND.	1350	1091	1178	1910	1370	1650	370	447	492	965	824	1040	370	1910	1057
TC	2540000	250000	6000000	10900000	1600000	2300000	8700000	400000	4100000	1100000	110000	610000	110000	10900000	3217500
FC	48000	37000	45000	300000	50000	190000	2230000	20000	91000	10300	2500	75000	2500	2230000	258233
FS	3800	900	1900	500	300	1100	6200	1000	7800	620	120	850	120	7800	2091

AGRA - U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.85	7.57	7.59	9.21	9.23	9.09	8.1	7.53	7.79	8.52	8.34	8.00	7.53	9.23	-
COD	28	32	40	78	93	87	29	19	15	32	39	21	15	93	43
BOD	5	8	11	18	19	25	13	7	4	10	15	7	4	25	12
AMM.	7.82	5.04	3.94	0.59	1.10	0.44	2.23	0.41	0.33	2.87	1.34	3.89	0.33	7.82	2.50
TKN	12.19	11.66	7.00	2.40	1.89	1.11	3.23	1.09	1.08	7.73	2.87	6.31	1.08	12.19	4.88
DO	8.9	6.3	8.5	17.5	22.8	10.2	6.1	4.0	4.1	13.1	10.6	4.4	4.0	22.8	9.7
WT	12.5	23.5	21.5	30.0	32.0	32.0	31.0	32.0	30.0	22.0	20.0	19.5	12.5	32.0	25.5
COND.	1448	1039	1103	1900	1390	1500	376	502	473	954	825	928	376	1900	1037
TC	261000	2700000	1250000	710000	400000	800000	570000	180000	160000	470000	1100000	530000	160000	2700000	760917
FC	3400	6200	7300	68000	150000	30000	3700	28000	9000	6000	12600	97000	3400	150000	35100
FS	690	350	600	2000	1800	1900	1500	700	1100	1500	2700	1500	350	2700	1362

AGRA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.82	7.38	7.27	8.92	7.94	8.41	7.92	7.55	7.94	8.45	8.08	6.73	6.73	8.92	-
COD	62	114	63	89	144	155	36	17	16	40	58	35	16	155	69
BOD	19	31	20	20	35	43	15	7	4	15	19	10	4	43	20
AMM.	9.01	7.74	3.68	0.61	5.93	0.20	4.05	1.46	0.94	2.03	3.39	5.58	0.20	9.01	3.72
TKN	15.39	11.36	6.00	3.00	12.00	0.66	7.80	3.28	2.99	4.75	7.74	7.75	0.66	15.39	6.89
DO	7.5	5.8	10.3	14.5	7.6	3.5	1.4	3.8	3.8	14.8	7.2	5.3	1.4	14.8	7.1
WT	12.5	24.0	22.0	31.0	32.5	34.0	32.0	33.0	30.0	23.0	22.0	20.0	12.5	34.0	26.3
COND.	1570	1084	1240	1980	1880	1580	510	460	469	960	894	967	460	1980	1133
TC	13900000	142000000	50000000	370000000	1580000000	1710000000	68000000	4700000	2900000	8500000	2100000	36000000	2100000	1710000000	332341667
FC	106000	3200000	840000	18600000	203000000	184000000	1960000	900000	210000	92000	320000	1710000	92000	203000000	34578167
FS	14000	17000	4200	4500	13800	7900	110000	15000	17000	27000	22000	37000	4200	110000	24117

AGRA - D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.66	7.32	7.52	8.92	8.29	8.77	7.9	7.57	7.58	8.46	8.06	7.12	7.12	8.92	-
COD	61	117	67	89	155	136	37	18	16	40	47	30	16	155	68
BOD	22	28	30	19	46	35	15	8	4	14	19	10	4	46	21
AMM.	9.39	7.43	10.33	2.25	3.20	0.54	4.05	1.84	0.74	1.92	3.26	2.32	0.54	10.33	3.94
TKN	15.97	12.55	14.00	4.00	17.00	1.11	7.26	3.55	2.17	4.75	7.17	6.02	1.11	17.00	7.96
DO	5.9	6.1	4.5	14.8	6.7	3.9	1.4	3.3	ND	14.4	7.2	5.3	1.4	14.8	6.7
WT	12.5	24.0	22.0	31.0	32.5	34.0	32.0	33.0	30.0	23.0	22.0	20.0	12.5	34.0	26.3
COND.	1578	1056	1275	1960	1850	1550	507	463	486	959	895	967	463	1960	1129
TC	19500000	152000000	77000000	400000000	1750000000	1890000000	75000000	18000000	3700000	9100000	2300000	41000000	2300000	1890000000	369800000
FC	135000	3400000	950000	19900000	217000000	221000000	2900000	1000000	300000	99000	450000	1950000	99000	221000000	39090333
FS	17400	20000	4700	7900	14500	11400	121000	21000	19000	30000	32000	45000	4700	121000	28658

BATESHWAR

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.69	8.00	7.62	9.08	9.01	9.14	8.25	8.28	8.08	8.66	9.17	7.94	7.62	9.17	-
COD	21	61	25	73	75	68	35	21	12	56	51	37	12.0	75.0	44.6
BOD	7	19	6	14	11	10	7	1	1	11	12	7	1.0	19.0	8.8
AMM.	5.4	1.00	0.78	0.41	0.48	0.14	0.25	0.58	0.54	0.57	0.22	0.32	0.14	5.40	0.89
TKN	11.03	5.61	2.70	3.00	1.90	0.53	1.35	1.36	1.64	0.95	1.15	0.57	0.53	11.03	2.65
DO	7.7	14.3	7.2	8.8	9.1	11.7	4.1	5.9	5.4	12.5	16.1	9.4	4.1	16.1	9.3
WT	17.0	23.5	26.0	38.0	34.0	29.5	33.0	31.0	31.5	26.5	23.0	17.0	17.0	38.0	27.5
COND.	1284	1080	1153	2220	1940	1630	455	479	528	990	743	964	455	2220	1122
TC	134000	840000	640000	2500000	3600000	1470000	171000000	67000000	17000000	2100000	1200000	440000	134000	171000000	22327000
FC	3700	9100	360000	97000	220000	750000	530000	18000	23000	49000	9000	4800	3700	750000	172800
FS	1200	600	11000	900	500	1000	1100	300	900	290	350	370	290	11000	1543

ETAWAH

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	7.7	8.21	8.07	8.92	8.82	9.3	8.15	8.28	7.58	8.49	9.3	8.19	7.58	9.30	-
COD	25	55	32	56	91	60	31	18	6	52	63	ND	6	91	44
BOD	6	14	6	11	16	10	8	1	1	10	13	ND	1	16	9
AMM.	4.24	0.51	0.37	0.09	0.56	BDL	0.59	2.53	0.46	1.08	0.07	0.27	BDL	4.24	0.98
TKN	8.71	5.02	1.20	1.50	2.70	0.28	1.08	3.28	1.64	2.31	0.57	0.86	0.28	8.71	2.43
DO	8.9	13.0	10.4	8.4	9.0	12.8	4.5	7.1	5.9	14.9	19.1	11.6	4.5	19.1	10.5
WT	23.0	23.0	25.5	31.5	34.0	33.0	32.0	29.0	31.0	26.5	23.0	18.0	18.0	34.0	27.5
COND.	1231	1010	1165	2110	1820	858	455	469	484	950	370	343	343	2110	939
TC	1950000	20500000	93000	1020000	3300000	630000	3700000	45000000	11000000	1500000	210000	350000	93000	45000000	7437750
FC	3200	6100	9500	38000	250000	28000	48000	3800	4700	12400	1700	3700	1700	250000	34092
FS	400	400	1200	500	1300	300	600	200	500	200	210	280	200	1300	508

JUHIKA

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.00	7.97	8.23	8.64	8.31	9.06	8.51	8.18	7.86	8.46	9.13	8.62	7.86	9.13	-
COD	5	20	36	26	23	65	17	12	9	28	11	29	5	65	23
BOD	2	8	6	4	2	7	4	1	2	4	2	4	1	8	4
AMM.	0.09	2.00	0.48	0.14	0.33	BDL	0.52	0.89	0.26	0.68	BDL	0.15	BDL	2.00	0.47
TKN	1.59	2.36	2.1	0.60	2.70	0.53	1.89	1.91	0.82	0.95	0.57	0.57	0.53	2.70	1.38
DO	11.7	11.4	11.51	9.6	8.4	13.0	5.5	6.9	5.6	11.0	17.5	9.8	5.5	17.5	10.2
WT	21.0	23.5	24.5	29.0	36.0	31.0	31.0	28.0	30.0	26.0	23.0	20.0	20.0	36.0	26.9
COND.	636	950	969	1260	1280	940	263	281	314	622	386	552	263	1280	704
TC	2230000	1140000	38000	80000	3300000	320000	560000	103000	300000	75000	30000	13500	13500	3300000	682458
FC	2100	1200	1300	6500	170000	11000	3300	1200	1300	4100	1100	1580	1100	170000	17057
FS	1200	100	100	200	300	300	200	200	600	150	60	150	60	1200	297

UDI (Chambal River)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
pH	8.06	7.99	8.06	8.98	8.91	9.32	8.45	8.33	7.86	8.11	ND	8.61	7.86	9.32	-
COD	5	10	17	20	7	22	14	12	10	2	ND	ND	2	22	12
BOD	2	2	4	5	1	1	3	1	2	1	ND	ND	1	5	2
AMM.	BDL	0.13	0.23	0.28	0.33	BDL	0.47	2.23	0.55	0.48	0.04	0.06	BDL	2.23	0.40
TKN	1.61	1.12	0.90	1.80	2.20	NT	0.81	3.55	1.36	0.68	0.86	0.29	0.29	3.55	1.38
DO	10.8	10.8	9.5	10.8	8.7	7.8	6.4	5.8	6.3	8.1	8.7	8.3	5.8	10.8	8.5
WT	22.0	21.5	25.0	32.0	35.0	32.0	32.0	30.0	31.0	25.0	23.5	18.0	18.0	35.0	27.3
COND.	676	570	588	796	874	750	195	181	236	329	540	846	181	874	548
TC	88000	1640000	830000	1240000	1600000	1040000	130000	14500000	8700000	700000	22000	21000	21000	14500000	2542583
FC	150	330	750	19000	220000	1700	340	450	690	560	150	1590	150	220000	20476
FS	10	60	100	0	100	70	140	200	110	50	30	20	0	200	74

YEAR - 2004

HATHNIKUND

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	12.5	14.5	20.0	26.0	24.5	25.0	26.0	23.0	25.0	24.5	18.0	15.0	12.5	26.0	21.2
DO	7.2	10.3	10.8	7.9	9.3	8.5	7.8	8.1	9.2	9.7	8.7	9.4	7.2	10.8	8.9
pH	6.83	7.38	8.04	7.68	8.11	8.89	8.20	8.20	8.86	8.34	8.11	8.88	6.83	8.89	-
AMM.	0.14	BDL	0.07	0.75	BDL	-	0.21	1.08	0.19	0.02	0.54	BDL	BDL	1.08	0.28
TKN	0.56	0.28	0.56	1.40	BDL	BDL	0.56	6.16	0.56	0.28	1.68	0.25	BDL	6.16	1.03
COD	5	11	2	3	6	14	7	5	5	5	12	12	2	14	7
BOD	1	2	1	1	1	1	2	1	1	1	3	3	1	3	2
COND.	255	358	284	110	223	192	219	269	204	393	203	246	110	393	246
TC	3000	3800	1200	1200	22000	40000	60000	80000	170000	30000	33000	11000	1200	170000	37933
FC	70	230	190	2100	4100	10200	8500	5200	1010	4600	5100	200	70	10200	3458
FS	10	20	10	8	4	20	170	1750	350	84	92	20	4	1750	212

KALANAUR

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	14.5	15.0	26.0	27.0	31.0	30.5	34.0	24.5	29.0	28.0	24.0	21.0	14.5	34.0	25.4
DO	10.7	7.5	10.3	8.9	8.3	7.7	8.3	7.9	8.5	9.7	6.9	8.8	6.9	10.7	8.6
pH	7.20	7.88	8.17	7.65	8.18	7.85	8.24	8.24	7.90	8.34	7.81	8.81	7.20	8.81	-
AMM.	0.27	BDL	BDL	1.08	BDL	0.07	0.16	1.04	0.16	0.06	0.14	0.03	BDL	1.08	0.25
TKN	1.68	2.24	0.84	2.24	BDL	1.68	0.56	3.92	0.56	1.12	2.52	1.00	BDL	3.92	1.53
COD	9	7	8	18	13	11	2	8	11	8	8	12	2	18	10
BOD	2	3	2	3	3	1	1	1	3	1	2	1	1	3	2
COND.	375	381	420.0	114	453	283	317	230	408	422	306	274	114	453	332
TC	8000	10000	4200	1270000	120000	2000000	220000	110000	37000	190000	170000	40000	4200	2000000	348267
FC	1080	140	1040	11500	29000	116000	10100	10900	2900	8400	11500	3600	140	116000	17180
FS	50	40	20	96	112	80	210	2520	440	240	190	180	20	2520	348

SONEPAT

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	11.0	20.5	22.0	23.0	30.5	29.0	28.5	28.5	30.0	28.5	19.5	15.5	11.0	30.5	23.9
DO	8.2	9.8	8.3	8.3	7.6	6.3	6.5	7.9	7.5	8.4	-	6.8	6.3	9.8	7.8
pH	7.03	7.56	7.95	7.62	7.26	7.84	7.91	7.91	8.00	8.44	7.65	8.80	7.03	8.80	-
AMM.	1.18	0.61	0.56	0.78	0.46	0.36	0.15	1.03	0.30	0.04	0.53	1.19	0.04	1.19	0.60
TKN	1.96	0.84	1.12	1.68	0.84	0.56	0.84	4.76	1.68	1.12	1.68	3.02	0.56	4.76	1.68
COD	9	12	7	9	21	16	12	8	17	8	22	15	7	22	13
BOD	3	2	3	2	4	3	3	1	5	1	8	3	1	8	3
COND.	453	440	518	250	892	312	345	258	355	260	388	410	250	892	407
TC	60000	11000	77000	1390000	180000	3100000	310000	300000	590000	260000	890000	90000	11000	3100000	604833
FC	4800	1300	1230	12800	33000	139000	28000	25000	22000	38000	47000	4000	1230	139000	29678
FS	120	70	80	350	170	28	390	2970	220	840	370	120	28	2970	477

PALLA

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	12.0	-	20.5	25.5	28.5	28.0	32.0	30.0	30.5	29.5	20.5	16.0	12.0	32.0	24.8
DO	7.6	8.1	8.7	7.4	7.9	9	9.9	7	7.2	10.2	8	7.9	7.0	10.2	8.2
pH	7.60	7.71	8.18	8.05	8.39	8.58	8.91	8.91	7.52	8.02	7.84	7.68	7.52	8.91	-
AMM.	0.39	BDL	0.09	0.78	0.78	0.03	0.21	1.21	0.71	0.15	0.64	0.59	BDL	1.21	0.47
TKN	5.32	1.4	1.12	1.68	1.96	1.12	0.8	7.28	1.12	1.9	1.68	2.77	0.80	7.28	2.35
COD	7	6	4	7	7	15	34	13	12	21	15	5	4	34	12
BOD	1	1	1	2	2	4	5	2	1	6	4	2	1	6	3
COND.	413	550	431	357	348	335	526	397	315	833	734	670	315	833	492
TC	6500	19800	37000	11800	47000	34000	131000	210000	31000	107000	81000	32000	6500	210000	62342
FC	1700	300	2300	1700	3500	15900	18000	15000	9500	22000	4100	700	300	22000	7892
FS	100	20	90	68	128	310	360	790	340	120	220	100	20	790	221

NIZAMUDDIN BRIDGE - MID STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	21.5	22.0	25.5	32.0	-	30.0	35.0	31.0	-	28.0	-	-	21.5	35.0	28.1
DO	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	-	0.0	-	-	0.0	0.0	0.0
pH	7.21	7.14	7.73	7.68	-	7.41	7.40	7.40	-	7.44	-	-	7.14	7.73	-
AMM.	25.46	-	28.94	27.67	-	24.73	11.31	4.84	-	21.65	-	-	4.84	28.94	20.66
TKN	31.14	-	33.90	39.20	-	30.20	22.10	10.92	-	34.72	-	-	10.92	39.20	28.88
COD	85	67	106	85	-	99	64	28	-	74	-	-	28	106	76
BOD	35	10	27	22	-	30	28	6	-	33	-	-	6	35	24
COND.	1180	1040	1270	1187	-	1145	1073	388	-	1023	-	-	388	1270	1038
TC	137000000	320000000	58000000	33000000	-	43000000	2000000	2500000	-	28000000	-	-	2000000	320000000	77937500
FC	62000000	44000000	15000000	19000000	-	11000000	1000000	690000	-	2600000	-	-	690000	62000000	19411250
FS	87000	76000	64000	15000	-	100000	40000	17000	-	37000	-	-	15000	100000	54500

NIZAMUDDIN BRIDGE - QUARTER STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	21.5	22.0	25.5	32.0	30.0	30.0	35.0	31.0	32.0	28.0	25.5	17.5	17.5	35.0	27.5
DO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
pH	7.25	7.09	7.80	7.57	7.74	7.31	7.45	7.45	7.27	7.51	7.60	8.11	7.09	8.11	-
AMM.	25.99	-	29.04	24.94	31.34	23.99	11.89	5.47	18.24	19.34	22.91	19	5.47	31.34	21.06
TKN	34.16	-	35.00	36.40	41.40	27.70	22.68	11.76	21.28	35.28	30.80	26.70	11.76	41.40	29.38
COD	89	61	103	77	116	93	67	25	84	110	93	85	25	116	84
BOD	37	8	36	24	35	19	25	6	23	49	37	34	6	49	28
COND.	1170	1060	1250	1199	1214	1130	1048	400	1290	1130	1120	1212	400	1290	1102
TC	135000000	340000000	90000000	39000000	9000000	48000000	3000000	3400000	3100000	33000000	31000000	29000000	3000000	340000000	63625000
FC	6400000	46000000	21000000	24000000	8000000	14000000	1000000	820000	2700000	2900000	3600000	6600000	820000	46000000	11418333
FS	88000	81000	75000	15000	74000	100000	50000	22000	45000	42000	19000	7200	7200	100000	51517

AGRA CANAL - MID STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	17.0	19.0	28.5	30.0	28.0	30.0	33.0	31.5	30.0	27.5	24.0	17.5	17.0	33.0	26.3
DO	0.0	0.0	0.0	0.0	0.0	1.4	1.0	0.3	0.5	0.0	0.0	0.0	0.0	1.4	0.3
pH	8.82	7.24	7.63	7.67	8.06	7.56	7.36	7.36	7.35	7.57	7.56	7.95	7.24	8.82	-
AMM.	15.73	-	21.36	26.73	27.47	8.89	5.16	10.26	9.03	14.13	13.50	9	5.16	27.47	14.62
TKN	26.88	-	26.60	40.60	39.50	10.10	8.10	21.28	15.68	20.44	20.20	15.40	8.10	40.60	22.25
COD	76	45	101	74	119	46	31	44	42	64	71	49	31	119	64
BOD	23	9	28	20	27	12	10	12	9	25	24	14	9	28	18
COND.	847	825	982	1154	1400	531	574	584	774	1053	1035	666	531	1400	869
TC	14600000	32000000	11500000	3300000	2000000	15900000	1000000	5400000	530000	2900000	9000000	2500000	530000	32000000	8385833
FC	4300000	2500000	2600000	2100000	1500000	4300000	300000	3900000	470000	160000	300000	880000	160000	4300000	1942500
FS	53000	47000	81000	59000	87000	100000	10000	52000	31000	31000	13000	4700	4700	100000	47392

AGRA CANAL - QUARTER STREAM

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	17.0	19.0	28.5	30.0	28.0	30.00	33.0	31.5	30.0	27.5	24.0	17.5	17.0	33.0	26.3
DO	0.0	0.0	0.0	0.0	0.0	0.6	1.5	0.2	0.2	0.0	0.0	0.0	0.0	1.5	0.2
pH	7.31	7.20	7.60	7.78	7.64	7.40	7.24	7.24	7.24	7.63	7.47	8.01	7.20	8.01	-
AMM.	14.10	-	21.67	21.26	25.68	9.34	3.74	8.68	8.67	17.56	20.63	10	3.74	25.68	14.63
TKN	28.00	-	26.90	31.60	37.80	9.80	6.20	17.92	13.16	27.44	28.30	15.90	6.20	37.80	22.09
COD	72	63	110	87	105	56	35	43	46	60	69	54	35	110	67
BOD	18	12	29	24	26	12	9	13	9	23	29	13	9	29	18
COND.	812	816	978	1142	1223	554	564	552	777	1030	1030	642	552	1223	843
TC	15300000	43000000	17800000	4300000	2500000	16600000	1000000	5900000	550000	3200000	11000000	2700000	550000	43000000	10320833
FC	4900000	3100000	3800000	2400000	1700000	5100000	400000	4200000	470000	190000	400000	930000	190000	5100000	2299167
FS	55000	49000	85000	62000	93000	100000	10000	59000	34000	35000	13000	4900	4900	100000	49992

MAZAWALI

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	16.0	18.5	24.0	28.0	28.0	28.0	34.0	32.0	30.5	26.0	25.0	18.5	16.0	34.0	25.7
DO	0.0	1.0	1.6	8.4	7.1	5.9	13.4	3.3	3.1	5.1	0.7	7.5	0.0	13.4	4.8
pH	7.60	7.57	7.88	8.06	7.89	7.92	7.91	7.91	7.76	7.76	7.74	7.97	7.57	8.06	-
AMM.	30.94	-	36.73	35.15	21.47	22.31	14.31	13.94	16.83	11.28	22.11	18	11.28	36.73	22.12
TKN	41.44	-	43.90	46.20	32.20	25.20	31.40	25.48	22.12	21.56	29.40	30.70	21.56	46.20	31.78
COD	74	63	102	82	89	75	54	29	60	39	84	68	29	102	68
BOD	25	6	16	26	26	17	19	4	11	11	18	24	4	26	17
COND.	1340	1300	1690	2060	1133	1718	778	606	1470	1023	1290	1438	606	2060	1321
TC	25000000	3800000	2000000	1400000	1300000	1200000	700000	80000	9800000	70000000	9000000	9900000	80000	70000000	11181667
FC	2100000	60000	7000	110000	510000	600000	400000	40000	240000	5400000	900000	2000000	7000	5400000	1030583
FS	19500	51000	2000	9000	9000	80000	2000	3400	8700	1100	3100	7700	1100	80000	16375

MATHURA U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	18.0	20.5	29.0	29.0	29.5	28.0	32.0	32.0	33.0	29.0	24.0	19.0	18.0	33.0	26.9
DO	2.1	4.8	8	5.4	1.8	7.8	7.2	4.6	11.9	7.6	6.8	3.6	1.8	11.9	6.0
pH	7.58	7.58	7.56	7.88	7.95	7.80	8.02	8.02	7.75	8.31	8.38	8.45	7.56	8.45	-
AMM.	20.84	13.04	17.1	7.99	8.81	3.5	1.42	3.05	5.28	2.05	7.23	17.56	1.42	20.84	8.99
TKN	41.41	17.92	24.9	14.3	14	5.6	6.72	12.32	8.12	4.2	8.96	23.68	4.20	41.41	15.18
COD	30	37	48	52	72	45	37	27	31	32	70	23	23	72	42
BOD	8	6	6	13	10	4	4	9	6	6	19	4	4	19	8
COND.	1240	1260	2040	2040	1238	1537	1776	737	701	1920	1538	1440	701	2040	1456
TC	84000	240000	2750000	6600000	530000	3100000	4700000	4900000	840000	1920000	130000	29000	29000	6600000	2151917
FC	1800	4900	68000	89000	9000	101000	107000	52000	163000	220000	60000	23000	1800	220000	74892
FS	150	20	1030	1000	400	1700	700	900	4000	14000	5000	1000	20	14000	2492

MATHURA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	17.0	19.5	28.0	29.5	29.0	29.0	33.0	31.0	32.0	30.0	25.0	20.0	17.0	33.0	26.9
DO	5.5	5.6	6.3	6	4.3	13.1	6.8	3.8	7.2	6.5	6.6	2.5	2.5	13.1	6.2
pH	7.50	7.43	7.65	8.03	8.49	8.43	8.24	8.24	7.81	7.92	8.50	8.46	7.43	8.50	-
AMM.	15.57	9.68	17.68	9.97	9.49	1.23	2.65	4.10	3.79	7.09	0.09	16.10	0.09	17.68	8.12
TKN	21.84	14.00	24.90	19.04	12.60	3.40	5.60	12.32	5.60	10.92	1.4	20.40	1.40	24.90	12.67
COD	23	40	53	45	69	39	36	32	36	19	59	25	19	69	40
BOD	11	9	7	11	15	6	6	11	11	4	10	5	4	15	9
COND.	1080	939	1950	1954	1294	1630	1840	744	708	1248	1634	1460	708	1954	1373
TC	310000	4500000	1090000	2190000	790000	4200000	13900000	5600000	1230000	2500000	340000	710000	310000	13900000	3113333
FC	5000	10400	120000	113000	28000	115000	123000	97000	1090000	111000	110000	41000	5000	1090000	163617
FS	310	260	1280	2000	900	2000	1000	2800	11000	17000	15000	4000	260	17000	4796

MATHURA - D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	17.0	19.5	28.0	29.5	29.0	29.0	33.0	31.0	32.0	29.0	25.0	20.0	17.0	33.0	26.8
DO	5.6	5.8	5.9	6.2	4.5	13.5	-	3.4	7.2	6.7	6.7	6.8	3.4	13.5	6.6
pH	7.35	7.22	7.68	8.05	7.90	8.52	8.25	8.25	7.80	8.10	8.44	8.55	7.22	8.55	-
AMM.	17.31	9.52	18.36	7.63	8.63	0.78	1.93	5.47	4.13	7.26	0.07	15.81	0.07	18.36	8.08
TKN	18.48	13.72	25.80	13.70	11.20	3.60	5.32	16.82	9.80	11.76	1.12	22.93	1.12	25.80	12.85
COD	16	36	49	39	60	48	36	32	35	20	60	25	16	60	38
BOD	6	5	6	8	10	5	5	14	11	5	10	6	5	14	8
COND.	1050	928	1970	1934	1258	1629	1842	707	710	1260	1721	1440	707	1970	1371
TC	370000	4700000	1150000	2260000	830000	6000000	16600000	5900000	1400000	2600000	410000	800000	370000	16600000	3585000
FC	6000	10900	136000	133000	32000	131000	135000	101000	1120000	113000	120000	45000	6000	1120000	173575
FS	300	270	1400	2000	1000	2000	1100	3200	11000	18000	15000	4000	270	18000	4939

AGRA - U/S

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	19.0	21.0	28.0	31.5	30.5	30.0	30.0	32.0	28.0	27.0	26.0	20.0	19.0	32.0	26.9
DO	4.7	9.4	13.8	14.1	15.8	5.7	11.2	3.6	10.6	7.4	6.4	8.6	3.6	15.8	9.3
pH	7.95	7.66	8.29	8.15	8.50	8.46	8.67	8.67	7.28	8.01	8.55	8.04	7.28	8.67	-
AMM.	12.89	1.29	2.13	0.73	3.37	1.24	0.11	4.20	6.24	4.50	13.30	12.38	0.11	13.30	5.20
TKN	20.70	15.96	5.00	1.68	8.20	3.60	5.60	10.08	10.64	8.68	18.76	19.65	1.68	20.70	10.71
COD	24	80	43	90	92	75	56	31	43	24	49	31	24	92	53
BOD	3	7	7	18	19	14	8	12	10	8	19	4	3	19	11
COND.	1270	1226	1800	1910	1342	1420	1728	714	732	1230	1567	1370	714	1910	1359
TC	550000	350000	2500000	100000	550000	310000	2600000	360000	450000	1300000	430000	260000	100000	2600000	813333
FC	81000	25000	1500000	40000	210000	290000	120000	116000	420000	140000	93000	47000	25000	1500000	256833
FS	800	700	500	100	3700	1500	300	2200	3000	3000	500	1100	100	3700	1450

AGRA - D/S (MID STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	22.0	24.0	28.0	34.5	31.0	31.5	32.0	32.0	29.0	28.0	27.0	20.0	20.0	34.5	28.3
DO	2.6	5.1	1.6	10.6	13.8	2.7	4.7	3.3	0.3	8.1	4.1	8.2	0.3	13.8	5.4
pH	7.67	7.57	7.81	8.50	8.47	8.13	8.04	8.04	7.40	8.07	8.26	8.10	7.40	8.50	-
AMM.	19.89	3.42	7.52	6.76	3.13	4.71	12.68	5.99	9.12	4.14	14.38	12.63	3.13	19.89	8.70
TKN	24.64	8.96	12.00	9.24	7.84	6.70	19.30	13.72	15.96	10.64	14.00	18.14	6.70	24.64	13.43
COD	40	53	62	152	88	76	77	33	111	40	59	35	33	152	69
BOD	15	11	11	34	20	16	15	17	40	14	21	8	8	40	19
COND.	1340	1128	1910	2080	1329	1494	2120	728	854	1320	1616	1360	728	2120	1440
TC	21000000	33000000	62000000	19000000	61000000	1103000000	290000000	29000000	85000000	5500000	400000000	3100000	3100000	1103000000	175966667
FC	5400000	2700000	28000000	16000000	4900000	6300000	24000000	10100000	47000000	490000	3700000	490000	490000	47000000	12423333
FS	52000	25000	12000	88000	60000	69000	11000	90000	250000	19000	50000	19000	11000	250000	62083

AGRA - D/S (QUARTER STREAM)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG

WT	22.0	24.0	28.0	34.5	31.0	31.5	32.0	32.5	29.0	27.5	27.5	20.0	20.0	34.5	28.3
DO	2.4	4.7	1.3	10.5	13.1	2.4	4.4	2.2	0.5	7.8	3.5	6.0	0.5	13.1	4.9
pH	7.70	7.61	7.70	8.55	8.49	8.18	8.05	8.05	7.42	7.96	8.50	7.80	7.42	8.55	-
AMM.	19.68	3.18	9.37	6.37	3.66	4.71	11.68	5.36	10.04	4.61	15.20	30.12	3.18	30.12	10.33
TKN	22.96	5.60	13.40	8.68	8.10	7.00	14.80	15.68	12.60	9.24	19.60	37.30	5.60	37.30	14.58
COD	36	67	60	122	107	80	79	41	115	31	60	56	31	122	71
BOD	14	9	11	30	27	18	14	16	41	10	36	16	9	41	20
COND.	1290	1140	1940	2080	1422	1543	2100	829	882	1260	1626	1430	829	2100	1462
TC	25000000	40000000	69000000	22000000	69000000	128000000	320000000	30000000	99000000	9100000	490000000	49000000	9100000	490000000	112508333
FC	6100000	3200000	33000000	17000000	5700000	7500000	26000000	10900000	51000000	6300000	7800000	6900000	3200000	51000000	15116667
FS	56000	25000	17000	96000	61000	73000	13000	105000	266000	24000	60000	21000	13000	266000	68083

BATESHWAR

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	15.5	21.0	27.5	29.5	32.0	28.0	33.0	30.0	30.0	26.0	25.0	18.0	15.5	33.0	26.3
DO	7.5	10	7.4	6.0	5.3	13.6	15.0	5.9	8.4	4.2	8.8	9.3	4.2	15.0	8.5
pH	8.20	8.04	8.87	8.71	7.74	8.55	8.72	8.72	8.30	7.92	7.77	7.53	7.53	8.87	-
AMM.	6.78	1.80	1.94	0.98	3.94	2.20	1.11	0.68	0.98	0.81	8.31	10.16	0.68	10.16	3.31
TKN	8.40	2.52	3.90	2.80	10.36	3.40	3.92	2.80	1.12	3.64	12.04	13.35	1.12	13.35	5.69
COD	31	46	-	69	113	78	79	18	46	37	49	41	18	113	55
BOD	7	4	-	12	16	22	14	6	8	11	17	14	4	22	12
COND.	1080	1219	1540	2150	1407	1645	2050	689	845	873	1635	1970	689	2150	1425
TC	440000	730000	1100000	1100000	430000	4600000	2700000	220000	197000	1800000	63000000	39000000	197000	63000000	9609750
FC	4700	11700	23000	280000	175000	290000	20000	82000	57000	70000	630000	310000	4700	630000	162783
FS	260	320	1640	1500	400	1300	900	4500	740	2100	15300	2000	260	15300	2580

ETAWAH

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	17.0	24.0	30.0	30.5	33.5	25.0	31.5	30.5	31.0	26.0	25.2	18.0	17.0	33.5	26.9
DO	11.5	19.5	12.9	10.2	12.9	11	8.3	5.2	9.1	7.2	10.0	15.8	5.2	19.5	11.1
pH	8.02	8.16	8.30	9.04	8.58	8.74	8.51	8.51	8.25	8.06	7.69	8.45	7.69	9.04	-
AMM.	5.98	0.68	1.73	0.94	3.12	0.82	1.13	0.93	0.76	0.39	3.50	6.69	0.39	6.69	2.22
TKN	7.56	1.12	3.64	2.52	6.44	0.50	2.80	1.40	2.52	2.24	5.04	11.34	0.50	11.34	3.93
COD	35	59	-	77	54	65	49	16	64	41	61	47	16	77	52
BOD	16	-	-	14	6	6	8	6	12	8	8	16	6	16	10
COND.	1110	436	1480	1890	1474	1610	546	529	840	921	1590	1400	436	1890	1152
TC	250000	110000	220000	920000	90000	360000	500000	130000	200000	1300000	3900000	27000000	90000	27000000	2915000
FC	3300	3900	14000	19000	8000	4700	4000	102000	49000	50000	550000	100000	3300	550000	75658
FS	140	400	1480	1100	300	1000	300	3900	620	1700	2500	1100	140	3900	1212

JUHIKA

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**

WT	-	22.5	28.0	29.5	33.0	21.0	31.0	28.5	30.5	26.5	25.3	17.5	17.5	33.0	26.7
DO	-	10.9	9.5	11.1	11	8.8	5.8	5.7	10.4	9.9	7.6	10.4	5.7	11.1	9.2
pH	-	8.83	8.54	8.27	8.34	8.84	7.85	7.85	8.30	8.49	7.91	8.46	7.85	8.84	-
AMM.	-	0.38	0.34	0.47	1.31	0.76	1.31	0.15	0.60	0.50	BDL	1.85	BDL	1.85	0.70
TKN	-	0.84	1.12	1.12	3.94	1.40	5.04	0.84	3.36	3.64	BDL	3.78	BDL	5.04	2.28
COD	-	40	25	27	20	36	9	14	21	27	19	38	9	40	25
BOD	-	7	8	6	3	5	3	3	4	7	2	10	2	10	5
COND.	-	685	692	852	1101	1088	574	222	409	477	838	640	222	1101	689
TC	-	70000	201000	29000	19000	1030000	900000	190000	410000	210000	130000	390000	19000	1030000	325364
FC	-	29000	1700	6700	3700	57000	10000	27000	77000	7000	8000	11900	1700	77000	21727
FS	-	290	820	120	40	40	280	1120	400	80	200	370	40	1120	342

UDI (Chambal River)

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	16.0	21.5	28.5	28.0	33.0	23.0	31.0	29.0	30.5	25.5	25.0	18.0	16.0	33.0	25.8
DO	10.3	9.7	10	8.1	9.3	7.6	5.5	5.9	10.1	10	9	9.4	5.5	10.3	8.7
pH	8.12	9.07	8.55	8.47	8.44	8.70	8.22	8.22	8.14	8.38	7.47	8.53	7.47	9.07	-
AMM.	0.11	0.08	BDL	0.21	1.22	0.49	0.77	0.52	0.27	1.12	BDL	0.96	BDL	1.22	0.48
TKN	2.80	1.12	0.56	0.84	3.64	1.40	2.50	3.64	1.90	2.52	BDL	1.01	BDL	3.64	1.83
COD	15	11	14	25	7	6	15	14	23	18	17	15	6	25	15
BOD	3	1	2	9	2	1	3	3	5	5	1	2	1	9	3
COND.	384	1184	600	592	529	680	1590	200	325	402	454	520	200	1590	622
TC	16000	11000	300000	22000	7000	90000	20000	390000	310000	20000	80000	22000	7000	390000	107333
FC	4200	1400	200	4800	2500	9200	1000	41000	10100	1800	900	630	200	41000	6478
FS	10	210	30	10	10	90	30	430	180	150	230	200	10	430	132

YEAR - 2005

HATHNIKUND

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	14.0	15.0	19.0	19.5	22.0	26.0	24.5	24.0	22.0	21.0	17.5	12.0	12.0	26.0	19.7
DO	10.8	11.0	9.7	9.1	8.0	8.9	7.8	8.7	9.1	7.9	9.6	10.3	7.8	11.0	9.2
pH	9.00	7.77	8.29	7.43	7.69	7.60	7.44	7.77	7.17	7.05	6.90	7.93	6.90	9.00	-
AMM.	BDL	0.74	0.15	0.46	0.42	BDL	0.77	0.62	BDL	BDL	0.18	0.09	BDL	0.77	0.29
TKN	0.80	1.10	1.67	1.68	1.40	0.28	2.77	1.96	-	-	-	-	0.28	2.77	1.46
COD	3	8	4	9	11	4	29	7	7	1	5	10	1	29	8
BOD	1	1	1	2	4	1	1	3	2	1	2	1	1	4	2
COND.	326	318	239	168	190	155	165	181	238	183	254	315	155	326	228
TC	21000	36000	15000	12700	161000	9700	87000	4300000	111000	72000	1040000	970000	9700	4300000	569617
FC	1300	2200	410	250	130	230	900	69000	430	22000	3500	200	130	69000	8379
FS	50	270	60	10	32	50	270	110	20	200	108	50	10	270	103

KALANAUR

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**

WT	16.5	16.0	20.0	24.0	28.0	29.0	25.5	25.0	30.0	22.5	19.0	14.0	14.0	30.0	22.5
DO	10.1	8.8	8.9	9.4	7.4	10.2	6.8	7.2	7.8	6.4	8.0	6.4	6.4	10.2	8.1
pH	8.73	8.10	8.30	8.10	8.10	7.71	7.51	7.56	7.26	7.48	7.25	7.95	7.25	8.73	-
AMM.	BDL	1.23	0.17	0.82	0.06	BDL	0.79	0.81	BDL	0.02	0.03	1.00	BDL	1.23	0.41
TKN	1.06	2.20	1.11	2.52	0.56	BDL	2.21	2.24	-	-	-	-	BDL	2.52	1.49
COD	3	9	4	7	4	6	34	14	8	5	4	25	3	34	10
BOD	1	1	1	2	1	1	2	3	1	1	1	7	1	7	2
COND.	413	430	360	383	370	325	155	201	407	244	418	474	155	474	348
TC	90000	39000	2700	4300	48000	10500	119000	5000000	135000	79000	66000	1800000	2700	5000000	616125
FC	10500	7500	1600	570	900	290	1400	93000	1610	8200	22000	7000	290	93000	12881
FS	180	420	20	20	48	180	420	770	20	340	170	1600	20	1600	349

SONEPAT

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	14.5	16.0	22.0	22.5	27.0	28.5	29.0	27.5	32.0	24.5	20.5	14.0	14.0	32.0	23.2
DO	7.5	7.2	7.4	7.3	6.1	6.5	6.6	5.7	7.6	6.3	12.0	10.0	5.7	12.0	7.5
pH	8.42	7.98	8.07	8.00	7.80	7.13	7.44	7.04	7.34	7.70	7.85	8.01	7.04	8.42	-
AMM.	BDL	1.77	0.77	1.06	0.20	0.22	1.09	1.13	BDL	0.03	0.15	1.57	BDL	1.77	0.67
TKN	0.53	3.03	2.50	2.24	0.84	0.28	3.05	2.52	-	-	-	-	0.28	3.05	1.87
COD	6	10	11	15	4	11	49	24	12	13	27	7	4	49	16
BOD	2	3	2	3	1	2	2	3	3	3	6	3	1	6	3
COND.	463	587	517	484	380	388	192	220	447	206	365	619	192	619	406
TC	170000	120000	2900	15500	80000	23000	123000	8100000	147000	101000	47000	2000000	2900	8100000	910783
FC	12000	8300	2000	560	3400	2800	1760	110000	1990	14100	6800	8000	560	110000	14309
FS	220	440	30	50	52	210	480	610	50	370	200	1600	30	1600	359

PALLA

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	15.0	16.0	22.0	26.0	26.0	29.5	28.0	33.0	32.0	26.5	20.5	15.0	15.0	33.0	24.1
DO	8.4	8.1	8.8	8.8	7.2	7.9	6.3	7.3	10.9	6.1	11.2	9.5	6.1	11.2	8.4
pH	8.08	8.11	8.15	8.61	7.75	7.09	8.33	7.25	7.26	7.30	7.41	7.42	7.09	8.61	-
AMM.	1.36	0.69	0.48	0.41	BDL	BDL	1.63	0.31	BDL	0.14	0.70	0.81	BDL	1.63	0.55
TKN	-	1.65	1.95	1.12	0.56	BDL	4.43	0.84	-	-	-	-	BDL	4.43	1.51
COD	4	6	13	9	3	12	11	19	8	19	13	10	3	19	11
BOD	1	2	4	2	1	1	2	1	3	2	2	2	1	4	2
COND.	475	574	446	518	465	496	398	190	485	265	850	662	190	850	485
TC	8000	20000	15000	18200	42000	24000	79000	61000	17900	26000	49000	130000	8000	130000	40842
FC	900	600	470	1650	1950	7400	380	300	310	12100	2500	6600	300	12100	2930
FS	90	70	30	20	150	390	50	80	60	300	60	80	20	390	115

NIZAMUDDIN BRIDGE - MID STREAM

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**

WT	-	-	-	-	-	-	-	30.0	30.0	26.5	-	-	26.5	30.0	28.8
DO	-	-	-	-	-	-	-	2.6	0.0	2.3	-	-	0.0	2.6	1.6
pH	-	-	-	-	-	-	-	7.82	7.50	7.30	-	-	7.30	7.82	-
AMM.	-	-	-	-	-	-	-	4.95	7.13	5.85	-	-	4.95	7.13	5.98
TKN	-	-	-	-	-	-	-	7.56	-	-	-	-	7.56	7.56	7.56
COD	-	-	-	-	-	-	-	13	36	21	-	-	13	36	23
BOD	-	-	-	-	-	-	-	7	12	10	-	-	7	12	10
COND.	-	-	-	-	-	-	-	518	922	586	-	-	518	922	675
TC	-	-	-	-	-	-	-	-	11500000	12900000	-	-	11500000	12900000	12200000
FC	-	-	-	-	-	-	-	-	5700000	19000	-	-	19000	5700000	2859500
FS	-	-	-	-	-	-	-	-	22000	2900	-	-	2900	22000	12450

NIZAMUDDIN BRIDGE - QUARTER STREAM

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	17.5	21.0	25.0	26.0	31.0	33.5	30.5	30.0	30.0	26.5	22.0	15.0	15.0	33.5	25.7
DO	0.0	0.0	0.0	1.2	0.0	0.0	2.3	3.0	0.0	1.9	0.0	0.0	0.0	3.0	0.7
pH	7.86	7.34	7.45	7.78	7.05	7.19	7.48	7.69	7.46	7.18	7.00	7.25	7.00	7.86	-
AMM.	25.90	18.83	18.24	25.00	20.60	20.40	-	5.25	6.53	6.46	11.13	33.30	5.25	33.30	17.42
TKN	26.06	23.20	21.00	32.48	29.40	29.40	-	8.12	-	-	-	-	8.12	32.48	24.24
COD	94	78	88	89	80	63	-	15	36	22	87	86	15	94	67
BOD	27	31	21	26	24	26	-	7	14	10	28	35	7	35	23
COND.	1330	1230	1050	132	1310	1650	-	495	929	608	1260	1247	132	1650	1022
TC	33000000	7000000	41000000	7800000	8000000	6200000	-	-	12100000	15000000	50000000	190000000	6200000	190000000	37010000
FC	2000000	2900000	3500000	3200000	900000	2400000	-	-	6000000	21000	3600000	5000000	21000	6000000	2952100
FS	18000	3000	20000	130000	21000	67000	-	-	25000	3100	31000	62000	3000	130000	38010

AGRA CANAL - MID STREAM

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	17.0	19.5	26.0	24.5	29.5	31.0	30.0	29.0	30.0	27.0	21.5	15.0	15.0	31.0	25.0
DO	0.0	0.0	0.0	0.9	0.5	0.9	3.0	1.3	0.0	2.5	0.0	0.0	0.0	3.0	0.8
pH	7.89	7.44	7.46	8.21	7.00	7.16	7.34	7.45	7.34	7.26	7.27	7.27	7.00	8.21	-
AMM.	20.50	9.57	9.57	13.70	7.34	9.73	2.11	3.88	9.44	6.95	2.66	21.94	2.11	21.94	9.78
TKN	26.07	12.90	11.60	19.04	12.32	15.12	8.03	6.44	-	-	-	-	6.44	26.07	13.94
COD	109	57	46	57	39	39	35	10	38	34	47	58	10	109	47
BOD	34	15	15	21	11	10	5	5	15	9	16	22	5	34	15
COND.	1144	653	741	855	678	826	256	465	792	650	823	803	256	1144	724
TC	10900000	5000000	10600000	9900000	10000000	4000000	7100000	12100000	1700000	2700000	30000000	58000000	1700000	58000000	13500000
FC	1600000	700000	960000	1600000	800000	110000	620000	35000	1400000	21000	1930000	2000000	21000	2000000	981333
FS	13000	2000	17000	21000	35000	14000	8100	9000	12000	2300	26900	85000	2000	85000	20442

AGRA CANAL - QUARTER STREAM

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**

WT	17.0	19.5	26.0	24.5	29.5	31.0	30.0	29.0	30.0	27.0	21.5	15.0	15.0	31.0	25.0
DO	0.0	0.0	0.0	0.8	0.0	0.6	3.0	2.2	0.0	2.0	0.0	0.0	0.0	3.0	0.7
pH	7.92	7.42	7.42	7.91	7.00	7.16	7.35	7.43	7.47	7.23	7.23	7.36	7.00	7.92	-
AMM.	20.90	9.74	10.75	13.60	7.26	8.08	0.92	4.62	8.97	5.84	2.36	21.45	0.92	21.45	9.54
TKN	23.14	13.30	12.90	24.08	11.76	14.28	4.15	7.28	-	-	-	-	4.15	24.08	13.86
COD	107	58	45	57	51	32	38	9	36	25	59	59	9	107	48
BOD	32	18	11	20	11	10	5	3	14	8	14	22	3	32	14
COND.	1134	648	671	933	655	828	218	476	790	631	826	842	218	1134	721
TC	11500000	9000000	11500000	10700000	14000000	4500000	8500000	13000000	2500000	3100000	21000000	49000000	2500000	49000000	13191667
FC	2300000	1000000	1400000	2300000	1100000	140000	670000	39000	1570000	25000	2200000	2000000	25000	2300000	1228667
FS	17000	2000	19000	24000	37000	19000	8500	9000	13000	2500	30000	71000	2000	71000	21000

MAZAWALI

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	16.0	21.0	20.0	23.5	30.5	31.0	30.5	28.0	31.0	26.0	22.0	16.0	16.0	31.0	24.6
DO	0.0	0.0	1.4	4.1	6.8	6.4	3.3	3.9	0.0	1.9	1.0	0.0	0.0	6.8	2.4
pH	8.17	7.72	8.13	7.78	7.51	7.76	7.31	7.50	7.42	7.33	7.49	7.54	7.31	8.17	-
AMM.	33.10	36.82	30.40	13.60	20.00	21.89	1.15	3.95	12.00	11.13	8.00	43.34	1.15	43.34	19.62
TKN	39.37	41.10	38.40	18.76	30.24	31.64	4.43	6.72	-	-	-	-	4.43	41.10	26.33
COD	94	102	79	46	66	55	32	17	39	39	49	71	17	102	57
BOD	5	39	25	9	24	32	6	6	13	10	11	27	5	39	17
COND.	1642	1880	1090	952	1720	2090	221	520	1090	870	1179	1525	221	2090	1232
TC	4100000	3000000	190000	7400000	1200000	350000	2500000	-	400000	4500000	6000000	20000000	190000	20000000	4512727
FC	1700000	100000	21000	310000	110000	190000	42000	-	90000	280000	470000	5000000	21000	5000000	755727
FS	11000	2000	4000	9000	63000	19000	2200	-	8000	1700	2500	74000	1700	74000	17855

MATHURA U/S

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	10.0	20.0	29.0	28.0	33.0	35.0	30.0	31.0	29.0	31.0	23.0	17.5	10.0	35.0	26.4
DO	7.9	2.0	6.7	6.5	6.2	8.3	5.5	6.0	5.0	6.0	9.8	5.4	2.0	9.8	6.3
pH	8.18	7.73	8.12	7.52	7.50	7.38	7.28	7.43	7.61	7.61	7.82	7.68	7.28	8.18	-
AMM.	27.80	21.80	23.76	7.15	3.57	3.53	1.32	3.35	2.14	3.46	8.37	21.56	1.32	27.80	10.65
TKN	29.79	26.80	26.60	13.72	7.00	5.88	5.81	6.16	-	-	-	-	5.81	29.79	15.22
COD	43	81	48	33	41	51	16	22	21	24	24	35	16	81	37
BOD	3	25	9	10	8	20	8	8	5	9	4	7	3	25	10
COND.	1687	1850	1600	1410	1310	1340	516	1180	839	721	1025	1392	516	1850	1239
TC	21000	510000	32000	12700000	490000	190000	230000	2100000	110000	220000	1200000	2600000	21000	12700000	1700250
FC	15000	11000	25000	250000	29000	9000	31000	65000	25000	7500	145000	80000	7500	250000	57708
FS	6000	1000	3000	3000	5000	5000	3000	2200	210	450	2000	12000	210	12000	3572

MATHURA - D/S (MID STREAM)

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	11.0	21.0	28.0	29.0	32.0	36.5	31.0	32.0	30.0	32.0	24.0	18.0	11.0	36.5	27.0

DO	7.7	8.0	7.6	5.6	5.5	6.7	4.6	2.2	4.7	2.2	8.5	4.3	2.2	8.5	5.6
pH	8.14	8.05	8.07	7.50	6.77	8.01	7.20	7.35	7.62	7.52	7.75	7.82	6.77	8.14	-
AMM.	24.40	24.20	36.60	3.60	5.72	0.55	1.54	7.50	2.66	2.99	5.08	15.89	0.55	36.60	10.89
TKN	27.99	28.20	41.30	8.96	9.52	1.12	3.88	12.32	-	-	-	-	1.12	41.30	16.66
COD	35	45	41	20	38	58	29	34	13	23	18	25	13	58	32
BOD	4	14	12	5	6	9	11	8	5	8	3	6	3	14	8
COND.	1531	1640	1800	1510	1150	1820	338	961	496	672	858	1380	338	1820	1180
TC	890000	500000	26100000	1620000	350000	310000	290000	2700000	450000	270000	1550000	2800000	270000	26100000	3152500
FC	220000	14000	2820000	101000	41000	19000	43000	78000	270000	10200	230000	100000	10200	2820000	328850
FS	25000	3000	4000	1800	7000	13000	3700	10500	270	510	3000	7000	270	25000	6565

MATHURA - D/S (QUARTER STREAM)

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	11.0	21.0	28.0	29.0	32.0	36.5	4.8	32.0	30.0	32.0	24.0	18.0	4.8	36.5	24.9
DO	7.8	7.7	7.9	5.5	5.7	6.2	7.12	1.3	4.5	1.3	8.1	4.1	1.3	8.1	5.6
pH	8.12	8.00	8.16	7.26	7.00	7.81	1.57	7.24	7.64	7.44	7.76	7.78	1.57	8.16	-
AMM.	23.80	23.40	34.40	3.24	3.57	0.41	4.43	7.53	2.39	2.98	5.11	15.51	0.41	34.40	10.56
TKN	33.25	27.00	39.20	9.52	7.00	0.84	35	12.04	-	-	-	-	0.84	39.20	20.48
COD	36	44	38	28	29	56	10	32	11	25	17	30	10	56	30
BOD	3	14	15	8	7	6	349	8	3	9	2	6	2	349	36
COND.	1530	1610	1770	1520	1160	1790	300000	951	592	670	860	1390	592	300000	26154
TC	930000	550000	27100000	1990000	390000	490000	47000	3000000	470000	330000	1670000	2900000	47000	27100000	3322250
FC	250000	17000	2890000	172000	42000	23000	4000	80000	250000	11100	270000	100000	4000	2890000	342425
FS	26000	3000	4000	2000	7000	16000	1100	11000	300	720	3000	7000	300	26000	6760

AGRA - U/S

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	20.0	23.0	26.0	28.0	30.5	32.0	30.0	31.0	30.0	29.0	21.0	15.0	15.0	32.0	26.3
DO	6.7	5.1	8.8	8.1	13.9	15.7	3.6	6.1	6.0	8.3	10.2	7.2	3.6	15.7	8.3
pH	8.40	8.05	8.20	7.71	8.29	8.48	7.18	7.22	7.35	8.24	7.99	7.62	7.18	8.48	-
AMM.	13.62	19.70	9.12	1.94	1.54	4.45	0.47	0.11	3.08	0.57	1.15	10.17	0.11	19.70	5.49
TKN	22.08	23.70	15.80	5.88	3.08	7.56	2.77	0.56	-	-	-	-	0.56	23.70	10.18
COD	30	36	31	27	44	65	20	23	25	29	27	30	20	65	32
BOD	4	11	6	11	10	17	4	7	8	10	6	11	4	17	9
COND.	1525	1650	1700	1520	844	2040	369	730	732	672	889	1286	369	2040	1163
TC	3000000	830000	1390000	250000	110000	1100000	420000	57000000	240000	101000	185000	430000	101000	57000000	5421333
FC	2300000	78000	61000	47000	3000	130000	3800	77000	33000	4600	4600	7000	3000	2300000	229083
FS	1700	700	4800	8000	1000	3000	2800	1000	2000	2000	2000	2500	700	8000	2625

AGRA - D/S (MID STREAM)

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	21.5	22.5	22.0	28.0	31.0	33.0	31.0	31.0	30.5	30.0	23.0	17.5	17.5	33.0	26.8

DO	4.0	1.7	2.9	4.0	10.2	7.9	3.6	2.7	2.2	8.4	6.5	6.5	1.7	10.2	5.1
pH	8.03	7.77	7.73	7.44	8.02	8.28	7.18	7.32	7.42	7.83	7.67	7.88	7.18	8.28	-
AMM.	19.79	21.60	10.36	5.40	3.19	5.30	1.33	1.18	5.42	1.25	4.09	10.39	1.18	21.60	7.44
TKN	21.81	29.30	16.30	8.68	5.32	9.24	6.09	1.96	-	-	-	-	1.96	29.30	12.34
COD	70	53	44	33	60	91	26	30	27	35	43	34	26	91	46
BOD	15	18	11	15	12	22	6	12	12	13	7	11	6	22	13
COND.	1582	1680	1740	1520	952	2290	413	820	878	705	987	1310	413	2290	1240
TC	41000000	33000000	262000000	3300000	900000	7800000	1410000	15300000	5300000	3800000	35000000	15000000	900000	262000000	35317500
FC	4400000	2200000	5200000	290000	300000	140000	240000	1450000	1400000	320000	2800000	2000000	140000	5200000	1728333
FS	10000	26000	10000	16000	97000	22000	6900	21000	23000	15000	210000	51000	6900	210000	42325

AGRA - D/S (QUARTER STREAM)

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	21.5	22.5	22.5	28.0	31.5	33.0	31.0	31.0	30.5	30.0	23.0	17.0	17.0	33.0	26.8
DO	3.8	1.3	0.0	4.3	7.8	7.5	3.5	1.5	1.9	8.4	6.1	6.3	0.0	8.4	4.4
pH	8.10	7.84	7.67	7.43	7.79	8.28	7.10	7.25	7.40	7.91	7.72	7.65	7.10	8.28	-
AMM.	18.97	21.50	13.62	4.11	5.00	4.84	1.23	1.15	5.99	1.14	4.00	12.87	1.14	21.50	7.87
TKN	23.40	26.50	17.60	7.28	8.96	8.12	4.15	2.24	-	-	-	-	2.24	26.50	12.28
COD	67	60	54	35	55	83	27	30	28	38	43	62	27	83	49
BOD	14	22	13	13	16	26	7	12	12	12	7	25	7	26	15
COND.	1590	1710	1810	1410	992	2270	400	800	718	718	980	1380	400	2270	1232
TC	62000000	410000000	620000000	4100000	1100000	10100000	1990000	16000000	6200000	4500000	84000000	18000000	1100000	620000000	103165833
FC	6600000	35000000	22000000	310000	360000	480000	271000	1530000	1680000	370000	3500000	2100000	271000	35000000	6183417
FS	12000	30000	11000	18000	115000	25000	7200	22000	25000	15000	221000	60000	7200	221000	46767

BATESHWAR

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	19.5	21.5	29.0	30.0	32.0	36.5	34.0	33.0	30.0	30.0	20.0	15.0	15.0	36.5	27.5
DO	8.9	9.0	12.8	16.0	11.1	14.2	4.4	9.5	2.9	13.0	12.7	8.3	2.9	16.0	10.2
pH	8.34	7.85	7.94	8.96	8.63	8.36	7.09	7.45	7.42	8.51	7.86	8.12	7.09	8.96	-
AMM.	14.80	14.30	5.60	0.37	0.94	0.71	0.29	0.14	0.93	0.23	1.21	10.80	0.14	14.80	4.19
TKN	19.39	17.10	11.30	1.96	2.24	1.40	1.66	0.56	-	-	-	-	0.56	19.39	6.95
COD	35	42	55	69	51	72	24	34	23	35	59	30	23	72	44
BOD	11	10	21	21	4	7	3	12	3	13	14	10	3	21	11
COND.	1570	1740	1570	1510	1040	1710	352	840	486	128	910	1540	128	1740	1116
TC	330000	270000	1450000	210000	35000	170000	11100000	140000	75000	280000	180000000	8000000	35000	180000000	16838333
FC	27000	14500	7300	7500	1200	12000	2100	75000	16700	91000	25000	7000	1200	91000	23858
FS	7000	2000	2000	700	170	220	410	1300	1000	100	750	250	100	7000	1325

ETAWAH

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	19.0	21.0	28.0	30.5	32.5	35.0	29.0	32.5	30.0	29.0	21.0	17.0	17.0	35.0	27.0

DO	14.5	13.0	11.8	15.9	16.1	13.1	6.1	12.4	5.1	5.5	8.1	17.3	5.1	17.3	11.6
pH	8.48	8.20	8.55	9.10	8.71	8.54	7.53	7.47	7.41	8.19	7.81	8.66	7.41	9.10	-
AMM.	10.05	6.92	0.73	0.18	1.14	BDL	0.32	0.13	1.04	0.59	1.27	7.53	BDL	10.05	2.49
TKN	17.17	9.70	7.10	1.40	1.96	0.28	1.38	0.28	-	-	-	-	0.28	17.17	4.91
COD	44	53	54	70	60	80	21	34	26	33	67	14	14	80	46
BOD	12	22	12	24	11	19	3	10	3	13	17	16	3	24	14
COND.	1448	1710	1480	1520	1090	1810	342	770	519	668	812	1420	342	1810	1132
TC	290000	200000	1210000	17000	27000	100000	4500000	80000	49000	440000	161000000	6000000	17000	161000000	14492750
FC	25000	2700	6300	6200	900	8000	1700	37000	27000	78000	19000	4000	900	78000	17983
FS	1200	900	1200	180	150	170	170	900	300	100	650	150	100	1200	506

JUHIKA

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JU L**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**MIN**	**MAX**	**AVG**
WT	19.0	20.0	27.0	29.0	32.0	30.0	25.0	31.0	29.5	28.0	21.5	17.0	17.0	32.0	25.8
DO	-	7.2	7.7	10.7	7.9	8.5	5.7	6.3	7.2	8.6	6.2	15.4	5.7	15.4	8.3
pH	8.26	8.19	8.48	8.17	8.05	8.38	7.58	7.50	7.49	8.29	7.90	8.68	7.49	8.68	-
AMM.	5.94	1.15	2.08	1.32	0.19	BDL	0.19	0.06	1.03	0.18	BDL	0.30	BDL	5.94	1.04
TKN	6.64	2.76	13.94	3.08	0.28	0.28	1.66	0.28	-	-	-	-	0.28	13.94	3.62
COD	18	16	23	25	38	39	19	8	21	25	36	28	8	39	25
BOD	3	5	4	3	8	10	3	4	2	7	9	7	2	10	5
COND.	556	600	642	518	969	1050	356	289	355	481	515	605	289	1050	578
TC	53000	77000	101000	430000	29000	25000	57000	9000	37000	1270000	230000	520000	9000	1270000	236500
FC	4900	1070	8500	5000	1800	3100	1500	2700	14900	55000	10000	2000	1070	55000	9206
FS	70	220	230	340	160	92	200	10	260	60	280	200	10	340	177

UDI (Chambal River)

	JAN	FEB	MAR	APR	MAY	JUN	JU L	AUG	SEP	OCT	NOV	DEC	MIN	MAX	AVG
WT	18.5	20.5	27.0	28.5	32.5	38.5	30.0	31.5	30.0	29.0	22.5	16.0	16.0	38.5	27.0
DO	10.1	9.3	7.8	8.4	9.5	7.5	7.3	8.7	7.3	8.3	14.3	10.2	7.3	14.3	9.1
pH	8.51	8.40	8.61	8.54	8.07	8.40	7.62	7.70	7.65	8.04	7.85	8.30	7.62	8.61	-
AMM.	1.12	0.89	1.71	1.19	0.24	BDL	0.04	0.11	0.95	-	BDL	0.06	BDL	1.71	0.58
TKN	5.60	3.03	6.05	2.80	0.84	0.28	1.11	0.28	-	-	-	-	0.28	6.05	2.50
COD	16	16	18	22	4	7	15	9	10	-	19	13	4	22	14
BOD	3	4	4	6	3	1	5	4	2	-	2	4	1	6	3
COND.	392	400	477	320	984	580	288	317	229	337	411	475	229	984	434
TC	10000	8100	45000	17000	2200	3700	23000	30000	21000	6900	50000	20000	2200	50000	19742
FC	210	200	3700	210	230	270	1100	4700	7100	4500	1200	300	200	7100	1977
FS	30	50	110	10	68	28	30	400	90	20	60	140	10	400	86

Legend:

COD = Chemical Oxygen Demand, mg/l
BOD = Biochemical Oxygen Demand, mg/l
AMM. = Free Ammonia, mg/l
TKN = Total Kjeldahl Nitrogen, mg/l
Traceable Limit for Ammonia and TKN = 0.04 mg/l till 2003 afterwards 0.02 mg/l
DO = Dissolved Oxygen, mg/l
WT = Water Temperature, Degree celsius

COND. = Conductivity, Micro mhos/cm
TC = Total Coliform, Nos./100 ml
FC = Faecal Coliform, Nos./100 ml
FS = Faecal Streptococci, Nos./100 ml
BDL = Below Detection limit
ND = Not Done

Note:

For the calculation of Average BDL is considered as half of the Traceable limit

Continued