6. ENVIRONEMNTAL IMPACT

6.1 Introduction

Any development activity invariably involves some changes in the existing natural environment. Of late, there has been a considerable awareness regarding the need for preservation of existing environment and ecology. While large-scale disturbance in the environment is not desirable, a country cannot afford not to carry out the development process for increasing human population and its need. Therefore, environmental program will have to be based on the implicit policy of "Development is necessary". The goal cannot be only conservation or protection of natural environment resources but the conservation of productivity of primary natural resources to ensure that their productivity does not deteriorate on account of development activities. In other words the philosophy would be to limit the erosion of environment quality to the minimum possible extent with the developmental needs where it cannot be avoided.

6.2 Environmental Impact Associated with various methods of flood control

The water resources project particularly flood control and drainage improvements have certain environmental consequences. These are health effect, sub-merging of land, water logging, deforestation, siltation of reservoirs, etc.

6.2.1 Health

Creation of large water bodies like storage reservoirs result in water borne diseases. Storage reservoir for flood moderation, detention basins and hydraulically inefficient drainage channels particularly which are designed for rare storms may cause this kind of environmental effect. Proper maintenance of drainage channel is the remedial measure.

6.2.2 Water Logging

NCR experiencing water logging problems in some areas mainly due to rise of ground water level because of seepage from canals and inadequate drainage systems. The problem of water logging and consequent salinity result in reduction of cultivated area hence the agricultural land needs to be completely remedied to save cultivable area from logging and salinity. Adequate drainage system can reduce this problem. In addition to this, ground water level with respect to time should be monitored in the water logging affected areas, to detect tendency of the ground water to rise and to create conditions of water logging and also increase in salinity. Conjunctive use of surface and ground water should be promoted which helps in prevention of water logging and decrease in salinity.

6.2.3 Deforestation

Construction of water resource projects, urban development projects, construction of transport networks (roads railways) etc. often involves destruction of forests or vegetation cover. The loss of forest / vegetal cover resulting in rapid surface run off and reduce ground water recharge

and soil erosion. It is necessary to have immediate control on deforestation and construction activities in the areas involving destruction of forest/vegetal cover.

6.3 Core Water Quality Monitoring Parameters

In order to address the water-related environmental problems, it is necessary to have accurate information and to know precisely what the problem is, where it is occurring, how serious it is, and what is causing it. Such information is necessary for determining cost-effective and lasting solutions to water-related problems. The goal should be to provide appropriate picture of current water-quality conditions and trends in water quality and water uses, and also to facilitate the identification of emerging issues and future priorities. The water quality monitoring is performed with following objectives:

- For rational planning of pollution control strategies and their prioritisation;
- To assess nature and extent of pollution control needed in different water bodies;
- To evaluate effectiveness of pollution control measures already in existence;
- To evaluate water quality trend over a period of time;
- To assess assimilative capacity of a water body thereby reducing cost on pollution control;
- To understand the environmental fate of different pollutants; and
- To assess the fitness of water for different uses.

The monitoring activities under national network serve various assessment goals. These goals are determination of natural freshwater qualities in the absence of significant direct human impact, determination of long-term trends in the levels of critical water quality indicators in freshwater resources and determination of the fluxes of organic matter, suspended solids, nutrients, toxic chemicals and other pollutants from major river basins to the seawater/coastal water interfaces. To meet the objectives and goals, highly selective network of strategically located monitoring stations is created and operated by CPCB in the major, medium and minor watersheds of rivers, lakes, ponds, tanks, creeks, drains, canals and subsurface aquifers in the country. Three types of monitoring stations are set up for monitoring i.e. baseline, trend and impact or flux stations.

Groundwater quality problems have reached to a cause of concern throughout the country. Increase in salinity and use of agrochemicals mandate the monitoring of trends in important aquifers, particularly in the arid and semi-arid climate belt. Trace contaminants, Fluoride and Nitrates, by levels and trends, are the primary monitoring concerns for aquifers in agriculture, industrialized and grossly polluted areas. Monitoring of groundwater quality needs to be strengthened for parameters from pollution point of view.

The Central Pollution Control Board has classified water resources and designated best uses or setting water quality objectives for different water bodies. The water quality criteria for various uses of fresh water based on designated uses is given in Table 6.1.

Table 6.1 Water Quality Criteria for Various uses of Fresh Water based on Designated Best Use

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	1. Total Coliforms Organism MPN/100ml shall be 50 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 6mg/l or more 4. Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Outdoor bathing (Organized)	B	1. Total Coliforms Organism MPN/100ml shall be 500 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 5mg/l or more 4. Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	1. Total Coliforms Organism MPN/100ml shall be 5000 or less 2. pH between 6.5 to 8.5 3. Dissolved Oxygen 4mg/l or more 4. Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Propagation of Wild life and Fisheries	D	1. pH between 6.5 to 8.5 2. Dissolved Oxygen 4mg/l or more 3. Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	1. pH between 6.0 to 8.5 2. Electrical Conductivity at 25°C micro mhos/cm Max.2250 3. Sodium absorption Ratio Max. 26 4. Boron Max. 2mg/l
	Below-E	Not Meeting A, B, C, D & E Criteria

Source: Central Pollution Control Board, MOEFCC, Government of India

6.4 Monitoring of Water Quality in Major Rivers in NCR

Central Pollution Control Board started national water quality monitoring in 1978 under Global Environmental Monitoring System (GEMS), Water Programme. Monitoring Programme was started with 24 surface water and 11 groundwater stations. Parallel to GEMS, a National Programme of Monitoring of Indian National Aquatic Resources (MINARS), was started in 1984, with a total of 113 stations spread over 10 river basins. The present network comprises of 870 stations on rivers, lentic water bodies and subsurface waters. Central Pollution Control Board monitors the pollution level in the rivers Ganga and Yamuna. In NCR samples are collected at

Garhmukteshwar & Narora from Ganga River and at Kalanaur, Sonepat, Palla, Nizamuddin Bridge from Yamuna River and from Agra Canal.

6.5 Condition of Major Rivers in NCR

In NCR, there are two perennial rivers Ganga and Yamuna. Due to diversion of water to various canals for irrigation purposes, the flow in the rivers has decreased. In addition to this, the drainage channels carrying untreated sewage ultimately discharge into these rivers. Due to insufficient flow in the rivers, it gets polluted and unusable for a long distance on the down streamside. In addition to above there are several industries which discharge their polluted water into the rivers.

6.5.1 Ganga River

Ganga River originated from Gangotri covers a length of about 2,525 km with a basin area of 8, 62,000 sq. km is the largest river basin of the country. The annual average rainfall in the basin varies from 39 cm. to 200 cm. with an average of 110 cm. About 80% of the rainfall occurs during the monsoon months i.e. from June to October. Due to large temporal variations in precipitation over the year, there is wide fluctuation in the flow characteristics of the river. Numerous cities located in the Ganga basin generate and discharge huge quantities of wastewater, a large portion of which eventually reaches the river through natural drainage system. Ganga River forms the eastern most boundary of the NCR and flows southerly directions for the entire length area. Before reaching NCR, Ganga River flows through the main towns of Rishikesh, Hardwar and Bijnor. Ganga River in NCR .The pollution level is monitored at two locations in NCR i.e. Garhmukteshwar and Narora. Water quality data in respect of Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) (five days) for river Ganga at Garhmukteshwar is given in Table no.6.2.

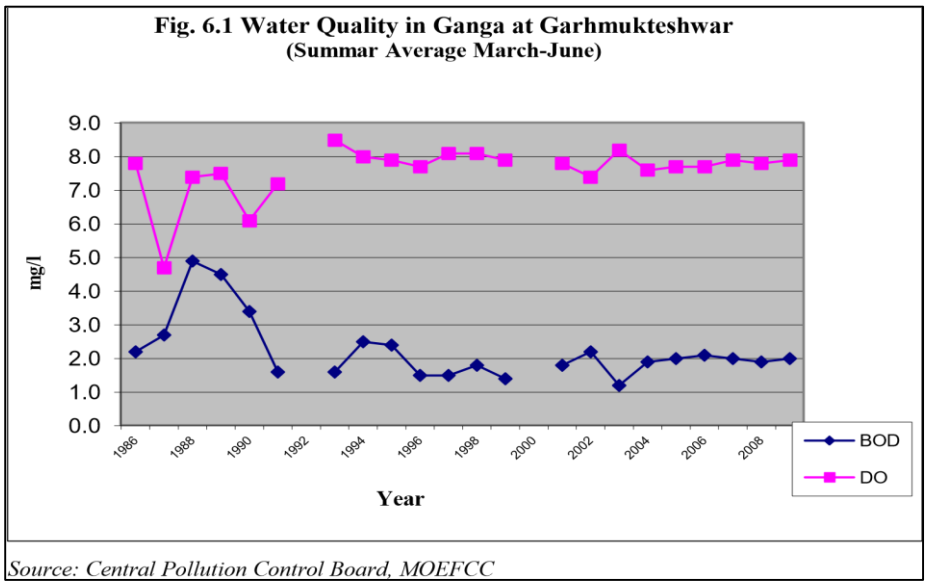
Table 6.2 Water Quality Data for River Ganga at Garhmukteshwar

Summer Average March-June			
Sl. No	**Year**	**Dissolved Oxygen (mg/L)**	**Biochemical Oxygen Demand (mg/L)**
1	1986	7.8	2.2
2	1987	4.7	2.7
3	1988	7.4	4.9
4	1989	7.5	4.5
5	1990	6.1	3.4
6	1991	7.2	1.6
7	1992	-	-
8	1993	8.5	1.6
9	1994	8.0	2.5
10	1995	7.9	2.4
11	1996	7.7	1.5
12	1997	8.1	1.5
13	1998	8.1	1.8

14	1999	7.9	1.4
15	2001	7.8	1.8
16	2002	7.4	2.2
17	2003	8.2	1.2
18	2004	7.6	1.9
19	2005	7.7	2.0
20	2006	7.7	2.1
21	2007	7.9	2.0
22	2008	7.8	1.9
23	2009	7.9	2.0

Source: Central Pollution Control Board, MOEFCC (DO and BOD levels at other location are at Annexure 6.2)

Figure 6-1 Water quality in Ganga at Garmukteshwar (Summer Average March-June)



Source: Central Pollution Control Board, MOEFCC

It is observed from the above table that the BOD level was 4.9 mg/l (above acceptable limits) in 1988 which dipped to 4.5 and 3.4 in year 1989 and 1990 respectively. After 1990, the BOD level remained consistently within acceptable limits. In the case of DO, it remained within acceptable limits consistently after 1988 (Table-6.2 and Fig.6.1). The data available at web site of UP Pollution Control Board indicates water of Ganga River is of category D i.e. fit for propagation of wild life and fisheries. The water is not fit for outdoor bathing or to be used as drinking water source after conventional treatment and disinfections (Annexure 6.1. In NCR though the DO and BOD are within permissible limits, but even these parameters indicate highly polluted situation on the downstream of Kanpur beyond NCR.

The river is polluted not only due to discharge of urban wastewater and pollutants but also discharge of industrial wastes and leakage of industrial pollutants into the river/water courses directly. The State Pollution Control Board at the state level and the Central Pollution Control Board, Ministry of Environment, Forests and Climate Change at the central Government level monitors the pollution in the Rivers. As per data available on the website of Ministry of Environment, Forests and Climate Change, in January, 2010 there are 481 Grossly Polluting Industries in Ganga basin having BOD load of 100kg/day or more. The data indicates that

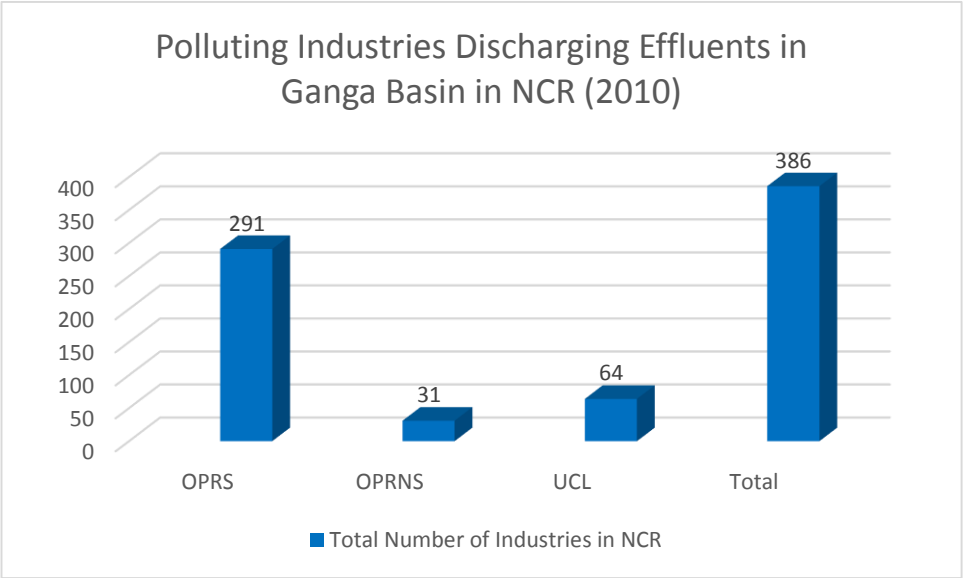
353 units (73 %) are operating satisfactorily 53 (11%) units are not operating satisfactorily and 75 units (16%) have been closed down. Of the 481 polluting industries, 386 polluting industries located in the river basins of Ganga, Yamuna, Hindon and Kali which are flowing through the NCR. The data indicates that 291 units (75 %) are operating satisfactorily 31 (8 %) units are not operating satisfactorily and 64 units (17 %) have been closed down. The Grossly Polluting Industries having BOD load of 100kg/day or more in Ganga Basin in NCR (January, 2010) given in Table 6.3 and Figure 6.2.

Table 6.3 No. of Grossly Polluting Industries Discharging Effluents in Ganga Basin in NCR (2010)

Sl. No.	Rivers	OPRS	OPRNS	UCL	Total
1	Ganga	96	21	38	155
2	Hindon	25	1	4	30
3	Kali	45	0	10	55
4	Yamuna	125	9	12	146
	Total	**291**	**31**	**64**	**386**

Legend
OPRS: ETP operating satisfactorily
OPRNS: ETP not operating satisfactorily
UCL: Unit closed

Figure 6-2 Total Number of Polluting Industries Discharging Effluents in Ganga Basin in NCR (2010)



6.5.2 Yamuna River

The Yamuna River from its origin near Yamunotri to its confluence with Ganga River at Allahabad is about 1,376 km. is the largest tributary to Ganga River and it accounts to about 40% of Ganga basin. The total basin area of the river is 3,66,223 km^2 which covers part of geographical area in the states of Uttaranchal, Uttar Pradesh, Himachal Pradesh, Haryana, NCT Delhi, Rajasthan and Madhya Pradesh. 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 it gets segregated into four independent segments due to the presence of three barrages from where almost the entire river water is being diverted for various human needs. The main cities and towns located along the Yamuna river are, Hathinkhurd and ,Yamuna Nagar upstream ,Panipat, Sonepat, Bagpat ,Delhi, Noida, Greater Noida, Faridabad, Ballabgarh, Palwal within NCR and Mathura,Agra Etawah and Hamirpur Allahabad downstream. Water quality of river Yamuna is regularly monitored by CPCB at 22 locations covering entire stretch.

The DO and BOD levels are within acceptable limits up to NCT Delhi border. In fact, the condition of river Yamuna deteriorated due to abstraction of significant quantity of river water at Wazirabad Barrage, leaving almost no fresh water in the river, which is essential to maintain the assimilation capacity of the river.

Table 6.4 Water Quality of River Yamuna at Palla

S. No	Year	DO(mg/L) Acceptable >5 mg/L	BOD(mg/L) Acceptable < 3 mg/L
1	1996	13.95	6.00
2	1997	11.15	4.50
3	1998	8.40	1.00
4	1999	7.30	1.70
5	2000	8.67	1.50
6	2001	7.80	1.50
7	2002	7.50	3.30
8	2003	7.50	1.50
9	2004	8.00	1.70
10	2005	8.20	2.00
11	2006	8.00	4.80
12	2007	9.40	5.25
13	2008	8.30	1.30
14	2009	7.10	2.50

Fig. 6.2 Water Quality of Yamuna at Palla

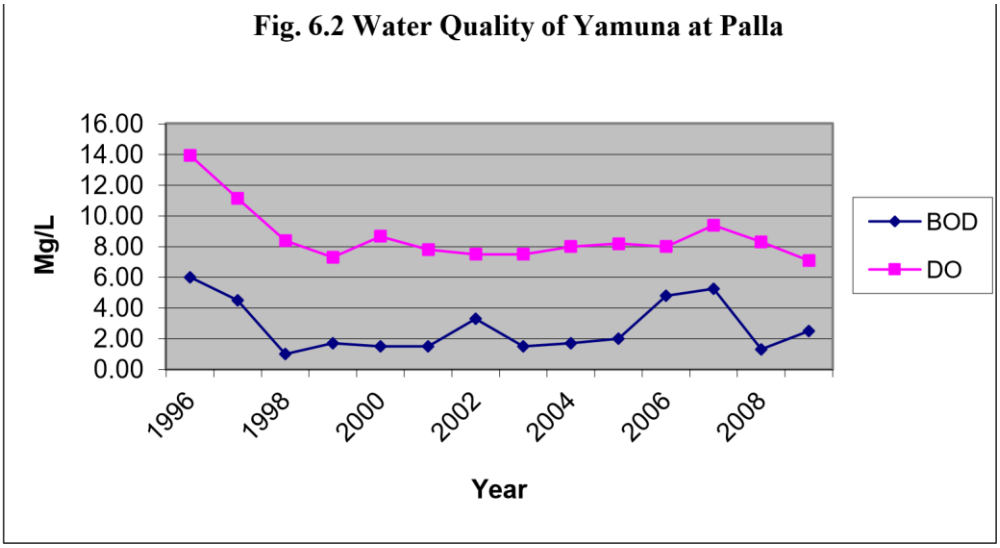
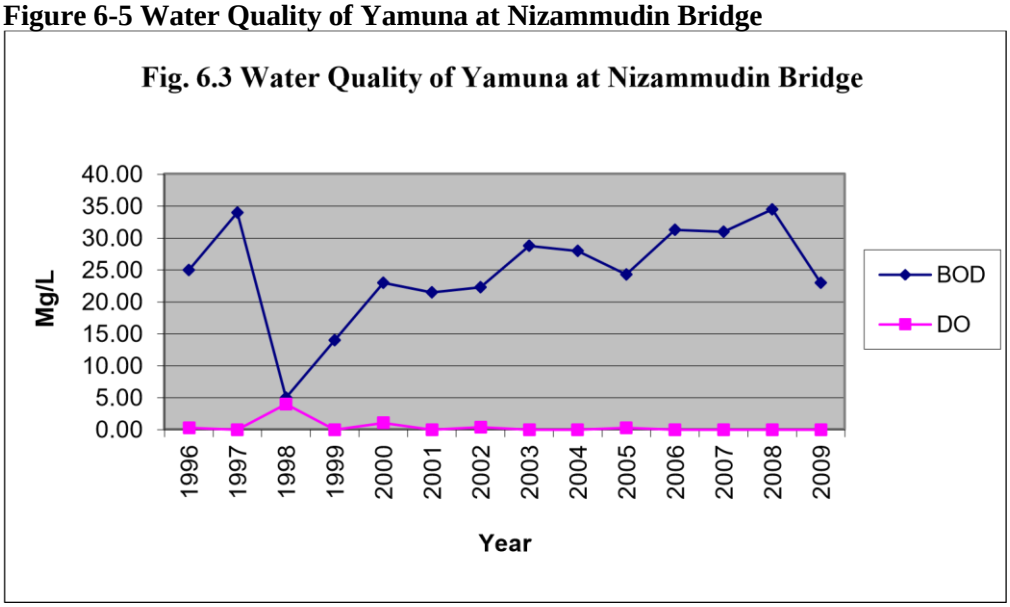


Table 6.5 Water Quality of River Yamuna at Nizamuddin Bridge

Summer Average March-June

Sl. No	Year	DO (mg/L) Acceptable>5 mg/L	BOD (mg/L) Acceptable<3 mg/L
1	1996	0.30	25.00
2	1997	0.00	34.00
3	1998	4.00	5.00
4	1999	0.00	14.00
5	2000	1.03	23.00
6	2001	0.00	21.50
7	2002	0.40	22.30
8	2003	0.00	28.80
9	2004	0.00	28.00
10	2005	0.30	24.30
11	2006	0.00	31.30
12	2007	0.00	31.00
13	2008	0.00	34.50
14	2009	0.00	23.00

Figure 6-5 Water Quality of Yamuna at Nizammudin Bridge



It is important to note that downstream to Tajewala Barrage there is no water in Yamuna river. The minimum quantity of water as per the water distribution agreement is not flowing in the river. Whatever water flowing in the river at some locations is due to drain water joining the river. The water of these polluted drains is inadequate to maintain the flow in the river. After flowing for a few kilometres in the river water percolates into the ground and the riverbed becomes dry. The polluted water percolating into the ground could cause irreversible pollution of ground water.

There are 22 major drains carrying polluted water to the river Yamuna Delhi. The list of existing drain along with the BOD load being discharged into the river is given in Table 6.6

Table 6.6 BOD Load Contribution to River Yamuna by different Drains in Delhi

Sl. No	Drain	BOD load			%age BOD contribution
		Min	Max	average	
1	Najafgarh Drain	64.60	459.53	121.57	32.99
2	Shahdara Drain	27.75	203.40	64.71	17.56
3	Sarita Vihar Drain	7.74	86.86	39.93	10.83
4	Sen Nursing Home Drain	8.50	66.65	28.17	7.64
5	Maharani Bagh Drain	8.75	60.51	23.99	6.51
6	Drain No. 14	3.70	44.39	21.41	5.81
7	Drain Near Sarita Vihar Bridge	7.18	56.60	17.25	4.68
8	Barapulla Drain	0.06	103.20	14.30	3.88
9	Civil Mill Drain	3.55	28.00	12.89	3.50
10	Delhi Gate Drain	4.58	25.41	10.61	2.88
11	ISBT Drain	0.85	9.34	3.42	0.93
12	Drain at LPG Bottling Plant	0.32	6.29	2.33	0.63
13	Magazine Road Drain	0.36	3.93	1.61	0.44
14	Tonga Stand Drain	0.25	8.16	1.50	0.41
15	Tehkhand Drain	0.38	2.77	1.43	0.39
16	Sweepers Colony Drain	0.07	1.76	0.73	0.20
17	Tuglakabad Drain	0.23	1.71	0.68	0.18
18	Drain No. 12 A	0.17	3.19	0.63	0.17
19	Metcalf House Drain	0.19	1.95	0.54	0.15
20	Kalkaji Drain	0.05	1.71	0.49	0.13
21	Khyber Pass Drain	0.03	1.05	0.25	0.07
22	Moat Drain	0.03	0.26	0.10	0.03
	Total	**139.34**	**1176.67**	**368.54**	**100.00**

Source: Central Pollution Control Board Annual Report, 2001-02

A comparison of water quality data (BOD and DO) at Palla village (Table 6.4 and Fg,6.2) located upstream of Wazirabad Barrage and that of at Nizummuddin Barrage downstream (Table 6.5 and Fig.6.3) clearly indicates that pollution is added in Delhi. BOD at Palla recorded 2.5 which is well within acceptable limit of 3 mg/l**)** while at Nizummuddin Bridge it is 23 i.e. more than nine times. In the case of DO, it consistently recorded zero since 2006 which is much lower than the acceptable limit of 5 mg/l.. (Fig.6.3) .The Total Coliform level (Fig. 6.5) exceeds acceptable limits sometimes even in Yamunotri. Delhi Pollution Control Committee (DPCC,) Government of NCT- Delhi also monitors water quality of Yamuna

River. Water Quality Status Report March,2015, given at Annexure 6.2 indicate that highest BOD (62 mg/l recorded at Khajori Paltoon pool (38 mg/l) downstream Najafgarh drain followed by Kudesia Ghat (45 mg/l) and after meeting Shahdara drain downstream Okhla Barrage also establishes the same the fact.

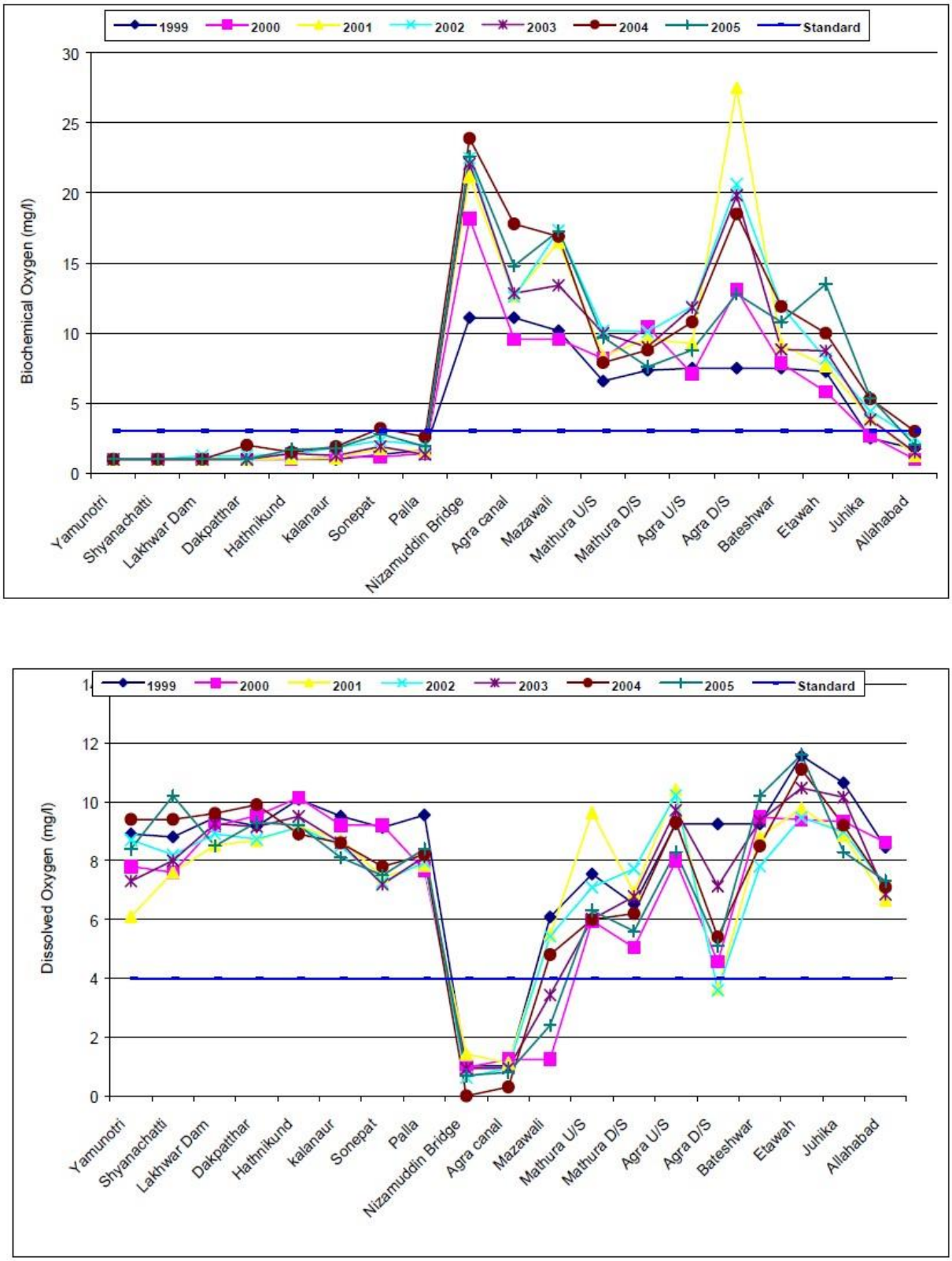
Yamuna River receives about 84 percent of the total BOD load through major drains and rest through canals. About 90 percent of the total discharge joins the river through these drains and rest to canals. Najafgarh and Shahdara drains continue to remain highest contributors to BOD load and discharge. These two drains contribute about 66 percent of BOD load and about 72 percent of total discharge. DPCC, Government of NCT- Delhi also monitors water quality of drain in Delhi. The water quality status of drains out falling Yamuna River as of April,, 2015 given at Annexure-6.3 also indicates the same fact.

6.5.3 Monitoring of Sewage Treatment Plants in NCR

CPCB monitors the performance of Sewage Treatment Plants (STP) of NCR. Sewage Treatment Plants in Delhi have the total installed capacity of 2,305 MLD whereas utilization capacity is 1,252 MLD i.e. 53%. Performance Evaluation Analytical results of various STPs in Delhi are given at Annexure 6.4 It is evident from the data that with respect to BOD, STPs at Vasant Kunj Phase-I and Okhla Phase I to IV do not meet the General Standards for Discharge of Environmental Pollutants into inland surface, public sewers, land for irrigation, marine coastal areas under Schedule-VI of The environment (Protection) Rules, 1986, while STPs at Okhla Phase–II do not meet the General Standards for COD. DPCC, GNCT-Delhi monitors the operation of 13 Common Effluent Treatment Plant (CETP) regularly. The details of the CETP wise Analysis Reports pertaining to February/March, 2015 are at Annexure-6.4.

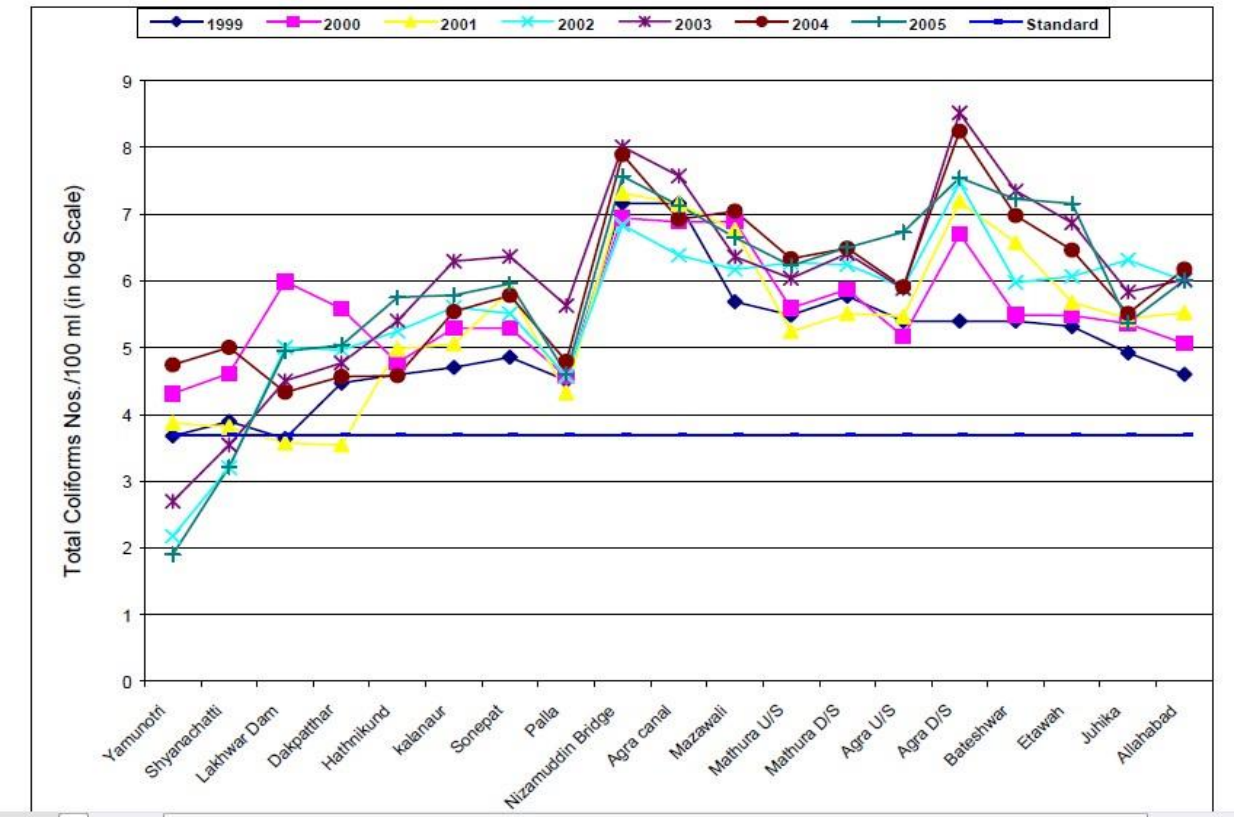
CPCB monitored the status of performance of 10 STPs in Sonepat, Panipat, Faridabad and Ballabgarh in Haryana Sub-region and Ghaziabad & Noida, in UP Sub-region of NCR. Analytical results of these STPs given at Annexure6.5 indicates that in respect to BOD ,two STPs at Panipat, Faridabad- Mirzapur, Ballabgarh, Indirapuram and Vijay Nagar do not meet the General Standards for Discharge of Environmental Pollutants into inland surface, public Sewers, land for irrigation, marine coastal areas under Schedule-VI of The Environment (Protection) Rules, 1986. The STPs at Sonepat, Panipat, Jattal Road and Ballabgarh do not meet COD Standards.

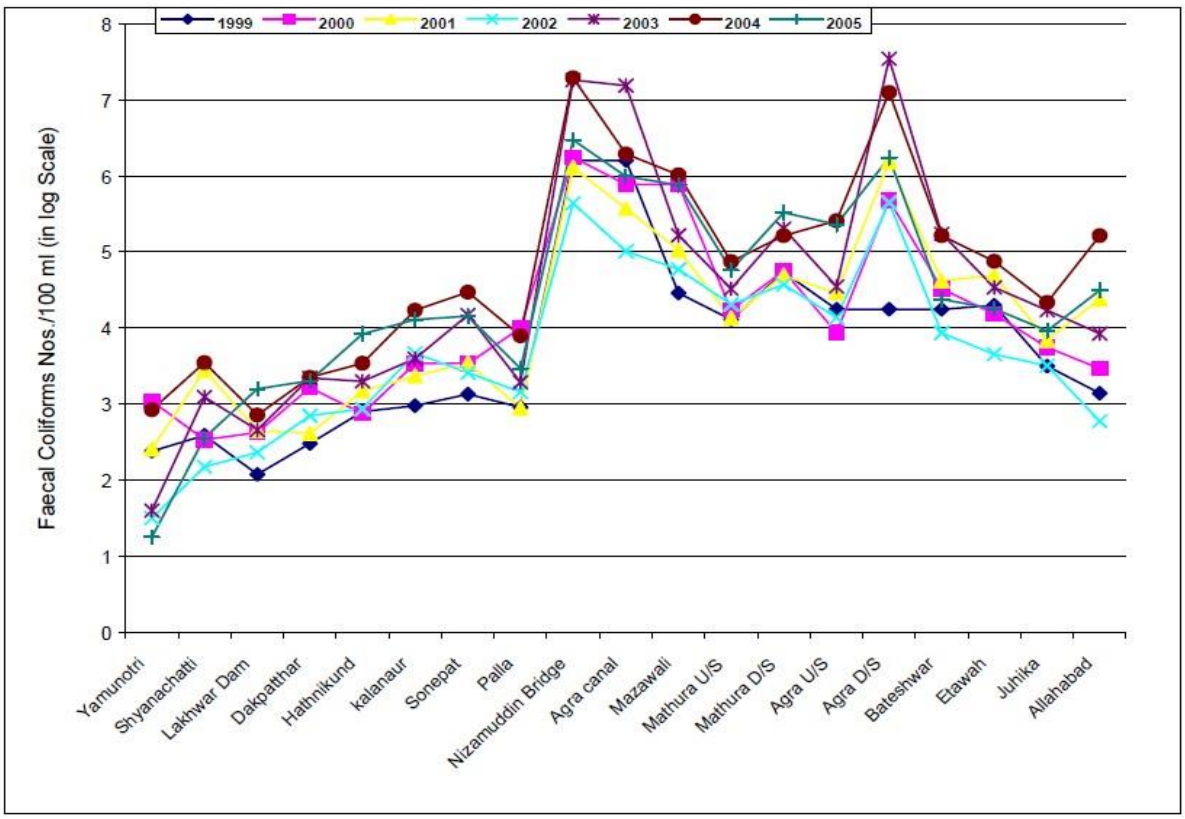
Figure 6-6 Longitudinal Profile of BOD and DO in Yamuna



Source: Report on Water Quality Status of Yamuna River 1999-2005, Central Pollution Control Board MOEFCC

Figure 6-7 Longitudinal Profile of Total and Faecal Coliform in Yamuna River





Source: Report on Water Quality Status of Yamuna River 1999-2005, Central Pollution Control Board, MOEFCC

The desired and existing Water Quality Levels at Various Sampling Station in water bodies of UP – 2010 given in Table 6.7 shows that existing category in respect of river Ganga, Hindon and

Yamuna is B i.e. the best designated use is out door bathing whereas the existing category in all these rivers is below the desired category. This warrants an urgent need for necessary action for strict control of pollution in these rivers.

Table 6.7 Desired and Existing Water Quality Levels at Various Sampling Station in Water Bodies of UP – 2010

Name of river/sampling location	Desired Category	Existing Category	Pollution Characteristics
River Ganga			
Ganga Rajghat D/s Narora	B	C	T. Coliform
Ganga D/s Garhmukteswar	B	D	T. Coliform
Bulandshahr	B	C	T. Coliform
Hindon River			
Ghaziabad D/s Kuleshra Bridge	B	E	BOD, T. Coliform, Ammonia
Kali River			
Downstream of Modinagar to confluence with Ganga	C	Partly D/E	DO, BOD, Coliforms
Yamuna River			
At Nizammudin Bridge*	B	E	DO, BOD, Coliforms

Source: http://www.uppcb.com/river quality.htm