

Chapter 4

Sewerage Management

All sewage generated in the NCT of Delhi ultimately finds its way into the river (whether treated or untreated). However, the Board did not have reliable figures of water usage and sewage generation in Delhi to address the problem of pollution in River Yamuna effectively. Treated effluent from 25 out of 35 STPs did not meet the norms prescribed by DPCC. The Biological Treatment Process at the STP continued to deteriorate, despite intimations from the quality control wing resulting in poor quality of treated effluent and bad odour in and around the plants of DJB. 74 per cent of the treated effluent was not fit for reuse.

DJB is responsible for sewage disposal and drainage within NCT of Delhi and for matters connected therewith. All sewage generated in the NCT of Delhi ultimately finds its way into river Yamuna (whether treated or untreated). As per Delhi Pollution Control Committee (DPCC) report (March 2022), the BOD¹ levels in river Yamuna were up to 70 mg/l i.e. 23 times, and FC² levels as high as 6300000 MPN i.e. 12,600 times higher than the recommended criteria of Central Pollution Control Board (CPCB). These data clearly shows the high levels of pollution in the Yamuna.

This chapter reports on the sewerage system of Delhi including sewer generation, collection, conveyance, treatment and disposal during the period 2017-18 to 2021-22.

4.1 Anomalies in the estimation of sewage generated in Delhi

As per DPCC report, the total water flow (both treated water and untreated sewage) to Yamuna (March 2022) from Delhi through the untapped drains, STPs and CETPs is given in **Table 4.1**.

Table 4.1: Total water-flow to Yamuna River from Delhi

Drains ➔	Qudsia Bagh+ Morigate Drain	Barapulah Drain	Maharani Bagh Drain	Najafgarh Drain	Shahdara Drain	STP outfall	CETP outfall	Total
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Flow (MGD)	9.51	14.5	4.43	201	105	545	12.78	892.22

Source: DPCC Report (March 2022)

It can be seen from **Table 4.1** that STPs in Delhi treated 545 MGD (Col. g) of sewage and Common Effluent Treatment Plants (CETP) in Delhi treated 12.78 MGD (Col. h) of industrial effluent. As per the report, discharge from Najafgarh drain and Shahdara drain of 306 MGD includes 155 MGD raw sewage received from Haryana and U.P. Besides, several other smaller drains deposit sewage generated within the city into the River Yamuna.

¹ BOD-Biochemical Oxygen Demand.

² FC- Faecal coliform.

However, as per DJB, 742.81 MGD (2021-22) of potable water reaches the residents. Sewage water is estimated at 80 *per cent* of the supplied water and thus the estimate of waste water generated by this method gives 594.25 MGD of sewage generated in Delhi. Thus, there is a clear gap of 142.97 MGD³ in the sewage/waste-water generation estimates of DJB and that of DPCC.

Given the multiplicity of data, Audit is of the opinion that unless DJB works to arrive at realistic figures of sewage generated in Delhi, a concrete and effective plan for its treatment would elude any remediation.

During the Exit Conference, DJB submitted that the flow measurements of various drains by DPCC were not accurate and all the flow was being captured before falling into River Yamuna.

However, in case DJB differs from the DPCC estimates, they need to take up the issue of reconciliation of data by the involved agencies’ so as to have a coherent data set, a sine qua non for effective planning.

The matter was referred to the Government in July 2023, reply was awaited (April 2025).

Recommendation 8: Government should ensure the availability of realistic data on sewage generation based on scientific methods to enable effective management of sewerage and reduce dependency on other agencies.

4.2 Collection and conveyance of sewage generated in Delhi

Delhi Jal Board has a network of branching peripheral sewers (Main and Sub-Main sewers) of about 9000 km. Also, there is a 200 km network of trunk sewers.

DJB had finalized the Sewage Master Plan- 2031 (SMP) in June 2014. As per the SMP, the sewerage infrastructure in Delhi was to be improved in four phases according to the estimated sewage generation. For providing sewerage facilities in unsewered areas, DJB had formulated 93 schemes under SMP in four phases. The Phase-1 cover the period up to 2016, Phase-2 covers the period 2016-21, Phase-3 covers 2022-27 and Phase-4, 2027-31. The unsewered areas identified in SMP-2031 mainly consisted of unauthorized colonies (UACs) in Delhi. The estimated volume of the sewage generated from the unsewered areas in Delhi was about 212.59 MGD. Irregularities noticed in the implementation of SMP-2031 are discussed in the Chapter 5 of the report.

4.2.1 Untreated sewage (212.59 MGD) from 1080 colonies flowing into the stormwater drains in Delhi

Section 24 of The Water (Prevention and Control of Pollution) Act, 1974 prohibits the disposal of untreated sewage into stormwater drains/ water bodies. The unsewered areas identified in SMP-2031 mainly consisted of unauthorized colonies (UACs) in Delhi. As per the Economic Survey of Delhi 2021-22, of the

³ Gap= Total flow of water as per DPCC report – (sewage generation from Delhi + sewage from other states) i.e. 892.22-(594.25 + 155) = 142.97 MGD.

estimated volume of the sewage generated from the unsewered areas in Delhi, 28 per cent (212.59 MGD) originated from the 1080 UACs which did not have sewer connection and was flowing through storm water drains (**Annexure 4.1**).

In its reply, DJB admitted (February 2023) that the quantum of untreated sewage in Delhi is 238 MGD and also outlined various efforts being made to trap the untreated sewage by construction of new STPs/DSTPs and trapping of sewage from drains. It also intimated that as on February 2023 sewer lines are functional in 747 UACs. However, no documents were provided in support of the assertions.

4.3 Treatment and disposal of sewage

The sewerage treatment infrastructure of DJB as on 31 March 2022 is given in the **Table 4.2**.

Table 4.2: Sewerage Infrastructure in Delhi

No. of STPs	No. of functional STPs	Installed treatment capacity (MGD)	Available capacity ⁴ (MGD)	Utilised capacity ⁵ (MGD)	Length of Sewer Lines (Km)
38	35	697	622	545	9200

Source: Data furnished by DJB

Capacity utilisation of all the 38 STPs as of March, 2022 has been outlined in **Annexure 4.2**

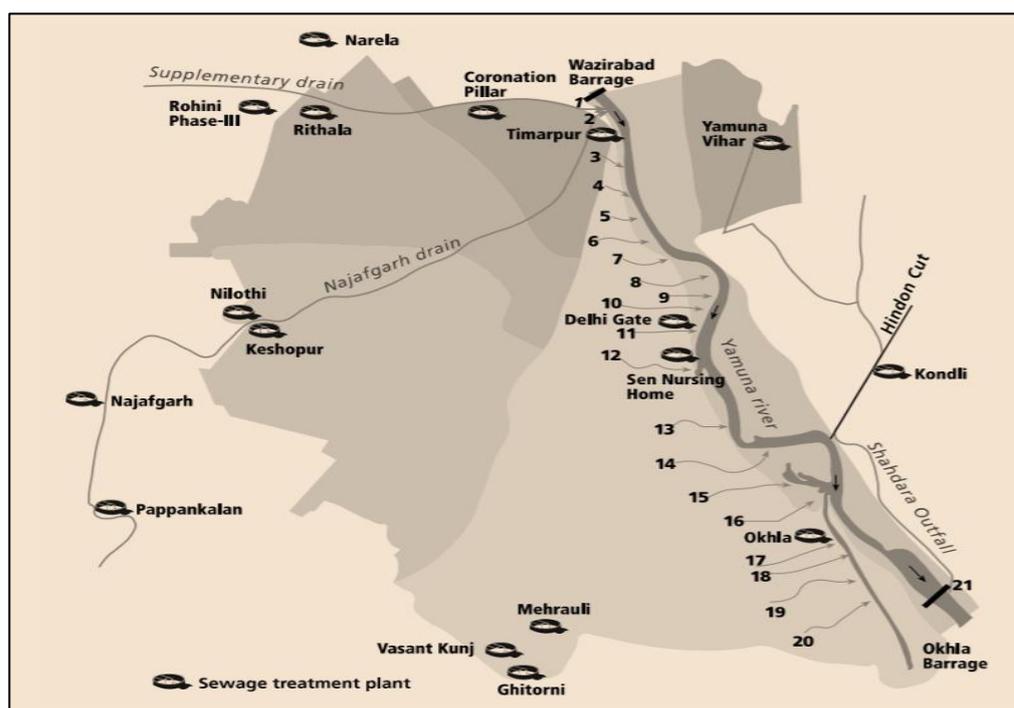
STPs in Delhi mainly use Biological processes for the treatment of sewage, where in Biological organisms are cultured and allowed to consume the organic matter and multiply their population through metabolism. The multiplied organisms are settled out and the clear treated sewage is free from the organic matter. The metabolism can be (a) by aerobic organisms needing oxygen like human beings or (b) by anaerobic organisms that do not need oxygen. The anaerobic digestion is preferred as it yields valuable methane gas, a source of thermal energy used to generate electricity. The digested remains are referred to as digested sludge and can be disposed off as soil filler.

The position of STPs along with major drains out-falling into river Yamuna is depicted in **Figure 4.1**.

⁴ Three STPs of total capacity 75 MGD were under rehabilitation (01/2024).

⁵ Based on availability of sewage.

Figure 4.1: Location of STPs and drains



Source: Internet

National Green Tribunal (NGT) vide its order dated 20 September 2018 directed GNCTD to restore Yamuna waters to at least bathing standards. Deficiencies in the treatment and disposal of sewage are discussed in the succeeding paragraphs.

4.3.1 No new STP constructed out of 56 STPs proposed under SMP-2031

As per the SMP 2031, the projected sewage generation of Delhi in 2021 was 863.4 MGD and sewage treatment capacity was to be augmented accordingly. For this purpose, 32 STPs with treatment capacity of 118.9 MGD were planned to be constructed by 2021 which were later revised to 56 STPs.

Audit noted that though the period of Phase- II (2017-21) of SMP has ended in 2021, not a single new STP against the proposed 56 STPs were constructed (June 2023). DJB did not furnish a reply to the audit observation.

During the Exit Conference, DJB stated that lack of progress was mainly because of unavailability of land.

4.3.2 Operation of 25 Sewage Treatment Plants in violation of CPCB/DPCC norms

Delhi Pollution Control Committee (DPCC) using its powers under the Water (Prevention and Control of Pollution) Act, 1974 revised (April 2016) the standards for treated effluent of sewage treatment plants to BOD/TSS⁶ to 10/10 mg/l for discharge in water sources as well as for land disposal.

⁶ The Biochemical Oxygen Demand (BOD) of 3 mg/l or less of the water ensures reasonable freedom from oxygen demanding pollutants and prevent production of obnoxious gases. TSS stands for Total Suspended Solids in the treated water.

The deadline for the achievement of the standards for existing STPs was within two years i.e. by April 2018.

Audit observed that out of the 35 functional STPs of DJB (as on March 2022), only 10 STPs are designed as per the parameters prescribed by DPCC and the remaining 25 STPs still have design parameters for the BOD/TSS levels in excess of 10/10 mg/l, a violation of the established norms.

Thus, the objective of restoring the Yamuna waters to bathing standards could not be achieved as under-treated effluent was continuing to be discharged into the river.

In its reply, DJB stated (January 2023) that the remaining STPs were in various phases of upgradation.

4.3.3 Absence of mechanism to monitor Faecal Coliform (FC) bacteria levels in the treated effluent

As per the primary water quality criteria for bathing water, FC levels of < 500 MPN/100 ml are required to ensure low sewage contamination.

During joint physical inspections of 22 STPs (April – December 2022), the Audit noticed that DJB was not monitoring the levels of FC in the treated effluent emanating from STPs. DJB's labs were monitoring Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) only.

This is not only in violation of the orders of Hon'ble NGT but also the Yamuna waters cannot be restored to bathing standards without monitoring the FC levels, as the treated effluent ultimately finds its way into the river.

In its reply (December 2023), DJB stated that monitoring of FC level in treated effluent is being done at Okhla, Yamuna Vihar and Keshopur STPs. In the rest of STPs, it is in process. Audit, however, noticed that regular monitoring of FC level in treated effluent emanating from all STPs' were not being done till December 2023.

4.3.4 Major irregularities in O & M of Kondli STP

The work of 45 MGD STP at Kondli, Delhi on DBO⁷ basis was awarded (May 2008) and the Operation and Maintenance (O&M) period of the STP started w.e.f. February 2016.

Audit observed the following major irregularities in contract management on the part of DJB as below:

1. No reserve fund was created⁸ as per clause 5.3.3 of Contract Agreement to support the cost of major maintenance, repairs and replacements of STP.

⁷ Design, Build and Operate.

⁸ By setting aside a portion of the periodic fixed payment component.

As a result, the functioning of the plant was badly affected due to lack of regular repair and maintenance by the contractor who cited lack of funds.

2. The plant was allowed to be operated manually in violation of contract provisions which required the O&M of the plant through Programmable Logic Controllers (PLC) based automation system i.e. Supervisory Control and Data Acquisition (SCADA) System (clause.1.2.8 of the CA).

As a result of the above, the Biological Treatment Process at the STP continued to deteriorate, despite intimations from the quality control wing resulting in poor quality of treated effluent and bad odour in and around the plant. The Audit team also observed that diffusers in the aeration tanks were not functioning during Joint Inspection which may lead to anaerobic conditions⁹.



Photo 4.1: Malfunctioning of diffusers in Aeration Tank observed at Kondli STP

Despite residents’ complaints since 2014, the work order for Retrofitting Odour Control Units at the STP was delayed and issued only in August 2021 in compliance to NGT’s orders. DJB paid an amount of ₹ 25 lakh to CPCB on account of penalty imposed by NGT for delay in action. Thus, inactivity on the part of DJB in addressing an issue which was persistent since 2014 resulted in an avoidable payment.

During the Exit Conference, DJB admitted that there were some lapses on the part of DJB and that they were being rectified.

4.4 Irregularities in Septage Management

There are more than 1000 unauthorised colonies in Delhi (February 2023) where sewerage system was not functional, septage is collected in septic tanks. GNCTD notified (12 November 2018) the Delhi Water Board Septage

⁹ Lack of oxygen needed for bacterial growth.

Management Regulations 2018, for regulating collection, transportation and disposal of waste of septic tanks (septage) and for matters connected therewith in NCT of Delhi.

Audit, however, observed the following irregularities in the septage management in violation of the said regulations.

4.4.1 Issue of 272 licenses for collection and transportation of septage in violation of the septage managements regulations

DJB issued 284 licenses (till 5 June 2022) for septage collection, out of which only 12 licensees (four *per cent*) were in compliance with the conditions laid down in the regulations. The rest 272 licensees (96 *per cent*) did not fulfil conditions viz. availability of valid transport permit, trained workers, availability of safety gear etc. and insurance cover for the workers.

Despite lack of compliance, these licensees have been functional for more than three years as provisional licenses for six months were issued and renewed by DJB though there is no provision for provisional licences in the Rules.

During the Exit Conference DJB assured to take necessary action.



Photo 4.2: Licensees disposing of septage at DJB installation without safety gear

4.4.2 Negligible collection of septage through tankers

The estimated volume of the sewage generated from the 1080 unauthorised colonies in Delhi is about 212.59 MGD as on March 2022 whereas the rate of septage collection through tankers was 0.27 MGD (March 2022), which is negligible as compared to the volume of untreated sewage in Delhi. This indicates that the scheme had limited effectiveness and DJB needs to take urgent steps to lay sewers in the unsewered areas to mitigate the problem of untreated sewage finding its way into the water bodies.

4.4.3 Absence of monitoring mechanism

Scrutiny of records revealed that there is no monitoring mechanism to check whether the fee charged by the septage collectors from the residents of the UACs was as per approved rates, whether septage only from the Delhi region was being hauled, whether disposal was at designated locations only etc.

In the absence of any checks, proper implementation of septage management regulations cannot be ensured as is evident from the complaints received from general public against the tanker operators and checks by CPCB teams.

The matter was referred to the Government in July 2023, reply was awaited (April 2025).

4.5 Reuse of treated wastewater/effluent

Wastewater is a water resource identified under the Delhi Water Policy. The major reuse of treated wastewater is for irrigation, horticulture, construction and industrial use. There is demand for use of treated wastewater for cooling in the power stations. Other options include ground water recharge, return to be raw water source, flushing of toilets, use of non-potable purposes like the washing of Railways and Buses, construction etc. Out of the total estimated wastewater of 594 MGD generated in Delhi, DJB produces 545 MGD of treated wastewater out of which, it is bound to return 250 MGD wastewater to River Yamuna under the Upper Yamuna Water Sharing Agreement. Thus, 295 MGD of treated wastewater is available for re-use and against this, DJB supplied a total of 89 MGD treated wastewater to the irrigation department, power plants and CPWD and DDA for horticulture purposes during 2017-18 to 2021-22.

Deficiencies in utilization of wastewater resource are discussed in the succeeding paragraphs.

4.5.1 Non-availability of wastewater conforming to prescribed parameters for reuse

As pointed out in para 4.3.2, out of the 35 functional STPs (utilized treatment capacity - 545 MGD), effluent of 25 STPs did not conform to the prescribed parameters¹⁰ and combined utilized capacity of these non-conforming STPs was 405 MGD. DJB was also not monitoring the Fecal Coliform (FC) levels in the treated effluent (para 4.3.3) which rendered it unfit even for agricultural reuse as per CPHEEO norms¹¹. This meant that 74 *per cent* of the treated wastewater was of inferior quality and not fit for any kind of reuse.

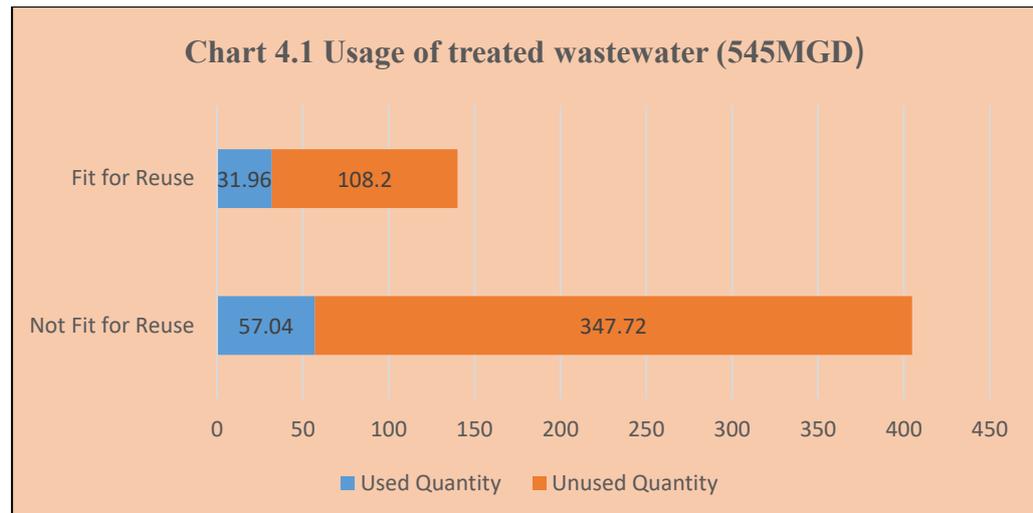
Thus, despite incurring expenditure on treatment of wastewater, 74 *per cent* of the treated effluent was not fit for reuse which not only defeated the purpose of treatment but also led to wasteful expenditure on treatment.

4.5.2 Under-utilization of treated wastewater

The quality parameters of treated effluent produced by 10 STPs were within permissible limit and therefore, could be reused for non-potable usage after chlorination. The quantity of this fit-for-reuse treated effluent was 140 MGD (545-405). Utilisation of effluent, both fit for use and unfit for use, was as shown in **Chart 4.1**.

¹⁰ BOD/TSS values less than or equal to 10/10 mg/l.

¹¹ For agricultural reuse BOD/TSS values upto 20/30 and FC levels upto 230/100 ml were needed.



Source: DJB and Economic Survey

As can be seen from the chart above, even fit-for-reuse treated wastewater supplied by DJB for various purposes was only 32 MGD whereas 108 MGD reusable effluent was returned to Yamuna River through drains.

One of the reasons for inability to re-use / low demand for wastewater could be failure of DJB in making treated wastewater easily available to the intended consumers. Effluent was sold at Seven Rupees *per* Kilo litre from the STPs for non-drinking purposes whereas potable water was supplied by DJB in its own tankers free of cost. Thus, it was easier to get potable water than the treated effluent (which required buying of wastewater from STP and hiring a tanker for its transportation).

4.5.3 Use of treated wastewater in construction activities not mandated

DJB is responsible not only for supply of potable water but also for regulating ground water extraction in NCTD (other than NDMC area). This makes DJB the only agency dealing with the supply of water in Delhi as all the water resources are at its disposal.

As per the National Framework on the Safe Reuse of Treated Water (Ministry of Jal Shakti, Government of India), one of the potential areas of reuse is construction. However, Audit observed that despite having monopoly, DJB has not mandated the use of treated wastewater even for its own construction activities/works, let alone for those of other departments/agencies. It was further observed that despite having sufficient treated wastewater, instead of supplying the same for construction activities, DJB was making reimbursements of water charges to its own contractors (**Para 5.4.5**).

Thus, lack of leadership and direction by DJB on mandatory reuse of wastewater in construction not only resulted in wasting of treated wastewater but also encouraged misuse of potable/ground water.

Best practice- Reuse of Effluent by Pragati Power Corporation Limited (PPCL)

DJB supplied 7.5 MGD treated effluent to PPCL for its power plant at Bawana from Rohini STP. For supplying treated effluent water, DJB constructed effluent pumping station and laid rising main as a deposit work. PPCL also bears the O&M expenses, electricity charges and other recurring expenses of the pumping station. In addition, DJB charges PPCL at the rate of ₹ four per KL for the supplied effluent. This arrangement is an ideal case for DJB, as it generates revenue without incurring any capital expenditure.

DJB may explore such revenue earning avenues from other power companies, MCD, DDA and private companies.