



# Draft SFD Lite Report

## Kanpur India

This SFD Lite Report was prepared by  
Centre for Science and Environment

Date of production: 16/04/2020

# 1 The SFD Graphic

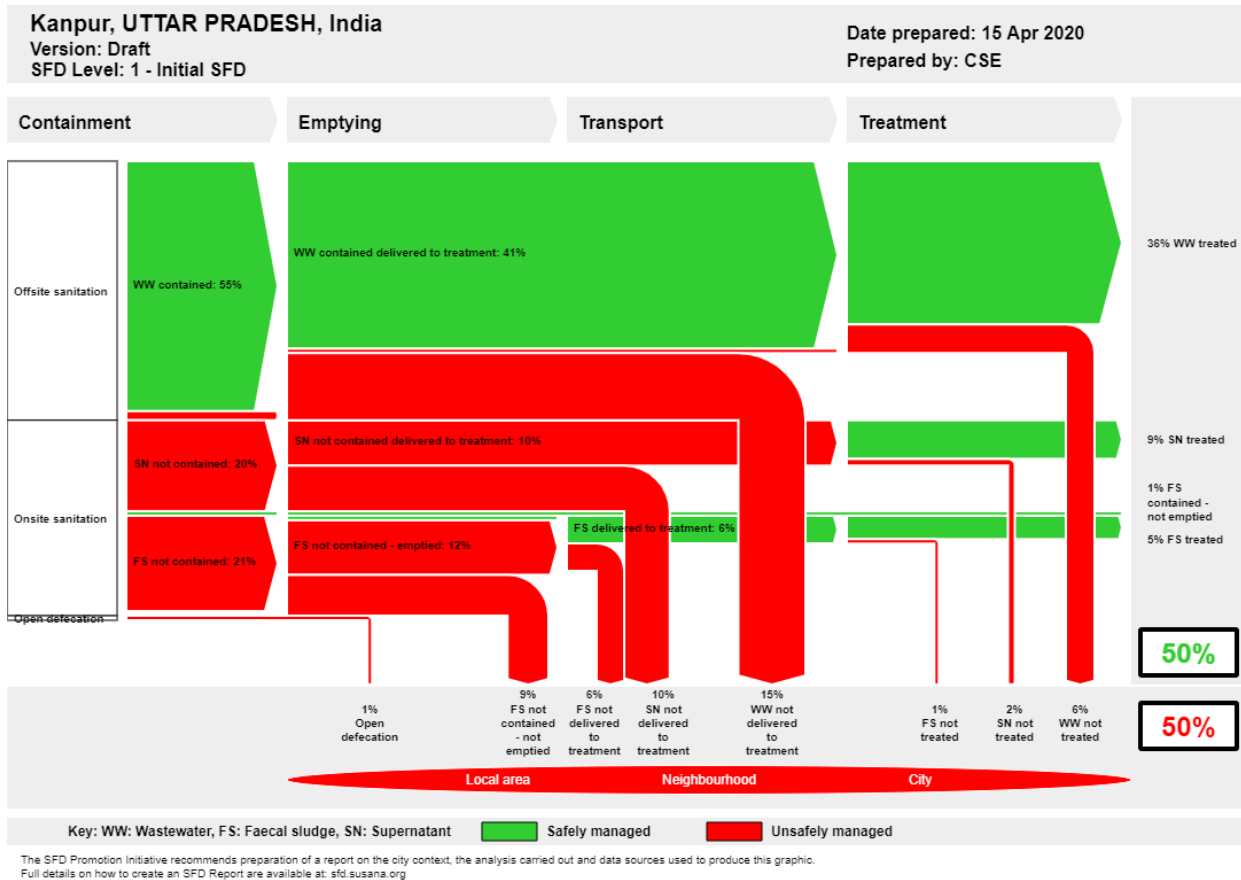


Figure 1: SFD Graphic for Kanpur

# 2 SFD Lite information

**Produced by:**

Centre for Science and Environment (CSE), New Delhi.

**Acknowledgement:**

This report was compiled as part of the SFD Promotion Initiative project funded by Bill and Melinda Gates Foundation (BMGF). We would like to thank Mr. Akshay Tripathi Municipal Commissioner, Arvind Rai and Roli Gupta Additional Municipal Commissioner and Rahul Awasthi Urban Infrastructure Specialist who help in providing secondary data and cooperating in Key Informant Interviews & Focus Group Discussions.

**Collaborating partners:**

- Kanpur Nagar Nigam (Municipal Corporation), Unnao, Uttar Pradesh

**Date of production:** 16/04/2020

### 3 General city information

Kanpur is the biggest city of the state and is the main center of commercial and industrial activities. Formerly it was known as Manchester of India. Now it is the commercial capital of Uttar Pradesh. The city is the divisional headquarter of Kanpur commissionerary consisting of six districts i.e. Kanpur-Nagar, Kanpur-Dehat, Etawah, Aurayia, Farrukhabad and Kannauj. The city is part of Indo Gangetic Plain and lies between 25° 25' N and 25° 54' N latitudes and 79° 34' N and 80° 34' N longitudes. It is situated on the right bank of the Ganga River. The city is famous for its leather and textile Industry. As per statistics released by District Industrial Corporation, Kanpur, the city has over 17444 registered industrial units.

The Urban Local Body (ULB) governing the city is Kanpur Nagar Nigam (KNN). The population of the city is 30,11,693 and total no. of households (HH) is 5,32,665 and is spread across 260 sq.km and is divided into 110 administrative wards as per ULB records 2019. As per the census 2011, the population of the city was 27,65,348 and total no. of households (HH) were 4,86,382. There is no change in the city boundary and area since 2011 census. For this study, only area that falls under Nagar Nigam i.e. Municipal boundary is taken into consideration.

The average annual rainfall is 821.9 mm. Climate is dry-winter humid subtropical climate under the Köppen climate classification. It is characterized by hot summer and pleasant monsoon and cold to mild winter. About 90% of rainfall takes place from June to September. Depth of ground water in pre and post monsoon ranges between 5-10 meters below ground level (mbgl) with fluctuation of 1.5 mbgl during monsoon and 2-5 mbgl respectively.

### 4 Service outcomes

Table 1: SFD matrix for Kanpur (2020)

| Kanpur, UTTAR PRADESH, India, 15 Apr 2020. SFD Level: 1 - Initial SFD  |  |  |  |  |  |   |   |   |   |   |
|--|--|--|--|--|--|---|---|---|---|---|
| Population: 3011693  |  |  |  |  |  |   |   |   |   |   |
| Proportion of tanks: septic tanks: 50%, fully lined tanks: 50%, lined, open bottom tanks: 50%  |  |  |  |  |  |   |   |   |   |   |
| System label   | Pop  | W4a  | W5a  | W4c  | W5c  | F3  | F4  | F5  | S4e   | S5e   |
| <b>System description</b>  | Proportion of population using this type of system | Proportion of wastewater in sewer system, which is delivered to centralised treatment plants | Proportion of wastewater delivered to centralised treatment plants, which is treated | Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants | Proportion of wastewater delivered to treatment plants, which is treated | Proportion of this type of system from which faecal sludge is emptied | Proportion of faecal sludge emptied, which is delivered to treatment plants | Proportion of faecal sludge delivered to treatment plants, which is treated | Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants | Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated |
| <b>T1A1C2</b><br>Toilet discharges directly to a centralised foul/separate sewer   | 55.0   | 75.0   | 85.0   |  |  |   |   |   |   |   |
| <b>T1A1C6</b><br>Toilet discharges directly to open drain or storm sewer   | 2.0  |  |  | 50.0   | 85.0   |   |   |   |   |   |
| <b>T1A2C6</b><br>Septic tank connected to open drain or storm sewer  | 24.0   |  |  |  |  | 60.0  | 50.0  | 85.0  | 50.0  | 85.0  |
| <b>T1A3C6</b><br>Fully lined tank (sealed) connected to an open drain or storm sewer   | 16.0   |  |  |  |  | 60.0  | 50.0  | 85.0  | 50.0  | 85.0  |
| <b>T1A4C10</b><br>Lined tank with impermeable walls and open bottom, no outlet or overflow   | 1.0  |  |  |  |  | 30.0  | 50.0  | 85.0  |   |   |
| <b>T1B11 C7 TO C9</b><br>Open defecation   | 1.0  |  |  |  |  |   |   |   |   |   |
| <b>T2A4C10</b><br>Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution | 1.0  |  |  |  |  | 0.0   | 0.0   | 0.0   |   |   |

Overview on technologies and methods used for different sanitation systems through the sanitation service chain is as follows:

**Containment:**

In Kanpur, 55% of the population is dependent on the offsite sanitation system and 45% of the population depends on onsite sanitation system (OSS). Despite being certified ODF++ in 2019, 1% of the population still lacks access to toilets and defecate in open (OD). This is due to the fact that slum population has not been considered for ODF certification.

Customarily, the population dependent on OSS have constructed either septic tanks (ST) or fully lined tank (FLT) (with outlets), lined tanks with open bottom. Any kind of lined tanks (with outlet) with baffle wall in between (2-3 chamber) connected to toilets are locally called septic tanks irrespective of whether it adheres to the design specifications prescribed by Bureau of Indian Standards (BIS) or not and Lined tank (with outlet) without baffle wall is considered as fully lined tank. As per Focused Group Discussion (FGD) with masons and based on field observation, it was seen that, septic tank was more prominent as compared to fully lined tank. ST and FLT was observed particularly in the area settled nearby like Rawatpur, Anand nagar, Yashodanagar, Monoharnagar, Jajmau, Chadesingh purwa, Naubasta, Jaroli etc. Lined tank with impermeable wall observed particularly in areas of Low-Income Group (LIG). OD can be seen area like Jajmau and in notified slum areas. The size of the containments is usually decided on the basis of space availability and affordability of the households. Due to no standardization being followed while constructing the containment system, few households have constructed their containments large in capacity irrespective of their household size. However, due to low ground water level of city within the concerned study area there is low risk of ground water pollution. However, during monsoon season, the groundwater level rises and increases the chances of contamination.



**Septic Tank**



**Under Construction Sewer System**

**Figure 2: Types of Containment in Kanpur**

There have been 15,000 Individual Household Latrines (IHHL), Community Toilets (CT) with 1292 no of seats and Public Toilets (PT) with 1200 no of seats constructed in Kanpur under the Swachh Bharat Mission.

**Open Defecation:**

As the slum population is not considered in ODF certification that the Kanpur city secured and based on the field observations and subsequent calculations in which we have accounted slum population as well, it is estimated that 1% of the population of Kanpur lacks proper access to toilets and still defecate in open (OD). During household surveys, OD was observed in the outskirts areas of Kanpur Nagar Nigam.

**Emptying:**

Emptying frequency varies widely across the city, depending upon the type of Onsite Sanitation Systems (OSS). Containments, which have outlet, have an emptying frequency ranging from 6-10 year depend upon the size of the tank, whereas system with open bottom increases to 15-20 years.

ULB does not own any vacuum tanker and not has not registered any private desludgers. UP Jal Nigam had registered around 14 private desludgers for emptying faecal sludge at STP in Bingawan. As per KII with private desludger, there are approximately 40 private vacuum tankers operating in the city. The



faecal sludge carrying capacities of these trucks varies between 4000-5000 litres and fee charged by them ranges from INR 500 to 1500 per trip. As per KII with private operator, the depth of septic tank differs with pertinence of location. These private desludgers advertise their contact number by distributing business cards or posters on wall. On an average, private vacuum tank, trips per day varies from 1 to 3, monsoon being the peak season for emptying. On an average, it takes about 1–2 hours for completing one trip depends on the distance covered during the trip.



*Drain emptying at Open ground*



*Containment emptying at open Drain*

**Figure 3: Containments connected to different systems**

**Transportation:**

Wastewater generated from households connected with sewer network is approximately 160 MLD. Out of which only 50% directly reaches the STPs and for the rest 50% wastewater in sewer finally meets open drains/nullahs which are eventually tapped and reached STP. Supernatant generated from containments (Septic tank/Fully lined tank) connected to open drains, is transported through lined open drains. These small drains eventually converge to form big drains. There are around 20 big drains (locally called nullahs) which discharges around 320 MLD of wastewater in the city. Out of the total 20 big drains, 18 drains, with an average flow of 250 MLD, are eventually intercepted and diverted to STP and the rest discharge into Rivers Ganga or in open areas. For effective planning, implementation and maintenance, the UPJN has divided the whole city into four sewerage districts. The transportation efficiency of these sewage networks has been assumed as 85%.

Faecal sludge from the tanks is conveyed through truck/tractor mounted vacuum tankers. The tankers decant the septage at designated site i.e. Bingawan STP notified by the Kanpur Nagar Nigam. However, only 60 % of the septage is decanted at the STP and rest 40% is decanted either at the low-lying area or in the SWD.



*Faecal sludge decanting at Bingawan STP*



*Open Drain*

**Figure 4: Different means of faecal sludge/wastewater conveyance**

**Treatment and End-use/disposal:**

The total wastewater generated in Kanpur Nagar Nigam is ~361 MLD. The wastewater from the sewer network and tapped open drains/nullahs is treated at STPs situated in different parts of the city constructed according to sewerage plan. There are total of 05 STPs in the city with cumulative sewage treatment capacity of 415 MLD, However, based on KIIs and field observations, it was revealed only 330 MLD sewage is being received at the STPs at present.

**Table 2: Sewage Treatment Plant**

|              |                          |
|--------------|--------------------------|
| District I   | 162 MLD JAJMAU(130+5+27) |
| District II  | 210 MLD BINGAWAN         |
| District III | 210 MLD BINGAWAN         |
| District IV  | 43MLD SAJRI              |

Treated sewage from the STPs is discharged into Ganga Rivers. Untreated wastewater flowing in open drains that are not intercepted by the sewerage network flows into River Ganga, without treatment or in open drain. In future, three new STP have been proposed of capacity 43,15 and 30 MLD at Jajmau, Baniyapur and Panka respectively.

Total faecal sludge generated in Kanpur Nagar Nigam is 702 KLD. There is no dedicated faecal sludge treatment plant (FSTP) in Kanpur, but there is a provision of co-treatment of faecal sludge with the wastewater at 210 MLD Bingawan STP as it is the only STP in Kanpur that is functioning at about 70% of its capacity based on the average inlet flow of 150 MLD. As per the private desludgers logbook at STP, the number of trip varies. On an average 10-15 tanker decant the faecal sludge per day. However, during monsoon the number of trips decanting at the STP can increase as high as 40 trips per day.



*Inlet of Bingawan STP*



*UASB reactors*

**Figure 5: Sewage Treatment Facility in Kanpur**

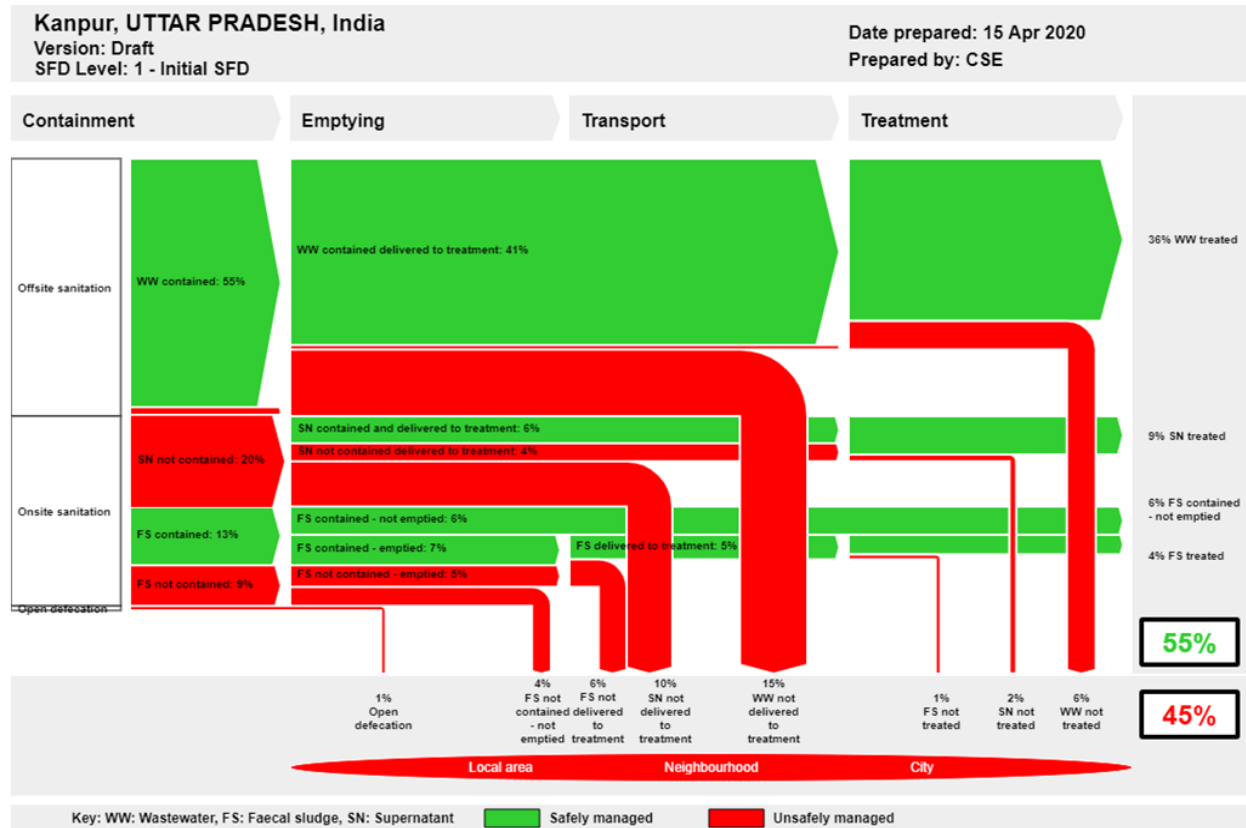
## 5 Data and assumptions

Census 2011 was considered as the baseline and the data for all the stages of sanitation chain were updated based on the data collected from field through KII, FGDs, observations, secondary data collected from relevant stakeholders. Following assumptions were made for developing the SFD.

Assumptions followed for preparing SFDs:

- Volume of wastewater generated is 80% of water supplied.
- 50% of the contents of tanks and pits is Faecal Sludge

## 6 Context adapted SFD graphic



**Figure 6: Context adapted SFD Graphic for Kanpur**

The context adapted SFD is prepared to highlight the difference at the containment stage for correctly designed septic tanks that are connected to open drains.

From the previous assumption that 50% of the proportion of the content of the septic tank is solid FS, rest 50% is supernatant. SN generated from septic tanks connected to open drain is considered as unsafely managed (represented in red). The solid FS collected in the septic tank is considered as contained, as it is neither polluting the ground water nor the solid excreta is overflowing in the open drain. Hence, out of 13% FS contained from septic tanks, 7% FS contained from septic tank is emptied and rest 6% FS remains in the tank which is contained and never emptied.

The context adapted SFD Graphic for Kanpur has FS contained as 13% in containment stage as compared to 0 in SFD generated using graphic generator. FS contained-not emptied is 6% whereas in original SFD Graphic it is 0 and FS contained-emptied is 7% in the Emptying stage. FS delivered to treatment plant is 5% and 85% of it is assumed as treated at the treatment facility. FS not contained-not emptied is 4% as compared to 9%.

Overall, excreta of 55% of the population of Kanpur is safely managed in the context adapted SFD Graphic.

## 7 List of data sources

Below is the list of all data sources and assumption used for the production of the SFD Lite report:

### Reports and literature

- District Census Handbook 2011 for Kanpur (Houses and household amenities and assetstable HH-08: percentage of households by availability of the type of Latrine Facility <http://censusindia.gov.in/DigitalLibrary/MFTableSeries.aspx>
- District Census Handbook 2011 (Population Census Abstract Data Table (India & State/UTs-Town /Village /Ward Level) [http://censusindia.gov.in/2011census/population\\_enumeration.html](http://censusindia.gov.in/2011census/population_enumeration.html)
- IHHL, SBM data, Kanpur, U.P (2018-19).
- Service Level Benchmark under 14<sup>th</sup> Finance Commission, Kanpur, UP (2018-19)
- Groundwater Year Book - Uttar Pradesh (2015-16): Central Ground Water Board, Available at <http://cgwb.gov.in/Regions/GW-year-Books/GWYB-2015-16/GWYB%20NR%202015%20-%202016.pdf>

### Key informant interviews

- KII-1; Akshay Tripathi, Municipal Commissioner, Kanpur Nagar Nigam
- KII-2; Arvind Rai, Additional Commissioner, Kanpur Nagar Nigam
- KII-3; Roli Gupta, Additional Commissioner, Kanpur Nagar Nigam
- KII-4; Rahul Awasthi, Urban Infrastructure Specialist, Kanpur Nagar Nigam
- KII-5; A K Gupta, General Manager, Uttar Pradesh Jal Nigam, Kanpur
- KII-6; Mohd. Ahsan, Project Manager, Uttar Pradesh Jal Nigam, Kanpur
- KII-7; Harsh Vardhan, Computer Operator, Uttar Pradesh Jal Nigam,
- KII-8; Pramod Kumar, Junior Enggnier, Jal Kal Vibhag, Kanpur Nagar Nigam

### Focus group discussions

- FGD-1; Private Desludger
- FGD-2; Masons
- FGD-3; STP Plant Operator

Kanpur, India, 2020

Produced by:

CSE, Sarim Ansari

CSE, Shweta Jaiswal

Editing:

CSE, Dr Suresh Kumar Rohilla

CSE, Rahul Mankotia

### © Copyright

All SFD Promotion Initiative materials are freely available following the open-source concept for capacity development and non-profit use, so long as proper acknowledgement of the source is made when used. Users should always give credit in citations to the original author, source and copyright holder.

This SFD lite report is available from:  
[www.sfd.susana.org](http://www.sfd.susana.org)

### SFD Promotion Initiative

