

Draft SFD Lite Report

Bhagalpur India

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

Date of production/ last update: 13/04/2020

1 The SFD Graphic

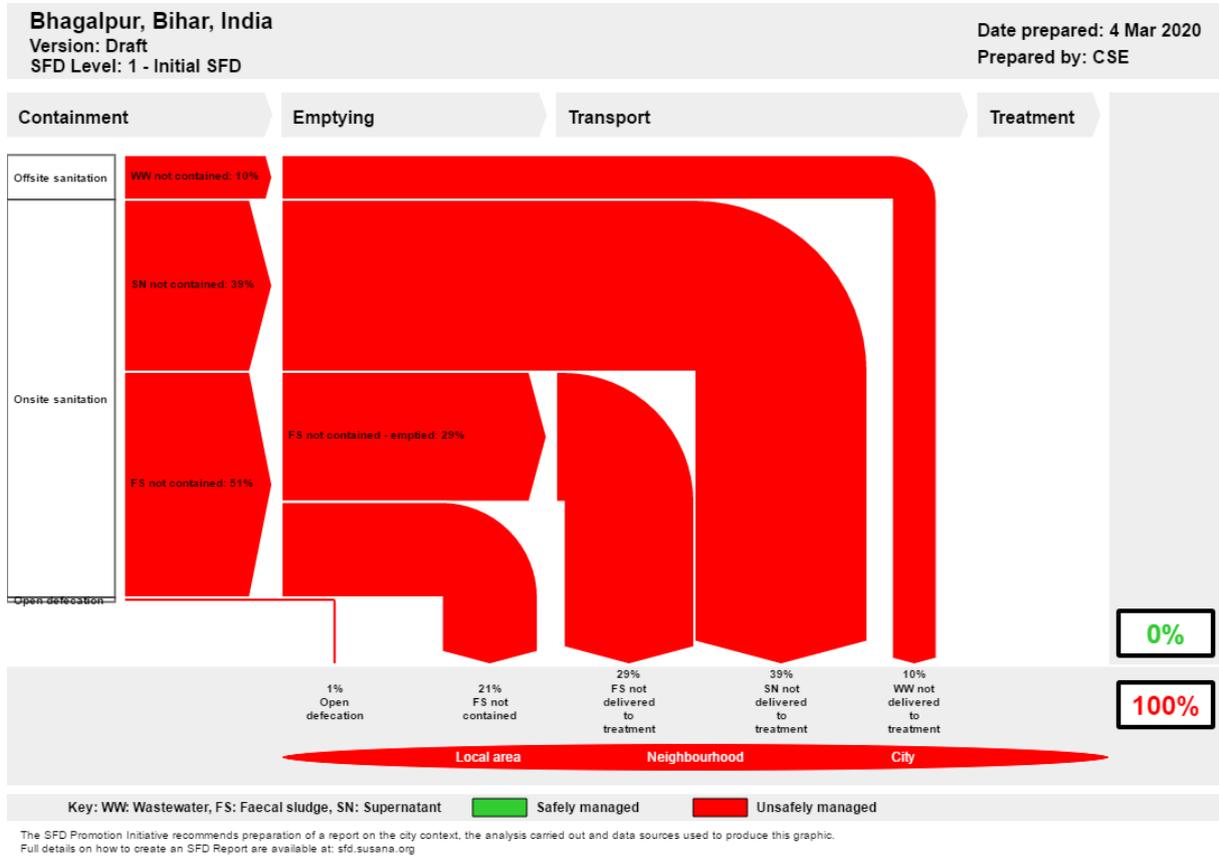


Figure 1: SFD Graphic for Bhagalpur city (CSE 2020)

2 SFD Lite information

Produced by:

- Centre for Science and Environment, New Delhi
- This report was compiled as part of the SFD Promotion Initiative project funded by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). We would like to thank Shri. Satyendra Prasad Verma, Additional Municipal Commissioner; Mr. Raveesh Kumar Kashyap, City Manager; Mr. Satyanarayan, Health Inspector; Mr. Gautam Kumar Shah, Computer operator; Mr. Mohammad Rehan Ahmed; Swasthya Prabhari, Office Incharge; Mr. Krishna Prasad, Engineer for providing all the required secondary data and cooperating for Key Informant Interviews (KIIs) & Focus Group Discussions (FGDs).
- This report would not have been possible without the cooperation of Mr. Jay Prakash, Head of Tax department who helped in researching ground.

Collaborating partners:

- Bhagalpur Nagar Nigam, Bhagalpur, Bihar

Date of production: 13/04/2020

3 General city information

Bhagalpur is a city located on the southern alluvial plains of River Ganga, 220 km east of Patna and 410 km North-West of Kolkata. It is the third-largest urban centre of the state. Bhagalpur city is also the headquarters of Bhagalpur district. The city is divided into 51 wards. As per census 2011, the city's population was 400146, residing in 68193 households. The current population of the city has increased to 470,335 and in turn increases the total number of households to 94065, based on this data the SFD 2020 has been generated¹. The urban local body, Bhagalpur Nagar Nigam (BNN) has an area jurisdiction of 30.17 sq.km.

The city lies on the Indo-Gangetic plains having typical characteristics of flat and alluvial soil. Most parts of the city are flat with slopes near the banks of the river. The soil is mainly loamy and rich in organic content, rejuvenated every year by constant deposition of silt, clay and sand brought by river streams and by floods in Bihar². The temperature in Bhagalpur city during summer rises to 45 degrees and during winters the temperature falls to 5-6 degrees. Bhagalpur has a very high groundwater table between 2-5 meter below ground level³.

Table 1: Population Growth rate Bhagalpur City

Census Year	Population	Growth Rate (%)	Source
1991	253,225	-	Census 1991
2001	340,767	35	Census 2001
2011	400,146	17	Census 2011
2020	470,335	18	Tax Dept., BNN, 2020

4 Service outcomes

Table 2: SFD Matrix for Bhagalpur (CSE 2020)

Bhagalpur, Bihar, India, 4 Mar 2020. SFD Level: 1 - Initial SFD

Population: 470335

Proportion of tanks: septic tanks: 50%, fully lined tanks: 50%, lined, open bottom tanks: 100%

System label	Pop	W4c	W5c	F3	F4	F5	S4e	S5e
System description	Proportion of population using this type of system	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
T1A1C6 User interface discharges directly to open drain or storm sewer	10.0	0.0	0.0					
T1A2C6 Septic tank connected to open drain or storm sewer	32.0			60.0	0.0	0.0	0.0	0.0
T1A3C6 Fully lined tank (sealed) connected to an open drain or storm sewer	45.0			60.0	0.0	0.0	0.0	0.0
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater contamination	10.0			50.0	0.0	0.0		
T1A5C10 Lined pit with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater contamination	2.0			50.0	0.0	0.0		
T1B11 C7 TO C9 Open defecation	1.0							

¹ Departmental data received from tax and revenue department during Key Informative Interviews with Mr. Ravish Kumar Kashayap, City Manager and Mr. Jay Prakash, Revenue Inspector, Bhagalpur Nagar Nigam (BNN).

² DPR for faecal sludge management solution for Bhagalpur city, Bihar, 2017- prepared by CDD society

³ Central Groundwater Water Board Report (CGWB), 2013; http://cgwb.gov.in/District_Profile/Bihar/Bhagalpur.pdf.

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

4.1 Offsite Systems

There is no sewerage network in Bhagalpur city⁴. However, during field observation and HH survey, it was found that there are certain wards in central Bhagalpur area where household toilets are directly connected to open drains (figure-2). Therefore, T1A1C6 system is considered as 10%⁵ of the total population of the city to generate the SFD graphic. In the absence of sewerage system, the faecal sludge in T1A1C6 is directly discharged into the river Ganga or other drains leading to agricultural lands⁶. Another interesting fact we noticed during our field visit was that, the households adjacent to the river bank or parallel to natural drains in the city were more likely to have T1A1C6 systems.



Figure 2: Existing STP of 11 MLD Capacity (Source: Shrutaswinee/CSE 2020)



Figure 3: Household in ward 25 (vicinity to Ganga river) had toilet directly connected to drain (Source: Harsh/CSE, 2020)

Currently, there are no functional treatment plants for wastewater in the city. A proposal is passed to refurbish the existing defunct 11 MLD plant into a 45 MLD plant by the Bihar Urban Infrastructure Development Corporation Ltd (BUIDCO) under Namami Ganga Yojana. The project includes interception and diversion work for 7 major drains carrying domestic sewage through city⁷.

4.2 On-site Sanitation Systems

Containment: Based on sample household survey, Key Informative Interviews and Focus Group Discussions with relevant stakeholders it is estimated that 90% of the population is dependent on the Onsite Sanitation Systems (OSS). The most prevalent OSS/containment systems in the city are Fully lined tank (FLT) connected to open drain (T1A3C6, 45%), Septic tanks (ST) connected to open drains (T1A2C6, 32%) and Lined pits with impermeable (T2A4C10, 10%) or semi-permeable walls with open bottom (T2A5C10, 2%)⁸.

⁴ KII with Shri Satyendra Prasad Verma and Raveesh Kumar Kashyap. It was told that Bhagalpur city never had a sewer line. During the Census survey of 2011, households who were found to have no contaminants but had toilets were assumed by default into the sewer network. Usually these households were found to be in slums or lower income groups.

⁵ In Focused Group Discussions (FGD) with masons and private desludgers it was informed that HHs on banks of river Ganga or HHs who have natural drains adjacent to their houses usually do not prefer to construct containments. The 10% of system T1A1C6 is considered after triangulating the information given by masons, private emptier, manual emptier and sanitary staff.

⁶ DPR for faecal sludge management solution for Bhagalpur city, Bihar, 2017- (CDD Society): According to the study, the city has no sewer system at the moment and wastewater is generally going to Ganga River or agricultural lands.

⁷ In KII with City Engineer in AMRUT department Mr Krishna Prasad; Under Namami Gange project there are 7 major drains which were identified as source of pollution in Ganga River in vicinity. At the moment, these drains have been fitted with screens on their outfalls in Ganga River to collect the solid waste at the entry point.

⁸ FGD with Masons who were in practice of constructing containment systems in Bhagalpur were interviewed. They were not aware of the standards prescribed for containment systems in the Bureau of Indian Standards (BIS). They decide HH containment system on the basis of area available and size of family.



Figure 4: Fully Lined Tank and Lined Pit impermeable wall and open bottom (Source: Harsh/CSE, 2020)

During primary HH survey, we observed that the septic tanks cannot be called as “contained systems”, as they are connected to open drains⁹. Since there is no monitoring or design standards followed in the construction of a containment system by ULB, the usual practice is to construct very large capacity tanks. The tanks as observed require emptying after a period of 8-10 years¹⁰. The average capacity of tanks was found to be varying from 4 cubic meters to 10 cubic meters.



Figure 5: Lined Pit semi-permeable wall and open bottom (Source: Harsh/CSE, 2020)

The third and fourth type of OSS is seen commonly in the economically weaker section of Bhagalpur city is lined pit impermeable walls and open bottom (LIO) (T2A4C10) which constituted 10% of the total population and lined pit semi-permeable wall and open bottom (LSO) (T2A5C10) which constituted 2% of the total population ¹¹ (figure-5). T2A4C10 and T2A5C10 systems are the upgraded version of unlined pits with a slab or without slabs as shown in the 2011 census data ¹². There are no service latrines or latrines served by animals found in the city.

According to Swachha Bharat Mission’s (Countrywide mission to provide basic sanitation infrastructure by financial help) IHHL data, 5329 toilets have been provided to households with no toilets or to households with unsanitary toilets¹³. Based on a field visit and our understanding from HH survey, it is assumed that 30% of people practising open defecation are given IHHL under SBM and the containment systems are assumed to be equally divided among FLTOD, LIO and LSO and the remaining 50% of the population practising OD started using public toilets or community toilets (field observation) and 20% built their toilets with septic tanks as a containment system. It is also assumed that 50% of the population using PT/CT is given toilets under SBM and containment systems are assumed to be STOD (field

⁹ After FGDs with masons, private emptier, manual emptier and City sanitation staff, the Census percentage was bifurcated into 50% FLT and 30% ST respectively corresponding to 2020 populations.

¹⁰ As observed in HH sample survey and reported in FGDs with sanitation staff of BNN.

¹¹ As informed in FGD with masons and manual emptiers, these contaminants are usually made from precast concrete rings of diameter ~ 1 meter and width of ~ 0.5 meter. They are easy to install and require less space. These rings are stacked over each other which may or may not be sealed. The bottom is usually open.

¹² In the sample HH survey and FGD with sanitation staff of BNN, it was informed that currently there is no HH who have service latrines or pit latrines with or without slabs in the city. These systems have been upgraded either in Swachh Bharat Mission or HHs themselves have raised their standards of contaminants. The replacement of these systems is done by T2A4C10 or T2A5C10.

¹³ IHHL and CT/PT data received from city manager Mr Raveesh Kumar Kashyap. The data is extracted from Swachh Bharat Mission Website with access only with ULB officials.

observation) and the remaining 50% practices open defecation. It can be said from a field visit that the real cost of building a toilet is highly variable and often exceeds the monetary help given under SBM and size/type of containment system is majorly decided by factors like financial capability, space availability and size of household.

Community Toilets/Public Toilets: In Bhagalpur, there are 150 public and community toilets. These toilets are connected to STOD¹⁴. The containment systems of PT and CT do not adhere to the standards stated in the CPHEEO (Central Public Health & Environmental Engineering Organization) manual. The average size of septic tanks in CT found to be 33 cubic meters whereas for PT it was 24 cubic meters. The average emptying period of the CT and PT was told to be 0.5 to 1 years which was done by BNN. The community toilets and public toilets are not very well serviced especially near commercial areas¹⁵(figure-6). People were seen urinating and defecating in the open. Even though the city has been declared as an Open Defecation Free city in January 2019, the practice of defecating and urinating in the open continues¹⁶. There is a portion of the population which categorically falls under non-notified slums where basic facilities are practically absent. The situation is further worsened by the lack of coverage of this population under poverty and slum up-gradation.



Figure 6: Urinals in of the CT and PT in the commercial area of the city (Source: Harsh/CSE 2020)

Emptying: The city is majorly dependent on private desludging service providers for emptying faecal sludge (FS) from household containment systems which are not registered under BNN. BNN itself owns two tractors mounted desludging tankers, out of which only one was functional at the time of visit. The desludging vehicles or tractor-mounted vacuum tankers are equipped with a motorised pump, storage tank and a 200 feet (~70m) long hose to access narrow roads and congested areas. The households located in the periphery of the city emptied their containment systems by private operators who charge INR 1500-3000 per trip¹⁷. The emptying charge of the government’s operating vacuum truck is INR 1600 per trip. During the survey, it was found that in 30% of the households (economically weaker section), non-mechanized means of desludging is used.



Figure 7: Open drains in Bhagalpur (Source: Harsh/CSE 2020)

The basti (informal LIG settlement) near Ibrahim Shah Tomb wherein the occupants, themselves empty the containment system of their households, as they cannot afford to get it done by others. This is the settlement where most of the households have toilets funded by the government. Apart from mechanical emptying, the practice of manual emptying is also present in the city usually in the congested and LIG settlement areas where roads are not wider than 4 feet (1.2m). Manual emptiers reside in pockets all over the city, generally belonging to a community called ‘Doms.’ Though manual emptying is not their regular business

¹⁴ Informed by City Manager Ravish Kumar Kashyab, BNN. It was also observed during a field survey of toilets.

¹⁵ City Manager informed that maintenance of CT was done by BNN and PT is done by private contractors.

¹⁶ During the visit to public toilets, it was observed that people due to behavioral issues or the maintenance level of PTs often urinate in nearby open drains

¹⁷ In the KII with Mr Shakaldev Singh, Driver Government Desludging Vehicles and FGD with private operators, it was informed that overall the city gets demand of 1 to 2 trips through mechanized desludging process.

as few of them also work as a road or drain cleaners in the city or do pig meat business, still manual emptying is done for extra income¹⁸.

Desludging is carried out in groups of 3 to 5 persons and a fee of INR 500 to 800 per feet depth is charged. Considering all the prevalent condition of the city and the resources available for providing emptying services, it is assumed that 60% of households with septic tanks and fully-lined tanks and 50% of the households with pits are emptying their containment systems on time. As mentioned before, there is no functional sewer line in Bhagalpur and all the black water and greywater generated from households is transported by open drains and discharged into agricultural fields (field observation). The septage emptied by manual emptier is discretely dumped into any nearby open drain. The open drains in Bhagalpur are choked due to indiscriminate solid waste dumping (field observation) as shown in figure- 7¹⁹.

Transportation: The emptied faecal sludge is transported using a tractor mounted vacuum tanker. These vehicles cover a distance of 3-5 km per trip on an average. In the group discussion with the private emptiers it was revealed that time taken for emptying and discharge of FS is one hour on an average with exceptions of households in congested areas where it may take as long as four hours. Since none of the FS getting emptied is delivered to the treatment facility F4 is considered to be zero.



Figure 8: Desludging vehicle owned by Private emptier and its advertisement and ULB owned vacuum machine (Source: Harsh/CSE 2020)

Treatment/Disposal: BNN has no designated site for the disposal of FS. Therefore in the absence of such provision the private emptiers discharge the faecal sludge in low lying areas along the road sides and farms (field observation). Since there is no proper treatment of emptied FS, F5 is also considered to be zero.

¹⁸ In FGD with sanitation staff workers it was informed that some of them practice manual emptying of containment systems in lower and middle income group settlements where roads are narrow. Around 100 to 150 persons (*Doms*) are working as manual emptiers in the overall city boundary.

¹⁹ FGD with Sanitation Staff workers; The manual emptiers usually ask the HH owner to provide space for dumping the FS. The farther the dumping site higher will be the charges of emptying. However, the charge depends on the depth of containment systems. Generally, they receive the demand of 5 to 6 trips per month i.e 0.2 trips per day.

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 for Bhagalpur.

- 80% of water supplied is wastewater generated. 50% of the contents of septic tanks and fully lined tanks is Faecal sludge
- 100% of the contents in the Lined tank with impermeable wall and open bottom and Lined pit semi-permeable wall and open bottom is FS.
- Proportion of wastewater conveyed to treatment plant in open drain is estimated to be 80% considering leakage and diversions into account
- The proportion of OSS emptied is considered to be 60% for septic tanks and fully lined tanks as observed in the survey.
- The proportion of OSS emptied is considered to be 50% for lined pits impermeable walls and open bottom and Lined pits semi-permeable wall and open bottom as observed in the survey.

6 Context adapted SFD Graphic

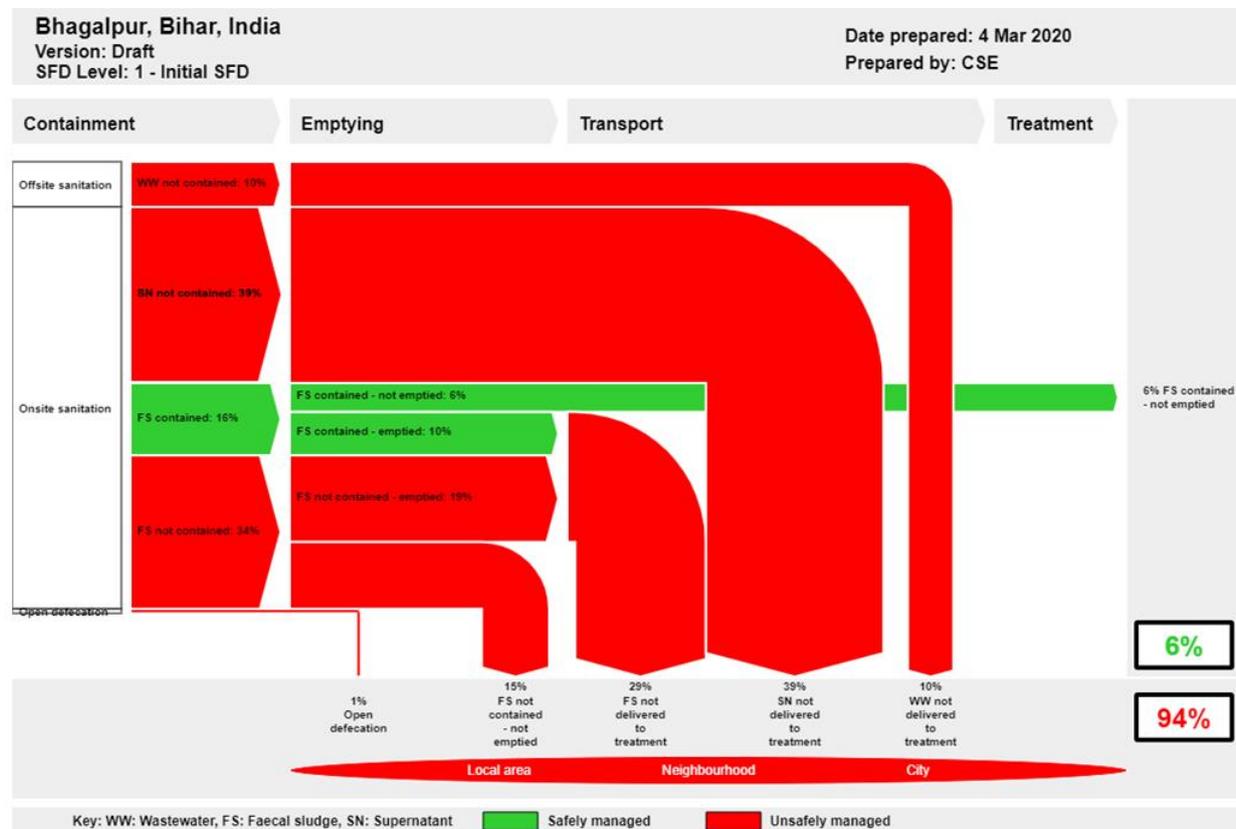


Figure 9: Context Adapted SFD for Bhagalpur city

The only difference suggested in the context adapted SFD is at containment stage for correctly designed septic tanks, though connected to open drains. With an earlier assumption of 50% of the proportion of the content of the septic tank which is solid FS, generated and collected inside the septic tanks. 50% of

the content is supernatant which attributes to be 16% of the population flows through open drains. The solid FS collected in the septic tank are considered to be contained and hence 16% of FS is contained (represented green in colour at containment stage). Followed by this, 10% FS contained is emptied, remaining 6% is FS remains in the tank which is contained and never emptied. The supernatant generated from the septic tank connected to open drain are not contained and hence considered to be unsafely managed (represented red in colour). Overall, excreta of 94% population is not managed safely according to the context adapted SFD.

7 List of data sources

Reports and literature

- District Census Handbook 2011 for Bhagalpur (Houses and household amenities and assets table HH-08: percentage of households by availability of the type of Latrine Facility <http://censusindia.gov.in/DigitalLibrary/MFTTableSeries.aspx>
- District Census Handbook 2011 (Population Census Abstract Data Table (India & State/UTs-Town/Village/WardLevel) http://censusindia.gov.in/2011census/population_enumeration.html
- IHHL, SBM data, Bhagalpur, Bihar(2018-2019).
- MoSJE. 2014. The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 [18th September, 2013]. Ministry of Social Justice and Empowerment.
- MoUD. 2017. National Policy on Faecal Sludge and Septage Management. Ministry of Urban Development
- MoUD. 2014. Guidelines for Swachh Bharat Mission.: Ministry of Urban Development. Government of India.
- MoUD. 2013. Septage Management in Urban India. Ministry of Urban Development, Government of India.
- NIUA. 2015. Report of The Fourteenth Finance Commission (2015-2020. Online] [Accessed 15 February 2020] Available at: <https://smartnet.niua.org/content/1aa83088-04ef-4e97-be11-9d4d93abc210>
- NMCG. 2011a. National Mission for Clean Ganga. [Online] [Accessed 15 February 2020] Available at: http://nmcg.nic.in/about_nmcg.aspx

Key Informant Interviews (KII)

- KII-1, 2020; Interview with Shri Satyendra Prasad Verma (Additional Municipal Commissioner, Bhagalpur Nagar Nigam)
- KII-2, 2020; Interview with Shri Raveesh Kumar Kashyap (City Manager, Bhagalpur Nagar Nigam)
- KII-3, 2020; Interview with Mr Satyanarayan (Health Inspector, Bhagalpur Nagar Nigam)
- KII-4, 2020; Interview with Mr Shakal Dev Singh (Govt. desludger, Bhagalpur Nagar Nigam)
- KII-5, 2020; Interview with Mr Sharvan Kumar (Vacuum Truck Driver, Bhagalpur Nagar Nigam)
- KII-6, 2020; Interview with Mr Gautam Kumar Shah (Computer Operator, Bhagalpur Nagar Nigam)
- KII-7, 2020; Interview with Mr Mohammad Rehan Ahmed (Office Incharge, Swasthya Prabhari, Bhagalpur Nagar Nigam)
- KII-8, 2020; Interview with Mr Jay Prakash (Head, Tax department, Bhagalpur Nagar Nigam)
- KII-9, 2020; Interview with Mr Krishna Prakash (Engineer, Bhagalpur Nagar Nigam)

Focus Group Discussions (FGD)

- FGD-1, 2020; Focus Group Discussion with masons
- FGD-2, 2020, Focus Group Discussion with Mr Murari, Mr Subodh Mandal, Mr Rajesh Mandal (Private Desludgers)
- FGD-3, 2020; Focus Group Discussion with Sanitation Staff workers of Bhagalpur Nagar Nigam
- FGD-4, 2020; Focus Group Discussion with ward members

Field Observations

- Visit to approximate 100 households covering Lower Income Groups (LIG), Middle Income Groups (MIG) and Higher Income Groups (HIG) spread throughout the city.
- Survey of Public toilet and community toilets
- Visit to Sewage Treatment Plant and its outlet/discharge point
- Visit to current FS discharge locations.

Bhagalpur, India, 2020

Produced by:

CSE, Harsh Yadava

CSE, Shrutaswinee Hazarika

Editing:

CSE, Dr Suresh Kumar Rohilla

CSE, Praveen Chature

© 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

SFD Promotion Initiative

