SHIT FLOW DIAGRAM (SFD)

The Shit Flow Diagram (SFD) for municipalities in Nepal visually represents existing sanitation practices across the entire sanitation service chain. According to the diagram below, at the initial stage, waste generated from about 71% of the population comprising 64% faecal sludge (FS) contained, and 7% wastewater (WW) is safely managed (green).

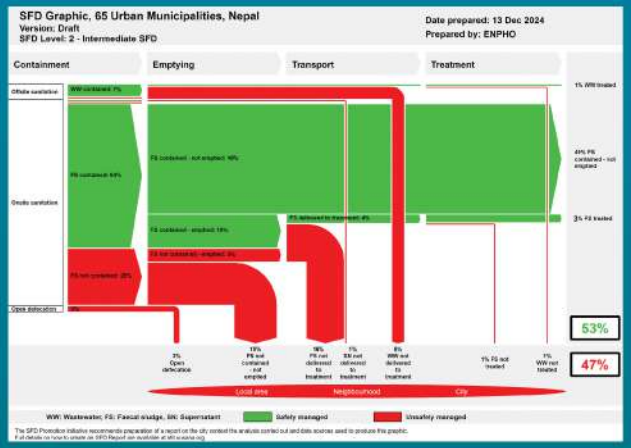
However, the waste passes through the subsequent stages of the sanitation service chain, the proportion of safely managed waste declines significantly. In the diagram, out of 64% of FS only 15% of is emptied, while 3% undergo treatment through either on-site or centralized treatment facilities and the remaining 1% is transported but not treated. Meanwhile, 49% remains stored in containment systems and is considered safely managed based on its storage condition.

Regarding WW, which constitutes 7% of the total waste, only 1% is treated and 1% reaches treatment plants but is not treated, similarly the remaining 5% does not reach any treatment facility at all.

On the other hand, waste from 29% of the population is found to be properly not contained (red). This includes 25% FS, 1% Supernatant (SN), and 3% open defecation. The diagram shows that 1% of SN is unsafely discharged, while 3% of the population still practices open defecation. The remaining 25% of FS is properly not contained in on-site sanitation systems and is managed unsafely. Of this, 20% has never been emptied, and 5% that has been emptied is unsafely discharged.

Overall, although 71% of the waste appears to be safe at the initial stage, only 53% remain safely managed by the end of the sanitation service chain. This underscores the need for improved safe management at each stage of the sanitation service chain.

Finally, these findings highlight critical gaps in faecal sludge management that contribute to environmental pollution and public health risks, emphasizing sustainable urban sanitation to be ensured.



RECOMMENDATIONS

Infrastructure Upgrade:

- Retrofit and replace unsafe containment systems with appropriate techniques and technologies such as septic tanks, biogas digesters, and twin pits.

Promote Mechanical Desludging:

- Advocate for providing desludging services in the municipality where the services are not available, along with its formal registration and proper regulation.

Construction of treatment facilities:

- Construction of treatment facilities to ensure the safe and effective management of faecal sludge, addressing critical gaps in treatment and disposal.
- Ensure safe disposal by ensuring proper operation and maintenance of the treatment facilities.

Regulate Sanitation Service:

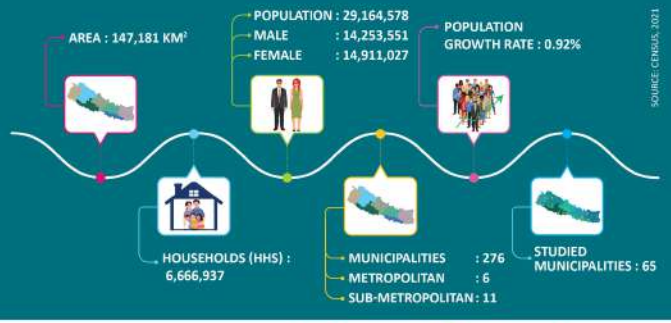
- Promote regular emptying of containments, ideally at least once every 3 to 5 years, to prevent over flow and ensure proper functioning.
- Formulate and enforce policies and regulations mandating the use of safe sanitation technologies in new construction or renovations.

SANITATION SYNOPSIS OF URBAN MUNICIPALITIES OF NEPAL 2024

(BASED ON SURVEY FROM 65 MUNICIPALITIES)


Mt. Everest (Sagarmatha)

DEMOGRAPHICS



BILL & MELINDA GATES foundation

UCLG ASPAC

ENPHO Creating Pure Sanitation

ABOUT

A study on Faecal Sludge Management (FSM) was conducted in 65 municipalities of Nepal as part of the Municipalities Network Advocacy on Sanitation in South Asia II (MuNASS II) program. MuNASS II was implemented in Nepal, with the financial support from the Bill & Melinda Gates Foundation (BMGF), executed by United Cities and Local Governments Asia Pacific (UCLG ASPAC) and implemented by the Municipal Association of Nepal (MuAN), with Environment and Public Health Organization (ENPHO) as a technical partner. This sanitation study was carried out in selected municipalities of 7 provinces covering 3 geographical regions of Nepal.

OBJECTIVE OF THE STUDY

The study aimed to assess the sanitation conditions with a focus on the faecal sludge management (FSM) and develop Shit Flow Diagram (SFD) for selected 65 municipalities in Nepal.

METHODOLOGY OF THE STUDY

A total of 65 municipalities were selected out of 293 including Metropolitan, Sub-Metropolitan and municipalities, using purposive stratified random sampling. The municipalities were selected based on the criteria developed considering agro-ecological zone, provincial municipality ratio, municipalities with varying establishment years, population density, and heterogeneous geographical spatial distribution to ensure representativeness. In each selected municipalities sample sizes were determined using statistical formula considering Confidence Level of 95% and error of margin at 5%, with households proportionally distributed across municipal wards (stratum). Systematic random sampling was employed for sample selection within each stratum.

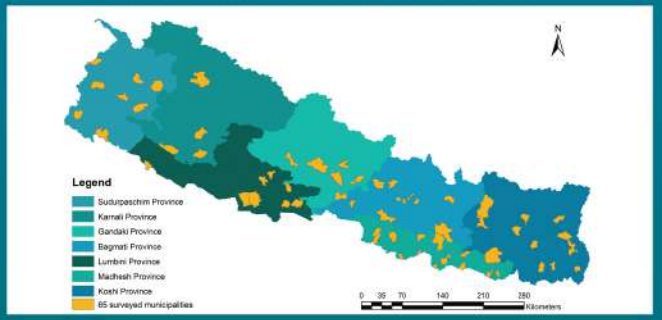
Local enumerators, selected by the respective municipalities, were trained and mobilized under the close supervision of the technical team at ENPHO in coordination with respective municipalities and MuAN. Quantitative data was collected using a mobile application-based questionnaires set while qualitative data was collected through Key Informant Interviews (KIIs) and direct observations of sanitation systems. The key stakeholders were involved throughout the process to ensure accuracy and reliability.

This methodology ensured a comprehensive and representative assessment of sanitation status of the municipalities, combining statistical rigor and engagement of relevant stakeholders for accuracy and validation of the information collected.

NEPAL PROFILE

Nepal is a landlocked country in South Asia, nestled in the foothills of the Himalayas. It is bordered by China in North and India in the East, South, and West. It lies between approximate coordinates of 26°22' to 30°27' N latitude and 80°4' to 88°12' E longitude. Nepal occupies 0.03 percent of the Earth's total land area and 0.3 percent of Asia's total land area. Topographically, it is divided into 3 regions: Hill, Himalayan, and Terai, and administratively divided into 7 provinces, 77 districts and, 753 local governments including 6 metropolitans, 11 sub-metropolitans, 276 municipalities and 460 rural municipalities. Nepal has a diverse geography, including fertile plains, forested hills, and eight of the worlds ten tallest mountains, including Mount Everest.

MAP OF NEPAL WITH STUDIED MUNICIPALITIES



संकलन (User Interface) → ढल (Sewer) → भण्डारण (Containment) → रित्याउने र ढुवानी (Emptying & Transportation) → प्रशोधन (Treatment) → पुन: प्रयोग वा सुरक्षित विसर्जन (Re-use or Safe Disposal)

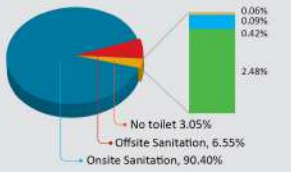
The Sanitation Service Chain (SSC) is a comprehensive service framework delineating the sequential stages of faecal sludge management from excreta generation to safe disposal. It encompasses five key phases: collection, containment, emptying and transportation, treatment, and reuse/safe disposal.

USER INTERFACE FACILITY

The basic sanitation facility, commonly referred to as toilet, serves as collection points for human waste and directs it to either offsite or onsite sanitation system. The findings show that 3.05% of the households (HHs) do not have access to basic sanitation facilities.

Among 6.55% of offsite sanitation, 5.63% are connected to sewer network, and 0.92% are illegally connected to open drains and water bodies, while about 90.40% of the HHs toilets are connected to onsite sanitation systems. Meanwhile, those containments which are connected to sewered network and open drain (4.70%) are also taken as onsite sanitation in this study.

Sanitation Facilities



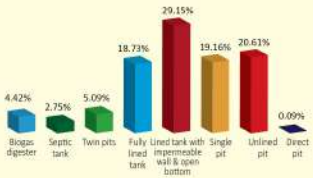

Toilet structure at household

CONTAINMENT

The human waste collected from toilet is stored in different types of tanks for certain time period which is known as containment, and the accumulated human waste in it is termed as faecal sludge (FS).

The HH having onsite sanitation system have installed different types of containments, substantial proportion of the HH have built unsafe containments as lined tank with impermeable walls and open bottom, followed by unlined pit and single pit. Additionally, direct pit is installed by a negligible proportion of HH. These containments are considered unsafe as it holds high risk of groundwater contamination due to leachate percolation through their permeable bases. Fully lined tank is installed by significant proportion of the HH. Only a small proportion of HHs have installed safe containment, such as septic tanks, biogas, and twin pits.

Types of Containments



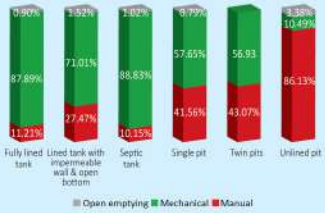

Twin pits

EMPTYING AND TRANSPORTATION

Regular emptying is essential for maintaining the functionality of these containments. The survey reveals that only 23.41% of HHs have emptied their containments at least once since installation. The containments are emptied in different time intervals, where 34.98% are emptied in an interval of 3 to 5 years. The emptying mechanism varies as per the containment types which is shown in the graph.

Emptying Interval

Emptying Mechanism



TREATMENT

Biogas digesters, if functioning properly, are regarded as safe and considered capable of treating faecal sludge. However, FS stored in other types of containments requires further treatment. However, during the study, it was found that most of the municipalities lack faecal sludge treatment facilities (FSTPs). Only 11% of the surveyed municipalities have the FSTPs.


Charali FSTP, Mechinagar Municipality

Availability of Mechanical Desludging Service

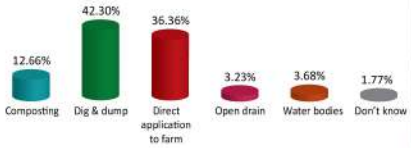
Details of desludging services in surveyed municipalities

Service Provider	Municipality	Private
No. of service providers	19	120
No. of vehicles	19	170
Capacity of vehicles (litres)	2500-5000	2500-9,000
Average number of trips per day per vehicle	5	7
Service charge per trip (NPR)	1500-7,000	1500-18,000

SAFE DISPOSAL OR REUSE

The mechanically collected FS are usually taken to treatment plant, if available. In places where treatment plants are not available or not functional, the disposal practices of mechanically emptied FS vary. As per the KII findings, some desludgers directly applied it to farms, water bodies, and forests without any treatment. Meanwhile, the majority of HH who practice manual emptying dig and dumped the FS, followed by direct application to farm, and composting. Small proportion of HHs illegally disposed the FS into water bodies, and nearby open or stormwater drains. This practice of direct application in farmland, disposal in water bodies, and open drain increases risks to the environment and public health.

Disposal practice after manual emptying



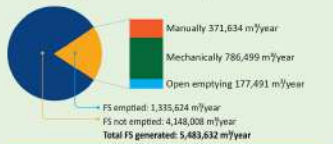

FS disposed in farmland

ESTIMATION OF FAECAL SLUDGE

The estimation of faecal sludge production was derived based on containment volume and average emptying frequency. Notably, faecal sludge from biogas digesters which does not require emptying like other containments, was excluded from the calculation. Based on a study conducted in 65 municipalities of Nepal, an estimation of FS generation and management can be made.

- Total estimated volume of FS generation in the urban municipalities of Nepal: 5,483,632 m^3 per year which is 15,024 m^3 per day.
- Total estimated volume of FS emptied: 1,335,624 m^3 per year which is 3,659 m^3 per day.
  - Total estimated volume of mechanically emptied FS: 786,499 m^3 per year which is 2,155 m^3 per day.
  - Total estimated volume of manually emptied FS: 371,634 m^3 per year which is 1,018 m^3 per day.
  - Total estimated volume of FS emptied by open emptying: 177,491 m3 per year which is 486 m3 per day.

Summary on faecal sludge produced, emptied, and transported in Urban Municipalities



FS Generated and Emptied Annually by Containment Type (m³/year)