SFD Report

Gaur Municipality
Nepal

Final Report

This SFD Report - SFD level 2 - was prepared by
Environment and Public Health Organization (ENPHO)

Date of production: 04/05/2023

Last update: 30/06/2023

SFD Report Gaur Municipality, Nepal, 2023

Produced by:

Jagam Shrestha, ENPHO

Anita Bhuju, ENPHO

Shreeya Khanal, ENPHO

Buddha Bajarchaya, ENPHO

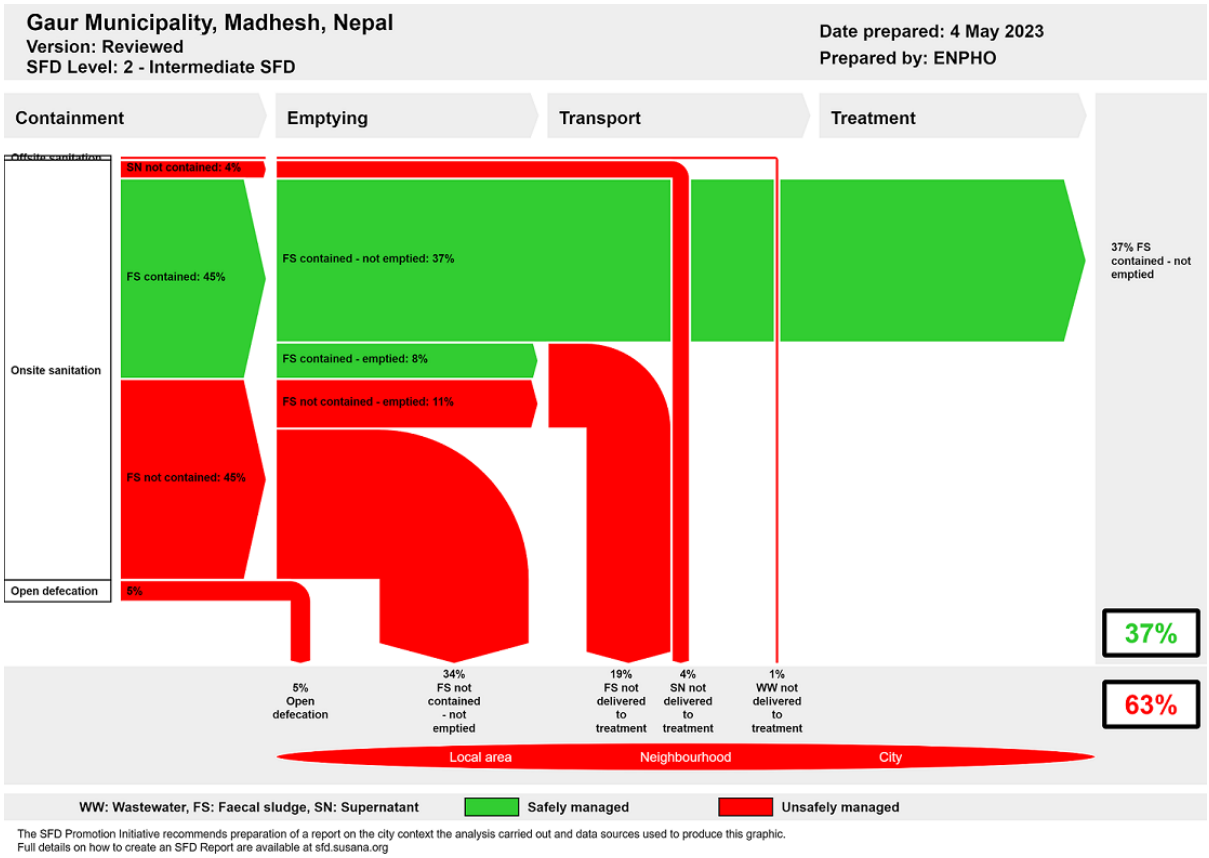
Rupak Shrestha, ENPHO

Sabuna Gamal, ENPHO

This Executive Summary and SFD Report are available from:

www.sfd.susana.org

1. The SFD Graphic



2. Diagram information

SFD Level:

This SFD is a level 2 - Intermediate report.

Produced by:

Environment and Public Health Organization (ENPHO).

Collaborating partners:

Gaur Municipality

Municipal Association Nepal (MUAN)

United Cities Local Government-Asia pacific (UCLG-ASPC)

Status: Final SFD Report.

Date of Production: 04/05/2023

3. General city information

Gaur Municipality is in Nepal's southern Terai area. The municipality was formed in April 1992 by merging Gaur, Tikuliya, Purenywa, Sirshiya and Swagadha Village Development Committees (VDCs). The municipality is divided into nine political ward boundaries. According to the census 2021, the municipality has a total population of 39,846 and there are 7,235 households with an annual growth rate of 1.4% per annum.

The municipality has a humid and tropical climate. The months of March to August are summer seasons and the average daily temperature ranges from 27°C to 35°C. The winter part of the year prevails from the month of October to March. The rainy period of the year lasts for 6.8 months, from April 10 to November 3. The month with the most rain in Gaur is July, with an average rainfall of 253 millimetres (weatherspark, 2023).

The geological structure of the city contents alluvial sediments i.e., sand, silt and clay (Dahal, 2006).

4. Service outcomes

This section provides a quick summary of the various sanitation technologies used across the municipality's sanitation value chain. All data in this section is from the household and institutional surveys conducted for this study (ENPHO, 2023).

Despite the municipality being declared as ODF zone, only 95% of the population have access to basic sanitation facilities.

Even though direct discharge of wastewater and sewage into water bodies or public places is against the law, 0.5% of population's excreta are directly disposed into storm water drains. The excreta from 2.0% and 31.4% of population are contained in septic tanks and fully lined tanks, respectively. The excreta from 4.7% and 56.6% of the population are collected in lined tanks with impermeable walls and an open bottom, and lined pits with semi-permeable walls and open bottom.

Only 26.8% of containments have been emptied at least once after use. Mechanical emptying is most popular in the municipality, while manual emptying is still in practice. The sanitation sub-section of the municipality has been providing emptying services with a single desludging vehicle, also private desludging is prohibited in the municipality. Since there is no wastewater or faecal sludge treatment plant in the municipality, the emptied faecal sludge is dumped into barren land in the periphery of Bakaiya River.

In the municipality, groundwater is a major source of drinking water. Piped drinking water supply service is being provided by Nepal Water Supply Corporation Gaur Branch and Siswa Water Supply and Sanitation Users Committee (WSUC). Together these water service providers have connected 1,629 private taps. The remaining households rely on handpump or tube wells for drinking water.

Upon assessing the risk of groundwater through technically inappropriate containments and sources of drinking water, it was observed that almost 25% of population are at risk to consumption of polluted groundwater.

Thus, overall, the SFD graphic shows that 37% of the excreta generated are safely managed while 63% of the excreta generated are not. The safely managed percentage of faecal Sludge (FS) generated by 37% of the population is temporary until the tanks and pits become full and FS from the containment is emptied.

5. Service delivery context

Access to drinking water and sanitation has been defined as fundamental rights to every citizen by the constitution of Nepal. To respect, protect and implement the rights of citizen embedded in the constitution, the Government of Nepal (GoN) has endorsed the Water Supply and Sanitation Act 2022 which has emphasized on a right to quality sanitation services and prohibited direct discharge of wastewater and sewage into water bodies or public places.

Several policies have been in place to accomplish the sanitation needs of people. Particularly, the National Sanitation and Hygiene Master Plan (NSHMP) 2011 has proved as an important strategic document for all stakeholders to develop uniform programs and implementation mechanism at all levels. It strengthens institutional set up with the formation of water and sanitation coordination committee at every tier of government to actively engage in sanitation campaigns.

Currently, the Gaur Municipality has been working with the Department of Water Supply and Sewerage Management (DWSSM) for construction of faecal sludge treatment plant in the municipality.

6. Overview of stakeholders

Based on the regulatory framework for Faecal Sludge Management (FSM), the major stakeholders for effective and sustaining service delivery as presented in Table 1.

Table 1: Overview of Stakeholders.

Key Stakeholders	Institutions / Organizations
Public Institutions at Federal Government	Ministry of Water Supply, Department of Water Supply and Sewerage Management
Public Institutions at Provincial Government	Ministry of Water Supply and Energy Development
Public Institutions at Local Government	Gaur Municipality, Siswa WSUC, NWSC Gaur Branch

Non-governmental Organizations	Environment and Public Health Organization (ENPHO),
Development Partners, Donors	WHH, MuAN,

7. Credibility of data

The major data were collected from proportionate stratification random sampling. Altogether, 367 households were surveyed from 9 wards of the municipality. Primary data on emptying, transportation, and current sanitation practices in the municipality were validated from Key Informant Interviews (KIIs) with municipal officers, staffs from sanitation sub-section, caretaker of public toilets and water supply service providers. The overall data and findings were shared with the stakeholders of the municipality and validated through a sharing program.

8. Process of SFD development

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2023). Enumerators from the municipality were mobilized after providing orientation on sanitation technologies, objectives of the survey and proper use of mobile application, KOBOCOLLECT for collection of data for survey. Along with this, KIIs were conducted with officers and engineer of municipality city and private desludging service providers to understand the situation practices across the service chain. Types of sanitation technologies used in different locations were mapped using ARCGIS. To produce the SFD graphic, initially a relationship between sanitation technology used in questionnaire survey and SFD PI methodology was made. Then, data were fed into SFD graphic generator to produce the SFD graphic.

8. List of data sources

The list of data sources to produce this executive summary is as follows:

- CBS. (2020). Multiple Indicator Cluster Survey, 2019. Kathmandu, Nepal: Central Bureau of Statistics.
- Dahal, K. R. (2006). Geology of Nepal. Retrieved from Geology of Nepal: http://www.ranjan.net.np/index.php/resources/geology-of-nepal
- Gaur Municipality. (2018). Municipal Profile of Gaur Municipality.
- ENPHO. (2023). Sanitation situation analysis of Gaur municipality. unpublished.
- NSO. (2022). National population and housing census 2021. Kathmandu: National Statistics Office.
- Weatherspark. (2023). Climate and average weather year round in Gaur, Nepal. Retrieved from weatherspark: https://weatherspark.com/y/111091/Average-Weather-in-Gaur-Nepal-Year-Round#Sections-Humidity

SFD Gaur Municipality, Nepal, 2023

Produced by:

Jagam Shrestha, ENPHO
Anita Bhuju, ENPHO
Shreeya Khanal, ENPHO
Buddha Bajracharya, ENPHO
Rupak Shrestha, ENPHO
Sabuna, Gamal

This Executive Summary and the SFD Report are available from: www.sfd.susana.org

Table of Contents

List of Tables

List of Figures

Abbreviations

CBS	Central Bureau of Statistics
DHM	Department of Hydrology and Metrology
DWSSM	Department of Water Supply and Sewerage Management
ENPHO	Environment and Public Health Organization
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSTP	Faecal Sludge Treatment Plant
GON	Government of Nepal
GW	Groundwater
IRF	Institutional and Regulatory Framework
KII	Key Informant Interview
MCDC	Mahauli Community Development Center
MEAL	Monitoring, Evaluation and Learning
MICS	Multiple Indicator Cluster Survey
MLD	Million Litres per Day
MUAN	Municipal Association Nepal
NPC	National Planning Commission
NPR	Nepalese Rupees
NSHMP	National Sanitation and Hygiene Master Plan
NUWSSSP	National Urban Water Supply and Sanitation Sector Policy
NWSSP	National Water Supply and Sanitation Policy
ODF	Open Defecation Free
PPP	Private Public Partnership
RWSSNP	Rural Water Supply and Sanitation National Policy
SDP	Sector Development Plan
SFD	Shit Flow Diagram
VDC	Village Development Committee
WASH	Water Supply and Sanitation Hygiene
WHH	Welthungerhilfe
WHO	World Health Organization
WSSDO	Water Supply and Sanitation Divisional Office
WSST	Water Supply and Sanitation Technician
WSUC	Water Supply and User's Committee

1 City context

Gaur Municipality is in the southern terai region of Nepal. The municipality was formed in April 1992 by merging five Village Development Committees (VDCs). Gaur, Tikuliya, Purenywa, Sirshiya and Swagadha VDCs were merged to form the municipality. The municipality is divided into nine political ward boundaries. The municipality is extended to 29.53 square kilometres. It shares its boundary with Rajdevi Municipality in the east, Ishnath Municipality in the west, Rajpur Municipality in the north and Sitamadi of India in the south (Gaur Municipality, 2022). Figure 1 shows the map of the municipality with its ward boundaries.

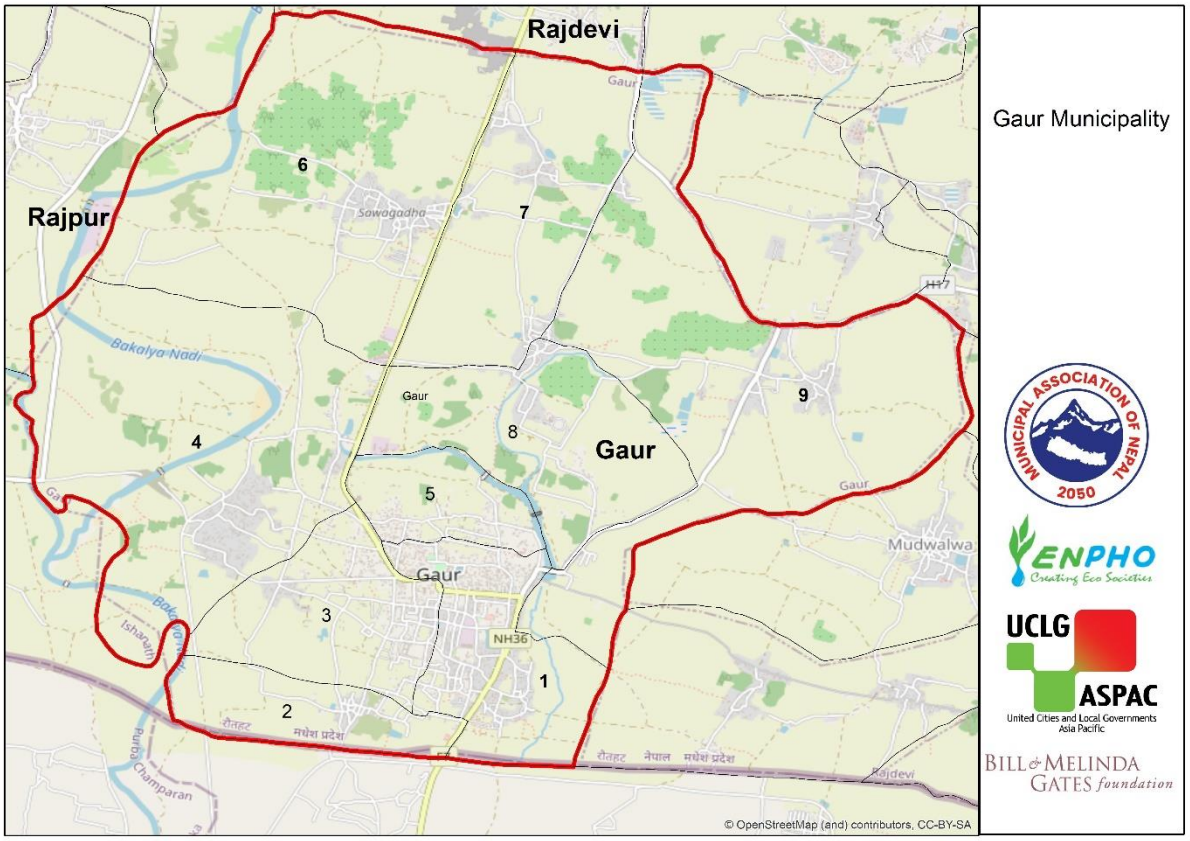


Figure 1: Map of Gaur Municipality with ward boundaries.

1.1 Population

The total population of the municipality is 39,846 and there are 7,235 households as per the census 2021. The total male and female populations were 20,441 and 19,405, respectively (NSO, 2022). The total population of the municipality has increased at the annual growth rate of 1.4% per annum.

1.2 Climate

The municipality has a humid and tropical climate. The months of March to August are summer seasons and the average daily temperature ranges from 27°C to 35°C. The winter part of the year prevails from the month of October to March. Figure 2 shows the average monthly maximum and minimum temperature obtained from weatherspark in 2023.

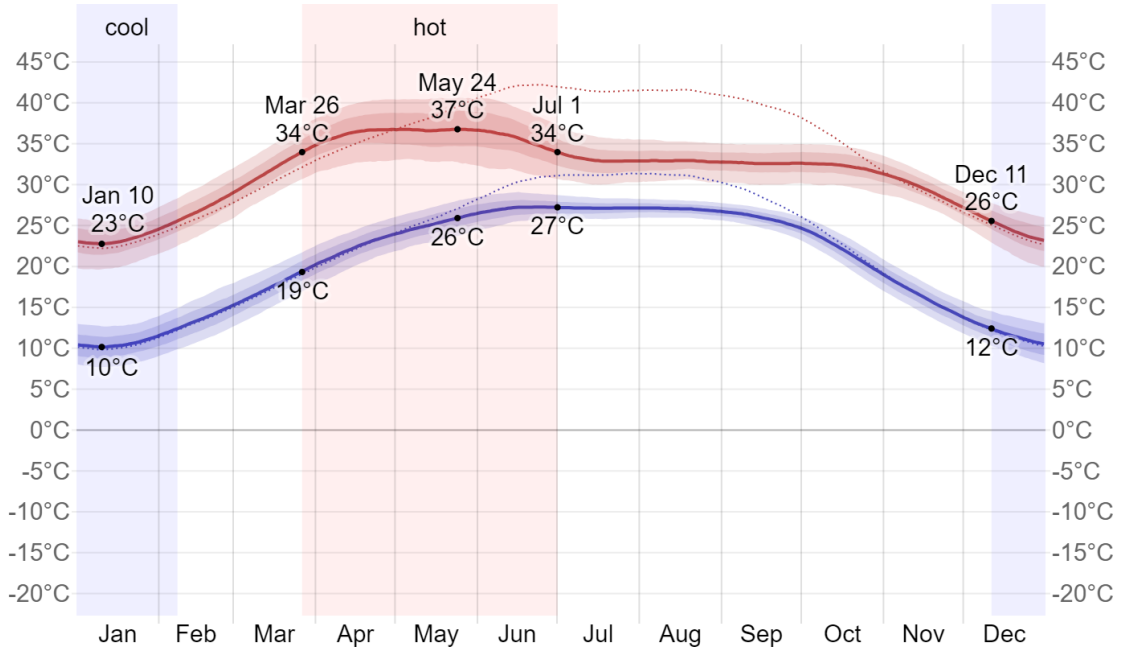


Figure 2: Average monthly maximum and minimum temperature.

The rainy period of the year lasts for 6.8 months, from April 10 to November 3. The month with the most rain in Gaur is July, with an average rainfall of 253 millimetres (weatherspark, 2023). Figure 3 shows the average rainfall in each month in Gaur.

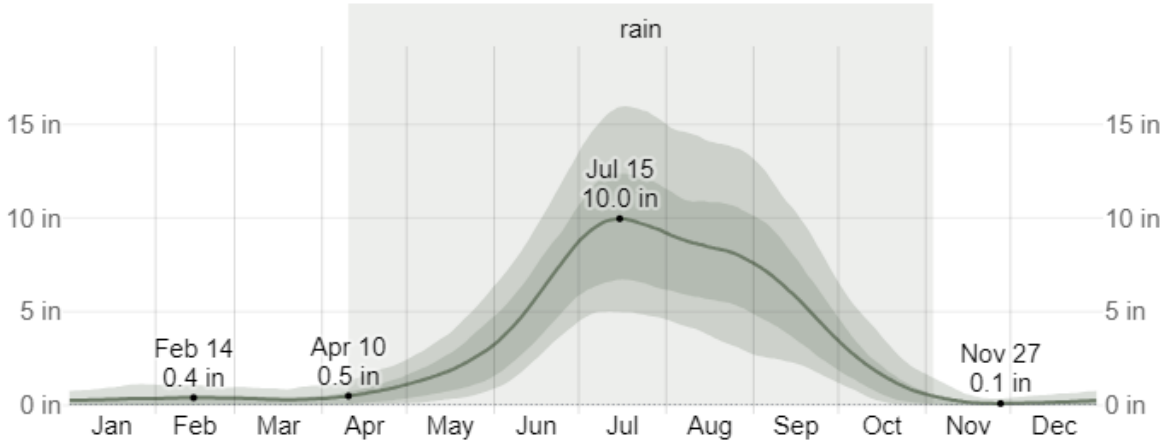


Figure 3: Graph on average monthly rainfall in Gaur (weatherspark, 2023).

1.3 Topography

The geological structure of the city contents alluvial sediments i.e., sand, silt and clay (Dahal, 2006). Groundwater is the source of drinking water in the Terai region. In addition, shallow groundwater aquifers are mostly used for the purpose of drinking water. The shallow groundwater originates from unconfined or semi-confined aquifers.

2 Service Outcomes

2.1 Overview

The government of Nepal on 30th September 2019 has declared the nation free of open defecation and have achieved universal access to improved sanitation facilities throughout the country. The municipality has significantly improved access to basic sanitation facilities since 2011. Back in 2010, only 48% of the population had access to basic sanitation facilities (Water Aid, 2012). However, the national census 2021 shows that 8% of the population do not have access to basic sanitation facilities. Similarly, the household survey in 2023 conducted under the "Municipalities Network Advocacy in South Asia (MuNAS)" implemented by Nepal Municipal Association (MuAN) and technically supported by Environment and Public Health Organization (ENPHO) revealed that still 5% of the total population do not have access improved sanitation facilities, where improved sanitation is referred as sewered and non-sewered sanitation facilities with cistern flush or pour flush toilets connected to sewer or septic tanks or pits, ventilated improved pit latrines, pit latrines with cover slabs or compositing toilets.

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2023). A total of 367 households were sampled from 10,594 households distributed in nine wards (further details are presented in section 4). The results obtained after the triangulation and validation of the data with all the data sources including literature reports, Key Informant Interviews (KIIs) and a validation workshop is presented in this section.

2.1.1 Sanitation Systems in household buildings

The municipality does not have a sewer network while stormwater drainage has been developed in many parts. Despite being illegal to connect blackwater directly in the stormwater drains, approximately 0.5% of the toilets have such a connection.

Onsite sanitation refers to a sanitation technology or sanitation system in which excreta (referred to as faecal sludge) is collected and stored and emptied from or treated on the plot where they are generated (Susana, 2018). The blackwater from the toilet is stored in the containment. Generally, all rectangular containments are locally termed as septic tanks irrespective of the characteristics. While circular containments constructed by piling up precast concrete rings one after another without using any sealing is termed as single offset pits. Thus, during the household survey the respondents were asked and observed the characteristics of their containment. Upon analysing the characteristics, the containment are classified as septic tank, fully lined tank, lined tank with impermeable walls, single offset pit, twin pits and direct or unimproved pit as shown in Table 1.

Table 1: Percentage of different types of containment installed and their characteristics (ENPHO, 2023).

Containment	Wall construction Materials	Bottom of containment	Chamber	Number	Connected to	Percent
Septic tank	Concrete walls OR Cemented brick/stone walls	PCC or plastered	Two or more than two	NA	Soak pit Open drain/storm sewer Open ground	1.9%
Fully lined tank	Concrete walls OR Cemented brick/stone walls	PCC or plastered	One Two	NA	Soak pit Open drain/storm sewer Open ground No outlet/overflow	31.3%
Lined tank with impermeable walls and open bottom	Concrete walls OR Cemented brick/stone walls	soiling Nothing	one two More than two	NA	Open drain/storm sewer Open ground No outlet/overflow	4.6%
Single pit	Concrete rings piled one after other	soiling Nothing	NA	one	NA	55.6%
Twin pits	Concrete rings piled one after other	soiling Nothing	Na	two	NA	1.1%
Offsite	-	-	-	-	-	0.6%
Open defecation	-	-	-	-	-	4.9%
Total						**100.0%**

In the municipality, a well-designed septic tank was installed in only 1.9% of households. Instead, fully lined tanks having a single chamber or double chamber without provision of soak pits have been installed by 31.3% of the households. Similarly, lined tanks with impermeable walls and open bottom were constructed by 4.6% of the households. Twin pits were installed by 1.1% of the households while single offset pits are popular in the municipality. 55.6% of households have installed the pits by assembling pre-cast concrete rings one after another.

Ideally twin pits are designed to safely store and treat faecal sludge onsite. The facility consists of two sets of pits, used alternatively to store blackwater, dug or made from assembling precast concrete rings at the minimum horizontal distance of 1.2m. Both pits are connected from diversion box. However, most twin pits installed by the households are not as per the design. The minimum distance between two sets of pits is not maintained. Also, the connection pipes to the pits are in series. Thus, these pits function only as lined tanks with semi-permeable walls and open bottoms. Figure 4 shows the design of twin pits and pits installed at household level.

Figure 4: Inappropriate design of the twin pits, where the distance between two pits is less than 1.2 m

The municipality is in the flood plain of Bagmati River and Bakaiya River. The area is inundated regularly during the monsoon season. Thus, to prevent the inflow of the surface runoff, many households have raised the plinth level of the containments above the ground. Figure 5 shows the plinth level raised containment.

Figure 5: Containment with plinth level raised above ground to prevent inflow of runoff.

Moreover, 19% and 7% of households have provision of discharging effluent from containment to open drain or open ground/farm. The discharge of effluent into open drains and open ground possess a higher risk of polluting sources of water and reduces the aesthetic view of the municipality as shown in Figure 6.

Figure 6: A discharge of effluent from containment to an open drain.

Figure 7 shows the map locating households with different types of containments in the municipality.

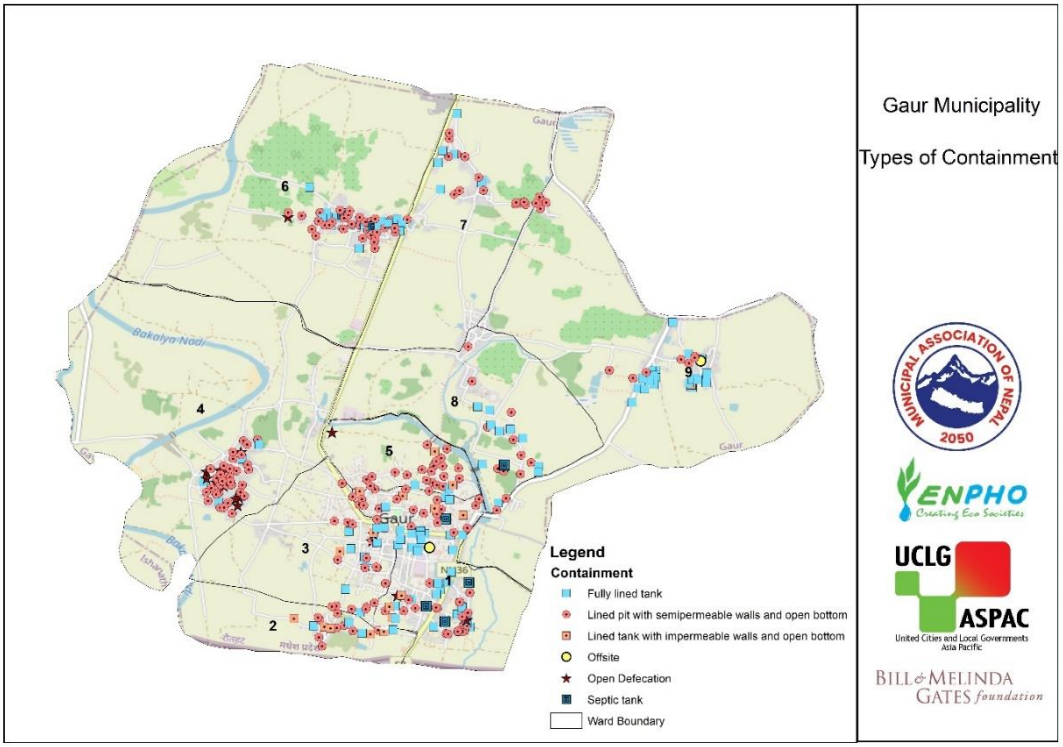


Figure 7: Map locating households with different types of containment in Gaur Municipality (ENPHO, 2023).

The types of household containments in the municipality are re-categorized to match the containments defined by Shit Flow Diagram Promotive Initiative (SFD PI). Twin pits and single pits constructed by assembling pre-cast concrete rings one above another are classified as lined pits with semi-permeable walls and open bottom. Table 2 shows the types of containment re-categorized according to Shit Flow Diagram Promotive Initiative (SFD PI).

Table 2: Percentage of different types of containment installed and their characteristics (ENPHO, 2023).

Containments	Percentage of Households
Fully Lined Tank	31.4%
Lined Pit with semi-permeable walls and open bottom	56.6%
Lined Tank with Impermeable walls and open bottom	4.7%
Septic Tank	2.0%
Offsite Sanitation	0.6%
Open Defecation	4.9%
Total	**100%**

2.1.2 Public Toilets

Public toilets have been operated in public places such as bus stations, markets, and public service offices in the municipality. To ease the daily operation and maintenance of the public toilets, it is leased through tendering process. Also, the public toilets opposite government offices were facilitated with space to run small business as an alternative source to generate operating cost as shown in Figure 8.

Figure 8: Public toilets opposite district court and irrigation office with space to run small business.

The toilet opposite district court and custom office are comparatively clean as compared to others. It was observed that the faecal sludge from containments have overflowed in public toilets of Gaur Bus station and opposite irrigation office. Figure 9 shows overflowed containments in public toilets located in the bus station and opposite irrigation office.

Figure 9: Overflowed faecal sludge from containment in the public toilet located opposite to Irrigation Office.

The public toilet in Gudri market was constructed by Impact Nepal, a non-government organization. The toilet is operated by the municipality through a caretaker. Figure 10 shows the public toilets in Gudri market, bus station and custom office near the boundary with India.

Figure 10: Public toilets in Gudri Market and Bus Station.

The location of the public toilets operated in the municipality is shown in Figure 11.

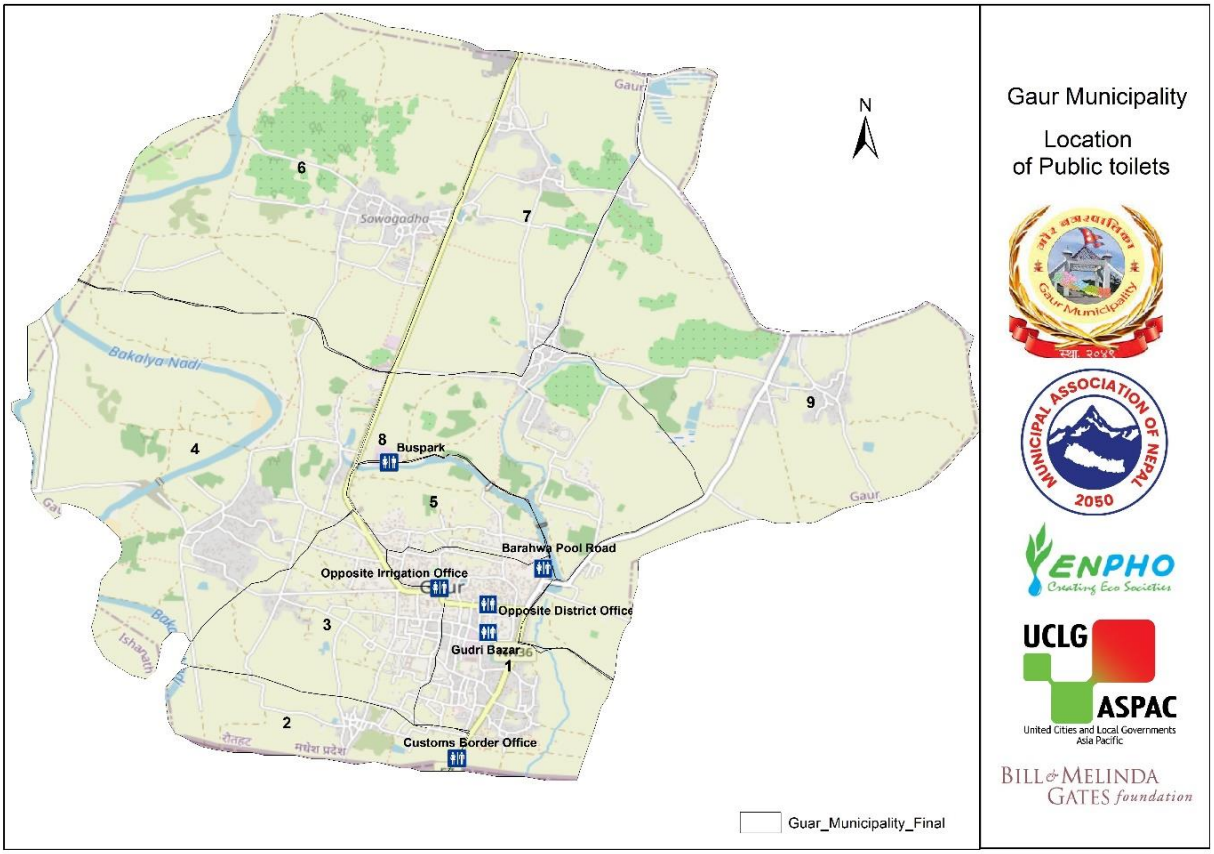


Figure 11: Location map of public toilets in Gaur Municipality (ENPHO, 2023).

2.1.3 Emptying and Transportation Services of Containment

Emptying is one of the major components of the sanitation service chain. It ensures the proper functioning of containment basically for the septic tank which functioned well until the volume of sludge is one-third of the total volume of the tank. Also, in other containments, regular emptying prevents overflow of the sludge and blockages. However, the household survey shows only 26.8% of the households have emptied their containment due to overflow of faecal sludge.

Mechanical emptying is popular in the municipality. While manual emptying is still in practice, 98% of the emptied containment was mechanically emptied. The desludging service is being provided by the sanitation sub-section of the municipality. The municipality started the desludging service in June 2016. The capacity of the desludging vehicle is 5,000 litres as shown in Figure 12. The average cost per trip is NRs. 1,500 (USD 11). The sanitation section mobilizes one driver and a maximum of two labours for the desludging (KII_2, 2023).

Figure 12: Mechanical emptying vehicle operated by Gaur Municipality.

2.1.4 Treatment and Disposal of Faecal Sludge

Treatment and safe disposal of faecal sludge is essential to ensure environmental protection and prevent health hazards. The municipality does not have a faecal sludge treatment plant. Currently, the desludged faecal sludge is being openly dumped in the farmland on the demand of farmers and barren land in Bakiya River. Recently, the municipality signed the memorandum of understanding with the Department of Water Supply and Sewage Management (DWSSM) for the construction of a Faecal Sludge Treatment Plant (FSTP). The municipality has already acquired the required land for the FSTP (KII_1, 2023).

2.1.5 Risk Assessment of Groundwater Pollution from open bottom containment

The risk of groundwater pollution was assessed based on source of drinking water, secondary data on water quality and the depth and vulnerability of the aquifer with regard to lateral spacing between sanitation systems and groundwater sources.

a. Sources of Drinking Water and Water Production

The 2021 census reported that 72% of the households in the municipality rely on groundwater sources for drinking water, while 24% of the households have access to piped drinking water supply within the premises of their building and 4% of households served through public tap stands (NSO, 2022). Nepal Water Supply Corporation (NWSC) Gaur Branch and Siswa Water Supply and Sanitation Users Committee (WSUC) is providing piped drinking water supply in the municipality. While the water supply and sanitation user's committee in ward number 4 is yet to operate the service.

NWSC_Gaur branch office has distributed 1,379 private households taps and 10 public taps in the municipality. The service area of the NWSC is wards number 1, 2, 3 and 5 of the municipality. Currently, it has been producing approximately 1.6 Million Litres per Day (MLD)

of water from five deep tube wells. The water is distributed after chlorination (KII_4, 2023). Figure 13 shows the overhead tank of NWSC Gaur Branch.

Figure 13: An overhead tank for distribution of water from NWSC Gaur Branch Office.

Siswa WSUC started to operate the drinking water supply service in 2020 even though the water supply scheme was installed in 2017. It serves 250 households in ward number 7. In average, 0.25 MLD of water is being produced in the scheme. It distributes water without any treatment (KII_3, 2023). Figure 14 shows an overhead tank for distribution of water by Siswa WSUC.

Figure 14: Overhead tank of Siswa WSUC.

b. The vulnerability of the aquifer and lateral spacing between sanitation systems and groundwater source

The term aquifer pollution vulnerability is intended to represent the varying level of natural protection afforded by the contaminant attenuation capacity of the unsaturated zone or semi-confining beds above an aquifer, because of physicochemical processes (filtration, biodegradation, hydrolysis, adsorption, neutralization, volatilization, and dispersion)—all of which vary with their texture, structure, clay content, organic matter, pH, redox and carbonate equilibria. Groundwater vulnerability is specific to containment type and pollution scenarios (Andreo, 2013). Here, among the various types of onsite sanitation technologies, lined tanks with impermeable walls and open bottom and lined pits are more prone to contribute to aquifer pollution as the nature of such containments impose more containment load from the land surface to groundwater.

A key determinant of risk variation is the soil and geological setting. Especially for consolidated hard rock sediments with poor soil cover and shallow water tables, the risk is higher. According to WHO criteria, if the travel time of pollutant to groundwater source is less than 25 days, there is significant risk to contamination; low risk, if the travel time is between 25 and 50 days; and very low risk if the travel time is greater than 50 days (Krishnan, 2011). The size of pores in the soil determines the infiltration rate. In the sandy loam soil, the permeability is approximately 2.5 cm per hour. Thus, between 25 and 50 days the pollutant could travel to the depth of approximately 30 metres (98.67 feet) in sandy loam soil. The soil profile as obtained during the digging of deep tube well in Guar by Nepal Water Supply Corporation (NWSC) is shown in Figure 15. It shows that the topsoil, mainly loamy soil ranges between 0 to 6m.

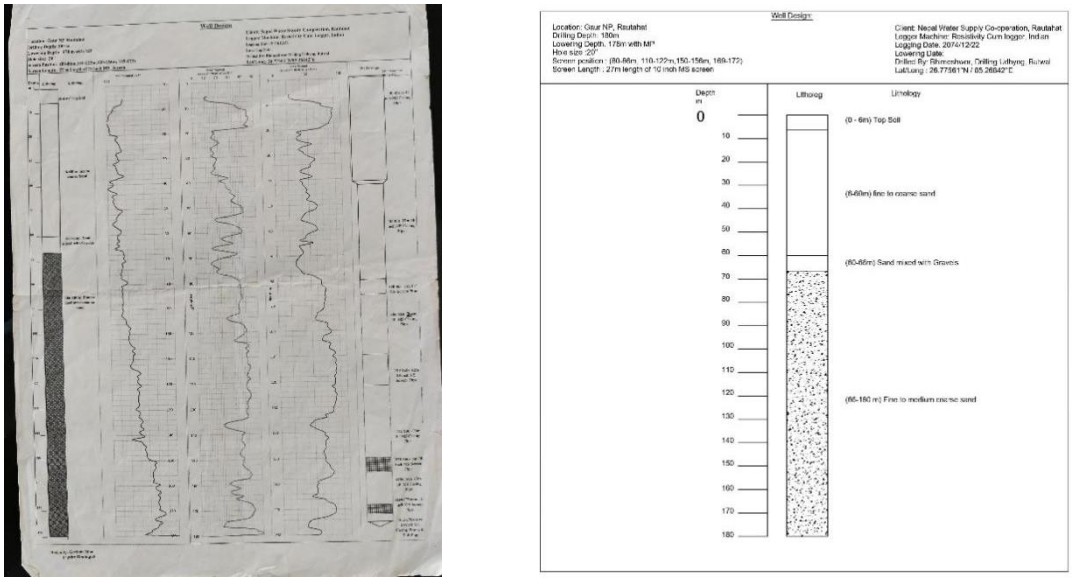


Figure 15: Soil lithology of the Gaur Municipality, source: NWSC Gaur Branch.

Hence, the people using open bottom tanks and consuming water from the handpumps with the depth up to 100 feet (30m) and horizontal distance of the pump within 25 feet (7.6m) from the source of pollutants are assumed at significant risk to groundwater pollution.

Figure 16 demonstrates the depth of hand pumps and horizontal distance of it with the containment type lined pit with semi-permeable walls and open bottom (twin pits and single offset pit). Altogether, 56.7% of households have installed lined pits with semi-permeable walls and open bottoms. Among these, it was revealed that 43% of the households (i.e., T2A5C10: 24.5% of the overall population) are at high risk of groundwater contamination as the water pumped through handpump in these households.

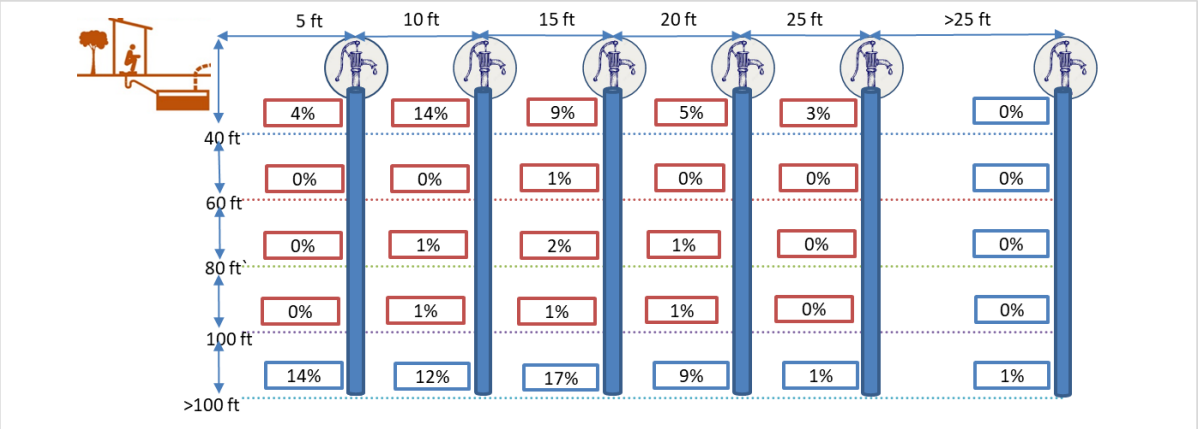


Figure 16: Depth of hand pumps and lateral spacing of it with containment types lined pits with semi-permeable walls and open bottom (ENPHO, 2023).

c. Water Quality

The water quality analysis of samples for drinking water in the Environment and Public Health Organization's (ENPHO) laboratory during 2022 shows that the water in tube wells was contaminated with microbial pollutants. Table 3 shows the water quality results from three groundwater sources. The result implies that groundwater sources in the unconfined aquifer have higher potential of getting contaminated.

Table 3: Water quality report of three groundwater sources from Gaur.

S.N.	Parameters	Unit	Tube well	Deep Well 1	Deep well 2
1	pH		6.95	6.69	7.05
2	Electrical Conductivity	µS/cm	406	414	378
3	Turbidity	NTU	2.98	5.69	6.95
4	Total Hardness	mg/l	168.92	167.66	189.98
5	Iron	mg/l	1.137	0.309	3475
6	Nitrate	mg/l	0	0.88	0.017
7	Ammonia	mg/l	0.599	0.546	0.552
8	Total Coliform	CFU	1,235	506	0
9	*E.coli*	CFU	6	0	0
Source: ENPHO LAB,2022					

2.2 SFD Selection Grid

The types of household containments in the municipality are re-categorized to match the containments defined by Shit Flow Diagram Promotive Initiative (SFD PI). Particularly, twin pits and single pits constructed by assembling pre-cast concrete rings one above another are classified as lined pits with semi-permeable walls and open bottom. Upon reclassification of the containments, the types of sanitation technologies and their connections are selected in the SFD selection grid as shown in Figure 17.

List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?)	List B: What is the containment technology connected to? (i.e. where does the outlet or overflow discharge to, if anything?)									
	to centralised combined sewer	to centralised foul/separate sewer	to decentralised combined sewer	to decentralised foul/separate sewer	to soakpit	to open drain or storm sewer	to water body	to open ground	to 'don't know where'	no outlet or overflow
No onsite container. Toilet discharges directly to destination given in List B					Significant risk of GW pollution Low risk of GW pollution	T1A1C6				Not Applicable
Septic tank					T2A2C5 Low risk of GW pollution	T1A2C6		T1A2C8		
Fully lined tank (sealed)					Significant risk of GW pollution T1A3C5	T1A3C6		T1A3C8		T1A3C10
Lined tank with impermeable walls and open bottom	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	T1A4C6		T1A4C8		Significant risk of GW pollution T1A4C10
Lined pit with semi-permeable walls and open bottom	Not Applicable									T2A5C10 T1A5C10
Unlined pit										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied but abandoned when full and covered with soil										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil										
Toilet failed, damaged, collapsed or flooded										
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded										
No toilet. Open defecation	Not Applicable								T1B11 C7 TO C9	Not Applicable

Figure 17: SFD selection grid for Gaur Municipality.

A brief explanation of terms used to indicate different frames selected in the SFD selection grid is explained in Table 4.

Table 4: Explanation of terms used to indicate different frame selected in the SFD selection grid.

T1A1C6	This is a fully functioning toilet discharging directly to an open drain or storm sewer. The excreta is raw, untreated and hazardous and since it discharges directly to an open drain or storm sewer, all the excreta in this system is considered not contained.
T1A2C6	This is a correctly designed, properly constructed, fully functioning septic tank with an outlet connected to an open drain or storm sewer. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, therefore all the excreta in this system is considered not contained.

T1A2C8	This is a correctly designed, properly constructed, fully functioning septic tank with an outlet connected to an open ground. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, therefore all the excreta in this system is considered not contained.
T1A3C10	A correctly designed, properly constructed, and well-maintained fully lined tank with impermeable walls and base. Since the tank is not fitted with a supernatant/effluent overflow this system is considered contained.
T1A3C5	A correctly designed, properly constructed, and well-maintained fully lined tank with impermeable walls and base. Since the tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning soak pit the excreta in this system is considered contained.
T1A3C6	A correctly designed, properly constructed, and well-maintained fully lined tank with impermeable walls and base. Since the tank is fitted with a supernatant/effluent overflow connected to an open drain or storm sewer the excreta in this system are considered not contained.
T1A3C8	A correctly designed, properly constructed and well-maintained fully lined tank with impermeable walls and base. Since the tank is fitted with a supernatant/effluent overflow connected to open ground the excreta in this system is considered not contained.
T1A4C6	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. Since the tank is fitted with a supernatant/effluent overflow connected to an open drain or storm sewer, the excreta in this system are considered not contained.
T1A4C8	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. Since the tank is fitted with a supernatant/effluent overflow connected to open ground, the excreta in this system is considered not contained.
T1A4C10	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. However, since the tank is not fitted with a supernatant/effluent overflow this system is considered contained.
T1A5C10	A correctly designed, properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow, so this system is considered contained.
T2A2C5	A correctly designed, properly constructed, fully functioning septic tank with a supernatant/effluent outlet connected to a correctly deigned, properly constructed, fully functioning soak pit. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, since there is significant risk of groundwater pollution and the effluent is captured in a soak pit, all the excreta in this system is considered not contained.
T2A5C10	A correctly designed, properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow but since there is a ‘significant risk’ of groundwater pollution this system is considered not contained.

T1B11C7 to C9	With no toilet, users defecate in water bodies, on open ground and to don't know where; consequently, the excreta is not contained.

2.3 SFD Matrix

2.3.1 Proportion of Faecal Sludge from types of sanitation technologies

The second step in the process of developing SFD graphics is calculation of proportion of faecal sludge (FS) contained in each type of sanitation technologies. A detailed instruction on how to calculate the proportion of FS in SFD PI was followed. It stated that the default "100%" value is used where onsite containers are connected to soak pits, to water bodies or to open ground. It will model the contents as 100% faecal sludge and a proportion of this may be emptied periodically. The remaining not emptied fraction is made up of one or more of the following: faecal sludge which remains in the container, supernatant (when discharging to water bodies or to open ground), and infiltrate. Where onsite containers are connected to a sewer network or to open drains, a value of "50%" is used which means that half the contents are modelled as faecal sludge; a proportion of this may be emptied periodically.

The remaining not emptied fraction will comprise faecal sludge which remains in the container and, in the case of open-bottomed tanks, infiltrate. The other half of the contents is modelled as supernatant discharging into the sewer network or to open drains. The formula used for FS proportion calculation is shown below:

$$\frac{(Onsite\ container\ connected\ to\ soak\ pit, no\ outlet, water\ bodies\ or\ open\ ground) * 100 + (Onsite\ container\ connected\ to\ sewer\ network\ or\ open\ drain) * 50}{Onsite\ Container}$$

The calculated FS proportion in each type of sanitation technologies are:

i. The proportion of FS in septic tanks is 65%. The proportion of FS from septic tanks connected to stormwater drain or open drain is considered at 50% of the total FS accumulated in the containment. This implies that almost 50% of FS from such types of containment is discharged into open or stormwater in the form of supernatant.

ii. The proportion of FS in fully lined tanks is calculated as 76%. The proportion of FS from fully lined tanks connected to open drain is considered at 50% of total FS.

iii. The proportion of FS from lined tanks with open bottoms and all types of pits is 99%, as the proportion of lined tanks with impermeable walls and open bottom connected to open drain is 1.4%.

Upon calculation of proportion of FS in each type of sanitation technologies, the proportion of population using the technology selected in the SFD selection grids are fed in. Figure 18 shows the SFD matrix of the municipality.

Gaur Municipality, Madhesh, Nepal, 4 May 2023. SFD Level: 2 - Intermediate SFD
Population: 39846
Proportion of tanks: septic tanks: 65%, fully lined tanks: 76%, lined, open bottom tanks: 99%

Containment								
System type	Population	WW transport	WW treatment	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	W4c	W5c	F3	F4	F5	S4e	S5e
System label and description	Proportion of population using this type of system (p)	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 Toilet discharges directly to open drain or storm sewer	0.6	0.0	0.0					
T1A2C6 Septic tank connected to open drain or storm sewer	1.4			48.0	0.0	0.0	0.0	0.0
T1A2C8 Septic tank connected to open ground	0.3			0.0	0.0	0.0		
T1A3C10 Fully lined tank (sealed), no outlet or overflow	12.5			22.9	0.0	0.0		
T1A3C5 Fully lined tank (sealed) connected to a soak pit	0.3			0.0	0.0	0.0		
T1A3C6 Fully lined tank (sealed) connected to an open drain or storm sewer	15.3			11.4	0.0	0.0	0.0	0.0
T1A3C8 Fully lined tank (sealed) connected to open ground	3.3			6.6	0.0	0.0		
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	0.3			0.0	0.0	0.0		
T1A4C6 Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	1.4			48.0	0.0	0.0	0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	3.0			65.5	0.0	0.0		
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	32.1			16.9	0.0	0.0		
T1B11 C7 TO C9 Open defecation	4.9							
T2A2C5 Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	0.3			80.0	0.0	0.0		
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	24.5			26.7	0.0	0.0		

Figure 18: SFD Matrix of Gaur Municipality.

2.3.2 Proportion of Faecal Sludge Emptied (F3)

The proportion of faecal sludge emptied (F3) is calculated based on percentage containment emptied (ENPHO, 2023) and amount of FS emptied during the process (KII_2, 2023). The information on FS emptied from containment is obtained from KIIs with desludging service providers. It is revealed that most of the containment gets filled due to intrusion of the groundwater into the containment. Thus, the portion of liquid in the FS is high which can be easily pumped out by the desludging vehicle. However, in an average, 20% of the FS in the containment is very thick and does not dissolve in water, so it is not removed during emptying (KII_2, 2023). Hence, actual proportion of FS emptied from each containment is calculated as:

$$Actual\ Proportion\ of\ FS\ emptied\ (F3) = percentage\ of\ containment\ emptied \times proportion\ of\ FS\ removed\ during\ emptying$$

Table 5 shows the actual proportion of FS emptied from each containment.

Table 5: Sanitation technologies and proportion of emptied faecal sludge (ENPHO 2023[1]; KII_2, 2023[2]).

SN	Sanitation Technologies	SFD Reference Variable	Percentage of Population[1]	Percentage of Emptied Containment[1]	Emptied Proportion of FS[2]	Actual Proportion of Emptied FS (F3)
1	Septic tank connected to open drain or storm sewer	T1A2C6	1.4%	60%	80%	48.0%
2	Septic tank connected to open ground	T1A2C8	0.3%	0%	0%	0.0%
3	Fully lined tank (sealed), to soak pit, low risk of GW pollution	T1A3C5	0.3%	0%	0%	0.0%
4	Fully lined tank (sealed), to open drain	T1A3C6	15.3%	14.29%	80%	11.4%
5	Fully lined tank (sealed), no outlet or overflow	T1A3C10	12.5%	28.6%	80%	22.9%
6	Fully lined tank (sealed) connected to open ground	T1A3C8	3.3%	8.3%	80%	6.6%
7	Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	0.3%	0%	0%	0.0%
8	Lined tank with impermeable walls and open bottom, connected to an open drain or storm water	T1A4C6	1.4%	60%	80%	48%
19	Lined tank with impermeable walls and open bottom, connected to an open ground	T1A4C8	3.0%	81.8%	80%	65.5%
10	Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	32.1%	21.2%	80%	16.9%
11	Septic tank connected to soak pit, where there is 'significant risk' of groundwater pollution	T2A2C5	0.3%	100%	80%	80.0%
12	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A5C10	24.5%	33.3%	80%	26.7%

2.3.3 Proportion of wastewater (W4c and W5c) and FS emptied which is delivered to Treatment Plant and treated (F4 and F5)

The municipality does not have a treatment plant to treat either wastewater or faecal sludge. Also, the people using twin pits reclassified as lined pits with semi-permeable walls and open bottoms are not using properly. Hence, the portion of FS delivered to treatment plant (F4) and treated (F5) is 0% for all sanitation systems.

For system T1A1C6 (toilet discharges directly to open drain or storm sewer), values for variables W4c and W5c are also 0% since here is no treatment plant in the municipality.

2.3.4 Proportion of supernatant in open drain or storm sewer delivered to treatment and treated (S4e and S5e)

The actual proportion of supernatant from the containment to open drain and storm water drain cannot be observed. For system T1A2C6 (septic tank connected to open drain or storm sewer), values for variables S4e and S5e are 0% since there is no treatment plant in the municipality.

2.4 SFD Graphic

Figure 19 represents the fate and flow of faecal sludge through each sanitation service chain.

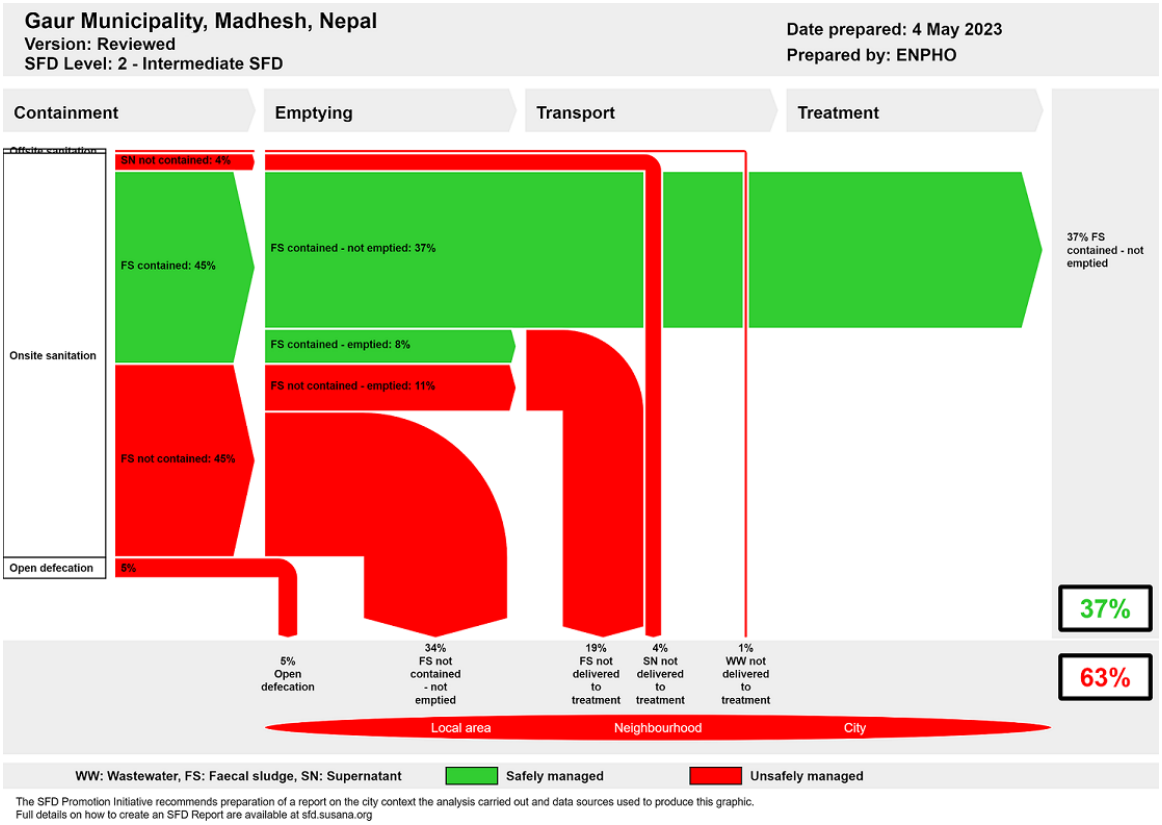


Figure 19: SFD Graphic of Gaur Municipality

The SFD graphic shows that FS generated from 37% of the population is safely managed represented by “Green” colour arrowhead. It resembles the FS stored in containment without significant risk to groundwater. This 37% of safely managed FS should be considered as only

temporary, as most of the pits and tanks have not yet filled up and the FS generated remains 'not emptied'. Therefore, these systems will require emptying services in the short to medium term as they fill up.

FS from 63% of the population is unsafely managed, represented by "RED" arrow heads. The percentage of unsafely managed FS is generated from uncontained containments and openly dumped FS emptied from the containments.

2.4.1 Offsite Sanitation

Nepal Multiple Indicator Cluster Survey (MICS) reported that among the total households in Nepal, 10.7% of households have a toilet connected to sewer network and in Madhesh province it is only 1.1% (CBS, 2020). All the excreta generated from the 1% of population using offsite sanitation unsafely managed as it is directly disposed into either open drain or storm sewer.

2.4.2 Onsite Sanitation

The excreta produced by 94% of the population is stored in onsite sanitation technologies. Among them, FS from 45% of the population are properly stored in technically effective containment represented as FS contained in the SFD graphic, while FS from 45% of the population is stored in unsafe containments represented as FS not contained. Also, since there is no treatment plant, all the supernatant from the containments connected to open drain or storm sewer is unsafely managed (4% SN not delivered to treatment on Figure 19).

FS contained

Faecal sludge that is contained within an onsite sanitation technology which is technically effective is defined as FS contained. The FS generated by 45% of the population is contained in the municipality.

The value is the summation of the percentage of population using fully lined tanks (sealed) connected to soak pit with 'low risk' to groundwater pollution (T1A3C5) and without outlet or overflow (T1A3C10), lined tanks with impermeable walls and open bottom without outlet or overflow (T1A4C10) and lined pits with semi-permeable walls and open bottom without outlet or overflow (T1A5C10) multiplied by proportion of FS contained in each containment.

FS not contained

FS collected in either technically appropriate or inappropriate containment with potential risk on direct contact with human or contamination of groundwater is termed FS not contained. FS generated by 45% of the population in the municipality is not contained.

The value is obtained from the summation of the percentage of population using septic tanks connected to open drain or storm sewer (T1A2C6), open ground (T1A2C8) and to a soak pit with 'high risk' to groundwater pollution (T2A2C5); fully lined tanks (sealed) connected to an open drain or storm sewer (T1A3C6) and open ground (T1A3C8); lined tanks with impermeable walls and open bottom connected to an open drain or storm sewer (T1A4C6) and open ground (T1A4C8). Similarly, the FS collected in lined pits with semi-permeable walls and open bottom, no outlet or overflow with 'significant risk' to groundwater pollution also accounts for FS not contained (T2A5C10).

FS contained and not contained which is emptied or not emptied

Altogether, 26.8% of the containments have been emptied at least once after installation as revealed from household survey. Considering the proportion of FS in the containment (septic tank 65%, fully lined tank 76% and lined, open bottom tank 99%) together with proportion of FS emptied at 80% during emptying process, result to total proportion of FS emptied from both contained and not contained containments to 19%. Moreover, only 8% of FS contained is emptied and 37% of FS remains safely stored.

In addition, 11% is FS not contained which is emptied and 34% is FS not contained - not emptied.

FS not delivered to treatment

The municipality does not have a treatment facility to treat either wastewater or faecal sludge. So, all the wastewater, FS emptied and supernatant from contained and not contained containments is disposed of untreated into farmlands, riverbanks, and the jungle.

Open Defecation

Despite Open Defecation Free (ODF) status, 5% of population still defecate openly. Mostly, the households living in poverty and those who do not own land do not have toilets.

3 Service delivery context description

3.1 Policy, legislation, and regulation

The constitution of Nepal 2015 has established right to access to clean drinking water and citizen as fundamental right. In Article 35 (4) related to right to health recognizes citizen's rights to access to clean drinking water and sanitation. In addition, Right to Clean Environment, Article 30 (1) recognizes that every person shall have the right to live in a healthy and clean environment (GoN 2015). To respect and promote the right of citizens to wards accessing clean drinking water and sanitation services, the government has promulgated and amended necessary laws. The most relevant legislation for promotion of safe sanitation services is discussed here.

Local Government Operation Act, 2017

Local Governance Operation Act 2017 has promulgated to implement the rights of local government and promote co-operation, co-existence, and co-ordination among federal, provincial, and local government. The act defined roles and responsibility of municipalities along with provision and procedure for approving laws and regulations at local level. Regarding the management of sanitation, the act entitles local government to conduct awareness campaigns, design and implement sanitation programs at the local level.

Environment Protection Act, 2019

Environment protection act 2019 is promulgated to prevent and control pollution from different development activities. It defines "Pollution" as the activities that significantly degrade, damage the environment, or harm the beneficial or useful purpose of the environment, by changing the environment directly or indirectly because of wastes, chemical, heat, noise, electrical, electro-magnetic wave, or radioactive ray. It provides the mechanism for appointing environmental inspectors to control pollution by federal, provincial, and local government.

Water Supply and Sanitation Act, 2022

The act was promulgated to ensure the fundamental right of citizen to easy access on clean and quality drinking water, sanitation services and management of sewerage and wastewater. It defines sewerage and wastewater management as construction of sewer networks and treatment plants to preserve sources of water. It has entitled federal, provincial, and local level for the operation and management of water and sanitation services. The act also explicitly defines the responsibility of every citizen to preserve, conserve and maintain the sources of water and use responsibly.

Environment Friendly Local Governance Framework 2013

The environment-friendly local governance framework 2013 has been issued to add value to environment-friendly local development concept encouraging environmental protection through local bodies. The framework has set basic and advanced indicators for households, settlement, ward, village, municipality, and district levels for declaration of environment friendly. The use of water sealed toilets in households as basic indicators for sanitation and health. Provision of toilet with safety tank and use as advanced indicators for sanitation. Provision of gender, children and disabled friendly public toilets in parks, petrol pumps and

main market as basic indicator for municipal level. Advance indicators such as drainage discharged only after being processed through biological or engineering technique. While it has failed to identify the necessity of faecal sludge treatment plants as it has assumed safety tank in the households is sufficient for treating faecal sludge.

Institutional and Regulatory Framework for Faecal Sludge Management, 2017

Ministry of Water Supply through its Department of Water Supply and Sewerage Management (DWSSM) articulated and endorsed Institutional and Regulatory Framework (IRF) for Faecal Sludge Management in Urban Areas of Nepal in 2017. The main objective of the IRF is to define the specific roles and responsibilities of key institutions for the effective management and regulation of FSM. The framework primarily envisioned featuring FSM in the national policy and issuing policy directives into local government to incorporate FSM in their urban planning along with strengthening and enhancing the capacity of the local government to deliver effective services. A local government has been endowed with overall responsibility to plan, implement, and regulate the FSM services within its jurisdiction. The provision of the ability to engage the private sector and other relevant stakeholders such as the Water and Sanitation Users Committee (WSUC) in the framework reflects a participatory approach that would help in sustaining the interventions.

Total Sanitation Guideline, 2017

Total Sanitation Guideline was promulgated by the Ministry of Water Supply in April 2017 after the successful implementation of National Sanitation and Hygiene master Plan (NSHMP) 2011. It provides guidelines for sustaining ODF outcomes and initiating post-ODF activities through an integrated water, sanitation and hygiene plan at municipalities and districts. The guideline redefined sanitation as management of services and facilities to safely dispose of/reuse faecal sludge, collection and treatment of solid waste and wastewater to establish a hygienic environment and promote public health. Indicators are set to guide total sanitation movement with an arrangement for resource management, monitoring and evaluation, capacity building.

3.2 Policies

Historically, the National Sanitation Policy (1994) was the guideline for the planning and implementation of sanitation programs. The policy had promoted sanitation issues together with issues on water supply in rural communities. Also, Rural Water Supply and Sanitation National Policy (RWSSNP) 2004, has set a new target to provide safe, reliable, and affordable water supply with basic sanitation facilities. The policy focused on delivering quality services on water and sanitation to the marginalized and vulnerable groups. However, it was unable to address the complex operational issue of urban water supply and sanitation service delivery. Thus, the National Urban Water Supply and Sanitation Sector Policy (NUWSSSP) was formulated and enforced in 2009. It focused on achieving coherent, consistent, and uniform approaches of development in urban areas with the involvement of different agencies and institutions. Both these policies were limited to addressing emerging issues and challenges in the rural and urban areas. Thus, the National Water Supply and Sanitation Policy (NWSSP) was formulated in 2014 by GON to address the emerging challenges and issues with the adoption of new approaches and resolve the inconsistency in RWSSNP and NUWSSSP.

The goal of the NWSSP was to reduce urban and rural poverty by ensuring equitable socio - economic development, improving health and the quality of life of the people and protection of environment through the provision of sustainable water supply and sanitation services. It adopted innovative technologies and knowledge emerged in the sector. Remarkably, it was the first official document that recognized discharge of untreated wastewater and dumping of septic sludge heavily polluted the surface water sources in urban areas.

Nepal is a signatory of the historical resolution of 2010 United Nations General Assembly on the Human Right to Water and Sanitation. Nepal committed to Millennium Development Goals (MDGs) for 2000- 2015 The goal was accomplished through declaration of the country as free from open defecation on 30th September 2019. National Sanitation and Hygiene Master Plan, 2011 was developed for coordinated planning and implementation of National Sanitation Campaign. The campaign strengthened institutional set-up tier of government in a participatory approach. In an alignment total sanitation campaign was initiated formally to sustain ODF. The guideline set various indicators to assess the sustainability of sanitation services. Remarkably, it extended sanitation definition as management of services and facilities to safely dispose of/reuse faecal sludge, collection and treatment of solid waste and wastewater to establish the hygienic environment and promote public health (NPC, 2017).

Similarly, Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (SDP 2016-2030) was formulated in 2016 for sector convergence, institutional and legal reforms, capacity development and establishing coordination and harmonization in the sector. The SDP classified service system and delineated roles and responsibilities for effective and sustainable service delivery. The SDP highlighted that majority of households rely on onsite sanitation system (70%) that requires effective treatment of faecal sludge. However, there is lack of concrete policies, guidelines, and indicators on Faecal Sludge Management in the sector for effective planning, implementation, and service delivery.

3.3 Institutional roles

Federal, provincial, and local government are entitled for implementation of water and sanitation programs to ensure the rights on access to safe water and sanitation.

At Federal Government

National Planning Commission: At the federal government, the National Planning Commission is the specialized and apex advisory body for formulating a national vision, developing policy, periodic plans, and sectoral policies. The NPC assesses resource needs, identifies sources of funding, and allocates budget. It serves as a central agency for monitoring and evaluating development policy, plans and programs. It supports, facilitates, and coordinates with federal, provincial, and local government for developing policy plans and implementation.

Ministry of Water Supply: Ministry of Water Supply is the lead ministry responsible for planning, implementation, regulation, and monitoring and evaluation of sanitation programs in the country (GoN, 2015). Under the MoWS, Department of Water Supply and Sewerage Management (DWSSM) plan and implement water and sanitation projects funded by foreign donors or inter provincial projects or serves at least 15,000, 5,000 and 1,000 people in terai,

hilly and mountain region respectively (GoN, 2015). The organizational structure of DWSSM is shown in Figure 20.

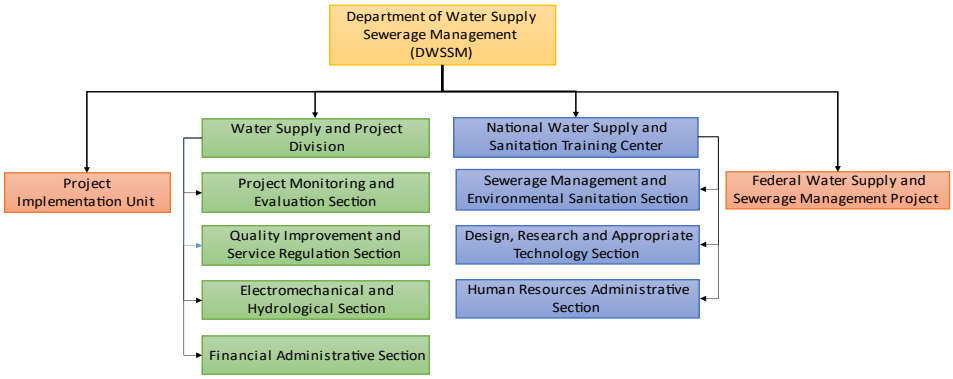


Figure 20: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

At Provincial Government

Ministry of Physical Infrastructure: Ministry of water supply and energy development of provincial government in Madhesh province is major executing body for planning, developing, and implementing water supply and sanitation programs. Planning and implementation of water supply and sanitation infrastructure in the province is executed through Water supply and Sanitation Divisional Office (WSSDO). WSSDO implements the water and sanitation programs meeting the following criteria:

i. Inter local government projects.

ii. Beneficiaries between 5,000 to 15,000 in terai region, 3,000 to 5,000 in hilly region and 5,00 to 1,000 in Himalayan region.

At Local Government

Municipal council: Figure 21 shows the institutional arrangement of the municipality. The sanitation sub-section is under the Infrastructure Development and Environment Management Section. The sub-section has initiated containment emptying services in the municipality. The service seekers must register for the service and pay the service charge of NRs. 1,500 (USD 11) per trip.

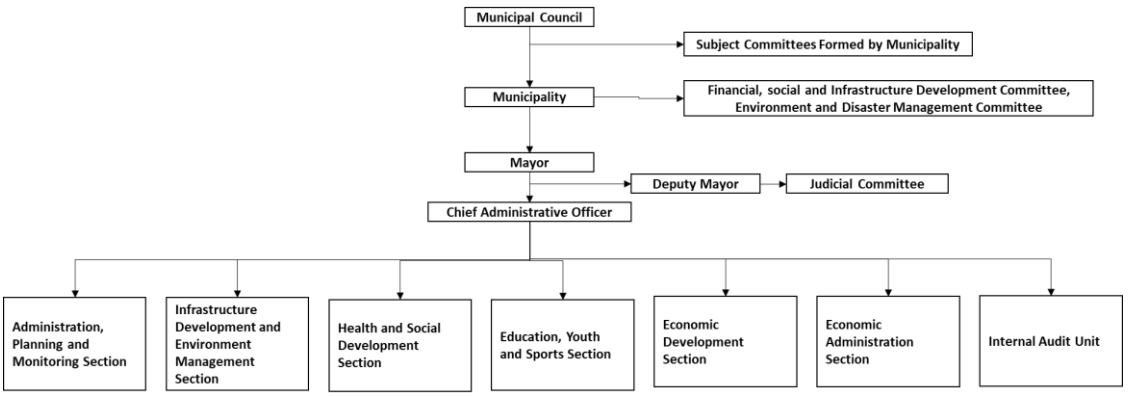


Figure 21: Institutional arrangement of Gaur Municipality.

3.4 Service provision

Urban Water Supply and Sanitation Policy 2009 has emphasized the Public-Private Partnership (PPP) in water supply and sanitation to improve service delivery (MoPIT, 2009). Also, the Public-Private Partnership Policy, 2015 encourages private sector investment in the development and operation of public infrastructure services for comprehensive socio-economic development. The policy has aimed to remedy challenges such as structuring of projects, land acquisition, coordination and approval, payments to private sectors and approval for environment impact (MoF, 2015).

3.5 Service standards

The sanitation service standards have set by Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016-2030). It classifies sanitation services as high, medium, and basic based on sanitation facilities in place. The sanitation service levels with indicators are shown in Table 6. However, FSM specific standards have yet to be developed and implemented.

Table 6: Sanitation Service Level and its Components.

S.N.	Service Components	Service Level		
		High	Medium	Basic
1	Health and Hygiene Education	✓	✓	✓
2	Household Latrine	✓	✓	✓
3	Public and School Toilets	✓	✓	✓
4	Septic tank sludge collection, transport, treatment, and disposal	✓	✓	✓

5	Surface drains for collection, transmission, and disposal of greywater	✓	✓	✓
6	Small-bore sewer collection for toilet and septic tank effluent, low-cost treatment and disposal		✓	
7	Sanitary sewers for wastewater collection, transmission, non-conventional treatment, and disposal	✓		
8	Sanitary sewers for wastewater collection, the transmission of conventional treatment and disposal	✓		
9	Limited solid waste collection and safe disposal	✓	✓	✓

4 Stakeholder Engagement

4.1 Key Informant Interviews (KIIs)

KIIs and objective sharing of the study were conducted with the major stakeholders of sanitation sector of the municipality. Interaction regarding the sanitation situation and planning of the municipality was conducted with Mr. Shambhu Shah, Mr. Shuvas Kumar Thakur, and Mr. Dhirendra Kumar lal Das, Mayor, Chief Administrative Officer, and Legal Officer of the municipality. Also, KII with Mr. Ram babu Keshari, a staff from sanitation sub-section of the municipality was conducted to understand the containment emptying services in the municipality. Besides, Ms. Shanti Devi Jha, a chairperson of Siswa WSUC and Mr. Govinda Shah and Mr. Amrendra Kumar Singh, Branch Manager and Supervisor respectively from Nepal Water Supply Corporation (NWSC) Gaur Branch was interviewed regarding the water supply services and quality of the water.

Figure 22 shows the key interview conducted with Chairperson of Siswa WSUC.

Figure 22: Interview with Chairperson of Siswa WSUC.

Similarly, caretakers from public toilets were interviewed to understand the status of public toilets in the municipality. List of KIIs conducted with their designation in the organization are working is shown in Table 7.

Table 7: List of Key Informant Interviewed personnel (ENPHO, 2023).

S.N.	Name	Designation	Organization/ Company	Purpose of KII	Date
1.	Shambhu Shah (KII-1)	Mayor	Gaur Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	23rd February 2023
2.	Shuvas Kumar Thakur (KII-1)	Chief Administrative Officer	Gaur Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	23rd February 2023
3	Dhirendra Kumar lal Das (KII-1)	Legal Officer	Gaur Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	23rd February 2023
4.	Ram babu Keshari (KII-2)	Staff, Sanitation sub-section	Gaur Municipality	Emptying practices, finances, requirement, disposal and treatment	23rd February 2023
5.	Shanti Devi Jha (KII-3)	Chairperson	Siswa WSUC	Water supply services	24th February 2023
6.	Govinda Shah (KII-4)	Branch manager	NWSC Gaur Branch	Water Supply Services	24th February 2023
7.	Amrendra Kumar Singh (KII-4)	Supervisor	NWSC Gaur Branch	Water Supply Services	24th February 2023
8.	Gajendra Malli (KII-5)	Caretaker	Public toilet at Gaudri market	Public toilet facilities	24th February 2023

4.2 Household Survey and Direct Observation

Household survey was conducted in all wards of the municipality through mobilization of enumerators selected by the municipality. The enumerators were given two days orientation about sanitation and methods for conducting the household survey. The household survey was conducted using the mobile application “KOBOCOLLECT” after orientation. SFD team members along with municipal focal person went on field visits in households to encourage enumerators and observe household sanitation status.

Various sanitation technologies in the households in all the wards were observed and visual references were kept. Also, observation of the emptying of containments and transportation of faecal sludge were carried out. Figure 23 depicts some pictures taken during the household survey and field monitoring visit.

Figure 23: Household survey and field monitoring visit.

4.2.1 Determining Sample Size

The number of households to be sampled in the municipality was determined by using Cochran (1963:75) sample size formula $no = \frac{z2pq}{e2}$ and its finite population correction for the proportion $n = n_o/(1 + (n_o-1)/N)$.

Where,

Z	1.96	At the confidence level of 95%
p	0.5	Assuming that about 50% of the population should have some sanitation characteristics that need to be studied (this was set at 50% since this percentage would yield the maximum sample size as the percentage of the population practising some form of sanitation is not known at the intervention sites).
q	1-p	
e	+/-5%	Level of precision or sampling error.
N		A total number of population (households in the municipality).

This is followed by proportionate stratification random sampling such that each ward in the municipality is considered as one stratum. The sample sized required in each ward is calculated as

$n_h = (N_h/N)*n$, where N_h is a total population in each stratum.

Thus, a total of 367 households were sampled from estimated 10,594 households distributed in 9 wards with proportionate stratification random sampling. The household samples surveyed in the municipality is shown in Figure 24.

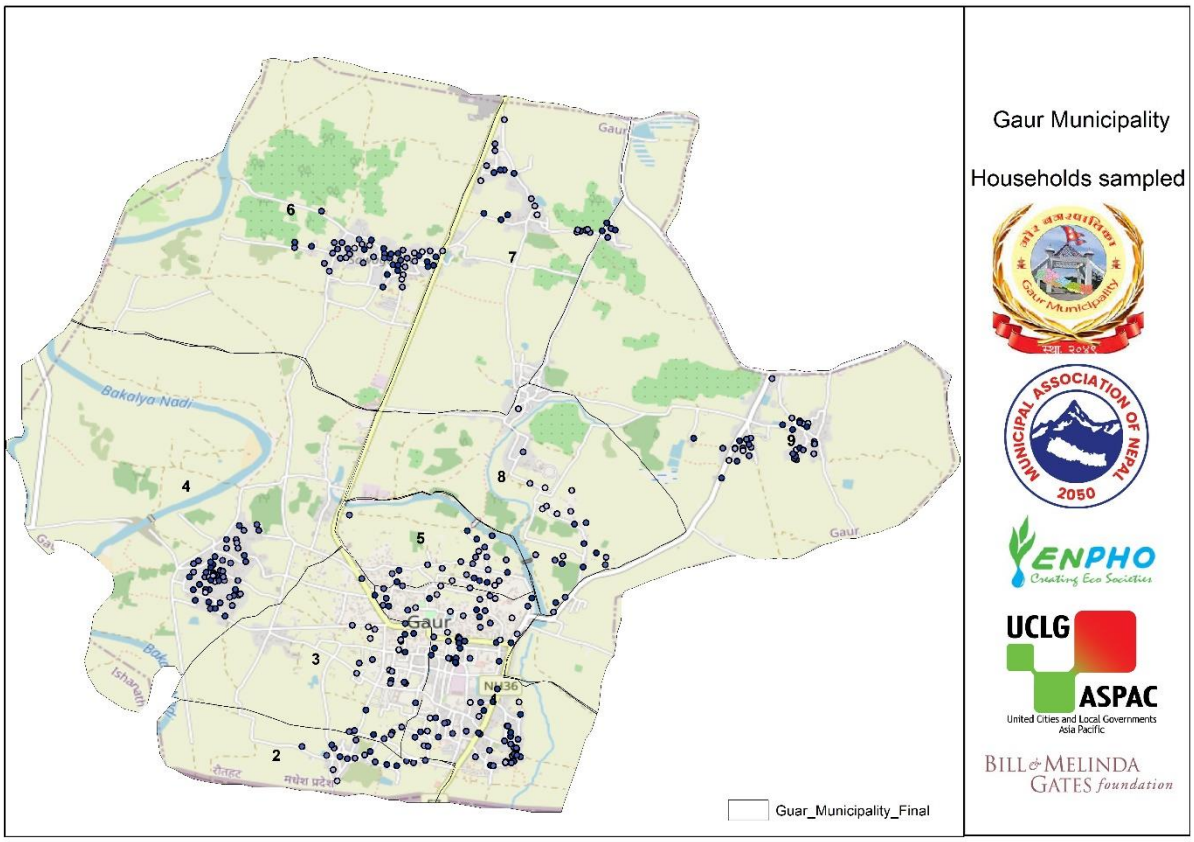


Figure 24: Distribution of sampling points in different wards of Gaur Municipality (ENPHO, 2023).

4.2.2 Sharing and Validation of Data

The Shit Flow Diagram Sharing and Validation workshop was conducted in the municipality to share the findings of the sanitation situation survey and to receive suggestions from municipal stakeholders. Altogether, 28 participants including the mayor, ward chairpersons, members from municipal executive council and sectoral staff actively attended the program and provided valuable suggestions (Figure 25, 26 and 27). In the sharing program, mayor and municipal executive council mentioned that the municipality does not have provision for the registration of private desludging service providers and are not permitted to conduct their services in the municipality. The municipality provides desludging service to serve public with only desludging vehicle owned by the municipality. The mayor and municipal executive council also insisted that land for the FSTP has already been designated and construction work will start soon. The list of participants with their designation is attached in Appendix 2.

Figure 25: Sharing program being facilitated by and the program headed by Deputy mayor of the municipality.

Figure 26: A remark from Mayor of the municipality in sharing and validation workshop.

Figure 27: Sharing findings in the sharing and validation workshop.

5 Acknowledgements

We would like to thank Mr. Shambhu Shah, Mayor, Mr. Shuvas Kumar Thakur, Chief Administrative Officer and Mr. Dhirendra Kumar Lal Das, Legal Officer of Gaur Municipality for continuous support in the study. We would also like to thank Mr. Ram Babu Keshari a staff from sanitation sub-section of the municipality.

We would like to thank Mr. Govinda Shah, the Manager, and Mr. Amrendra Kumar Singh from the NWSC Gaur Branch Office for providing valuable information on drinking water supply. Also, we would like to thank Ms. Shanti Devi Jha, Chairperson of Siswa WSUC for providing insight on water supply services from WSUC in the municipality.

We are grateful to Ms. Bhawana Sharma, Executive Director and Mr. Rajendra Shrestha, Program Director of Environment and Public Health Organization (ENPHO) for tremendous support and guidance during the whole process of the study.

We would also like to appreciate Dr. Roshan Raj Shrestha, Deputy Director of Bill and Melinda Gates Foundation (BMGF), Dr. Bernadia Irawati Tjandradewi, Secretary General and Mr. Satish Jung Shah, Knowledge Management Officer at UCLG ASPAC. Similarly, we are very much obliged to Mr. Bhim Prashad Dungana, President and Mr. Kalanidhi Devkota, Executiv Director, Mr. Muskan Shrestha, Sanitation Advocacy Specialist in MuAN for their gracious support during the study.

6 References

Andreo, S. F. (2013). The aquifer pollution vulnerability concept: aid or impediment in promoting groundwater protection? *Hydrogeology Journal*.

CBS. (2020). *Multiple Indicator Cluster Survey, 2019.* Kathmandu, Nepal: Central Bureau of Statistics.

Dahal, K. R. (2006). *Geology of Nepal*. Retrieved from Geology of Nepal: http://www.ranjan.net.np/index.php/resources/geology-of-nepal

ENPHO, 2023. *Sanitation Situation Assessment of Gaur Municipality: Unpublished,* s.l.: s.n.

Gaur Municipality. (2022). *Municipal Profile of Gaur Municipality.*

GoN. (2015, September 30). *Constitution of Nepal: Goverment of Nepal*. Retrieved from https://lawcommission.gov.np/en/wp-content/uploads/2021/01/Constitution-of-Nepal.pdf

KII_1. (2023). Current sanitation status and plans for improvement in Gaur municipality.

KII_2. (2023). Containment emptying services in the Gaur Municipality.

KII_3. (2023). Water Supply Services by Water Supply and Sanitation User's Committee in Gaur Municipality.

KII_4. (2023). Drinking water supply services from Nepal Water Supply Corporation in Gaur municipality .

Krishnan, S. (2011). *On-site Sanitation and Groundwater Contamination: A Policy and Technical Review.* Anand: INREM Foundation.

MoF. (2015). Public-Private Partnership Policy. In M. o. Finance. Kathmandu, Nepal: Goverment of Nepal.

MoPIT. (2009). National Urban Water Supply and Sanitation Sector Policy. Ministry of Physical Infrastructure and Transport.

NSO. (2022). *National population and housing census 2021.* Kathmandu: National Statisitics Office.

-Susana, 2018. *SFD Manual.* s.l.:s.n.

Water Aid. (2012). *Universal access to sanitation and drinking water forall: municipal areas of Nepal by 2017.* Water Aid in Nepal.

weatherspark. (2023). *Climate and average weather year round in Gaur, Nepal*. Retrieved from weatherspark: https://weatherspark.com/y/111091/Average-Weather-in-Gaur-Nepal-Year-Round#Sections-Humidity

7 Appendix

7.1 Appendix 1: Roles and Responsibility of Various Tiers of Governments Delineated in Drafted SDP 2016 – 2030

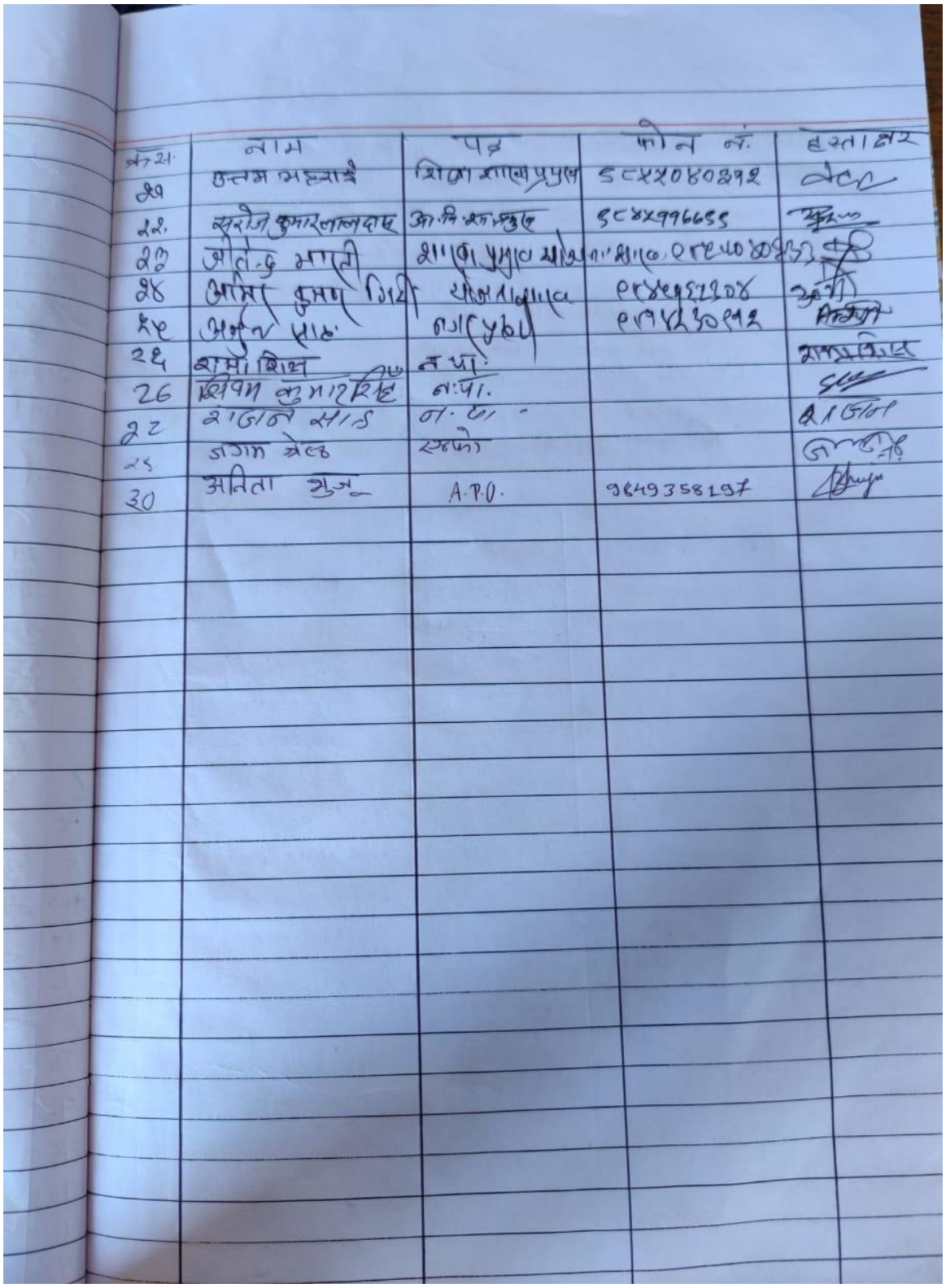
System Classification		**Minimum Key HR Required**	**Regulation & Surveillance**	**Financing & Construction**	**Ownership of System**	**Service Delivery**	
Size	Sanitation					Provision	Production
Small	Onsite sanitation	Water Supply and Sanitation Technician (WSST)	Federal and or Provincial Government	User+/ community+/ other			
Medium	Septage Management	Sub-engineer	Federal and or Provincial Government	Provincial+/ Local Govt+/ Community+/ Private Sector		Local Govt	Users committee/ Utility manager
Large	Septage or FSM Management	WASH Engineer + finance & admin staff	Federal and or Provincial Government	Provincial+/ Local Govt+/ Community+/ Private Sector		Local Govt	Utility Manager
Mega	Septage/ FSM Management	WASH Engineer + finance & admin staff	Federal and or Provincial Government	Provincial+/ Local Govt+/ Community+/ Private Sector		Local Govt	Utility Manager

7.2 Appendix 2: List of Participants present in Sharing and Validation meeting of SFD report

आज मिति २०८०/०२/१६ गतेका दिन नेपाल नगरपालिका संघको आयोजनामा वातावरण र जनस्वास्थ्य संस्था (एन्फो) को प्राविधिक सहयोग तथा The United Cities and local Government Asia Pacific (UCLG - ASPAC) को सहकार्यमा Municipalities Network Advocacy on Sanitation in South Asia (MuNASS II) कार्यक्रम अन्तर्गत गौर नगरपालिका-मा संचालन गरिएको Shit Flow Diagram (SFD) सम्बन्धी अन्तरक्रिया र प्रमाणीकरण गोष्ठीमा निम्न अनुसार मुख्य सरोकारवालाहरूको सहभागिता रह्यो। साथै दिसाजन्य लेदो सम्बन्धी अन्तरक्रियामा उपस्थिति रह्यो।

उपस्थिति

क्र.सं.	नाम	पद	फोन नं.	हस्ताक्षर
१.	शम्भु साह	नगर प्रमुख	९८५५०४२८०२	
२.	शैल कुमारी साह	नगर उप-प्रमुख	९८५५०४६७८८	
३.	सुभाष कुमार ठाकुर	प्रमुख प्रशासकीय अधिकृत	९८५५०८६१११	
४.	सुरज कला देवी	कार्यपालिका सदस्य वडा १	९८४५१६१६४१	
५.	प्रेम शील (साह) देवी	कार्यपालिका सदस्य वडा ८	९८६४०१४१९८	
६	हरिवंश पाण्डे	वडा अध्यक्ष-६	९८४५०३४८१६	
७	अब्दुल ताहिर	वडा अध्यक्ष २	९८६५०८५६१४	
८	विनोद साह	वडा ११	९८५५१३४४६८	
९	अवध बिहारी प्र०	वडाध्यक्ष ६	९८४५२५११५८	
१०	संजय गिरी	वडा अध्यक्ष-४	९८५५०४८८८२	
११	लाल बाबु चौधरी	वडा अध्यक्ष १	९८४५०३७२२२	
12	शिव शंकर ठाकुर	१५/अध्यक्ष-५	९८४८१३६१४६	
१३	दीनबन्धु यादव	स्वा. शाखा प्रमुख	९८४५०८७८८३	
१४	मनोज कुमार सिंह	कार्यपालिका सदस्य	९८४५८८८८९४९	
१५	लक्ष्मी कुमारी साह	कार्यपालिका सदस्य	९८६५०१५८६२	
१६	कुमार अर्जुन सिंह	वडा अध्यक्ष	9855042398	
१७	रोशनी कुमारी शेख	ब० राजपा०	९८४५०५८८९६	
१८	अकलेश कुमार साह	कृ. अ.	९८४५५६८२८२	
१९	रौशन कु. श्रीवास्तव	सू.प्र.अ.	९८४५५२६५६०	
20	जनार्दन साह	वडा अध्यक्ष	९८५५०४४६४२	



क्र.सं.	नाम	पद	फोन नं.	हस्ताक्षर
20	उत्तम महताै	शिक्षा शाखा प्रमुख	9CX2080892	
21	सुरेज कुमार लालदास	आ.वि.अ.प्रमुख	9CX996655	
22	अनिल भारती	शाखा प्रमुख		
23	अमर कुमार गिरी			
24	अर्जुन साह			
25	रामाशिष			
26	शिवम कुमार सिंह			
27	रंजन साह			
28	जगत बेल्ब			
29	अनिता गुरु	A.P.O.	9849358197	

SFD Promotion Initiative

SFD Gaur Municipality, Nepal, 2023

Produced by:
Jagam Shrestha, ENPHO
Anita Bhuju, ENPHO
Shreeya Khanal, ENPHO
Buddha Bajarchaya, ENPHO
Rupak Shrestha, ENPHO
Sabuna Gamal, ENPHO

This Executive Summary and the SFD Report are available from:

www.sfd.susana.org