SFD Report

Parsagadhi Municipality
Nepal

Final Report

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

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SFD Report Parsagadhi Municipality, Nepal, 2023

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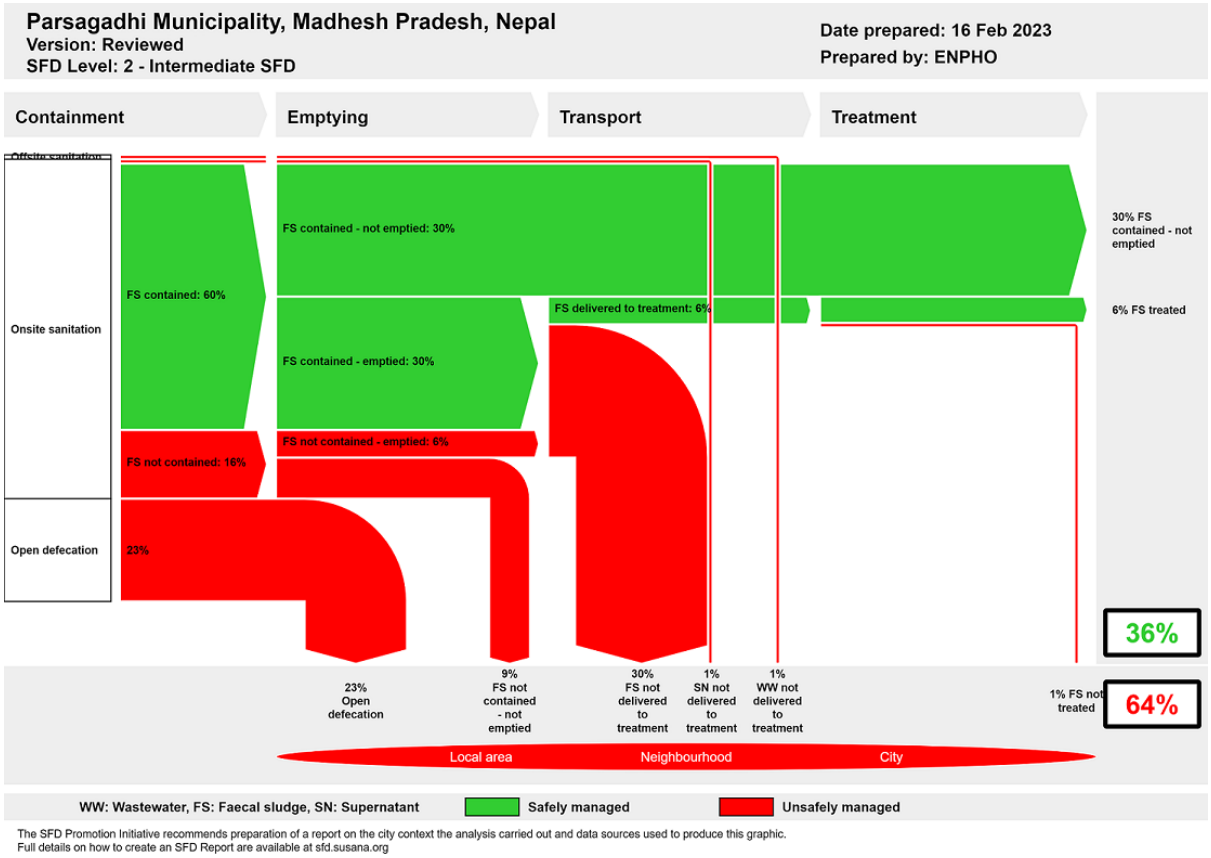
1. The SFD Graphic



The SFD Promotion Initiative recommends preparation of a report on the city context the analysis carried out and data sources used to produce this graphic.
Full details on how to create an SFD Report are available at sfd.susana.org

2. Diagram information

SFD Level:

This SFD is a level 2- Intermediate report.

Produced by:

Environment and Public Health Organization (ENPHO).

Collaborating partners:

Parsagadhi Municipality, Municipal Association of Nepal (MuAN), United Cities and Local Government – Asia Pacific (UCLG-ASPAC).

Status:

Final SFD report.

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3. General city information

Parsagadhi Municipality was established in 2016. The municipality is located in Parsa District, Madhesh Province. The municipality is divided into nine political wards.he municipality has a total population of 41,569 with 21,011 males and 20,558 females (Census 2021, n.d.).

Out of total wards, ward number 3 has the largest population (7,221) while ward number 9 has the least number of populations with (3,234). The municipality has a total of 7,632 households. Ward number 3 has the most households with a total (1,662), while ward number 9 has the least number of households with a total (561).

The average temperature here is 23 °C i.e., 74.7 °F. The annual rainfall is 1,402 mm (climate-data, n.d.).

4. Service outcomes

The overview of different sanitation technologies across the sanitation value chain in the municipality is briefly explained in this section. All data in this section is from the household and institutional surveys conducted for this study (ENPHO, 2022). Basic sanitation coverage in the municipality is 76.69%. Basic sanitation is defined as having access to facilities for the safe disposal of human waste (faeces and urine), as well as having the ability to maintain hygienic conditions, through services such as garbage collection, industrial/hazardous waste management, and wastewater treatment and disposal. The families without toilets defecate in open places, public toilets or use neighbour's toilet. Among the households having their own toilets 99.7% HHs rely on onsite sanitation system.

Containment:

Different types of containment used to store faecal sludge in the onsite sanitation systems are: Septic tanks (0.8%), Fully lined tanks (16.3%), Lined tanks with impermeable walls and open bottom (9.0%), Lined pits with semipermeable walls and open bottom (50.3%). Moreover, 0.3% of households rely on offsite sanitation and 23.3% practise open defecation.

Emptying and Transportation:

There are regular emptying practices of the containments. 41.01% of the households had emptied the containment at least once since installation. Both manual and mechanical desludging mechanism is practiced.

Treatment and Disposal:

The municipality lacks a faecal sludge treatment facility. The majority of faecal sludge emptied is used in agricultural lands as well as dumped in the environment untreated. Households having a biogas digester installed utilize its energy in cooking and other purposes.

The SFD graphic shows that 36% of the excreta generated are safely managed while 64% of the excreta generated are unsafely managed. The safely managed percentage of FS generated by 30% 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 enforced the Water Supply and Sanitation Law 2022 which 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, NSHMP 2011 has proved to be an important strategic document for all stakeholders to develop uniform programs and implementation mechanisms at all levels. It strengthened institutional set up with the formation of Water and Sanitation Coordination Committee (WASH-CC) to actively engage in sanitation campaigns. The sanitation campaign was implemented throughout the country mainly focusing on achieving universal access to improved sanitation.

The draft Sector Development Plan (SDP) has envisioned the delineation of roles and responsibilities of federal, provincial and local government in an aim to initiate sustainability of national sanitation campaign.

6. Overview of stakeholders

The major stakeholders envisioned by the regulatory framework for faecal sludge management (FSM) in urban cities are presented in Table 1.

Table 1: Overview of Stakeholders.

Key Stakeholders	Institutions / Organizations
Public Institutions at Local Government	Parsagadhi Municipality
Non-governmental Organizations	Environment and Public Health Organization (ENPHO)
Private Sector	Public Toilet Operators.
Development Partners, Donors	MuAN, BMGF, UCLG ASPAC

7. Credibility of data

The major data had been collected from random household sampling. Altogether, 356 households and 16 institutions were surveyed from nine wards of Parsagadhi Municipality. Primary data on emptying, transportation and current sanitation practices in the municipality are triangulated with the data obtained from KII with Mayor, Municipal Officers, Operator of

public toilet, sanitation, and environmental section. Also, a data sharing and validation workshop with key stakeholders was performed.

8. Process of SFD development

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2023). Enumerators from the municipality have been 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 was conducted with officers and engineers of municipality, Water Supply and Sanitation Users Committee. Types of sanitation technologies used in various locations have been mapped using ARCGIS. For the Shit Flow Diagram (SFD) graphic production, initially, a relationship between sanitation technology used in questionnaire survey and Shit Flow Diagram Promotive Initiatives (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:

- Census 2021. (n.d.). Retrieved from https://censusnepal.cbs.gov.np/results/population?province=2&district=20&municipality=13
- climate-data. (n.d.). Retrieved from en.climate-data.org: https://en.climate-data.org/asia/nepal/western-development-region/parsa-799343/#weather
- ENPHO. (2022). *Sanitation Situation Assessment of Parsagadhi Municipality: Unpublished.*
- MoFAGA. (2017). Ministry of Federal Affairs & General Administration. Retrieved from Government of Nepal, Ministry of Federal Affairs & General Administration: https://www.sthaniya.gov.np/gis/.

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Abbreviations

ENPHO	Environment and Public Health Organization
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSTP	Faecal Sludge Treatment Plant
GoN	Government of Nepal
HH	Household
JMP	Joint Monitoring Programme
KII	Key Informant Interview
KM	Kilometres
mm	Millimetre
MoEST	Ministry of Education, Science and Technology
MoFAGA	Ministry of Federal Affairs and General Assembly
MoH	Ministry of Health
MoHP	Ministry of Health and Population
MoUD	Ministry of Urban Development
MoWS	Ministry of Water Supply
MuAN	Municipal Association of Nepal
NPC	National Planning Commission
NUWSSP	National Urban Water Supply and Sanitation Sector Policy
NWSSP	National Water Supply and Sanitation Policy
ODF	Open Defecation Free
RWSSNP	Rural Water Supply and Sanitation National Policy
SCEIS	Sector Coordination and Efficiency Improvement Section
SDG	Sustainable Development Goal
SDP	Sector Development Plan
SFD	Shit Flow Diagram
SFD PI	Shit Flow Diagram Promotion Initiative
SN	Supernatant
UCLG ASPAC	United Cities and Local Governments Asia Pacific
UNICEF	United Nations Children's Education Fund
VDC	Village Development Committee
WASH	Water, Sanitation and Hygiene
WASH-CC	Water, Sanitation and Hygiene Coordination Committee
WHO	World Health Organization
WSP	Water Supply Providers
WSUC	Water Supply and User's Committee
WW	Wastewater

1. City context

Parsagadhi Municipality is one of the new municipalities declared by the government of Nepal in 2016, which is formed by joining four contemporary Village Development Committees (VDCs) namely Bagbanna, Viruwaguthi, Hapur, Bageshwari Titrauna Pancharukhi VDCs. It is located in Parsa District, Madhesh Province.

The Municipality has a total of nine political wards. It covers 99.69 square kilometres of area. The Municipality is enclosed by Birgunj Metropolitan City in the East, Sakhwa Prasauni VDC in the West, Parsa Wildlife Reservation in the North and Bahudaramai Municipality in the South (Parsagadhi Municipality, n.d.). Figure 1 shows the Geo-political map of Parsagadhi Municipality.

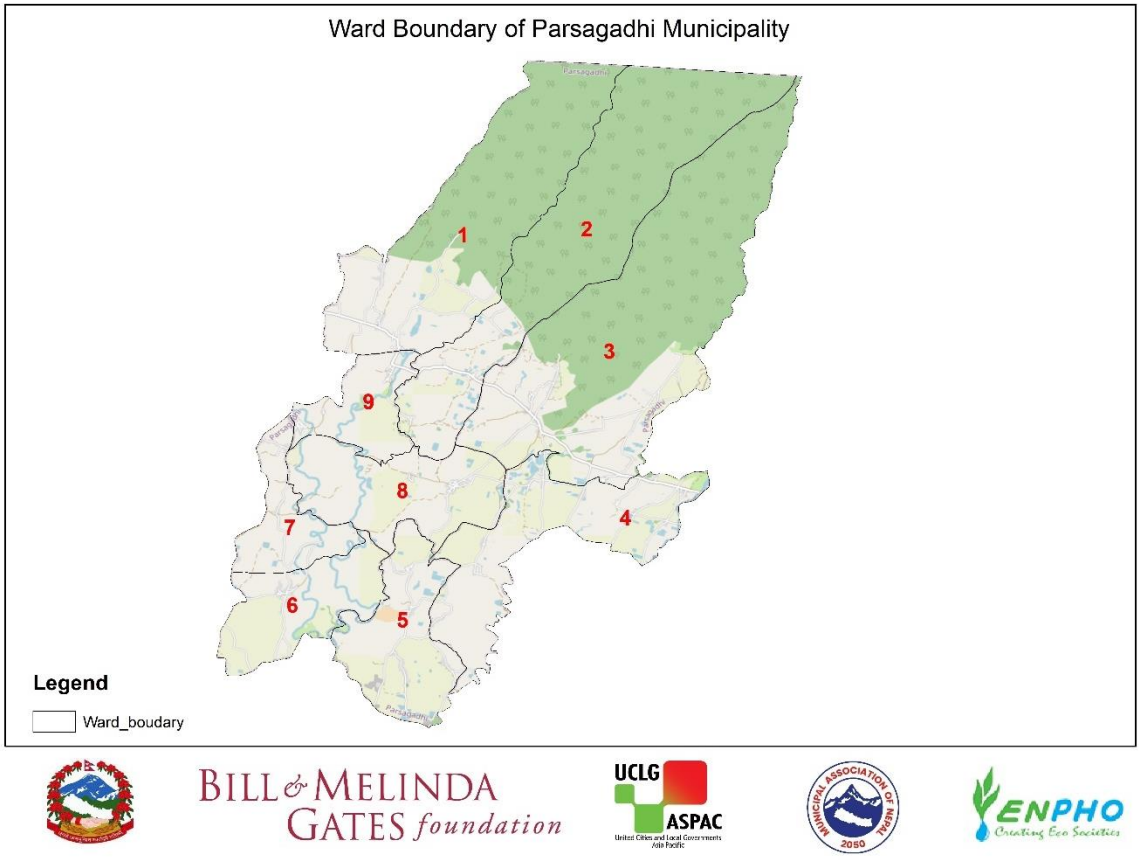

Figure 1: Map of Parsagadhi Municipality with ward boundaries.

1.1 Population

There are 41,569 people living in Parsagadhi Municipality, with 21,011 men and 20,558 women. Out of all the wards, ward number 3 had the most residents (7,612), while ward number 9 had the fewest (3,234). The number of households in Parsagadhi Municipality is 7,632. With a total of 1,662 households, Ward 3 had the most, while Ward 9 had the fewest, with a total of 561 households. Table 1 shows the total population and households in each ward (Parsagadhi Municipality, n.d.) (CBS, 2021).

Table 1: Ward Wise Household and Population Data.

Ward No.	Households	Male	Female	Total Population
1	742	1,747	1,776	3,523
2	712	1,742	1,764	3,506
3	1,662	3,774	3,845	7,619
4	1,226	3,617	3,604	7,221
5	925	3,053	2,992	6,045
6	567	1,791	1,615	3,406
7	591	1,975	1,721	3,696
8	646	1,635	1,684	3,319
9	561	1,677	1,557	3,234
Total	**7,632**	**21,011**	**20,558**	**41,569**

(Census 2021, n.d.)

1.2 Climate

The climate here is mild and generally warm and temperate. The summers have a good deal of rainfall, while the winter has very little. The average temperature is 23 °C. The annual rainfall is 1,402 mm (55.2 inch) (climate-data, n.d.).

1.3 Topography

The municipality lies at 27º8’46” N latitude, 84º52’38” E longitude (mapcarta, n.d.). In the Parsa district, lower tropical zones are found below 300 metres, whereas upper tropical zones are found between 300 metres and 1,000 metres (wikiwand, n.d.).

2 Service Outcomes

2.1 Overview

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2022). A total of 356 households were sampled from 7,632 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 Status

The municipality was declared as an Open Defecation Free (ODF) zone on 3rd January 2019. It suggests that everyone has access to basic sanitation facilities, where it is defined as having access to facilities for the safe disposal of human waste (faeces and urine), as well as having the ability to maintain hygienic conditions, through services such as garbage collection, industrial/hazardous waste management, and wastewater treatment and disposal. However, the sanitation situation assessment conducted by ENPHO in 2022 showed that the municipality's basic sanitation coverage is only 76.69% (ENPHO, 2022), the remaining households still defecate outside in the vicinity of forests and other open spaces.

Offsite sanitation refers to a sanitation system in which excreta (referred to as wastewater) is collected and transported away from the plot where they are generated. An offsite sanitation system relies on a sewer technology for transport (Susana, 2018), whereas 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). Figure 2 shows the types of sanitation system in the municipality.

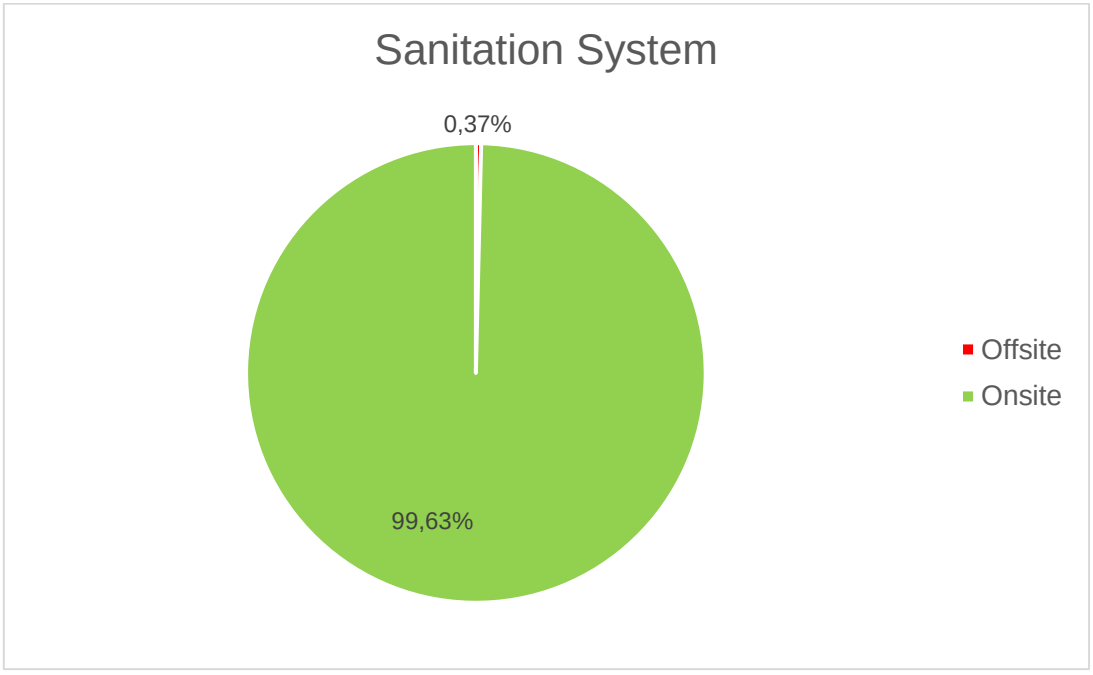

Figure 2: Household sanitation system of Parsagadhi Municipality (ENPHO, 2022).

Onsite sanitation systems are prevalent in the municipality. Out of 76.69% households having basic sanitation coverage, 99.63% households rely on onsite sanitation technologies in the municipality. Although there is lack of sewerage network remaining households have connected their toilet to open drain and water bodies near their houses.

2.1.2 Types of Containment

99.63% of the households in the municipality use an onsite sanitation system. The different types of containment installed to store faecal sludge is explained as bellow:

A well-designed septic tank is installed in only 1.10% of the households. 14.34% of the households use fully lined tanks in their houses which is a rectangular onsite sanitation technology used to safely store faecal sludge. There are no outlets or overflow to discharge the effluent. The walls and bottom of the tank are totally lined and sealed. Figure 3 shows the type of fully lined tank constructed in the households of Parsagadhi Municipality.

Figure 3: Fully Lined Tank.

Also, 6.99% of the households in the municipality are connected to a biogas digester that uses natural anaerobic decomposition of organic matter under controlled conditions. Figure 4 shows the type of biogas digester built in the households of Parsagadhi Municipality.

Figure 4: Biogas Digester.

11.76% of the households in the municipality have built lined tanks with impermeable walls and open bottom, which is a rectangular onsite technology where the walls of the tank are lined and the bottom of tank is not lined and allows infiltration of effluents.

Twin pits and single pits are popular in the municipality. Together, 65.81% of the households have such types of pits installed by assembling pre-cast concrete rings one after another. Figure 5 and Figure 6 show the design of a single pit and a twin pit installed at household level.

Figure 5: Single Pit.

Figure 6: Inappropriate design of the twin pits, where the distance between two pits is less than 1 m.

Table 2 shows the percentage of households with different types of containments in the municipality.

Table 2: Types of containments in households of Parsagadhi Municipality (ENPHO, 2022).

Containments	Percentage of Households
Biogas Digester	6.99%
Fully Lined Tank	14.34%
Lined Tank with Impermeable walls and Open bottom	11.76%
Septic Tank	1.10%
Single Pit	43.75%
Twin Pit	22.06%
Total	**100.00%**

Figure 7 shows the distribution of various types of sanitation technologies in different wards of Parsagadhi Municipality.

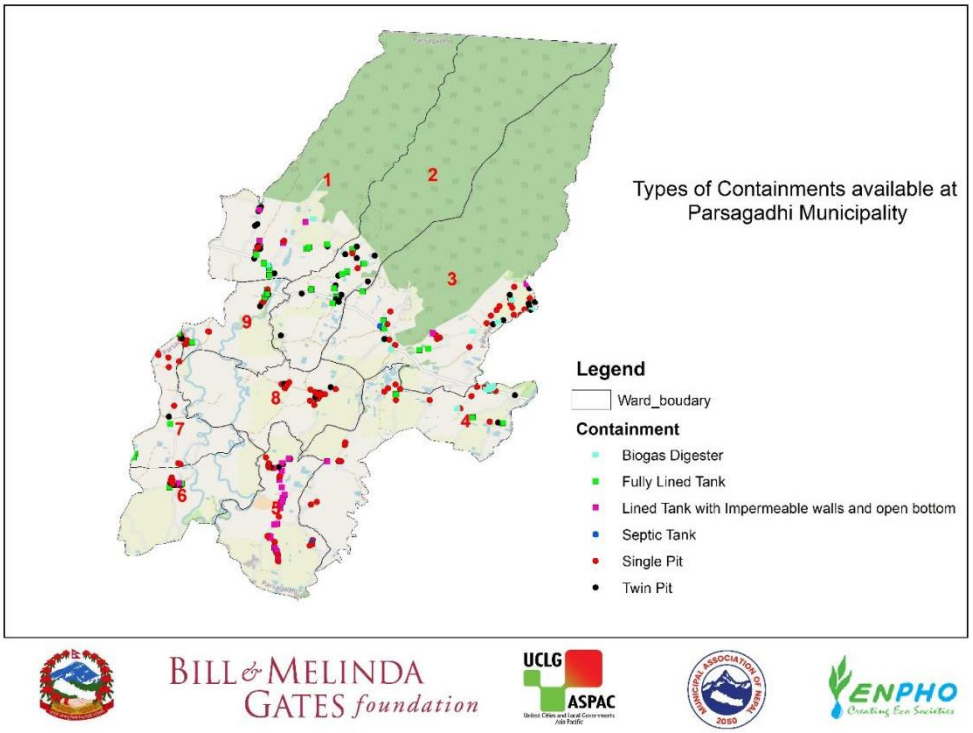

Figure 7: Sanitation Technologies installed at household level (ENPHO, 2022).

The types of household containments in the municipality are re-categorized to match the containments defined by Shit Flow Diagram Promotive Initiative (SFD PI). For that anaerobic biogas digester used to treat household organic waste is also utilized by households to store and treat their faecal sludge. For the purpose of generating the SFD graphic, the biogas digester is modelled as a fully lined tank. Similarly, 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 3 shows the types of containment re-categorized according to Shit Flow Diagram Promotive Initiative (SFD PI).

Table 3: Types of containment re-categorized according to Shit Flow Diagram Promotive Initiative (SFD PI) (ENPHO, 2022).

Containments	Percentage of Households
Fully Lined Tank	16.3%
Lined Pit with semi-permeable walls and open bottom	50.3%
Lined Tank with Impermeable walls and open bottom	9.0%
Septic Tank	0.8%
Offsite Sanitation	0.3%
Open Defecation	23.3%
Total	**100.0%**

2.1.3 Emptying and Transportation

Emptying is one of the major components of the sanitation value chain. It ensures proper functioning of containment basically for septic tank which functioned well until the volume of sludge is one-third of the total column of the tank. Also, in other containments, regular emptying

prevents overflow of the sludge and blockages (Linda Strande, 2014). Figure 8 represents the map of Parsagadhi Municipality showing the status of sanitation technology that has been emptied at least once.

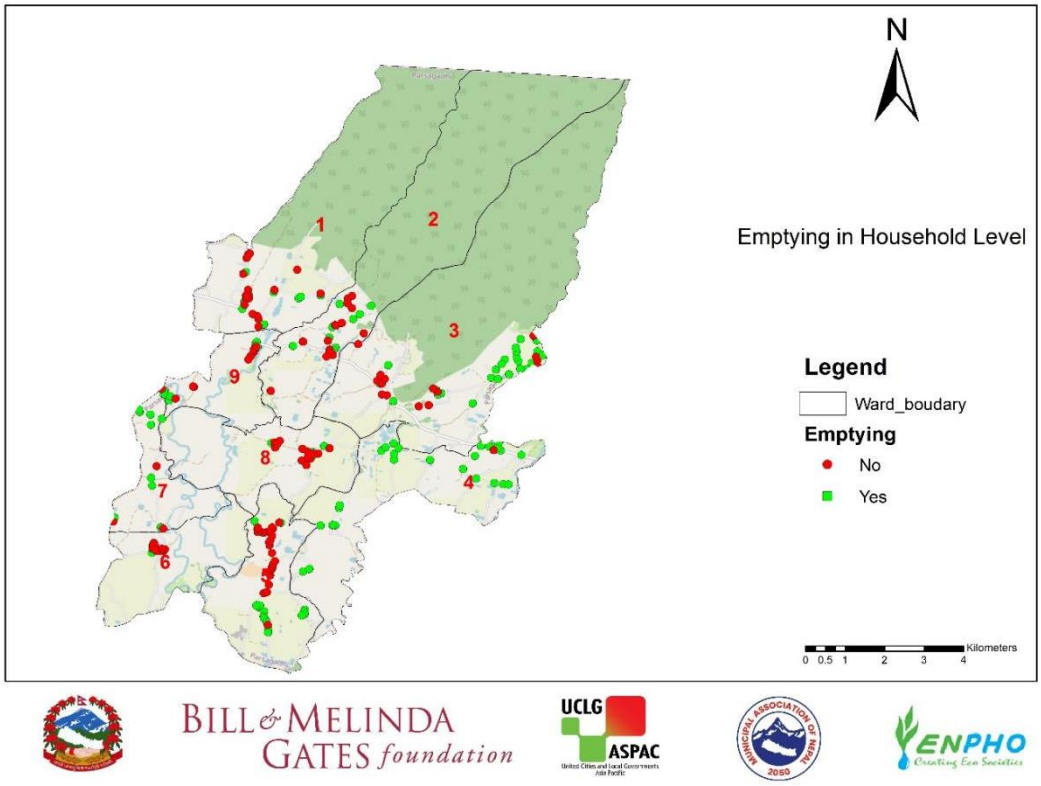

Figure 8: Status of households which have emptied their containment at least once (ENPHO, 2022).

41.01% of households have emptied the containment at least once since installation through manually or mechanical emptying services, whereas 35.39% of the households did not empty their containment as it has not been filled yet.

Table 4: Overall Emptying percentage of Containment at least once since installation (ENPHO, 2022).

Containment	Never emptied	Emptied at least once	Not Applicable
Biogas Digester	0.00%	5.34%	0.00%
Fully Lined Tank	7.58%	3.37%	0.00%
Lined Tank with Impermeable walls and open bottom	6.18%	2.81%	0.00%
Offsite	0.00%	0.00%	0.28%
Open Defecation	0.00%	0.00%	23.31%
Septic Tank	0.28%	0.56%	0.00%
Single Pit	13.20%	20.22%	0.00%
Twin Pit	8.15%	8.71%	0.00%
Grand Total	**35.39%**	**41.01%**	**23.60%**

Private desludging service providers and traditional labour engaged in desludging activities are the major emptying service providers in the municipality. There are not any private desludging service providers within the municipality. Desludging service providers from nearby municipalities i.e., Birgunj Sub Metropolitan City are providing their services in this municipality as well. For example, one service provider is equipped with two numbers of desludging vehicles with a truck equipped with a tank with a capacity of 4,000 litres and a 3,000-litre tractor. One driver and two helping staff work in desludging vehicles. The staff do not have any uniforms, gloves, boots or masks for safety during work. It charges NPR 300 to 500 (USD 2.3 to 3.8) for circular ring and NPR 2,000 to 3,000 (USD 15.2 to 22.8) per trip for the rectangular containments which also varies according to travel distance (KII-4, 2023).

Traditional labours are also equally involved in the desludging activities in the municipality. They charge NPR 3,000 to 4,000 (USD 22.8 to 30.4) for emptying and depends upon the volume of the containments (Offier, 2023).

Figure 9: Mechanical Emptying of Containments in Parsagadhi Municipality.

2.1.4 Treatment and Disposal/Reuse

Parsagadhi Municipality does not have any form of treatment plant for faecal sludge. The majority of FS emptied is applied in farmlands and a few percentages of FS emptied are disposed through dig and dump method, which are both considered as an unsafely managed practise. Fewer households in the city have illegal connection of toilet to open drainage.

Figure 10 shows the percentage of perception of people residing in the municipality about disposal of FS after the onsite sanitation system is emptied. Application in farm is the most practised way for disposal of FS.

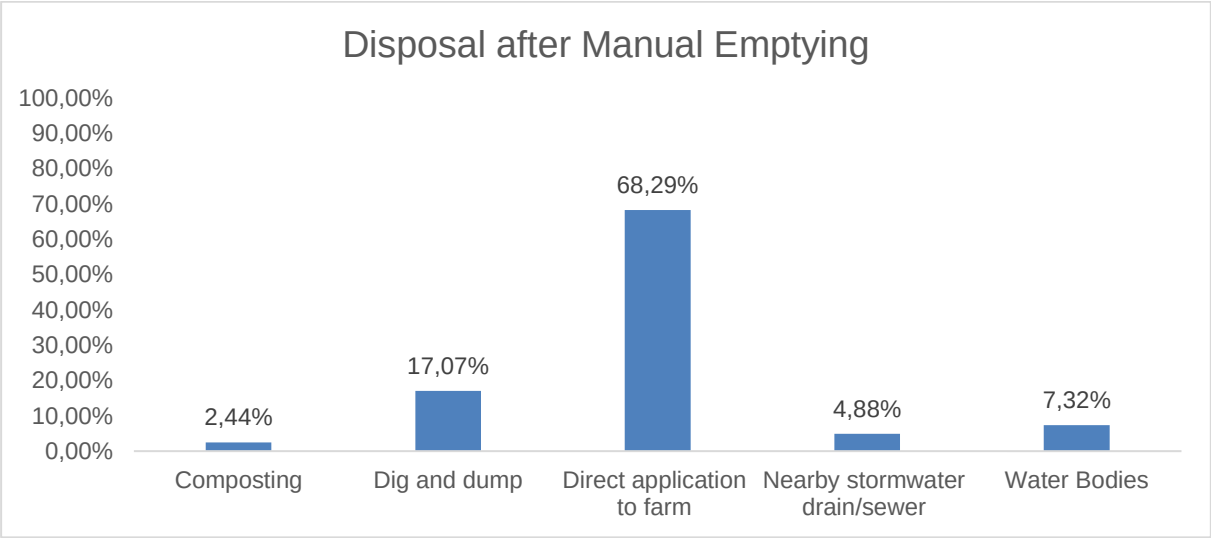

Figure 10: Disposal of Manually emptied faecal sludge (ENPHO, 2022).

2.1.5 Institutional Level Sanitation System

Altogether 16 institutions from commercial buildings, educational institutions, governmental and non-governmental offices, health care centres and hotels were assessed randomly. It was revealed that 100% of such buildings had connected their toilet to onsite sanitation technologies. The percentage of types of onsite sanitation technologies in these buildings are shown in Figure 7.

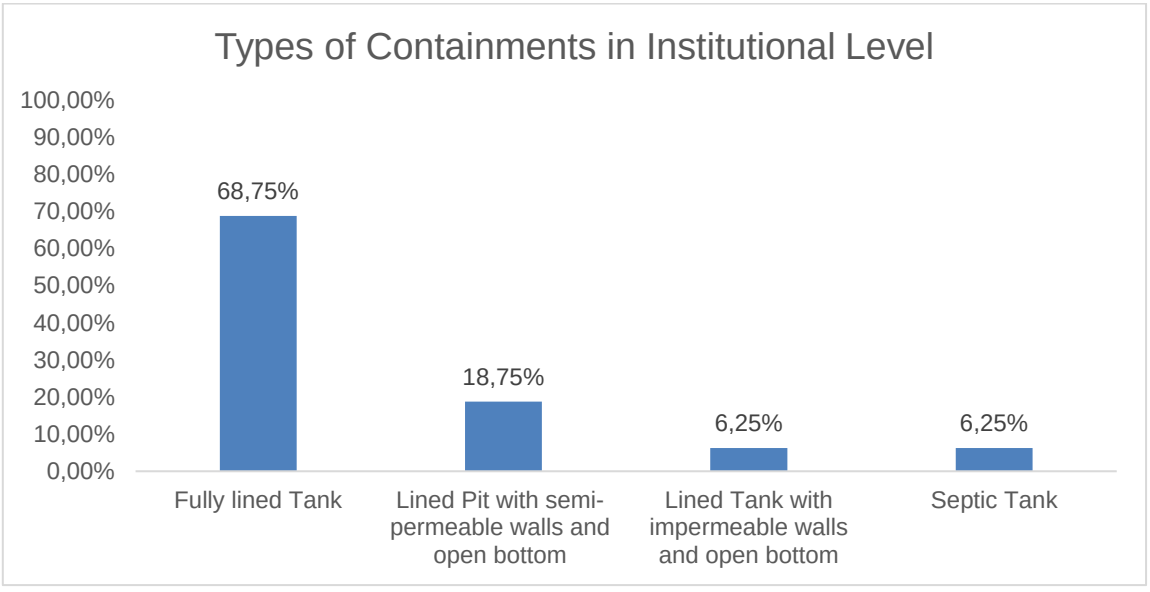

Figure 11: Types of containment in institutions of Parsagadhi Municipality (ENPHO, 2022).

From the institutional survey, 25% of institutions in Parsagadhi Municipality have emptied their containments and 75% of institutions have not emptied because they were never filled. Distribution of different types of onsite sanitation technologies of institutions in various wards of Parsagadhi Municipality is shown in Figure 12.

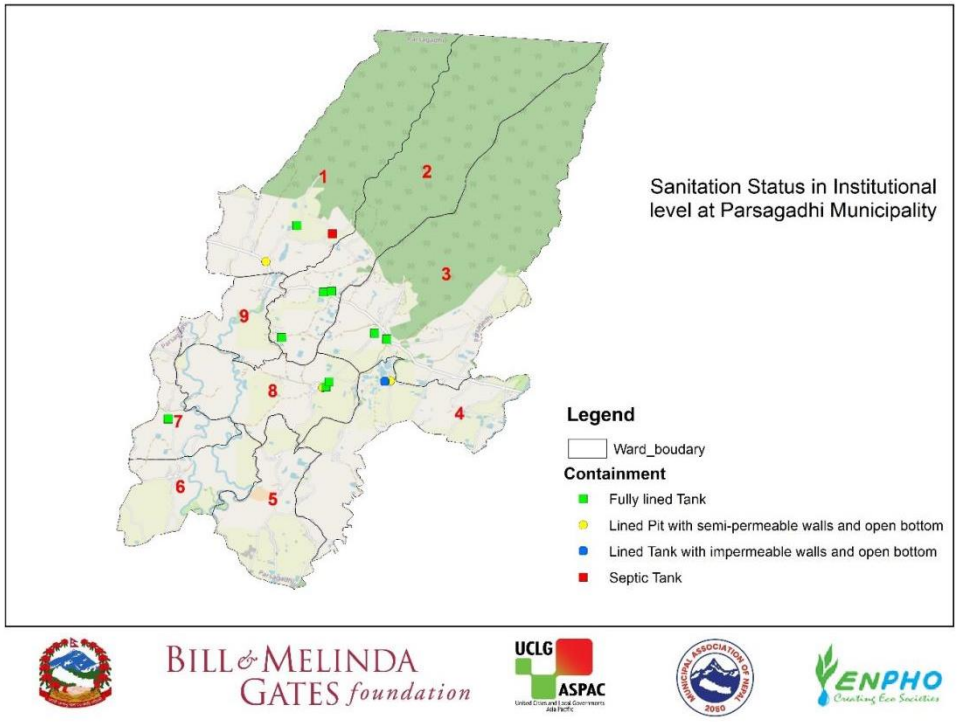

Figure 12: Types of onsite sanitation systems in institutions of Parsagadhi Municipality (ENPHO, 2022).

2.1.6 Public Toilets

Parsagadhi Municipality has only one public toilet near the vegetable market that runs every Monday and Friday which is used by customers and shopkeepers of the market. The toilet consists of 6 urinals for male and 4 pans as there is no separate compartment for males and females. Operation and maintenance of the toilet is done by the operators which are hired by the Market Management Committee (Sahani, 2023). Figure 13 shows the public toilet located in the local vegetable market.

Figure 13: Public Toilet in local vegetable market area at Parsagadhi Municipality.

2.1.7 Risk of Ground Water Pollution

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

2.1.8 Source of Drinking water and water Production

a) Water Supply

All the surveyed households in the municipality depend on groundwater sources for both drinking and other daily activities. Even though there is no pipe supply system, planning for the distribution is going on. 89.30% of the households in the municipality use handpump to draw water from the ground. Figure 14 shows the various mediums to extract the groundwater in the municipality.

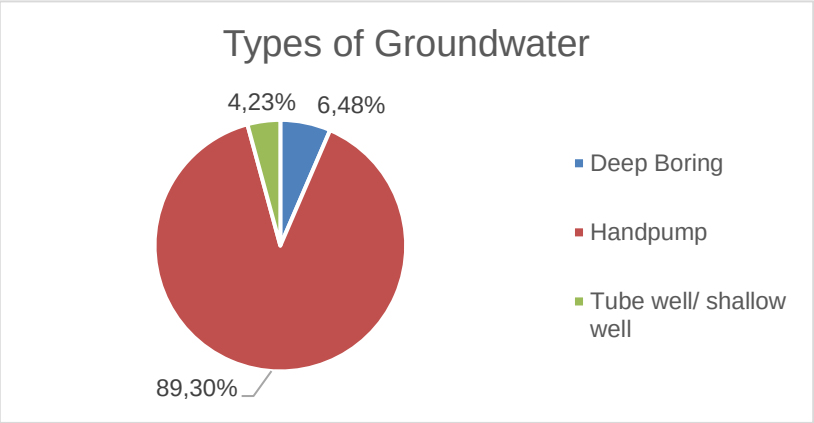

Figure 14: Types of groundwater extraction methods in the municipality.

b) The vulnerability of the aquifer and lateral spacing between sanitation system 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). 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. Hence, the people using open bottom tanks and consuming water from the handpumps with the depth up to 98.67 feet (30 m) and horizontal distance of the pump within 25 feet (7.62 m) from the source of pollutants are assumed at significant risk to groundwater pollution.

Figure 15 demonstrates the depth of handpumps and horizontal distance of it from source of pollutant by lined tanks with impermeable walls and open bottom. 9.1% of the people using lined tanks with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of ground water pollution (T2A4C10, 0.3%) is at risk of consumption of groundwater pollution from their containment. Whereas the remaining 90.9% of people using lined tank with impermeable walls and open bottom, no outlet or overflow (T1A4C10, 2.8%) is at low risk from ground water pollution.

Figure 15: Depth of handpumps and lateral spacing of it with containment types lined tank with impermeable walls and open bottom (ENPHO, 2022).

Similarly, 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. It shows that 18.2% of the people using lined pits with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of ground water pollution (T2A5C10, 9.0%) is at risk of consumption of groundwater pollution from their containment, whereas the remaining 81.8% of people using lined pits with semi-permeable walls and open bottom, no outlet or overflow (T1A5C10, 41.3%) is at low risk from ground water pollution.

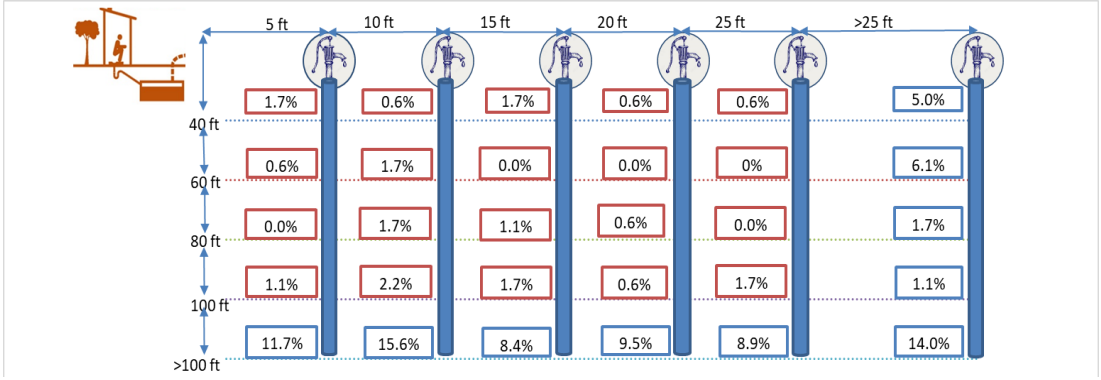

Figure 16: Depth of hand pumps and lateral spacing of it with containment types lined pit with semi-permeable walls and open bottom (ENPHO, 2022).

2.2 SFD Selection Grid

Types of sanitation technologies selected in the SFD selection grid in the municipality are shown in figure 17. The vertical column in the left side of the SFD selection grid has a list of technologies to which the toilet is connected to and open defecation in case of households without toilet. Similarly, horizontal row at the top of the selection grid shows options for connection for outlet or overflow discharge from toilet.

The types of household containments in the municipality are re-categorized to match the containments defined by Shit Flow Diagram Promotive Initiative (SFD PI). For that anaerobic biogas digester used to treat household organic waste is also utilized by households to store and treat their faecal sludge. For the purpose of generating SFD graphics, the biogas digester is connected as fully lined tank. Similarly, twin pits and single pits constructed by assembling pre-cast concrete rings one above another are classified as lined pits with semipermeable walls and open bottom.

Thus, different types of sanitation systems and their outlet are selected in the selection grid and the proportion of the population using such types of systems is calculated in the SFD graphic generation process.

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			T1A1C8		Not Applicable
Septic tank					Significant risk of GW pollution Low risk of GW pollution	T1A2C6				
Fully lined tank (sealed)					Significant risk of GW pollution Low risk of GW pollution					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		T2A4C10 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 Parsagadhi Municipality.

Brief explanation of terms used to indicate different frames selected in the SFD selection grid in Figure 17 is explained in Table 5.

Table 5: Explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 17.

T1A1C8	A fully functioning toilet discharged directly to an open ground. All the excreta in this system are 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.
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.
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 are considered not contained.
T2A4C10 (High Risk)	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. 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.
T1A4C10 (Low Risk)	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.
T2A5C10 (High Risk)	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.
T1A5C10 (Low Risk)	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.
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.

2.2.1 SFD Matrix

SFD matrix is the second step to generate the SFD graphic. The SFD matrix calculates the proportion of people using each type of system and the proportion of each system from which FS and supernatant is emptied, transported and treated. A detailed instruction on how to calculate the FS proportion in SFD PI was used as guide to calculate the SFD proportion. As stated on SFD PI, the default "100%" value is used for onsite containers which are connected to soak pits, water bodies or to open ground. This 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. The value for onsite containers that are connected to a sewer network or to open drains is used as "50%" which means half of the contents are modelled FS and 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 obtained from SFD PI used for FS proportion calculation is shown below:

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

Here, data for each selected sanitation system on the SFD Matrix are entered. The proportion of the contents of each type of onsite container (either septic tanks; or fully lined tanks (sealed); or lined tanks with impermeable walls and open bottom and all types of pits), is shown in column Population (Pop) of Figure 18. Since the municipality does not have proper sewer networks or a wastewater treatment plant, the proportion of wastewater delivered to the treatment plant is 0. Similarly, W5c is the proportion of wastewater treated in the treatment plant, which is also 0%. Moreover, the proportion of FS emptied (F3) is obtained from KIIs. The FS delivered to treatment and treated is shown in columns F4 and F5, respectively. In this case, as there is no either a wastewater/faecal sludge treatment plat, both values are set to 0% in all sanitation systems except for biodigesters (modelled as fully lined tanks) where values for F4 and F5 are set to 80% and 95%, respectively. Values for supernatant (S4e and S5e) were also set to 0% in septic tanks and lined tanks connected to drains. Figure 18 shows the SFD matrix of Parsagadhi Municipality.

Parsagadhi Municipality, Madhesh Pradesh, Nepal, 16 Feb 2023. SFD Level: 2 - Intermediate SFD
Population: 41569
Proportion of tanks: septic tanks: 50%, fully lined tanks: 100%, lined, open bottom tanks: 99%

Containment						
System type	Population	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	F3	F4	F5	S4e	S5e
System label and description	Proportion of population using this type of system (p)	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
T1A1C8 Toilet discharges directly to open ground	0.3					
T1A2C6 Septic tank connected to open drain or storm sewer	0.8	63.0	0.0	0.0	0.0	0.0
T1A3C10 Fully lined tank (sealed), no outlet or overflow	16.3	48.0	80.0	95.0		
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	2.8	27.0	0.0	0.0		
T1A4C6 Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	1.7	44.0	0.0	0.0	0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	4.2	18.0	0.0	0.0		
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	41.3	53.0	0.0	0.0		
T1B11 C7 TO C9 Open defecation	23.3					
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	0.3	84.0	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	0.0	48.0	0.0	0.0		

Figure 18: SFD Matrix of Parsagadhi Municipality.

2.2.2 SFD Matrix Explanation

The sanitation technologies and the corresponding percentage of the population using such technologies are shown in Figure 18. These values are derived from the HH survey (ENPHO, 2022) and KIIs with desludging service providers (KII-4, 2023).

Proportion of FS emptied and transported

The proportion of faecal sludge emptied (F3) is calculated based on percentage containment emptied (ENPHO, 2022) and amount of FS emptied during the process (KII-4, 2023). The information on FS emptied from containment is obtained from Key Informant Interviews (KIIs) with desludging service providers. As per desludging service provider portion of liquid in the FS is high which can be easily pumped out by the desludging vehicle. So, almost 90% of the FS content in the containment is removed during emptying. Hence, actual proportion of FS emptied from each containment is calculated as:

$$FS\ proportion\ emptied\ from\ containment = percentage\ of\ containment\ emptied \times proportion\ of\ FS\ emptied$$

The proportion of FS emptied from different types of sanitation technologies are shown in Table 6.

Table 6: Sanitation Technologies and Proportion of Faecal Sludge Emptied (ENPHO[1], 2022; KII-4, 2023[2]).

S.N.	Sanitation Technologies	SFD Reference Variable	Percentage of Emptied Containment[1]	Proportion of FS emptied during emptying[2]	F3
1	Toilet discharges directly to open ground	T1A1C8	0.00%	90%	0%
2	Septic tank connected to open drain or storm sewer	T1A2C6	70.00%	90%	63%
3	Fully lined tank (sealed), no outlet or overflow	T1A3C10	53.44%	90%	48%
4	Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	T1A4C6	49.41%	90%	44%
5	Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	20.00%	90%	18%
6	Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	30%	90%	27%
7	Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	58.50%	90%	53%
8	Open defecation	T1B11 C7 TO C9	0.00%	90%	0%
9	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A4C10	93.33%	90%	84%
10	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A5C10	53.84%	90%	48%

Summary of Assumptions

Offsite sanitation System:

- ✓ 0.3% of the toilets discharge directly to an open ground (T1A1C8). Since there is no treatment plant, all wastewater is disposed of untreated into the environment.

Onsite Sanitation System:

- ✓ The proportion of FS in septic tank were set to 50%, the proportion of FS in fully lined tanks were set to 100% and the proportion of FS in lined tanks with impermeable walls and open bottom and all types of pits was set to 99% according to the relative proportions of the systems in the municipality, as per the guidance given in the Frequently Asked Question (FAQs) in the sustainable Sanitation Alliance (SuSanA) website.
- ✓ Variable values for F3, for all onsite sanitation systems were derived from the HH survey and cross-checked with KIIs conducted.
- ✓ The municipality does not have any form of treatment plant to treat faecal sludge. Also, the people using twin pits reclassified as lined pits with semi-permeable walls and open bottoms are not using them properly. The FS emptied from the containments is dumped openly in farmland or water bodies. Thus, variables F4 and F5 for all sanitation systems are set to 0%. However, FS from anaerobic biogas digesters, classified as fully lined tanks (system T1A3C10), is considered as transported (F4 = 80%) and treated with a treatment efficiency estimated at 95% (F5 = 95%). Values for supernatant (S4e and S5e) were also set to 0% in septic tanks and lined tanks connected to drains.

2.3 SFD Graphic

Figure 19 shows the SFD graphic for Parsagadhi Municipality. In the graphic, percentage of Faecal Sludge (FS) and wastewater (WW) indicated by colour green represent safely managed or stored excreta (36%) whereas the percentage in colour red represents unsafely stored or managed excreta (64%).

Similarly, FS contained, i.e., FS kept in a container which is safe from human contact, in onsite sanitation, either emptied or not are safe. Further, FS not contained is FS kept in containment which possesses risk to human health through groundwater contamination. The lack of a Faecal Sludge Treatment Plant (FSTP) in the municipality, which was confirmed by the information collected during KII with the municipal officer, leads to disposal of untreated FS in farmland and water bodies.

The faecal sludge that is safely managed is further segregated as 6% of FS treated in the biodigesters and 30% of FS safely collected in the containment which has not been emptied. This 30% 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 empty section services in the short and medium term as they fill up.

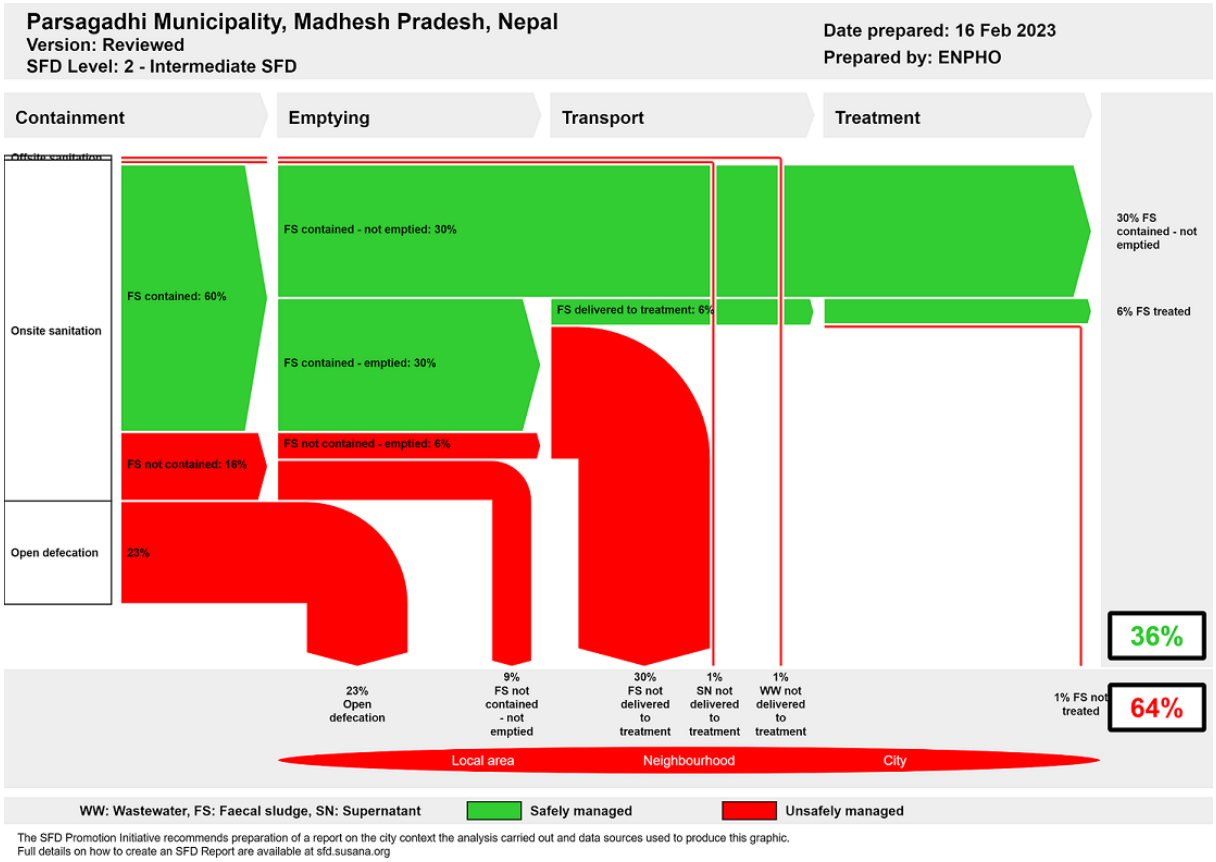

Figure 19: SFD graphic of Parsagadhi Municipality.

The FS that is unsafely managed is divided into two categories: as 6% of FS is unsafely collected which is emptied and 9% of FS is unsafely managed as it has not been emptied, both having a risk of groundwater contamination through seepage. 30% of FS (contained and not contained) is emptied and unsafely disposed into the environment or water bodies without treatment. 30% of the FS contained is emptied whereas only 6% of FS from onsite sanitation containment which are treated are those connected in biogas digester. Additionally, wastewater generated from 1% of the population is disposed untreated as well as 1% of the supernatant which is not delivered to treatment.

Lack of FSTP in the municipality leads to disposal of FS in farmland and water bodies. Considering the SFD graphic, FS management is a concern for the municipality even through FS which is safely collected but emptied will eventually be emptied in future and requires safe management.

2.3.1 Offsite Sanitation

Nepal Multiple Indicator Survey (MICS) reported that among the total households in Nepal, 10.7% of households has a toilet connected to sewer network and in Madhesh province it is only 1.1% (CBS, 2020). However, 0.3% of the population (rounded to 1% on the SFD graphic) have connected their toilet to open ground near their houses.

2.3.2 Onsite Sanitation

The population relying on onsite sanitation system is 99.63%. Among them, 60% are using technically effective containment that safely stores faeces and 16% with unsafe containment. The description on flow of FS from the onsite sanitation system as shown in the SFD graphic is explained in Table 7.

Table 7: Description of the percentages of the SFD graphic (Susana, 2018).

Variables	Description	Percent
FS contained	Faecal sludge that is contained within an onsite sanitation technology which is technically effective.	60%
FS not contained	Faecal sludge that is stored in an unsafe onsite sanitation technology.	16%
FS contained - not emptied	FS that is contained within an onsite sanitation technology and not removed where there is no significant risk to groundwater pollution. These containments are fully lined tanks (sealed), no outlet or overflow (T1A3C10), fully lined tanks with impermeable walls and open bottom without outlet or overflow (T1A4C10) and lined pit with semi-permeable walls and open bottom without outlet or overflow (T1A5C10).	30%
FS contained – emptied	FS that is contained in onsite sanitation technology and emptied either mechanically or manually.	30%
FS not contained - emptied	The proportion of FS not contained emptied is the summation of the proportion of FS emptied from either technically appropriate or inappropriate containment with potential risk on direct contact with human or contamination of groundwater.	6%
FS not contained – not emptied	FS that is not contained within an onsite sanitation technology and not removed which may either remain in the containment or infiltrate to ground polluting groundwater.	9%
FS - treated	FS treated in a well functioned anaerobic biogas digester.	6%
FS not delivered to treatment	FS emptied from an onsite sanitation system is either FS contained or not but is not delivered to the treatment plant.	30%
SN not delivered to treatment	SN not contained from septic tanks connected to open drain or storm sewer.	1%
WW not delivered to treatment	All wastewater from toilets discharges going directly to open drain or water bodies.	1%
FS not treated	FS emptied from an onsite sanitation system but is not delivered to the treatment plant.	1%

2.3.3 Open Defecation

Nepal Multiple Indicator Survey (MICS) reported that among the total households in Nepal, 5% of households still practices open defecation and only in Madhesh Province it is 16% (CBS, 2020). Despite ODF free status, people residing in 23% of households still go for open defecates outside in the vicinity of forests and other open spaces. This population with a high defecation rate is economically underdeveloped. The people living in poverty and those who do not own land mostly do not have toilets.

3 Service delivery context

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 inspector 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 citizens 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 Faecal Sludge Management (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 the 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 in the marginalized and vulnerable groups. However, it was unable to address the complex operational issue of urban water supply and sanitation service delivery (DWSSM, 2009).Thus, 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 the 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 (UNGA, 2010). 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 setup 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.

3.2.1 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 Level

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 plan 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.

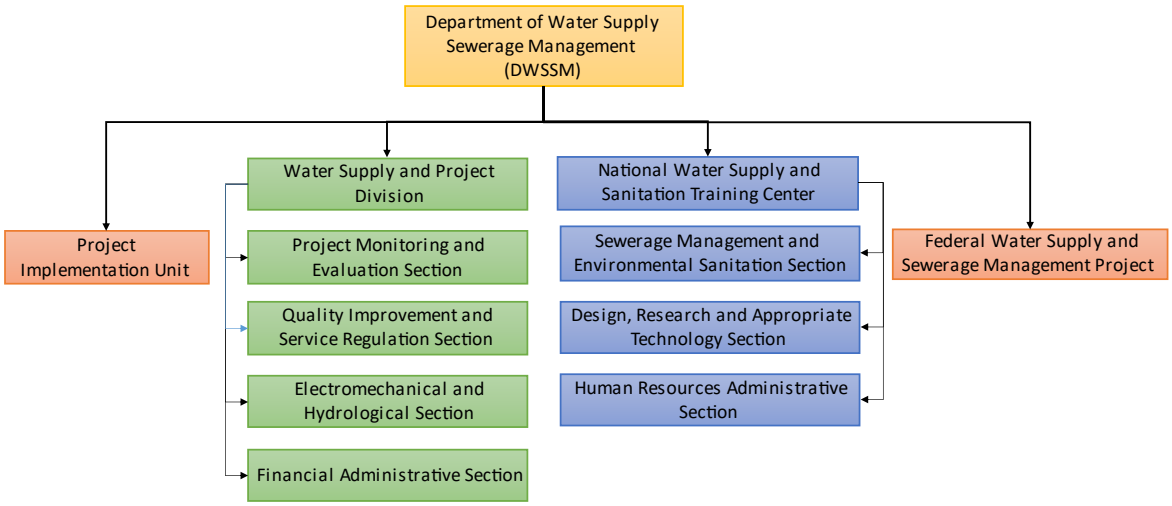

Figure 20: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

At Provincial Level

Ministry of Physical Infrastructure: Ministry of physical infrastructure of provincial government in Madesh Province is major executing body in the province. 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 the terai region, 3,000 to 5,000 in hilly region and 5,00 to 1,000 in Himalayan region.

3.2.2 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 socioeconomic 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).

3.2.3 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 8. However, FSM specific standards have yet to be developed and implemented.

Table 8: 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 grey water	✓	✓	✓
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	✓	✓	✓

3.3 Planning

3.3.1 Service Targets

The plans and programs for development in Nepal is guided by a national development framework formulated by the national planning commission in coordination with sectoral ministries. The ministry of finance allocates budgets and releases them to executing agencies and coordinates with development partners to address resource gaps. Nepal is committed to the SDGs which has been reaffirmed in key documents such as the current 15th development plan and the 25-year long-term vision 2100 that internalizes the sustainable development goals (NPC, 2020). The SDGs codes are assigned for all national development programs through the Medium-Term Expenditure Framework (MTEF). The MTEF sets out three-year spending plans of the national and provincial governments which aims to ensure that budgets reflect social and economic priorities and give substance to reconstruction and development commitments (NPC, 2020). Further, Nepal has prepared the SDG status and roadmap to localize the SDG indicators with baselines and targets for 2030. Nepal has set the following target and indicator focused on sanitation based on global SDGs as shown in Table 9.

Table 9: National SDG target and indicator on sanitation.

National SDG Target and Indicator	2015	2019	2022	2025	2030

Target 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations						
6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water						
1	Households using improved sanitation facilities which are not shared (%)	60	69.3	78.7	85.7	95
2	Proportion of population using latrine (%)	67.6	75.7	83.8	90	98
3	Sanitation coverage (%)	82	86.5	89.9	93.3	99
4	Urban households with toilets connected to sewer systems/ proper FSM (%)	30	46	62	74	90

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. Interview was performed with Mr. Gokarna Pathak, Mayor of Parsagadhi Municipality for the planning and the activity that is going on sanitation sector and Mr. Jagat Sahani, Member of Market Management Committee in the municipality. Table 10 shows the KII with the Mayor, Municipal officers and Public Toilet Operator and Private Desludger (Figure 21).

Table 10: List of Key Informant Interviewed personnel (ENPHO, 2023).

S.N.	Name	Designation	Organization	Purpose of KII	Date
1.	Gokarna Pathak, (KII-1)	Mayor	Parsagadhi Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	2nd January, 2023
2.	Arbind Kumar Singh and Chet Kumari Timalsena, (KII-2)	Officers	Parsagadhi Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	2nd January, 2023
3.	Jagat Sahani, (KII-3)	Member	Market Management Committee	Quantitative and management data on public toilet and public toilet operation	3nd January, 2023
4	Rajendra Nepali (KII-4)	Private Desludger	Birgunj Sub-metropolitan city	Emptying practices, finances, requirement, disposal and treatment	2nd January, 2023

Figure 21: KII with member of market management committee at Parsagadhi Municipality.

4.2 Household Survey

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 HH survey. The household survey was conducted using 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.

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= no/(1+ (no-1)/N).

Where,

Z^2	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

nh= (Nh/N)*n, where Nh is the total population in each stratum.

Thus, a total of 356 households were sampled from 7,632 households distributed in nine wards with proportionate stratification random sampling which is shown in Figure 22.

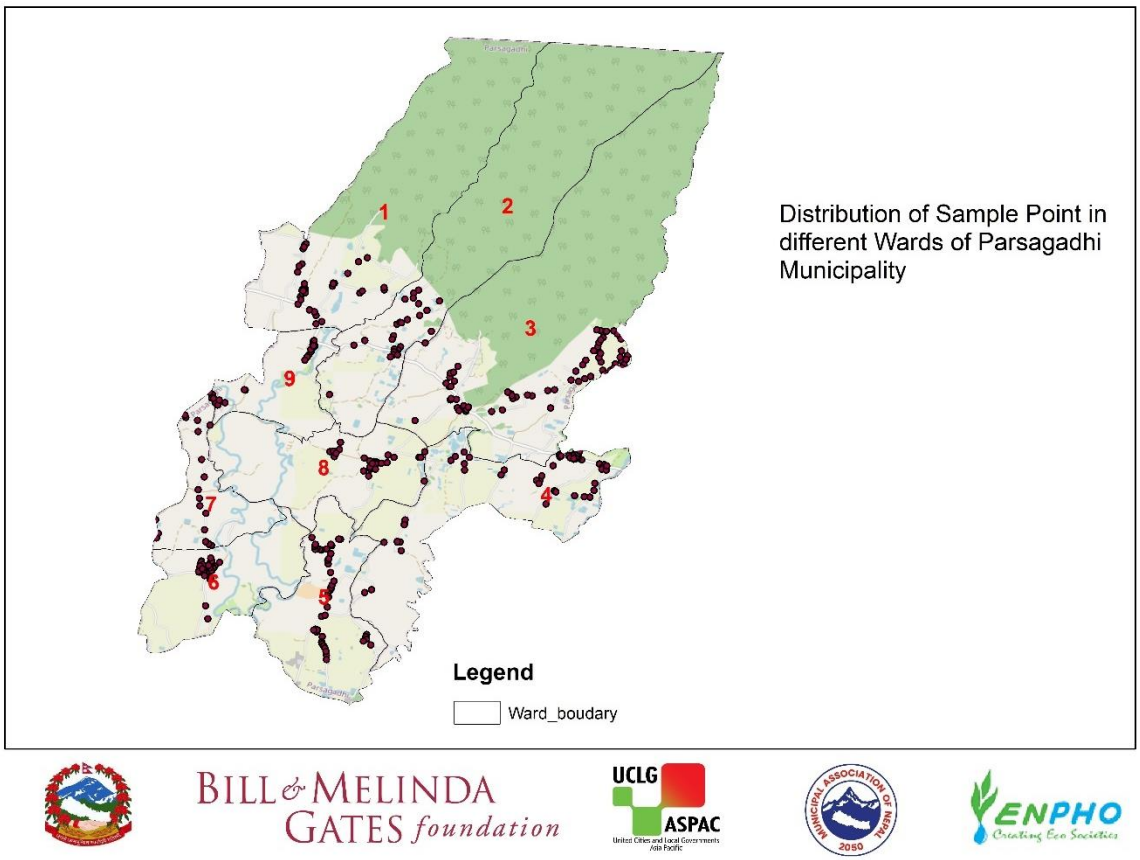

Figure 22: Distribution of sampling points in different wards of Parsagadhi Municipality (ENPHO, 2022).

4.2.2 Direct Observation

Various sanitation technologies in the households in all the wards were observed and visual references were kept in Figure 23. Also, observation of the toilet, water source, containments and transportation of faecal sludge were carried out.

Figure 23: Direct observation survey in the municipality.

4.3 Sharing and Validation of Data

The sharing and validation of findings on sanitation status were conducted in the municipality hall in participation of the Mayor, Deputy Mayor, Chief Administrative Officer (CAO), Ward Chairpersons, Municipal Officers, General members of the municipal council and other relevant stakeholders. The participants agreed upon the findings of this study that showed the current sanitation status of the municipality (Figure 24).

Figure 24: Sharing and Validation at Parsagadhi Municipality.

5 Acknowlgements

We would like to acknowledge United Cities Local Government – Asia Pacific (UCLG ASPAC) for funding the Municipalities Advocacy on Sanitation in South Asia – II (MuNASS-II) and Municipal Association of Nepal (MuAN) for coordination with the Municipality.

We offer our sincere gratitude to Mr. Gokarna Pathak, Mayor, Mrs. Puja Chaudhari, Deputy Mayor, Mr. Chabiraman Bhattrai, Chief Administrative Officer of Parsagadhi Municipality. We would also like to thank Mr. Arbin Kumar Singh and Mrs Chet Kumari Timalsena Officers and staff of Parsagadhi Municipality for their remarkable support during the study.

We would like 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 ASPAC. Similarly, we are very much obliged to Mr. Ashok Kumar Byanju Shrestha, President and Mr. Kalanidhi Devkota, Executive Director, Mr. Muskan Shrestha, Sanitation Advocacy Specialist, MuAN for their gracious support during the study.

We are very grateful to Ms. Bhawana Sharma, Executive Director and Mr. Rajendra Shrestha, Program Director in Environment and Public Health Organization (ENPHO) for tremendous support and guidance during the whole process of the study. Together, we would like to thank all ENPHO colleagues for their support in the development of questionnaire for the survey and uploading data in KOBOCOLLECT tool.

We are grateful to the enumerators, Mrs. Anjuli Kumari Khawas, Mrs. Mintu Kumari, Mrs. Sirjana Upreti, Mr. Sandeep Gurung, Mr. Krishna Chaudhary Tharu, Mr. Rambinay Prasad Yadav, Mr. Dipak Kumar Patel, Mr. Anand Das and Mrs. Anju Kumari.

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7 Appendix

7.1 Appendix 1: List of Participants on Orientation on Survey for Shit Flow Diagram

UCLG ASPAC

Municipalities Network Advocacy on Sanitation in South Asia(MuNASS) - II

Attendance Sheet

1- Dalit
2- Brahmin/Chettri/Thakuri
3- Janajati
4- Muslim
5- Madhesi
6- Others

Program: SFD orientation
Date: 2075/03/17
Venue: Parsagadhi Municipality

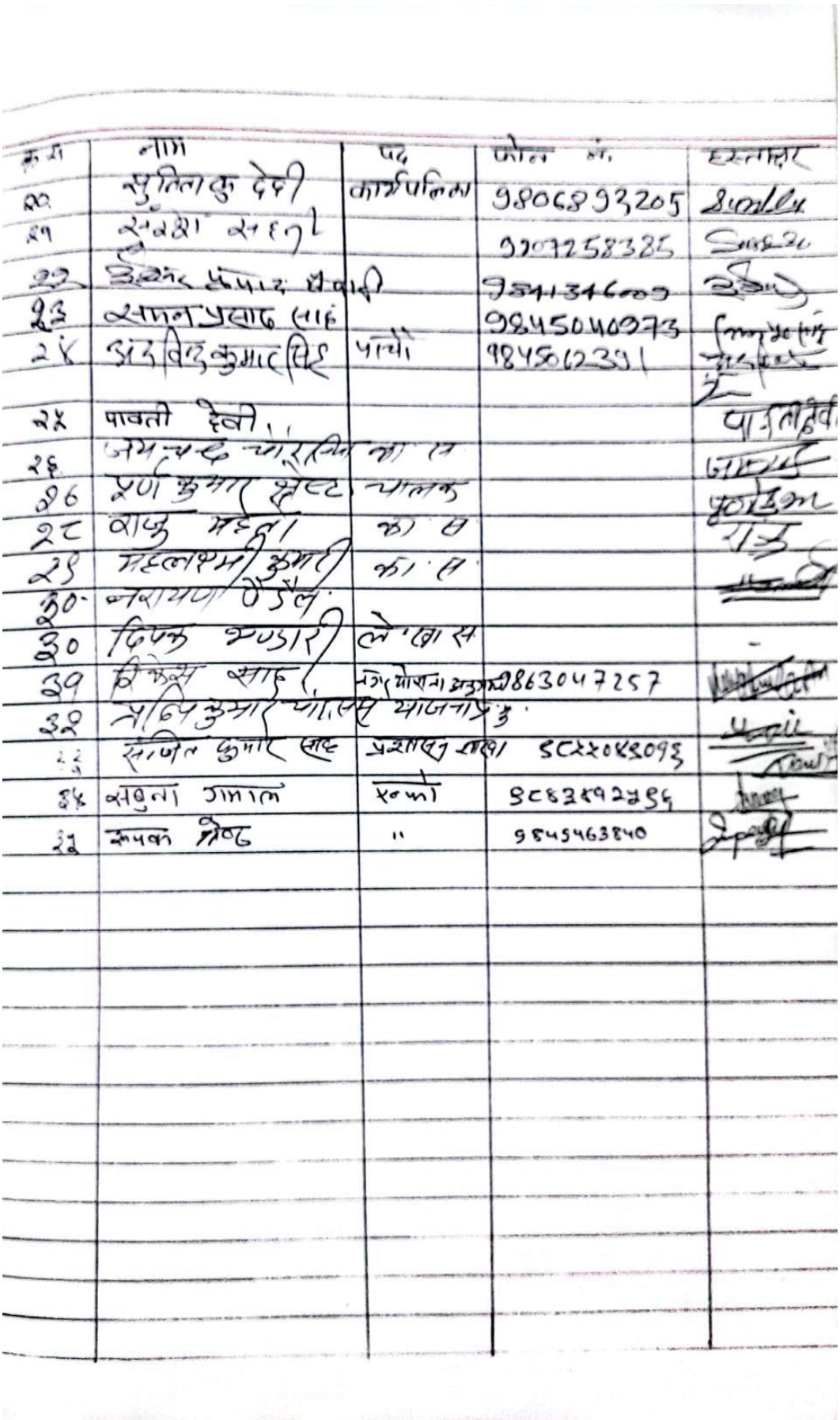
S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity	Age
1	Lokaran Pathak	Parsagadhi Municipality	Mayor	9845558405	[illegible]			
2	Nawal Kishor P. Kalwar	Parsagadhi	ward chairperson	9855031459	[illegible]			
3	Chandra Bdr. Puri	Parsagadhi 3	personal assistant	9845[illegible]	[illegible]	[illegible]	3	33
4	Minty Kumari	2 Khekhariya		9812226855	[illegible]	[illegible]	3	22
5	Anjuli Kumari Khawal	1 Manawa		9811240272	[illegible]	[illegible]	1	31
6	Sirjana Upreti	3 Jhapra		9851068108	[illegible]	[illegible]	3	30
7	Sandeep Gurung	4 Sakhuwa Tandi		9819331271	[illegible]	[illegible]	3	31
8	Anand das	8 Harpur		9862091597	[illegible]	[illegible]	3	21
9	Krishna Chaudhary	5 Pratimukhi		9815153131	[illegible]	[illegible]	3	[illegible]
10	Sambhav Pd. Yadav	6 Bageshwari Litra		9809211962	[illegible]	[illegible]	5	29
11	Dipak Kumar Patel	7 Bageshwari		[illegible]	[illegible]	[illegible]	5	31
12	Anju Kumari	9 Baldeswa		9814284112	[illegible]	[illegible]	5	
13	Surendra Prasad [illegible]			9815021592	[illegible]	[illegible]		
14	[illegible]	3 Baitorhar		98[illegible]	[illegible]	[illegible]		
15	Shambhu Pandit	5 Hardiya		9807263734	[illegible]	[illegible]		
16	Kumar Raut	7 Manawa		98[illegible]	[illegible]	[illegible]		26
17	[illegible]	[illegible]		98[illegible]	[illegible]	[illegible]		
18	Gobinda Kumar Chaudhary	3 Paladiya		[illegible]	[illegible]		6	19
19	Subuna Gamal	ENPHO		9843412595	[illegible]	[illegible]		
20	Rupak Shrestha	"		9849463840	[illegible]	[illegible]		

7.2 Appendix 2: List of Participants in Sharing and Validation Workshop

आज मिति २०७९।११।१८ 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 पर्सागढी नगरपालिकामा संचालन गरेको Shit Flow Diagram (SFD) सम्बन्धी अन्तरक्रिया र प्रमाणीकरण गोष्ठीमा निम्न अनुसार मुख्य सरोकारवाला-हरूको सहभागिता रह्यो।

उपस्थिति,

क्र.स	नाम	पद	फोन नं.	हस्ताक्षर
१	गोकर्ण पाठक	प्रमुख		
२	पुजा चौधरी	उप प्रमुख	9842090254	
३	हरिरमण [illegible]	प्र.प्र.अ.	९८५५०८८२२२	
४	सुकमान तमाङ	वडा अध्यक्ष	९८[illegible]३६८८३४२	
५	[illegible] महतो	वडा अध्यक्ष	९८२९२३६०६०	
६	श्रवण [illegible]	वडा अध्यक्ष ४	9819294560	
७	सर्वत [illegible]	वडा सदस्य	9807158046	
८	रामजीवन [illegible]	वडा सदस्य ३	9811185729	
९	ध्रुव प्रसाद कुर्मी	वडा नं ८	9846250114	
१०	सुनीता बरेल	उ.वि.से.	९८६८८४८८००	
११	कुमार राउत	फि. स.	९८६६११६६६६	
१२	खगेन्द्र बहादुर कार्की	MIS Operator	९८६४१९२५६६	
१३	[illegible] प्रसाद मण्डल	[illegible]	९८४१३८३६६८	
१४	प्रदिप कुशवाहा	सं. स.	९८४५६४२३३१	
१५	[illegible] पंडित	फिल्ड सहायक	९८०६२६३६३४	
१६	[illegible] थापा	मनोसामाजिक परामर्शकर्ता	९८१४२८२३९८	
१७	[illegible]	[illegible]	९८४५४२५०२२	
१८	मोहन लाल महतो	कार्यपालिका [illegible]	९८१६२२१२८१	
१९	दिल बहादुर [illegible]	"	९८०३६९२८ [illegible]	



क्र.सं	नाम	पद	फोन नं.	हस्ताक्षर
२०	सुतिलकु देवी	कार्यपालिका	9806893205	
२१	[illegible]		9709758385	
२२	[illegible]		9541346009	
२३	[illegible]		9845040973	
२४	[illegible]	पार्षद	9845023911	
२५	पावती देवी			
२६	[illegible]			
२७	[illegible]	चालक		
२८	[illegible]	का.स		
२९	[illegible]	का.स		
३०.	[illegible]			
३०	[illegible]	ले.स.स		
३१	[illegible]	[illegible]	9863047257	
३२	[illegible]	[illegible]		
३३	[illegible]	[illegible]	9CC2048209	
३४	[illegible]	[illegible]	9C83592984	
३५	[illegible]	"	9845463840	

SFD Parsagadhi Municipality, Nepal, 2023

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