SFD Report

Phungling Municipality
Nepal

Final Report

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Environment and Public Health Organization (ENPHO)

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SFD Report Phungling Municipality, Nepal, 2023

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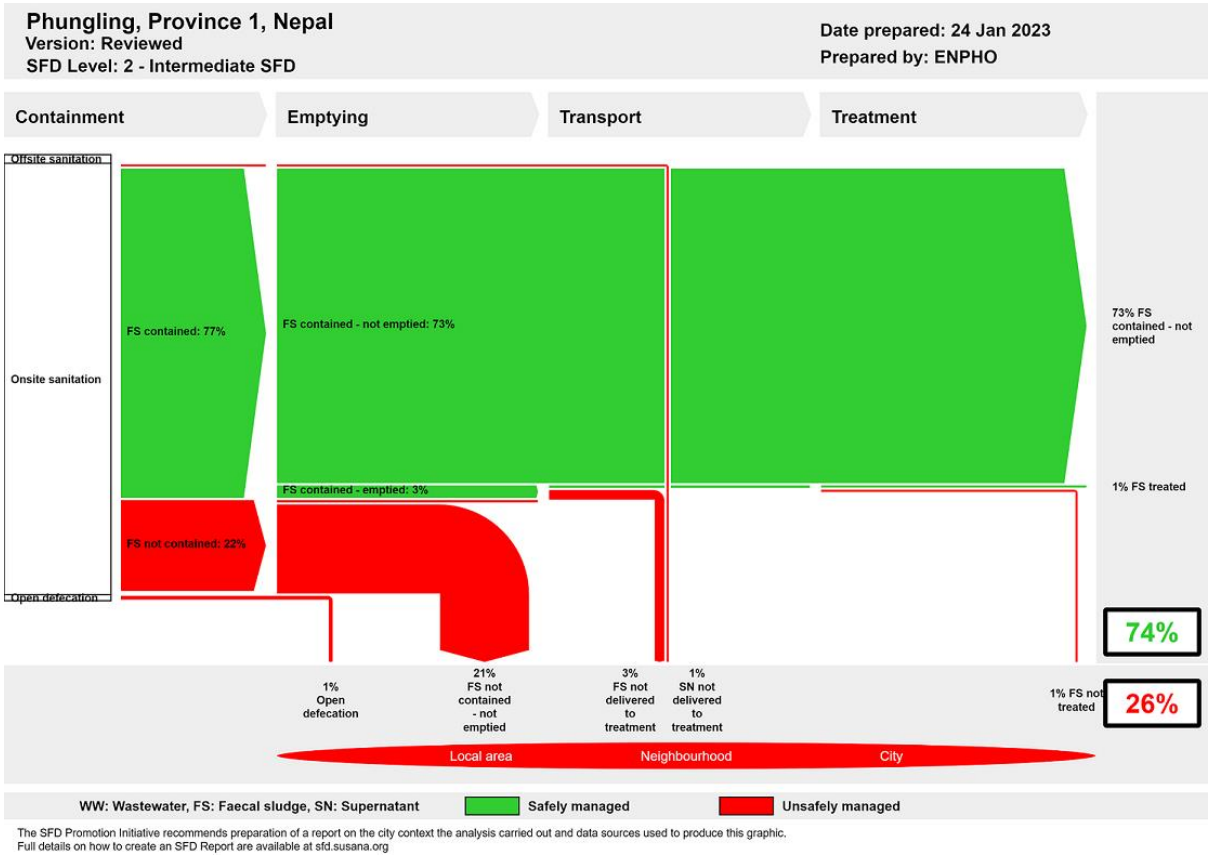
1. The SFD Graphic



2. Diagram information

SFD Level:

This SFD is a level 2 - Intermediate report.

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

Status:

Final SFD Report.

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24/01/2023

3. General city information

Phungling Municipality is in the Taplejung District of Koshi Province of Nepal and is the only municipality of this district. The total area of the municipality is 125.57 square kilometres which is divided in 11 wards (Phungling, 2023).

The total population of the municipality is 28,786, with male and female population percentage of 49.2% and 50.8%, respectively. In Phungling Municipality, 7,306 families are residing in 5,888 households. The family size of the municipality is 4 (Phungling, 2023).

The municipality reaches its highest temperature up to 24°C in summer and the lowest temperature up to 4°C in winter. Monthly precipitations above 150 mm are mostly wet, below 30 mm mostly dry (meteoblue, 2023).

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, 2021). Basic sanitation coverage in the municipality is 98.6%. The rest of the population defecate in open places or use a neighbour's toilet.

None of the Households (HHs) in the municipality has toilet or containment connected to an offsite sanitation system.

1.1% have a toilet connected to a biogas digester, 3.6% of the households have a toilet connected to a fully lined tank, 14.4% are connected to lined tank with impermeable walls and open bottom, 0.6% are connected to a septic tank and 80.4% constructed a toilet connected to an unlined pit, which all contributes to the percentage of households having toilet excluding open defecation.

Public Toilets (PTs) are installed for commuters to achieve and sustain open defecation-free status in the municipality. Altogether, six public toilets are installed to serve the floating population and travellers. These toilets are located in the bus park areas, highway road, local market area, near temples and other populated areas (KII-1, KII-2).

2.9% of containments have been emptied at least once since the installation. Both manual and mechanical emptying of the containments are practised in the municipality. Mechanical emptying facilities are provided by private desludgers of neighbouring municipality, Phidim. Among the containments that have been emptied at least once, only 10% were mechanically emptied.

Phungling does not have any form of treatment plant to treat faecal sludge (FS) generated in the municipality. FS emptied is dumped untreated into open areas, farmlands or water resources.

Overall, the SFD graphic shows that 74% of the excreta generated are safely managed while 26% of the excreta generated are not. The safely managed percentage of FS generated by 73% of the population is temporary until the tanks and pits become full and Faecal Sludge from the containment is emptied. 1% of the FS that is safely managed and treated is due to the 1% of households having a biogas digester.

5. Service delivery context

The Constitution of Nepal 2015 in Article 35 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 recognizes that every person shall have the right to live in a healthy and clean environment (GoN, 2015).To respect, promote and fulfil the provisions related to right on water and sanitation, Government of Nepal has billed Drinking Water and Sanitation Act, 2019 through Ministry of Water Supply. The act elaborates right to clean water as to receive affordable, sufficient, and quality drinking water regularly as well as access to sanitation as affordable access to quality sanitation services (MoWS, 2017).

Several policies have been in place to accomplish the sanitation need 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 into sanitation campaign. The document adopted sanitation facilities as improved, basic, and limited in line with WHO/UNICEF guideline. The sanitation campaign throughout the country focused to achieve universal access to improved sanitation (NPC, 2020).

The draft Sector Development Plan (SDP) has envisioned the delineation of roles and responsibility of federal, provincial, and local government in an aim to initiate sustainability of Open Defecation Free (ODF) outcomes.

It is the duty and responsibility of Phungling Municipality to improve access to accessible, safe and sustainable drinking water and sanitation services to the people of the municipal area as mentioned in chapter 3 of the Local Government Operation Act 2074 under the title of municipal work, duties and rights; the policy, laws, standards, plan implementation and regulation related to local water supply mentioned in sub-section D of section 11. To implement this responsibility, water supply, sanitation and hygiene plan and policy has become essential. Development without planning and estimation will not lead to the expected success in the areas of access to water and sanitation (UNICEF, 2020).

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 Local Government	Phungling Municipality.
Non-governmental Organizations	Environment and Public Health Organization (ENPHO).
Private Sector	Private FS Emptying and Desludging facility providers, public toilet operators.
Development Partners, Donors	MuAN, BMGF, UCLG ASPAC.

7. Credibility of data

Primary data were collected from random household sampling. Altogether, 365 households and 59 institutions were surveyed from 11 wards of the municipality. Primary data on emptying, transportation and current sanitation practices in the municipality were validated from Key Informant Interviews (KIIs) with private desludgers, public toilet management, sanitation, and environmental section. The overall data and findings were shared with the stakeholders of the municipality and validated through sharing program.

8. Process of SFD development

Data on sanitation situation is collected through household and institutional survey (ENPHO, 2021). 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 the survey. Along with this, KIIs were conducted with officers of municipality, private desludging service providers and engineer of International non-governmental organizations (INGO) to understand the situation practices across the service chain. Data were entered in the 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:

- ENPHO. (2021). *Data Collection Survey on Water Supply and Sanitation Management in Major Cities of Nepal.* Kathmandu: ENPHO, JICA.
- 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
- Phungling. (2023). Phungling Municipality. Obtenido de phunglingmun.gov.np: https://phunglingmun.gov.np/ne/node/3
- metoblue. (s.f.). Simulated historical climate & weather data for Siraha. Obtenido de https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/siraha_nepal_1282770
- 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/
- MoWS. (2017). Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016-2030). Ministry of Water Supply.
- NPC. (2020). National Review of Sustainable Development Goal. Kathmandu Nepal: National Planning Commission.

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Abbreviations

BMGF	Bill and Melinda Gates Foundation
CAO	Chief Administrative Officer
DUDBC	Department of Urban Development and Building Construction
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
GDP	Gross Domestic Product
GON	Government of Nepal
HH	Household
IRF	Institutional and Regulatory Framework
JMP	Joint Monitoring Programme
KII	Key Informant Interview
KM	Kilometre
MDG	Millennium Development Goal
MICS	Multiple Indicator Cluster Survey
MoUD	Ministry of Urban Development
MTEF	Medium-Term Expenditure Framework
MuNASS-II	Municipalities Advocacy on Sanitation in South Asia – II
NGO	Non-Governmental Organization
NRS	Nepali Rupees
NWSC	Nepal Water Supply Corporation
NSHMP	Nepal 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
RWSSNP	Rural Water Supply and Sanitation National Policy
SDG	Sustainable Development Goal
SDP	Sector Development Plan
SFD	Shit Flow Diagram
SFD PI	Shit Flow Diagram Promotion Initiative
SMC	Sub-metropolitan City
UCLG ASPAC	United Cities and Local Governments Asia Pacific
UNICEF	United Nations Children's Education Fund
UCLG ASPAC	United Cities Local Government – Asia Pacific
VDCs	Village Development Committee
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WSP	Water Service Providers
WSSDO	Water Supply and Sanitation Divisional Office
WSUC	Water and Sanitation Supply and User's Committee
WW	Wastewater

1. City context

Phungling Municipality is located in the Taplejung District of Koshi Province of Nepal and is the only municipality of this district. On 10 March 2017, Hangdeva, Phurumbu and Phawakhola Village Development Committees (VDCs) merged with the then Taplejung Municipality and renamed it as Phungling Municipality. Initially, the name of Phunging Municipality was Taplejung Municipality which was formed on May 8, 2014. The total area of the municipality is 125.57 square kilometres which is divided in 11 wards. The main inhabitants in Phungling are Limbu and other residents of the municipality are Rai, Gurung, Magar, Newar, Bahun, Chhetri, Tamang, Sunuwar, Kami, Damai, Saraki, Sherpa Chhetri, Tamang, Brahman, Sherpa, Bhote, Newar, and Gurung. Figure 1 shows the ward boundary map of Phungling Municipality (Phungling, 2023).

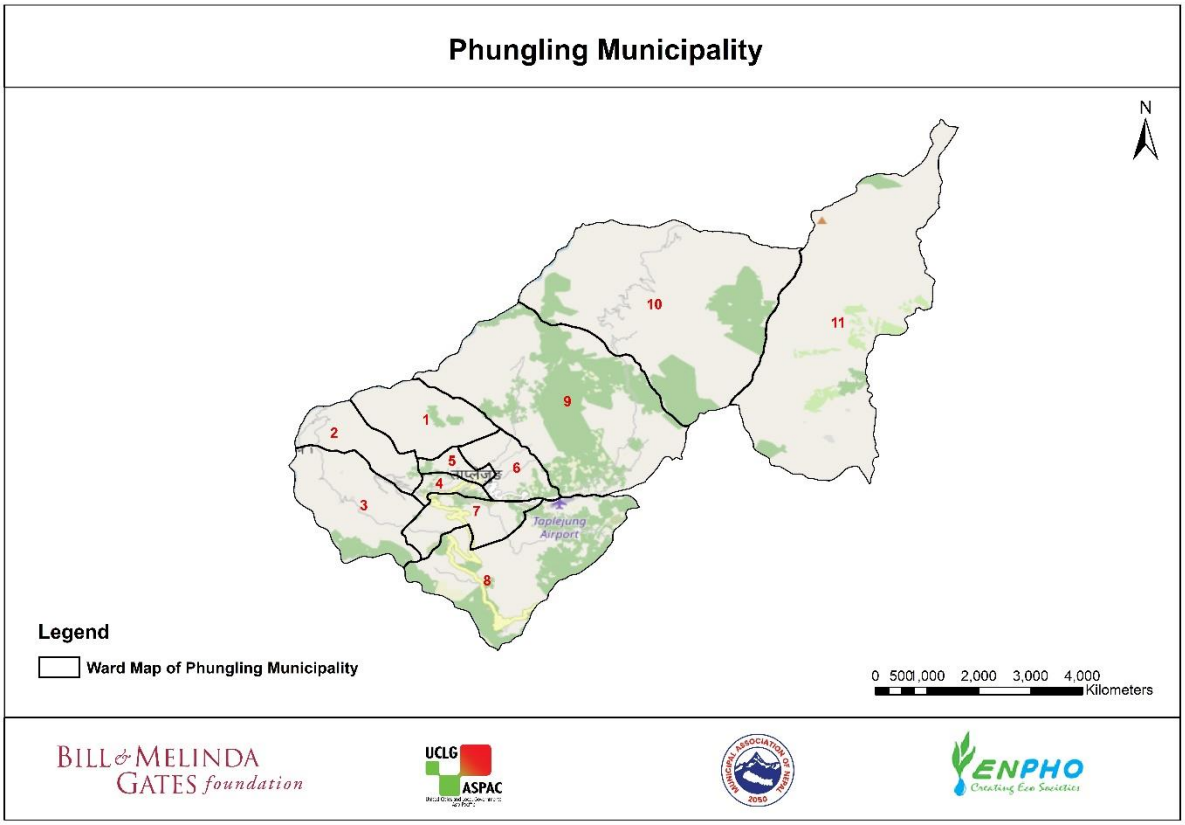


Figure 1: Map of Phungling Municipality with ward boundaries.

1.1 Population

The total population of the municipality is 28,786, with male and female population percentage of 49.2% and 50.8%, respectively. In Phungling Municipality, 7,306 families are residing in 5,888 households. The family size of the municipality is 4.

Figure 2 shows the population density in different wards of Phungling Municipality where it can be observed that wards number 4 and 5 displays high population densities whereas ward number 3, 8, 9, 10 and 11 have comparatively low population densities.

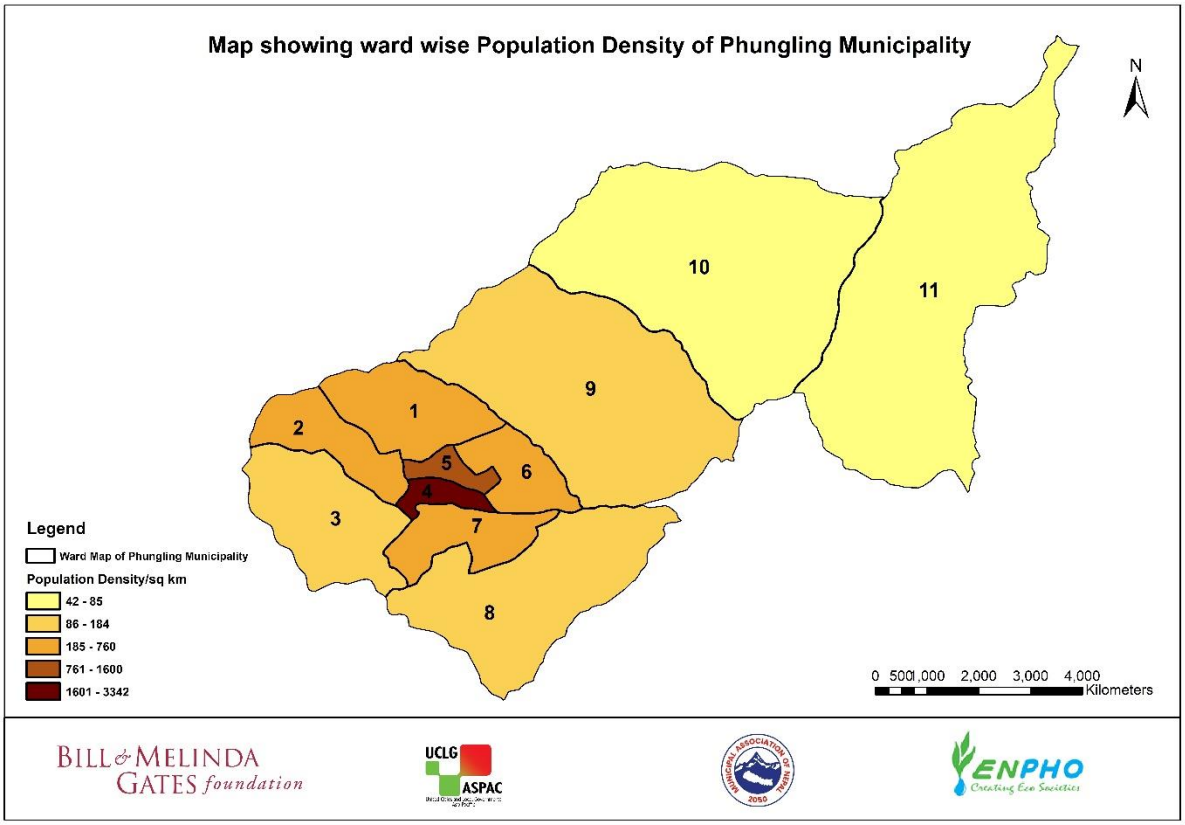
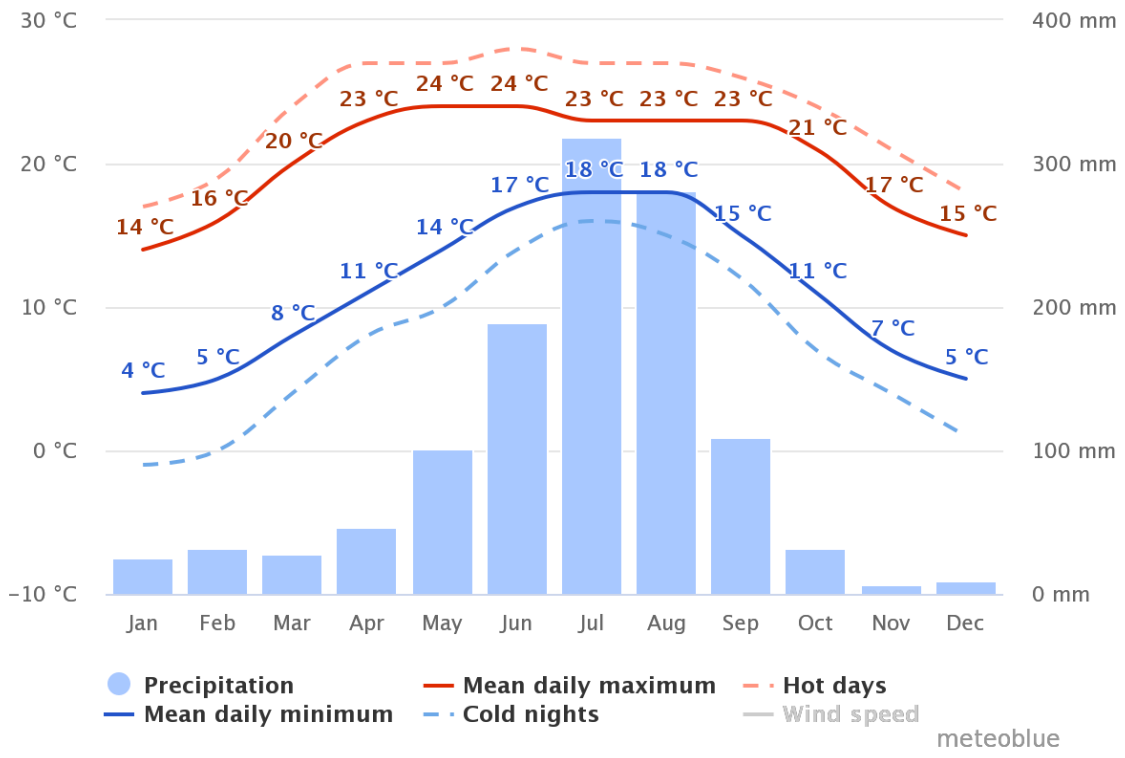


Figure 2: Ward wise population density of Phungling Municipality.

1.2 Climate

Figure 3 shows the graph on weather of Phungling. The municipality reaches its highest temperature up to 24ºC in summer and the lowest temperature up to 4°C in winter. The mean daily maximum (solid red line) shows the maximum temperature of an average day for every month for Phungling. Likewise, mean daily minimum (solid blue line) shows the average minimum temperature. Hot days and cold nights (dashed red and blue lines) show the average of the hottest day and coldest night of each month of the last 30 years. Monthly precipitations above 150 mm are mostly wet, below 30 mm mostly dry (meteoblue, 2023).



(meteoblue, 2023)

Figure 3: Graphs on precipitation, mean daily maximum and minimum temperature of Phungling Municipality.

1.3 Topography

Phungling Municipality is situated in the Taplejung District of eastern Nepal. The altitude of the municipality is at 1.441 metres above sea level and is located at 27°21'0N 87°40'0E. Phungling showcases a diverse topography, including lowlands suitable for agriculture, hills covered in thick forests, fertile valleys with small settlements and mountains offering captivating landscapes.

2. Service Outcomes

2.1 Overview

The Joint Monitoring Programme (JMP) defines improved sanitation facilities as those designed to hygienically separate excreta from human contact (WHO, n.d.). In Phungling Municipality, people residing in 98.6% of households have improved sanitation facilities. In the present context, the category of sanitation provision has seemingly improved from not having toilets in houses through to building a storage facility to contain Faecal Sludge (FS) produced at household level in the municipality. The municipality achieved Open Defecation Free (ODF) status in 2019. Despite being declared as ODF municipality, people residing in 1.4% households in wards number 3, 8 and 10 do not have access to basic sanitation facilities and defecate openly.

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2021). A total of 365 households were sampled from 5,888 households distributed in 11 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 Household Level Sanitation System

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). In Phungling Municipality, 98.6% of the households having toilet have connection to onsite sanitation system, which is the total percentage of households with toilet.

Types of Onsite Sanitation Systems

Table 1 demonstrates the type of containments used in the household level in Phungling along with its distribution according to the SFD methodology. Column 2 in the table shows the percentage of people using sanitation system as obtained from the household survey. Column 4 and 5 demonstrates the same system and its percentage according to the SFD methodology.

In column 3, the sum of types of containments only contributing to onsite sanitation systems (85%) excluding households without toilet and offsite sanitation is shown.

Table 1: Types of containment used in the household level in Phungling Metropolitan City.

Containment used at household level	% of population using such containment	Contributing to 85% Onsite Sanitation	Distribution of the sanitation systems according to the SFD methodology	Percentage
Septic Tank	0.5%	0.6%	Septic Tank connected to open drain	0.5%
Biogas Digester	1.1%	1.1%	Fully Lined Tank no outlet or overflow	4.6%
Fully Lined Tank	3.5%	3.6%		
Lined Tank with Impermeable Walls and Open Bottom	14.2%	14.4%	Lined Tank with Impermeable Walls and Open Bottom	14.2%
Unlined Pit	79.3%	80.4%	Unlined pit	79.3%

Different types of onsite sanitation systems used in households of Phungling Municipality are described below:

Biogas Digester: Biogas digester is a waste to energy conversion technology designed to treat household faecal sludge and organic matter and is proved to be a beneficial method of stabilising FS. Here, faecal sludge is converted into biogas and slurry. The slurry is relatively biologically stable and can be used as a soil conditioner (Linda Strande, 2014). In Phungling Municipality, 1.1% households use a biogas digester to store and treat the FS generated in their houses. Figure 5 shows the top view of biogas built in a household of Phungling Municipality.

Figure 4: Biogas Digester installed and used in a household of Phungling Municipality.

Fully lined tank: Fully lined tank is a rectangular onsite sanitation technology which is used to safely store faecal sludge. There is no outlet or overflow to discharge effluent. The walls and bottom of the tank are totally lined and sealed (Linda Strande, 2014). People residing in 3.6% of households with access to toilet in their houses in the municipality having onsite sanitation technology use fully lined tanks. None of the households have outlet or overflow from the fully lined tank. Figure 6 shows a fully lined tank built in a household of the municipality.

Figure 5: Fully Lined Tank in household of Phungling Municipality.

Lined tank with impermeable walls and open bottom: Population residing in 14.4% of households with a toilet in their houses in the municipality have built a lined tank with impermeable walls and open bottom, which are rectangular onsite technologies where the walls of the tank are lined and the bottom of tank is not lined and allows infiltration of effluents which could contaminate groundwater. 92.3% of such containments do not have outlet or outflow, 1.92% have connection to open drain and 5.8% have connections to open ground. Figure 7 shows a lined tank with impermeable walls and open bottom in a household of the municipality.

Figure 6: Lined Tank with Impermeable Walls and Open Bottom in household of Phungling Municipality.

Septic Tank: Septic tank is a watertight chamber made of concrete through which blackwater and greywater flows for primary treatment. Septic tanks should have at least two chambers. The first chamber should be at least 50% of the total length, and when there are only two chambers, it should be two thirds of the total length. Most of the solids settle out in the first chamber. A correctly designed septic tank has an outlet from the second chamber to a sub-surface infiltration system (such as a soak pit) or to a sewer for further management of the liquid effluent (Susana, 2018). Only 1% of people residing in the municipality have access to a properly made septic tank whose outlet is connected to an open drain which is shown in Figure 8.

Figure 7: Septic Tank installed in household of Phungling Municipality.

Unlined Pit: Unlined pits are semipermeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. Population residing in 80.4% of households with access to toilet in their houses have built such type of onsite sanitation technology. There are no lining and the walls and bottom of such type of pits are not sealed. Such pits do not have designed outlets. Figure 9 shows the top view of unlined pit observed in the household survey in the municipality.

Figure 8: Unlined pit in household of Phungling Municipality.

Figure 10 shows the distribution of various types of sanitation technologies in different wards of Phungling Municipality.

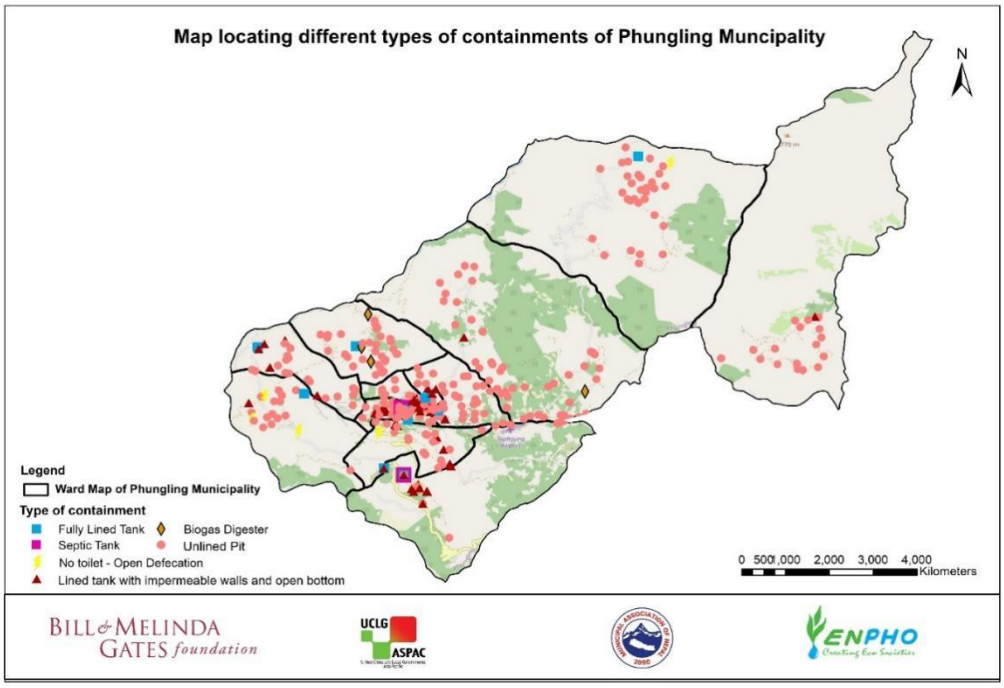


Figure 9: Types of containments installed at household levels (ENPHO, 2021).

2.1.2 Percentage of FS emptied from containments

Emptying is one of the major components of the sanitation value chain. It ensures the proper functioning of containment basically for the septic tanks which functioned well until the volume of sludge is one-third of the total volume of the tanks. Also, in other containments, regular emptying prevents overflow of the sludge and blockages (Linda Strande, 2014).

Only 2.9% of the households have emptied their containment due to overflow of faecal sludge. Moreover, lined tanks with impermeable walls and open bottom and unlined pits are emptied more than other types of containment in the household buildings. Among the households which have emptied containment at least once, 0.6% emptied are lined tanks with impermeable walls and open bottom, 2% are unlined pits and 0.3% are septic tanks.

In the SFD graphic generation process, households using biogas digesters are considered as fully lined tanks which are emptied and the FS is delivered to the treatment plant and treated.

Emptying rate of the containment is determined by number of users, duration of use, types, and size of the containment. The average number of users and average size of containments that are emptied are 8 and 5.2 m^3 and not emptied are 5 and 7.3 m^3, respectively.
The final values used for the proportion of faecal sludge emptied from each sanitation system (which accounts for variable F3 in the SFD matrix and shown in Figure 14) are derived from

the data obtained in the household (HH) survey and consider all sanitation systems that have been emptied at least once.

Among the households that have emptied their containment at least once, manual emptying, involving labours or household members to manually remove the faecal sludge from the containment and transport it for disposal in farmlands, is practised in 90% within the municipality. Likewise, 10% of households use mechanical emptying. There are no FS desludging facilities in the municipality. Lack of road access and hilly landscape makes it difficult for mechanical FS truck to reach containments in the households. Private desludgers from a neighbour municipality, Phidim, provide this facility once in a few months upon the request of household owners. The emptying status of containments throughout different wards of the municipality is shown in Figure 11. Blue circle in the figure represents the containments that have not been emptied and the red circle represents containments that have been emptied at least once after construction.

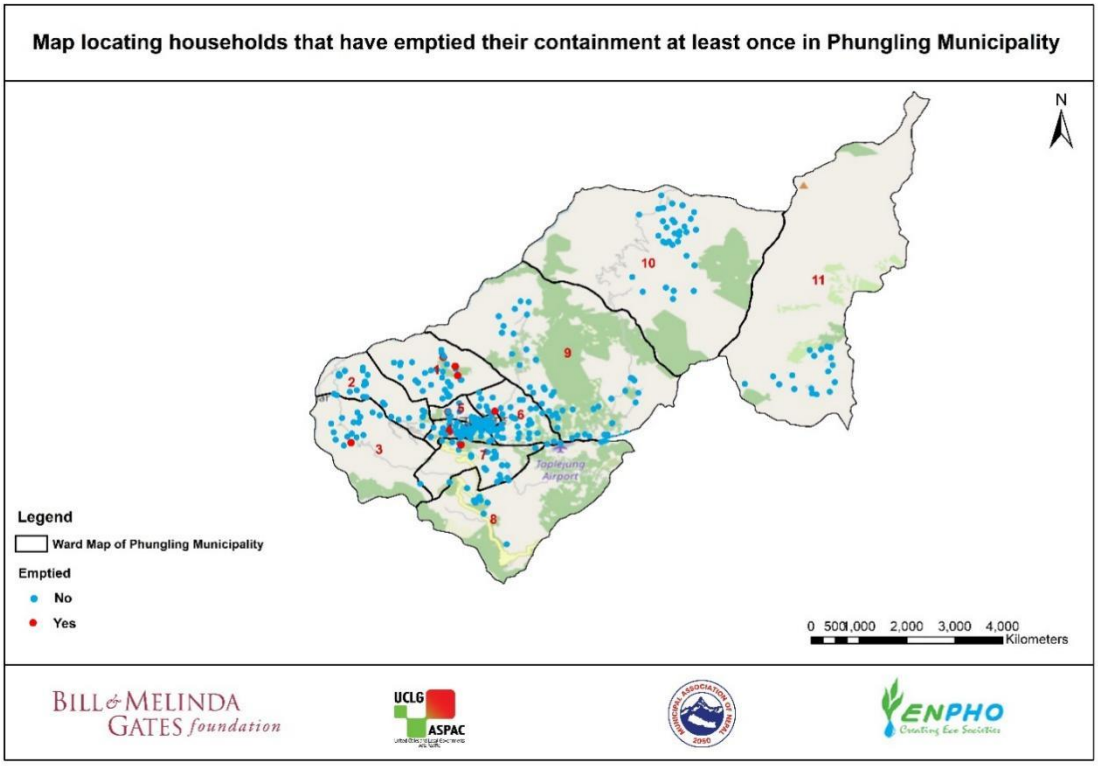


Figure 10: Status of containments that has been emptied at least once (ENPHO, 2021).

The diverse topography of Phungling Municipality results in variations in soil types across different locations, including alluvial soil, sandy loam soil, and clay soil. Among these soil types, alluvial soil exhibits high permeability, while sandy loam and clay soil have moderate permeability. The differences in emptying frequency among the types of containments can also be attributed to several factors including volume of containment and number of users. Majority of the containments were built in the households during the process of declaring the municipality open defecation free. Thus, most of the containments are not filled yet. Among

the few households that have emptied their containment, the average emptying frequency and average volume containments in the municipality is shown in Table 2.

Table 2: Average emptying frequency of different types of containment in Phungling Municipality (ENPHO, 2021).

Types of Containment	Average Emptying Frequency	Average Volume (m^3)
Septic tank	Once every four years	10.5
Lined tank with impermeable walls and open bottom	Once every five years	6.5
Unlined pit	Once every two years and five months	5.3

2.1.3 Treatment and Disposal/Reuse

Phungling 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 the emptied is dumped into forest areas and nearby water bodies. Application on farm is the most easy and convenient way for disposal of FS as it can be used as soil conditioner for agricultural purposes since there is no treatment plant. However, this is not considered as a safely disposal of FS.

2.1.4 Institutional Level Sanitation System

100% of the surveyed institutions have an onsite sanitation system in the municipality. Institutions buildings such as community school, health post, government buildings, etc. were surveyed. The percentage of types of sanitation technologies in these buildings are shown in Figure 12.

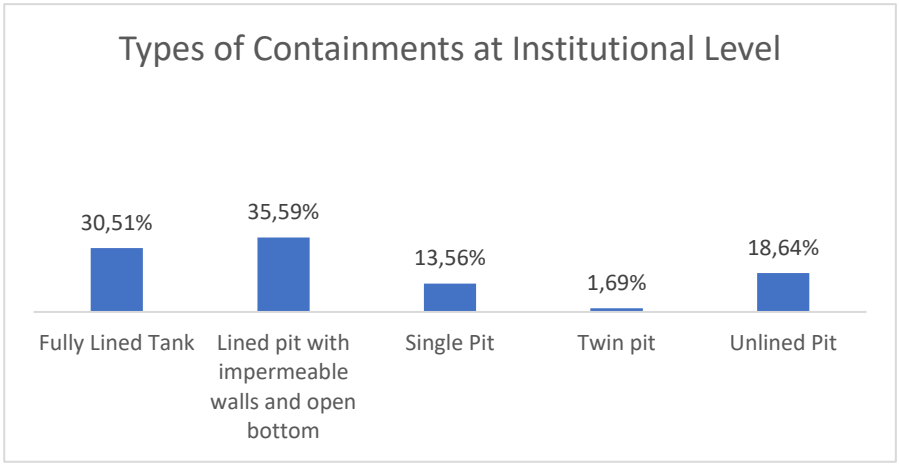


Figure 11: Types of containment in institutions of Phungling Municipality (ENPHO, 2021).

None of the institutions having containment in their institutions have emptied their containment at least once after construction. It is mostly because the containments have not been filled.

2.1.5 Public Toilets

Public Toilets (PTs) are installed for commuters to achieve and sustain open defecation free status in the municipality. Altogether, six public toilets are installed to serve the floating population and travellers. These toilets are located in the bus park areas, highway road, local market area, near temples and other populated areas (KII-1, KII-2).

The public toilet near a highway road (PT: E) in Phungling Municipality has a capacity of four users at a time, two in male and three in female compartment. Initially, the toilet was maintained and operated by a local person appointed by the municipality. At present, overall operation and maintenance of the public toilet is carried out by the shopkeeper near the toilet. List of pictures of public toilet located at different places of the municipality are shown in Table 3.

Table 3: Pictures of public toilets in Phungling Municipality.

	
Public toilet structure (PT: A)	Public toilet structure (PT: B)
	
Public toilet structure (PT: C)	Public toilet structure (PT: D)

	
Public toilet structure (PT: E)	Public toilet structure (PT: F)

2.1.6 Risk of Groundwater Pollution

The risk of groundwater pollution is assessed based on source of drinking water and the vulnerability of the aquifer with regards to lateral spacing between sanitation system and groundwater sources. 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, as a result 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).

Groundwater vulnerability is specific to containment type and pollution scenarios (Andreo, 2013). Among the various types of containments, lined tanks with impermeable walls and open bottom and unlined pits are more prone to contribute to aquifer pollution as the seepage from such types of containments can readily infiltrate the surrounding soil and groundwater and cause contamination. The types of soil found in Phungling Municipality are alluvial soil, sandy loam soil, and clay soil. Among these soil types, alluvial soil exhibits high permeability, while sandy loam and clay soil have moderate permeability, allowing liquid to penetrate ground easily. 30.8% of the households use private/yard tap, 67.9% uses spring source and 1.4% use public taps as major sources of drinking water in the municipality. Water service providers providing drinking water in private taps and public taps in Phungling use chlorination as safety measure from contamination of water. Thus, such households are considered at low risk. Since there is no use of groundwater, the risk of groundwater pollution is very low.

Nevertheless, population using spring sources (located near residential areas with high percentage of households having lined tanks with open bottom and unlined pits) as major source of drinking water without using any form of point of use options are considered at significant risk. Therefore, 1.9% of the population use lined tanks with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution

and 18.3% of the population rely on unlined pits, no outlet or overflow, where there is a 'significant risk' of groundwater pollution.

2.2 SFD Selection Grid

Sanitation technologies selected in the SFD grid in Phungling Municipality are shown in Figure 13. 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 the outlet or overflow discharge from the toilet. Twin pits and single pits observed in the household survey are selected as lined pits with semi-permeable walls and open bottom in the SFD grid.

Thus, different types of sanitation systems in Phungling Municipality and their outlet are selected in the selection grid and the proportion of population using such type of systems is calculated further 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					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									Significant risk of GW pollution Low risk of GW pollution
Unlined pit										T2A6C10 T1A6C10
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 12: SFD selection grid for Phungling Municipality.

Here, sanitation technologies and/or systems which ensure safe level of protection from excreta i.e., pathogen transmission to the user or general public is limited, are considered to contain the FS. Similarly, sanitation technologies and/or sanitation systems which do not sure safe level of protection from excreta. I.e., pathogen transmission to the user or general public, do not to contain FS (Susana, 2018).

Brief explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 13 is explained in Table 4.

Table 4: Explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 13.

T1A2C6	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.
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 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.
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.
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	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.
T2A6C10 (High Risk)	A correctly designed, properly constructed and well-maintained unlined pit with permeable walls and 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.
T1A6C10	A correctly designed, properly constructed and well-maintained unlined pit with permeable walls and 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 proportion and matrix

The second step in the process of developing the SFD graphic is the calculation the proportion of contents of each type of onsite container which is faecal sludge. A detailed instruction on how to calculate SFD proportion in SFD PI was used as guide to calculate SFD proportion. It stated that the default "100%" value is used where onsite containers are connected to soak pits, to 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. 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:

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

Here, data for each selected sanitation system on the SFD Matrix is entered. The proportion of the contents of each type of onsite container (either 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 14. F3 is the proportion of the contents of each type of onsite container which is emptied at least once after its construction. Here, only 80% of the proportion of FS in the containment is emptied as suggested by data from household survey and interview with private desludgers in Phidim. Thus, the values in variable F3 are only 80% of total emptied proportion of each type of containment.

Variable F4 accounts for FS emptied that is transported to treatment plant. As shown in Figure 14 of SFD matrix, fully lined tanks (sealed) no outlet or overflow (4.6%), are comprised of two types of containments; biogas digesters (1.1%) and fully lined tanks without outlet (3.5%). Moreover, 23.5% of T1A3C10 emptied that is shown in F3 is biogas digester used in the municipality and none of the fully lined tank without outlet has been emptied. 100% of T1A3C10 emptied pertains to biogas digester, which is considered as FS transported to treatment plant. 90% of T1A3C10 taken to treatment plant is treated as seen in column F5.

All other values of F4 and F5 are zero because there is no treatment plant established in the area. FS emptied manually is not dug into the farmland or utilized as soil conditioner, instead, they are disposed of on top of farmlands untreated, which cannot be considered as a safely disposal of FS.

Phungling, Province 1, Nepal, 24 Jan 2023. SFD Level: 2 - Intermediate SFD
Population: 28786
Proportion of tanks: septic tanks: 50%, fully lined tanks: 100%, lined, open bottom tanks: 100%

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
T1A2C6 Septic tank connected to open drain or storm sewer	0.5	50.0	0.0	0.0	0.0	0.0
T1A3C10 Fully lined tank (sealed), no outlet or overflow	4.6	23.5	100.0	90.0		
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	11.2	2.4	0.0	0.0		
T1A4C6 Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	0.3	0.0	0.0	0.0	0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	0.8	0.0	0.0	0.0		
T1A6C10 Unlined pit, no outlet or overflow	61.0	3.4	0.0	0.0		
T1B11 C7 TO C9 Open defecation	1.4					
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	1.9	14.3	0.0	0.0		
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	18.3	0.0	0.0	0.0		

Figure 13: SFD Matrix of Phungling Municipality.

2.3 Summary of Assumptions

Offsite sanitation systems:

✓ There are no offsite sanitation systems in the municipality.

Onsite sanitation systems:

✓ The proportion of FS in septic tanks were set to 50%, the proportion of FS in fully lined tanks was 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 100% according to the relative proportions of the systems in the municipality, as per the guidance given in the Frequently Asked Questions (FAQs) in the Sustainable Sanitation Alliance (SuSanA) website.

✓ Variables F3, F4 and F5 for all onsite sanitation systems were derived from the HH survey and cross-checked with the KIIs conducted.

2.4 SFD Graphic

Figure 15 shows the SFD graphic for Phungling Municipality where 74% of the excreta generated are safely managed while 26% are unsafely managed.

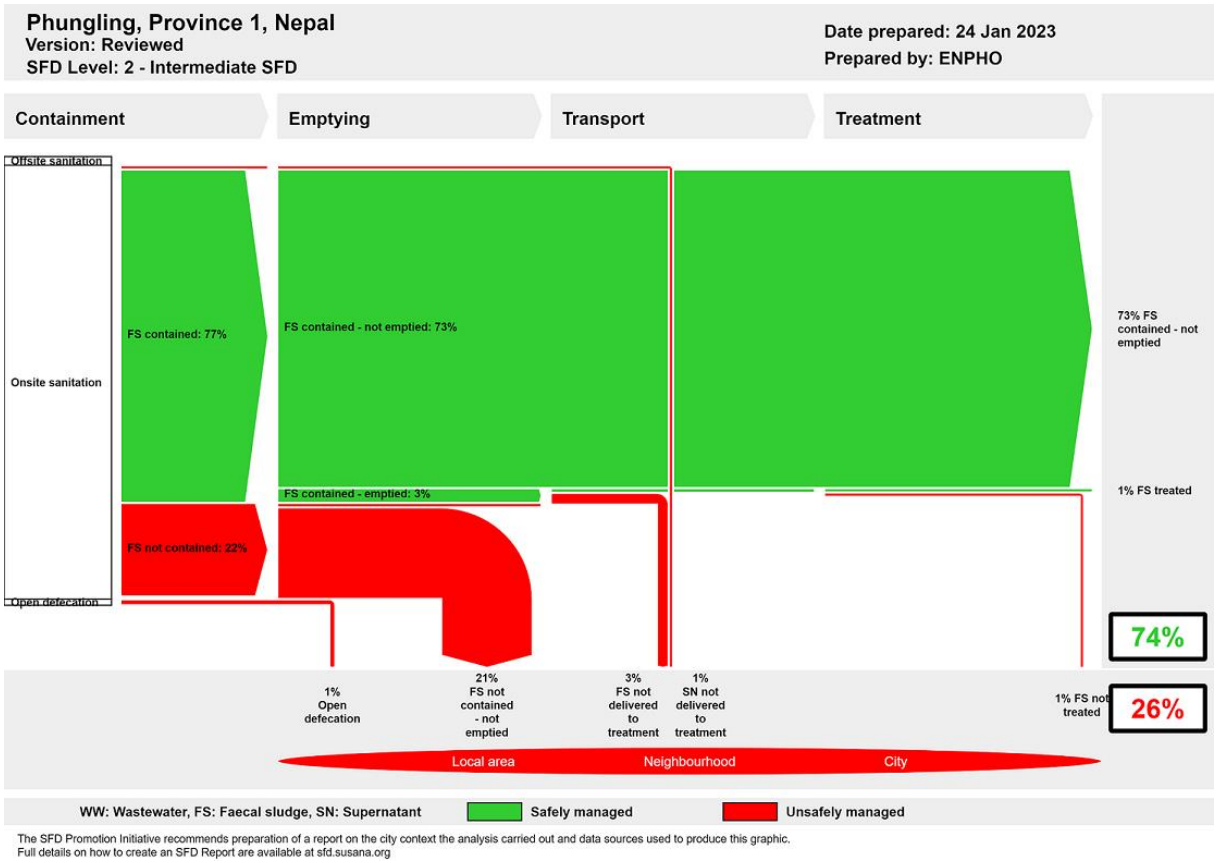


Figure 14: SFD graphic of Phungling Municipality.

77% of FS is contained i.e., FS kept in a container, either emptied or not, is safe from human contact. 73% is FS contained - not emptied which is stored in fully lined tanks, lined tanks and

pits. This 73% 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 and medium term as they fill up.

In the SFD graphic generation process, 1.1% of households using biogas digesters are considered as fully lined tanks without outlet which are emptied and the FS is delivered to treatment. 90% of the FS transported for treatment are considered as treated which accounts for 1% of FS treated.

Likewise, 22% is FS not contained, that is, FS kept in containment which poses risk to human health through groundwater contamination or human contact. Lack of a treatment facility in the municipality leads to disposal of FS in open areas and rivers. The unsafely managed excreta originate from: Supernatant (SN) not delivered to treatment (1%), FS not delivered to treatment (3%), FS not treated (1%) and FS not contained - not emptied (21%).

Despite ODF status, people residing in 1% of the households still go for open defecation. This percentage of population going for open defecation are people from low-income families who are not financially sound enough to build toilets and containment.

3. Service Delivery Context

3.1 Policy, legislation, and regulation

3.1.1 *Policy*

The Constitution of Nepal 2015 in Article 35 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 recognizes that every person shall have the right to live in a healthy and clean environment (GoN, 2015). To respect, promote and fulfil the provisions related to right on water and sanitation, Government of Nepal has billed Drinking Water and Sanitation Act, 2019 through Ministry of Water Supply. The act elaborates right to clean water as to receive affordable, sufficient, and quality drinking water regularly as well as access to sanitation as affordable access to quality sanitation services (MoWS, 2019).

Historically, 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. Participatory approach, community leadership project development, optimization of local resources and installation of locally appropriate technologies were major principles in the policy (DWSSM, 2004). 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. Cost recovery principles, public private partnership, and sector effectiveness for improved service delivery are key principles of the policy (DWSSM, 2009). Both these policies were limited to address 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 Government of Nepal (GON) to address the emerging challenges and issues with the adoption of innovative 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.

Recently, National Water, Sanitation and Hygiene Policy, 2022 has been drafted and undergone the process for endorsement. The draft policy is updated till date, including the wide range of sanitation services including treatment, reuse/safe disposal of faecal sludge/wastewater. It emphasizes on the preparation of the municipal level WASH plan with the local leadership to ensure the WASH services for all (MoWS, 2022).

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. In alignment, 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). It is framed upon existing laws such as Environmental Protection Act (2019) and Environmental Protection Rules (2020), Self-Local Governance Act and Rules 1999, Environmental Standards on Effluent Discharge 2000, Nepal National Building Code 2003, and Land Acquisition Act amendment 2010 (MoWS, 2019). 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 Water and Sanitation User's Committee (WSUC) in the framework reflects a participatory approach that would help in sustaining the interventions.

The constitution of Nepal has provided the right for local government to form acts, rules and regulation based on the national policies and laws. Local Governance Operation Act 2017 has been formed to implement the right of local government and promote co-operation, co-existence, and co-ordination among federal, provincial, and local government. The act has mentioned the rights, roles, and responsibility of municipalities along with provision and procedure for approving laws and regulations at local level.

It is the duty and responsibility of the Phungling Municipality to improve access to accessible, safe, and sustainable drinking water and sanitation services to the people of the municipal area as mentioned in chapter 3 of the Local Government Management Act 2074 under the title of municipal work, duties, and rights; the policy, laws, standards, plan implementation and

regulation related to local water supply mentioned in sub-section D of section 11. To implement this responsibility, water supply, sanitation and hygiene plan and policy has become essential. Development without planning and estimation will not lead to the expected success in access to water and sanitation (UNICEF, 2020).

3.1.2 *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, develop 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, facilitate and coordinate 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 16.

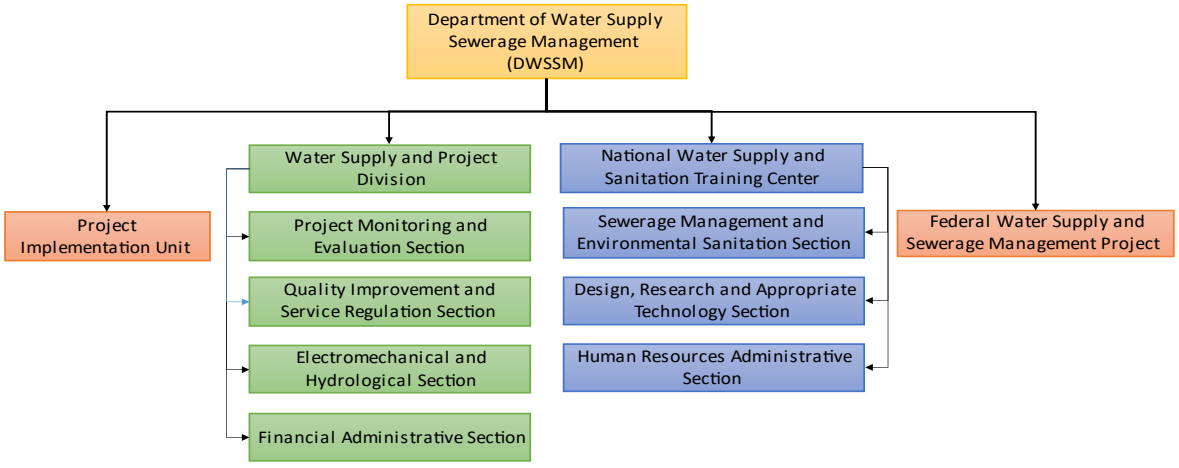


Figure 15: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

Ministry of Urban Development: The Ministry of Urban Development (MoUD) works on integrated urban planning and development in municipalities, including faecal sludge management. Department of Urban Development and Building Construction (DUDBC) under

MoUD is implementing body and sets the standards for safe, affordable building construction and implementation for managed residential environment.

At Provincial Level

Ministry of Physical Infrastructure: Ministry of physical infrastructure of provincial government in Sudurpaschim is major executing body in the province. Planning and implementation of water supply and sanitation infrastructure is 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.

3.1.3 *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 5. However, FSM specific standards have yet to be developed and implemented.

Table 5: 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 grewater	✓	✓	✓
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	✓	✓	✓

3.2 Planning

3.2.1 *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 Sustainable Development Goals (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 6.

Table 6: 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

3.3 Investments

A preliminary estimate of the annual investment requirement for the entire SDG period, 2016-2030 ranges between 42% to 54% of Gross Domestic Product (GDP). The average requirement is estimated to be about NPR 1,770 billion (USD 9.17 billion) per year, or nearly 49% of GDP over the entire duration of the SDGs (NPC, 2017).

The 15th year sanitation sector road map has estimated NRP 696 billion (USD 5.45 billion) for implementing the sector development plan of WASH. The gap on the budget allocated and required on WASH sector as mentioned in SDP (2016-2030) is shown in Figure 17. This scale

of investment needs a full mobilization of all national and international sources including both public and private sector (MoWS, 2017).

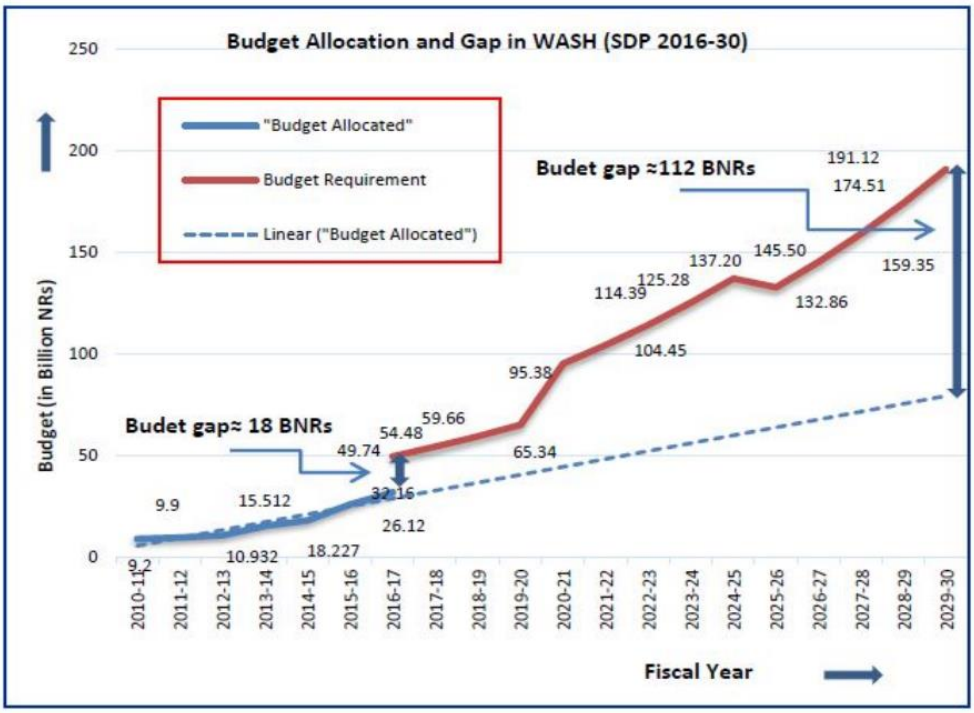


Figure 16: Budget allocation and GAP in WASH SDP 20016-2030.

3.4 Equity

3.4.1 *Current choice of urban poor*

The government has developed a Multiple Indicator Cluster Survey (MICS) for periodic monitoring of different sectors of SDG including water and sanitation service delivery (CBS, 2022). The program is supported by the Joint Monitoring Programme (JMP) from the WHO/UNICEF.

3.4.2 *Stimulating demand for services*

The mandatory provision of septic tanks during construction of building as per the National Building Code is major legal initiative for stimulating sanitation service demand in the city. Besides, the municipality must conduct awareness programs on sanitation at the community level for increasing the demand.

3.4.3 *Strengthening service provider roles*

Local government operation act 2017 and bill on drinking water and sanitation 2019 has entitled local government with authority for planning, implementation, monitoring and supervision of water and sanitation programs and services in the city. Similarly, institutional and regulatory framework on FSM has designated the local government with authority for planning, implementation, monitoring and supervision of sanitation programmes *(MoWS, 2017).*

4. Stakeholder Engagement

4.1 Key Informant Interviews

During the study, Key Informant Interviews (KIIs) were conducted to gather valuable insights from key stakeholders of the municipality and water supply committee. The objective of the interviews was to gain a comprehensive understanding of the current sanitation service practices.

Mr. Amir Maden, Mayor and Basanta Sunuwar, Computer Operator of Phungling Municipality were interviewed specifically regarding the municipality's sanitation services practices considering technical, institutional, and financial aspects.

Another interview was conducted with Ganga Ram Gurung, the Office Head *(Karyalaya Pramukh)* of Taplejung Brihat Water Supply User's Committee which focused on the supply, quality, and distribution of drinking water in the municipality.

Furthermore, private desludgers of Phidim Municipality were interviewed to gain insights into the FS emptying and disposal practices. The discussion covered topics such as types of containments, containment volumes, and the frequency of emptying.

The KIIs also extended to the context of public toilets, where operators of the toilets were interviewed. This allowed for a deeper understanding of the operational aspects and management practices related to public toilets.

Table 7 provides a list of the KIIs conducted, including the names of the individuals interviewed and their respective designations within their affiliated organizations.

Table 7: List of Key Informant Interviews conducted to personnel (ENPHO, 2021).

S.N.	Name	Designation	Organization	Purpose of KII
1.	Amir Maden (KII-1)	Mayor	Phungling Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development
2.	Basanta Sunuwar (KII-2)	Computer Operator	Phungling Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development
3.	Ganga Ram Gurung (KII-3)	Office Head (Karyalaya Pramukh)	Taplejung Brihat Water Supply User's Committee	No of users, Water Quality Tests, Source of water

4.2 Household Questionnaire Survey

Random household questionnaire 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 on 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 visit 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 $n = n_o/(1 + (n_o-1)/N)$. 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 $n_h = (N_h/N)*n$, where N_h is a total population in each stratum.

Thus, a total of 365 households were sampled from 5,888 households distributed in 11 wards with proportionate stratification random sampling which is shown in Figure 18.

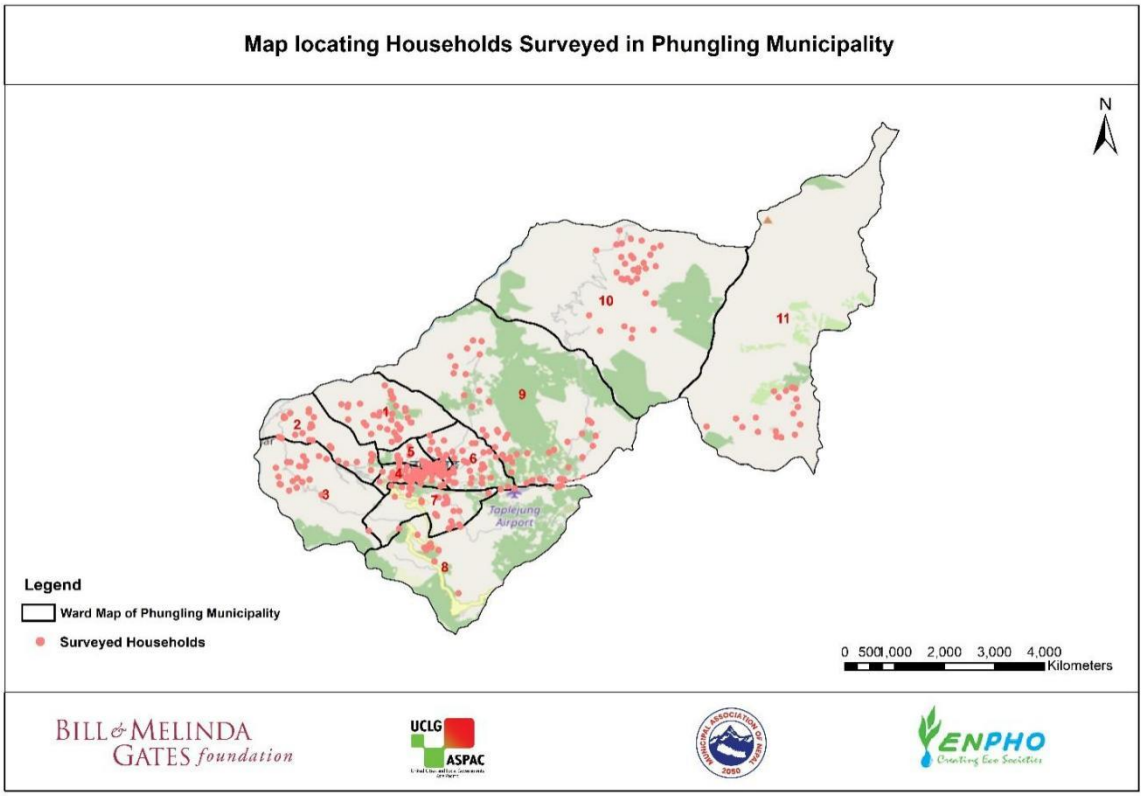


Figure 17: Distribution of sampling points in different wards of Phungling municipality (ENPHO, 2021).

4.2.2 *Direct Observation*

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.

4.3 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 receive the suggestion from municipal stakeholders. Altogether, 35 participants including the mayor, deputy mayor, ward chairpersons, other members from municipal executive council, sectoral staffs, faecal sludge desludging service providers etc. actively participated on the workshop and provided the valuable suggestions. Amir Maden, mayor of the municipality suggested exploring desludging FS emptying and transportation facilities. The municipality will work to bring FS emptying truck in the municipality. The local representatives realized the need for enhancement of the sanitation status in their sub-metropolitan city. Participants suggested promoting activities and campaigning for sustainability of ODF. They agreed on the data obtained from the households and institutional survey. The list of participants with their designation is attached in Appendix 2. Figure 19 shows participants in sharing and validation workshop in Phungling Municipality.

Figure 18: Validation workshop at Phungling Municipality.

5. Acknowledgements

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

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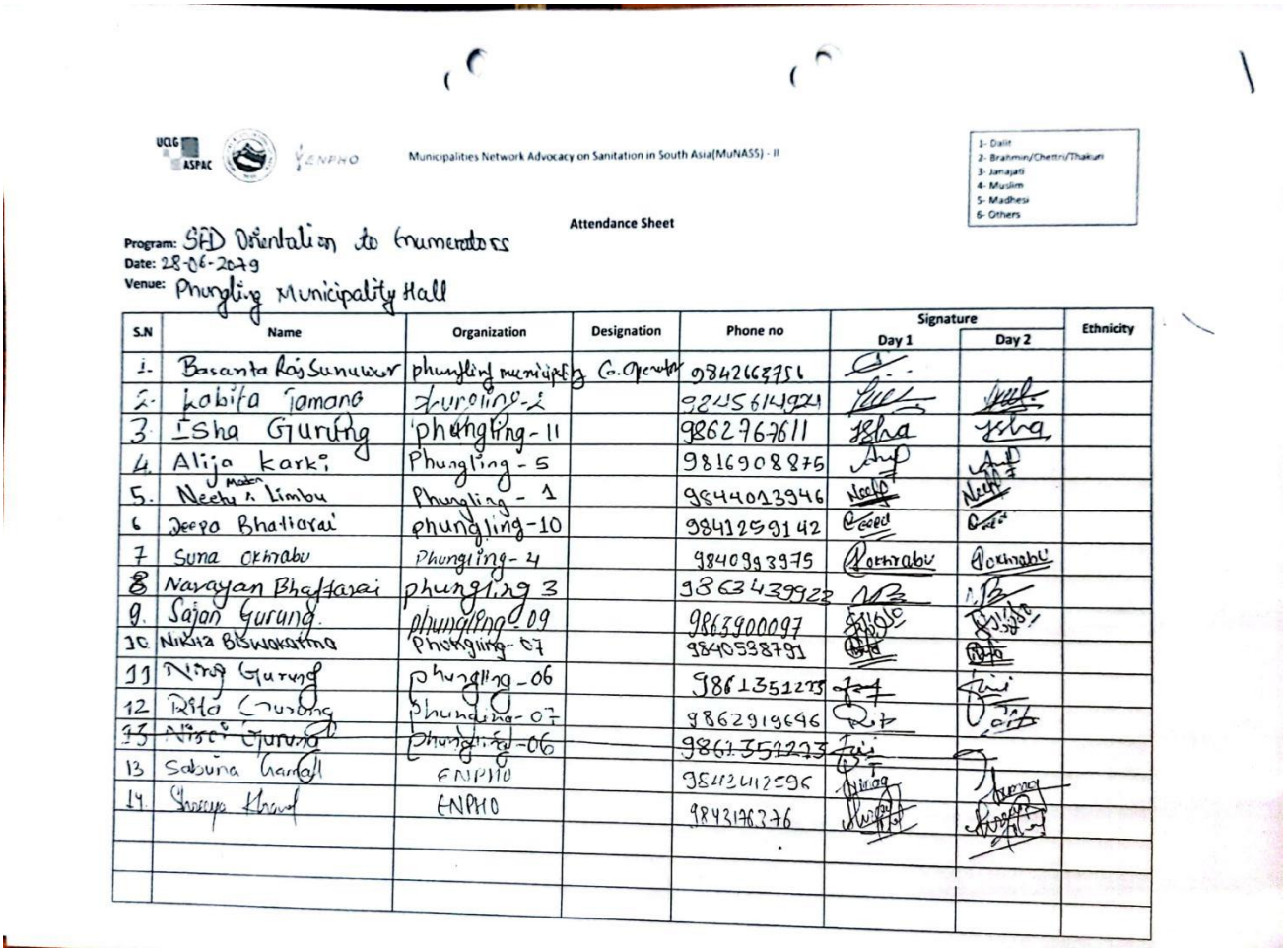
7. Appendix

7.1 Appendix 1: List of participants on orientation on survey for SFD



UCLG ASPAC | ENPHO | Municipalities Network Advocacy on Sanitation in South Asia(MuNASS) - II

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

Attendance Sheet

Program: SFD Orientation to Enumerators
Date: 28-06-2079
Venue: Phungling Municipality Hall

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity
1.	Basanta Raj Sunuwar	phungling municipality	G.Operator	9842665756			
2.	Kabita Tamang	Phungling-2		9845614921			
3.	Isha Gurung	phungling-11		9862767611			
4.	Alija Karki	Phungling-5		9816908875			
5.	Neeta Limbu (Moktan)	Phungling-1		9844013946			
6	Deepa Bhatiarai	phungling-10		9841259142			
7	Suna Okhrabu	Phungling-4		9840993975			
8	Narayan Bhattarai	phungling 3		9863439923			
9.	Sajan Gurung	phungling 09		9863900097			
10	Nikita Biswokarma	Phungling-07		9840598791			
11	Niraj Gurung	Phungling-06		9861351273			
12	Rita Gurung	Phungling-07		9862919646			
13	Sabina Gurung	Phungling-06		9861351273			
14	Sabina Karki	ENPHO		9841241796			
	Deepa Khanal	ENPHO		9843196376			

7.2 Appendix 2: Attendance sheet of sharing and validation workshop

आज मिति २०८०/०२/२८ गते फुङलिङ नगरपालिकामा नेपाल नगरपालिका संघको आयोजनामा वातावरण र जनस्वास्थ्य संस्था (एन्फो) को प्राविधिक सहयोग, The United Cities and Local Government Asia Pacific (UCLG-ASPAC) को सहकार्यमा र Bill and Melinda Gates Foundation (BMGF) को आर्थिक सहयोगमा मानव मलमूत्र प्रवाह रेखाचित्र (Shit Flow Diagram - SFD) प्रमाणीकरण सम्बन्धि अन्तर्क्रिया तथा दिसाजन्य लेदो व्यवस्थापन सम्बन्धि अभिमुखीकरण कार्यक्रमका निम्न अनुसार सरोकारवालाको उपस्थिति रहेको छ ।

उपस्थिति :-

क्र.स.	नाम	पद	कार्यालय	फोन नं.	हस्ताक्षर
१.	श्री अमिर माडेन	नगर प्रमुख	फुङलिङ नगरपालिका	[illegible]	
२.	श्री भीमादेवी ओझा	नगर उपप्रमुख	" — " — "	[illegible]	
३.	श्री युवराज भट्टराई	११ नं. वडा अध्यक्ष	" — "	[illegible]	
४.	श्री मोहन [illegible]	२ नं. वडा अध्यक्ष	" — "	[illegible]	
५.	श्री महेन्द्र प्रसाद निरौला	६ नं. वडा अध्यक्ष	" — "	[illegible]	
६.	श्री [illegible] कुमार माडेन	१ नं. वडा अध्यक्ष	" — "	[illegible]	
७.	श्री लक्ष्मण गुरुङ	९ नं. " — "	" — "	[illegible]	
८	श्री इन्द्र बहादुर पालुङवा	३ नं. " — "	" — "	[illegible]	
९.	श्री मदन गुरुङ	५ नं. " — "	" — "	[illegible]	
१०.	श्री सोजित श्रेष्ठ	७ नं. वडाध्यक्ष	" — "	[illegible]	
११.	श्री दुर्गा ब. पालुङवा	८ नं. " — "	" — " — "	[illegible]	
१२.	श्री सन्तोष लिम्बु	१० नं. " — "	" — "	[illegible]	
१३.	श्री क्षितिज सुनुवार	८ नं. " — "	" — " — "	[illegible]	
१४.	श्री सिता नेपाल	कार्यपालिका सदस्य	" — " — "	[illegible]	
१५.	श्री दिनेश खवास	कार्यपालिका सदस्य	" — " — "	[illegible]	
१६.	श्री गंगाराम [illegible]	" — "	" — "	[illegible]	
१७.	श्री सविना माडेन	" — "	" — "	[illegible]	

क्र.सं.	नाम	पद	कार्यालय	फोन नं.	हस्ताक्षर
१८.	श्री कमला खत्री	कार्यपालिका सदस्य	फुङलिङ नगरपालिका	९८६६८८६६८१	[illegible]
१९.	श्री मिनकला दर्जी	〃	〃	९८२४०५०९६४	[illegible]
२०	श्री विनिता राई	〃	〃	९८६२०१६६०६	[illegible]
२१	श्री साङ्गेपाल्देन शेर्पा	〃	〃	९८६५२३६६२०	[illegible]
२२	श्री भूपाल कुमार लेम्बुङ	नि.प्र.प्र.अ.	〃	९८५२६६०६६४	[illegible]
२३	श्री सरिता लिङदेन	रोजगार संयोजक	〃	९८६२६६६८५०	[illegible]
२४	श्री कमला गौतम	लेखापाल	〃	९८५२५१२२८	[illegible]
२५	श्री अंग्यल गुरुङ	निजि सचिव	〃	९८४८६००६८८	[illegible]
२६	श्री भोलानाथ सिग्देल	लेखापाल	〃	९८४२६६०२३६	[illegible]
२७	श्री राजन श्रेष्ठ	सब इन्जिनियर	〃	९८४२२६४३६५	[illegible]
२८	श्री महेश मिश्र	सूचना प्रविधि अधिकृत	〃	९८४२६४२४८२	[illegible]
२९.	श्री मञ्जु गुरुङ	ज.स्वा.नि.	〃	९८४४३८२२२१	[illegible]
३०	श्री सिता गुरुङ	म.वि.नि.	〃	९८६२६६०६००	[illegible]
३१	श्री बसन्त राज सुनुवार	ऊ.अ.	〃	९८४२६६२६७६	[illegible]
३२	श्री तुलसा निरौला	नायब सुब्बा	〃	9762627559	[illegible]
३३,	द्विपेन्द्र भट्टराई	कृषि पशु शाखा	〃		[illegible]
३४,	दिपेन्द्र भण्डारी	〃	〃		[illegible]
३५,	गुलसा विरौला	इसोमा शाखा	〃		[illegible]

7.3 Appendix 3: SFD orientation to enumerators for household and institutional survey and field visits

SFD Promotion Initiative

SFD Phungling Municipality, Nepal, 2023

Produced by:

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