SFD Report

Dhangadhi Sub-Metropolitan City
Nepal

Final Report

This SFD Report - SFD level 3 - was prepared by
Environment and Public Health Organization (ENPHO)

Date of production: 28/04/2022

Last update: 15/08/2022

SFD Report Dhangadhi Municipality, Nepal, 2022

Produced by:

Shreeya Khanal, ENPHO

Jagam Shrestha, ENPHO

Buddha Bajracharya, ENPHO

Sabuna Gamal, ENPHO

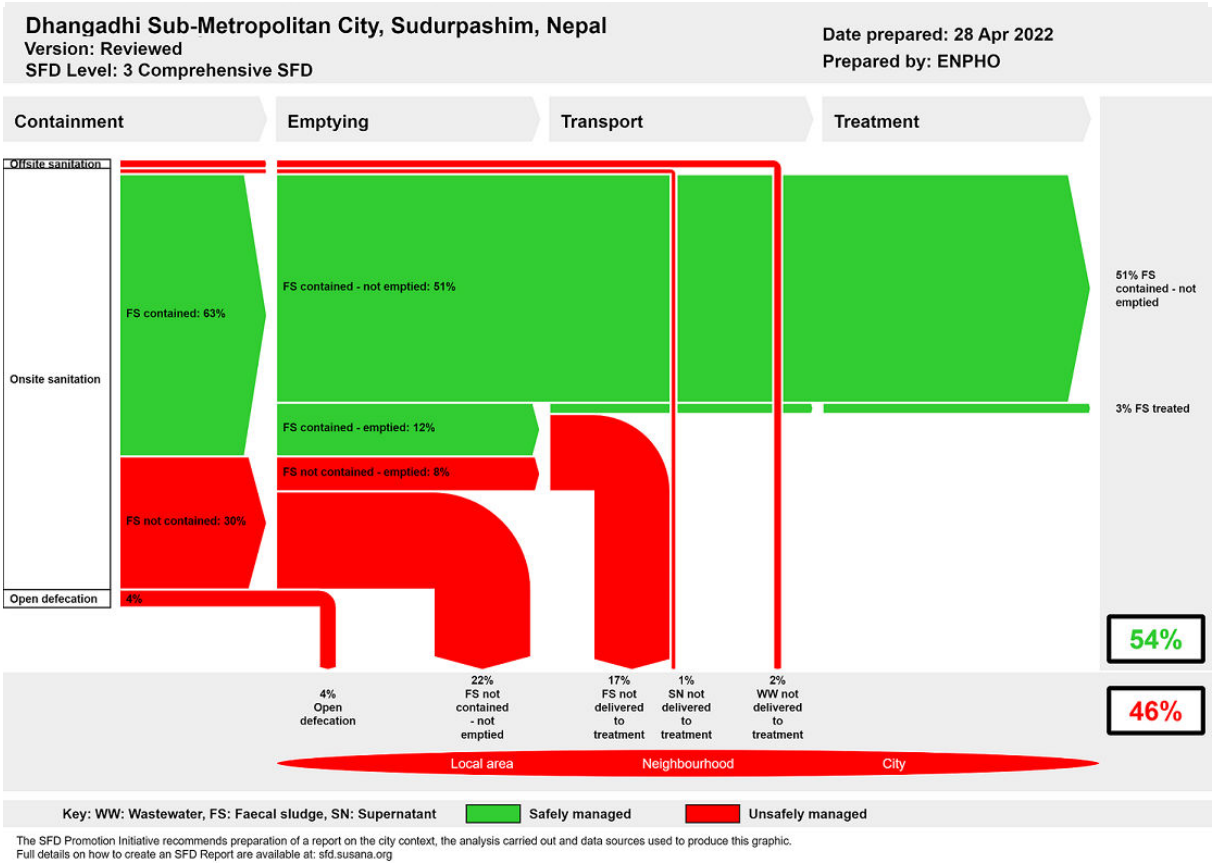
Anita Bhuju, ENPHO

Rupak Shrestha, ENPHO

This Executive Summary and SFD Report are available from:

www.sfd.susana.org

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 3 - Comprehensive report.

Produced by:

Environment and Public Health Organization (ENPHO).

Collaborating partners:

Dhangadhi Sub-metropolitan City, Municipal Association of Nepal (MuAN), United Cities and Local Government – Asia Pacific (UCLG-ASPAC)

Status:

Final SFD Report.

Date of Production:

28/04/2022

3. General city information

Dhangadhi Sub-Metropolitan City is located on Southern belt of Nepal in the Kailali District of Sudur Paschim Province, Nepal. The city is surrounded by Kailari Rural Municipality in the east, Mohana River in the west, Godawari and Gauriganga Municipality in the north and India in the South. It is divided into 19 wards.

As per 2011 population census, Sub-Metropolitan City has a total of 147,741 population with 73,462 males and 74,279 females. Out of total wards, ward number 1 had the largest population with 14,333, while ward number 9 had the least number of population with 14,333. Sub-Metropolitan City has a total of 29,143 households. Ward number 1 had most households with a total of 3,105, while ward number 10 had the least number of households with a total of 559 households.

4. Service outcomes

The overview of different sanitation technologies across the sanitation value chain in the sub-metropolitan city is briefly explained in this section. Basic sanitation coverage in the sub-metropolitan city is only 96%. The families without own toilet defecate in open places or use neighbour's toilet.

Although there is lack of sewerage network and a Wastewater Treatment Plant (WWTP) in the city, 2.0% of the population have connection of their toilet to open drain and water bodies near their houses without any treatment which indicates unsafe sanitation practice.

Four public toilets in public bus park and premises of the municipal building were assessed. These toilets are constructed by Dhangadhi Sub-metropolitan City, Transportation Committee and Red Cross Society.

52% of containments have been emptied at least once since the installation. Both traditional manual scavenging and mechanical emptying of the containments are practised in the sub-metropolitan city. Among the containments that have been emptied at least once, 42% used the service from mechanical emptying service from private desludging service providers whereas 58% of containments have been emptied manually. Emptying is done based on demand instead of regular emptying.

The main water supply service provider in the sub-metropolitan city is Nepal Water Supply Corporation (NWSC) and some wards are served by Shivanagar Water Supply and Sanitation User's Committee. Department of Water Supply and Sewerage Management (DWSSM) has supported for installation of water supply systems in many wards of the sub-metropolitan city.

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 billed the Water Supply and Sanitation Law 2018 which has emphasized on a right to quality sanitation services and prohibited direct discharge of wastewater and sewage into water bodies or public places.

Several policies have been in places 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.

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.

Dhangadhi Sub-Metropolitan City municipal council has enforced Waste Management Act (WMA) 2017 and Waste Management Regulation (WMR) 2020 as per the local governance Act 2017 article 102 (1) and published in local gazette. WMA defines waste as households, industrial, chemical, healthcare, or other harmful waste. It has set the criteria for the selection of land, collection, transport, treatment, and disposal of waste (DSMC, 2017). WMR has adopted to collaborate with private sector, user's committee and non-government organizations for waste management. It emphasizes on the awareness raising campaign for waste reduction, proper provision for collection and transport.

The sub-metropolitan city has contextualized the Sustainable Development Goals (SDGs) and indicators under social development; economic development; infrastructure development; forest environment and disaster management and institutional development, service provision and good governance section with the support of GIZ. The city has set targets to develop treatment plants, waste management, proper management of drainage system, clean and healthy community.

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 Government	Ministry of Water Supply and Sewerage Management
Public Institutions at Local Government	Dhangadhi Sub-metropoliltan City Office Nepal Water Supply Corporation (NWSC), Branch
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

The major data were collected from random household sampling. Altogether, 378 households and 49 institutions were surveyed from 19 wards of sub-metropolitan city. Primary data on emptying, transportation and current sanitation practices in the sub-metropolitan city are 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 sub-metropolitan city and validated through sharing program.

8. Process of SFD development

Data on sanitation situation is collected through household and institutional survey. Enumerators from the sub-metropolitan city were mobilized after providing orientation on sanitation technologies, objectives of the survey and proper use of mobile application, KOBOCOLLECT for collection of data for survey. Along with this, KIIs were conducted with officers and engineer of sub-metropolitan city, Nepal Water Supply Corporation and Water Supply and Sanitation Division Office, private desludging service providers to understand the situation practices across the service chain. Types of sanitation technologies used in different locations were mapped using ARCGIS. For the production of the SFD graphic, initially a relationship between sanitation technology used in questionnaire survey and SFD PI methodology was made. Then, data were fed in 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.
- MoWS, 2018. Bill on Drinking Water and Sanitation Policy: Draft Ministry of Water Supply, Government of Nepal.
- 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/
- MoH, N. N. (2017). Nepal Demographic and Health Survey 2016. Ramshah Path, Kathmandu, Nepal: Ministry of Health.
- National Census. (2021, April 20). National Census 2021. Retrieved from Government of Nepal, National Planning Commission, Central Bureau of Statistics.

SFD Dhangadhi Municipality, Nepal, 2022

Produced by:

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

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

Table of Contents

List of Tables

List of Figures

Abbreviations

ADB	Asian Development Bank
AEPC	Alternative Energy Promotion Centre
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
KII	Key Informant Interview
KM	Kilometre
MICS	Multiple Indicator Survey
NGO	Non-Governmental Organization
NRS	Nepali Rupees
NSHMP	National Sanitation and Hygiene Master Plan (NSHMP)
NWSC	Nepal Water Supply Corporation
ODF	Open Defecation Free
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
WHO	World Health Organization
WSP	Water Supply Providers
WSUC	Water Supply and User's Committee
WW	Wastewater
WWTP	Wastewater Treatment Plant

1 City context

Dhangadhi Sub-Metropolitan City is located on Southern belt of Nepal in the Kailali District of Sudurpaschim Province. Kailari Rural Municipality lies in the east, Mohana River in the west, Godawari and Gauriganga Municipality in the north and India in the South of the city. It is comprised of 19 wards (Dhangadhi Sub-metropolitan, 2022). Figure 1 shows the ward map of Sub-metropolitan city.

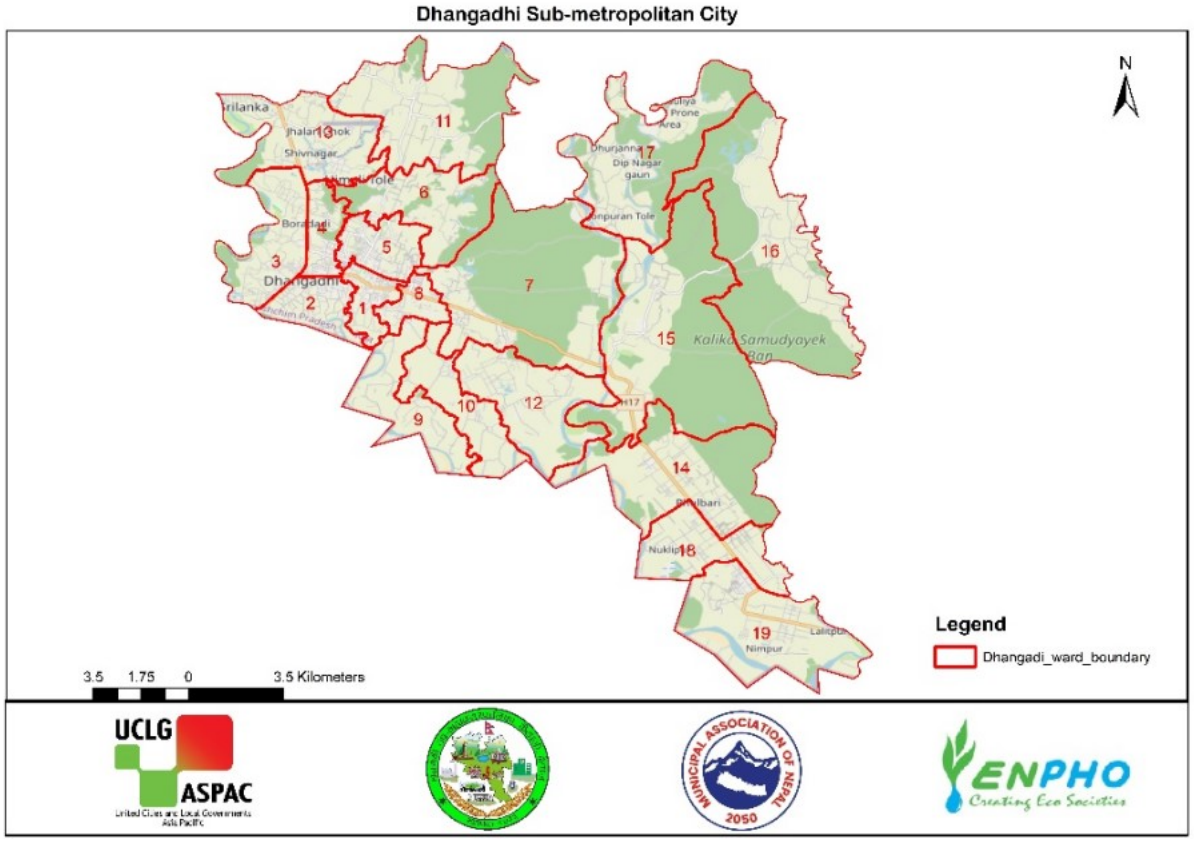


Figure 1: Map of Sub-Metropolitan City with ward boundaries.

1.1 Population

As per 2011 census, Sub-Metropolitan City has a total of 147,741 population with 73,462 males and 74,279 females. Out of total wards, ward number 1 had the largest population with 14,333, while ward number 9 had the least number of population with 14,333. The city has a total of 29,143 households. Ward number 1 had the most households with a total of 3,105, while ward number 10 had the least number of households with a total of 559 households (Dhangadhi Sub-metropolitan, 2022).

1.2 Climate

The city has tropical savannah climate based on the Köppen–Geiger classification with mean annual air temperature above 26°C and mean annual precipitation within the range of 1,800-2,000 mm (Karki, Talchabhadel, & Aalto, 2015).

1.3 Topography

Dhangadhi sub-metropolitan city lies at 28.6852^{o} N latitude, 80.6216^{o} E longitude and the altitude of 109 m from sea-level. It is spread over 271.74 sq. km (Dhangadhi Sub-metropolitan, 2022). The geological structure of the city contents alluvial sediments i.e., sand, silt and clay (Dahal, 2006). Groundwater is the source of drinking water in the Terai region. In addition, shallow groundwater aquifers are mostly used for the purpose of drinking water. The shallow groundwater originates from unconfined or semi-confined aquifers.

2 Service Outcomes

2.1 Overview

2.1.1 Household Level Sanitation System

Sanitation according to World Health Organization (WHO) can be simply defined as infrastructures, facilities, or services provided for protection as well as safe management of human excreta emanating from the toilet via its handling, storage, and treatment onsite or off-site by conveying same waste safely to the end use or disposal (Augustine Chioma Affam, 2021). The sub-metropolitan city has been declared as an Open Defecation Free (ODF) zone. It indicates universal access to basic sanitation facilities. However, data revealed that basic sanitation coverage in the sub-metropolitan city is only 96%. The families without own toilet defecate in open places or use neighbour's toilet.

Figure 2 shows the types of sanitation system in the sub-metropolitan city. Sanitation system in which the user interface is transported directly to a sewer network, storm water drainage or open drainage without being contained in the place where it is generated is called offsite sanitation system. Although there is lack of sewerage network and a Wastewater Treatment Plant (WWTP) in the city, 2.0% of the population have connection of their toilet to open drain and water bodies near their houses without any treatment which indicates unsafe sanitation practice.

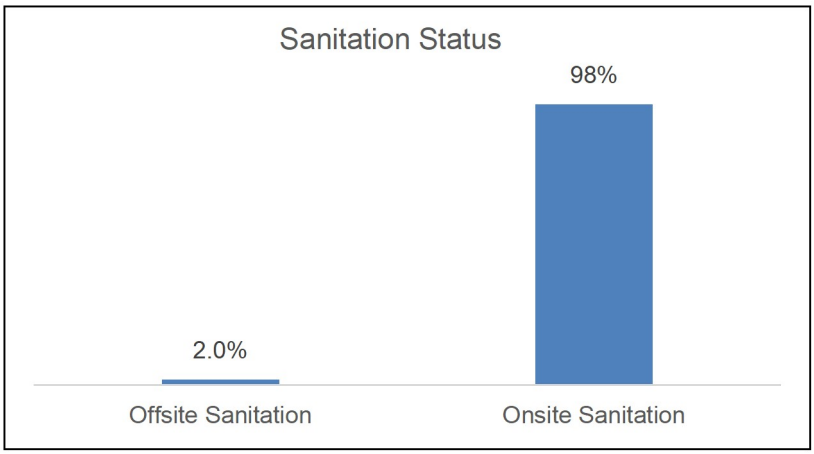


Figure 2: Household level Sanitation Status in Dhangadhi Sub-metropolitan City.

Any toilet system designed to handle or treat faeces or sewage at its source rather than transporting to another location is termed an onsite sanitation system (Augustine Chioma Affam, 2021) . 98% of households rely on onsite sanitation technology. Household level anaerobic biogas digester, septic tanks and pits latrine are widely used as onsite sanitation system in the sub-metropolitan city. Biogas digester is a waste to energy conversion technology designed to treat household organic waste and Faecal Sludge (FS). 19% of households with onsite sanitation system have the toilet waste connected to an anaerobic biogas digester in their houses. The high percentage of use of biogas digester is mainly because of the promotional activity from Alternative Energy Promotion Centre (AEPC). AEPC in collaboration with the sub-metropolitan city has been installing approximately 40-50 biogas

digesters every year which was confirmed by KII-1. The technology is capable for stabilizing the faecal sludge and potential to produce biogas (Linda Strande, 2014).

21% of households relying in onsite sanitation system use fully lined tanks to store the faecal sludge. The walls and bottom of the tank are totally lined and sealed. 5.3% use septic tanks, which are properly sealed without open bottom and the effluent is discharged into a soak pit. 20% of households have lined tanks with impermeable walls and open bottom, but the bottom is not lined and allows infiltration of effluents. A circular concrete ring is used for pit latrines and 32% of households use them. There is no lining between the two rings and allows infiltration of effluents from walls and bottom. While 0.8% of households use twin pits. Each pit is used alternatively after filled. FS is left to decompose after the pit is filled. Twin pits effectively treat FS if there is no exfiltration of water. Unlined pits are a hole dug just beneath the toilet to store FS. 1.4% of households use such type of containment. A single ring pit was observed during household field survey observation in the sub-metropolitan city which is shown in Figure 3.

Figure 3: Top view of single ring pit in Dhangadhi Sub-metropolitan City.

Figure 4 shows the distribution of various types of sanitation technologies in different wards of sub-metropolitan city.

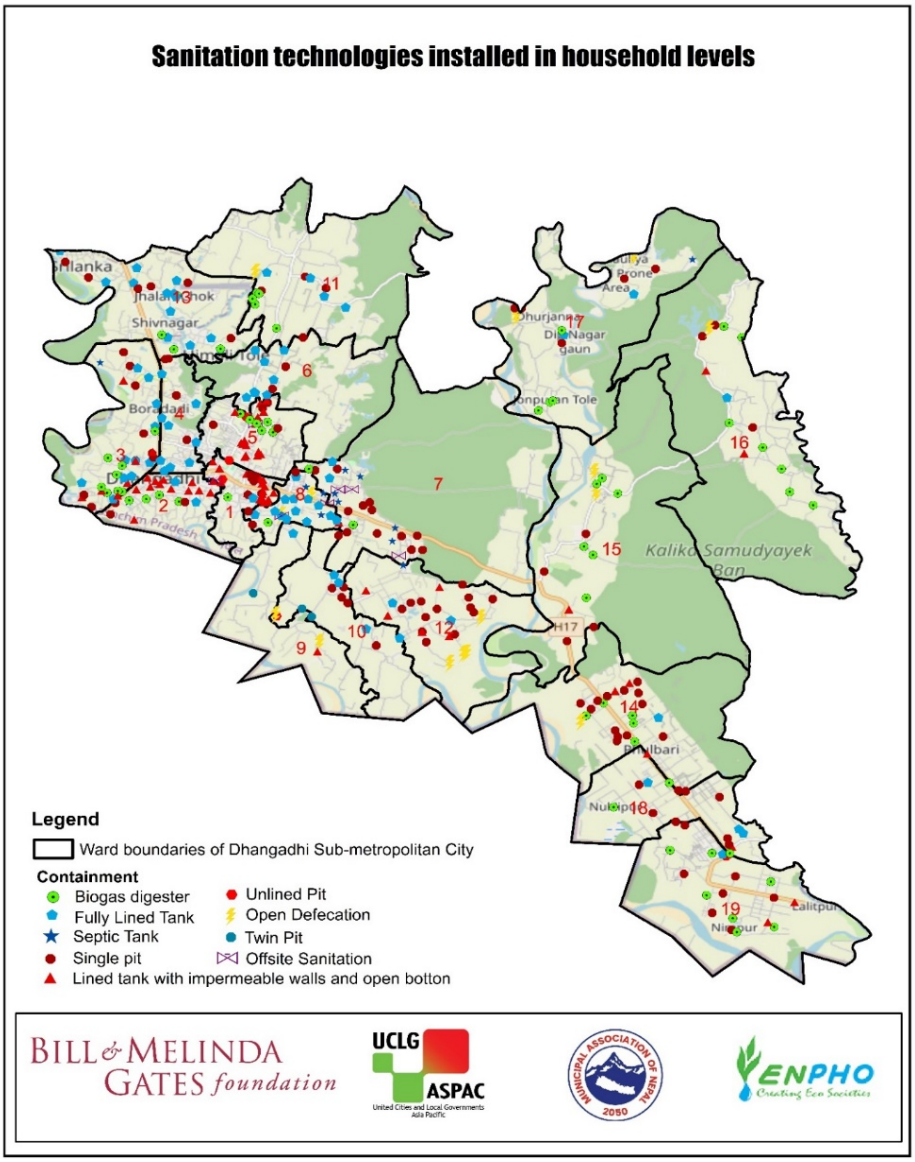


Figure 4: Sanitation technologies installed in household levels.

2.1.2 Institutional Level Sanitation System

All institutional buildings in the sub-metropolitan city have toilets constructed in their buildings. Figure 5 shows the percentage of types of onsite sanitation systems installed in institutional buildings that were surveyed.

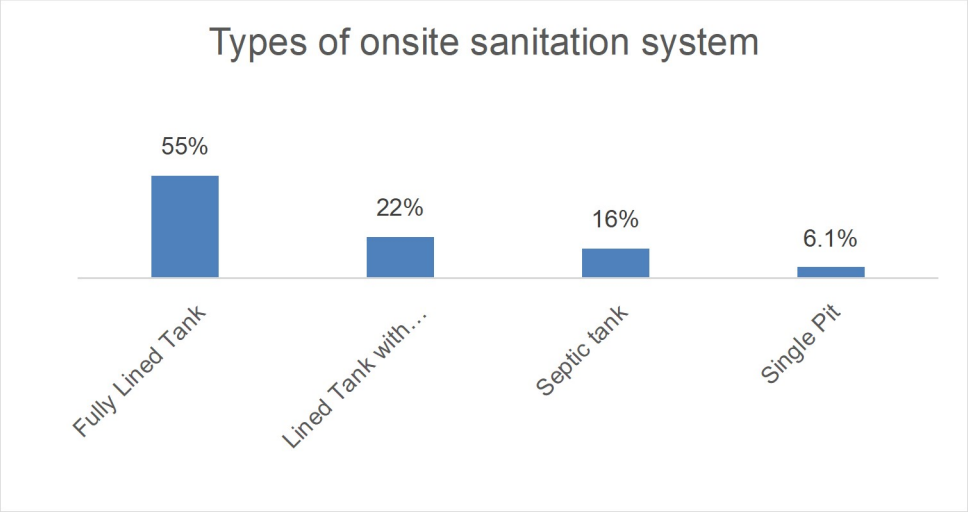


Figure 5: Percentage of types of onsite sanitation system in buildings from institutions surveyed in Dhangadhi Sub-metropolitan City.

Figure 6 shows the location map of institutions surveyed with types of onsite sanitation system in the sub-metropolitan city.

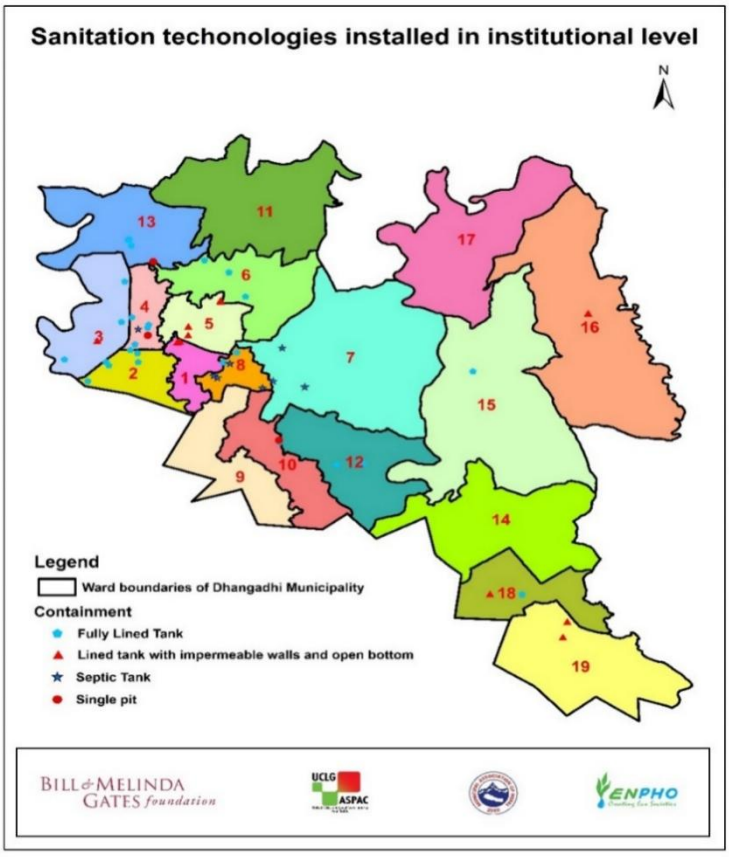


Figure 6: Types of onsite sanitation system used in institutional level in Dhangadhi sub-metropolitan city.

2.1.3 Public Toilets

Public toilets are installed in the major urban clusters having higher flow of the people. Four public toilets in public bus park and premises of the municipal building were assessed. These toilets are constructed by Dhangadhi Sub-metropolitan City, Transportation Committee and Red Cross Society. The descriptions of the public toilets are shown in Table 1.

Table 1: Descriptions of public toilets in sub-metropolitan city.

Public Toilet						
S.N	**No. of Urinal**	**No. of Toilet Seat/Pan in**		**No. of users per day**	**Size of Containments (m^3)**	**Constructed by**
		Male	**Female**			
Public Toilet A	2	2	3	350	22	Redcross, Dhangadhi sub-metropolitan city, Sudhur Paschim Transportation Association, Federation of Contractor's Association of Nepal
Public Toilet B	6	3	3	50	22	Dhangadhi Sub-Metropolitan city
Public Toilet C	No	1	1	60	14	Transportation Association
Public Toilet D	3	2	2	200	22	Dhangadhi Sub-Metropolitan city

The toilets in the public bus station serve passengers and local people operating their small business around the park. These toilets have been leased by the sub-metropolitan city and transportation committee. Overall operation and maintenance of the public toilet is carried by the operator. Similarly, the toilet around the municipal building premises serves the service pursuers.

Groundwater is the major source for regular cleansing and flushing of toilets along with handwashing. The service charge for using the toilet is set NPR 5 (USD 0.04) for urination and NPR 10 (USD 0.08) for defecation. Public toilets in different locations of sub-metropolitan city are shown in Table 2.

Table 2: Public toilets in sub-metropolitan city.

Identity	Infrastructure	Inner structure	Containment
Public Toilet A			
Public Toilet B			
Public Toilet C			
Public Toilet D			

The number of users in the public toilet in the bus park is higher as compared to other public toilets. It is newly constructed and located at the main entrance of the bus station and easily accessible to the passengers. The waste from the toilet is collected in the two lined tank with impermeable walls and open bottom without outlet or overflow mechanism.

2.2 SFD Matrix

The sanitation technologies and the corresponding percentage of the population using such technologies are shown in Table 3.

Table 3: Sanitation technologies with SFD reference variable and percentage of the population using each type.

SN	Sanitation Technologies	SFD Reference Variable	Percentage of Population
1	User interface discharges directly to open drain or storm sewer	T1A1C6	1%
2	User interface discharges directly to water body	T1A1C7	1%
3	Septic tank connected to open drain or storm sewer	T1A2C6	3%
4	Septic tank connected to open ground	T1A2C8	1%
5	Fully lined tank (sealed) connected to an open drain or storm sewer	T1A3C6	1%
6	Fully lined tank (sealed) connected to open ground	T1A3C8	1%
7	Fully lined tank (sealed), no outlet or overflow	T1A3C10	37%
8	Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	T1A4C6	1%
9	Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	1%
10	Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	10%
11	Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	16%
12	Open defecation	T1B11 C7 TO C9	4%
13	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A4C10	6%
14	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A5C10	16%
15	Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A6C10	1%

The data on significant risk to groundwater pollution were calculated based on assessing the risk of groundwater pollution of the population consuming the groundwater and using the unlined containments.

2.2.1 Emptying of Faecal Sludge

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 volume of the tank. Also, in other containments, regular emptying prevents overflow of the sludge and blockages (Strande, 2014).

Onsite sanitation technologies that have and have not been emptied in different wards throughout the sub-metropolitan city are shown in Figure 7. 52% of containments have been emptied at least once since the installation.

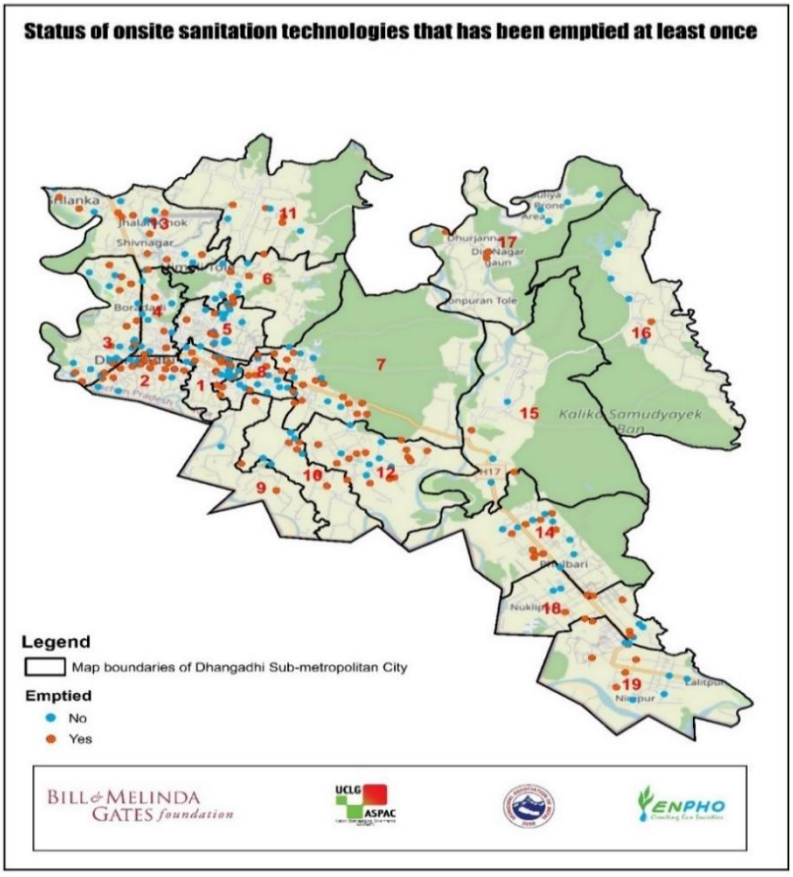


Figure 7: Status of household which have emptied their containment at least once.

Both traditional manual scavenging and mechanical emptying of the containments are practised in the sub-metropolitan city. Among the containments that have been emptied at least once, 42% used the service from mechanical emptying service from private desludging service providers whereas 58% of containments have been emptied manually. Emptying is done based on demand instead of regular emptying. Emptying frequency varies with type of sanitation technology. Table 4 shows the average emptying frequency of different types of containment in the sub-metropolitan city.

Table 4: Average Emptying Frequency of Onsite Sanitation Systems in Dhangadhi Sub-metropolitan City.

Onsite Sanitation System	Average Emptying Frequency
Septic Tank	Two years
Fully Lined Tank	Two years and six months
Lined tank with impermeable walls and open bottom	Nine months
Pits	Eleven months
Unlined Pits	One year

Figure 8: Mechanical FS trucks used in sub-metropolitan city.

Figure 8 and Figure 9 show images of types of FS mechanical desludging vehicles and emptying of the onsite sanitation system in sub-metropolitan city. During the SFD assessment, KII-4, KII-5, KII-6 and KII-7 respondents confirmed the emptying efficiency was 80% to 90%.

Figure 9: Private desludger performing emptying of containment.

2.2.2 Treatment and Disposal

Figure 10 shows the percentage of perception of people residing in the sub-metropolitan city about disposal of FS after the onsite sanitation system is emptied.

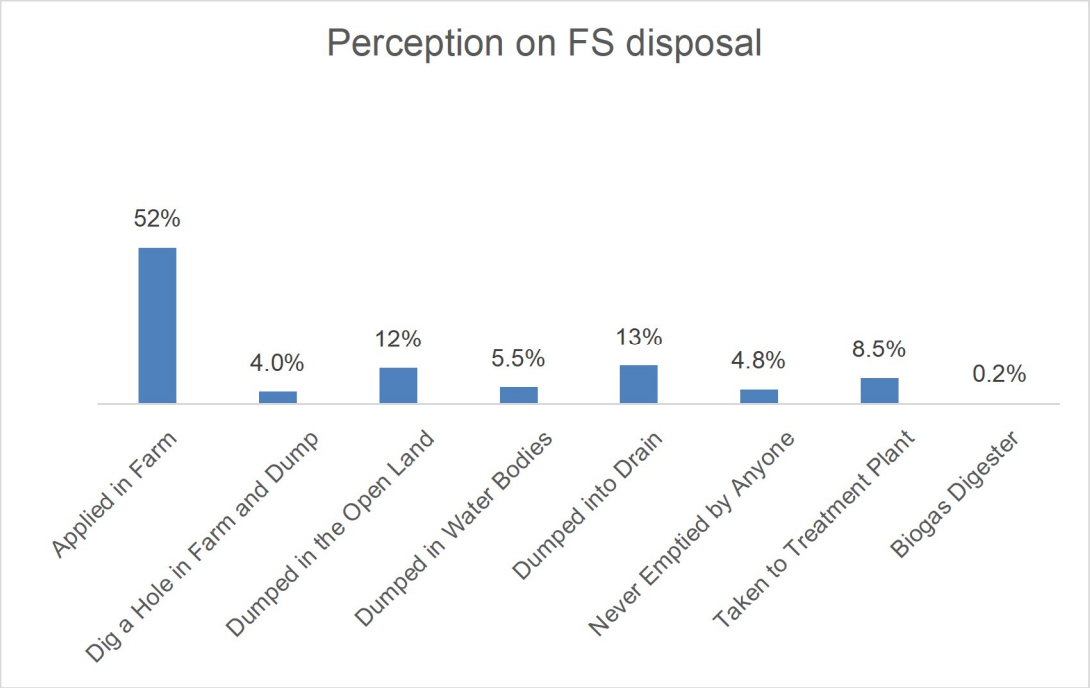


Figure 10: Perception on Faecal Sludge disposal.

These percentages can also be justified by KII-3, 4, 7, 8, 9 and Figure 11. Application in farm is the most easy and convenient way for disposal of FS as it can used as soil conditioner for agricultural purpose and there are no Faecal Sludge Treatment Plant (FSTP) where private desludgers can dispose FS in a safer manner.

Figure 11: Disposal of FS in farmland from mechanical FS truck.

2.2.3 SFD Proportion and Matrix

The second step in the process of developing SFD graphic is calculation of proportion of people using each type of system and the proportion of each system that is emptied, transported, and treated. 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 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 12. Since the sub-metropolitan city does not have proper sewer networks and 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 (set to 0% as well). Similarly, the proportion of FS emptied taken to treatment plant and then to treatment afterwards is shown column F4 and F5 respectively (Susana, 2018). Figure 12 shows the SFD matrix of the sub-metropolitan city.

Dhangadhi Sub-Metropolitan City, Sudurpashim, Nepal, 28 Apr 2022. SFD Level: 3 - Comprehensive SFD
Population: 147741
Proportion of tanks: septic tanks: 63%, fully lined tanks: 99%, lined, open bottom tanks: 97%

Containment								
System type	Population	WW transport	WW treatment	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	W4c	W5c	F3	F4	F5	S4e	S5e
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants	Proportion of wastewater delivered to treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated	Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants	Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated
T1A1C6 Toilet discharges directly to open drain or storm sewer	1.0	0.0	0.0					
T1A1C7 Toilet discharges directly to water body	1.0							
T1A2C6 Septic tank connected to open drain or storm sewer	3.0			29.0	0.0	0.0	0.0	0.0
T1A2C8 Septic tank connected to open ground	1.0			40.0	0.0	0.0		
T1A3C10 Fully lined tank (sealed), no outlet or overflow	37.0			15.0	45.0	100.0		
T1A3C6 Fully lined tank (sealed) connected to an open drain or storm sewer	1.0			20.0	0.0	0.0	0.0	0.0
T1A3C8 Fully lined tank (sealed) connected to open ground	1.0			80.0	0.0	0.0		
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	10.0			20.0	0.0	0.0		
T1A4C6 Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	1.0			0.0	0.0	0.0	0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	1.0			27.0	0.0	0.0		
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	16.0			29.0	0.0	0.0		
T1B11 C7 TO C9 Open defecation	4.0							
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	6.0			12.0	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	16.0			28.0	0.0	0.0		
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	1.0			80.0	0.0	0.0		

Figure 12: SFD Matrix of the sub-metropolitan city.

2.2.4 Risk of Groundwater 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.

a. Sources of Drinking Water and Water Production

The main water supply service provider in the sub-metropolitan city is Nepal Water Supply Corporation (NWSC) and some wards are served by Shivanagar Water Supply and Sanitation User's Committee. Department of Water Supply and Sewerage Management (DWSSM) has supported for installation of water supply systems in many wards of the sub-metropolitan city. The water supply system development project under the Water Supply Service Extension and Rehabilitation Project listed in descriptions of project list published by Ministry of Water Supply in fiscal year 2019/20 are:

i. Water Supply Schemes in ward 9 to 13
ii. Water Supply Schemes in ward 17 and
iii. Ward Supply Scheme in ward 20

Water quality and sanitation management survey in the sub-metropolitan city during 2019 showed that 49,352 people are served with piped drinking water. The water coverage of the sub-metropolitan is 27% and NWSC covers 65% of total served population (ENPHO, 2021).

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

The term aquifer pollution vulnerability is intended to represent the varying level of natural protection afforded by the contaminant attenuation capacity of the unsaturated zone or semi-confining beds above an aquifer, 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) Here, among the various types of onsite sanitation technologies, lined tank 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.

Figure 13 demonstrates the depth of hand pumps and horizontal distance of it with the containment type lined tank with impermeable walls and open bottom. 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 above travel time 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). Sandy Loamy soil found in region has more ability to hold water or liquid (permeability of 2.5 cm/h) (FAO, n.d.). Thus, water pumped through hand pump in households within 25 distances from the containment and depth below 70 ft (21.3 m) have significant risk. It shows that 51% of the households are at high risk of groundwater contamination.

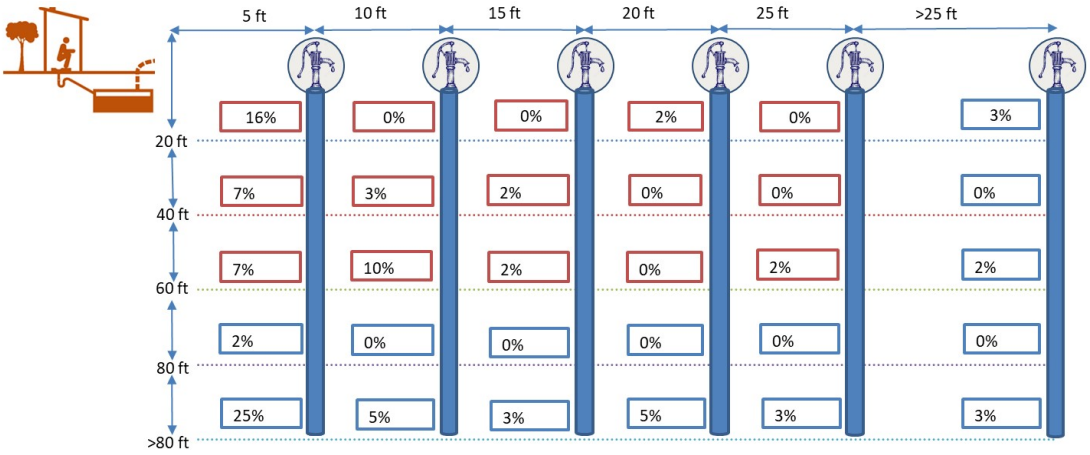


Figure 13: Depth of hand pumps and lateral spacing of it with containment types lined tank with impermeable walls and open bottom.

Figure 14 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 53% of the households are at high risk of groundwater contamination as the water pumped through hand pump in these households are within 25 feet (7.6 m) distance from the pit and depth below 70 feet (21.3 m).

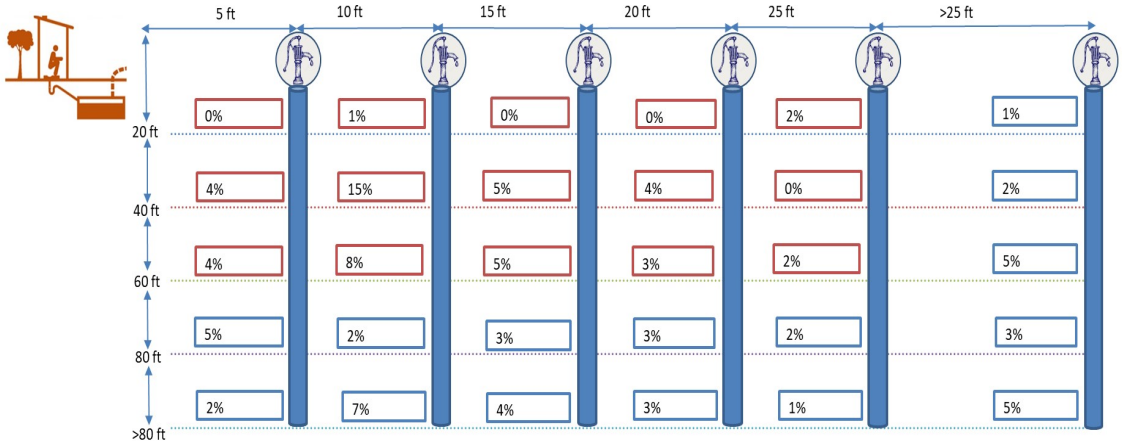


Figure 14: Depth of hand pumps and lateral spacing of it with containment types lined pit with semi-permeable walls and open bottom.

The proportion of FS emptied from each containment is calculated based on the percentage of containment emptied and portion of FS emptied during the process. The percentage of emptied containment is obtained from the household survey data while the portion emptied during the process was based on the KIIs with desludgers. Table 6 represents the percentage of emptied containment, emptied portion and actual proportion of FS emptied from each containment.

Table 5: Sanitation technologies and proportion of emptied faecal sludge.

SN	Sanitation Technologies	SFD Reference Variable	Percentage of Emptied Containment	Emptied Proportion of FS	Actual Proportion of Emptied FS (F3)
1	Septic tank connected to open drain or storm sewer	T1A2C6	36%	80%	29%
2	Septic tank connected to open ground	T1A2C8	50%	80%	40%
3	Fully lined tank (sealed) connected to an open drain or storm sewer	T1A3C6	25%	80%	20%
4	Fully lined tank (sealed) connected to open ground	T1A3C8	100%	80%	80%
5	Fully lined tank (sealed), no outlet or overflow	T1A3C10	19%	80%	15%
6	Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	T1A4C6	0%	80%	0%
7	Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	33%	80%	27%
8	Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	25%	80%	20%
9	Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	36%	80%	29%
10	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A4C10	15%	80%	12%
11	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A5C10	36%	80%	28%
12	Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A6C10	100%	80%	80%

2.2.5 Proportion of FS emptied which is delivered to Treatment Plant

The sub-metropolitan city does not have any form of the treatment plant for faecal sludge. The percentage of population using anaerobic biogas digester is considered as the proportion of FS treated. Majority of FS emptied is applied in farmlands and a few percentages of FS emptied are dumped into forest areas and nearby water bodies.

2.2.6 SFD Selection Grid

Types of sanitation technology selected in the SFD selection grid in the sub-metropolitan city are shown in Figure 15. 47% of the containments under fully lined tank in T1A3C10 in Figure 6 are biogas digester. Biogas digester is a waste to energy conversion technology designed to treat household organic waste and FS and generates biogas and odours. It can provide a beneficial method of stabilising FS, as it also results in the production of biogas that can be used for energy generation (Strande, 2014). Thus, such digester has been assumed as regularly emptied and treated fully lined tank in the SFD graphic.

Figure 15: SFD selection grid for sub-metropolitan city.

Brief explanation of terms used to indicate different frame selected in the SFD selection grid is explained in Table 6.

Table 6: Explanation of terms used to indicate different frame selected in the SFD selection grid.

T1A1C6	A fully functioning toilet discharging directly to an open drain or storm sewer. All the excreta in this system is considered not contained.
T1A1C7	A fully functioning toilet discharging directly to a water body. All the excreta in this system is considered not contained.
T1A2C6	This is a correctly designed, properly constructed, fully functioning septic tank with an outlet connected to an open drain or storm sewer. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, therefore all the excreta in this system is considered not contained.

T1A2C8	A correctly designed, properly constructed, fully functioning septic tank with an outlet connected to open ground. All the excreta in this system is considered not contained.
T1A3C6	A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and open bottom. 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.
T1A3C8	A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and open bottom. Since the tank is fitted with a supernatant/effluent overflow connected to open ground the excreta in this system is considered not contained.
TA3C10	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 is considered not contained.
T1A4C8	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. Since the tank is fitted with a supernatant/effluent overflow connected to open ground, the excreta in this system is considered not contained.
T2A4C10 (HR)	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 (HR)	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 (HR)	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 (LR)	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.
T2A6C10 (HR)	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.
T1B11C7 to C9	With no toilet, users defecate in water bodies, on open ground and to don't know where; consequently, the excreta is not contained.

2.3 Summary of assumptions

Offsite sanitation systems:

✓ 1% of the toilets discharge directly to open drain or storm sewer (T1A1C6). Since there is no WWTP, all wastewater is disposed of untreated into the environment. Therefore, variables W4c and W5c were set to 0%.

Onsite sanitation systems:

✓ The proportion of FS in septic tanks was set to 63%, the proportion of FS in fully lined tanks was set to 99% and the proportion of FS in lined tanks with impermeable walls and open bottom and all types of pits was set to 97% 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.

- ✓ Variable F3 for all onsite sanitation systems were derived from the HH survey and cross-checked with the KIIs and FGDs conducted (Table 5).
- ✓ Variable F3 for anaerobic digesters (modelled as fully lined tanks (sealed), no outlet or overflow, system T1A3C10) was set to 15%. Variables F4 and F5 for this system were set to 45% and 100%, as per the data obtained from the household survey.
- ✓ Variables F4 and F5 for the rest of the systems were all set to 0% since there is no WWTP or FSTP in the city.

2.4 SFD Graphic

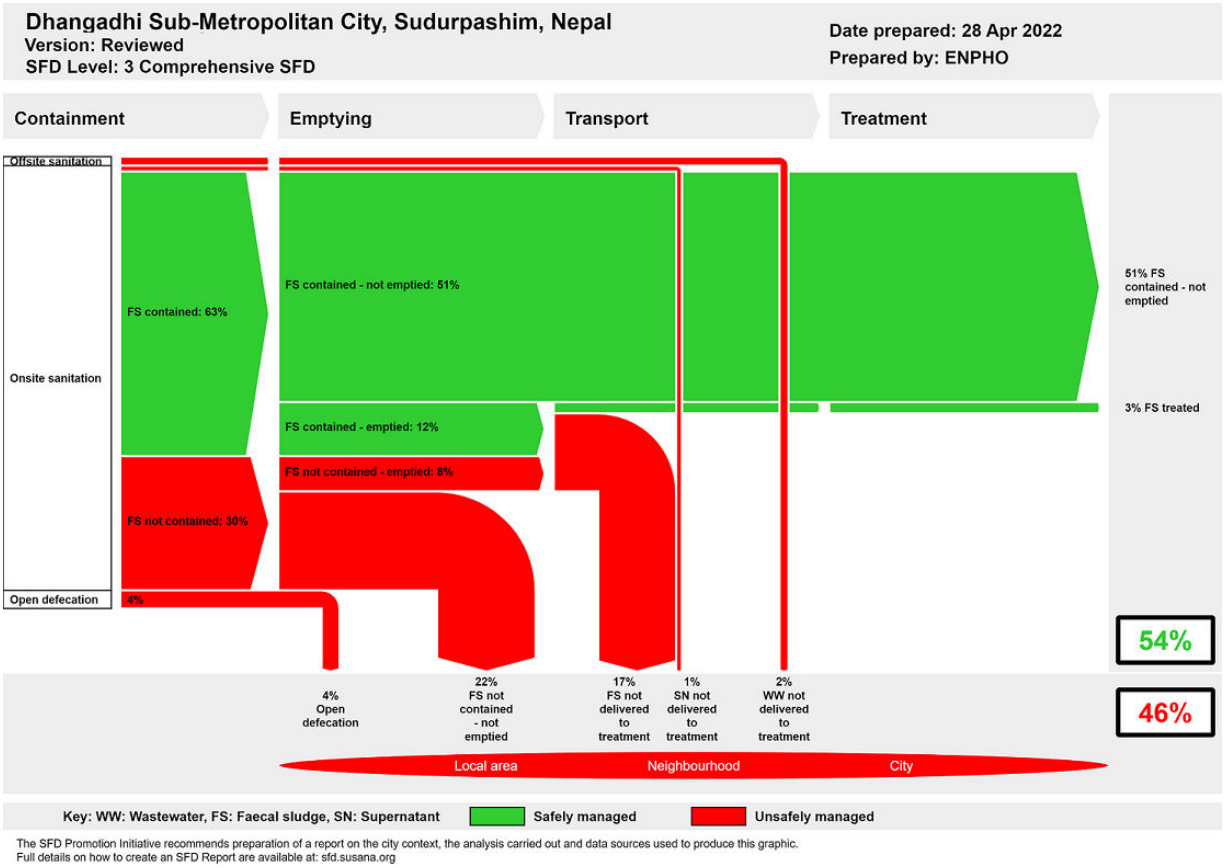


Figure 16: SFD graphic of Dhangadhi Sub-metropolitan City.

Figure 16 shows the SFD graphic for Dhangadhi sub-metropolitan city. In the graphic, percentage of FS and WW indicated by color green represent FS and WW which are safely managed or stored whereas the percentage in color red represents FS and WW which are unsafely stored or managed. Figure 16 also represents the sanitation value chain going from left to right. A low percentage of toilets connected to offsite sanitation are the toilets connected to water resources or open drainage, where the wastewater is transported at certain distance from household but are not safely disposed. Similarly, FS contained, i.e. FS kept in a container which is safe from human contact, in onsite sanitation, either emptied or not are considered to be safe. This percentage of FS not emptied is either stored in septic

tanks or fully lined tanks. Large percentage of such FS contained not emptied is also FS stored in lined tanks and pits which are in safe distance from sources of drinking water. However, those systems will require emptying services in the short and medium term as they fill up.

2% of FS from onsite sanitation containment which are treated are those connected in biogas digester. Further, FS not contained is FS kept in containment which posses risk to human health through groundwater contamination. Lack of FSTP in the sub-metropolitan city leads to disposal of FS in farm land and water bodies.

2.4.1 Offsite Sanitation

Nepal Multiple Indicator Survey (MICS) reported that among the total households in Nepal, percentage of household which has outlet of toilet connected to sewer network is 11%. (Central Bureau of Statistics (CBS), 2020). However, 2% population have connection of their toilet to open drain and water bodies near their houses in the city.

2.4.2 Onsite Sanitation

The population relying on onsite sanitation system is 92%. Among them, 63% are using technically effective containment that safely stores faeces and 30% with unsafe containment. Sub-metropolitan city does not have treatment plant or land separated for disposal of FS, which was confirmed by the information collected during KII-3. Majority of FS emptied is taken to open land or farmland for disposal. There is also practice of dumping FS illegally in the water resources like nearby stream. 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.

Variables	Description	Percent
FS contained	Faecal sludge that is contained within an onsite sanitation technology which is technically effective.	63%
FS not contained	Faecal sludge that is stored in an unsafe onsite sanitation technology.	30%
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 pits with semi-permeable walls and open bottom without outlet or overflow (T1A5C10).	51%
FS contained – emptied	FS that is contained in onsite sanitation technology and emptied either mechanically or manually.	12%
FS not contained emptied	FS that is removed from an onsite sanitation technology where FS is not contained which is emptied using wither motorized or manual emptying equipment.	8%
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.	22%
FS - treated	FS treated in a well functioned anaerobic biogas digester.	2%

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.	17%
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, open ground or water bodies.	2%

2.4.3 Open Defecation

Despite of ODF free status, people residing in 4% of households still go for open defecation. During KII-3, it was found out that this percentage of population going for defecation are economically backward and if they are provided with subsidy to build toilet, can achieve a hundred percentage open defecation free status.

3 Service delivery context description

3.1 Policy, legislation and regulation

3.1.1 Policy

The Constitution of Nepal 2015 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, promote and fulfill 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, Also, 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, 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 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.

Recently, National Water, Sanitation and Hygiene Policy, 2022 has been drafted and undergone the process for endorsement. The draft policy is updated policy till date which has included the wide range of the 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 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, 2017) . 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 Users 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 right, roles and responsibility of municipalities along with provision and procedure for approving laws and regulations at local level.

Dhangadhi Sub-Metropolitan City municipal council has enforced Waste Management Act (WMA) 2017 and Waste Management Regulation (WMR) 2020 as per the local governance Act 2017 article 102 and published in local gazette. WMA defines waste as households,

industrial, chemical, healthcare, or other harmful waste. It has set the criteria for the selection of land, collection, transport, treatment, and disposal of waste (DSMC, 2017). WMR has adopted to collaborate with private sector, users committee and non-government organizations for waste management. It emphasizes on the awareness raising campaign for waste reduction, proper provision for collection and transport (DSMC, 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, 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 17.

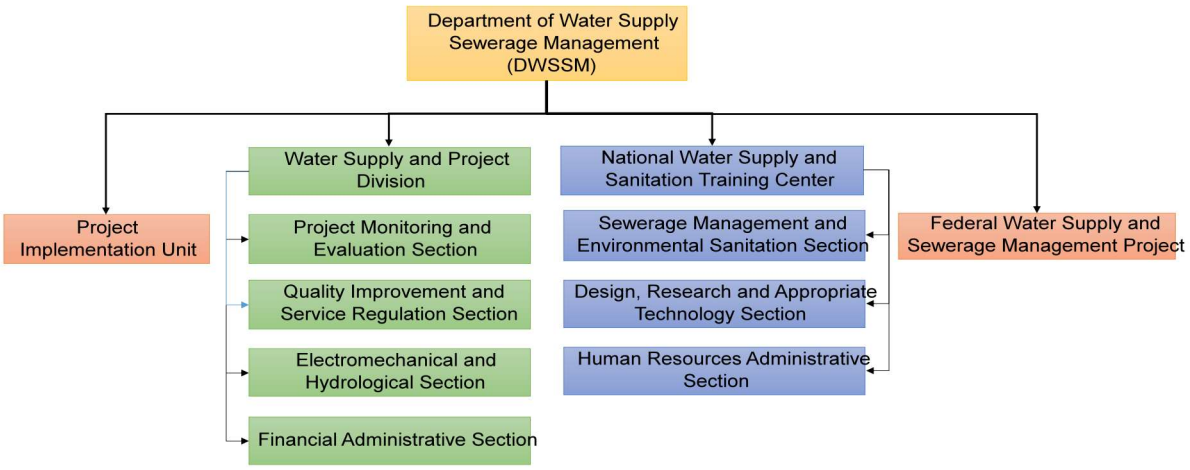


Figure 17: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

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 also 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.

At Local Government:

Municipal council: The sub-metropolitan consists of 7 division including sanitation related section. The Sanitation Management section lies under urban development and infrastructure division. The awareness raising program, behaviour change focused activities on sanitation have been implemented by health and social development division. The urban development and infrastructure division has constructed the drainage system and other infrastructure and planning for construction of faecal sludge treatment plants in coordination with Regional Urban Development Project which has been implemented under Ministry of Urban Development.

3.1.3 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, 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).

Nepal Water Supply Cooperation (NWSC) has been providing drinking water since 1997 in ward 16 and 17 completely and some portion of ward 1, 3 and 6 of in Dhangadhi Sub-metropolitan City. The major source of water is groundwater. It is distributed after water treatment using pressure filter, aeration and chlorination ensuring National Drinking Water Quality Standards. Moreover, Shivnagar Water Supply Users Committee has been providing the services for some parts of ward 1, 5 and 7 of SMC (KII_11, 2022) .

Regarding the sanitation services, urban development and infrastructure division of the sub-metropolitan city plan and implement sanitation infrastructure development programs. Currently the sub-metropolitan city in coordination with the MoUD is implementing Regional Urban Development Project (RUDP). Under the project roadside stormwater drainage, solid waste treatment plant and faecal sludge treatment plant among many other urban

infrastructure developments is being implemented. The project implementation modality is as shown in Figure 18.

Figure 18: Project implementation modality of the RUDP.

The major executing agencies engaged in the project from federal government are MoUD, MoFALD, Social Coordination Committee from MoUD, Department of Road (DOR), Department of Water Supply and Sewerage Management (DWSSM) and Solid Waste Management Technical Support Center (SWMTSC). The project implementation organization is the Department of Urban Development and Building Construction supported by Project Coordination Office and Social Development Section of the MoUD. The project implementing agencies in the field are Regional Project Implementation Unit (R-PIU) under DUDBC, Municipal Project Coordination Committee (MPCC), Project Implementation Units (PIUs) and Asian Development Bank, a funding agency. The representative from the sub-metropolitan city represents in the municipal project coordination committee and project implementation units.

Besides, regional urban development project, the sub-metropolitan has been providing regular services on door-to-door solid waste collection from sanitation section. The solid waste is being managed in the temporary solid waste dumping site. Also, the public toilets have been constructed and operation is leased to the private sector in major urban cluster of the sub-metropolitan city.

Regarding faecal sludge management, private desludging service providers are engaged in emptying and transporting services. Bhojraj Septic Tank Safai, Sanju Chaudhary Septic Tank Safai, Nhu Chaudhary Septic Tank Safai and Kali Ram Septic Tank Safai are some of the private desluding service providers in the sub-metropolitan city. All together 12 desluding vehicles with the tank capacity between 3,000 litres to 5,500 litres is utilized for the service. The collected faecal sludge is applied in the farmland without any treatment by most of the

service providers. While one of the service providers has constructed a trench to dispose the faecal sludge as suggested by KII-4, KII-5, KII-6 and KII-7.

3.1.4 Service standards

The sanitation service standards have been 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 greywater	✓	✓	✓
6	Small-bore sewer collection for toilet and septic tank effluent, low-cost treatment and disposal		✓	
7	Sanitary sewers for wastewater collection, transmission, non-conventional treatment, and disposal	✓		
8	Sanitary sewers for wastewater collection, the transmission of conventional treatment and disposal	✓		
9	Limited solid waste collection and safe disposal	✓	✓	✓

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 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

The sub-metropolitan city has contextualized the SDG goals and indicators under social development; economic development; infrastructure development; forest environment and disaster management and institutional development, service provision & good governance section with the support of GIZ. The city has set targets to develop treatment plants, waste management, proper management of drainage system, clean and healthy community etc. (DSMC, 2022). The city has set the following target and indicator focused on sanitation as shown in Table 10.

Table 10: SDG target and indicator by DSMC.

SMC - SDG Target and Indicator		**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 (%)	82	85	98
2	Proportion of population using latrine (%)	99.93	100	100
3	Urban households with toilets connected to sewer systems/ proper FSM (%)	2.77	5	10

3.2.2 Investments

A preliminary estimate of the annual investment requirement for the entire SDG period, 2016-2030 ranges between 42 to 54 percent 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 percent 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 19. This scale of investment needs a full mobilization of all national and international sources including both public and private sector (MoWS, 2017).

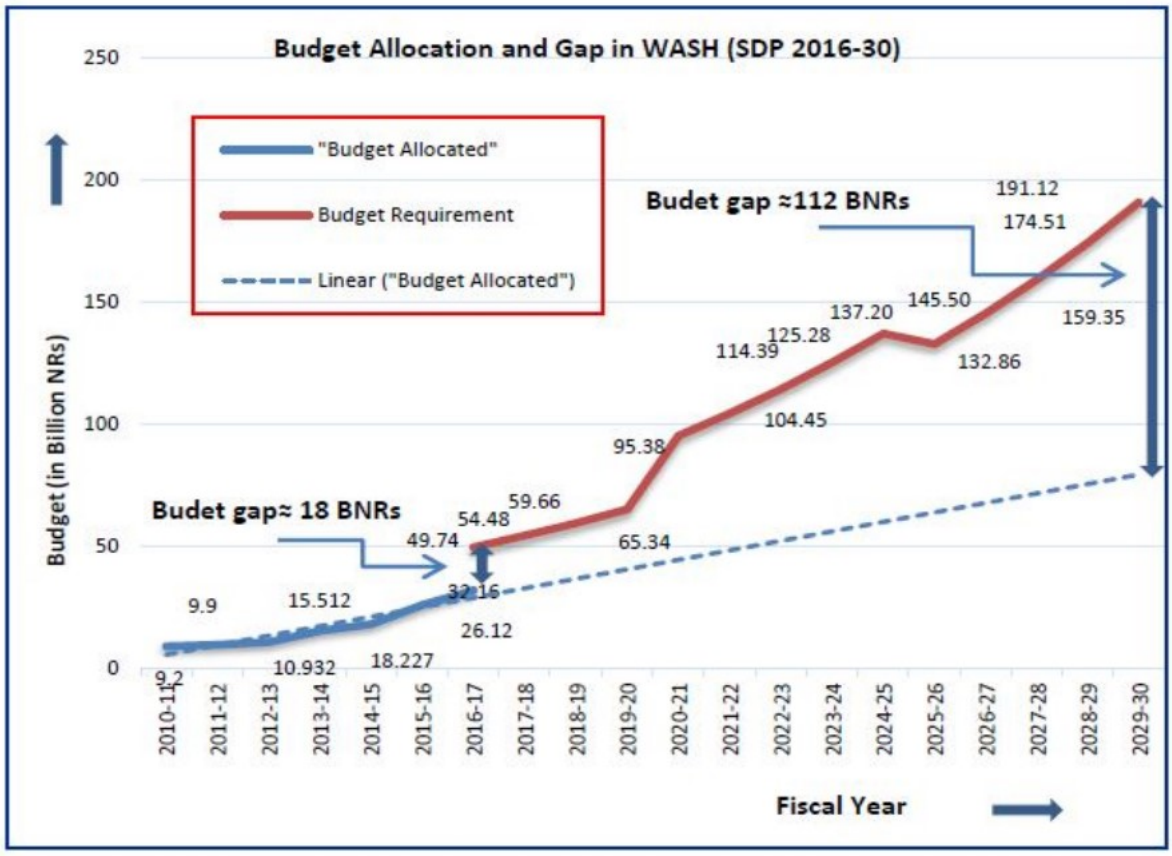


Figure 19: Budget allocation and GAP in WASH SDP 20016-2030. Source: (MoWS, 2017).

The sub-metropolitan city has initiated Clean and Healthy Municipality Campaign conducting different activities at community. For the purpose the sub-metropolitan city has been allocating the annual budget on sanitation. The sub-metropolitan city has spent 0.9% of its total annual budget for sanitation in fiscal year 2021/22. The total budget spent for the fiscal year is NPR. 1,812,822,103 (USD 14,219,443.84) (KII-2, 2022).

Table 11 shows the plan of RUDP project for the faecal sludge management in the sub metropolitan city. The project has estimated 112 m^3/day of FS generation in the city by 2043 and will require 12 desludging vehicles for the service delivery.

Table 11: Faecal sludge management plan in SMC.

FSM Plan in SMC	
Population (by 2043)	595,680
Households	116,892
Population included in design year	443,384
Population included for FSM	75 %
Households included for FSM	86,938
Number of FSTPs	12
Capacity of FSTP (m^3/day)	112
Required Land (square meter)	17,364
Desludging and Transporting Vehicle	12
Public toilet	12

The RUDP project has proposed the plan and estimated budget for wastewater treatment management plan and sanitation management in the city. Table 12 shows the proposed plan and estimated budget in four different phases.

Table 12: Capital Investment plan under RUDP for wastewater and faecal sludge management.

Capital Investment Plan- SMC						
S N	**Description**	**Phase I (2023-2028)**	**Phase II (2028-2033)**	**Phase III (2033-2038)**	**Phase IV (2038-2043)**	**Total**
1	Wastewater Management Plan					
1.1	Sewer Network and Appurtenances (NPR in million)	260	212	217	163	854
1.2	Wastewater Treatment Plant (NPR in million)	194	127	107	51	481
Sub-Total		454	340	325	214	1,335
2	Sanitation Plan					
2.1	Faecal Sludge Treatment Plant (NPR in million)	171	171	171	171	686
2.2	Public Toilet (NPR in million)	13	10	6	3	34
Sub-Total		185	181	178	175	720
Total		639	522	504	389	2,056
Total with Contingency		767	627	605	467	2,467
Total with VAT		867	709	683	528	2,788

3.3 Equity

3.3.1 Current choice of urban poor

The government has developed 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 Joint Monitoring Programme (JMP) from the WHO/UNICEF.

3.3.2 Stimulating demand for services

The mandatory provision of septic tanks during construction of building as per the National Building Code and promotion of biogas digester at household level through alternative energy promotion centre with subsidies are major legal and initiatives for stimulating sanitation service demand in the city. Besides, the sub-metropolitan city must conduct awareness programs on sanitation at the community level for increasing the demand.

3.3.3 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 programs (MoWS, 2017).

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 sub-metropolitan city. Interviews was performed with Mr. Deej Raj Bhatt, Divisional Engineer, Urban Development and Technical Section, Mr. Tanka Bista, Section Head of Social Development and Sanitation Section and Mr. Ashok Awasthi, Environmental Officer from Environment Section of Municipality on current sanitation services practices with respect to technical, institutional and financial aspects.

Similarly, private desludging service providers were interviewed to understand faecal sludge management practice and the business opportunities of the sector in the sub-metropolitan city. KIIs was also performed in context of public toilets with care takers of the toilets to find faecal sludge generation from the public toilets of the sub-metropolitan city as well as public toilet management practice. Other stakeholders interviewed were a sub-engineer from Nepal Water Supply Corporation and an engineer from Water Supply and Sanitation Division Office to find supply and demand, water sources and distribution practice for drinking water in the sub-metropolitan city. List of KIIs conducted to personnel along with their designation in the organization they are working is shown in Table 13.

Table 13: List of Key Informant Interviewed personnel.

S.N.	Name	Designation	Organization/ Company	Purpose of KII	Date
1.	Deej Raj Bhatta (KII-1)	Division Engineer (Urban Development and Technical Section)	SMC	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	2 April, 2022
2.	Tanka Bista (KII-2)	Section Head (Social Development and Sanitation Section)	SMC	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	29 March, 2022
2.	Ashok Awasthi (KII-3)	Environment Officer	SMC	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	29 and March, 2022
3.	Sanju Chaudhary (KII-4)	Private Desludging Service Provider	Private Desludging Service Provider	Emptying practices, finances, requirement, disposal and treatment	2 April, 2022
4.	Bal Bahadhur Chaudhary (KII-5)	Private Desludging Service Provider	Private Desludging Service Provider	Emptying practices, finances, requirement, disposal and treatment	2 April, 2022
5.	Shiva Kumar Chaudhary (KII-6)	Private Desludging Service Provider	Private Desludging Service Provider	Emptying practices, finances, requirement, disposal and treatment	2 April, 2022

6.	Kali Ram Dangaura (KII-7)	Private Desludging Service Provider	Private Desludging Service Provider	Emptying practices, finances, requirement, disposal and treatment	2 April, 2022
7.	Public toilet A (reference Table 2) (KII-8)	Public Toilet Caretaker		Quantitative and management data on public toilet and public toilet operation	
8.	Public toilet B (reference Table 2) (KII-9)				
9.	Public toilet C (reference Table 2) (KII-10)				
10.	(KII-11)	Engineer	Water Supply and Sanitation Division, Branch	Supply and demand of water, water sources, groundwater contamination risk, availability of water, geological information	1 April, 2022
11.	Pushpanjali Bista (KII-12)	Sub-Engineer	Nepal Water Supply Corporation	Supply and demand of water, water sources	1 April, 2022

4.2 Household Survey

Household survey was conducted in all wards of the sub-metropolitan city through mobilization of enumerators selected by the sub-metropolitan city. The enumerators were given two days orientation about on sanitation and methods for conducting the household survey. The household survey was conducted using the mobile application "KOBOCOLLECT" after orientation. SFD team members along with municipal focal person went on field visit in households to encourage enumerators and observe household sanitation status (Figure 20).

Figure 20: Household survey and field monitoring visit.

4.2.1 Determining Sample Size

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

Where,

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

This is followed by proportionate stratification random sampling such that each ward in the sub-metropolitan city 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 378 households were sampled from 29,143 households distributed in 19 wards with proportionate stratification random sampling which is shown in Figure 21.

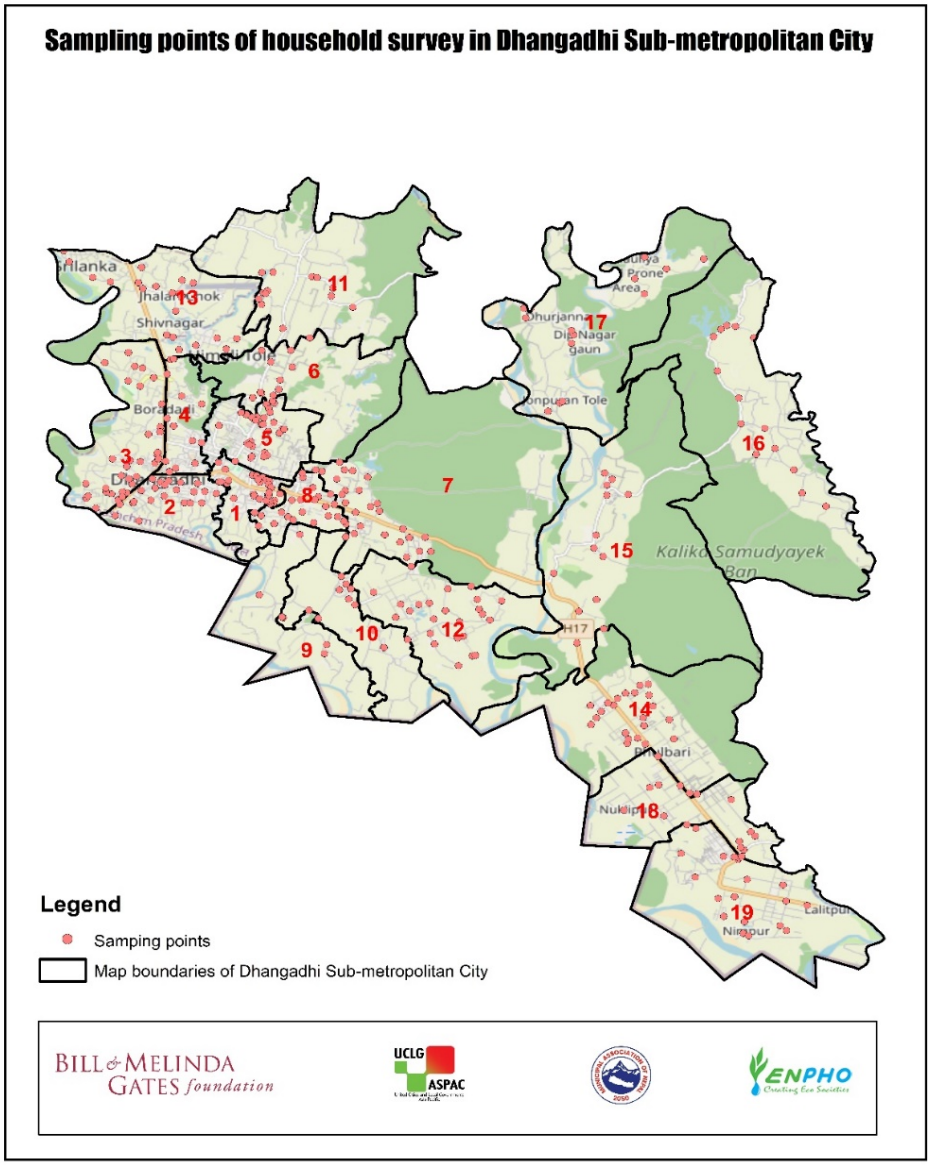


Figure 21: Distribution of sampling points in different wards of Dhangadhi Sub-metropolitan City.

4.2.2 Direct Observation

Various sanitation technologies in the households in all the wards were observed and visual references were kept (Figure 22). Also, observation of the emptying of containments and transportation of faecal sludge were carried out. The disposal site of private entrepreneur was observed during the usage.

Figure 22: Household survey observation along with municipal representatives and enumerators.

4.2.3 Sharing and Validation of Data

The Shit Flow Diagram Sharing and Validation workshop was conducted in the sub-metropolitan city to share the finding of the sanitation situation survey and receive the suggestion from municipal stakeholders. Altogether, 36 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 (Figure 23). Kandakala Rana, deputy mayor said that the information collected on sanitation status is very useful for the sub-metropolitan city for planning and management of sanitation services within all wards of the sub-metropolitan city. The local representatives realized the need for enhancement of the sanitation status in their sub-metropolitan city. 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 23: Sharing and validating the finding of households and institutional survey on sanitation in Dhangadhi sub-metropolitan city.

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 sub-metropolitan city.

We offer our sincere gratitude to Mr. Gopal Hamal, Mayor, Ms. Kandakala Kumari Rana, Deputy Mayor and Mr. Ramlal Shrestha, Chief Administrative Officer of Dhangadhi Sub-metropolitan city. We would also like to thank Mr. Deej Raj Bhatta, Division Engineer of Urban Development and Technical Section, Mr. Tanka Bista, Section Head of Social Development and Sanitation Section, Mr. Ashok Awasthi, Environment Officer and entire staffs of sub-metropolitan city for their remarkable support during the study. We appreciate former Mayor of Sub-metropolitan City, Mr. Nrip Bahadur Oda for his support and guidance 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 Officer, UCLG 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 much grateful to Ms. Bhawana Sharma, Executive Director and Mr. Rajendra Shrestha, Program Director of Environment and Public Health Organization (ENPHO) for tremendous support and guidance during the whole process of the study. Together, we would like to thank entire team of ENPHO for their gracious support and MuNASS-II team without whom the study would not have been possible.

We are grateful towards the enumerators, Ms. Sangita Chaudhary, Ms. Sujila Chaudhary, Ms. Sumitra Chaudhary, Mr. Dambar Singh Khati, Ms. Jyoti Pandey, Ms. Aarati Acharya, Ms. Sarada Bogati, Mr. Bijaya Rana and Ms. Maya Chand for their support during the survey.

6 References

AEPC. (2022). *Renewable Energy Subsidy Policy.* Alternative Energy Promotion Centre, Ministry of Energy, Water Rresources and Irrigation .

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

Augustine Chioma Affam, E. H. (2021). Sanitation Systems and Technology Options.

CBS. (2022). *Multiple Indicator Cluster Survey 2019.* Central Bureau of Statistics and United Nations Children's Fund.

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

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

Dhangadhi Sub-metropolitan. (2022, April 20). *Dhangadhi Sub-Metropolitan City*. Retrieved from Dhangadhi Sub-Metropolitan City, Government of Nepal: https://dhangadhimun.gov.np/en

DSMC. (2017). *Waste Management Act*. Retrieved from Dhangadhi sub-metropolitan city, local gazette : https://dhangadhimun.gov.np/

DSMC. (2020). *Waste Management Regulation*. Retrieved from Dhangadhi Sub-Metropolitan City's Gazette: https://dhangadhimun.gov.np/

DSMC. (2021). *Dalit Rights Working Procedure*. Retrieved from Dhangagdhi Sub-metropolitan City.

DSMC. (2022). *Plan and Budget of Fiscal year 2021/22*. Retrieved from Dhangadhi Sub-Metropolitan City:

DWSSM. (2004). *National Rural Water Supply and Sanitation Sector Policy. Kathamndu, Nepal.* Department of Water Supply and Sewarage Management, Ministry of Water Supply, Goverment of Nepal.

DWSSM. (2009). *National Urban Water Supply and Sanitation Sector Policy.* Kathmandu, Nepal: Department of Water Supply and Sewerage Management, Ministry of Water Supply, Government of Nepal.

DWSSM. (2014). *National Water Supply and Sanitation Sector Policy.* Kathmandu, Nepal: Department of Water Supply and Sewerage Management, Ministry of Water Supply, Government of Nepal.

Elizabeth Tilley, L. U. (n.d.). *Compendium of Sanitation Systems and Technologies.*

ENPHO. (2021). *Data Collection Survey on Water Supply and Sanitation Management in Major Cities of Nepal.* Kathmandu: ENPHO, JICA.

FAO. (n.d.). *FAO - Training*. Retrieved from www.fao.org: https://www.fao.org/fishery/docs/CDrom/FAO_Training/FAO_Training/General/x6706e/x6706e09.htm

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

https://www.fao.org/fishery/docs/CDrom/FAO_Training/FAO_Training/General/x6706e/x6706e09.htm. (n.d.).

Inter-American Development Bank, O. N. (2020). *SFD Promotion Initiative.* Cap-Haïtien: Benjamin Biscan, Independent Consultant.

Kansakar, D. R. (1980). *Understanding Groundwater for Proper Utilization and Management in Nepal.* IWMI.

Karki, R., Talchabhadel, R., & Aalto, J. (2015). New climatic classification of Nepal. *Theoretical and Applied Climatology*, 799-808.

KII_11. (2022). Status of water supply in Dhangadhi sub-metropolitan city.

KII-2. (2022). Sanitation Planning and Budgeting, Biogas Promotion.

KII-3. (2022). Capacity Need Assessment of Municipality.

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

Linda Strande, M. R. (2014). *Faecal Sludge Management Systems Approach for Implementation and Operation.* London: IWA Publishing.

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

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/

MoFAGA. (2022). *Capacity Need Assessment of Local government.* Local Government Capacity Development Division; Ministry of Federal Affairs and General Administration .

MoH, N. N. (2017). *Nepal Demographic and Health Survey 2016.* Ramshah Path, Kathmandu, Nepal: Ministry of Health.

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

MoWS. (2017). *Institutional and Regulatory Framework for Faecal Sludge Management in Urban Areas of Nepal.* Kathmandu,Nepal: Ministry of Water Supply.

MoWS. (2017). *Institutional and Regulatory Framework for Faecal Sludge Management in Urban Areas of Nepal.* Kathmandu, Nepal: Ministry of Water Supply,.

MoWS. (2017). *Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016-2030).* Ministry of Water Supply.

MoWS. (2019). *Bill on Drinking Water and Sanitation.* Ministry of Water Supply; Goverment of Nrpal.

MoWS. (2022). *Draft National Water, Sanitation and Hygiene Policy .* Ministry of Water Supply.

National Census . (2021, April 20). *National Census 2021*. Retrieved from Government of Nepal, National Planning Commission, Central Bureau of Statistics: https://censusnepal.cbs.gov.np/Home/Details?tpid=5&dcid=3479c092-7749-4ba6-9369-45486cd67f30&tfsid=17

NPC. (2017). *Nepal Sustainable Development Goals, Status and Roadmap: 2016-2030.* National Planning Commission.

NPC. (2020). *National Review of Sustainable Development Goal.* Kathmandu Nepal: National Planning Commission.

Susana. (2018). *SFD Manual.*

UNGA. (2010). *Human Right to Water and Sanitation*. Retrieved from United Nations General Assembly.

7 Appendix

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

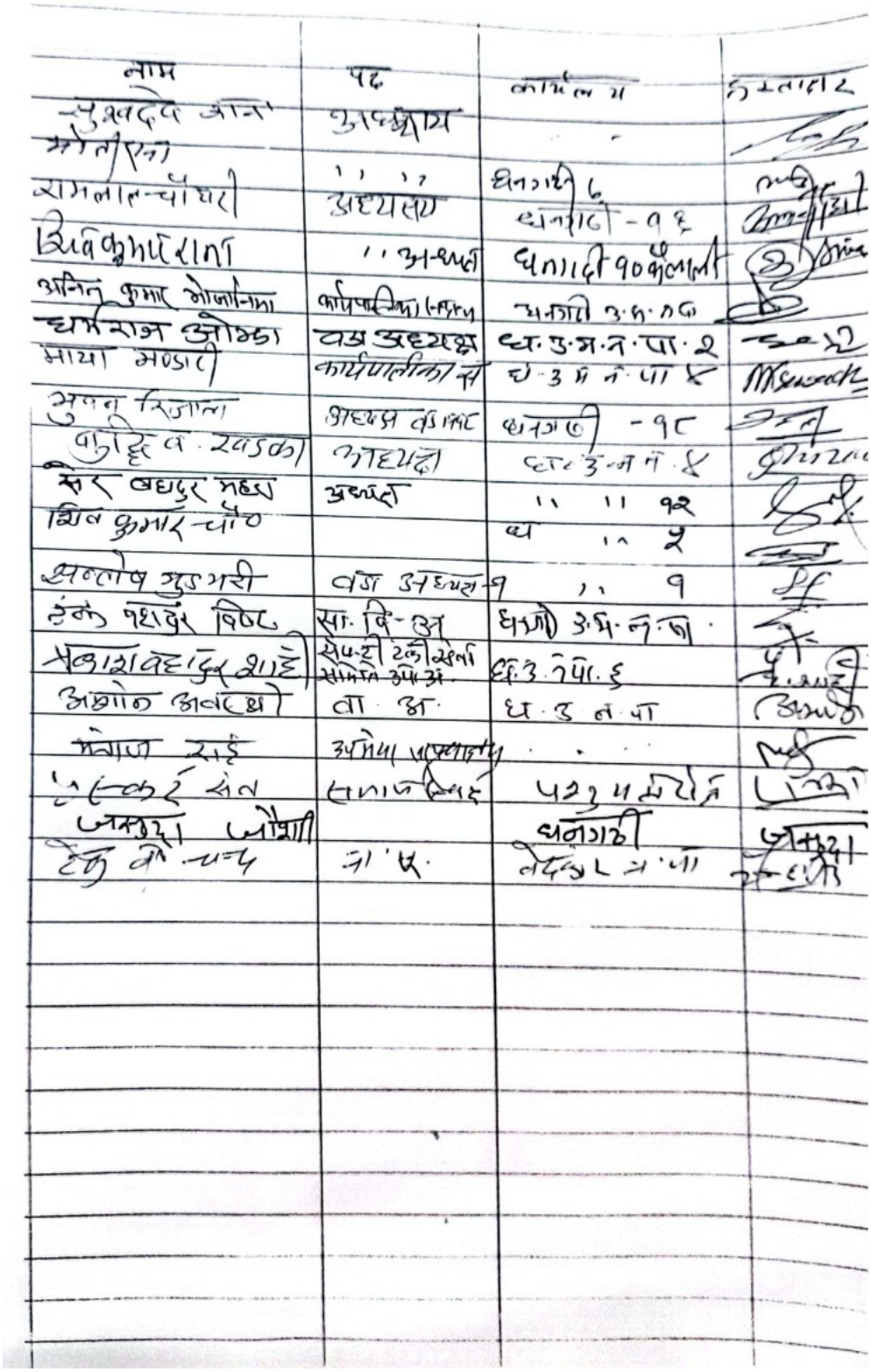
System Classification		Minimum Key HR Required	Regulation & Surveillance	Financing & Construction	Ownership of System	Service Delivery	
Size	Sanitation					Provision	Production
Small	Onsite sanitation	Water Supply and Sanitation Technician (WSST)	Federal and or Provincial Government	User+/ community+/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

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

आज मिति २०७६ जेष्ठ महिनाको २३ गतेका दिन नेपाल नगरपालिका संघको आयोजनामा वाटरएड र जनस्वास्थ्य संस्था (एन्फो) को प्राविधिक सहयोग र The United Cities and local Goverments Asia Pacific (UCLG ASPAC) को सहकार्यमा Municipalities Network Advocacy on Sanitation in South Asia (MuNASS II) कार्यक्रम अन्तर्गत धनगढी उप-महानगरपालिकामा आफ्नो नगरस्तरीय समावेशी सरसफाइ (CWIS) र दिसाजन्य लेदो व्यवस्थापन (FSM) सम्बन्धी अभिमुखीकरण र SFD-Shit Flow Diagram सम्बन्धी अन्तरक्रिया कार्यक्रममा निम्न अनुसारका व्यक्तिहरूको उपस्थिति रहेको छ।

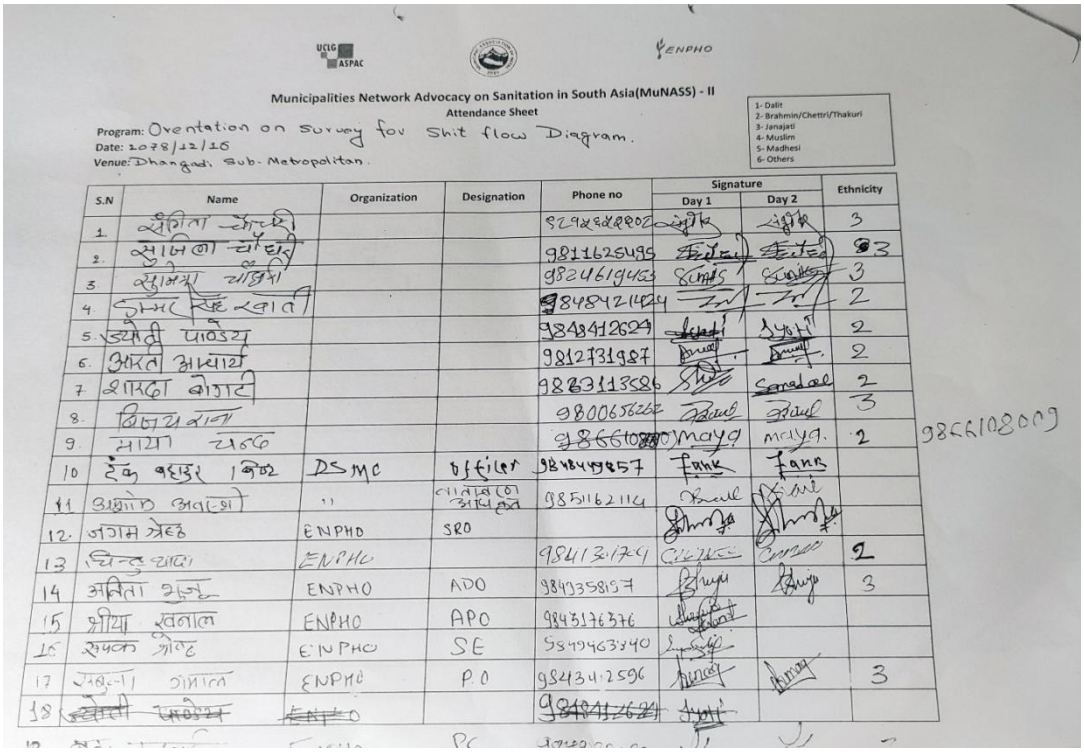
उपस्थिति:

क्र.सं.	नाम	पद	कार्यालय	हस्ताक्षर
१	गोपाल हमाल	नगरप्रमुख	धनगढी उप.म.न.पा.	[illegible]
२	कल्पकला राना	उप नगरप्रमुख	''	[illegible]
३	रुप ब. कुँवर	वडा अध्यक्ष	'' ११	[illegible]
४.	माधव रावत	वडा अध्यक्ष	'' १६	[illegible]
५.	बाबुराम चौधरी		'' १३	[illegible]
६.	सुष्मा चौधरी	सदस्य	'' १५	[illegible]
७	निशा कु० आउजी	कार्यपालिका सदस्य	'' १३	[illegible]
८	बिन्दु लामा	''	'' १४	[illegible]
९.	चक्र ब० नेपाली	कार्य सदस्य	'' १४	[illegible]
१०	यशोदा भण्डारी	का. सदस्य	'' ५	[illegible]
११	भागीराम चौधरी	वडा अध्यक्ष	'' ०७	[illegible]
१२	पतिराम चौधरी	वडा अध्यक्ष	'' ०८	[illegible]
१३.	ओम कु. कुँवर	प्रदेश प्रबन्धक	नेपाल नगरपालिका संघ	[illegible]
१४	गजेन्द्र शाही	वडा अध्यक्ष	'' ५	[illegible]
१५	प्रेम ब. [illegible]	वडा अध्यक्ष	धनगढी ३	[illegible]
१६	बल बहादुर चौ.		धनगढी -४	[illegible]
१७	[illegible]		धनगढी ६	[illegible]



नाम	पद	कार्यालय	हस्ताक्षर
सुखदेव आचार्य	उपाध्यक्ष		
[illegible]	" "	धनगढी ६	
रामलाल चौधरी	अध्यक्ष	धनगढी - १६	
विकुमारी रानी	" अध्यक्ष	धनगढी १० कैलाली	
अनिल कुमार मोजाम्मा	कार्यपालिका सदस्य	धनगढी उ.म.न.प	
घनश्याम ओझा	वडा अध्यक्ष	ध.उ.म.न.पा. २	
माया भण्डारी	कार्यपालिका सदस्य	ध उ म न पा ४	
अमन रिजाल	अध्यक्ष वडासभा	धनगढी - १८	
पुष्पराज खड्का	सदस्य	ध.उ.म.न.पा. ४	
शेर बहादुर महत	अध्यक्ष	" " १२	
शिव कुमार चौधरी		ध " २	
सन्तोष गुडगरी	वडा अध्यक्ष	" " १	
टंक बहादुर विष्ट	सा. वि. अ	धनगढी उ.म.न.पा.	
भक्तबहादुर थापा	सेफ्टी टेक्नोसर्भा सामाजिक अधिकारी	ध.उ.म.न.पा. ६	
अशोक अवस्थी	वा अ	ध.उ.म.न.पा	
भगवान राई	अध्यक्ष उपभोक्ता समिति		
[illegible]	समाज विकास	धनगढी	
जगदम्बा जोशी		धनगढी	
टंक बो चन्द	ना.प.	नेपालगञ्ज उ.म.पा	

7.3 Appendix 3: List of participants on Orientation on survey for Shit Flow Diagram

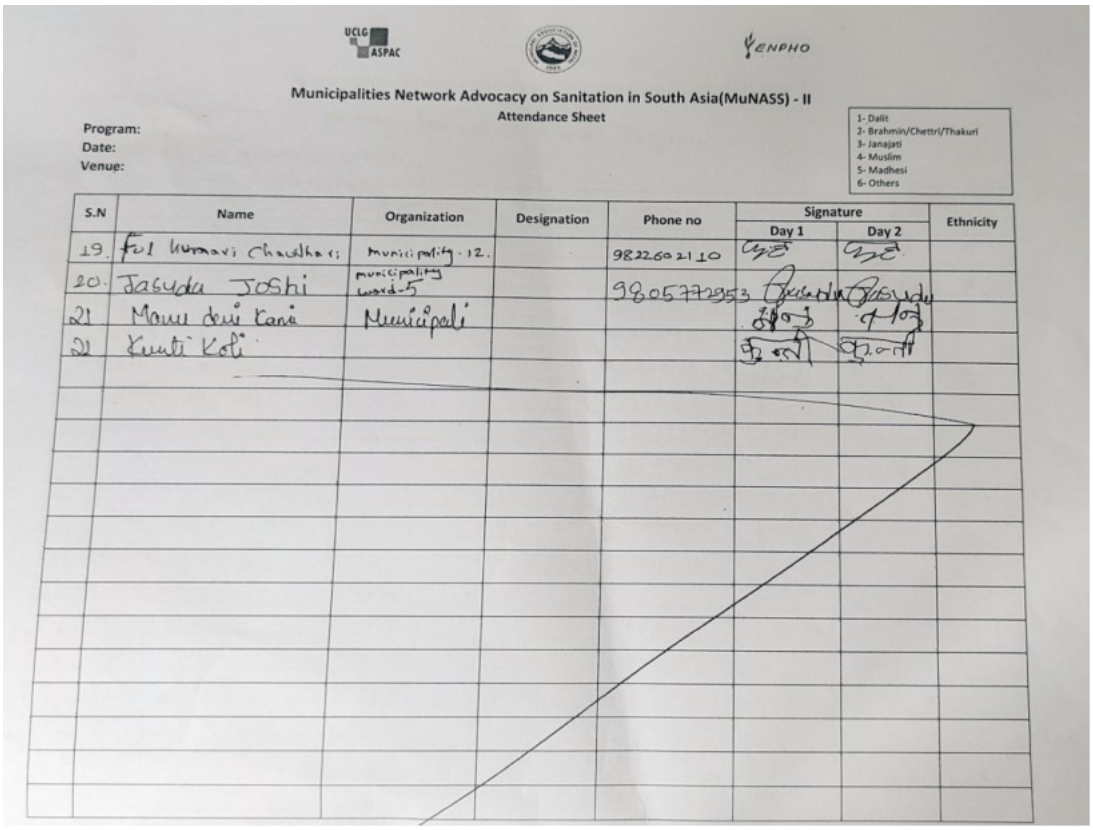


Municipalities Network Advocacy on Sanitation in South Asia(MuNASS) - II
Attendance Sheet

Program: Orentation on survey for Shit flow Diagram.
Date: 2078/12/16
Venue: Dhangadi Sub-Metropolitan

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

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity
1.	सुनिता चौधरी			9779848808			3
2.	साबिला चौधरी			9811625495			3
3.	सुमित्रा चौधरी			9824619453			3
4.	कुमार सिंह खाती			9848421424			2
5.	ज्योती पाण्डेय			9848412624			2
6.	अरती आचार्य			9812731987			2
7.	शारदा बोगटी			9863113586			2
8.	विष्णु दत्त			9800658262			3
9.	माया चन्द			9866108800			2
10	देव बहादुर बिष्ट	DSMC	Officer	9848499857			
11	अशोक अवस्थी	"		9851162114			
12.	जगम श्रेष्ठ	ENPHO	SRO				
13	चिन्तु चाचा	ENPHO		9841317241			2
14	अमित भुजेल	ENPHO	ADO	9849358157			3
15	प्रीया खनाल	ENPHO	APO	9843176376			
16	सचक श्रेष्ठ	ENPHO	SE	9849463340			
17	[illegible]	ENPHO	P.O	9843412596			3
18	~~[illegible]~~	~~ENPHO~~		~~9849412624~~			



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

Program:
Date:
Venue:

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

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity
19.	Ful kumari Chaudhary	Municipality - 12.		9822602110			
20.	Jagyda Joshi	municipality ward-5		9805772953			
21	Maya devi Rana	Municipali					
21	Kunti Koli						

SFD Dhangadhi Municipality, Nepal, 2022

Produced by:

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

This Executive Summary and the SFD Report are available from:

www.sfd.susana.org

SFD Promotion Initiative