SFD Report

Badimalika Municipality
Nepal

Final Report

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

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SFD Report Badimalika Municipality, Nepal, 2022

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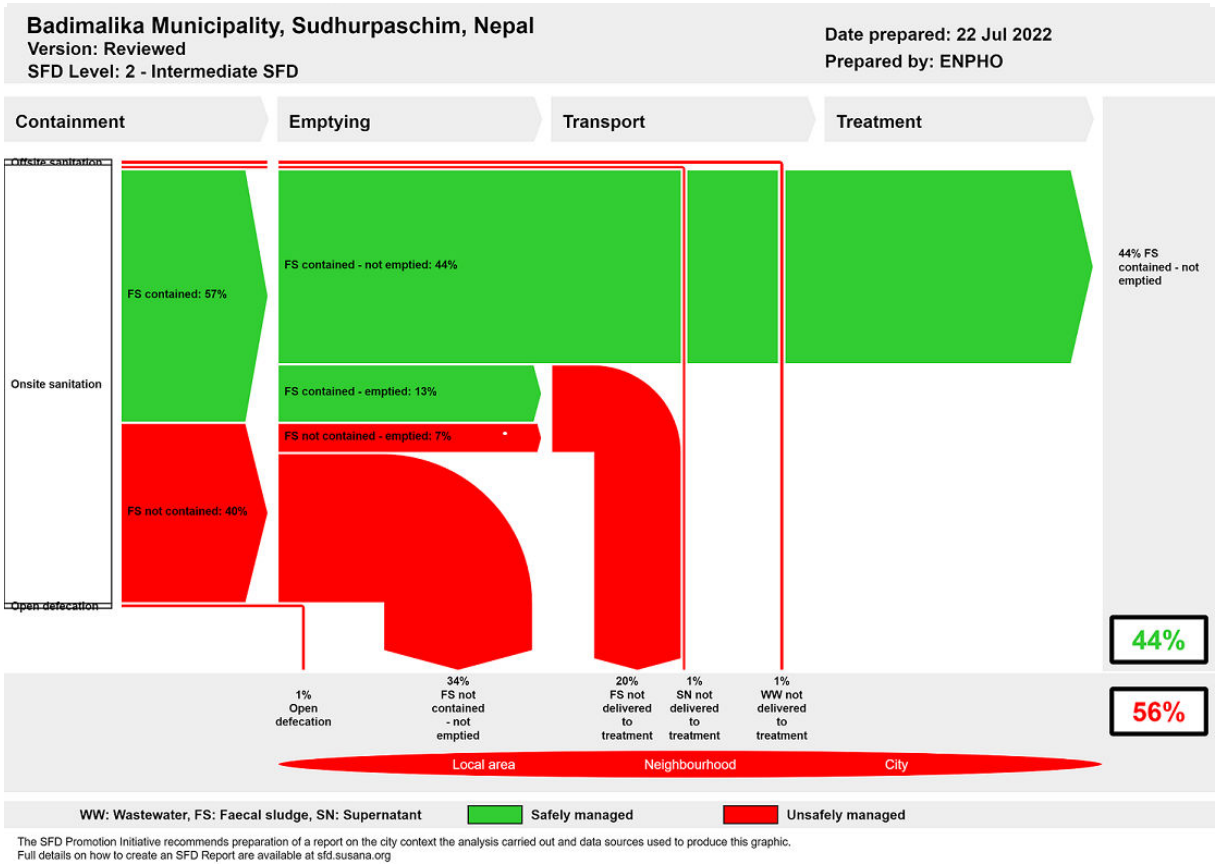
1. The SFD Graphic



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

2. Diagram information

SFD Level:

This SFD is a level 2 - Intermediate report.

Produced by:

Environment and Public Health Organization (ENPHO).

Collaborating partners:

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

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3. General city information

Badimalika Municipality lies in Bajura District in Sudurpaschim Province of Nepal. It was established in March 2017 in accordance with the 2015 Nepali Constitution, as decided by the cabinet. It is formed by merging previously three Village Development Committees (VDCs) named Martadi, Budiganga and Jugada. There are nine political wards in the municipality.

Population of Municipality is 17,227, with 8,852 male and 8,375 female. Ward 9 has the highest population (2,889), while ward number 4 has least (937). The Badimalika Municipality has 3,129 total households. With a total of 590 households, ward number 8 had the most, while ward number 4 had the fewest with168.

4. Service outcomes

The overview of sanitation technologies across the sanitation value chain in the municipality is briefly explained in this section.

Sanitation system: Basic sanitation coverage in the municipality is only 99%. The families without own toilet defecate in open places or used neighbour's toilet.

Containment: 99% of the households in municipality depend on onsite sanitation system. Majority of the households (43%) have connected their toilet to a single pit whereas twin pits are the least used containment system.

Since Martadi is the district headquarters of the Bajura district and a part of the Badimalika municipality, it serves as the primary location for most institutions. In most of these facilities, the toilet is connected to either a fully lined tank or unlined pits.

Emptying and Transportation: There is no regular emptying practices of the containments. Only 21.53% of the containments have been emptied at least once after the installation, out of which 95.89% of the households did so manually which is not a safe practice. The remaining 4.11% used the open emptying method, which also requires manual labour or self-help because there is no mechanism for mechanical emptying. 78.47% of HHs have not emptied their containment as it has not yet been filled.

Treatment and Disposal: The municipality lacks a faecal sludge treatment facility. The FS that is emptied from the containments is used in the agricultural land as well as dump in the pits.

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 om 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.

6. Overview of stakeholders

The major stakeholders envisioned by the regulatory framework for Faecal Sludge Management (FSM) in urban cities is presented in Table 1.

Table 1: Overview of Stakeholders.

Key Stakeholders	Institutions / Organizations
Public Institutions at Local Government	Badimalika Municipality
Public Institutions at Local Government	Martadi Comprehensive Water Users Committee, Martadi, Bajura
Non-governmental Organizations	United Nations International Children's Emergency Fund (UNICEF) Environment and Public Health Organization (ENPHO)
Private Sector	Public toilet operators
Development Partners, Donors	MuAN, BMGF, UCLG ASPAC

7. Credibility of data

The major data were collected from random household sampling. Altogether, 347 households and 78 institutions were surveyed in Badimalika Municipality. Primary data on emptying, transportation and current sanitation practices in the municipality were validated from Key Informant Interviews (KIIs) with

Municipal Officers, Water supply and Sanitation Section and Operator of Public toilet.

8. Process of SFD development

Data on sanitation situation were collected through household and institutional survey. Enumerators from the municipality were mobilized after providing orientation on sanitation technologies. and objectives of the survey. Data were collected by using mobile application KOBOCOLLECT. Along with this, KIIs were conducted with Municipal Officers, Engineer of municipality and Martadi comprehensive water users committee, Martadi, Bajura. Various sanitation technologies such as types of containments, emptying frequencies were mapped using ARC GIS. 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: https://censusnepal.cbs.gov.np/Home/Details?tpid=5&dcid=3479c092-7749-4ba6-9369-45486cd67f30&tfsid=17
- Nations, F. a. (n.d.). FAO - Training. Retrieved from www.fao.org: https://www.fao.org/fishery/docs/CDrom/FAO_Training/FAO_Training/General/x6706e/x6706e09.htm

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Abbreviations

DWSSM	Department of Water Supply and Sewerage Management
DUDBC	Department of Urban Development and Building Construction
ENPHO	Environment and Public Health Organization
FAO	Food and Agriculture Organization
FS	Faecal Sludge
FSM	Faecal Sludge Management
GoN	Government of Nepal
HH	Household
IRF	Institutional and Regulatory Framework
JMP	Joint Monitoring Programme
KII	Key Informant Interview
KM	Kilometres
MDG	Millennium Development Goal
mm	Millimetre
MoEST	Ministry of Education, Science and Technology
MoFAGA	Ministry of Federal Affairs and General Assembly
MoH	Ministry of Health
MoHP	Ministry of Health and Population
MoUD	Ministry of Urban Development
MoWS	Ministry of Water Supply
MTEF	Medium Term Expenditure Framework
MuAN	Municipal Association of Nepal
NPC	National Planning Commission
NUWSSP	National Urban Water Supply and Sanitation Sector Policy
NWSSP	National Water Supply and Sanitation Policy
ODF	Open Defecation Free
PPP	Public Private Partnership
RWSSNP	Rural Water Supply and Sanitation National Policy
SCEIS	Sector Coordination and Efficiency Improvement Section
SDG	Sustainable Development Goal
SDP	Sector Development Plan
SEIU	Sector Efficiency Improvement Unit
SFD	Shit Flow Diagram
SFD PI	Shit Flow Diagram Promotion Initiative
SN	Supernatant
UCLG ASPAC	United Cities and Local Governments Asia Pacific

UNGA	United Nations General Assembly
UNICEF	United Nations Children's Education Fund
VDC	Village Development Committee
WASH	Water, Sanitation and Hygiene
WASH-CC	Water, Sanitation and Hygiene Coordination Committee
WHO	World Health Organization
WSP	Water Supply Providers
WSUC	Water Supply and Users Committee
WW	Wastewater

1. City context

Badimalika Municipality lies in Bajura district of Sudurpaschim Province in Nepal. It was formed by merging the three former Village Development Committees (VDCs), Martadi, Budiganga, and Jugada. Municipality's boundary is surrounded by Triveni Municipality in the south, Budhinanda Municipality in the east, Gaumul Rural Municipality, Chhededaha Rural Municipality, and Budhiganga Municipality in the west. There are nine political wards in the municipality, which are extended over 276 square kilometres of land. Martadi is the district headquarters of Bajura district that lies in ward 8 and 9 which is urban area of this region (Municipality, Badimalika, 2022).

Figure 1 shows the Geo-political map of Badimalika Municipality and its ward boundary.

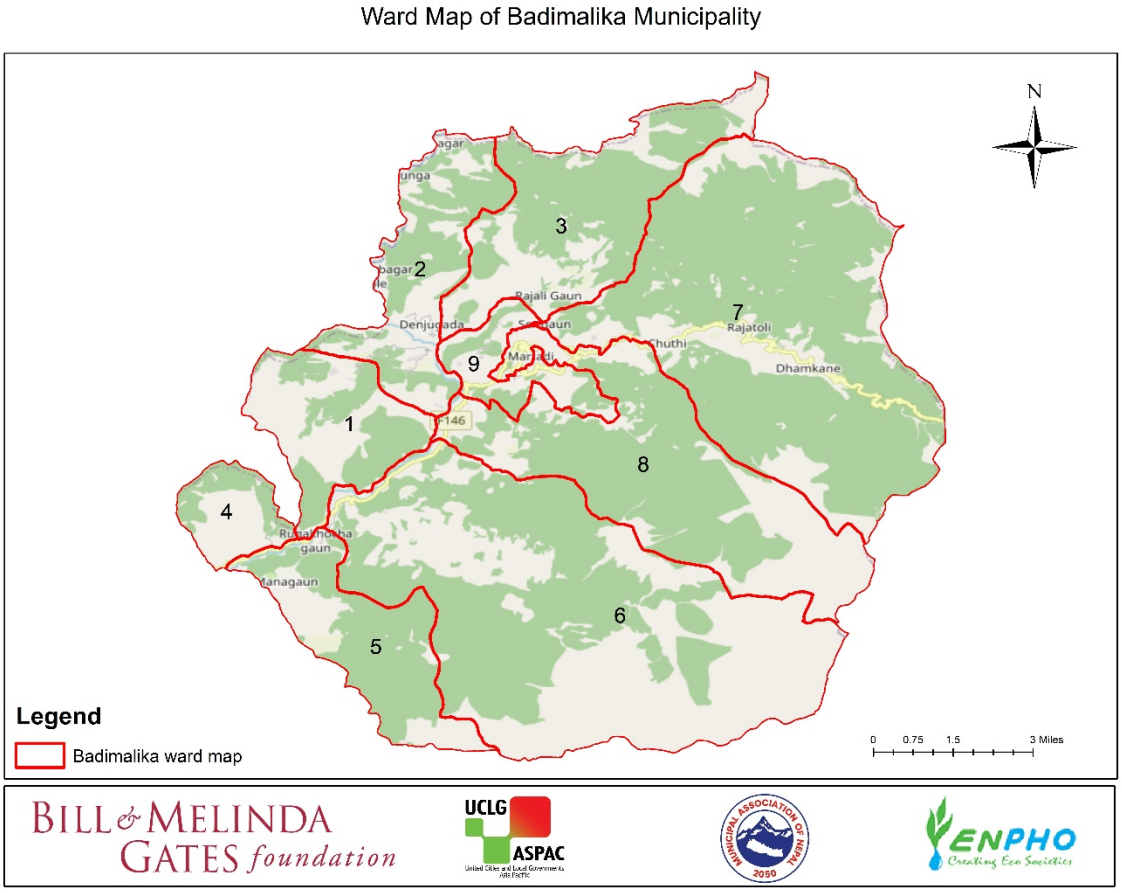

Figure 1: Map of Badimalika Municipality with ward boundaries.

1.2 Population

Badimalika Municipality has a population of 17,227 residing in 3,129 households with 51.385% male and 48.61% female. The distribution of population in not uniform in all the wards. The highest number of people resides in ward number 9 while only 937 people resides in ward number 4 (Badimalika Municipality, 2017). Table 1 shows the total population and households in each ward.

Table 1: Ward Wise Household and Population Data.

Ward No.	Households	Male Population	Female Population	Total Population
1	384	1,100	967	2,067
2	216	677	660	1,337
3	183	609	568	1,177
4	168	471	466	937
5	240	636	638	1,274
6	427	1,253	1,165	2,418
7	412	1,291	1,259	2,550
8	590	1,341	1,237	2,578
9	509	1,474	1,415	2,889
Total	**3,129**	**8,852**	**8,375**	**17,227**
				(Badimalika Municipality, 2017)

1.3 Climate

The largest portion of the municipality is located in a high alpine region. The average annual rainfall in the region is 162.5 mm. The average maximum and minimum temperature are 33 °C and 4 °C, respectively (Bajura Climate Weather Averages, 2022).

1.4 Geography and Topography

The geographical location of the municipality 81° 27' 18" east and 9° 26' 37" north. The altitude ranges between 1080 m and 4360 m above sea level.

The municipality's topography is primarily steep. On the banks of rivers and streams, there are often little fissures and holes. 60% of the land is covered by forests whereas 40% remaining land is covered by grassland, forests, and desert terrain and rock (Badimalika Municipality, 2017).

2. Service Outcomes

2.1 Overview

2.1.1 Sanitation Status

The Municipality has declared free from open defecation during the national sanitation movement led by National Sanitation and Hygiene Master Plan 2011. It indicates universal access to basic sanitation facility for all the people. However, it was revealed that still 1% of the households do not have access to basic sanitation facility. These households without toilet defecate in open places or uses neighbour's toilet.

Figure 2 shows the types of sanitation systems in the municipality. Sanitation systems 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. Although there is lack of sewerage network, 1% of the households have connected their toilet to open drain and water bodies near their houses. Thus, onsite sanitation systems are prevalent in the municipality. Any toilet system designed to handle or treat faeces at its source rather than transporting to another location is termed an onsite sanitation system (Augustine Chioma Affam, 2021). Almost 99% of households rely on onsite sanitation technologies in the municipality.

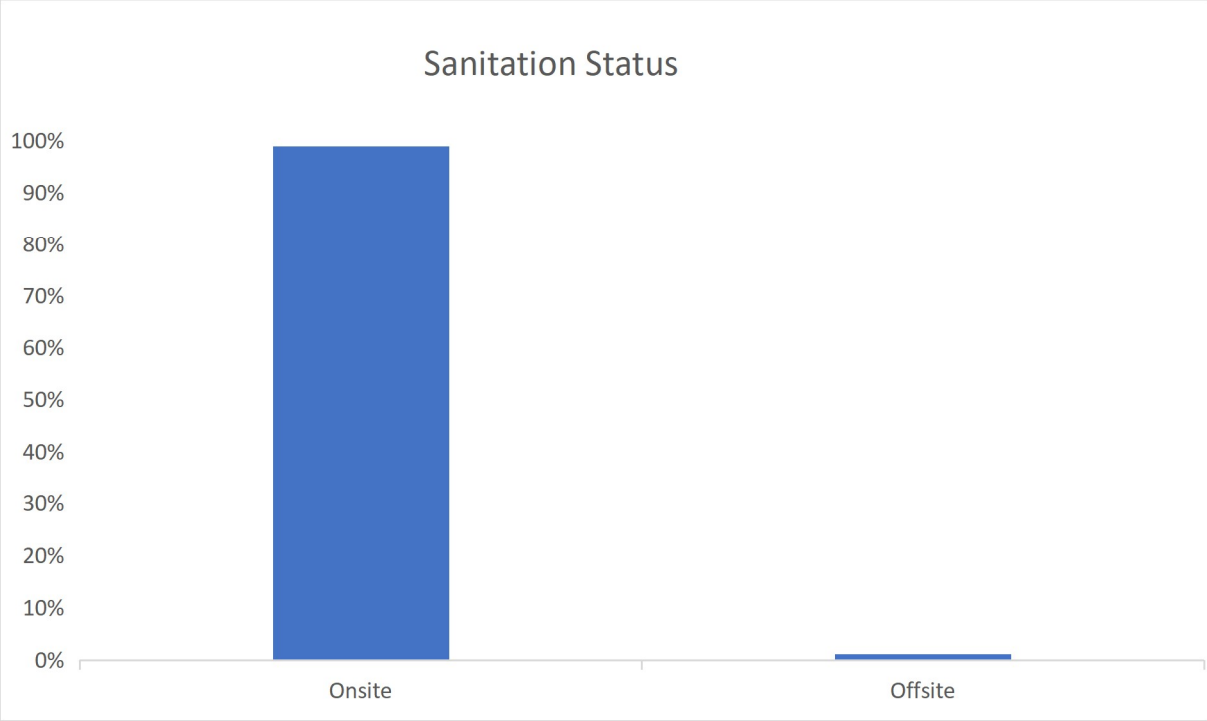

Figure 2: Sanitation Status of Badimalika Municipality.

2.1.2 Types of Containment

The national building code has mandatory provision of constructing septic tanks in each building. However, there is a general practice of constructing simple pits. A pit is dug and stone is piled up to prevent from collapsing to collect waste from toilet. This type of containment is termed as single offset pit. 42% of the households in the municipality has constructed such pits. While in the urban area, mainly headquarters, of the Bajura district with easy access to the transportation services, either fully lined tanks or tanks with walls constructed from a brick and cement and open bottoms are constructed. Figure 3 shows the percentage of households with different types of containments in the municipality.

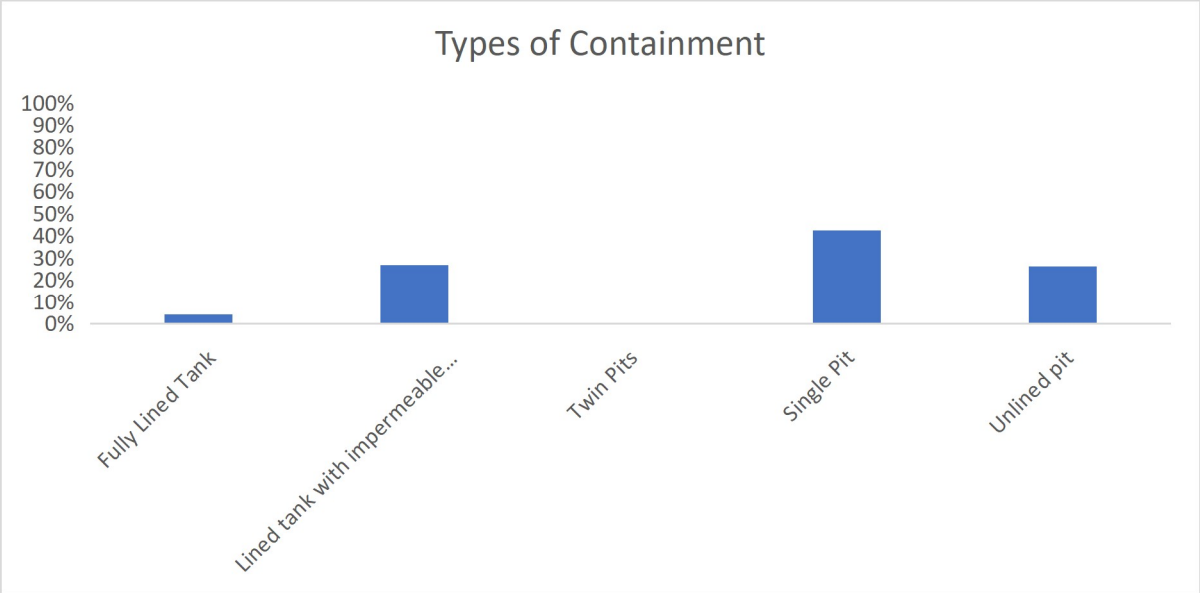

Figure 3: Types and percentage of containment system at households of Badimalika Municipality.

Figure 4 shows the location maps of the households with different types of containments. It clearly distinguishes the area with lined tanks and pits.

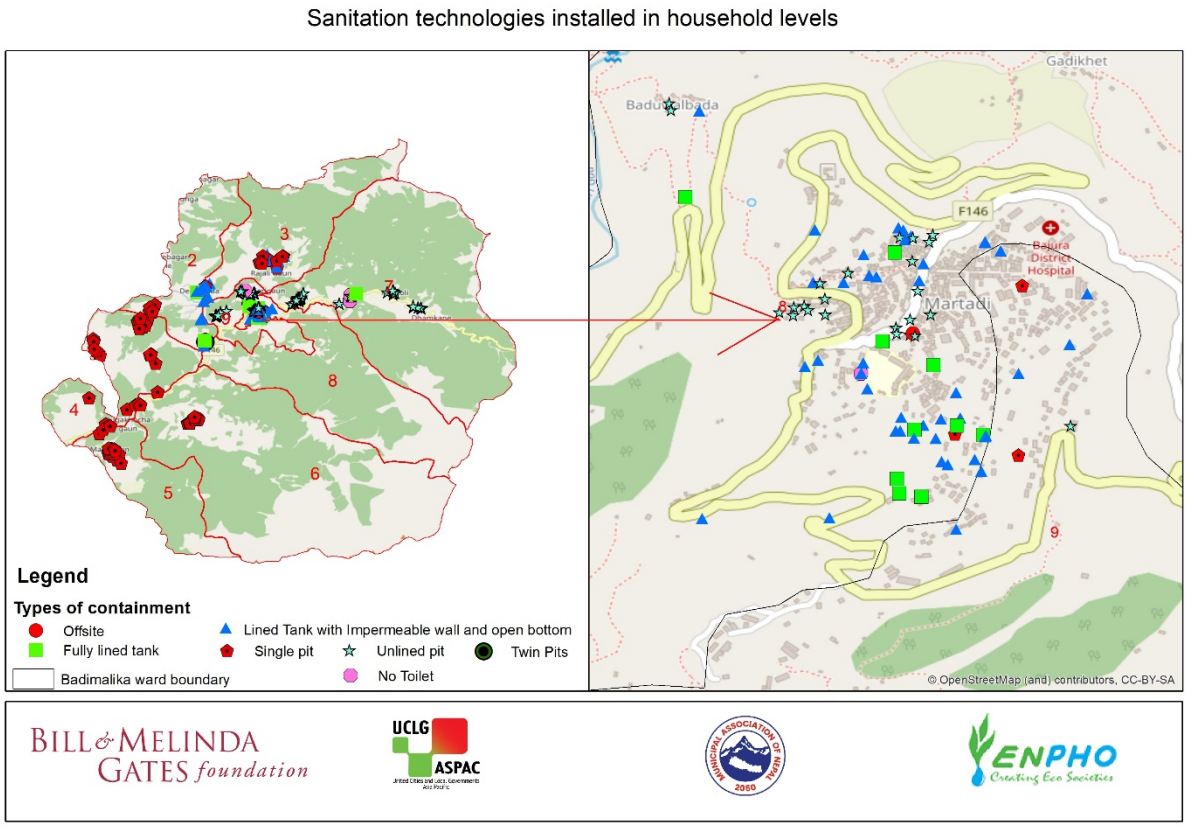

Figure 4: Sanitation technologies installed in household levels.

2.1.3 Emptying, Transportation and Treatment

Regular emptying is essential for proper functioning of the onsite sanitation systems, particularly for septic tanks and fully lined tanks. The emptying practices of containment in the municipality is not regular. Furthermore, only 22% of the containment in the households has been emptied at least once after installation as remaining containment has never been filled. This indicates the consequences of open bottom tanks and pits with higher permeable coarse and gravel soil characteristics of the region.

Also, manual emptying is the prevalent in the municipality. 96% of households that have emptied their containment at least once after installation were manually emptied. While remaining containment was emptied openly and drained out during rainy days.

The municipality does not have a faecal sludge treatment plant. The faecal sludge emptied from the containment is either directly applied in the farmland or buried in the pits. Equally the people practice composting of the faecal sludge in the compost pits. Figure 5 shows the percentage of reported disposal practices of the faecal sludge by the households in their locality.

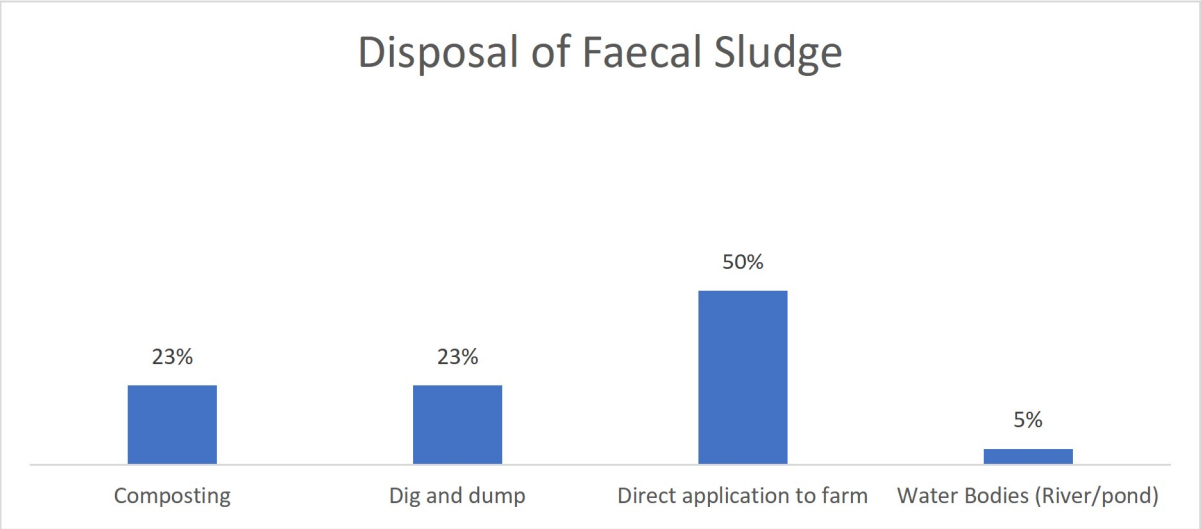

Figure 5: Disposal of manually emptied faecal sludge.

2.1.4 Institutional Level Sanitation System

Altogether 61 institutions from the commercial buildings, educational institutions, governmental and non-governmental offices, health care centres, financial, home stay and hotels were monitored. It was revealed that 100% of such buildings had connected their toilet to an onsite sanitation system. Figure 6 shows the types of containment installed in the institutions. Unlike in the households, 48% of the institutions have installed fully lined tanks while only 25% have single offset pits. The differences are observed as most of the institutions are located in the urban area.

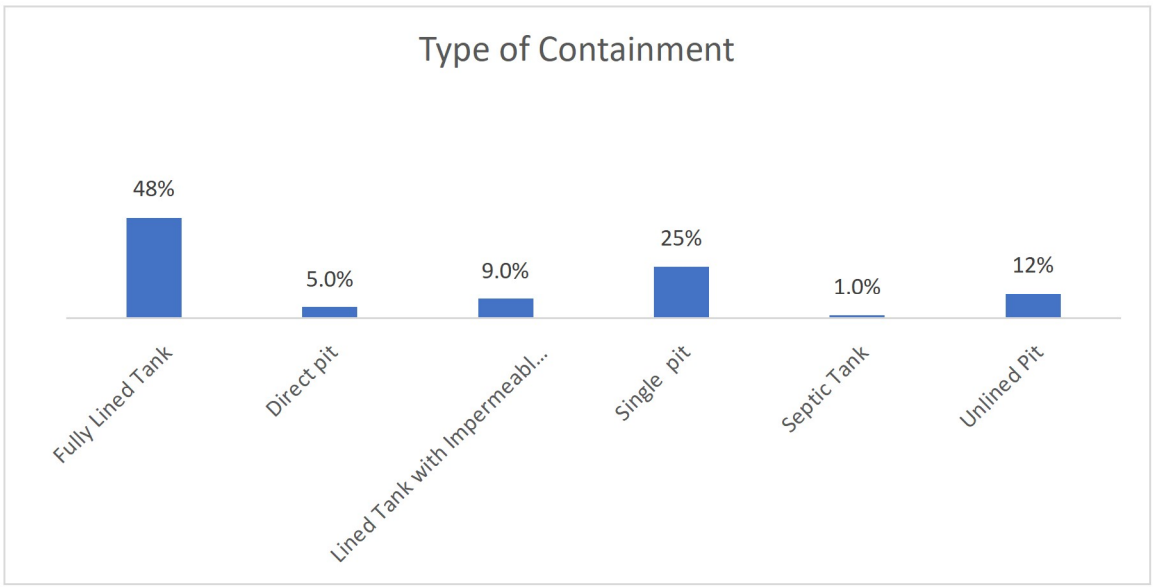

Figure 6: Types of containment in institutions of Badimalika Municipality.

Figure 7 displays the distribution of various onsite sanitation systems used by institutions in different wards of the Badimalika Municipality.

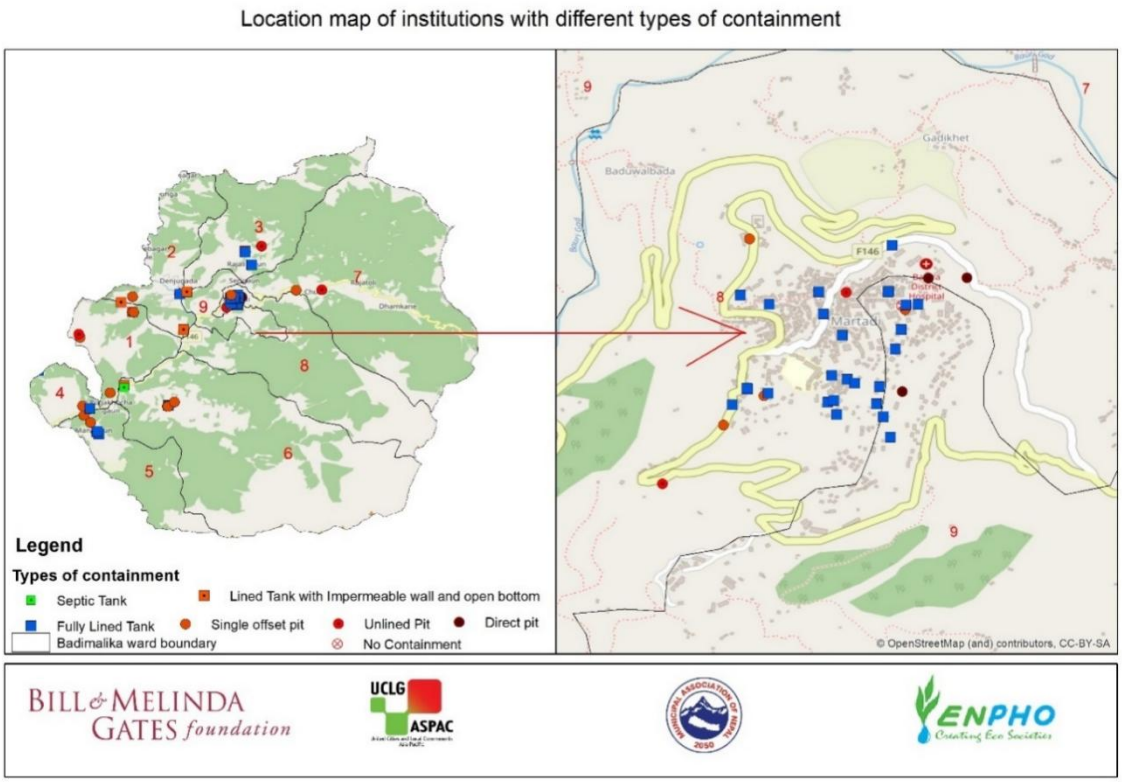

Figure 7: Types of onsite sanitation systems of institutions in Badimalika Municipality.

2.1.5 Water Supply

The river, stream and spring are major sources of water supply in the municipality. Currently, 94 small community level water supply projects are delivering the water supply services in the Municipality. The households served with private tap in the municipality is 379 and almost 2,398 households rely on the public tap.

Table 2 shows the number of water supply projects, types of sources and availability of water in the source. Out of 94 water supply projects in the municipality, 93 projects are gravity flow system whereas uplifting system is adopted in one of them.

Table 2: List of various types and regularity of water supply projects in the municipality.

Types and regularity of water supply projects									
Ward	Number of water supply projects	Type of project		Type of Source			Availability of the flow		
		Gravity	Electric Lifting	Spring	Stream	river	Yearly	Up to 11-12 months	Less than 11-12 month
1	4	4	0	5	0	0	2	2	1
2	6	6	0	6	0	0	4	2	0
3	6	6	0	6	0	0	5	0	1
4	8	8	0	10	0	0	10	0	0
5	9	9	0	9	0	0	7	0	1
6	14	14	0	13	2	0	14	1	0
7	22	21	1	20	3	0	21	1	1
8	18	18	0	14	3	2	14	0	5
9	7	7	0	6	0	0	6	0	1
Total	**94**	**93**	**1**	**89**	**8**	**2**	**83**	**6**	**10**
(WASH-Plan, 2020)									

Martadi Largescale Drinking Water Supply Users Committee is the major sector supplying the drinking water in this municipality since 1985 A.D. The system serves 450 households in ward-8 and ward-9. The water users committee has planned to extend its service for 900 HHs. The source of water is river which lies in the jungle. The water from the source is collected in 250,000 litres reservoir tank and four distribution tanks with each 50,000 litres capacity.

The system has used Rapid Sand Filter and Chlorination unit for the treatment of water. The system is distributing water for 2-3 hours a day in both dry and wet season. In addition, the service is providing 24 hours water supply in major institutions such as schools and health post in the municipality.

2.1.6 Public Toilet

There are three public toilets in the municipality. These toilets are installed in the premises of Temple, an open space nearby the municipal and district office building, and a local tourist destination.

Due to bad operation and maintenance, both systems are not successfully run and have not been used in a while. This is because there is no one to administer the facility (Municipal Officers, 2022).

Figure 8: Public Toilet at Badimalika Municipality.

2.2 SFD Selection Grid

Types of sanitation technology selected in the SFD selection grid in the municipality is shown in Figure 9. The vertical column in the left side of the SFD selection grid has a list of technologies to which the toilet is connected to and open defecation in case of households without toilet. Similarly, horizontal row at the top of the selection grid shows options for connection for outlet or overflow discharge from toilet. Twin pits, unlined 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 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	T1A1C6	T1A1C7			Not Applicable
Septic tank					Significant risk of GW pollution Low risk of GW pollution					
Fully lined tank (sealed)					Significant risk of GW pollution Low risk of GW pollution	T1A3C6		T1A3C8		T1A3C10
Lined tank with impermeable walls and open bottom	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	T1A4C6		T1A4C8		T2A4C10 T1A4C10
Lined pit with semi-permeable walls and open bottom	Not Applicable									T2A5C10 T1A5C10
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 9: SFD selection grid for Badimalika Municipality.

Sanitation technology and/or systems which ensure safe level of protection from excreta i.e., pathogen transmission to the user or general public is limited, is considered to have FS contained. Similarly, sanitation technology and/or sanitation system which does not ensure safe level of protection from excreta. I.e., pathogen transmission to the user or general public, is likely to be considered to have FS not contained (Susana, 2018).

2.2.1 Containment

The grid generated based on the study conducted at Badimalika Municipality shows containment technology and its connection, including an onsite container directly connected to open drain or storm sewer (T1A1C6) and to water body (T1A1C7). Fully lined tanks (sealed) connected to open drain or storm sewer (T1A3C6), to open ground (T1A3C8) and also with no outlet or overflow (T1A3C10) are found. Lined tanks with impermeable walls and open bottom connected to open drain or storm sewer (T1A4C6) and to open ground (T1A4C8) and also with no outlet or overflow (T1A4C10 and T2A4C10) are also encountered.

Twin pits and single pits are categorized as lined pits with semipermeable walls and open bottom for SFD graphic as the wall in this system is made up of mud mortar through which infiltration is high. Lined pits with semi-permeable walls and open bottom with no outlet or overflow are selected on (T1A5C10) and lined pits with semi-permeable walls and open bottom with no outlet or overflow with ‘significant risk’ are also selected on grid (T2A5C10).

Furthermore, unlined pits with no outlet or overflow are selected on grid (T1A6C10) and unlined pits with no outlet or overflow with 'significant risk' are also selected on grid (T2A6C10). Despite being declared as an Open Defecation Free (ODF) city, the municipality has knowledge of open defecation practises at water bodies and open ground, so this practice is selected on grid (T1B11C7 To C9).

Brief explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 9 is explained in Table 3.

Table 3: Explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 9.

T1A1C6	A fully functioning toilet discharging directly to an open drain or storm sewer. All the excreta in this system are considered not contained.
T1A1C7	A fully functioning toilet discharging directly to a water body. All the excreta in this system are considered not contained.
T1A3C6	A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. Since the tank is fitted with supernatant/effluent overflow connected to open drain or storm sewer the excreta in this system are considered not contained.
T1A3C8	A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. Since the tank is fitted with supernatant/effluent overflow connected to open ground the excreta in this system are considered not contained.
T1A3C10	A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. Since the tank is not fitted with a supernatant/effluent overflow this system is considered contained.
T1A4C6	A correctly designed, properly constructed and well maintained fully lined tank with sealed, impermeable walls and open; permeable base, through which infiltration can occur. Since the tank is fitted with a supernatant/effluent overflow connected to an open drain or storm sewer the excreta in this system are considered not contained.
T1A4C8	A correctly designed, properly constructed and well maintained fully lined tank with sealed, impermeable walls and open; permeable base, through which infiltration can occur. Since the tank is fitted with a supernatant/effluent overflow connected to open ground, the excreta in this system are considered not contained.
T2A4C10 (High Risk)	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. The tank is NOT fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered not contained.
T1A4C10 (Low Risk)	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. However, since the tank is not fitted with a supernatant/effluent overflow this system is considered contained.
T2A5C10 (High Risk)	A correctly designed, properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered not contained.
T1A5C10 (Low Risk)	A correctly designed, properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow, so this system is considered contained.

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.
T2A6C10 (Low 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, 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.

2.3 SFD Matrix

The second step in the process of developing the SFD graphic is the calculation of proportion of contents of each type of onsite container which is faecal sludge. Here, data for each selected sanitation system on the SFD Matrix is entered.

The SFD matrix calculates the proportion of people using each type of system and the proportion of each system from which FS and supernatant is emptied, transported and treated. A detailed instruction on how to calculate SFD proportion in SFD PI was used as guide to calculate SFD proportion. As stated on SFD PI, the default "100%" value is used for onsite containers which are connected to soak pits, water bodies or to open ground. This will model the contents as 100% faecal sludge and a proportion of this may be emptied periodically. The remaining not emptied fraction is made up of one or more of the following: faecal sludge which remains in the container, supernatant (when discharging to water bodies or to open ground), and infiltrate. The value for onsite containers that are connected to a sewer network or to open drains is used as "50%" which means half of the contents are modelled FS and a proportion of this may be emptied periodically. The remaining not emptied fraction will comprise faecal sludge which remains in the container and, in the case of open-bottomed tanks, infiltrate. The other half of the contents is modelled as supernatant discharging into the sewer network or to open drains. The formula obtained from SFD PI used for FS proportion calculation is shown below:

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

Here, data for each selected sanitation system on the SFD Matrix is 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 10. Since the Municipality does not have proper sewer networks or a wastewater treatment plant, the proportion of wastewater delivered to the treatment plant is 0. Similarly, W5c is the proportion of wastewater treated in the treatment plant, which is also 0%. Similarly, the proportion of FS emptied and delivered to treatment and then to a treatment plant afterwards is shown column F4 and F5 respectively. (Susana, 2018). Figure 10 shows the SFD matrix of the Municipality.

Badimalika Municipality, Sudhurpaschim, Nepal, 22 Jul 2022. SFD Level: 2 - Intermediate SFD
Population: 17227
Proportion of tanks: septic tanks: 100%, fully lined tanks: 79%, lined, open bottom tanks: 99%

Containment								
System type	Population	WW transport	WW treatment	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	W4c	W5c	F3	F4	F5	S4e	S5e
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants	Proportion of wastewater delivered to treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated	Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants	Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated
T1A1C6 Toilet discharges directly to open drain or storm sewer	0.6	0.0	0.0					
T1A1C7 Toilet discharges directly to water body	0.6							
T1A3C10 Fully lined tank (sealed), no outlet or overflow	2.0			14.3	0.0	0.0		
T1A3C6 Fully lined tank (sealed) connected to an open drain or storm sewer	1.7			16.7	0.0	0.0	0.0	0.0
T1A3C8 Fully lined tank (sealed) connected to open ground	0.3			0.0	0.0	0.0		
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	13.5			38.3	0.0	0.0		
T1A4C6 Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	6.3			50.0	0.0	0.0	0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	1.7			0.0	0.0	0.0		
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	17.6			9.8	0.0	0.0		
T1A6C10 Unlined pit, no outlet or overflow	23.6			25.6	0.0	0.0		
T1B11 C7 TO C9 Open defecation	1.1							
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	4.6			37.5	0.0	0.0		
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	24.2			4.8	0.0	0.0		
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	2.0			28.6	0.0	0.0		

Figure 10: SFD Matrix of Badimalika Municipality.

2.3.1 SFD Matrix Explanation

The sanitation technologies and the corresponding percentage of the population using such technologies are shown in Table 4.

Table 4: 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	0.6%
2	User interface discharges directly to water body	T1A1C7	0.6%
3	Fully lined tank (sealed), no outlet or overflow	T1A3C10	2.0%
4	Fully lined tank (sealed), connected to an open drain or storm sewer	T1A3C6	1.7%
5	Fully lined tank (sealed), connected to open ground	T1A3C8	0.3%
6	Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	13.5%
7	Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	T1A4C6	6.3%
8	Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	1.7%
9	Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	17.6%
10	Unlined pit, no outlet or overflow	T1A6C10	23.6%
11	Open defecation	T1B11 C7 TO C9	1.1%
12	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A4C10	4.6%
13	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A5C10	24.2%
14	Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A6C10	2.0%

2.3.2 Risk of Groundwater Pollution

The risk of groundwater pollution is assessed according to the following explained criteria.

Source of Drinking water and water production

Martadi Largescale water supply and sanitation users committee has been providing drinking water since 1985 in the urban areas of the municipality which is ward 8 and 9. The source of water is river from the nearby jungle. The water from the river gets stored in reservoir tank with capacity of 2,50,000 litres and four other 50,000 litres reservoir for the distribution. The system has used Rapid Sand Filter and Chlorination unit for the treatment of water. The system distributes water for 2-3 hours a day in both dry and wet season (KII, 2022).

From the Household survey of Badimalika Municipality, about 65% of the households have access to piped drinking water supply service through either a private tap or public taps operated by the water users committee while remaining households rely on spring source.

As per the water quality data report published by SUAAHARA, 2018 of Bajura District, all the systems including reservoir, source, private taps were found presence of *E. coli* (bacteria found in faecal sludge). Table 5 shows the water quality report in reservoir tank and sources.

Table 5: Water Quality Data.

Parameters	Unit	Sample Type	
		RVT	Source
Temperature (Celsius)	Celsius	20.5	20.9
pH	-	8.43	8.09
Turbidity (NTU)	NTU	5.00	5.00
Total Hardness (mg/L)	mg/L	135.00	135.00
Ammonia (mg/L)	mg/L	0.20	0.20
Nitrate (mg/L)	mg/L	ND (<0.2)	10.00
Iron (mg/L)	mg/L	ND (<0.05)	ND (<0.05)
Manganese (mg/L)	mg/L	ND (<0.05)	ND (<0.05)
Arsenic (mg/L)	mg/L	ND (<0.005)	ND (<0.005)
Free Residual Chlorine (mg/L)	mg/L	-	-
Total Coliform (CFU/100 mL)	CFU/100 mL	36	26
***E. Coli* (CFU/100 mL)**	CFU/100 mL	11	8
			(SUAAHARA, 2018)

Which indicates that the majority of the municipality's drinking water sources are contaminated, necessitating the use of any Point of Unit (POU) method, such as filtration, chlorination, sun disinfection, or boiling water. The household using any of these POU options before drinking in the municipality is shown in Table 6 below.

Table 6: Percentage of households using POU options.

Source	Do you use POU option for treatment	
	No	Yes
Private Tap	38.73%	4.34%
Public Tap	13.58%	7.51%
Spring Source	30.35%	5.29%
Dug Well	0	0.29%
Total	**82.66%**	**17.43%**

82.66% of the households in the municipality do not use any kind of Point of Unit (POU) options of treatment before drinking. That is considered as high risk as it can directly affect the human health. Whereas remaining household are in safe side as they are using POU option of treatment before drinking.

2.3.3 Proportion of FS emptied and transported

Proportion of FS emptied from the containment is considered as 100% as emptying is done manually and assumed that all FS gets emptied. All the containment that has been emptied at least once after the installation has been emptied manually. During the manual emptying, the containment is completely emptied, i.e., 100% of FS in the containment is emptied. Thus, the proportion of FS emptied from each containment is calculated as

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

The proportion of FS emptied from different types of sanitation technologies is shown in Table 7.

Table 7: Sanitation Technologies and Proportion of Faecal Sludge Emptied.

S.N.	Sanitation Technologies	SFD Reference Variable	Percentage of Emptied Containment	Proportion of FS emptied during emptying	F3
1	User interface discharges directly to open drain or storm sewer	T1A1C6	0%	100%	0%
2	User interface discharges directly to water body	T1A1C7	0%	100%	0%
3	Fully lined tank (sealed), no outlet or overflow	T1A3C10	14.3%	100%	14.3%
4	Fully lined tank (sealed), connected to an open drain or storm sewer	T1A3C6	16.7%	100%	16.7%
5	Fully lined tank (sealed), connected to open ground	T1A3C8	0%	100%	0%
6	Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	38.3%	100%	38.3%
7	Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	T1A4C6	50%	100%	50%
8	Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	0%	100%	0%
9	Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	9.8%	100%	9.8%
10	Unlined pit, no outlet or overflow	T1A6C10	25.6%	100%	25.6%
11	Open defecation	T1B11 C7 TO C9	0%	100%	0%
12	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A4C10	37.5%	100%	37.5%
13	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A5C10	4.8%	100%	4.8%
14	Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A6C10	28.6%	100%	28.6%

Composting and dig and dump practises are carried out without any pre-treatment of the emptied FS, so it is considered as an unsafely practise of managing the FS. Moreover, there is no treatment plant in the municipality. Therefore, the transported FS to treatment (variable F4) and treated (variable F5) are both set to 0% for all sanitation systems. Table 8 shows the sanitation technologies and the proportion of faecal sludge emptied, transported and treated.

Table 8: Sanitation Technologies and Proportion of Faecal Sludge Emptied, Transported and Treated.

S.N.	Sanitation Technologies	SFD Reference Variable	F3	F4	F5
1	User interface discharges directly to open drain or storm sewer	T1A1C6	0%		
2	User interface discharges directly to water body	T1A1C7	0%		
3	Fully lined tank (sealed), no outlet or overflow	T1A3C10	14.3%	0	0
4	Fully lined tank (sealed), connected to an open drain or storm sewer	T1A3C6	16.7%	0	0
5	Fully lined tank (sealed), connected to open ground	T1A3C8	0%	0	0
6	Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	38.3%	0	0
7	Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	T1A4C6	50%	0	0
8	Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	0%	0	0
9	Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	9.8%	0	0
10	Unlined pit, no outlet or overflow	T1A6C10	25.6%	0	0
11	Open defecation	T1B11 C7 TO C9	0%	0	0
12	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A4C10	37.5%	0	0
13	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A5C10	4.8%	0	0
14	Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A6C10	28.6%	0	0

2.4 Summary of assumptions

Offsite sanitation systems:

- ✓ 1.2% of the toilets discharge directly to an open drain or water body (T1A1C6 and T1A1C7). Since there is no treatment plant, all wastewater is disposed of untreated into the environment.

Onsite sanitation systems:

- ✓ The proportion of FS in septic tanks were set to 100%, the proportion of FS in fully lined tanks was set to 79% and the proportion of FS in lined tanks with impermeable walls and open bottom and all types of pits was set to 99% according to the relative proportions of the systems in the municipality, as per the guidance given in the Frequently Asked 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.
- ✓ The traditional practice of composting and dig and dump the FS after emptying is not considered to be as a safely practice of managing emptied faecal sludge. Moreover, the municipality does not have any designated faecal sludge treatment plant. Therefore, variables F4 and F5 are both set to 0% for all sanitation systems.

2.5 SFD Graphic

Figure 11 depicts the SFD graphic for the municipality where 44% of the excreta produced are managed safely while 56% are managed unsafely.

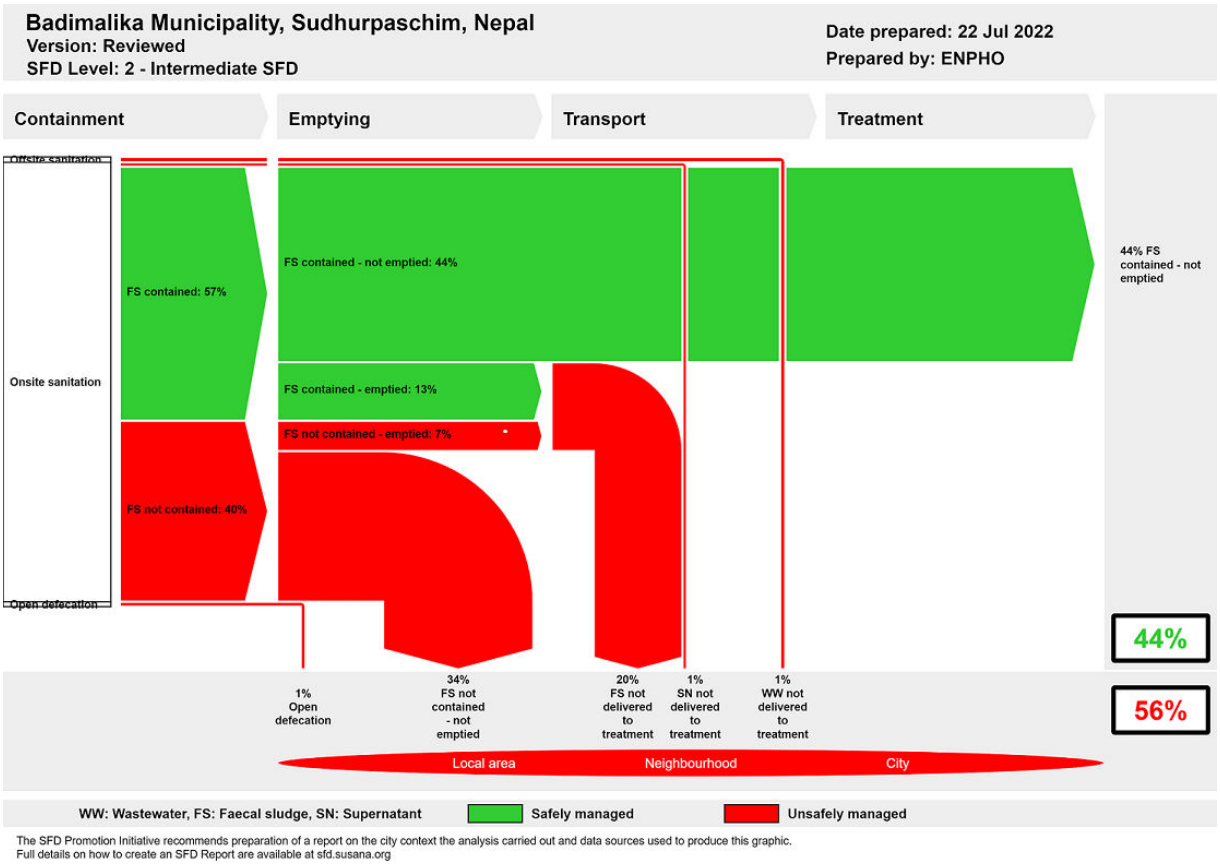

Figure 11: SFD graphic of Badimalika Municipality.

The faecal sludge that is safely managed is further segregated as 44% of FS is safely collected in the containment which has not been emptied. The FS that is unsafely managed is divided into two categories: as 7% of FS is unsafely collected which is emptied and 34% of FS is unsafely managed as it has not been emptied, both having a risk of groundwater contamination through seepage. 20% of FS (contained and not contained) is emptied and unsafely disposed of into the environment or water bodies without treatment.

Additionally, 1% of the supernatant is released into the environment untreated. Similar to this, wastewater generated from 1% of the population is disposed untreated.

Lack of a faecal sludge treatment plat in the municipality leads to disposal of FS in farmland and water bodies. Considering the SFD graphic, FS management is a concern for the municipality even though FS which is safely collected but not emptied will eventually be emptied in future and requires safe management.

2.5.1 Onsite Sanitation

According to the Nepal Demographic and Health Survey, off-site sanitation systems linked to piped sewer networks are used by 6.9% of the country's urban residents (MoH, 2017) . In Badimalika Municipality, no pipe networks have been established. However, 1% of the population has a connection between their toilet and a nearby open sewer or body of water.

2.5.2 Offsite Sanitation

The onsite sanitation system serves 98% of the municipality's population. 4% of the population in the municipality utilize fully lined tanks that are sealed, which is technically correct installation. Majority of people (42%) rely on lined pits with semi-permeable walls and open bottom which is followed by lined tanks with permeable walls and open bottom and unlined pits.

The description on flow of excreta from the onsite sanitation system as shown in the SFD graphic is explained in Table 9.

Table 9: 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.	57%
FS not contained	Faecal sludge that is stored in an unsafe onsite sanitation technology.	40%
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 with impermeable walls and open bottom without outlet or overflow (T1A4C10), lined pits with semi-permeable walls and open bottom without outlet or overflow (T1A5C10) and unlined pits (T1A6C10) without significant risk to groundwater.	44%
FS contained – emptied	FS that is contained in onsite sanitation technology and emptied either mechanically or manually.	13%
FS not contained – emptied	FS that is not contained within an onsite sanitation technology and emptied either mechanically or manually.	7%
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.	34%
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.	20%
SN not delivered to treatment	SN not contained from Fully lined tanks connected to open drain or storm sewer.	1%
WW not delivered to treatment	All wastewater from toilets discharges going directly to open drain or water bodies.	1%

2.5.3 Open Defecation

Despite being declared as open defecation free municipality, population residing in 1% of households still defecates outside in the vicinity of forests and other open spaces. This population with high defecation rate is economically underdeveloped.

3. Service Delivery Context

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 fulfil the provisions related to right on water and sanitation, Government of Nepal has enforced Drinking Water and Sanitation Act, 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 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.

3.1.2 *Institutional roles*

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 12.

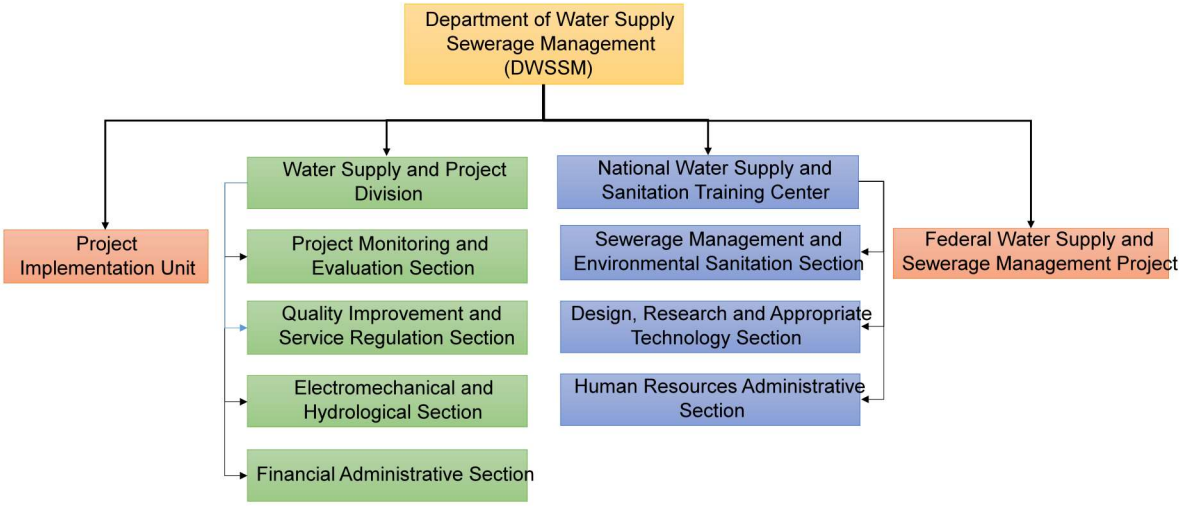

Figure 12: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

Ministry of Urban Development (MoUD): It works on integrated urban planning and development in municipalities, including faecal sludge management respectively (GoN, 2015). Department of Urban Development and Building Construction (DUDBC) under MoUD is proactive for setting 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 500 to 1,000 in Himalayan region.

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 socio-economic development. The policy has aimed to remedy challenges such as structuring of projects, land acquisition, coordination and approval, payments to private sectors and approval for environment impact (MoF, 2015).

Comprehensive Martadi Water Users Committee is providing drinking water since 1985 in ward 8 and 9 in the municipality. The major source of water is river. It is distributed after treatment using chlorination ensuring National Drinking Water Quality Standards (KII, 2022).

The municipality has been providing regular services on door-to-door solid waste collection from water supply and sanitation section. The solid waste is being managed in the solid waste dumping site without any segregation process. Also, the public toilets have been constructed and operation is leased to the users committee in major urban cluster of municipalities.

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

Table 10: Sanitation Service Level and its Components.

	Service Components	Service Level		
		High	Medium	Basic
1	Health and Hygiene Education	✓	✓	✓
2	Household Latrine	✓	✓	✓
3	Public and School Toilets	✓	✓	✓
4	Septic tank sludge collection, transport, treatment, and disposal	✓	✓	✓
5	Surface drains for collection, transmission, and disposal of grey water	✓	✓	✓
6	Small-bore sewer collection for toilet and septic tank effluent, low-cost treatment and disposal		✓	
7	Sanitary sewers for wastewater collection, transmission, non-conventional treatment, and disposal	✓		
8	Sanitary sewers for wastewater collection, the transmission of conventional treatment and disposal	✓		
9	Limited solid waste collection and safe disposal	✓	✓	✓

3.2 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 11.

Table 11: 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 Equity

3.3.1 *Current choice of services for 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.

3.3.2 *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 municipality. 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 municipality. Interviews were performed with Mr. Dambar Bahadur Mahat, Acting Mayor, Mr. Min Bahadur Dhani, Technical officer from Agricultural Development Branch, Mr. Shankar Kumar Khadka and Mr. Sher Bahadur Budha, Sub-Engineer of Badimalika Municipality for the planning and the activity that is going on sanitation sector and Mr. Karna Bahadur Rawal, Chairperson of Comprehensive Martadi Comprehensive Water Users Committee, Martadi, Bajura for drinking water supply in the municipality (Table 12 and Figure 13).

Table 12: List of Key Informant Interviewed personnel.

S.N.	Name	Designation	Organization	Purpose of KII	Date
1.	Dambar Bahadur Mahat, Min Bahadur Dhani, Shankhar Kumar Khadka, Sher Bahadur Budha. (KII-1)	Acting Mayor, Technical Officers, Sub-Engineer	Badimalika Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	9th June, 2022
2.	Karna Bahadur Rawal (KII-2)	Chairperson	Martadi Comprehensive Water Uses Committee	Supply and demand of water, water sources, groundwater contamination risk, availability of water	9th June, 2022

Figure 13: KII with Chairperson of Martadi Comprehensive Water Users Committee.

4.2 Household Survey

Household (HH) 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 the HH 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.

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 337 households were sampled from 4,733 households distributed in 9 wards with proportionate stratification random sampling which is shown in Figure 14.

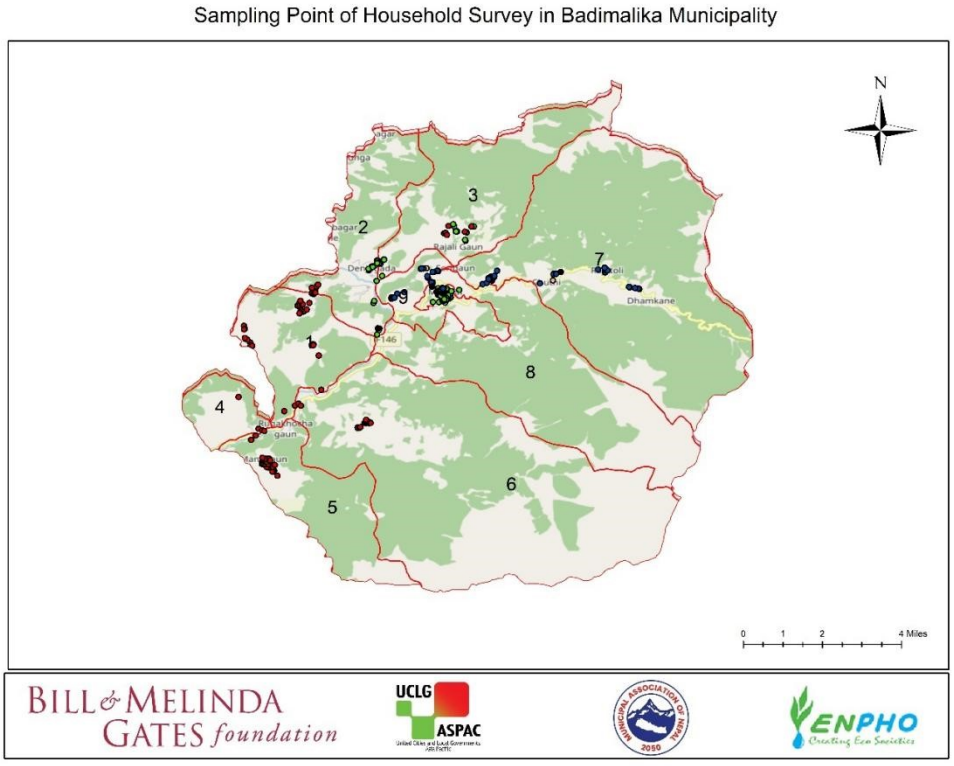

Figure 14: Distribution of sampling points in different wards of Badimalika Municipality.

4.2.2 *Direct Observation*

The urban areas of the municipality consists of storm water drain. From the KIIs with the municipal officers, it was confirmed that during the monsoon season, most of the households from the municipality empty their containment directly to the storm drainage though it is against the law. The main supply method for distributing drinking water in the municipality is the pipeline network, in a similar manner. Individual pipelines are, however, taken through the storm water drain, which is not a safe procedure because of the high level of contamination in this system (Figure 15).

Figure 15: Storm Water Drain in urban area of Badimalika Municipality.

4.3 Sharing and Validation of Data

The sharing and validation of findings on sanitation status were conducted in the municipality hall in participation of the Mayor, Deputy Mayor, Ward Chairpersons, CEO, General members of municipal council and other relevant stakeholders, as shown in Figure 16. The participants agreed upon the findings of this study that showed current sanitation status of the municipality. The mayor focused on the need to improve knowledge on faecal sludge of general members of municipal council, key stakeholders and general public as well. As the municipality is shifting towards urbanization, the mayor also mentioned the necessities of proper sanitation system for safe and beautiful city and added that findings of this study support in further planning of sanitation in the municipality.

Figure 16: Sharing and validation workshop of SFD at Badimalika 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 sub-metropolitan city.

We offer our sincere gratitude to Mr. Amar Khadka, Mayor, Ms. Nanda Thapa, Deputy Mayor and Mr. Kiran BK, Chief Administrative Officer of Badimalika Municipality. We would also like to thank Mr. Dambar Bahadur Mahat, Acting Mayor at the time of Program, Mr. Puspa Raj Bhatt, Information officer from Administrative Section, Mr. Hem Thapa IT Officer, Mr. Shankar Kumar Khadka and Mr. Sher Bahadur Budha, Sub-Engineer and other staffs of Badimalika Municipality for their remarkable support during the study.

We would like appreciate Dr. Roshan Raj Shrestha, Deputy Director of Bill and Melinda Gates Foundation (BMGF), Dr. Bernadia Irawati Tjandradewi, Secretary General and Mr. Satish Jung Shah, Knowledge Management 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

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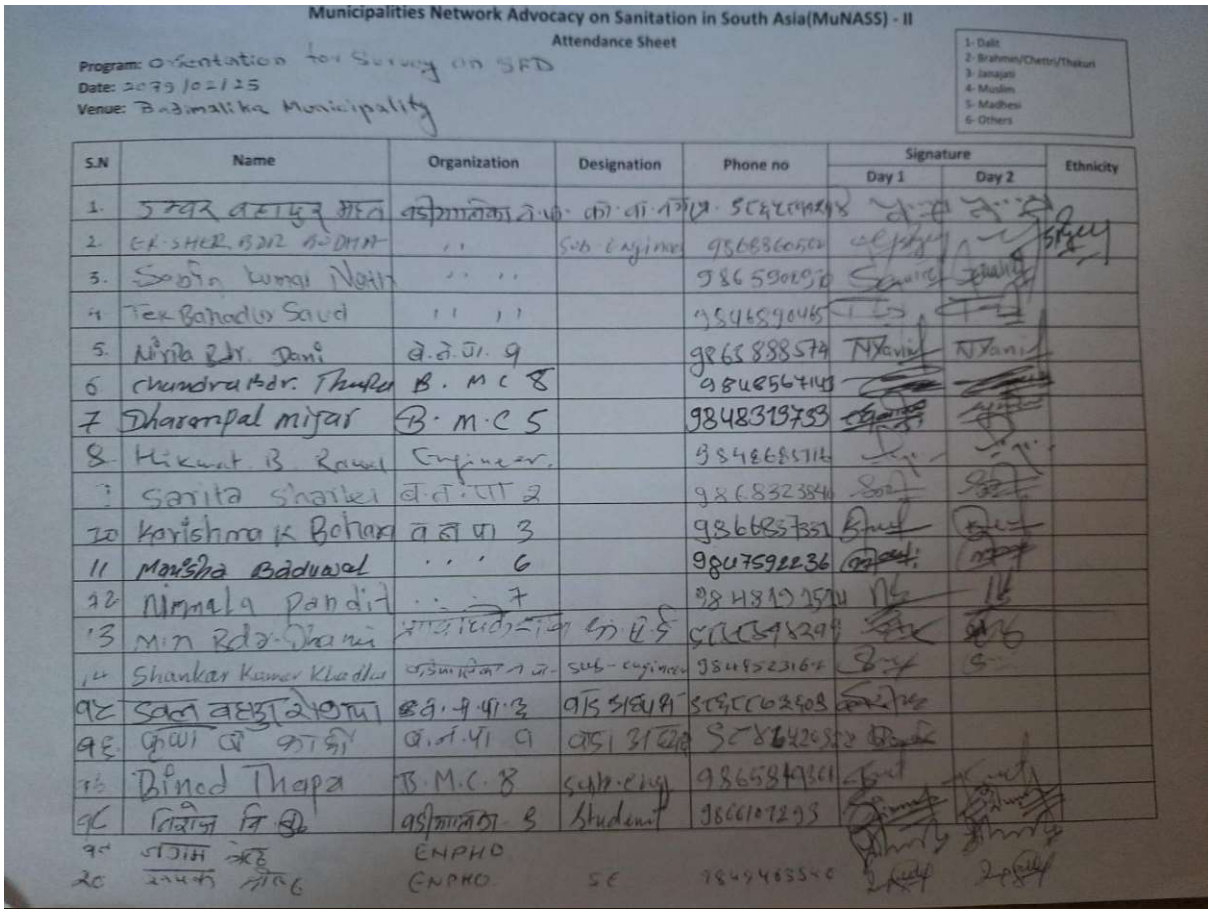
7 Appendix

7.1 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 Orientation Program on shit flow diagram for Household and Institutional Survey

7.3 List of participants on Orientation on Shit Flow Diagram for Survey



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

Attendance Sheet

Program: Orientation for Survey on SFD

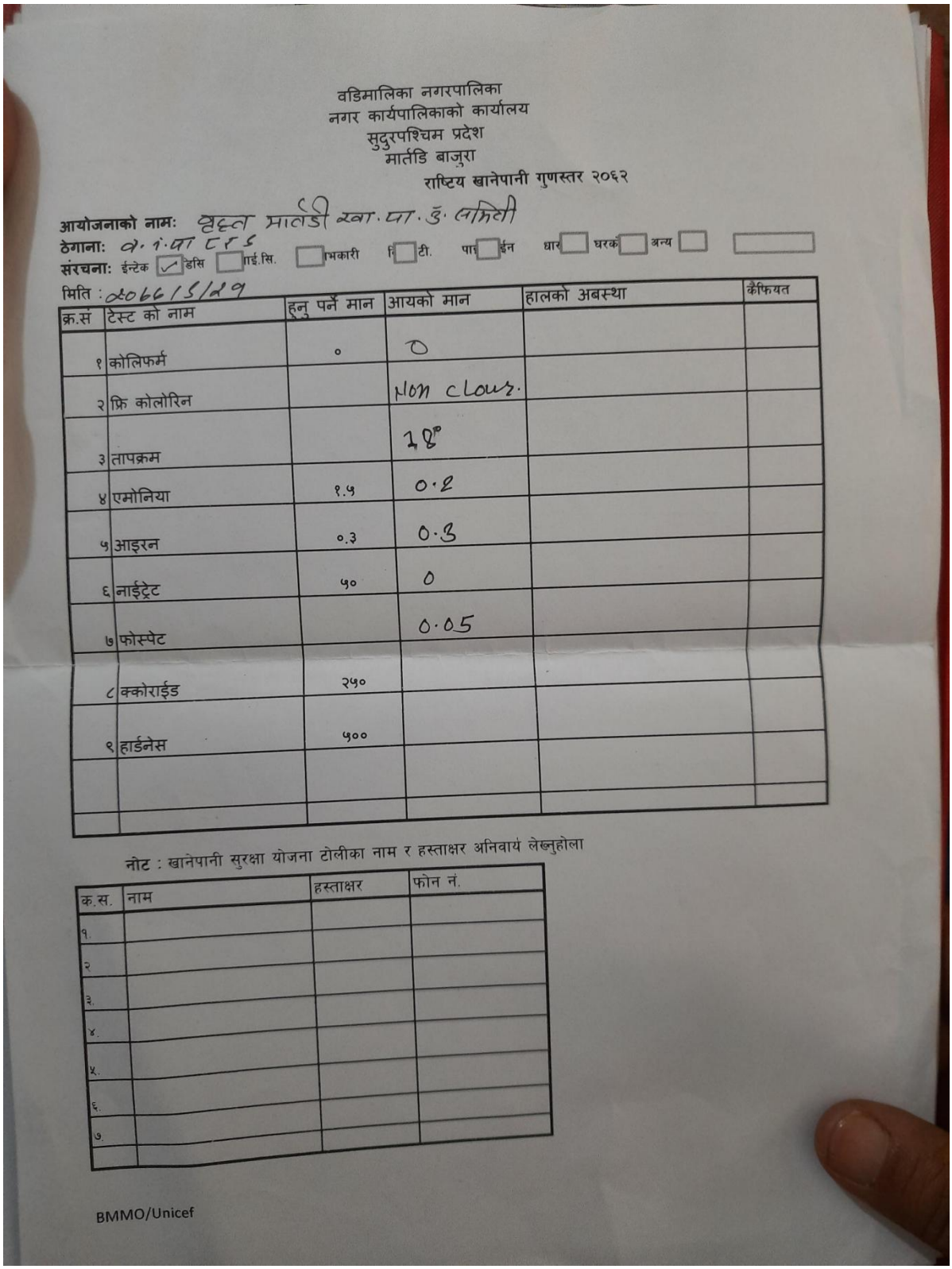
Date: 2079/02/25

Venue: Badimalika Municipality

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.							
2.			Sub Engineer				
3.	Sonia Lungi Nath						
4	Tek Bahadur Saud						
5.	Nirta Bdr. Dani						
6	Chandra Bdr. Thapa	B. M C 8					
7	Dharampal Mijar	B. M. C 5		9848319753			
8	Hikmat B. Rawal	Engineer.					
9	Sarita Shahi						
10	Krishna K Bohara						
11	Manisha Baduwal		6				
12	Nirmala Pandit		7				
13	Min Bdr. Dhami						
14	Shankar Kumar Khadka		Sub-Engineer				
15							
16							
17	Binod Thapa	B. M. C. 8	Sub-Engg				
18			Student				
19		ENPHO					
20		ENPHO	SE				

7.4 Water Quality test report of Martadi Comprehensive Water Users Committee



वडिमालिका नगरपालिका
नगर कार्यपालिकाको कार्यालय
सुदुरपश्चिम प्रदेश
मार्तडि बाजुरा

राष्टिय खानेपानी गुणस्तर २०६२

आयोजनाको नाम: वृहत मार्तडी खा.पा.उ. समिती
ठेगाना: ८.१.पा ८१५
संरचना: इन्टेक ☑ डिसि ☐ आई.सि. ☐ भकारी ☐ टी. पा ☐ ईन धार ☐ घरकै ☐ अन्य ☐

मिति : २०६८/५/२९

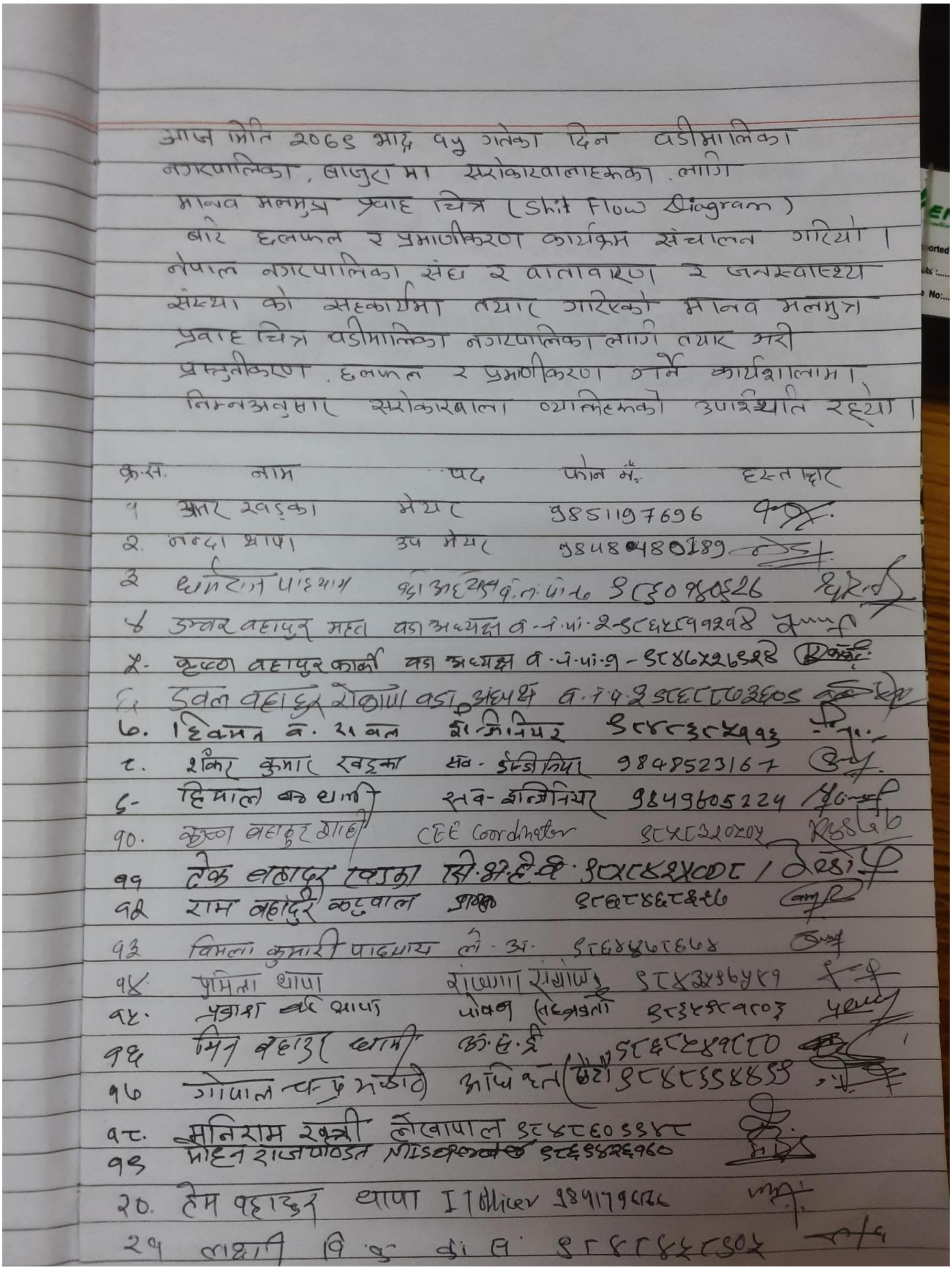
क्र.सं	टेस्ट को नाम	हुनु पर्ने मान	आयको मान	हालको अबस्था	कैफियत
१	कोलिफर्म	०	०		
२	फ्रि कोलोरिन		Non clour.		
३	तापक्रम		18°		
४	एमोनिया	१.५	०.२		
५	आइरन	०.३	०.३		
६	नाईट्रेट	५०	०		
७	फोस्पेट		०.०५		
८	क्कोराईड	२५०			
९	हार्डनेस	५००			

नोट : खानेपानी सुरक्षा योजना टोलीका नाम र हस्ताक्षर अनिवार्य लेख्नुहोला

क.स.	नाम	हस्ताक्षर	फोन नं.
१.			
२.			
३.			
४.			
५.			
६.			
७.			

BMMO/Unicef

7.5 List of Participants in Sharing and Validation Workshop


आज मिति २०७९ भाद्र १५ गतेका दिन बडीमालिका नगरपालिका, बाजुरा मा सरोकारवालाहरूको लागि मानव मलमुत्र प्रवाह चित्र (Shit Flow Diagram) बारे छलफल र प्रमाणीकरण कार्यक्रम संचालन गरियो। नेपाल नगरपालिका संघ र वातावरण र जनस्वास्थ्य संस्था को सहकार्यमा तयार गरिएको मानव मलमुत्र प्रवाह चित्र बडीमालिका नगरपालिका लागि तयार गरी प्रस्तुतीकरण छलफल र प्रमाणीकरण गर्ने कार्यशालामा निम्नअनुसार सरोकारवाला व्यक्तिहरूको उपस्थिति रह्यो।

क्र.सं.	नाम	पद	फोन नं.	हस्ताक्षर
१	अतर खड्का	मेयर	9851197696	
२.	नन्दा थापा	उप मेयर	9848480189	
३	धनराज पाध्याय	वडा अध्यक्ष ब.न.पा.८	९८६०९८०५२६	
४	उम्बर बहादुर महत	वडा अध्यक्ष ब.न.पा.२	९८६४५९१२१४	
५.	कृष्ण बहादुर कार्की	वडा अध्यक्ष ब.न.पा.१	९८४७५२६३२४	
६.	डबल बहादुर रोकाया	वडा अध्यक्ष ब.न.पा.३	९८६८८०३६०९	
७.	हिक्मत ब. रावल	इन्जिनियर	९८४८३८५११३	
८.	शंकर कुमार खड्का	सब-इन्जिनियर	984852316७	
९.	हिमाल ... शाही	सब-इन्जिनियर	9849605224	
१०.	कृष्ण बहादुर शाही	CEE Coordinator	९८५८३२०२०५	
११	टेक बहादुर खड्का	सि.अ.हे.व.	९८५८४२५००८	
१२	राम बहादुर कटुवाल	[illegible]	९८९८४६८४७६	
१३	विमला कुमारी पाध्याय	लो.अ.	९८६४५७८६७४	
१४	प्रमिला थापा	राजस्व सहायक	९८४३५४७५८१	
१५.	प्रकाश ... थापा	पोषण (तह्कुवर्ती)	९८३५९८१८०३	
१६	मिन बहादुर थापा	अ.हे.ई	९८६८२५९८८०	
१७	गोपाल चन्द्र अधिकारी	अधिकृत (छैटौं)	९८४८५५४४५५	
१८.	मनिराम खत्री	लेखापाल	९८४८६०५५४८	
१९	मोहन राज पण्डित	NIS...	९८६५४२६१६०	
२०.	हेम बहादुर थापा	IT Officer	९८४१७९...	
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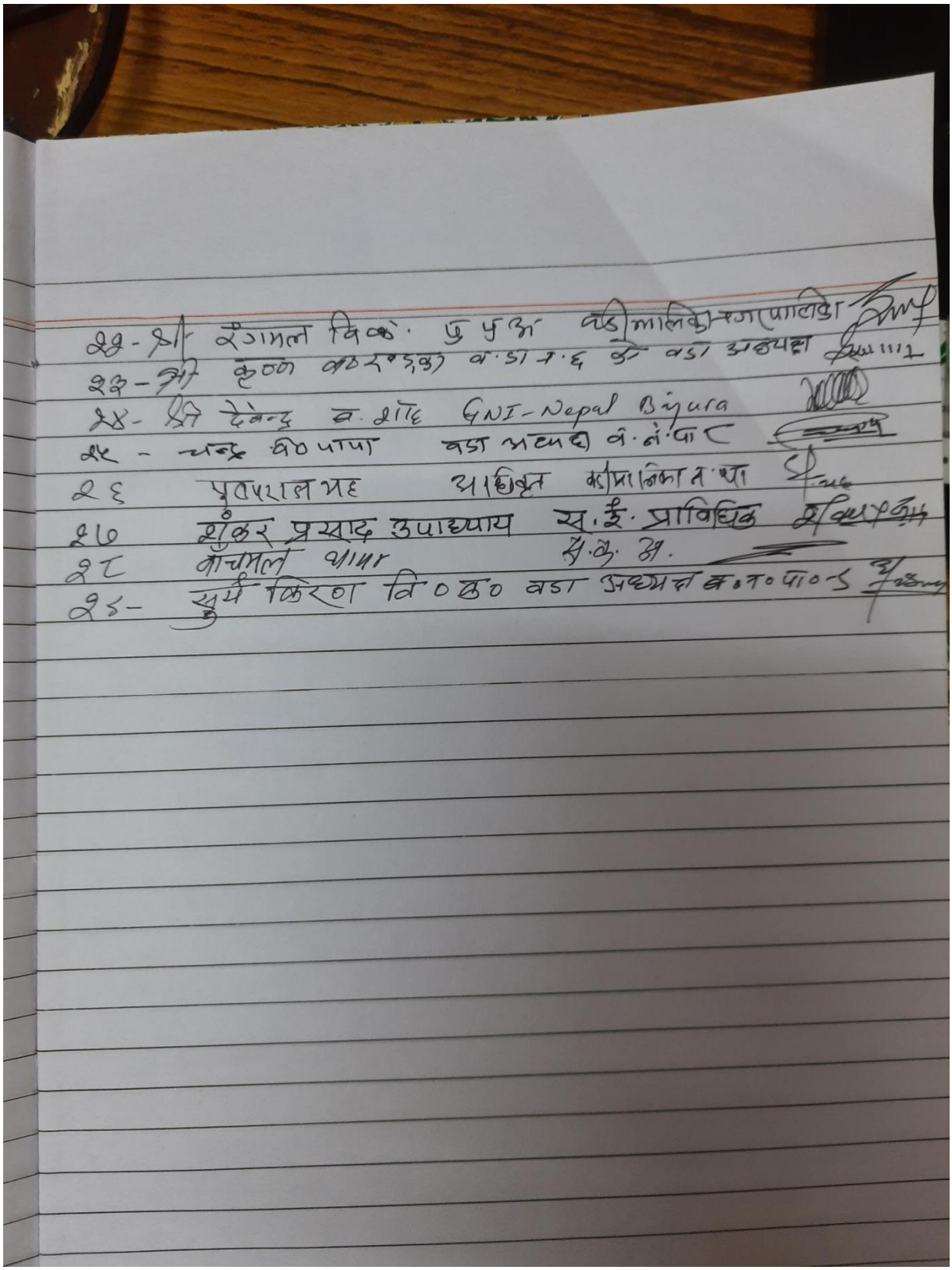
२३- श्री रंगमति वि.वं. उ.प्र.अ. बडीमालिका नगरपालिका
२३- श्री कृष्ण बहादुर बा.डा.ए.इ. को बडा अध्यक्ष
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२६ पृथ्वीराज भट्ट अधिशुल्क कार्यालय का.प्र.
२७ शंकर प्रसाद उपाध्याय स.ई. प्राविधिक
२८ बाचमति थापा ई.अ. अ.
२९- सूर्य किरण वि.ओ. बडा अध्यक्ष क.न.पा.-९

SFD Badimalika Municipality, Nepal, 2022

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