SFD Report

Bidur 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 Bidur Municipality, Nepal, 2025

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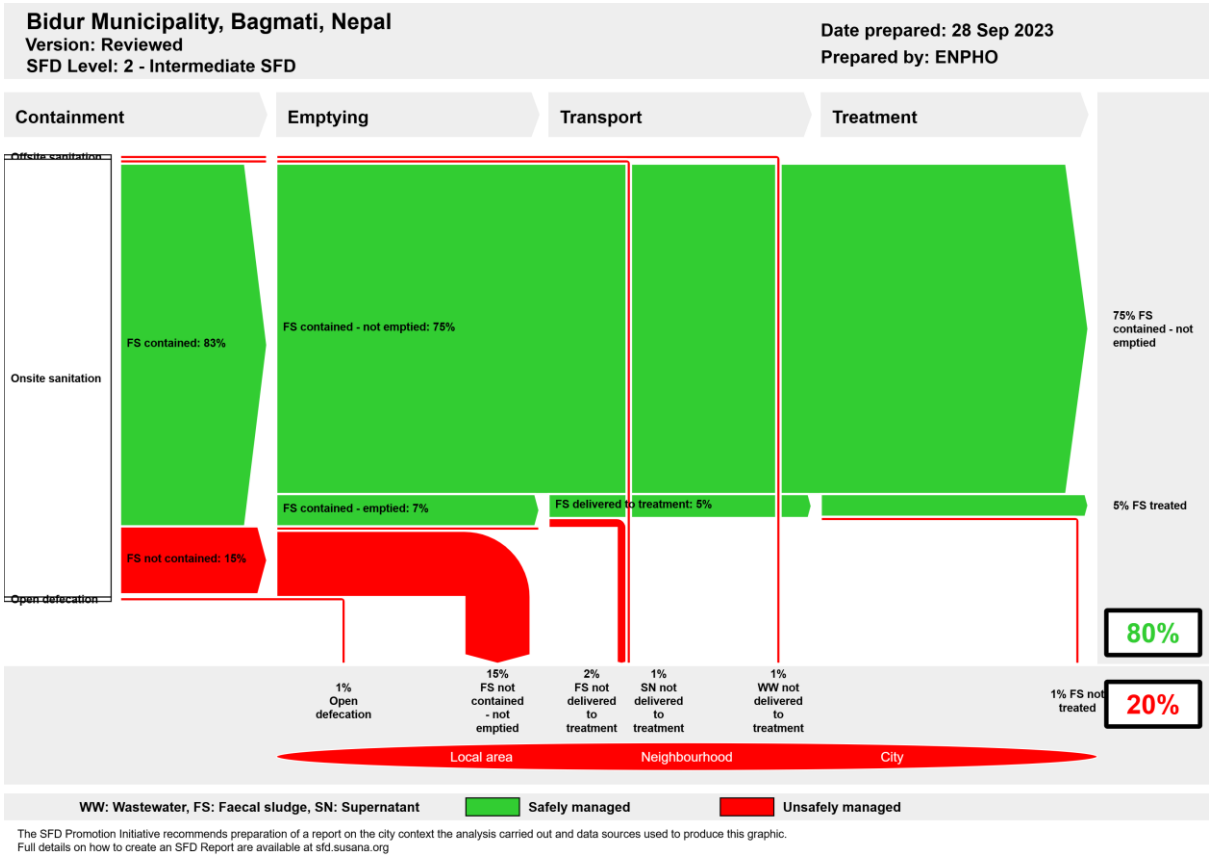
1. The SFD Graphic



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:

Bidur Municipality

Municipal Association Nepal (MUAN)

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

Status:

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3. General city information

Bidur, a municipality is situated in Nuwakot district of Bagmati Province, Nepal which is located at 69 km northwest of Kathmandu Valley. It comprises of 13 political wards and spread over an area of 130.01 square kilometres consisting of plains and hilly plateaus (Bidur Municipality, 2024).

It has a total population of 59,227 individuals across 15,234 households (NSO, 2021). It has subtropics and sub-humid climate, with maximum temperature ranges from 23°C in June to 11°C in January (Climate-Data, 2024).

The municipality lies at 27°53'24" latitude and 85°09'36 " longitude and the altitude of 700 m from sea-level. Human settlements are generally found in the river valley area formed due to alluviation by the Trishuli River and the Tadi River. Human settlements in the mountain rely on production of terraces (WLSP, 2016).

4. Service outcomes

This section provides a quick summary of the various sanitation technologies used across the municipality's sanitation value chain. All data in this section are from the household and institutional surveys conducted for this study. Despite municipality being declared as Open Defecation Free (ODF), still 1% of the total population are deprived from access to basic sanitation facilities and defecate in open places (ENPHO, 2023).

Containment:

Of the total population of municipality having improved sanitation facilities, about 1% rely on offsite sanitation system and 98% rely on onsite sanitation system. The municipality does not have a sewer network and the households with offsite sanitation systems have their toilets connected to an open/stormwater drain. The households with onsite sanitation system have different sanitation technologies. Fully lined tank and lined tank with impermeable walls and open bottom are used by population residing in 2% and 30% of households. Notably, 6% of households have biogas digester. A total of 3% and 57% of household have single offset pit and unlined pit respectively.

All 108 surveyed institutions in the municipality have access to a safely managed sanitation system: 19.44% have fully lined tanks, 25.93% have lined tanks with impermeable walls and open bottoms, 5.56% have lined pit with semi permeable walls and bottom, 47.22% have unlined pit, and a minimal 0.93% have septic tanks.

Emptying and transportation:

Among the household with onsite sanitation system, only 9.73% of household have been emptied their containment atleast once since the installation. Manual emptying is popular in the municipality, and the municipality does not have any kind of desludging services.

Treatment and Disposal:

Bidur Municipality does not have treatment plant for faecal sludge. The emptied faecal sludge is applied in farmlands and disposed by dig and dump method and some uses the sludge as composting.

Risk Assessment:

About 53.33% households have private piped drinking water supply services in the municipality. Bidur Drinking Water Supply and Sanitation User Committee has been providing drinking water services to ward 1,2,4,5,6 and 7 of the municipality. While 34.40% collect drinking water from spring sources and 1.60% rely on jar water. Population using spring sources (located near residential areas with high percentage of households having lined pit with open bottom and unlined pits) as a major source of drinking water are considered at significant risk.

Overall, the SFD graphic shows that excreta generated from 80% of the population is safely managed while 20% of the population are unsafely managed. The safely managed FS generated from 75% of the population is temporary until the FS from the containment is emptied. With the current practice of Faecal Sludge Management (FSM), the proportion of safely managed FS will become unsafely managed once the containments start filling up.

5. Service delivery context

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

Several policies have been in place to accomplish the sanitation 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 in sanitation campaigns. Currently, the municipality has planned to establish a wastewater treatment plant within the municipality with the support of Department of Water Supply and Sanitation Management (DWSSM).

6. Overview of stakeholders

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

Table 1: Overview of stakeholders.

Key Stakeholders	Institutions / Organizations
Public Institutions at Federal Government	Ministry of Water Supply
Public Institutions at Provincial Government	Ministry of Water Supply, Energy, and Irrigation (MoWSEI)
Public Institutions at Local Government	Bidur Municipality
Non-governmental Organizations	Environment and Public Health Organization (ENPHO)
Private Sector	Water Supply and Sanitation User Committees, Public toilet operators
Development Partners, Donors	MuAN, BMGF, UCLG ASPAC

7. Credibility of data

The major data were collected from proportionate stratification random sampling. Altogether, 375 households and 108 institutions were surveyed from 13 wards of the municipality. Primary data on emptying, transportation, and current sanitation practices in the municipality are validated from Key Informant Interviews (KIIs) with municipal stakeholders. The overall data and findings were shared with the stakeholders of the municipality and validated through a sharing program on 3rd January 2024.

8. Process of SFD development

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

9. List of data sources

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

- Bidur Municipality, 2024. Bidur Municipality. [Online] Available at: http://bidurmun.gov.np/
- CBS, 2., 2021. National Population and Housing Census. [Online] Available at: https://censusnepal.cbs.gov.np/results/population?province=3&district=27&municipality=4
- Climate-Data.Org, 2024. Climate-Data.Org. [Online] Available at: https://en.climate-data.org/
- ENPHO, 2023. Sanitation Situtaion Assessment of Bidur Municipality: Unpublished.
- WLSP, W., 2016. Integrated Development Planning of Bidur (2017-2035), s.l.: WLSP and WPDI.

SFD Bidur Municipality, Nepal, 2025

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Abbreviations

AEPC	Alternative Energy Promotion Centre
BMGF	Bill and Melinda Gates Foundation
DWSSM	Department of Water Supply and Sewerage Management
ENPHO	Environment and Public Health Organization
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSTP	Faecal sludge Treatment Plant
GoN	Government of Nepal
HH	Household
IRF	Institutional and Regulatory Framework
KII	Key Informant Interview
KM	Kilometres
MDG	Millennium Development Goal
MICS	Multiple Indicator Cluster Survey
MuNASS-II	Municipalities Advocacy on Sanitation in South Asia – II
MoH	Ministry of Health
MoHP	Ministry of Health and Population
MoWS	Ministry of Water Supply
MuAN	Municipal Association of Nepal
NGO	Non-Governmental Organization
NPC	National Planning Commission
NWSSP	National Water Supply and Sanitation Policy
ODF	Open Defecation Free
PPP	Public Private Partnership
RWSSNP	Rural Water Supply and Sanitation National Policy
SDP	Sector Development Plan
SFD	Shit Flow Diagram
SFD PI	Shit Flow Diagram Promotion Initiative
SN	Supernatant
UCLG ASPAC	United Cities and Local Governments Asia Pacific
UNICEF	United Nations Children's Education Fund
VDC	Village Development Committee
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WSUC	Water Sanitation and User's Committee

1 City context

Bidur Municipality is situated in Nuwakot district of Bagmati Province, Nepal and is located at 69 km northwest of Kathmandu Valley. The municipality was restructured in 2017 by merging Bidur Municipality and former Village Development Committees (VDCs) named Charghare, Tupche, Gerkhu, Kalyanpur, Khadga Bhanjyang. This municipality is located between Suryagarhi and Likhu Rural Municipality in the east, Meghang and Tarakeshwar Rural Municipality in the west, Kispang Rural Municipality and Rasuwa District in the north and Belkotgadhi Municipality in the southern border (Bidur Municipality, 2024). Bidur Municipality comprises of 13 political wards and is spread over an area of 130.01 square kilometres consisting of plains and hilly plateaus (Bidur Municipality, 2024). Figure 1 shows the map of the municipality with its ward boundaries.

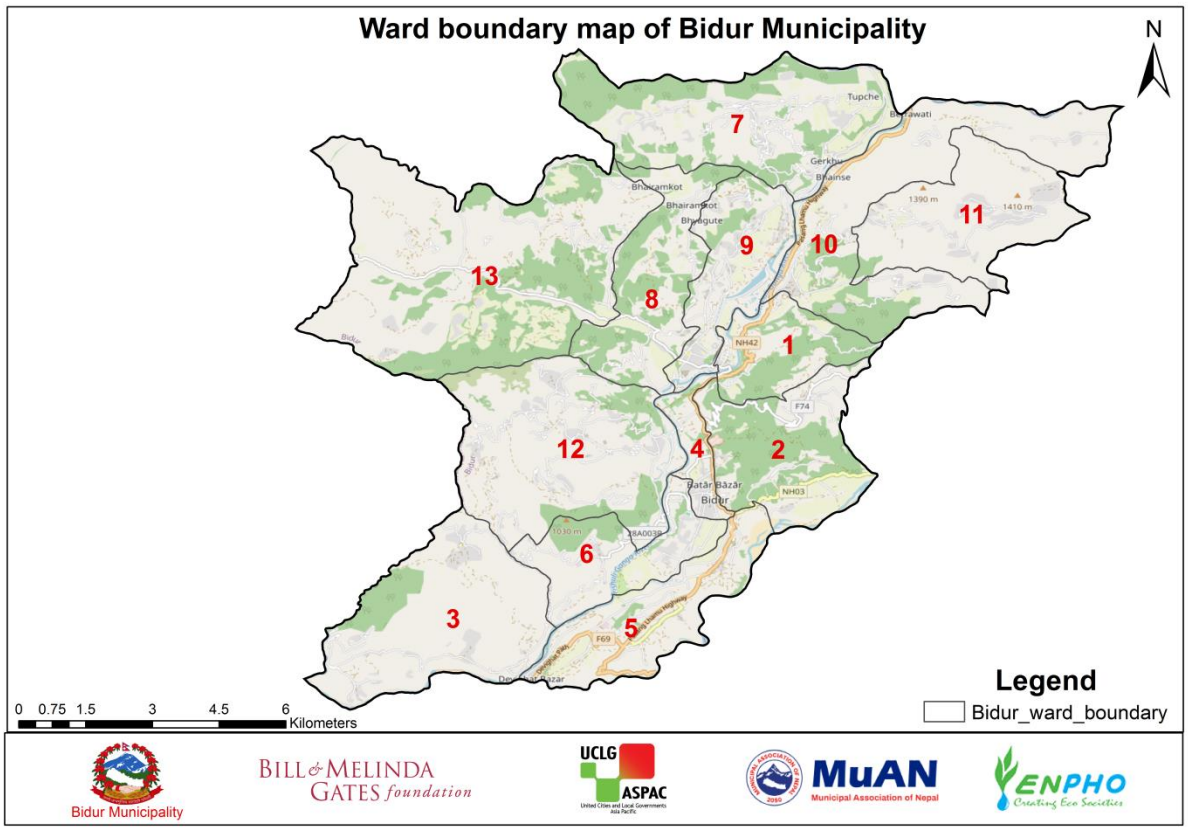

Figure 1: Map of Bidur Municipality with ward boundaries.

1.1 Population

As per the National Population and Housing Census conducted in 2021, municipality has a total population of 59,227 individuals distributed across 15,234 households. The total male and female populations were 28,449 and 30,778 respectively (NSO, 2021). The municipality has experienced an annual growth rate of 0.60% per annum, and a population density of 455.6/km² (City Population, 2023)

1.2 Climate

Bidur municipality has subtropics and sub-humid climate, the general climate is pleasant all year around. The average temperature ranges from a maximum of 23°C in June and minimum of 11°C in January. The difference in precipitation between the driest month and the wettest month is 762 mm. The driest month is December with 52 mm, while the precipitation reaches its peak in the month of July with an average of 812 mm. The month with the most relative humidity is July (81.51%) and least relative humidity is April (50.58%) (Climate-Data, 2024)

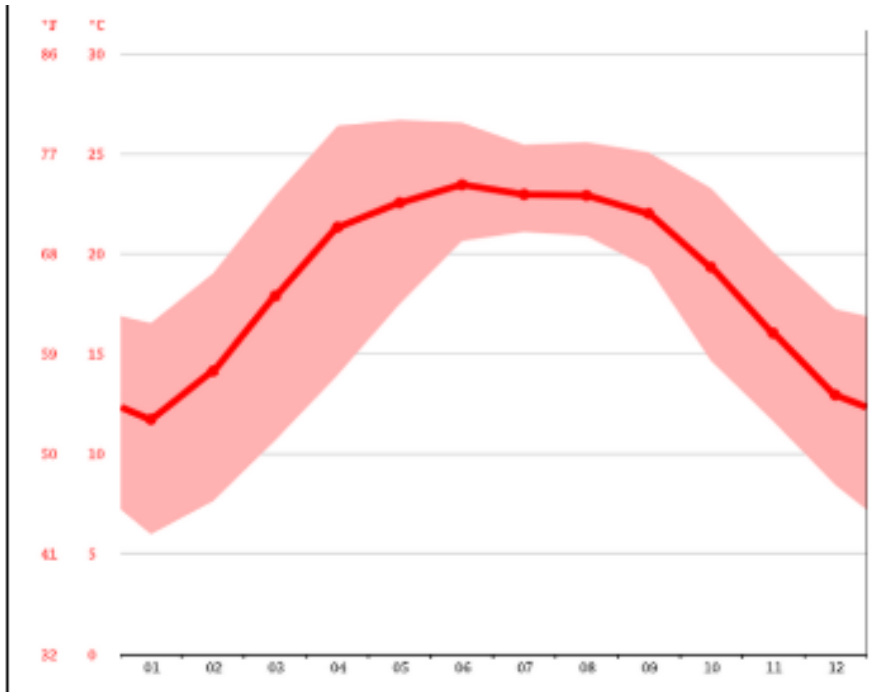

Figure 2: Average temperature by month of Bidur Municipality. Source (Climate-Data.Org, 2024).

1.3 Topography

It lies at 27°53'24" latitude and 85°09'36 " longitude and the altitude of 700 m from sea-level. It is spread over an area of 130.01 km^2. Human settlements are generally found in the river valley area formed due to alluviation by the Trishuli River and the Tadi River, and on gentle slopes in the mountains in the west, north and east respectively. The construction of terraces furthermore resulted in soil erosion causing damage to vegetation. This water supply for this municipality is mainly derived from rainwater and rivers in the city. Despite abundant water resources within the municipality, the disruption of water supply occurs as floods in the rainy season often damage water collection facilities and timelines (WLSP, 2016).

2 Service outcomes

2.1 Overview

Bidur Municipality has achieved Open Defecation Free (ODF) status in April 2018, initiating a new phase of sanitation management to address the challenges of treating faecal waste collected from toilets (News, 2018). Despite the nationwide ODF declaration in 2019, the sanitation situation in many places remains unsatisfactory across the country. To assess the sanitation status in the entire sanitation value chain, a household survey was conducted in 375 sampled households using a proportionate sampling. The results obtained after the triangulation and validation of the data with all the data sources including literature reviews, Key Informant Interviews (KIIs) and a validation workshop is presented in section 4.

2.1.1 Sanitation system in household buildings

A sanitation system is a context-specific series of technologies and services for the management of wastes and their collection, containment, transport, transformation, utilization, or disposal (Elizabeth Tilley, 2014). The sanitation system at a household building indicates basically the collection of faecal sludge in a containment. The findings from sanitation situation assessment conducted by ENPHO in 2023 in municipality depict 99% of households have access to basic improved sanitation. A minority, 1% of households, still defecate in open spaces (ENPHO, 2023).

A sanitation system in which faeces and wastewater are collected, stored, and treated in the plot where they are generated is referred to as onsite sanitation (Elizabeth Tilley, 2014). Likewise, sanitation systems in which excreta and wastewater are collected and conveyed away from the plot where they were generated are referred to as offsite sanitation technologies (Elizabeth Tilley, 2014). Bidur municipality does not have sewage collection and centralized treatment facilities (KII -2, 2023). The findings from the study revealed that few households in the municipality are illegally connecting excreta on nearby stormwater drain, offsite sanitation system.

Offsite Sanitation Systems

The municipality accounts for 1% of the households with offsite sanitation systems. The municipality does not have sewerage network and the toilets are connected to an open drain/stormwater drain. The drain is constructed for the transport of stormwater from roads and buildings but illegally being used for mixage of faecal sludge. Figure 3 shows the condition where wastewater is seen in an open drain.

Figure 3: Open drain as observed in one of the localities.

Onsite Sanitation Systems

Bidur Municipality accounts for 98% of the households with onsite sanitation system (ENPHO, 2023) (Table 1).

Table 1: Types of onsite sanitation system at households of Bidur Municipality.

Types of containment	Construction material used in the wall of the containment	Construction material used in the bottom of the containment	Number of Chambers	Number of containments	%	Recategorized as SFD	%
Biogas Digester	NA	NA	NA	NA	6%	Fully lined tank	8%
Fully lined tank	Cemented brick/stone walls or concrete walls	PCC or plaster	One or two	NA	2%		
Lined tank with impermeable walls and open bottom	Cemented brick/stone walls or concrete walls	Soiling or nothing	One or two or more than two	NA	30%	Lined tank with impermeable walls and open bottom	30%
Single pit	Concrete rings in piled up form	Soiling or nothing	NA	One	3%	Lined pit with semipermeable walls and bottom	3%
Unlined pit	Nothing	Soiling or nothing	NA	NA	57%	Unlined pit	57%
Offsite sanitation	NA	NA	NA	NA	1%	Toilet discharges directly to open drain or storm sewer	1%
Open defecation	NA	NA	NA	NA	1%	Open defecation	1%

The different types of onsite sanitation technologies are being used in the municipality. Its short descriptions are discussed as:

Biogas Digester: A biogas digester is a water sealed container for organic matter which uses natural anaerobic decomposition of organic matter under controlled conditions (Learn, 2023). A total of 6% of households used biogas digester in Bidur Municipality. Alternative Energy Promotion Centre (AEPC) has promoted biogas technology at households in 77 districts of Nepal. The installation of biogas at households has supported in improving situation of health status and sanitation status in Nepal (AEPC, 2018). Figure 4 shows the types of biogas digesters installed in one of the sampled households.

Figure 4: Biogas digester used in Bidur Municipality.

Fully lined tank: A rectangular shape with walls and bottoms of tank totally lined and sealed, which furthermore helps in no overflow and discharge of the effluent are generally termed as fully lined tank (Susana, 2018). About 2% of households used a fully lined tank in the municipality. Figure 5 shows the photos of fully lined tank in Bidur Municipality.

Lined tank with impermeable walls and open bottom: A rectangular onsite technology where the walls of the tank are lined and sealed, and a permeable base is termed as lined tank with impermeable walls and open bottom. The facility allows infiltration of effluents which could contaminate groundwater (Peal, et al., 2020). A total of 30% of households have constructed lined tanks with impermeable walls and open bottom. Figure 6 shows the photos of a lined tank with impermeable walls and open bottom.

Figure 5: Fully lined tank at Bidur Municipality.

Figure 6: Lined tank with impermeable walls and open bottom at Bidur Municipality.

Single offset pit: A circular onsite technology made from concrete rings is a single offset pit. There is no lining between rings, and it allows infiltration of effluents from walls and as well as bottom of the pit. No outlet or overflow for effluent is observed in this type of containment (SuSanA, 2018). 3% of households have built single offset pits in the municipality. Figure 7 shows pictures of a single offset pit found in the municipality.

Figure 7: Single offset pit found in Bidur Municipality.

Unlined pit: Unlined pit is a dug pit in the ground. It has no lining in the walls and a permeable base. It allows infiltration of effluents from walls as well as bottom of the pit (SuSanA, 2018). 57% of households have unlined pits, mainly constructed from dry stone walls in household within municipality. The location where different sanitation technologies are built is shown in Figure 8.

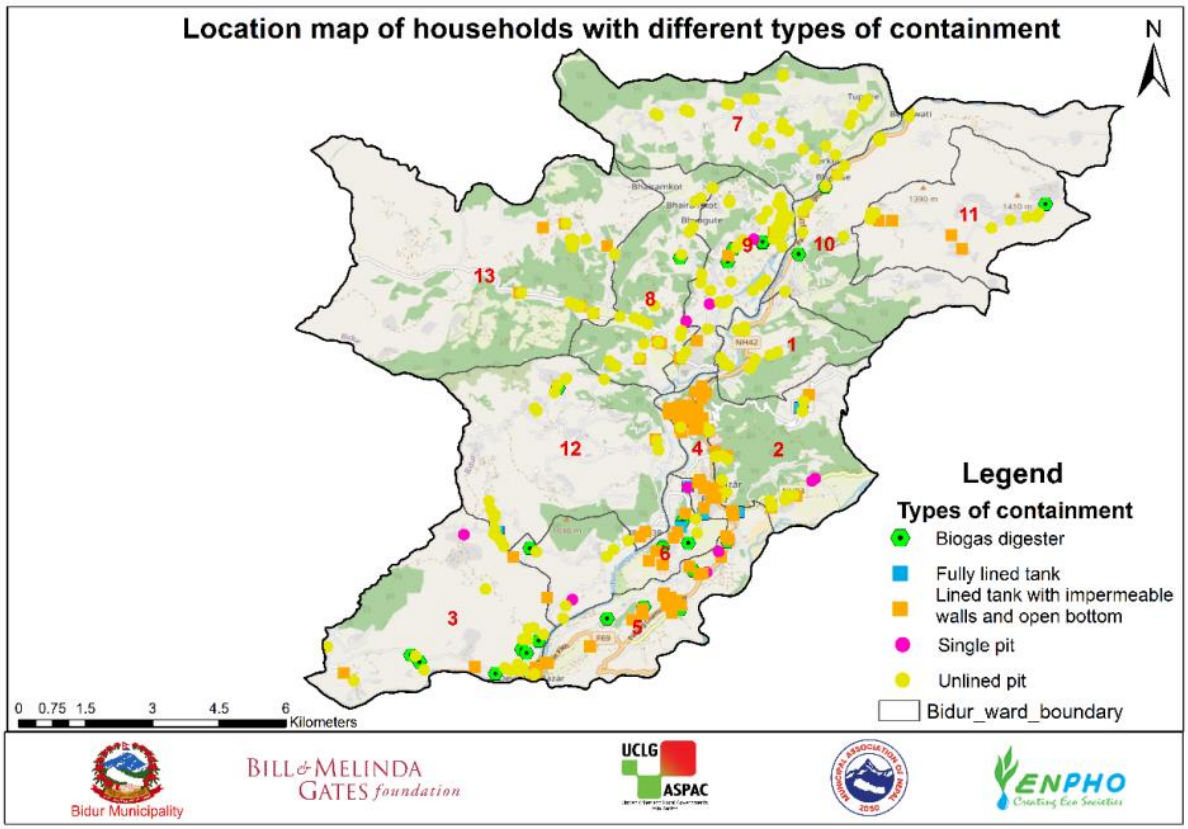

Figure 8: Map of households locating different types of containment.

2.1.2 Sanitation system in institutional buildings

All the surveyed 108 institutions had access to a safely managed sanitation system in the municipality, of which 35 were educational buildings, 36 government and non-governmental office, 5 commercial buildings, 17 health care institutions and 15 hotels.

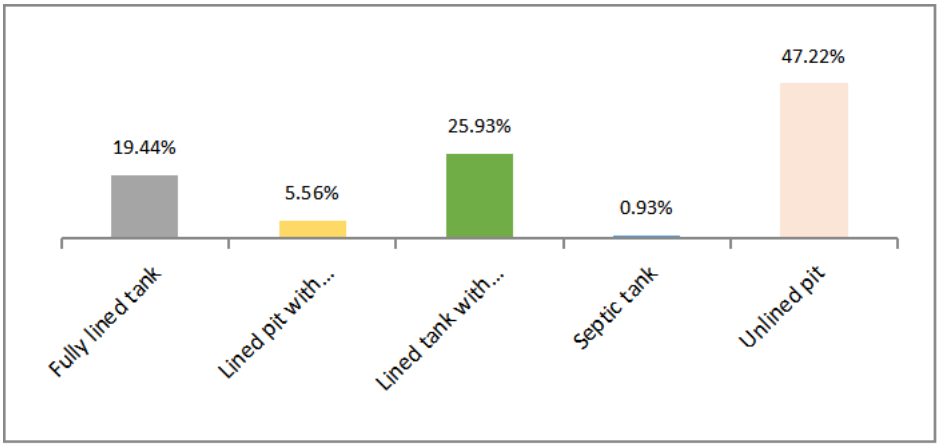

Figure 9: Types of containment used in institutional buildings.

The findings revealed that 19.44% of institutional buildings had fully lined tanks, 5.56% had lined pits with semipermeable walls and open bottom, 25.93% had lined tanks with impermeable walls and open bottom, while the majority (47.22%) of buildings had constructed unlined pit. Only 0.93% of institutional buildings have constructed septic tank for safe managed sanitation. Of the total survey institutions of Bidur Municipality, 0.93% of institutional buildings still discharge the faecal sludge in an open environment. The location of institutional buildings with different sanitation technologies are shown in Figure 10.

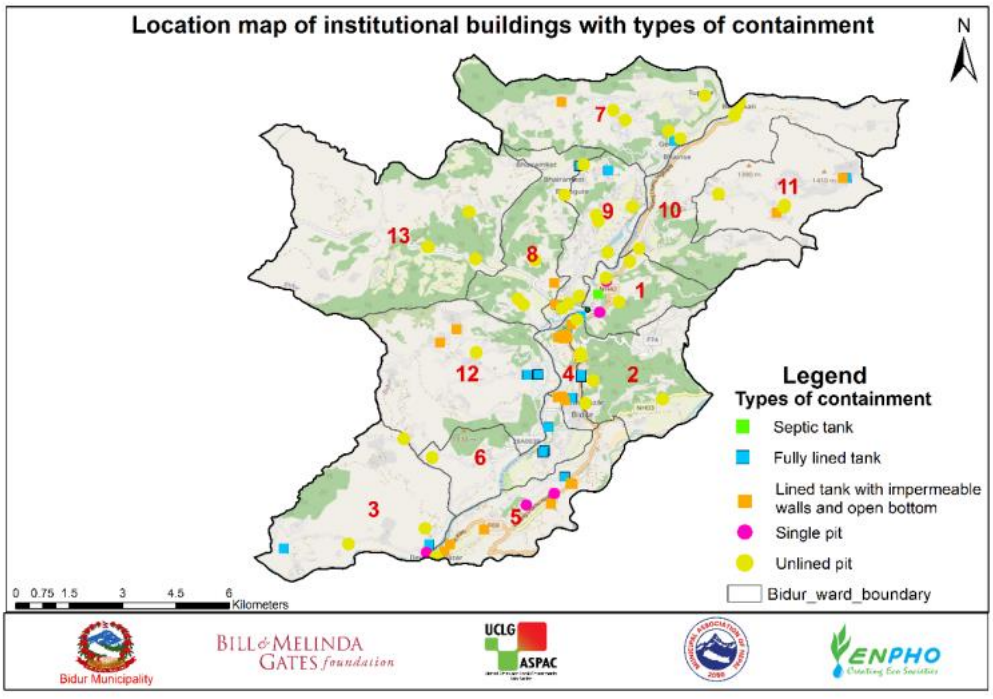

Figure 10: Map of households locating different types of containment.

2.1.3 Public toilets

One of the public toilet constructed by municipality was located in market area. The public toilet had very simple physical infrastructure made of concrete, with two seperate section for male and female, and had one single squatting pan in individual section. There was one handwashing station with availability of water. The sanitary condition of the toilet was very poor and unmanaged. There was no caretaker specified for operation and maintenance of public toilet. Figure 11 shows the photos of public toilet and sanitary condition of the public toilet of municipality.

Figure 11: Public toilet at marketplace of Bidur Municipality.

2.1.4 Emptying and transportation services of containment

Emptying of the containment is a key element of sanitation service chain. It ensures proper functioning of containment which furthermore prevents sludge overflow and blockages (Strande, et al., 2014). The filled containment with faecal sludge needs to be emptied and safely managed which is often neglected (CAWST, 2016). Of the total household, only 9.73% have emptied their containment due to faecal sludge overflow. The emptying rate of the containment is determined by the number of users, duration of use, types, and size of the containment. Fully lined tanks are emptied more frequently in the interval of 6 to 10 years.

In line to emptying mechanism, the data indicates that only 18.18% of the population opts for mechanical emptying, while a significant 81.82% still relies on manual methods. One of the contributing factors for manual emptying is that mechanical desludging services are not available within the municipality (Figure 12). The percentage of household who mechanically desludged the containments used nearest service available from Kathmandu Valley (KII-2, 2023).

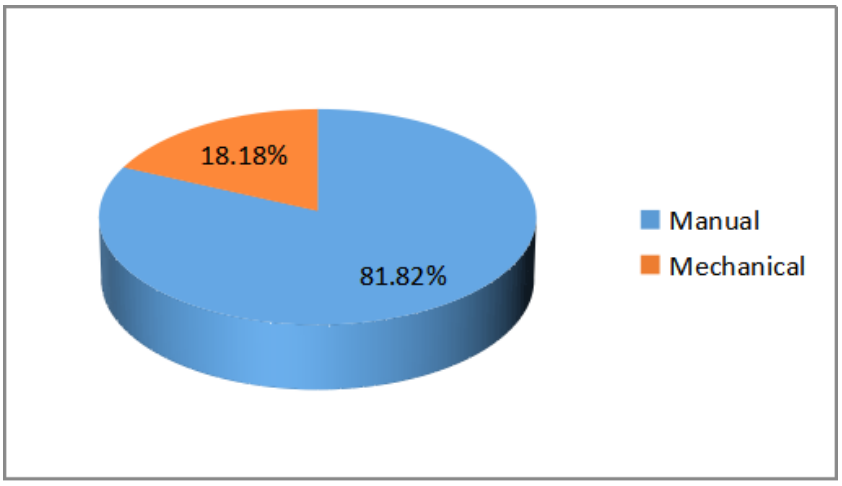

Figure 12: Emptying mechanism of the containments.

2.1.5 Treatment and disposal/reuse of faecal sludge

Bidur Municipality does not have any form of treatment plant for faecal sludge (FS) management. However, municipality in coordination with Department of Water Supply and Sewerage Management (DWSSM) are planning for construction of wastewater treatment plant inside the municipality (KII -2, 2023).

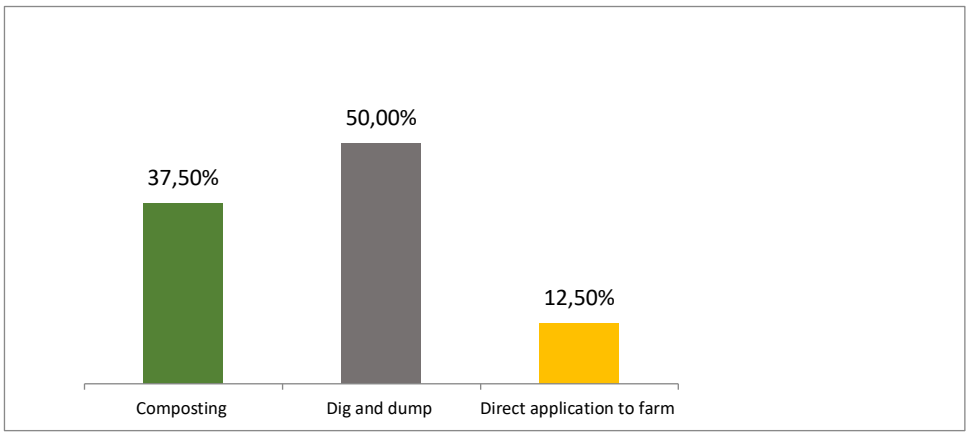

Figure 13: Disposal practice after manual emptying.

Figure 13 shows that the majority (50%) of FS disposed is through dig and dump method, while 12.50% FS were directly applied to farmland, and 37.50% of emptied FS were used as composting which cannot be considered as safe sanitation practice. Some households in the municipality even had illegal connection of toilet to open drainage as shown in above Figure 3.

2.1.6 Risk of drinking water source pollution

The risk of water source pollution was assessed based on source of drinking water, secondary data on water quality and lateral spacing between sanitation system and water sources.

Sources of Drinking Water

As per the findings from the survey, most households (53.33%) used private/yard tap as the major source of drinking water. Likewise, 34.40% of households consumed drinking water from spring source, 10.60% of households are dependent on community tap, and 1.60% relied on jar water as a major source of drinking water.

Since 1995 A.D., Bidur Drinking Water Supply and Sanitation User Committee has been providing piped drinking water to Ward 1 – Dhunge bazar area, Ward 2 – Bidur and Battar area, all areas of Ward -4, 5 and 6 and Ward 7 – Pipaltar areas. The major sources of drinking water provided by WSUC are from Falangu River and Trishuli River. The supply system provides water via private connections and community faucets. The water is collected on a 450 m^3 reservoir tank near Bidur Police station (KII-3, 2023). The Bidur WSUC is providing service to 2,000 households. In addition, three different other small water users' committees have been supplying water to the town. Recently, Asian Development Bank (ADB)-funded project is under construction with an aim to resolve the deepening water crisis by supplying 89 litres of water per second (CDKN global, 2020). Figure 14 shows the various sources of drinking water available in the municipality.

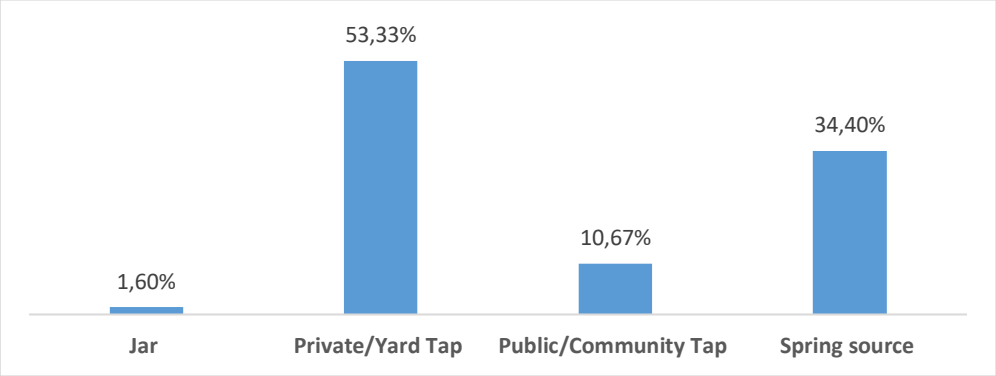

Figure 14: Major source of drinking water in Bidur Municipality.

For considering the contamination risk of water source and open bottom containment, different water quality test reports within Bidur Municipality were observed and analyzed. In accordance with the World Health Organization's (WHO) guidelines for drinking water quality, the presence of E. coli serves as an indicator of potential faecal contamination. As per the National Drinking Water Quality Standard of 2022, drinking water should be free of E. coli, indicated by a count of 0 colony-forming units (CFU) per 100 milliliters of water. Consequently, the water quality test reports from various WSUCs were analyzed (present in appendix 4), revealing *E. coli* contamination in some household taps. Thus, a thorough analysis of the risk posed by water distributed by WSUCs, particularly in terms of open-bottom containment systems was analyzed. Furthermore, the proximity between spring sources and open-bottom containment systems is a critical factor in assessing contamination risk. Springs located approximately 500 meters above residential areas are deemed to pose a lower risk of contaminating drinking water compared to those situated below residential areas.

Therefore, 24% of the population relies on lined tanks with impermeable walls and open bottom, no outlet or overflow (T1A4C10, 23%: low risk and T2A4C10, 1%: high risk); 3% uses lined pits with semi-permeable walls and an open bottom, with no outlet or overflow

(T1A5C10, 2.5%: low risk and T2A5C10, 0.5%: high risk) and 57% relies on unlined pits (T1A6C10, 49%: low risk and T2A6C10, 8%: high risk).

2.2 SFD selection grid

The SFD grid consists of different containment technology used in list A and its connection in list B. Sanitation technologies selected in the SFD grid in Bidur Municipality are shown in Figure 14. The vertical column on the left side of the SFD selection grid has a list of technologies to which the toilet is connected to, and households without toilet resorting to open defecation. Similarly, horizontal row at the top of the selection grid shows options for connection made for the outlet or overflow of discharge from the toilet.

As per the containment definition by Shit Flow Diagram Promotive Initiative (SFD PI), various containments are categorized into different SFD categories. For example, biogas is reclassified as a fully lined tank, given that the walls and bottom of the biogas structure are water-sealed and share similar features with a fully lined tank. Similarly, single offset pits, constructed by assembling pre-cast concrete rings on top of each other, are collectively referred to as lined pits with semipermeable walls and an open bottom. However, fully lined tanks, lined tanks with impermeable walls and open bottom, and unlined pits do not require reclassification and remain unchanged. After the reclassification of these containments, the types of sanitation technologies and their connections are chosen in the SFD selection grid, as illustrated in Figure 15.

List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?)	List B: What is the containment technology connected to? (i.e. where does the outlet or overflow discharge to, if anything?)									
	to centralised combined sewer	to centralised foul/separate sewer	to decentralised combined sewer	to decentralised foul/separate sewer	to soakpit	to open drain or storm sewer	to water body	to open ground	to 'don't know where'	no outlet or overflow
No onsite container. Toilet discharges directly to destination given in List B					Significant risk of GW pollution Low risk of GW pollution			T1A1C8		Not Applicable
Septic tank					Significant risk of GW pollution Low risk of GW pollution					
Fully lined tank (sealed)					Significant risk of GW pollution Low risk of GW pollution					T1A3C10
Lined tank with impermeable walls and open bottom	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	T1A4C6		T1A4C8		T2A4C10 T1A4C10
Lined pit with semi-permeable walls and open bottom	Not Applicable									T2A5C10 T1A5C10
Unlined pit										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 15: SFD selection grid for Bidur Municipality.

A brief explanation of terms used to indicate different frames selected in the SFD selection grid is explained in Table 2.

Table 2: Explanation of terms used to indicate frame selected in the SFD selection grid.

T1A1C8	A fully functioning toilet discharging directly to open ground can occur. The excreta is raw, untreated and hazardous and since it discharges directly to open ground, all the excreta in this system is considered not contained.
T1A3C10	A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). However, 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. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). 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	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. The tank is not fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is

	considered not contained.
T1A4C10	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. However, since the tank is not fitted with a supernatant/effluent overflow this system is considered contained.
T2A5C10	A correctly designed, properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered not contained.
T1A5C10	A correctly designed, properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow, so this system is considered contained.
T1A6C10	This is 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.
T2A6C10	This is 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 SFD matrix

2.3.1 Proportion of faecal sludge from different types of sanitation technologies

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

The formula used for FS proportion calculation is shown below:

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

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

- ✓ The proportion of FS in septic tanks is 0%, since there are no septic tanks in the municipality.
- ✓ The proportion of FS in fully lined tanks is calculated as 100%, as the FS from fully lined tanks are not connected to open drains.
- ✓ The FS proportion from lined tanks with open bottoms and all types of pits is 98%, as 1% of lined tanks with impermeable walls and open bottoms connected to open drains.

After determining the proportion of FS in each type of sanitation technology, the corresponding population proportions from the selected technologies in the SFD selection grid are set. Figure 16 illustrates the SFD matrix of the municipality.

Bidur Municipality, Bagmati, Nepal, 28 Sep 2023. SFD Level: 2 - Intermediate SFD
Population: 59227
Proportion of tanks: septic tanks: 0%, fully lined tanks: 100%, lined, open bottom tanks: 98%

Containment						
System type	Population	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	F3	F4	F5	S4e	S5e
System label and description	Proportion of population using this type of system (p)	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated	Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants	Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated
T1A1C8 Toilet discharges directly to open ground	1.0					
T1A3C10 Fully lined tank (sealed), no outlet or overflow	8.0	71.0	96.0	95.0		
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	23.0	1.0	0.0	0.0		
T1A4C6 Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	3.0	8.0	0.0	0.0	0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	3.0	0.0	0.0	0.0		
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	2.5	0.0	0.0	0.0		
T1A6C10 Unlined pit, no outlet or overflow	49.0	3.0	0.0	0.0		
T1B11 C7 TO C9 Open defecation	1.0					
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	1.0	14.0	0.0	0.0		
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	0.5	0.0	0.0	0.0		
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	8.0	0.0	0.0	0.0		

Figure 16: SFD matrix of Bidur Municipality.

2.3.2 Proportion of faecal sludge emptied (F3)

The proportion of faecal sludge emptied (F3) is calculated based on the percentage of containment emptied and the amount of FS emptied during the process. The information on FS emptied from containment was obtained from Key Informant Interviews (KIIs) with municipal stakeholders (KII -2, 2023). As from the findings of survey data and KII information, it was revealed that about 85% of the FS content in the containment is removed

during emptying. Hence, actual proportion of FS emptied from each containment is calculated as (Table 3):

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

Table 3: Sanitation technologies and proportion of emptied faecal sludge (KII -2, 2023[1]; ENPHO, 2023[2]).

SN	Sanitation Technologies	SFD Reference Variable	Percentage of Emptied Containment (1)	Emptied Proportion of FS during emptying (2)	Actual Proportion of Emptied FS (F3)
1	Fully lined tank (sealed), no outlet or overflow	T1A3C10	84%	85%	71%
2	Lined tank with impermeable walls and open bottom, no outlet or overflow (high Risk)	T2A4C10	16%	85%	14%
3	Lined tank with impermeable walls and open bottom, no outlet or overflow (low Risk)	T1A4C10	1%	85%	1%
4	Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	T1A4C6	9%	85%	8%
5	Unlined pit, no outlet or overflow (low risk)	T1A6C10	4%	85%	3%

2.3.3 Proportion of FS emptied which is delivered to treatment plant (F4 and F5)

The municipality does not have any form of treatment plant to treat faecal sludge. However, biogas digester (6%), reclassified as fully lined tank (sealed), are considered treated at household settings. Thus, variables F4 and F5 for fully lined tank (sealed), no outlet or overflow sanitation system was set to 96% and 95% respectively. For all other sanitation systems, variables F4 and F5 are 0%.

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

About 1% of the households are illegally connected to storm water drain which is not treated, thus treated is 0%.

2.4 SFD graphic

Figure 17 represents the fate and flow of faecal sludge through each sanitation service chain. It shows that FS generated from 80% of the population is safely managed represented by “Green” colour arrowhead. However, 80% resembles the FS stored in the containment without significant risk to groundwater. However, FS generated by 80% of the population is temporary as it also includes FS not emptied and the proportion rises if all the faecal sludge from the containment are emptied.

The FS from 20% of the population is unsafely managed, represented by “RED” arrow heads. The percentage of unsafely managed FS is generated from containments where FS is not contained - not emptied (15%), FS not contained- FS not emptied (2%), supernatant not delivered to treatment (1%), FS not treated (1%) and people practicing open defecation (1%).

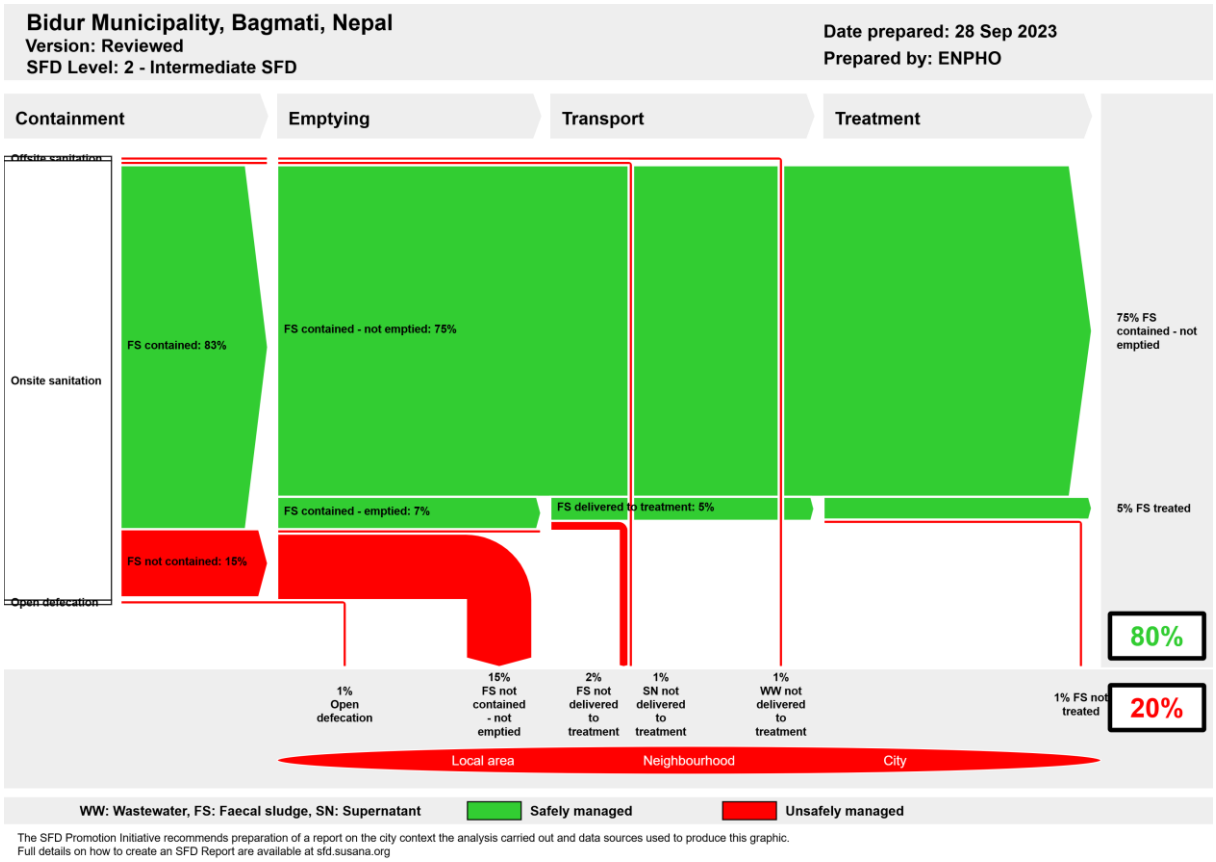

Figure 17: SFD Graphic of Bidur Municipality.

Offsite Sanitation

Bidur municipality does not have sewer network, however, 1% of households have offsite sanitation systems.

WW not delivered to treatment

The wastewater generated by the population residing in 1% of household is disposed of untreated to open drain or storm sewer not treated and is unsafely managed.

Onsite Sanitation

The 98% of the population in Bidur Municipality rely on onsite sanitation systems. According to SFD graphic, of the total households having onsite sanitation system, 83% of the population uses containment where FS is safely managed and illustrated as “FS contained” in SFD matrix.

FS contained

The term 'FS contained' is faecal sludge within an onsite sanitation technology which ensures safe level of protection from excreta, i.e. pathogen transmission to the user or public is limited. These containment systems, such as tanks or pits, are correctly designed, properly constructed, fully functioning, and pose little to no risk of polluting groundwater used for drinking (Susana, 2018). FS generated by 83% of the population is contained.

The value of FS contained i.e. 83% is obtained from the summation of population using fully lined tanks (sealed) with no outlet or overflow (T1A3C10), lined tanks with impermeable walls and open bottom with no outlet or overflow (T1A4C10) and lined pit with semi-permeable walls and open bottom with no outlet or overflow (T1A5C10), unlined pit, no outlet or overflow (T1A6C10) without posing a significant risk to groundwater.

FS not contained

The term 'FS not contained' refers to faecal sludge within an onsite sanitation technology that does not ensure a safe level of protection from excreta, with a likely risk of pathogen transmission. These containment systems, such as tanks or pits, are incorrectly designed, poorly constructed, poorly functioning, and/or pose a 'significant' risk of polluting groundwater used for drinking (Susana, 2018). FS generated by 15% of the population is not contained.

The value of FS not contained i.e. 15% is obtained from the summation of population using toilet discharges directly to open ground (T1A1C8), lined tanks with impermeable walls and open bottom connected to an open drain or storm sewer and to open ground (T1A4C6 and T1A4C8), open defecation (T1B11C7 to C9), lined tank with impermeable walls and open bottom, no outlet or overflow (T2A4C10), lined pit with semi-permeable walls and open bottom, no outlet or overflow (T2A5C10), unlined pit, no outlet or overflow (T2A6C10), poses ‘significant risk’ of polluting groundwater.

FS contained - not Emptied

The value of 75% is obtained from the proportion of the population using sanitation systems where the FS is contained and have not emptied their containment. However, this 75% of safely managed FS should be considered as only temporary, as most of the pits and tanks have not yet filled up and the FS generated remains ‘not emptied’. Therefore, these systems will require emptying services in the short and medium term as they fill up.

FS contained - Emptied

The value of 7% is obtained from the proportion of the population using sanitation systems where the FS is contained and have emptied their containment.

FS not contained - not Emptied

The value of 15% is obtained from the proportion of the population using sanitation systems where the FS is not contained and have not emptied their containment.

FS not delivered to treatment

The proportion of FS not delivered to treatment, i.e. 2%, is the summation of FS contained emptied and FS not contained emptied. Since Bidur Municipality does not have FSTP,

emptied FS is disposed of untreated to farmlands and open grounds. Therefore, this proportion of disposed FS possesses risk to local area and neighbourhood.

Supernatant (SN) not delivered to treatment

The proportion of supernatant is obtained from containments connected to open drain or stormwater sewer calculated as 50% of FS contained in each containment. The total proportion of supernatant (SN) is 1% of FS generated by the total population. Since the municipality lacks the sewer network and treatment plant, the supernatant is disposed of directly into water bodies. Hence the proportion of SN not delivered to treatment is 1%.

Open Defecation

Despite Open Defecation Free (ODF) status, people residing in 1% of households still go for open defecation. Mostly, people living in poverty and who do not own land, do not have toilets and despite having toilets, lack in behaviour changes have led to open defecation in the municipality.

3 Service delivery context descriptions.

3.1 Policy, legislation, and regulation

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

Local Government Operation Act, 2017

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

Environment Protection Act, 2019

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

Water Supply and Sanitation Act, 2022

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

Environment Friendly Local Governance Framework 2013

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

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

Institutional and Regulatory Framework for Faecal Sludge Management, 2017

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

Total Sanitation Guideline, 2017

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

3.1.1. Policy

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

formulated in 2014 by GON to address the emerging challenges and issues with the adoption of new approaches and resolve the inconsistency in RWSSNP and NUWSSSP.

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

Nepal is a signatory of the historical resolution of 2010 United Nations General Assembly on the Human Right to Water and Sanitation. Nepal committed to Millennium Development Goals (MDGs) for 2000- 2015 The goal was accomplished through declaration of the country as free from open defecation on 30th September 2019. National Sanitation and Hygiene Master Plan, 2011 was developed for coordinated planning and implementation of National Sanitation Campaign. The campaign strengthened institutional 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. Nepal was declared ODF nation on September 23, 2019 (MoWS, 2017) however, the target of 90% households with toilets connected to sewer system or proper FSM is yet to be achieved.

There has been no specific policy made on sanitation and faecal sludge management by Bidur Municipality.

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 Government

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

Ministry of Water Supply: Ministry of Water Supply is the lead ministry responsible for planning, implementation, regulation, and monitoring and evaluation of sanitation programs in the country (GoN, 2015). Under the MoWS, Department of Water Supply and Sewerage Management (DWSSM) plan and implement water and sanitation projects funded by foreign donors or inter provincial projects or serves at least 15,000, 5,000 and 1,000 people in terai, hilly and mountain region respectively (GoN, 2015). The organizational structure of DWSSM is shown in Figure 18.

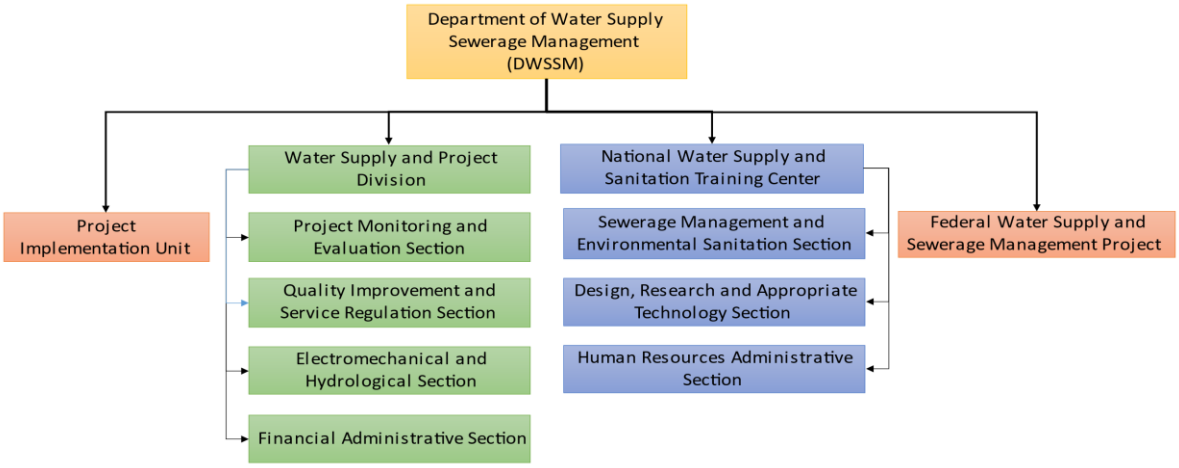

Figure 18: Organizational structure of Department of Water Supply and Sewerage Management (DWSSM).

At Provincial Government

Ministry of Water Supply, Energy and Irrigation (MoWSEI):: MoWSEI of provincial government in Bagmati province is major executing body for planning, developing, and implementing water supply and sanitation programs. Planning and implementation of water supply and sanitation infrastructure in the province is executed through Water supply and Sanitation Divisional Office (WSSDO). WSSDO implements the water and sanitation programs meeting the following criteria:

i. Inter local government projects.

ii. Beneficiaries between 5,000 to 15,000 in terai region, 3,000 to 5,000 in hilly region and 500 to 1,000 in Himalayan region.

At Local Government

Municipal council: Figure 19 shows the organizational structure of the municipality. The municipality consists of 9 sections, one of them is Forest, Environment and Disaster Management Section. Under this section, the municipality has been initiating an effort to plan a wastewater treatment plant within the municipality with support from Department of Water Supply and Sewerage Management (DWSSM).

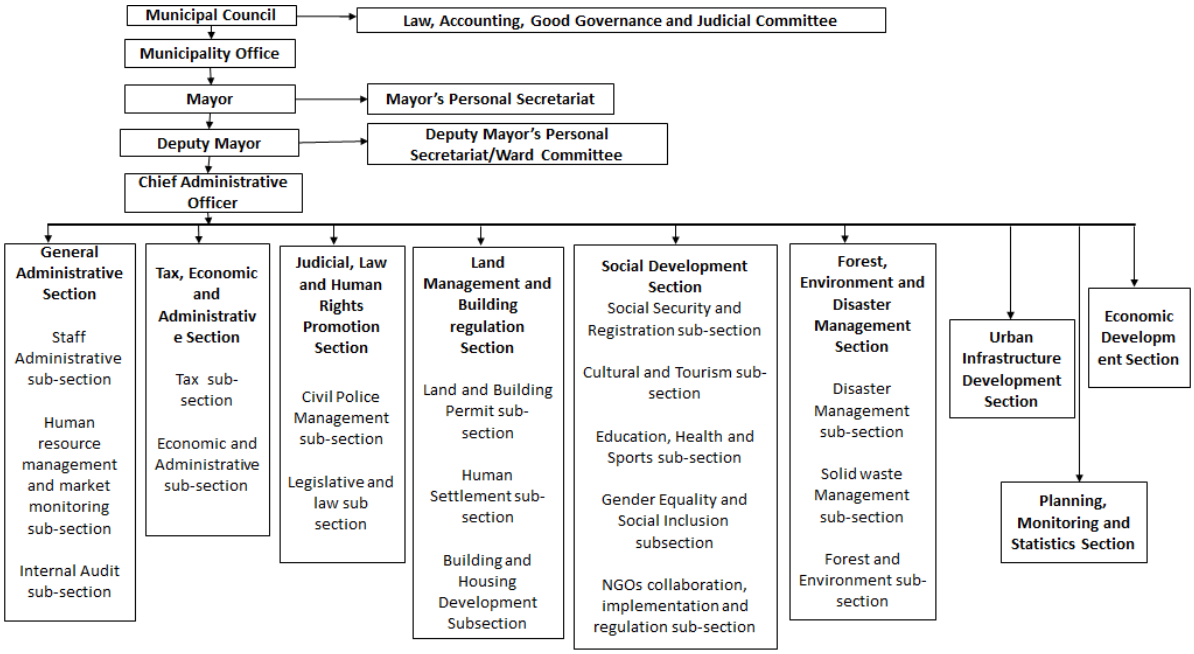

Figure 19: Organizational structure of Bidur Municipality.

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, the Public-Private Partnership Policy, 2015 encourages private sector investment in the development and operation of public infrastructure services for comprehensive socioeconomic development. The policy has aimed to remedy challenges such as structuring of projects, land acquisition, coordination and approval, payments to private sectors and approval for environment impact (MoF, 2015).

3.1.4. Service standards

The sanitation service standards have set by Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016-2030). It classifies sanitation services as high, medium, and basic based on sanitation facilities in place. The sanitation service levels with indicators are shown in Table 4. However, FSM specific standards have yet to be developed and implemented.

Table 4: Sanitation service level and its components.

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

4 Stakeholder Engagement

4.1 Key Informant Interviews (KIIs)

Key Informant Interviews (KIIs) were conducted with the major stakeholders of sanitation sector of the municipality. The objective of KIIs was to obtain a comprehensive understanding of current sanitation practices within the municipality. Interaction regarding the sanitation situation and planning of the municipality was conducted with Mr. Rajan Shrestha, Mayor of Bidur Municipality. Interviews were performed with Mr. Subash Pandey (focal person of Solid waste and environment section) about sanitation services provided by the municipality. The list of KIIs conducted with their designation in the organization are working is shown in Table 5.

Table 5: List of Key Informant Interviewed personnel.

S.N.	Name	Designation	Organization/ Company	Purpose of KII	Date
1.	Rajan Shrestha (KII-1)	Mayor	Bidur Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	4th June 2023
2.	Subash Pandey (KII-2)	Focal Person, Solid Waste Management Subsection	Bidur Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	4th June 2023
3.	Rajendra Pandey(KII-3)	Bidur WSUC	Bidur Municipality	Water supply services	4th June 2023

4.2 Household survey

Household survey was conducted in all wards of the municipality through mobilization of local enumerators selected by the municipality. The enumerators were given two days orientation about sanitation and methods for conducting the household survey. The household survey was conducted using the mobile application “KOBOCOLLECT” after orientation. SFD team member went on field visits in households to encourage enumerators and observe household sanitation status. The glimpses of orientation program are shown in Figure 19.

Figure 20: Glimpses of SFD orientation to enumerators in municipal hall.

4.2.1 Determining sample size

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

Where,

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

This is followed by proportionate stratification random sampling such that each ward in the municipality is considered as one stratum. The sample sized required in each ward is calculated as n_h= (N_h/N)*n, where N_h is a total population in each stratum.

Thus, a total of 375 households were sampled from 15,234 households distributed in 13 wards with proportionate stratification random sampling. The surveyed household in the municipality is shown in Figure 21.

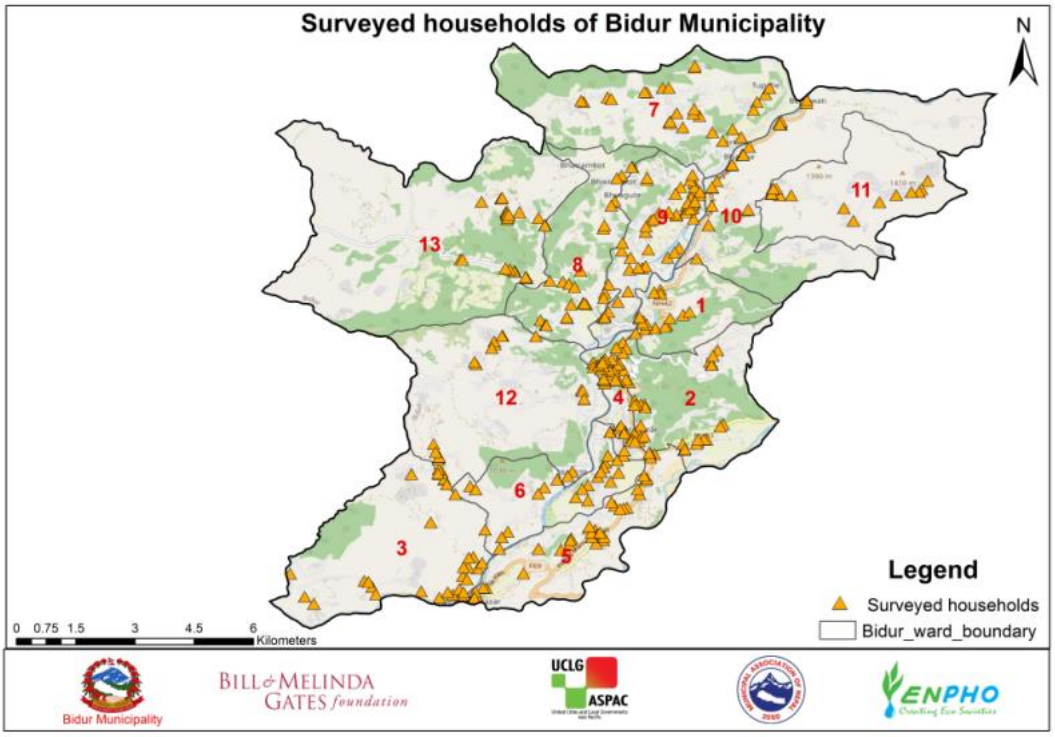

Figure 21: Location map of surveyed households.

4.3 Direct observation

Various sanitation technologies in the households in all the wards were observed and visual references were kept. Also, observation of the toilet, water sources, containments and different other relevant observations were done during the field survey. The observation during practiced field survey was done by the SFD team members and municipal stakeholders (Figure 22).

Figure 22: Field visit and observation of the containments during field practice survey.

4.4 Sharing and validation of data

The SFD sharing and validation workshop was conducted in the municipality to share the finding of the sanitation situation survey. Altogether, 32 participants including the deputy mayor, acting CAO, ward chairpersons and other members from municipal executive council, sectoral staffs etc. actively participated on the workshop and provided the valuable suggestions conducted on 3rd January, 2024. The glimpses can be seen in Figure 23 and detailed list of participants with their designation is attached in Appendix 3.

Figure 23: Glimpses of the sharing and validation workshop.

5 Acknowledgements

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

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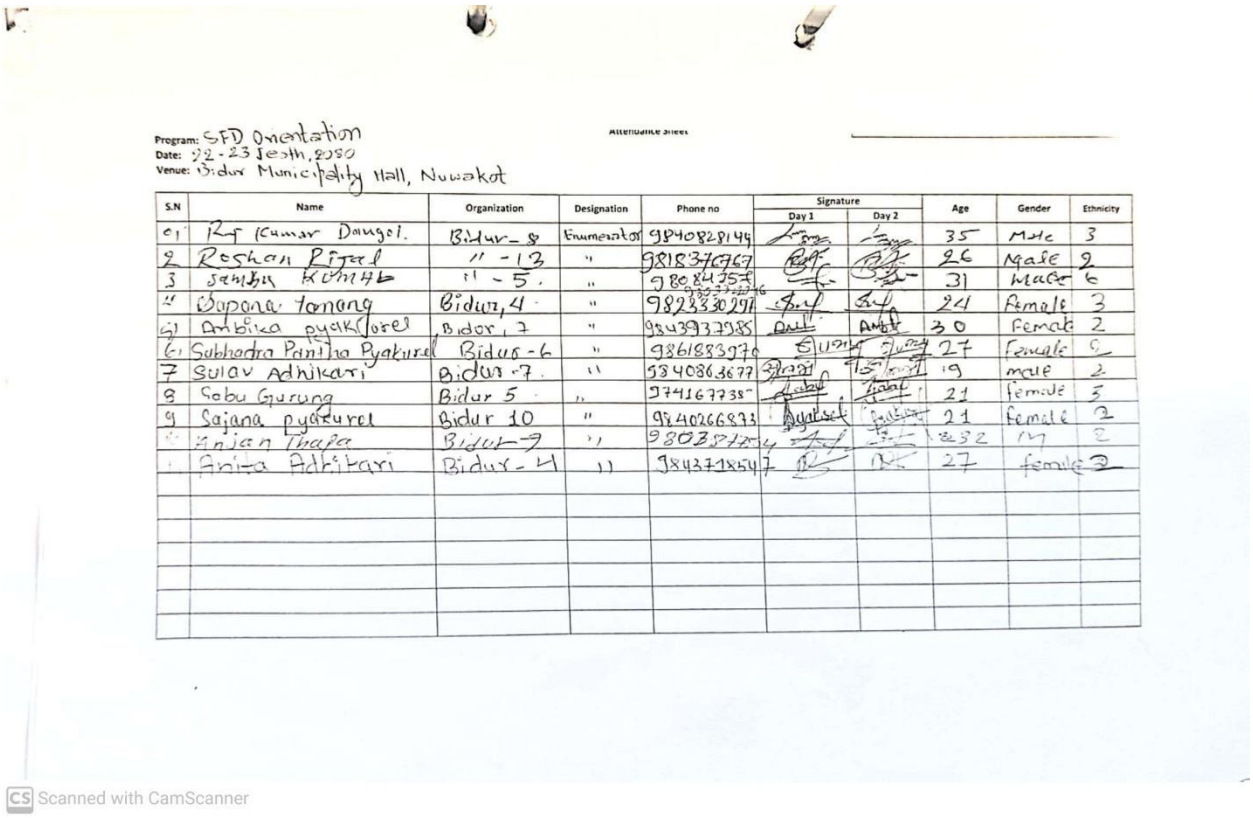
7 Appendix

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

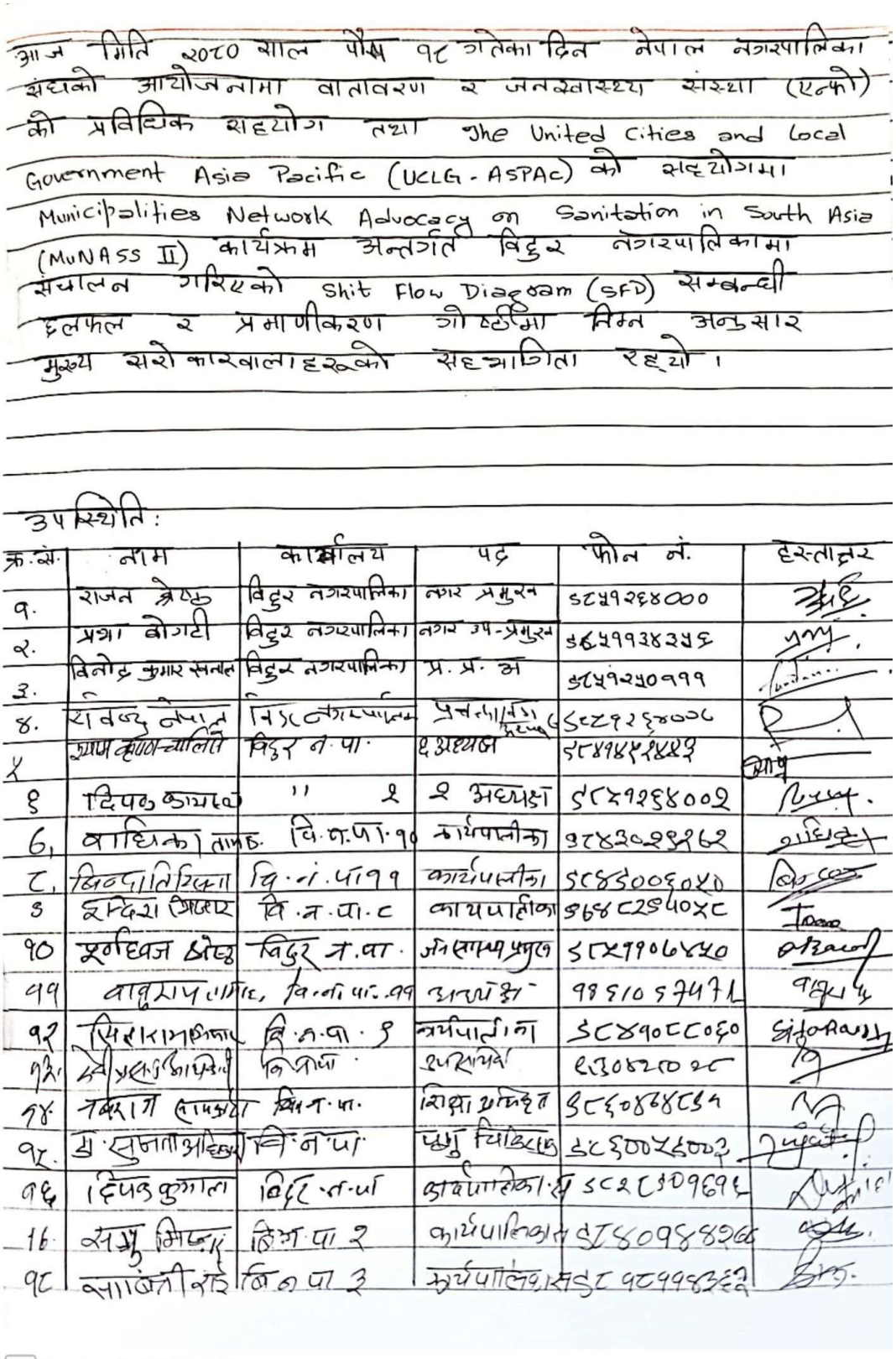
7.2 Appendix 2: List of participants on SFD survey orientation



Program: SFD Orientation
Date: 22-23 Jesth, 2080
Venue: Bidur Municipality Hall, Nuwakot

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Age	Gender	Ethnicity
1	Raj Kumar Dangol	Bidur-8	Enumerator	9840828149			35	Male	3
2	Roshan Rigal	" -13	"	9818376767			26	Male	2
3	Sanjiv Kumar	" -5	"	9804435746			31	Male	6
4	Bipana Tamang	Bidur, 4	"	9823330291			24	Female	3
5	Ambika Pyakurel	Bidur, 7	"	9843937985			30	Female	2
6	Subhadra Pantha Pyakurel	Bidur-6	"	9861883970			27	Female	2
7	Sulav Adhikari	Bidur-7	"	9840863677			19	male	2
8	Sabu Gurung	Bidur 5	"	9741677387			21	female	5
9	Sajana Pyakurel	Bidur 10	"	9840266893			21	female	2
10	Anjan Thapa	Bidur-7	"	9803877474			232	M	2
11	Anita Adhikari	Bidur-4	"	9843718547			27	female	3

7.3 Appendix 3: List of participants in sharing and validation workshop



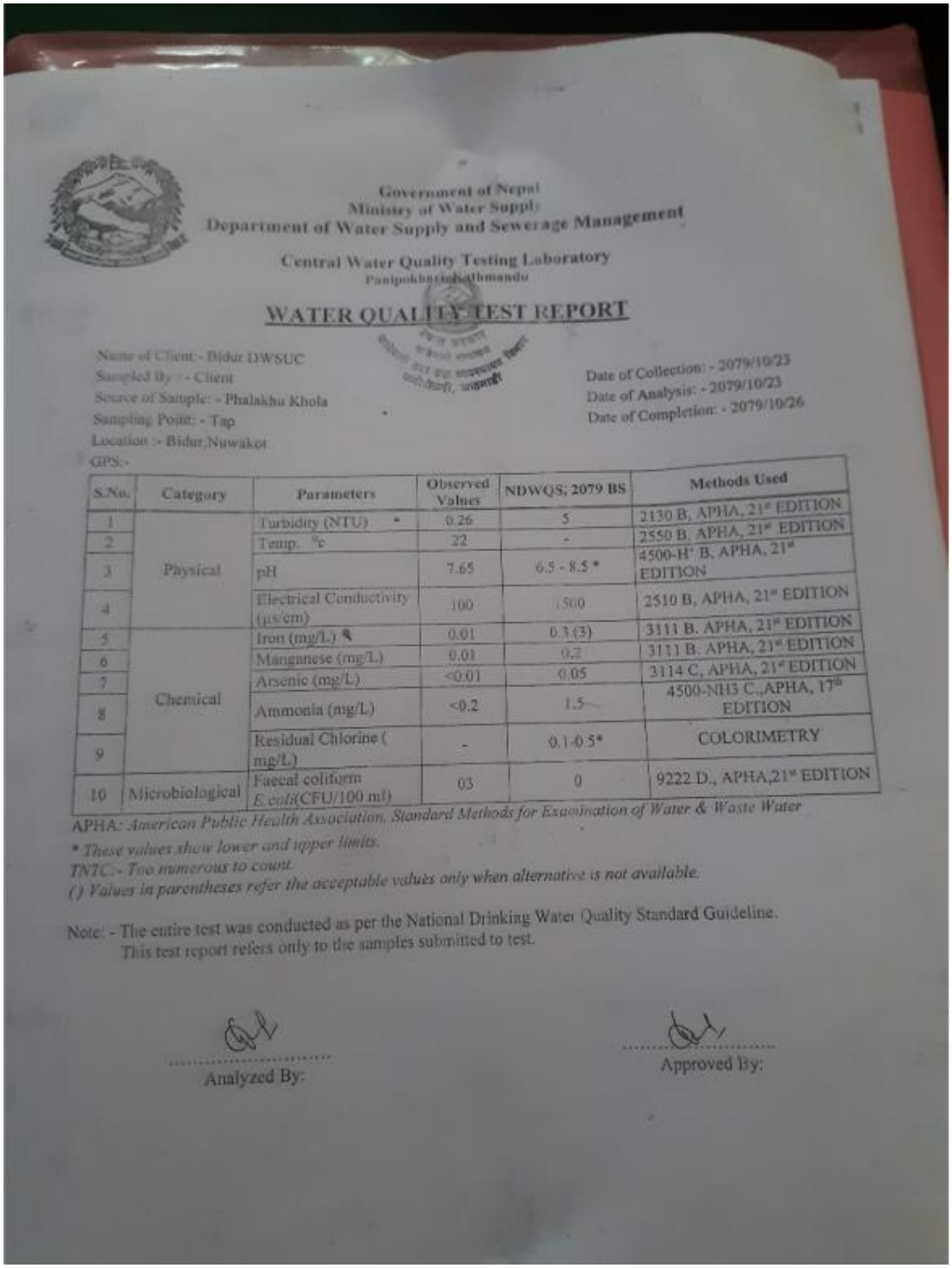
आज मिति २०८० साल पौष १८ गतेका दिन नेपाल नगरपालिका संघको आयोजनामा वातावरण र जनस्वास्थ्य संस्था (एन्को) को प्राविधिक सहयोग तथा The United Cities and Local Government Asia Pacific (UCLG-ASPAC) को सहयोगमा Municipalities Network Advocacy on Sanitation in South Asia (MuNASS II) कार्यक्रम अन्तर्गत विदुर नगरपालिकामा संचालन गरिएको Shit Flow Diagram (SFD) सम्बन्धी दृलफल र प्रमाणीकरण गोष्ठीमा निम्न अनुसार मुख्य सरोकारवालाहरूको सहभागिता रह्यो।

उपस्थिति:

क्र.सं.	नाम	कार्यालय	पद	फोन नं.	हस्ताक्षर
१.	राजन श्रेष्ठ	विदुर नगरपालिका	नगर प्रमुख	९८५१२६४०००	
२.	प्रभा बोगटी	विदुर नगरपालिका	नगर उप-प्रमुख	९८५११३४३५६	
३.	विनोद कुमार सनल	विदुर नगरपालिका	प्र. प्र. अ	९८५१२५०१११	
४.	[illegible]	[illegible]	[illegible]	[illegible]	
५	[illegible]	विदुर न.पा.	[illegible]	[illegible]	
६	दिपक काफ्ले	" २	२ अध्यक्ष	९८५१२६४००२	
७.	[illegible]	वि.न.पा.१	[illegible]	[illegible]	
८.	[illegible]	वि.न.पा.११	[illegible]	[illegible]	
९	इन्दिरा [illegible]	वि.न.पा.८	[illegible]	[illegible]	
१०	[illegible]	विदुर न.पा.	[illegible]	[illegible]	
११	[illegible]	वि.न.पा.११	[illegible]	[illegible]	
१२	[illegible]	वि.न.पा.९	[illegible]	[illegible]	
१३	[illegible]	[illegible]	[illegible]	[illegible]	
१४	[illegible]	वि.न.पा.	[illegible]	[illegible]	
१५	[illegible]	वि.न.पा.	[illegible]	[illegible]	
१६	[illegible]	वि.न.पा.	[illegible]	[illegible]	
१६	[illegible]	विदुर न.पा.	[illegible]	[illegible]	
१६	[illegible]	वि.न.पा २	[illegible]	[illegible]	
१८	[illegible]	वि.न.पा २	[illegible]	[illegible]	

क्र.सं	नाम	कार्यालय	पद	फोन नं.	हस्ताक्षर
१९	निलमबाबु ढुंङ्गेल	वडा - ४	अध्यक्ष	९८४१०५५५८८	[illegible]
२०	लोकेन गजुरेल	१	अध्यक्ष	९८५११६००२३	[illegible]
२१	लीलानाथ [illegible]	५	अध्यक्ष	९८५१२६४००५	[illegible]
22	गणेश कुमार नेपाल	१०	अध्यक्ष	[illegible]	[illegible]
२३	बद्री प्रसाद [illegible]	वडा ३	अध्यक्ष	९८५१२३६००३	[illegible]
२४	कमल [illegible]	वडा - ८	अध्यक्ष	९८५१२३४००८	[illegible]
२५	सुवास पाण्डे	विदुर न.पा	वातावरण सरसफाइ शाखा	९८६१५८३९१६	[illegible]
२६	पारस अधिकारी	विदुर न.पा.	प्रमुख योजना अधिकृत	९८४१५४५३९०	[illegible]
26	मदनराज न्यौपाने	विदुर न.पा	[illegible] कृषि प्र.से	९८४२२५४०४२	[illegible]
२८	जानुका [illegible]	विदुर न.पा	का.स.	9841671362	[illegible]
२९	राजन अर्याल	" "	" "		राजन
३०	मिना आचार्य	" "	स.क.अ		[illegible]
३१	अनिता [illegible]	ENPHO	A.P.O.		[illegible]
३२	बुद्ध बज्राचार्य	एन्फो	कार्यक्रम संयोजक	९८४५१३२०२०	[illegible]

7.4 Appendix 4: Water quality test report



Government of Nepal
Ministry of Water Supply
Department of Water Supply and Sewerage Management

Central Water Quality Testing Laboratory
Panipokhari, Kathmandu

WATER QUALITY TEST REPORT

Name of Client:- Bidur DWSUC
Sampled By :- Client
Source of Sample: - Phalakhu Khola
Sampling Point: - Tap
Location :- Bidur,Nuwakot
GPS:-

Date of Collection: - 2079/10/23
Date of Analysis: - 2079/10/23
Date of Completion: - 2079/10/26

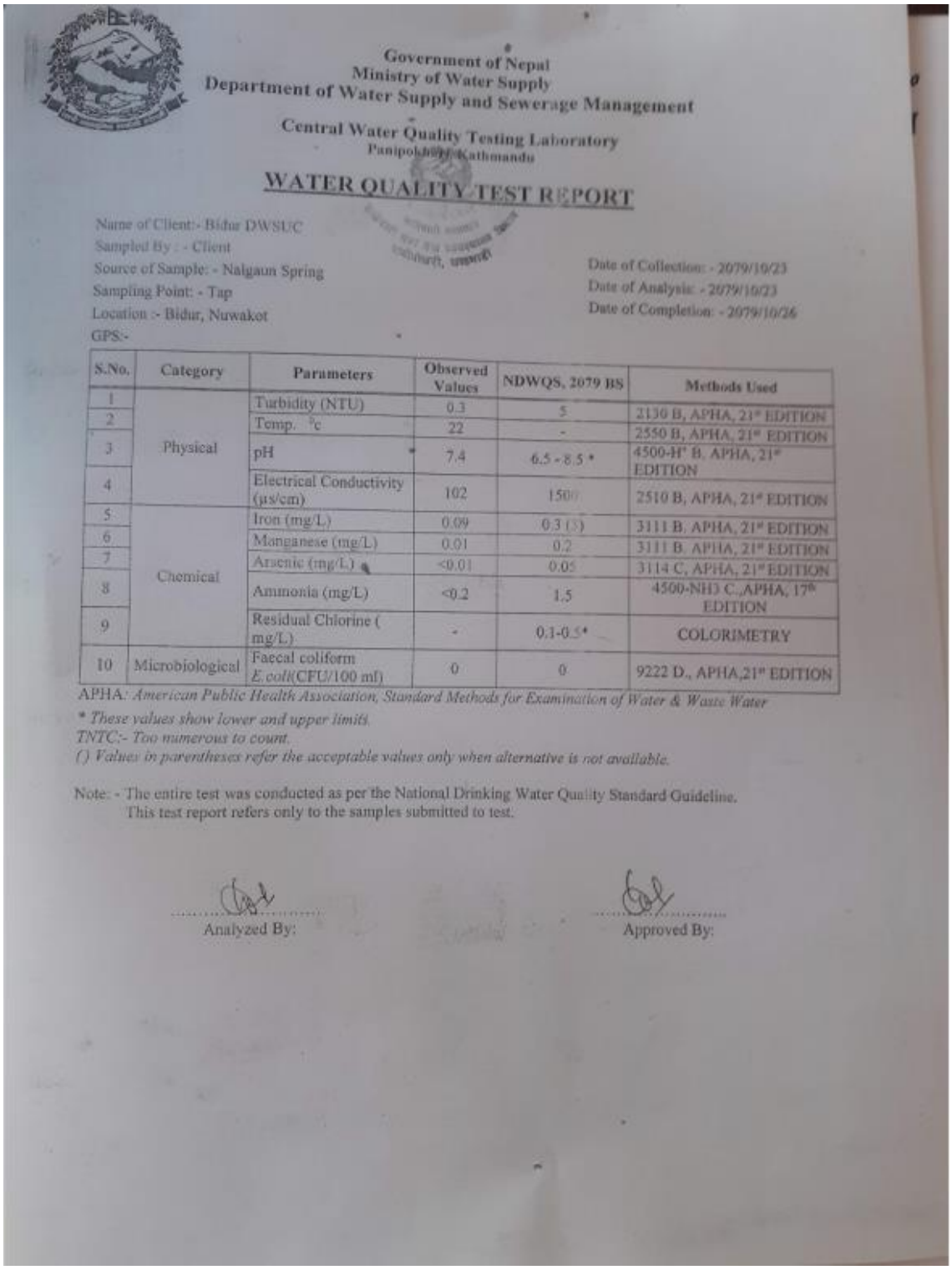
S.No.	Category	Parameters	Observed Values	NDWQS: 2079 BS	Methods Used
1	Physical	Turbidity (NTU)	0.26	5	2130 B, APHA, 21st EDITION
2		Temp. °c	22	-	2550 B, APHA, 21st EDITION
3		pH	7.65	6.5 - 8.5 *	4500-H+ B, APHA, 21st EDITION
4		Electrical Conductivity (µs/cm)	100	1500	2510 B, APHA, 21st EDITION
5	Chemical	Iron (mg/L)	0.01	0.3 (3)	3111 B, APHA, 21st EDITION
6		Manganese (mg/L)	0.01	0.2	3111 B, APHA, 21st EDITION
7		Arsenic (mg/L)	<0.01	0.05	3114 C, APHA, 21st EDITION
8		Ammonia (mg/L)	<0.2	1.5	4500-NH3 C.,APHA, 17th EDITION
9		Residual Chlorine (mg/L)	-	0.1-0.5*	COLORIMETRY
10	Microbiological	Faecal coliform *E.coli*(CFU/100 ml)	03	0	9222 D., APHA,21st EDITION

APHA: *American Public Health Association, Standard Methods for Examination of Water & Waste Water*
* *These values show lower and upper limits.*
TNTC:- Too numerous to count.
( ) Values in parentheses refer the acceptable values only when alternative is not available.

Note: - The entire test was conducted as per the National Drinking Water Quality Standard Guideline.
This test report refers only to the samples submitted to test.

Analyzed By:

Approved By:



Government of Nepal
Ministry of Water Supply
Department of Water Supply and Sewerage Management

Central Water Quality Testing Laboratory
Panipokhari, Kathmandu

WATER QUALITY TEST REPORT

Name of Client:- Bidur DWSUC
Sampled By :- Client
Source of Sample: - Nalgaun Spring
Sampling Point: - Tap
Location :- Bidur, Nuwakot
GPS:-

Date of Collection: - 2079/10/23
Date of Analysis: - 2079/10/23
Date of Completion: - 2079/10/26

S.No.	Category	Parameters	Observed Values	NDWQS, 2079 BS	Methods Used
1	Physical	Turbidity (NTU)	0.3	5	2130 B, APHA, 21st EDITION
2		Temp. °c	22	-	2550 B, APHA, 21st EDITION
3		pH	7.4	6.5 - 8.5 *	4500-H+ B, APHA, 21st EDITION
4		Electrical Conductivity (µs/cm)	102	1500	2510 B, APHA, 21st EDITION
5	Chemical	Iron (mg/L)	0.09	0.3 (3)	3111 B, APHA, 21st EDITION
6		Manganese (mg/L)	0.01	0.2	3111 B, APHA, 21st EDITION
7		Arsenic (mg/L)	<0.01	0.05	3114 C, APHA, 21st EDITION
8		Ammonia (mg/L)	<0.2	1.5	4500-NH3 C.,APHA, 17th EDITION
9		Residual Chlorine (mg/L)	-	0.1-0.5*	COLORIMETRY
10	Microbiological	Faecal coliform *E.coli*(CFU/100 ml)	0	0	9222 D., APHA,21st EDITION

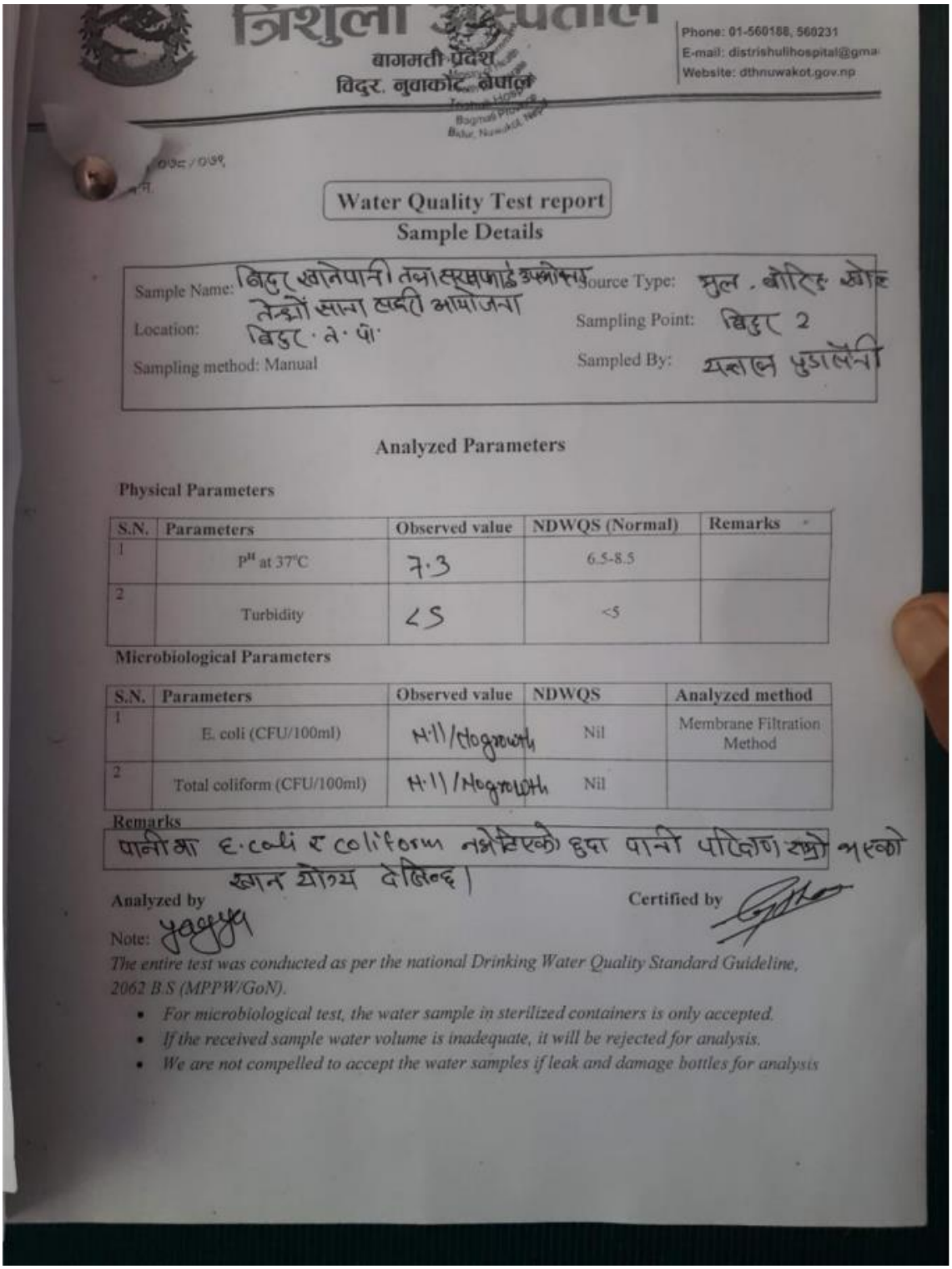
APHA: *American Public Health Association, Standard Methods for Examination of Water & Waste Water*

* *These values show lower and upper limits.*
TNTC:- Too numerous to count.
() Values in parentheses refer the acceptable values only when alternative is not available.

Note: - The entire test was conducted as per the National Drinking Water Quality Standard Guideline.
This test report refers only to the samples submitted to test.

Analyzed By:

Approved By:



त्रिशुली अस्पताल
बागमती प्रदेश
विदुर, नुवाकोट, नेपाल
Phone: 01-560188, 560231
E-mail: distrishulihospital@gma
Website: dthnuwakot.gov.np

Water Quality Test report

Sample Details

Sample Name: बिदुर खानेपानी तथा सरसफाई उपभोक्ता तेस्रो साना खर्ची आयोजना
Source Type: मुल . बोरिङ स्रोत
Location: बिदुर · ने · पा ·
Sampling Point: बिदुर 2
Sampling method: Manual
Sampled By: धनाल पुडासैनी

Analyzed Parameters

Physical Parameters

S.N.	Parameters	Observed value	NDWQS (Normal)	Remarks
1	pH at 37°C	7.3	6.5-8.5	
2	Turbidity	<5	<5	

Microbiological Parameters

S.N.	Parameters	Observed value	NDWQS	Analyzed method
1	E. coli (CFU/100ml)	Nil/Nogrowth	Nil	Membrane Filtration Method
2	Total coliform (CFU/100ml)	Nil/Nogrowth	Nil	

Remarks
पानीमा E.coli र coliform नभेटिएको हुदा पानी परिक्षण स्तर भएको खान योग्य देखिन्छ ।

Analyzed by
Note: yagya
Certified by

The entire test was conducted as per the national Drinking Water Quality Standard Guideline, 2062 B.S (MPPW/GoN).

- *For microbiological test, the water sample in sterilized containers is only accepted.*
- *If the received sample water volume is inadequate, it will be rejected for analysis.*
- *We are not compelled to accept the water samples if leak and damage bottles for analysis*

SFD Bidur Municipality, Nepal, 2025

Produced by:

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

SFD Promotion Initiative