SFD Report

Ilam Municipality
Nepal

Final Report

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

Date of production: 15/06/2023

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SFD Report Ilam Municipality, Nepal, 2023

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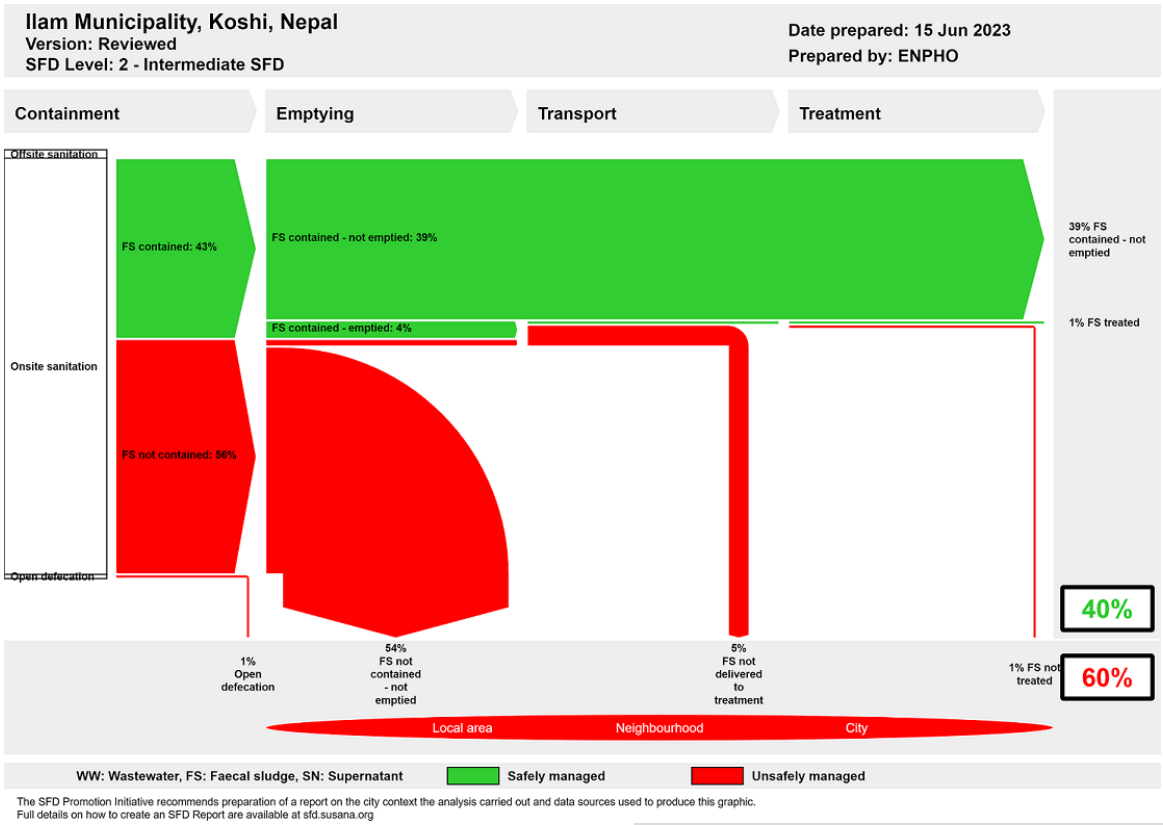
1. The SFD Graphic



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

2. Diagram information

SFD Level:

This SFD is a level 2- Intermediate report

Produced by:

Environment and Public Health Organization (ENPHO).

Collaborating partners:

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

Status:

Final SFD report.

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3. General city information

Ilam Municipality is in Ilam district, Koshi province of Nepal. The municipality was established in 1958; one of the oldest municipalities in Nepal. It has 12 wards and covers the area of 173.32 sq km. It is surrounded by Maijogmai rural Municipality and Suryodaya Municipality in the east, Sandakpur Municipality and Panchthar Distict in the north, Deumai Municipality in the west, and Mai and Suryodaya Municipalities in the south.

According to national population and housing census 2021, Ilam Municipality has a total population of 50,085 and 12,952 households (NSO, 2023).

It has warm and temperate climate with much less rainfall in winter than in summer. The average temperature is 18.7 °C (Climate Data, n.d.). The average annual precipitation amounts to about 3,390 mm and receives 239 rainy days on the 1 mm threshold annually (Nomadseason, 2022). The elevation of the Ilam ranges between

140 meters to 3,636 metres above mean sea level (Ilam municipality, 2017).

4. Service outcomes

The overview of different sanitation technologies across the sanitation value chain in the municipality is briefly explained in this section. All data in this section is from the household and institutional surveys conducted for this study (ENPHO, 2023). 99% of the households in the municipality have toilet. The 1 % of the households without toilet are using temporary pit. The municipality have a public toilet in a Taxi stand in Ilam Bazar. The public toilet was constructed by the municipality and operated by individual service provider.

Containment:

All of the households with access to toilet rely on onsite sanitation technologies. 55% of households have constructed an unlined pit. Similarly, 39% and 5% of the households have constructed lined tanks with impermeable wall and open bottom and fully lined tanks, respectively.

Emptying and Transportation:

According to assessment of sanitation situation of the municipality by ENPHO in 2022, only 8% of the households have emptied their containments at least once after used. 73% of these containments were emptied manually and the remaining were emptied mechanically. The municipality is providing the desludging.

Treatment and Disposal:

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

The SFD graphic shows that 40% of the excreta or faecal sludge generated are safely managed while 60% are unsafely managed. The safely managed Faecal Sludge (FS) generated by 39% of the population is temporary as this FS is only contained. So, once the containment gets filled and the FS from the containment is emptied, the percentage of unsafely managed FS would increase. The faecal sludge generated from 1% of the population is contained and safely treated in anaerobic biogas digesters.

Ilam Urban Water Supply and Sanitation Project (UWSSP) is the major water supply project in the municipality. The water supply scheme serves approximately 3,344 households from ward number 5, 6,7,8 and 9. The scheme consists of horizontal roughing filter, slow sand filter and chlorination unit to provide safe drinking water to its customers (KII_4, 2022).

Besides, water supply and sanitation committees exist in many community to supply drinking water through small scale water supply schemes.

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 passed the Drinking Water 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 needs 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. The document adopted sanitation facilities as improved, basic, and limited in line with WHO/UNICEF guidelines. 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.

Ilam municipal council have approved Health and Sanitation Act on 4 July, 2019 (Ilam Municipality, 2019). As per act, the sanitation section/unit of municipality must prepare standards for individual, households and community sanitation. The households must allocate proper place for managing the waste from toilet while constructing the building and must pay penalty if other

households are affected by the waste produced (faecal waste, wastewater or solid waste) from particular household.

6. Overview of stakeholders

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

Table 1: Overview of Stakeholders.

Key Stakeholders	Institutions / Organizations
Public Institutions at Federal Government	Ministry of Water Supply Department of Water Supply and Sewerage Management (DWSSM)
Public Institutions at Provincial Government	Ministry of Water Supply, Irrigation and Energy Water Supply and Sanitation Division Office (WSSDO)
Public Institutions at Local Government	Ilam Municipality Office Ilam Urban Water Supply and Sanitation Project Office
Non-governmental Organizations	Environment and Public Health Organization (ENPHO)
Private Sector	Public toilet operators, Desludging service providers
Development Partners, Donors	MuAN, BMGF, UCLG ASPAC

7. Credibility of data

The major data were collected from random household sampling. Altogether, 373 households and 56 institutions were surveyed from 12 wards of the municipality on 18-19 October 2022. Primary data on current sanitation practices in the municipality were triangulated from Key Informant Interviews (KIIs) with municipal officials, public toilet operators, desludging service providers and water supply committee. The overall data and findings were shared with the stakeholders of the municipality and validated through a sharing program on 8 June, 2023.

8. Process of SFD development

Data on sanitation situation were collected through household and institutional survey (ENPHO, 2023). The local enumerators from each wards of the municipality were trained on all aspects of sanitation service chain starting from user interface, containment, emptying, transport, treatment, end use or safe disposal of excreta and the use of mobile application; *KoboCollect* was used for collection of data from households and institutions. Moreover, KIIs were conducted with officers and the engineer of the municipality, public toilet operators, desludging service providers and water supply service provider to understand the situation practices across the service chain. Types of sanitation technologies used in different locations were mapped using ARCGIS. To produce 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:

- Climate Data. (n.d.). Climate of Ilam. Retrieved from climate data.org: https://en.climate-data.org/asia/nepal/eastern-development-region/ilam-1061931/
- Ilam municipality. (2017). Municipality profile: Preparation of GIS based Digital Base Urban Map, Ministry of Federal Affairs and Local Development.
- Ilam Municipality. (2019). Ilam Health and Sanitation Act, Ilam municipality.
- MoWS. (2017a). Institutional and Regulatory Framework for Faecal Sludge Management in Urban Areas of Nepal. Kathmandu,Nepal: Ministry of Water Supply.
- MoWS. (2022a). Water Supply and Sanitation Act. Ministry of Water Supply; Government of Nepal.
- Nomadseason. (n.d.). Nomadseason. Retrieved from Climate in Ilam, Koshi Province, Nepal:

https://nomadseason.com/climate/nepal/province-1/ilam.html

- NSO. (2023). National Population and Housing Census 2021. National Statistics Office.

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Table of Contents

List of Tables

List of Figures

Abbreviations

ADB	Asian Development Bank
AEPC	Alternative Energy Promotion Centre
CAO	Chief Administrative Officer
CFU	Colony Forming Unit
DUDBC	Department of Urban Development and Building Construction
DWSSM	Department of Water Supply and Sewerage Management
ENPHO	Environment and Public Health Organization
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSTP	Faecal Sludge Treatment Plant
FWSSM	Federal Water Supply and Sewerage Management
HH	Household
HRF	Horizontal Roughing Filter
ICIMOD	International Centre for Integrated Mountain Development
IRF	Institutional and Regulatory Framework
KII	Key Informant Interview
KM	Kilometers
MoUD	Ministry of Urban Development
MoWS	Ministry of Water Supply
MuAN	Municipal Association of Nepal
NDWQS	National Drinking Quality Standard
NGO	Non-Governmental Organization
NPC	National Planning Commission
NSO	Nepal Statistical Office
NUWSSSP	National Urban Water Supply and Sanitation Sector Policy
NWSSP	National Water Supply and Sanitation Policy
ODF	Open Defecation Free
PCC	Plain Cement Concrete
PMO	Project Management Office
PMQAC	Project Management and Quality Assurance Consultant
RPMO	Regional Project Management Office
RVT	Reservoir Tank
RWSSNP	Rural Water Supply and Sanitation National Policy
SDG	Sustainable Development Goal
SDP	Sector Development Plan
SFD PI	Shit Flow Diagram Promotion Initiative
SFD	Shit Flow Diagram
SN	Supernatant
SuSANA	Sustainable Sanitation Alliance
UCLG ASPAC	United Cities and Local Governments Asia Pacific
UNICEF	United Nations Children's Education Fund
UWSSP	Urban Water Supply and Sanitation Project
WASH	Water, Sanitation and Hygiene

WSS	Water Supply and Sanitation
WSUC	Water Supply Users' Committee
WW	Wastewater

1 City context

Ilam Municipality is in Ilam District, Koshi Province of Nepal (Figure 1). The municipality was established in 1958. It is one of the oldest municipalities in Nepal. It has 12 wards and covers the area of 173.32 sq km. It is surrounded by Maijogmai rural Municipality and Suryodaya Municipality in the east, Sandakpur Municipality and Panchthar District in the north, Deumai Municipality in the west, and Mai and Suryodaya Municipalities in the south. The municipality has been known as the famous tourism city in Nepal. In 2010, Ilam Municipality implemented a complete ban of polythene bags which has set an example for many municipalities all over Nepal.

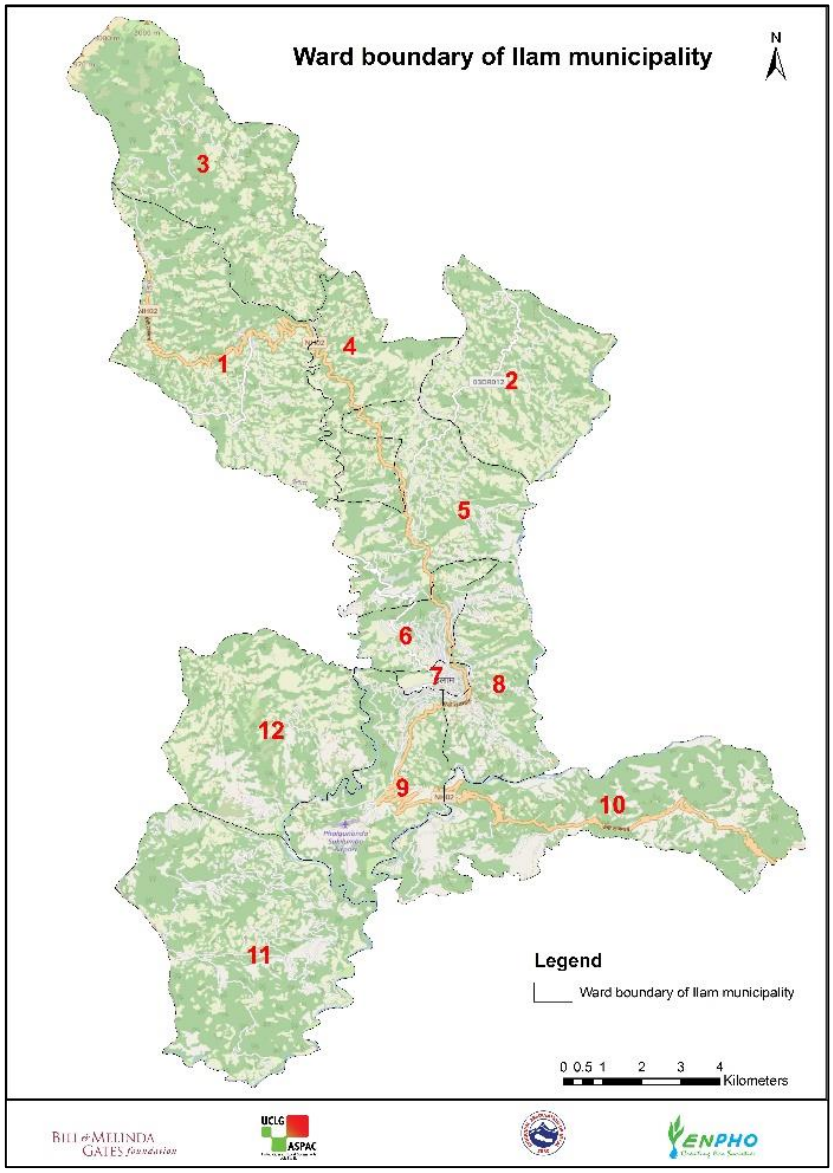

Figure 1: Map of Ilam municipality with ward boundaries.

1.1. Population

According to national population and housing census 2021, Ilam Municipality has total population of 50,085 and 12,952 households. The total male and total female are 24,411 and 25,674. The population density of the municipality is 289 people per square kilometre. A ward number 7 has the highest population of 7,755 (3,809 male and 3,946 female), while ward number 11 has the least population with 2,268 (1,113 male and 1,155 female). Moreover, ward 10 has the highest number of households (1,997), while ward 2 has the least number of households (548) (NSO, 2023).

1.2. Climate

The Ilam Municipality has warm and temperate climate with much less rainfall in Ilam in winter than in summer. This location is classified as Cwa by Köppen and Geiger. The average temperature in Ilam is 18.7 °C (Climate Data, n.d.). Temperatures typically range between 9 °C and 22 °C through the year, but rarely can drop to -1 °C or can rise to as high as 30 °C. Ilam Municipality usually has the most precipitation in June, July and August, with an average of 30 rainy days and 685 mm of precipitation per month. The driest months in Ilam Municipality are January, November and December. On average, 21 mm of precipitation falls during these months. The average annual precipitation amounts to about 3,390 mm and receives 239 rainy days on the 1 mm threshold annually (Nomadseason, n.d.).

1.3. Topography

Ilam Municipality is situated in the Mahabharata range. It is extended from 87° 53' 30" to and 87° 57' 46" E and 26° 51'58" to 26° 56'46" N. The elevation of the Ilam ranges between 140 meters to 3,636 metres above mean sea level (Ilam municipality, 2017). Mai River and Puwa River are the major rivers in the municipality. The major river originates in Mahabharat and flows northern to southern part of municipality. Beside these, there are some local streams originated in rainy season are filled with huge volume of water that leads to floods.

The southwest part of the Ilam Bazaar includes Siwalik, the Lesser Himalaya and the Higher Himalaya Crystalline thrust sheet, from south to north. The Higher Himalayan Crystallines are comprised of garnet-kyanite-sillimanite gneiss and white to grey quartzites. The Lesser Himalaya is subdivided into the phyllite and quartzite, the augen gneiss and the garnet-hornblende schist from bottom to top, respectively (Chamlagain, 2003).

Alluvial deposit spatially concentrated in the southern and alluvial fans located in northern part of the municipality are the landforms of Pleistocene. The loose beds of sands and gravel are roughly horizontal and show fining upward succession with cobble pebble with loose sands and silty sands at base and silty clay and clayey silt and clay as the residual soil on top. There is fine sediments in almost all part of the municipality (Ilam municipality, 2017).

2 Service Outcomes

2.1. Overview

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2023). A total of 373 households were sampled from 12,952 households distributed in fourteen wards (further details are presented in section 4). The results obtained after the triangulation and validation of the data with all the data sources including literature reviews, Key Informant Interviews (KIIs) and a validation workshop is presented in this section.

Particularly over the past 20 years, sanitation has been promoted in Nepal, which led to the nation as Open Defecation Free (ODF) nation on September 30, 2019, with the combine effort of the 3 tiers of the government (MoWS, 2020). The Ilam District was declared an Open Defecation Free Zone in 2011 (KII_1, 2022). However, it was revealed that 1% of the households still lack access to improved sanitation facilities.

2.1.1 Sanitation System in Households Building

The onsite sanitation refers to a sanitation technology or sanitation system in which excreta is collected and stored and emptied from or treated on the plot where they are generated (SuSanA, 2018). All the households with access to toilet in the municipality rely on onsite sanitation systems. Table 1 shows the percentage of households with different types of containment in the municipality

Table 1: Types of containment in households building in Ilam Municipality (ENPHO, 2023).

Containment	Wall construction Materials	Bottom of containment	Chamber	Connected to	%	Recategorized as SFD	%
Biogas Digester					1%	Fully lined tank	5%
Fully lined tank	Cemented walls or cemented brick / stone wall	PCC or plastered	One orTwo	No outlet/ overflow	4%		
Lined tank with impermeable wall and open bottom	Cemented walls or cemented brick / stone wall	Soiling / nothing	One ,Two or More than Two	Open ground No outlet/ overflow	39%	Lined tank with impermeable wall and open bottom	39%
Unlined pit	Mud mortar stone/ brick wall/ dry stone wall/ no lining	Soiling / nothing	One	No outlet/ overflow	55%	Unlined pit	55%
Open Defecation					1%		1%
Total					**100%**		**100%**

An anaerobic biogas digester has been installed in 1% of households to treat the household organic waste and generate energy (Figure 2). Also, excreta from toilet are connected to these digesters along with the cow dung and other organic solid waste. The capacity of these digesters are 4 m^3 and 6 m^3. The home biogas digesters are small on-site waste systems that use a process called anaerobic and replace conventional septic systems (Water Online, 2015). The biogas digesters are reclassified as fully lined tanks (sealed) which are regularly emptied, and the Faecal Sludge (FS) is treated for properly functioning digesters.

Figure 2: Biogas digester in households.

Fully lined tanks are constructed by 4% of the households and lined tanks with impermeable walls and open bottom are constructed by 39% of the households. Unlined pits are most common containment type in the municipality. 55% of the households in the municipality have constructed unlined pits. Unlined pits are constructed with mud mortar brick / stone wall or dry stone wall and soling or nothing at bottom as shown in Figure 3. There are permeable walls and base, through which infiltration can occur.

Figure 3: Unlined pit under construction in Ilam Municipality.

Figure 4 shows a map of the households with the types of containment observed in the survey.

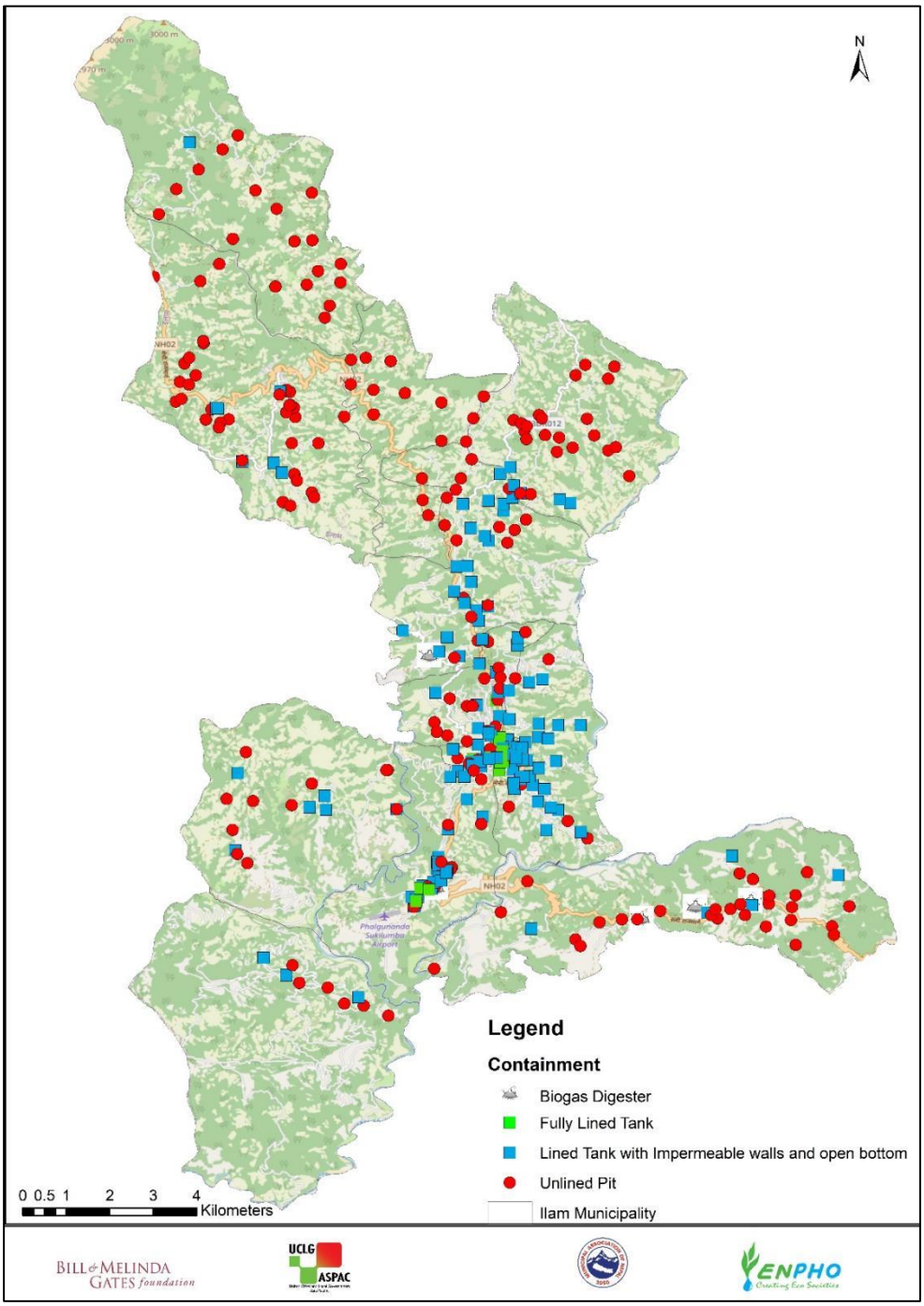

Figure 4: Map showing the households with the types of containments in Ilam Municipality.

2.1.2. Sanitation Systems in Institutional building

All institutional buildings (56 institutions) surveyed have been connected waste from toilet into onsite sanitation technologies. The lined tank with impermeable walls and open bottom is popular onsite sanitation technology in institutions of Ilam Municipality. Figure 5 shows the different sanitation technologies available in the institutions of Ilam Municipality.

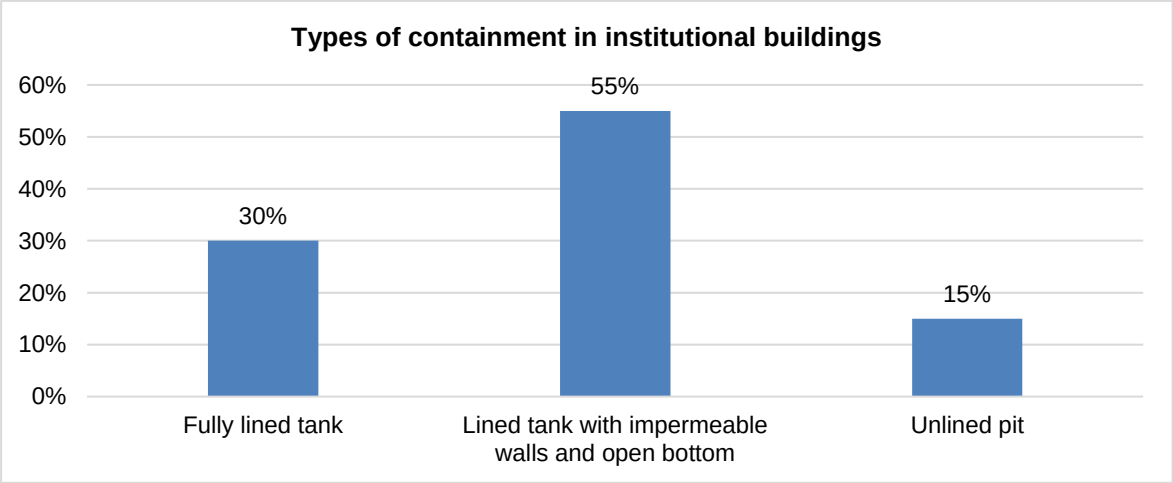

Figure 5: Types of containment in the institutional building of Ilam Municipality.

Figure 6 shows a map locating surveyed institutional buildings and types of sanitation technologies.

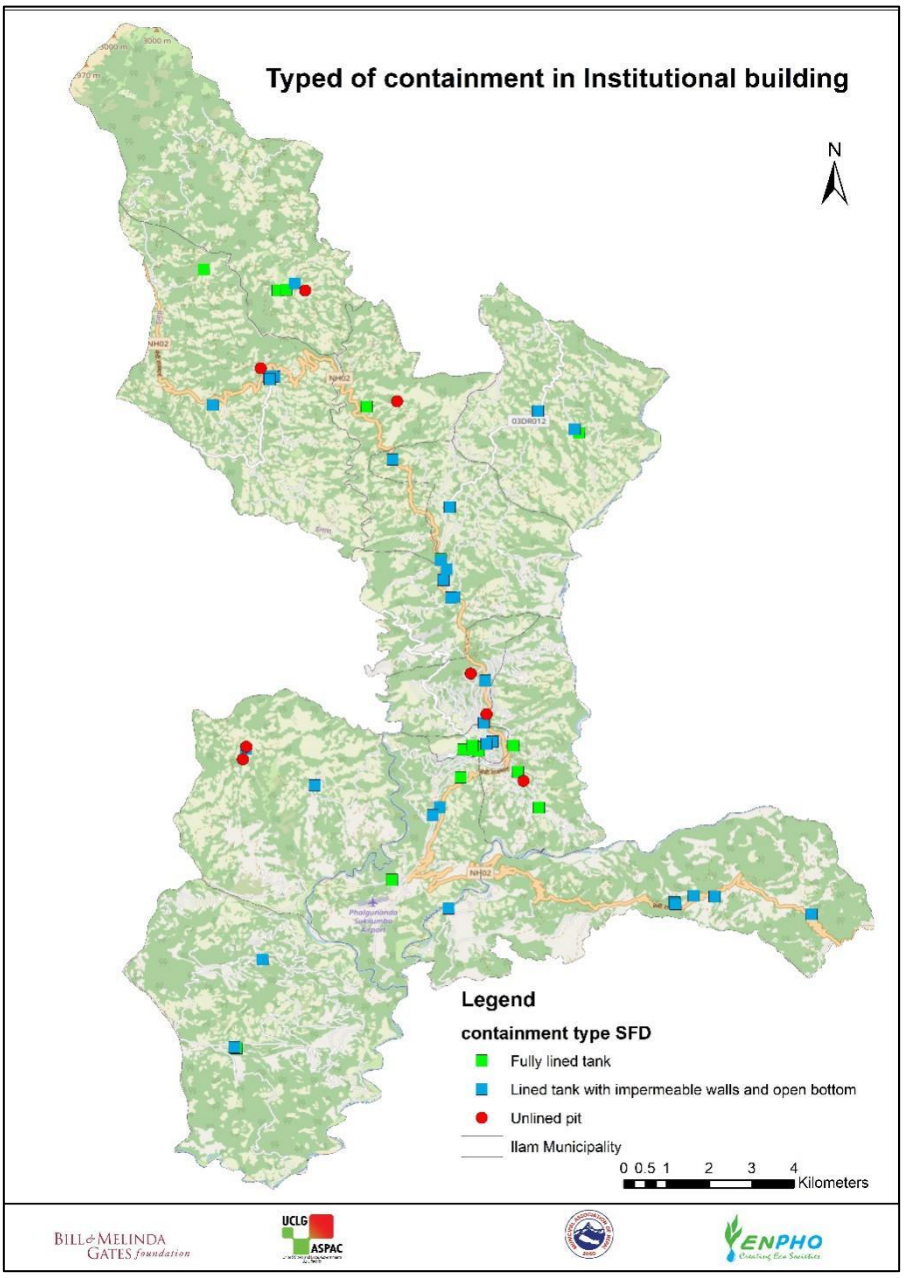

Figure 6: Map locating institutional building with types of sanitation technologies.

2.1.3. Public Toilet

There is a public toilet in the taxi stand of the municipality (Figure 7). It was constructed by Ilam Municipality. The operation and maintenance of the toilet is leased to private sector. The toilet is connected to a fully lined tank. It is emptied every year. The water required for cleaning the

toilet is fulfilled from a tap connected to pipeline distributed by Ilam Urban Water Supply and Sanitation Project. More than 300 people are using the toilet in daily basis (KII_2, 2022).

Figure 7: Components of the public toilet at Taxi stand in Ilam Municipality.

2.1.4. Emptying and Transport

Emptying and transporting faecal sludge is an essential service for proper functioning of onsite sanitation technologies (Linda Strande, 2014). Only 8% of the households have emptied their containments at least once since it was used. Among these households, 27 %, have emptied them mechanically while 73% of the households rely on self-manual emptying or traditional sanitation workers. Although the municipality is providing the desludging services since 2011, most of the households are emptying the containment manually due to difficulties on access to road network. Mostly, the people from Ilam bazar (ward 7) are requesting desludging services (KII_3, 2022). Poor emptying practices can lead to direct exposure of the person involved in emptying activities to pathogens (WHO, 2018).

The suction vehicle has a capacity of 4,000 L and approximately carries out 20 trips per month (KII_3, 2022). The people submit an application to municipality office to get services. It charges on average NPR 3,500 (USD 26.6) per trip. Usually, 3 staffs are involved for the desludging service who are also involved in the other sanitation works within municipality. The personal protective equipment has been used by the service providers while providing desludging services (Figure 8).

Figure 8: Desludging service providers from Ilam Municipality providing services.

2.1.5. Treatment and Disposal

FS emptied manually is either mixed with organic solid waste at household level without following any procedure to produce quality compost manure or directly applied into farmlands or discharged into water bodies. The direct use of faecal sludge has the highest level of risk for human health, therefore not recommended to practice it (Strande et. al., 2014). Thus, the handling of the manually emptied FS in the municipality in unhygienic and possess risk to human health.

The municipality does not have a faecal sludge treatment plant. The mechanically emptied faecal sludge is disposed of in ward 9, Khalte, nearby a solid waste landfill site (KII_3, 2022). Puwa River is situated at the downstream of the disposal site. However, the river is far from the disposal site by approximately more than 5 km.

Figure 9: Faecal Sludge disposal site along with solid waste landfill site.

2.1.6. Risk Assessment of Groundwater Pollution

a. Sources of Drinking Water

According to assessment, 58% of households in the municipality rely on private tap while 6% of households rely on public tap for drinking purpose (ENPHO, 2023). The Ilam Urban Water Supply and Sanitation Project (UWSSP) is the major water supply project in the municipality. The project implementation period is 2018 to 2023 (KII_4, 2022).UWSSP is supporting Government of Nepal in providing water supply and sanitation (WSS) services to Ilam through Asian Development Bank (ADB) financing. The executing agency of the UWSSP is the Ministry of Water Supply (MOWS). The Project Management Office (PMO), under the MoWS implementing the project. The project aims to enhance the quality of life for urban population, including the poor and marginalized, through provision of improved sustainable WSS services (MoWS, 2018).

Regional Project Management Offices (RPMOs) one in Easter Region at Itahari for project design, supervision & monitoring activities of each town sub-projects are being implemented. The Project Management and Quality Assurance Consultant (PMQAC) had been mobilized from 01 July 2019 and is working under the PMO office in central and providing support to the PMO and RPMOs (ADB, 2023).

Ilam UWSSP has provided drinking water for wards 6 and 7 completely and partially at ward 5, 8 and 9. Approximately 3,344 taps have been installed (KII_4, 2022). The description of the components such as intake, Reservoir Tank (RVT), Horizontal Roughing Filter (HRF), slow sand filter and dosing pumps of the water supply project have been mentioned in the Table 2.

Table 2: Components of Ilam Urban Water Supply and Sanitation Project.

Components	Location	Units
Intake	Rate	10 lps
	Mewa	10 lps
	Gitang	16 lps
	Bhadi	5 lps
RVT	Dada Gaun	50 m^3
	Gumba Dada	50 m^3
	Gadhi (new)	150 m^3
	Gadhi (existing)	125 m^3
	Shikharnagar (new)	150 m^3
	Shikharnagar (existing)	360 m^3
	Milenkendra (existing)	88 m^3
	Campus (new)	50 m^3
	Tudikhel	125 m^3
	Tilkeni	150 m^3
	Golakharka	150 m^3
Desilting Basin	Jalbire	3 units
HRF	Charkhade	4 units
Slow Sand Filter	Charkhade	3 units
Chlorine Dosing Pump	Charkhade	2 units (200 L)

Figure 10: RVT of Ilam Urban Water Supply and Sanitation Project.

The water quality testing reports shows that the treated water and tap water provided by the Ilam UWSSP meets the Nepal Drinking Water Quality Standards (NDWQS), 2022 while stream source water is contaminated with faecal matter.

Table 3: Water Quality Testing Report of Ilam UWSSP (FWSSM, 2023).

Date	Sample taken from	pH	Turbidity	Electrical conductivity	FRC	Faecal Coliform (*E.coli*)
	Unit		**NTU**	**µs/cm**	**mg/L**	**CFU/100 ml**
	NDWQS value	**6.5-8.5**	**5**	**1,500**	**0.1-0.5**	**0**
24-May-23	Stream Source (Melbote)	7.4	0.4	56	-	10
	After treatment	8.2	0.3	61	0.2	0
	Tap 1	8.3	0.2	71	0.5	0
	Tap 2	8.3	0.1	67	0.5	0
	Tap 3	8.5	0.2	66	0.5	0

The Small Water Supply Users Committee (WSUC) such as Sakhejung in ward 1, Majh kharka in ward 1, Adherikhola and Godak in ward 10, Dadagaun ward 12 have been providing the drinking water services. Moreover, 36% of households rely on spring sources. The households are using the spring water sources directly (Figure 11).

Figure 11: Spring water sources for drinking purposes.

As cited by District Coordination Committee, Ilam from the report of Strengthening of Environmental Administration and Management at the Local Level in Nepal (2014), the drinking water of Ilam Municipality has shown the microbial contamination of faecal coliform in each sample which also questions its suitability for drinking (DCC, 2015).

The water resources map of Ilam Municipality, obtained from the International Centre for Integrated Mountain Development (ICIMOD) Land Use Map in 2010, provides valuable insights into the water resources within the municipality. In Figure 12, the map illustrates the distribution of unlined pits alongside the water resources. Notably, the figure highlights that the unlined pits

are predominantly concentrated in areas with water resources. This poses a potential risk of water contamination due to the possibility of faecal coliform contamination from these pits. However, it is important to note that the map has limitations in terms of quantifying the extent of water contamination caused by these unlined pits.

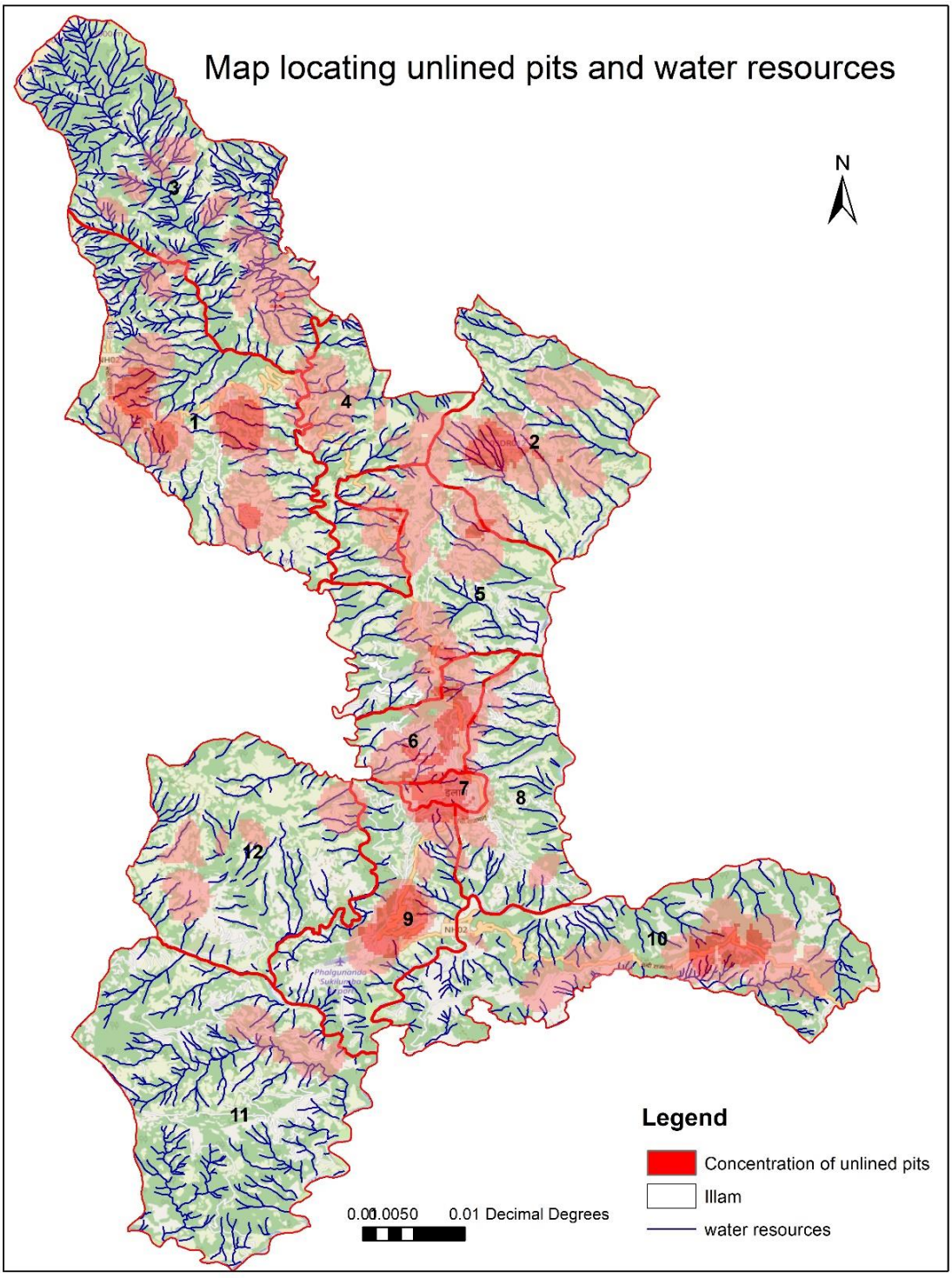

Figure 12: Map locating concentration of unlined pits and water resources.

Based on the literature review on water resources and water quality testing report and information obtained from stakeholders, the risk of the groundwater contamination has been assumed as follows:

Lined tanks with impermeable walls and open bottom, no outlet/overflow

Out of the total of households using lined tanks with impermeable walls and open bottom, no outlet /overflow (38%), 10% are using spring source for drinking purposes and considered to be at high risk of groundwater contamination (T2A4C10 = 10%). Therefore, the remaining 28% of the households using the drinking water from private and public taps are at low risk of groundwater contamination (T1A4C10 = 28%), as shown in Table 4.

Unlined pits

Out of the total of households using unlined pits (55%), 17%, 3% and 25% are using private or public taps provided by small community level water supply schemes without treatment units or are using spring source as their drinking water source, and therefore those households are considered to be at high risk of groundwater contamination (T2A6C10 = 45%) as shown in Figure 12. Therefore, the remaining 10% of the households using the water supply provided by Ilam Water Supply and Sanitation Project are at low risk of water contamination (T1A6C10 = 10%) as shown in Table 4.

Table 4: Containment types and risk of water contamination.

Containment Type	Drinking Water sources	High Risk	Low Risk
Lined tank with impermeable walls and open bottom	Private/Yard Tap	0%	25%
	Public/Community Tap	0%	3%
	Spring Source	10%	0%
Total		**10%**	**28%**
Unlined Pit	Private/Yard Tap	17%	10%
	Public/Community Tap	3%	0%
	Spring Source	25%	0%
Total		**45%**	**10%**

2.2. SFD Matrix

2.2.1. SFD Selection Grid

The SFD selection grid consists of the types of containment technologies in vertical column in List A, while top horizontal row (List B) consists of a list where each of containment technologies are connected to. The existing containment technology was classified to fit in the SFD grid.

Prior to selection of containment technologies, single pits constructed by assembling pre-cast concrete rings one above another is categorized as lined pit with semi-permeable walls and open bottom. Also, anaerobic biogas digester is categorized as a fully lined tank, which is regularly emptied and treated, as the technology can treat the Faecal Sludge (FS).

The various types of sanitation technologies selected for the SFD graphic generator are shown in the SFD selection grid, as shown in Figure 13 and explained in Table 5.

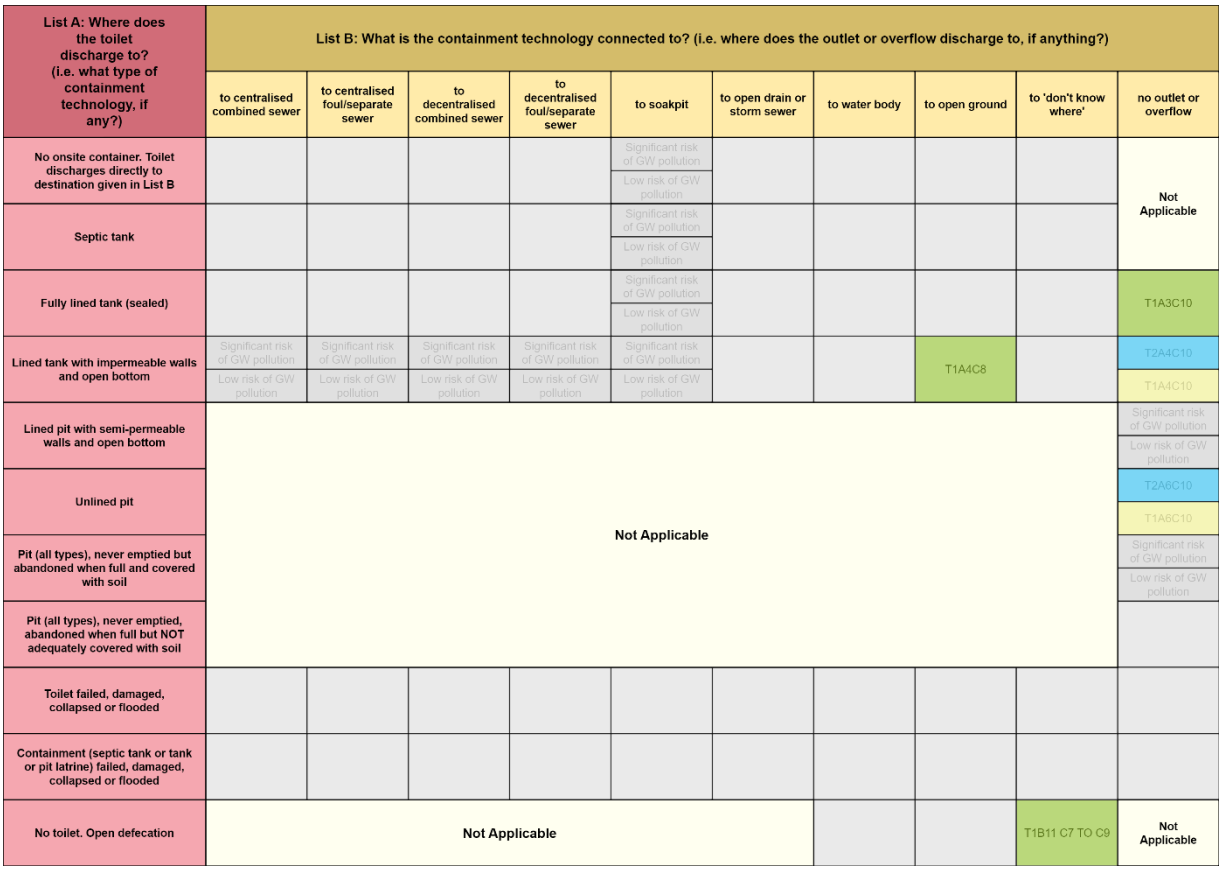

Figure 13: SFD selection grid of Ilam Municipality.

Table 5: Explanation of different variables and containment technologies selected in SFD selection grid (SuSanA, 2018).

SN	Variables	Explanation
1	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.
2	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.
3	T1A4C10	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, through which infiltration can occur. Since there is not a 'significant risk' of groundwater pollution, the excreta of this system are considered contained.
4	T1A6C10	This is 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 not fitted with a supernatant/effluent overflow, the excreta in this system are considered contained.
5	T1B11 C7 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.
6	T2A4C10	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, through which infiltration can occur. Since there is a 'significant risk' of groundwater pollution, the excreta of this system are considered not contained.
7	T2A6C10	This is a correctly designed, properly constructed and well maintained unlined pit with permeable walls and base, through which infiltration can occur. Since there is a 'significant risk' of groundwater pollution, the excreta of this system are considered not contained.

2.2.2. Proportion of the FS contents of each type of onsite container which is faecal sludge

A detailed instruction from the SFD PI was used as guide to calculate the proportion of the contents of each type of onsite container which is faecal sludge. It stated that the default "100%" value should be used where onsite containers are connected to soak pits, to water bodies or to open ground.

This will model the contents as 100% faecal sludge and a proportion of this may be emptied periodically. The remaining not emptied fraction is made up of one or more of the following: faecal sludge which remains in the container, supernatant (when discharging to water bodies or to open ground), and infiltrate. Where onsite containers are connected to a sewer network or to open drains, a value of "50%" is used which means that half the contents are modelled as faecal sludge; a proportion of this may be emptied periodically. The remaining not emptied fraction will comprise faecal sludge which remains in the container and, in the case of open bottomed tanks, infiltrate. The other half of the contents is modelled as supernatant discharging into the sewer network or to open drains. The formula used for faecal sludge proportion calculation is shown below:

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

The proportion of FS in fully lined tanks, lined tanks with impermeable walls and open bottom and all types of pits was set to 100% according to the relative proportions of the systems in the municipality, as per the guidance provided by SuSanA.

2.2.3. SFD matrix

SFD matrix is a table which contains the means to calculate the variables for each of the sanitation systems chosen in the SFD selection grid. It comprises of list of possible containment technologies in the first column and list of all possible places to which the containment technology could be connected in the top rows.

The sanitation technologies and the corresponding percentage of the population using such technologies are shown in Figure 14. These values are derived from the HH survey (ENPHO, 2023) and KIIs with desludging service providers (KII_3, 2022).

Ilam Municipality, Koshi, Nepal, 15 Jun 2023. SFD Level: 2 - Intermediate SFD
Population: 50455
Proportion of tanks: septic tanks: 100%, fully lined tanks: 100%, lined, open bottom tanks: 1

Containment				
System type	Population	FS emptying	FS transport	FS treatment
	Pop	F3	F4	F5
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
T1A3C10 Fully lined tank (sealed), no outlet or overflow	5.0	50.0	42.0	95.0
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	28.0	4.0	0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	1.0	0.0	0.0	0.0
T1A6C10 Unlined pit, no outlet or overflow	10.0	8.0	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	10.0	0.0	0.0	0.0
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	45.0	4.0	0.0	0.0

Figure 14: SFD matrix of Ilam Municipality.

2.2.4. Calculation of proportion of FS emptied from containment (Variable F3)

The proportion of faecal sludge emptied (F3) is calculated based on percentage containment emptied (ENPHO, 2023) and amount of FS emptied during the process (KII_3, 2022). In average, 80% of total faecal sludge from the containment is emptied during emptying mechanism as per household survey conducted. Thus, actual emptied proportion of faecal sludge was taken as 80% of the emptied containment. Hence, the proportion of FS emptied from the sanitation technology is calculated as 80% on the sanitation technology emptied.

As biogas digester have been considered as fully lined tank while preparing the SFD graphic, the emptied proportion includes the percentage of biogas digester emptied. The emptied percentage of the fully lined tank no outlet or overflow mentioned in Table 6 is the sum of the emptied proportion of biogas digester (26.3%) and fully lined tank (36.9%). Table 6 shows the calculation of variable F3.

Table 6: Actual emptying proportion for existing containment technologies (ENPHO, 2023[1]; KII_3, 2022[2]).

SN	Reference Variables	Containment technologies	Percentage of emptied containment [1]	Emptied proportion of FS [2]	Actual proportion of emptied FS (F3)
1	T1A3C10	Fully lined tank (sealed), no outlet or overflow	63.2%	80%	51%
2	T1A4C8	Lined tank with impermeable walls and open bottom, connected to open ground	0.0%	80%	0%
3	T1A4C10	Lined tank with impermeable walls and open bottom, no outlet or overflow	4.8%	80%	4%
4	T1A6C10	Unlined pit, no outlet or overflow	10.0%	80%	8%
5	T1B11 C7 TO C9	Open defecation	0.0%	80%	0%
6	T2A4C10	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	0.0%	80%	0%
7	T2A6C10	Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	5.4%	80%	4%

2.2.5. Calculation of FS emptied delivered to treatment plant and treated (Variables F4 and F5)

1% of households in the municipality have been using the biogas digesters which have been included as a fully lined tank (sealed) containment while preparing the SFD graphic. The actual emptied fully lined tanks with no outlet and biogás digestor is 51% (F3 = 51%). Among them,

42% are biogas digesters that have been used by households. Thus it has been considered as transported to treatment plant (F4 = 42%). Thus, 95% of the households who have been using biogas digester has been considered as treated (F5 = 95%). However, there is no Faecal Sludge Treatment Plant (FSTP) within the municipality for FS treatment (KII_1, 2022).

2.2. Summary of Assumptions

Offsite sanitation System:

- ✓ There is not any sewer network hence all households in the municipality depend on onsite sanitation in Ilam Municipality.

Onsite Sanitation System:

- ✓ The proportion of FS in septic tanks was set to 100%, the proportion of FS in fully lined tanks was set to 100% and the proportion of FS in lined tanks with impermeable walls and open bottom and all types of pits was set to 100% according to the relative proportions of the systems in the municipality, as per the guidance given in the Frequently Asked Question (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 KIIs conducted.
- ✓ The municipality does not have any form of treatment plant to treat faecal sludge. Also, the people using twin pits reclassified as lined pits with semi-permeable walls and open bottoms are not using them properly. The FS emptied from the containments is dumped openly in farmland or water bodies. Thus, variables F4 and F5 for all sanitation systems are set to 0%. However, FS from anaerobic biogas digesters, classified as fully lined tanks (system T1A3C10), is considered as transported (F4 = 42%) and treated with a treatment efficiency estimated at 95% (F5 = 95%).

2.3. SFD Graphic

Figure 15 represents the fate and flow of wastewater (WW), faecal sludge and supernatant through each sanitation service chain. It shows that FS generated from 40% of the population is safely managed represented by “Green” colour arrowhead where 39% resembles the FS stored in the containment without significant risk to groundwater pollution. However, the safely managed percentage of FS generated by this 39% of the population is temporary until the FS from the containment is emptied. Therefore, these containments will require emptying services in the short and medium term as they fill up. Only 1% of the population have treated the FS using biogas digesters.

The FS from 60% of the population is unsafely managed, represented by “Red” arrow heads. The percentage of unsafely managed is generated from FS emptied but not delivered to treatment plant (5%), FS from containments where FS is not contained - not emptied (54%), FS not treated (1%) and people practising open defecation (1%).

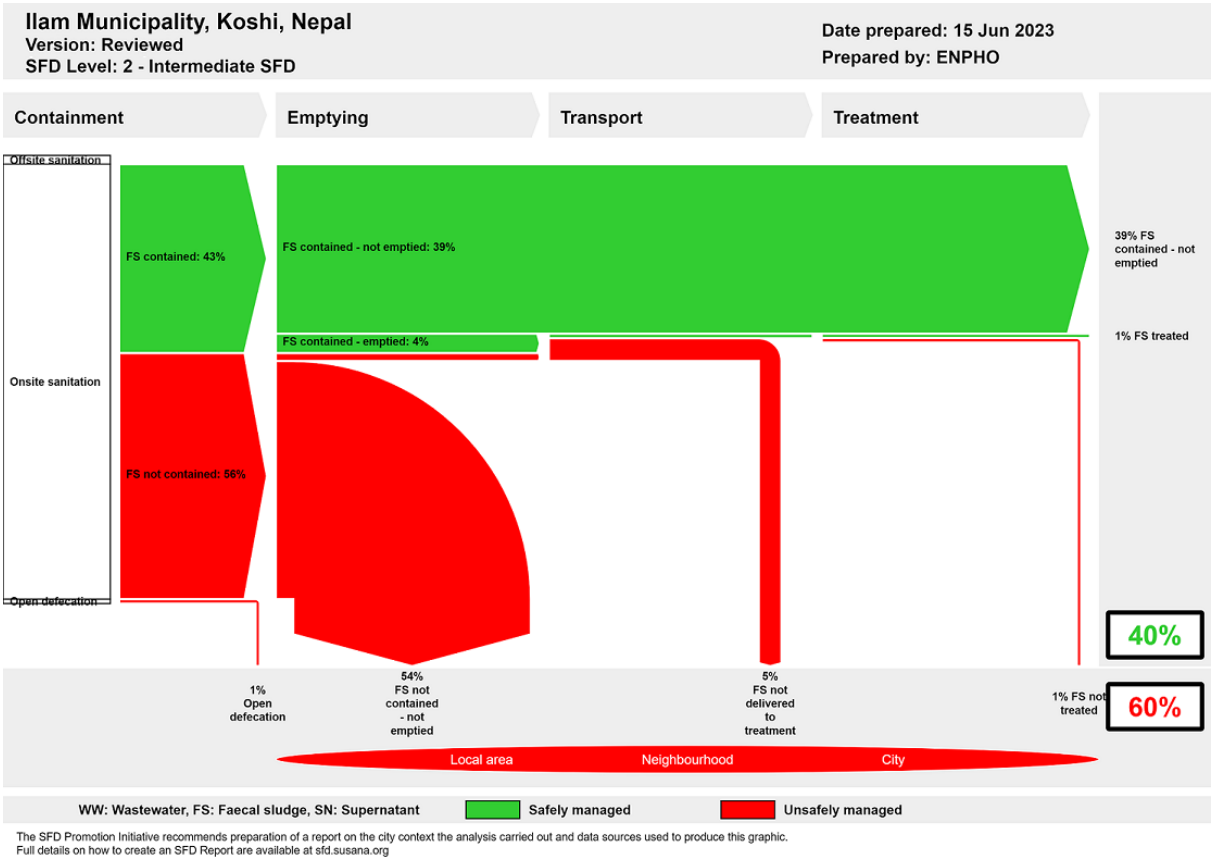

Figure 15: SFD graphic of Ilam Municipality.

All of the population with access to toilets relies on onsite sanitation systems. As shown on the SFD Graphic (Figure 15), it is estimated that 43% of the population uses systems where the FS is considered contained, while 56% of the population uses systems where the FS is considered not contained.

FS contained

The definition of 'FS contained' is faecal sludge contained within an onsite sanitation technology which ensures safe level of protection from excreta i.e. pathogen transmission to the user or general public is limited. These are tanks or pits that are correctly designed, properly constructed, fully functioning, and/or are causing no risk or only a 'low' risk of polluting groundwater used for drinking (SuSanA, 2018). The value is the summation of the percentage of population using fully lined tanks (sealed), no outlet or overflow (T1A3C10), lined tanks with impermeable walls and open bottom, no outlet or overflow (T1A4C10) and unlined pits with no outlet or overflow (T1A6C10). Thus, the FS generated by 43% of the population is considered contained.

FS not contained

The definition of 'FS not contained' is faecal sludge contained within an onsite sanitation technology which does not ensure safe level of protection from excreta i.e. pathogen transmission to the user or general public is likely. These are tanks or pits that are incorrectly designed, or poorly constructed, or poorly functioning, and/or are causing a 'significant' risk of polluting groundwater used for drinking (SuSanA, 2018).

The value is obtained from the summation of percentage of population using lined tanks with impermeable walls and open bottom, connected to open ground (T1A4C8), lined tanks with impermeable walls and open bottom, no outlet or overflow where there is a 'significant risk' of groundwater pollution (T2A4C10) and unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution (T2A6C10). Thus, the FS generated by 56% of the population is considered not contained.

FS contained - emptied

The proportion of FS contained - emptied is the summation of the proportion of FS emptied from fully lined tanks (sealed), no outlet or overflow (T1A3C10), lined tanks with impermeable walls and open bottom, no outlet or overflow (T1A4C10) and unlined pits with no outlet or overflow (T1A6C10). Thus, proportion of FS contained - emptied is 4%.

FS not contained - emptied

The proportion of FS not contained - emptied (2%) is FS that is not contained in onsite sanitation technologies and emptied either mechanically or manually.

FS not delivered to treatment

The municipality does not have treatment facility to treat faecal sludge. So, all the FS emptied from contained and not contained containments is disposed of into farmlands and disposal site. The proportion of FS not delivered to treatment (5%) is the summation of FS contained - emptied and FS not contained – emptied and not treated.

FS treated

The proportion of FS obtained from containment which has been transported to treatment and treated is 1%.

Open Defecation

The Ilam Municipality was declared as an open defecation free municipality in 2011. However, the household survey reveals that 1% of the households have no toilet and practise open defecation.

3. Service Delivery Context

3.1. Policy, Legislation and Regulation

3.1.1. Policy

The Constitution of Nepal 2015 in Article 35 related to right to health recognizes citizen's rights to 'access to clean drinking water and sanitation'. In addition, Right to Clean Environment, Article 30 recognizes that every person shall have the right to live in a healthy and clean environment (GoN, 2015). To respect, promote and fulfil the provisions related to right on water and sanitation, Government of Nepal (GoN) has passed Drinking Water and Sanitation Act in 2022 through Ministry of Water Supply. The act elaborates right to clean water as to receive affordable, sufficient, and quality drinking water regularly as well as access to sanitation as affordable access to quality sanitation services (MoWS, 2022a).

Historically, the National Sanitation Policy (1994) was the guideline for the planning and implementation of sanitation programs. The policy had promoted sanitation issues together with issues on water supply in rural communities. Also, Rural Water Supply and Sanitation National Policy (RWSSNP) 2004, has set a new target to provide safe, reliable, and affordable water supply with basic sanitation facilities. The policy focused on delivering quality services on water and sanitation in the marginalized and vulnerable groups. Participatory approach, community leadership project development, optimization of local resources and installation of locally appropriate technologies were major principles in the policy (DWSSM, 2004). However, it was unable to address the complex operational issue of urban water supply and sanitation service delivery (DWSSM, 2009).Thus, National Urban Water Supply and Sanitation Sector Policy (NUWSSSP) was formulated and enforced in 2009. It focused on achieving coherent, consistent, and uniform approaches of development in urban areas with the involvement of different agencies and institutions. Cost recovery principles, public private partnership, and sector effectiveness for improved service delivery are key principles of the policy (DWSSM, 2009). Both these policies were limited to addressing emerging issues and challenges in the rural and urban areas. Thus, National Water Supply and Sanitation Policy (NWSSP) was formulated in 2014 by the GON to address the emerging challenges and issues with the adoption of new approaches and resolve the inconsistency in RWSSNP and NUWSSSP. The goal of the NWSSP was to reduce urban and rural poverty by ensuring equitable socio-economic development, improving health and the quality of life of the people and protection of environment through the provision of sustainable water supply and sanitation services. It adopted innovative technologies and knowledge emerged in the sector. Remarkably, it was the first official document that recognized discharge of untreated wastewater and dumping of septic sludge heavily polluted the surface water sources in urban areas.

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 Water Sanitation and Hygiene (WASH) plan with the local leadership to ensure the WASH services for all (MoWS, 2022b).

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).

Together with a national commitment to pursuing and achieving the Sustainable Development Goals (SDGs) by 2030, National Planning Commission formulated targets and indicators for coordinated efforts to achieve the goals. This commitment has been reaffirmed in key policy documents, such as the current 15th Development Plan. Furthermore, Nepal has undertaken various initiatives to localize the SDG indicators by developing the SDG Status and Roadmap, which includes baselines and targets for 2030 (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 (FSM) 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, 2017a). 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.

Ilam municipal council has approved Health and Sanitation Act on 4 July, 2019 (Ilam Municipality, 2019). It has included some major aspects of sanitation as mentioned below:

- Sanitation section/unit of municipality must prepare standards for individual, households and community sanitation.
- Households must allocate proper place for managing the waste from toilet and solid waste while constructing the building.
- Households must pay penalty if other households are affected by the waste produced (faecal waste, wastewater or solid waste) from particular household.
- Municipality will collaborate with other government entities, private sector, community based organizations, trusty, experts for providing the sanitation services in the 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 Level

National Planning Commission: At the federal government, the National Planning Commission is the specialized and apex advisory body for formulating a national vision, developing policy, periodic plans, and sectoral policies. The NPC assesses resource needs, identifies sources of funding, and allocates budget. It serves as a central agency for monitoring and evaluating development policy, plans and programs. It supports, facilitates and coordinates with federal, provincial, and local government for developing policy 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 16.

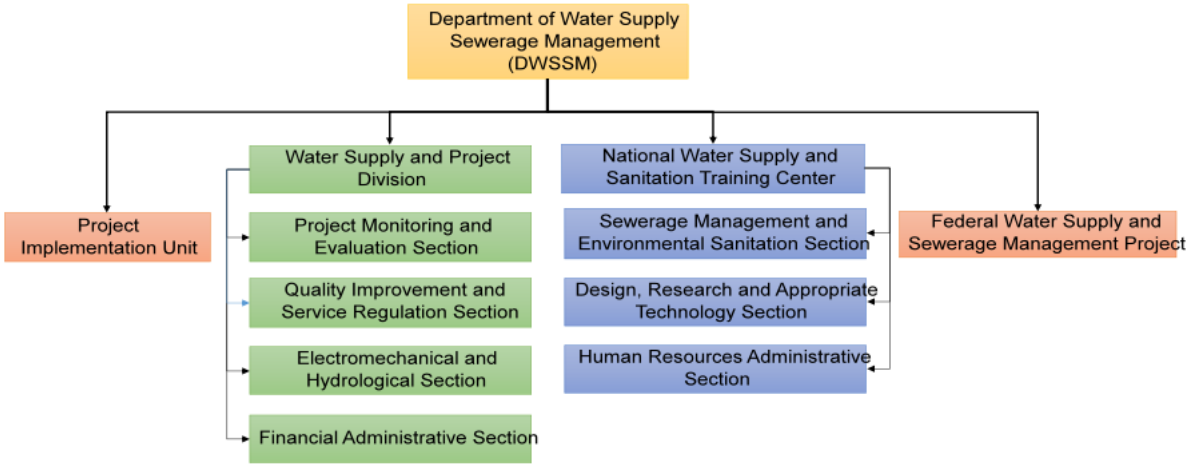

Figure 16: Organizational Structure Department of Water Supply and Sewerage Management.

Ministry of Urban Development: The Ministry of Urban Development (MoUD) works on integrated urban planning and development in municipalities, including faecal sludge management. DUDBC under MoUD is implementing body and sets standards for safe, affordable building construction and implementation for managed residential environment.

At Provincial Level

Ministry of Water Supply, Irrigation and Energy: Ministry of Water Supply, Irrigation and Energy of provincial government in Koshi province 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:

- Inter local government projects
- 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: The municipality consists of 5 major divisions such as Infrastructure development, Social Development, Economic Development, General Administration and Finance Management. Environment, Forest, Disaster and Sanitation section includes under Infrastructure Development Division. The municipality have contracted with private sector providing for solid waste collection service in the municipality. However, desludging services are providing by themselves. Figure 17 shows the organizational structure of the municipality.

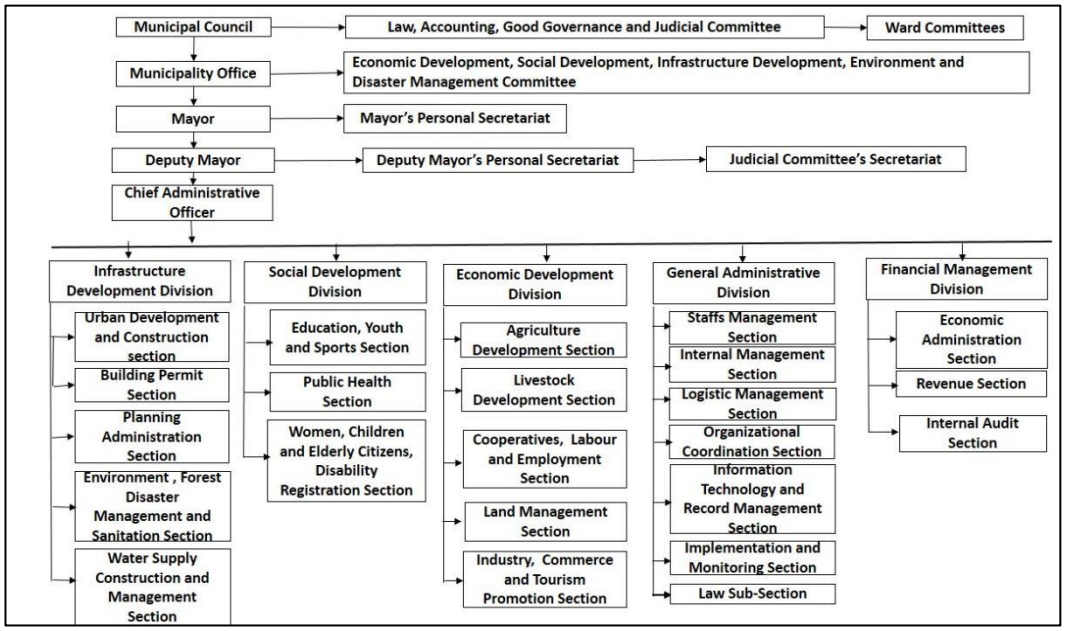

Figure 17: Organizational Structure of Ilam Municipality.

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

Table 7: 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) are qualitative in-depth interviews with people who know what is going on in the community. The purpose of key informant interviews is to collect information from a wide range of people who have first-hand knowledge about the concerned topic. KIIs were conducted with environment and sanitation related stakeholders. The KIIs were conducted with municipal officials, local elected bodies, water supply service provider, and public toilet service provider. The face-to-face interview was conducted and called after the interview to get more required information. The information was collected with key stakeholders about the status of sanitation services and water supply schemes. List of key informant stakeholders from the municipalities along with their organization and purpose are as shown in Table 8 and Figure 18.

Table 8: List of Key Informant Interviewed personnel.

KII code	Name	Designation	Organization	Purpose	Date
KII-1	Luna Khatiwada	Environment, Forest, Disaster and Sanitation Section Officer	Ilam Municipality	Sanitation Status of Ilam Municipality	18 October, 2022
KII-2		Public toilet operator	Private Sector	Status of public toilet	19 October, 2022
KII-3	Milan Basnet	Desludging service providers	Ilam Municipality	Faecal sludge desluding service	20 October, 2022
KII-4	Bishal Rai	Sub-engineer	Ilam small town water supply and sanitation organization	Water supply, coverage, treatment, water quality	20 October, 2022

Figure 18: Key informant interview with public toilet operator.

4.2. Household Survey

In each ward of the municipality, a random household survey was conducted. The two-day orientation was provided to local enumerators chosen by municipality representing each ward. They were oriented on each component of the sanitation service chain, starting from user interface to reuse / safe disposal along with the use of mobile application for data collection. During the closing session of the orientation, Mr. Kedar Thapa, Mayor of municipality emphasized on the importance of authentic data for planning and strategy development and motivated enumerators for collecting the authentic data from the field. After completion of orientation, the enumerators were mobilized to gather data from households and institutional level. The attendance sheet of the participants of orientation has been attached in appendix 3. The data were collected using the *KoboCollect* application.

Figure 19: Group photo of SFD orientation in presence of Mayor and CAO.

Determining Sample Size

The sample size for the household survey in Ilam municipality was determined by using Cochran (2963:75) sample size formula $n_0 = \frac{z^2pq}{e^2}$ and its finite population correction for the proportions:

$$n = \frac{n_0}{1+\frac{(n_0-1)}{N}}$$

Where,

n_0		Sample size
z	1.96	z value found in z table at 95 % of the confidence level
p	0.5	Assuming that about 50% of the population should have some sanitation characteristics that need to be studied (this was set as 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)
q	1-p	
e	± 5 %	desired level of precision or sampling error

n		Reduced sample size
N		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 one stratum. The sample size required in each ward of the municipality was calculated as $n_h = \frac{N_h}{N} \times n$ where, N_h is total population of each ward of municipality.

Thus, 373 households out of 12,952 households distributed in 12 wards were sampled using proportionate stratification random sampling. The number of ward wise sample size has been attached in appendix 4. The distribution of sampling points in the municipality is shown in Figure 20.

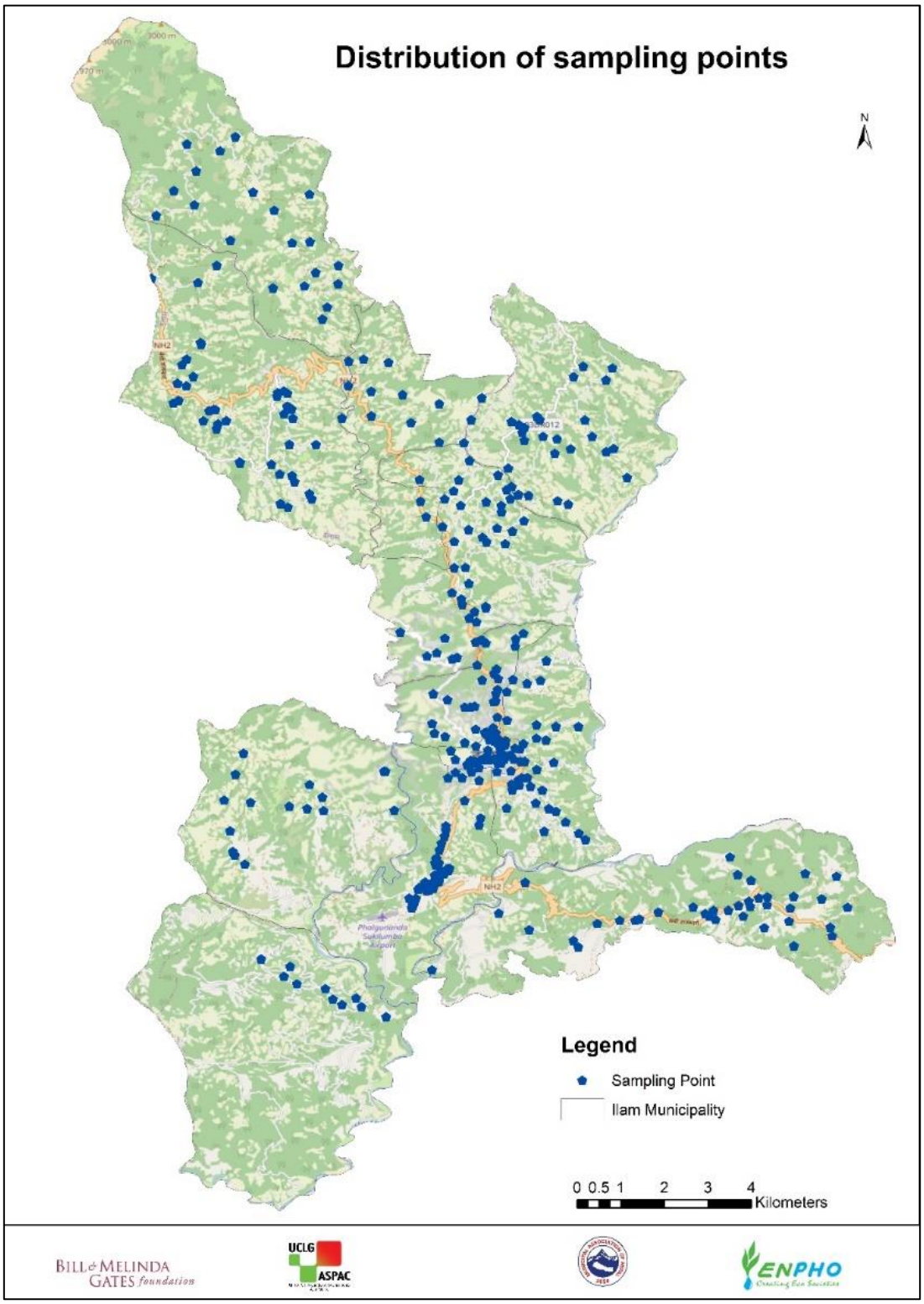

Figure 20: Distribution of sampling points in all wards of Ilam Municipality.

4.3. Sharing and Validation of Data

On 8 June 2023, a SFD validation workshop was organized at municipality hall. The results of SFD survey in municipality were presented to Deputy Mayor, Chief Administrative Officer (CAO), ward chairpersons, section officers and other relevant stakeholders. In the workshop, the results including sanitation status of the municipality, containment types in the municipality, emptying, transport, treatment and re-use or disposal practice of faecal sludge in the municipality were presented and discussed. Altogether, 19 participants including the Deputy Mayor, Chief Administrative Officer, ward chairpersons, other members from municipal executive council, sectoral staffs etc. actively participated on the workshop and provided the valuable suggestions. The minute of the validation workshop with participants' name and designation is attached in appendix 5.

Figure 21: Sharing and validating the SFD of Ilam Municipality.

“As one of the province's leading tourism destinations, we have a unique opportunity to effectively communicate positive messages to a large number of people. However, this study has identified a pressing issue: the inadequate number of public toilets within our municipality. Therefore, we are actively planning to address this concern by constructing new public toilets and upgrading the existing facilities, enhancing the overall status of public sanitation in our municipality” Bishnu Kumari Limbu, Deputy Mayor, Ilam Municipality, said.

"We acknowledge the vital importance of policies, guidelines, and legal documents in effectively managing faecal sludge. We eagerly anticipate receiving technical support to aid us in their development. Furthermore, we are committed to prioritizing sanitation and allocating

budgetary resources towards it in our fiscal year planning" Ganesh Kumar Khadka, Chief Administrative Officer, Ilam Municipality, said (Figure 22).

Figure 22: Remark sharing by Deputy Mayor of Ilam Municipality.

5. Acknowledgements

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

We offer our sincere gratitude to Mr. Kedar Thapa, Mayor, Ms. Bishnu Kumari Limbu, Deputy Mayor, Mr.Ganesh Kumar Khadka, Chief Administrative Officer, Ms. Luna Khatiwada, Environment, Forest, Disaster and Sanitation Section Officer, Mr. Bishal Rai, Sub-engineer, Mr. Milan Basnet desludging service providers and entire staffs of 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), Mr. Ashok Kumar Byanju Shrestha, President, Dr. Bernadia Irawati Tjandradewi, Secretary General and Mr. Satish Jung Shah, Knowledge Management Officer, UCLG ASPAC. Similarly, we are very much obliged to Mr. Bhim Prasad Dhungana, President, and Mr. Kalanidhi Devkota, Executive Director, Mr. Muskan Shrestha, Sanitation Advocacy Specialist, MuAN for their gracious support during the study.

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We are grateful towards the enumerators Ms. Manju Luitel, Mr. Bimal Rai, Ms. Susmita Gurung, Mr.Manoj Dulal, Ms. Matrika Devi Adhikari, Mr. Sanjeev Tamang, Mr. Tek Bahadur Shrestha, Ms. Goma Devi Shrestha, Mr. Sanjib Gautam, Mr. Ramesh Adhikari, Mr. Dipesh Phago, Ms. Ranjana Khatri Ghimire for their support during the survey.

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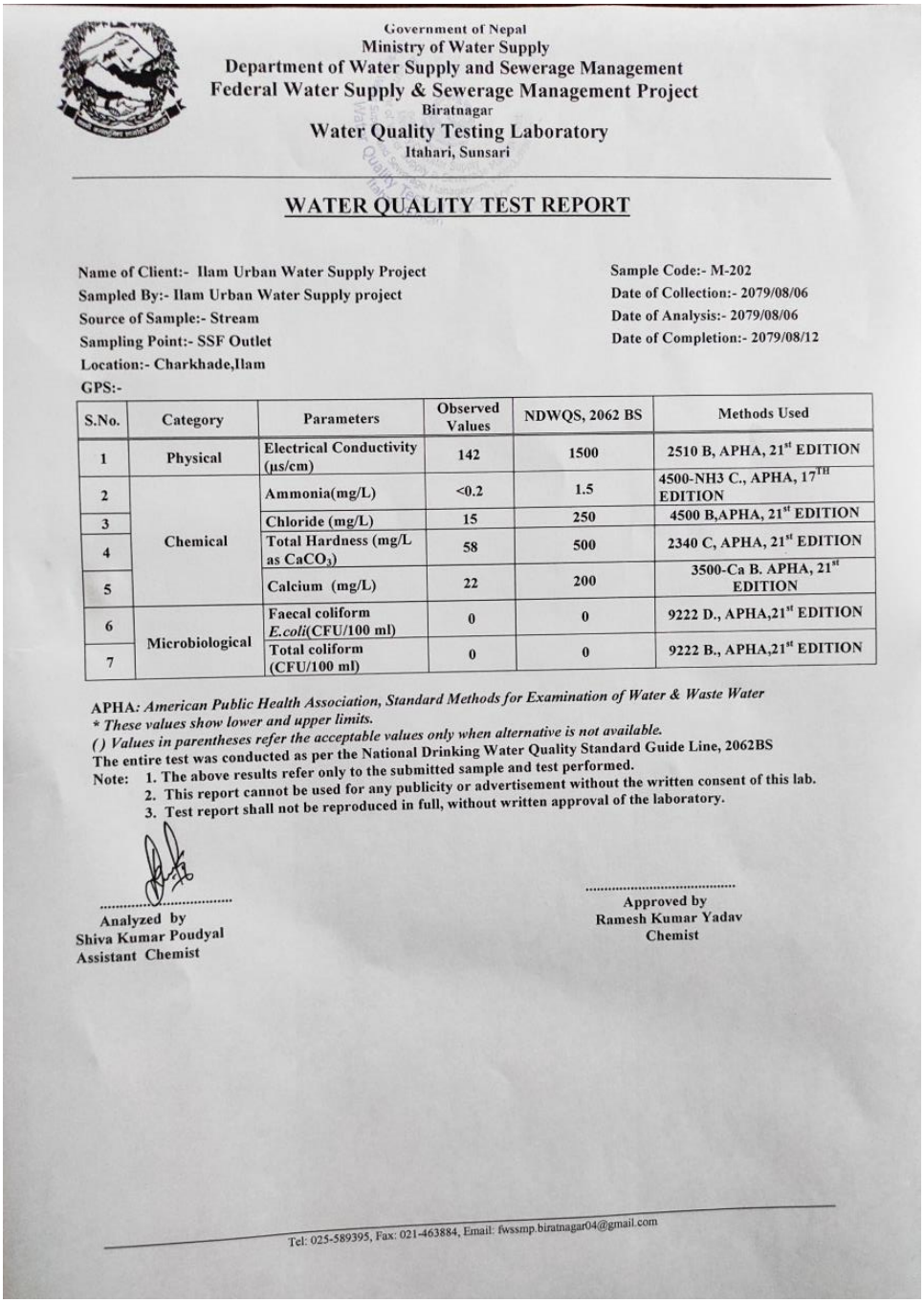
7. Appendix

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. Water quality testing report



Government of Nepal
Ministry of Water Supply
Department of Water Supply and Sewerage Management
Federal Water Supply & Sewerage Management Project
Biratnagar
Water Quality Testing Laboratory
Itahari, Sunsari

WATER QUALITY TEST REPORT

Name of Client:- Ilam Urban Water Supply Project
Sampled By:- Ilam Urban Water Supply project
Source of Sample:- Stream
Sampling Point:- SSF Outlet
Location:- Charkhade,Ilam
GPS:-

Sample Code:- M-202
Date of Collection:- 2079/08/06
Date of Analysis:- 2079/08/06
Date of Completion:- 2079/08/12

S.No.	Category	Parameters	Observed Values	NDWQS, 2062 BS	Methods Used
1	Physical	Electrical Conductivity (µs/cm)	142	1500	2510 B, APHA, 21st EDITION
2	Chemical	Ammonia(mg/L)	<0.2	1.5	4500-NH3 C., APHA, 17TH EDITION
3		Chloride (mg/L)	15	250	4500 B,APHA, 21st EDITION
4		Total Hardness (mg/L as $CaCO_3$)	58	500	2340 C, APHA, 21st EDITION
5		Calcium (mg/L)	22	200	3500-Ca B. APHA, 21st EDITION
6	Microbiological	Faecal coliform *E.coli*(CFU/100 ml)	0	0	9222 D., APHA,21st EDITION
7		Total coliform (CFU/100 ml)	0	0	9222 B., APHA,21st EDITION

APHA: *American Public Health Association, Standard Methods for Examination of Water & Waste Water*
** These values show lower and upper limits.*
( ) Values in parentheses refer the acceptable values only when alternative is not available.
The entire test was conducted as per the National Drinking Water Quality Standard Guide Line, 2062BS
Note: 1. The above results refer only to the submitted sample and test performed.
2. This report cannot be used for any publicity or advertisement without the written consent of this lab.
3. Test report shall not be reproduced in full, without written approval of the laboratory.

Analyzed by
Shiva Kumar Poudyal
Assistant Chemist

Approved by
Ramesh Kumar Yadav
Chemist

Tel: 025-589395, Fax: 021-463884, Email: fwssmp.biratnagar04@gmail.com

Ministry of Water Supply
Department of Water Supply and Sewerage Management
Federal Water Supply & Sewerage Management Project
Biratnagar
Water Quality Testing Laboratory
Itahari, Sunsari

WATER QUALITY TEST REPORT

Name of Client:- Ilam Urban Water Supply Project
Sampled By:- Ilam Urban Water Supply project
Source of Sample:- Stream
Sampling Point:- Tap(Santosh Karki)
Location:- Ilam Bazaar,Ilam
GPS:-

Sample Code:- M-203
Date of Collection:- 2079/08/06
Date of Analysis:- 2079/08/06
Date of Completion:- 2079/08/12

S.No.	Category	Parameters	Observed Values	NDWQS, 2062 BS	Methods Used
1	Physical	Electrical Conductivity (µs/cm)	98	1500	2510 B, APHA, 21st EDITION
2	Chemical	Ammonia(mg/L)	<0.2	1.5	4500-NH3 C., APHA, 17TH EDITION
3		Chloride (mg/L)	<5	250	4500 B,APHA, 21st EDITION
4		Total Hardness (mg/L as $CaCO_3$)	42	500	2340 C, APHA, 21st EDITION
5		Calcium (mg/L)	14	200	3500-Ca B. APHA, 21st EDITION
6	Microbiological	Faecal coliform *E.coli*(CFU/100 ml)	0	0	9222 D., APHA,21st EDITION
7		Total coliform (CFU/100 ml)	0	0	9222 B., APHA,21st EDITION

APHA: *American Public Health Association, Standard Methods for Examination of Water & Waste Water*
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( ) Values in parentheses refer the acceptable values only when alternative is not available.
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Note: 1. The above results refer only to the submitted sample and test performed.
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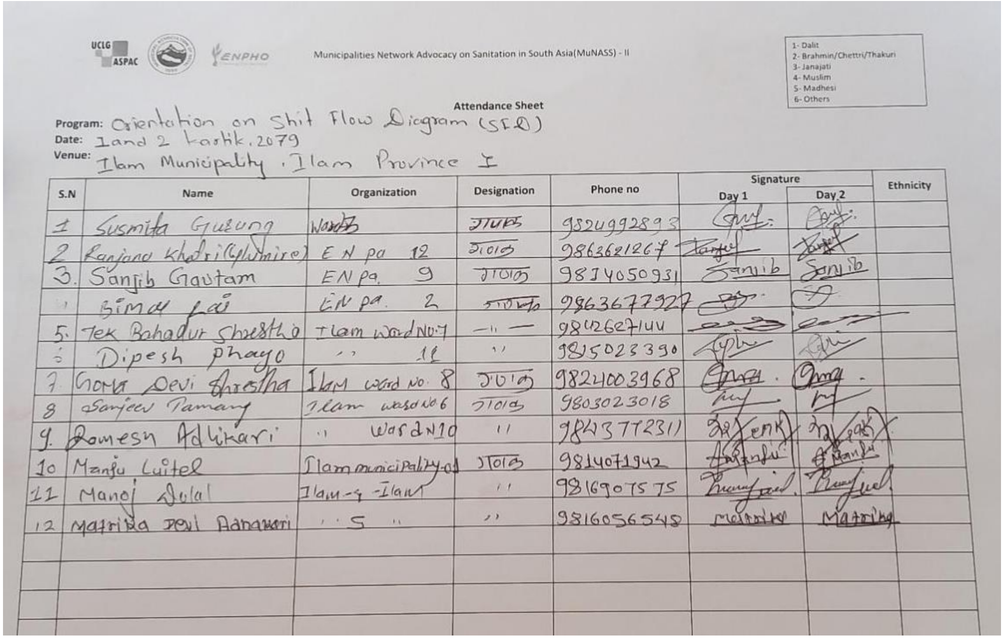
Analyzed by
Shiva Kumar Poudyal
Assistant Chemist

Approved by
Ramesh Kumar Yadav
Chemist

7.3. Appendix 3: List of participants of SFD orientation



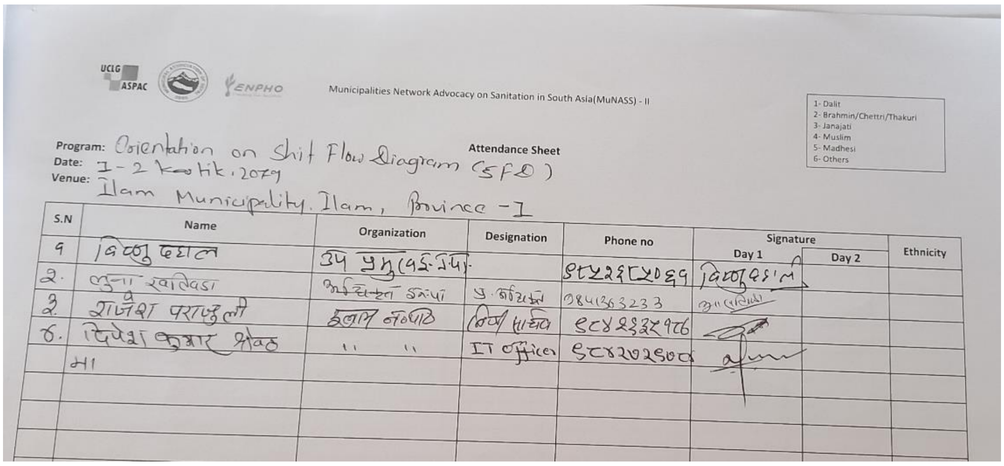
UCLG ASPAC ENPHO Municipalities Network Advocacy on Sanitation in South Asia(MuNASS) - II

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

Attendance Sheet

Program: Orientation on Shit Flow Diagram (SFD)
Date: 1 and 2 kartik, 2079
Venue: Ilam Municipality, Ilam Province I

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity
1	Susmita Gurung	Ward 3	[illegible]	9824992893	[signature]	[signature]	
2	Ranjana khatri (Ghimire)	EN pa 12	[illegible]	9863621267	[signature]	[signature]	
3.	Sanjib Gautam	EN pa 9	[illegible]	9814050931	[signature]	[signature]	
4	Bimal Rai	EN pa 2	[illegible]	9863677927	[signature]	[signature]	
5.	Tek Bahadur Shrestha	Ilam ward No 7	-"-	9842627144	[signature]	[signature]	
6	Dipesh Phago	" 11	"	9815023390	[signature]	[signature]	
7	Goma Devi Shrestha	Ilam ward no. 8	[illegible]	9824003968	[signature]	[signature]	
8	Sanjeev Tamang	Ilam ward no 6	[illegible]	9803023018	[signature]	[signature]	
9.	Ramesh Adhikari	" ward N 10	"	9843772311	[signature]	[signature]	
10	Manju Luitel	Ilam municipality-01	[illegible]	9814071942	[signature]	[signature]	
11	Manoj Dulal	Ilam-4 -Ilam	"	9816907575	[signature]	[signature]	
12	Matrika Devi Adhikari	" 5 "	"	9816056548	[signature]	[signature]	



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

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

Attendance Sheet

Program: Orientation on Shit Flow Diagram (SFD)
Date: 1 - 2 kartik, 2079
Venue: Ilam Municipality. Ilam, Province - 1

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity
१	विष्णु दहाल	उप प्रमुख (इ.न.पा.)		[illegible]	[signature]		
२.	जुना खतिवडा	अधिकृत [illegible]	प्र. अधिकृत	9841363233	[signature]		
३.	राजेश पराजुली	इलाम नगरपालिका	[illegible]	[illegible]	[signature]		
४.	दिपेश कुमार श्रेष्ठ	" "	IT officer	[illegible]	[signature]		
	मा						

7.4. Appendix 4: Ward wise sample size distribution in Ilam Municipality

Ward	Population	Households	Proportion	Required Sample
1	4,569	1,178	1%	34
2	2,453	617	5%	18
3	3,125	738	6%	21
4	3,034	775	6%	22
5	5,187	1,321	10%	38
6	4,511	1,229	9%	35
7	5,009	1,424	11%	41
8	4,566	1,228	8%	35
9	6,424	1,645	13%	47
10	4,611	1,201	9%	35
11	3,535	854	7%	25
12	3,061	742	6%	21
	50,085	**12,952**		**373**

7.5. Appendix 5: List of participants present in sharing and validation meeting

आज मिति २०८०/०२/२५ गते ईलाम नगरपालिकामा नेपाल नगरपालिका संघको आयोजनामा वातावरण र जनस्वास्थ्य संस्था (इन्फो) को प्राविधिक सहयोग, The United Cities and Local Government Asia Pacific (UCLG-ASPAC) को सहकार्य तथा Bill and Melinda Gates Foundation (BMGF) को आर्थिक सहयोगमा मानव मलमूत्र प्रवाह रेखाचित्र (Shit Flow Diagram - SFD) प्रमाणीकरण सम्बन्धि अभिमुखीकरण कार्यक्रममा निम्न अनुसार सहभागिहरुको उपस्थिति रहेको छ।

उपस्थिति :-

क्र. सं.	नाम	पद	कार्यालय	फोन नं.	हस्ताक्षर
१.	विष्णु कुमारी लिम्बु	उप. प्रमुख	ईलाम न.पा	[illegible]	[signature]
२.	गणेश कुमार खड्का	प्र. प्र. अ.	"	[illegible]	[signature]
३.	देवेन्द्र [illegible]	कार्यपालिका	"	[illegible]	[signature]
४.	दिपक प्रसाद गुरागाई	इन्जिनियर	-"-	[illegible]	[signature]
५.	सुदर्शन खड्का	वडा अध्यक्ष	ई. न. पा. ६	[illegible]	[signature]
६.	[illegible]	---"	-"- ८	[illegible]	[signature]
७.	[illegible] लिम्बु	वडा अध्यक्ष	ई.न.पा. १२	[illegible]	[signature]
८.	बसन्ती [illegible]	वडा "	ई.न.पा. ६	9844681230	[signature]
९	भावना [illegible]	" "	ई.न.पा. ९	9863781568	[signature]
१०	कमल अधिकारी	[illegible]	[illegible]	[illegible]	[signature]
११	धन मायालिम्बु	वडा सदस्य	ई.न.पा ११	[illegible]	[signature]
१२	रुपेन्द्रराज खनाल	[illegible]	[illegible]	[illegible]	[signature]
१३.	[illegible] बहादुर [illegible]	अनुसन्धानकर्ता	[illegible]	[illegible]	[signature]
१४	उपेन्द्र नेपाल	[illegible]	ईलाम नगरपालिका	[illegible]	[signature]
१५.	सुशिला पोखरेल	[illegible]	[illegible] महिला समूह	[illegible]	[signature]
१६	गिरीराज रिजाल	वडा अध्यक्ष	ई.न.पा.२ [illegible]	[illegible]	[signature]
१७.	साहिल ओझा	[illegible]	" -०८	[illegible]	[signature]
१८	जुना खतिवडा	अधिकृत	[illegible]	9841313233	[signature]
१९	गायत्रीराम [illegible]	वडा अध्यक्ष	ई.न.पा. ९	[illegible]	[signature]

SFD Promotion Initiative

SFD Ilam Municipality, Nepal, 2023

Produced by:

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