SFD Report

Bilwi
Nicaragua

Final Report

This SFD Report - Intermediate - was prepared by WaterAid.

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SFD Report Bilwi, Nicaragua, 2018

Produced by:

Joshua Briemberg

This Executive Summary and SFD Report are available from:

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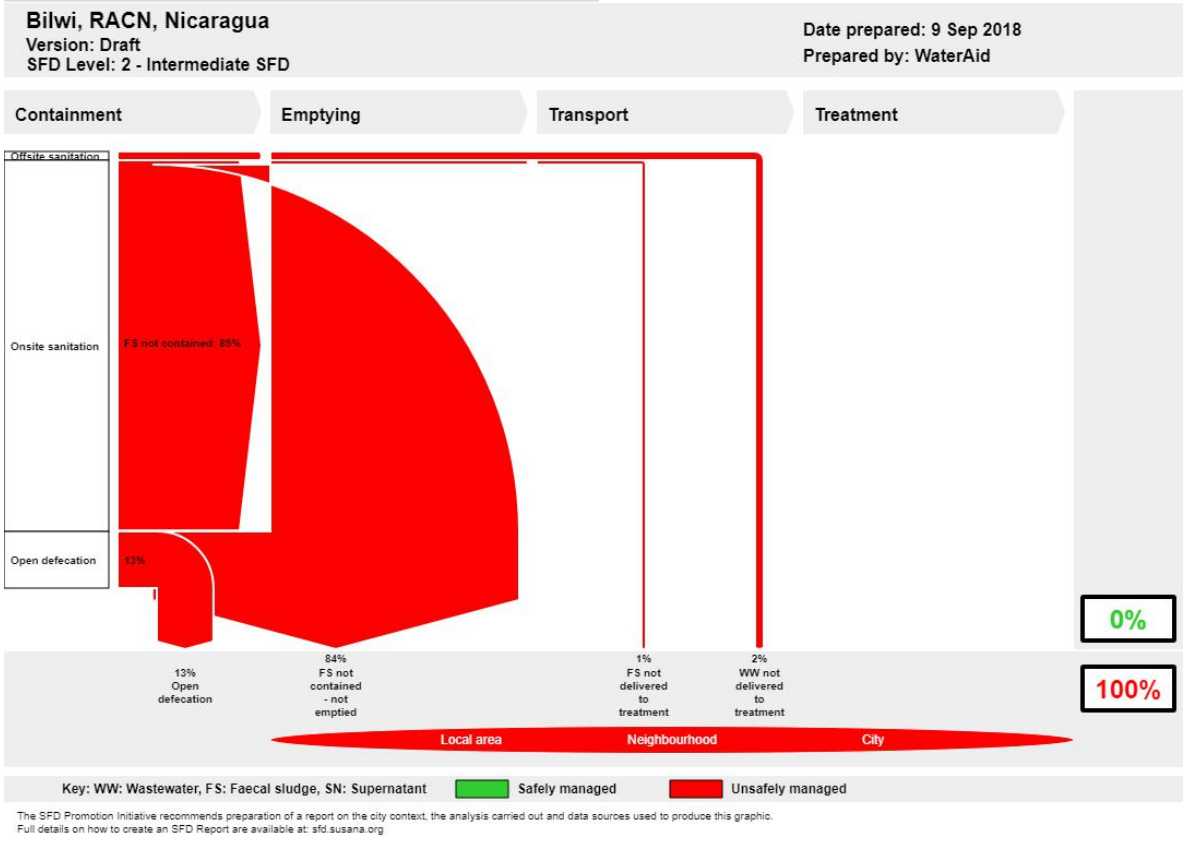
1. The SFD Graphic



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:

Intermediate

Produced by:

WaterAid.

Status:

Final SFD report

Date of production: 05/09/2018

3. General city information

Bilwi (also known as Puerto Cabezas) is located in the northeast of Nicaragua on the Caribbean coast with coordinates: 14º2'6.3" N and 83º23´19.7" W, thus forming part of both Central America and the Caribbean.

Bilwi is located on the coastal plain of the Caribbean Sea at an elevation of 4 meters above sea level and has a tropical climate with an average annual rainfall of 3,000mm.

Bilwi´s current population is estimated to be between 66,790 and 73,615 based on between 12,205 and 14,723 registered properties that are currently inhabited with an average population of five people per lot and a population density in the order of 15,000/km^2.[1]

Bilwi has demonstrated an accelerated growth rate of more than 5% per year over more than a decade starting first in the 1980s as a result of the internal displacement caused by the civil war and continuing through the post-war period starting in 1990 with migration from both the Pacific and Central regions of Nicaragua as well as from the rural Miskitu indigenous communities in the municipalities of Waspam and Puerto Cabezas. [2]

[1] Nicaragua Water and Sewerage Company (ENACAL) land registry exercise conducted in 2017 with technical support from GIZ registered 14,723 properties. Average population 5 per property. Ministry of Health (MINSA) household survey 2017 registered 12,205 households and a total population census of 66,790 persons (average 5.47 persons per household).

[2] National Census 2005, National Institute for Development Information (INIDE), Gobierno de Unidad y Reconciliacion Nacional. Population of Bilwi 37,282.

4. Service outcomes

Bilwi is currently characterized by an extremely deficient sanitation service chain where 100% of faecal sludge and supernatant is not safely managed. There is only on site sanitation technologies with no formal off-site services.

Onsite sanitation technologies can be categorized in four categories distributed in the following way[3]:

- 66% are unlined shallow pit latrines that fill within one to three years of use and are covered by soil and moved to a new location.
- 2% are hanging latrines and/or toilets that discharge directly into local streams and/or the ocean.
- 26% are flush or pour flush toilets that discharge into septic tanks or lined pits with impermeable walls and open bottoms.
- Less than 1% are pour flush toilets recently introduced by WaterAid with fully lined or sealed plastic septic tanks that discharge to a soak pit or shallow leaching field. Although they can be emptied, this is still an uncommon practice and the faecal sludge removed is deposited (buried) on site as per the instructions from the Ministry of Health.

Although septic tank emptying is rarely practised other than by institutions and fish packing plants, there are two existing service providers for septic tank emptying and maintenance.

There is a high dependence on shallow groundwater for drinking purposes given the limited service provided by the existing piped water system that originates in a surface water source 10km outside of the city.

5. Service delivery context

The city's service delivery context is extremely weak largely due to the fact that, as a city, Bilwi falls into institutional limbo with regards to sanitation in the sense that water and sanitation service provision is the responsibility of the state-owned water supply and sewerage company (ENACAL) and yet ENACAL has no mandate with regards to on site sanitation.

This situation has been compounded historically by the lack of policy leadership and investment by local government resulting in the absence of any sanitation plan. The city dump consists of a concrete basin for faecal sludge storage but this has never been used.

The Ministry of Health has fulfilled its role with regards to sanitary inspection and yet there is little evidence of inter institutional coordination to convert this information into the planning process.

Although equity is very much a relative issue given the total lack of safe management in the sanitation supply chain, neither has this relative issue been addressed and the municipal sewerage project, currently under construction, will provide services to the neighbourhoods that are in relatively better conditions of economic development.

6. Overview of stakeholders

At present, the stakeholders for sanitation service delivery for the city of Bilwi is characterized by a group of public institutions, two small entrepreneurs, development partners/donors and a local micro-finance institution.

The regulatory framework for sanitation service delivery is provided by a loosely articulated collection of public institutions, amongst which, the Ministry of Health has the greatest presence. Other than the Ministry of Health, government institutions with a mandate for water and sanitation for urban areas are generally restricted to sewerage systems and there is an institutional gap with respect to on-site sanitation which is characteristic of 100% of services in Bilwi.

At present, local (municipal) government has little to no involvement in the sanitation service chain. ENACAL has had no involvement until the recently launched sewer and waste water treatment plant project.

In recent years, starting in 2015, WaterAid has worked with Pana Pana, a local micro-finance institution (MFI), to develop a market for improved on-site sanitation in Bilwi.

The key stakeholders for service delivery are identified in the following Table 1.

Key Stakeholders	**Institutions / Organizations**
Public Institutions	ENACAL, Ministry of Health, Regional Government, Municipal Government
Private Sector	Ricardo Bonilla (Chackanblack), Lenin Gonzalez

[3] Ministry of Health (MINSA) household survey 2017 with classification of household services.

Development Partners, Donors	Spanish Development Agency (AECID), European Union (EU), Inter-American Development Bank (IADB)
Private Sector	Ricardo Bonilla (Chackanblack), Lenin Gonzalez

Table 1: Key Stakeholders (WaterAid, 2018)

7. Process of SFD development

This report was produced primarily by key informant interviews and unpublished data resulting from household sanitation inspections conducted by the Ministry of Health's Environmental Health Department (MINSA) and cross-checked with a similar survey partially completed by the state-owned water supply and sewerage company (ENACAL) as part the social component of a municipal water supply and sewerage project that started construction in 2017. In the process, 20 key informant interviews and two focus group discussions were conducted.

Other than the household survey data collected by the Ministry of Health in 2017 and more recently in the process of being collected by ENACAL, there is no documentation available on the situation of sanitary services for the city of Bilwi other than broad statements referring to the fact that Bilwi does not have any municipal sewerage system.

8. Credibility of data

This report was produced based on reliable primary sources provided by the local delegation of the Ministry of Health (MINSA) and the state-owned Nicaraguan Water and Sewerage Company. This comprehensive data based on land registry and house to house surveys was validated by field visits and first hand interviews with inhabitants and service providers. There is a high level of confidence in the credibility of the sources used to produce the report.

9. List of data sources

The data sources used for the production of this SFD Report Executive Summary were the household survey data provided by the Ministry of Health's Environmental Health Department and the land registry and partial diagnostic of household service levels conducted by the state-owned Nicaraguan Water and Sewerage Company of approximately 20% of the city.

Bilwi, Nicaragua, 2018

Produced by:

Joshua Briemberg, WaterAid

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

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Abbreviations

ENACAL	Empresa Nicaragüense de Acueductos y Alcantarillados
EU	European Union
GIZ	Gesellschaft für Internationale Zusammenarbeit (German Technical Cooperation Agency)
IADB	Inter-American Development Bank
INAA	Instituto Nicaragüense de Acueductos y Alcantarillados
LAC	Latin America and the Caribbean
MINSA	Ministerio de Salud (Ministry of Health)

1 City context

Location:

Bilwi (also known as Puerto Cabezas) is the administrative centre of the municipality of Puerto Cabezas and the administrative centre or capital of the North Caribbean Coast Autonomous Region of Nicaragua. It is located in the northeast of Nicaragua on the Caribbean coast at coordinates: 14º2'6.3" N and 83º23´19.7" W and thus forms part of both Central America and the Caribbean as part of the Latin America and Caribbean (LAC) Region (Figure 1 and Figure 2).

Figure 1 Map of Nicaragua (Central America) showing the location of the city of Bilwi, Municipality of Puerto Cabezas, in the North Caribbean Coast Autonomous Region (RACN).

Population:

Bilwi´s current population is estimated to be between 66,790 and 73,615 based on between 12,205 and 14,723 registered properties that are currently inhabited with an average population of 5 people per lot. An additional 1,169 lots are not inhabited representing an additional 7% of future population growth. This data is based on a household survey and census conducted by the Ministry of Health (MINSA) in 2017 and a mapping and inventory exercise currently being conducted by the state-owned water and sewerage company (ENACAL) with technical assistance from GIZ.[i]

Population growth rate:

The last official census conducted in 2005 identified the population of Bilwi at 39,428 which means that population growth over the last 12 years is on average 5.34% per year.[ii]

Bilwi is said to be the name of an indigenous village located near to where Puerto Cabezas was established as an administrative outpost and company town primarily for logging

operations through the 1950s and 60s. Following the Sandinista Revolution in 1979, the population of Puerto Cabezas grew significantly in 1981 as a result of the migration/displacement of the population from Waspam, a town located 160km north on the Coco River and border with Honduras. This growth accelerated even more in the post-war period starting in 1990 with migration from both the Pacific and Central regions of Nicaragua as well as from the rural Miskitu indigenous communities in the municipalities of Waspam and Puerto Cabezas.

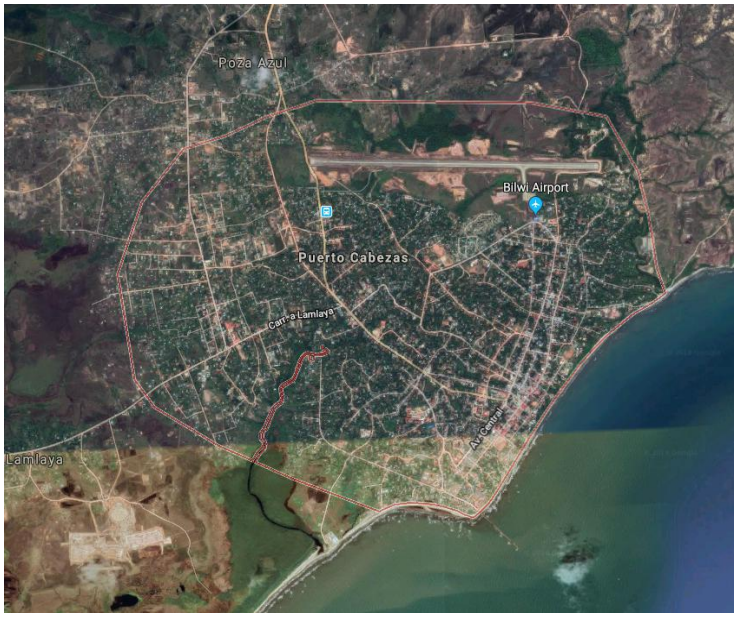

Figure 2: Aerial view of the city of Bilwi, also known as Puerto Cabezas. (Source: Google 2018).

Significant variations in population (diurnal/seasonal):

Bilwi does not have any significant diurnal variation but it is subject to seasonal variation during the lobster catching season (from July through February, when as many as 5,000 young men (18 to 40 years old) spend 15 days stints at sea.

Topography:

Bilwi is located on the coastal plain of the Caribbean Sea at an elevation of 4 meters above sea level.

Climate:

Bilwi has a tropical humid climate with the following characteristics:

- Average temperature: 26.9 ºC
- Minimum temperature: 16 ºC
- Maximum temperature: 34 ºC
- Average annual rainfall: 3,000mm
- Rainy season: June – February (9 months)
- Dry season: March – May (3 months)

Key Physical and Geographic Features:

The city has a small Caribbean Sea port and an international-scale airport landing strip. Approximately half of the coastal area of the town is located along a steep cliff face while the other half descends gradually down to the sea and is located along the beach. The town has a very small natural lagoon and two small streams that flow through the town, one on the north side and the other towards the south side of town. The town has been growing predominantly towards the south west into what was historically a low-lying humid wetlands area and to the north along the coast. Most of the road infrastructure is unpaved with paving stones on approximately 20% of the total road network.

Urban Boundaries:

Bilwi consists of 31 neighbourhoods (*barrios*) located on territorial lands of two indigenous territories: Karata and Twi Yauhbra (or the Ten Communities) as defined in a Treaty signed with the British at the beginning of the 20th Century. To the south and west of Bilwi lie the indigenous villages of Lamlaya and Kamla while to the north Bilwi borders on the territorial lands of the indigenous *territorio* of the village of Tuapi.

Economics:

The principal economic activity in Bilwi is fishing and particularly catching lobster and recently sea cucumber for the Chinese market. The only other economic activities of any significance are commerce and public employees.

2 Service Outcomes

2.1 Overview

Onsite sanitation technologies

Onsite sanitation technologies can be categorized in four categories (Figure 3):

- Unlined shallow pit latrines that fill within one to three years of use and are covered by soil and moved to a new location.
- Hanging latrines and/or toilets that discharge directly into either the creek (Bilwi Tingni) that flows through the southern part of the city or the creek that flows along the northern border of the city and discharges into the ocean at Bocana Beach.
- Flush or pour flush toilets that discharge into septic tanks or lined pits with impermeable walls and open bottoms.
- Pour flush toilets recently introduced by WaterAid with fully lined or sealed plastic septic tanks that discharge to a soak pit or shallow leaching field and although they can be emptied this is still an uncommon practice and the faecal sludge removed is deposited (buried) on site as per the instructions from the Ministry of Health.

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		T1A1C7			Not Applicable
Septic tank					Significant risk of GW pollution Low risk of GW pollution					
Fully lined tank (sealed)					T2A3C5 Low risk of GW pollution					
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					T2A4C10 Low risk of GW pollution
Lined pit with semi-permeable walls and open bottom	Not Applicable									Significant risk of GW pollution Low risk of GW pollution
Unlined pit										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied but abandoned when full and covered with soil										T2B7C10 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 3: Selection grid

Offsite sanitation technologies

There are currently no offsite sanitation technologies and/or systems in use in Bilwi although one is under construction as the research for this report was being conducted (Figure 4).

Figure 4: Site of construction of municipal waste water treatment plant, Lamlaya, Municipality of Puerto Cabezas (WaterAid, Eduardo Rodriguez, 2018)

Origen of Excreta

Households contribute the vast majority of excreta with some informally shared toilets used by the 13% of the population that currently has no sanitation solution of their own and otherwise practices open defecation. There are no known public toilets. The vast majority of institutions (government buildings), restaurants, hotels and industrial areas, of which there are just a handful of each, have flush or pour flush toilets that discharge into lined tanks with open bottoms referred to in popular language as *septic tanks*. The industrial areas are limited to a handful (less than five) of fish and seafood-processing plants scattered around the city.

Services:

Existing capacity through the sanitation service chain is extremely weak. Local tradespeople are almost all empirical with respect to the construction of on-site sanitation systems although WaterAid has implemented, starting in 2014, a series of vocation training courses for youth sanitation entrepreneurs.

The vast majority of households build their own latrines while the 20% of households that have on-site septic tanks contract informally-trained local masons to construct the concrete structures. WaterAid, in collaboration with the local regional government, has provided training to over 75 sanitation entrepreneurs of which ten are working in the installation of on-site sanitation solutions.

Pit emptying services are non-existent while *septic tank* (lined tanks with open bottom) emptying services consist in two local businesses:

- Chackamblack (proprietor: Ricardo Bonilla): one 1,600-gallon (6m^3) tanker truck.
- LV Contractors - House Construction, Maintenance and Repairs (proprietor: Lenin Gonzalez): one 500-gallon (2m^3) tanker truck and one 10,000-gallon (40 m^3) tanker truck.

Only 25% of the total number of septic tank systems (lined tanks with open bottoms) is deemed to be emptied based on interviews with the two local businesses that offer these services.

The faecal sludge extracted from septic tanks is dumped outside of the city with permission from the indigenous territorial government (GTI) with no provision made for environmental safety. A storage pond was constructed approximately ten years ago (Figure 5) at the city landfill site located 14km out of town but it is not operational.

Figure 5 : Inoperative storage pond designed for faecal sludge located at the city garbage dump site. (WaterAid/Eduardo Rodriguez)

2.2 SFD Matrix

Table 1 SFD matrix

Bilwi, RACN, Nicaragua, 9 Sep 2018. SFD Level: 2 - Intermediate SFD
Population: 66790
Proportion of tanks: septic tanks: 100%, fully lined tanks: 100%, lined, open bottom tanks: 1

System label	Pop	F3	F4	F5
System description	Proportion of population using this type of system	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
T1A1C7 Toilet discharges directly to water body	2.0			
T1B11 C7 TO C9 Open defecation	13.0			
T2A3C5 Fully lined tank (sealed) connected to a soak pit, where there is a 'significant risk' of groundwater pollution	1.0	0.0	0.0	0.0
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	20.0	4.0	0.0	0.0
T2B7C10 Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	64.0			

2.2.1 Technologies and methods used for different sanitation systems through the sanitation service chain

There are currently four classes of existing sanitation technologies in the city of Bilwi; all are on-site sanitation technologies limited to containment:

1. Pit latrines (66%) as seen in Figure 6.
2. Flush toilets with concrete septic tanks or deep unlined infiltration pits (26%).
3. Flush toilets with small plastic septic tanks and infiltration pits or fields – 35 units in total - introduced as part of a WaterAid driven sanitation marketing program (less than 1%).
4. Flush toilets with direct discharge into the urban stream (Bilwi Tigni) that flows into the sea; this option is referred to as flying or hanging toilets as seen in Figure 7 (less than 1%).

Figure 6: Traditional pit latrine (WaterAid/Eduardo Rodriguez, 2018)

Figure 7: Hanging latrine over Bilwi Tingni creek (WaterAid/Eduardo Rodriguez 2018)

There is no formally established method for emptying, transport, treatment nor reuse/disposal in the sanitation service chain. Two local entrepreneurs do provide septic tank emptying services with trash pumps (Figure 8 and Figure 9) and relatively small (1,500 litre) tanker trucks to transport and dump faecal sludge on open ground in surrounding rural communities.

Figure 8: Demonstration of rope pump prototype for extraction of faecal sludge from on-site septic tanks. (WaterAid/Eduardo Rodriguez, 2017)

Figure 9: Demonstration of rope pump prototype for extraction of faecal sludge from on-site septic tanks. (WaterAid/Eduardo Rodriguez, 2017)

2.2.2 *Percentages of the population using those systems and services along the sanitation service chain*

Table 2 presents the different types of systems and services along the sanitation service chain and the percentages of the population using those systems.

Table 2 Types of existing sanitation and proportional presence

System description	Equivalent (or modelled) system in the Graphics Generator	System label	% of the population using this type of system
Unlined pit latrines	Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow, where there is a significant risk of groundwater pollution	T2B7C10	64%
Flush toilets with septic tanks with concrete walls and gravel filter on the bottom with no outlet or overflow	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a significant risk of groundwater pollution	T2A4C10	20%
Hanging toilets, pour flush with direct discharge to ocean or Bilwi Tigni stream	Toilet discharges directly to water body	T1A1C7	2%
Economical pour flush ecotoilets with cistern consisting of recycled plastic drum or plastic tank	Fully lined tank (sealed) connected to a soak pit, where there is a significant risk of groundwater pollution	T2A3C6	1%
Open defecation	Open defecation	T1B11 C7 to C9	13%

- Based on household surveys collected by the Ministry of Health's Environmental Health, **64% of the total population use unlined pit latrines** of which 79% are considered to be in a relatively good state and 21% are considered to be in a rundown state.
- **2% of the total population use hanging latrines** or toilets that discharge directly into either Bilwi Tigni (a creek running through the southern part of the original city) or into a creek on the northern edge of the city that discharges into the ocean at Bocana Beach, or directly into the ocean from houses located directly along the coast, particularly in the neighbourhood known as *Muelle.*
- **23% of the total population uses flush toilets** of which 89% are considered to be in a relatively good state and 11% are considered to be in a rundown state.
- **83% of the population** that has toilets also has septic tanks with the remaining 17% discharging directly into existing water bodies; all the septic tanks are considered to be functional and not present any problems; they are lined on the sides but not sealed on the bottom
- **13%** of the total population practices open defecation and/or uses neighbouring latrines

2.2.3 Risk of groundwater contamination

There is an extremely high risk of groundwater contamination is Bilwi based on the fact that soil type is predominantly fine sandy clay and the depth of the groundwater table during the rainy season which is most of the year is less than 5 meters (usually as little as 3 meters) and subject to flooding in as much as 30% of the city which forms areas of natural wetlands.

The lateral separation between sanitation facilities and groundwater sources is minimal and rarely more than 10 meters horizontally and rarely more than 1 meter vertically.

Although groundwater is not the official source of supply for the city of Bilwi, it is still the source of water for human consumption for almost half of the population. At present, only 14% of the population is officially connected to the existing water supply which also originates in a surface water source (Brakira River) with the intake works located in the village of Tuapi 10km to the north of the city. An additional 18% have informal access to this piped water supply leaving 68% of the population without access to piped water.

There are 132 registered community wells of which the vast majority (as many as 85%) are lined hand dug wells while the remaining 15% are shallow borehole wells with depths in the range of 20 – 30m. 46% of the population has private wells of which 71% are lined and 29% are unlined and as few as 10% are shallow borehole wells in the same range of 20 – 30 m deep.

A project is currently under way to provide water to 100% of the population of Bilwi from a surface water source (Likus River) with the intake works located 35km to the north of the city in the village of Sisin.

2.2.4 Level of certainty/uncertainty associated with data used for the SFD Matrix

There is a high degree of certainty associated with the data used for the SFD Matrix given that it is based primarily on unpublished household surveys conducted by field sanitary inspectors from the Ministry of Health and validated by data from a similar, though partial household survey, currently being conducted by the state-owned water and sewerage company ENACAL. Further corroboration was provided by first-hand testimony from a sample of people representing 15 of the 31 neighbourhoods (*barrios*) of Bilwi.

2.3 The SFD Graphic

The SFD produced to characterize for the current situation (September 2018) of the city of Bilwi is presented in Figure 10.

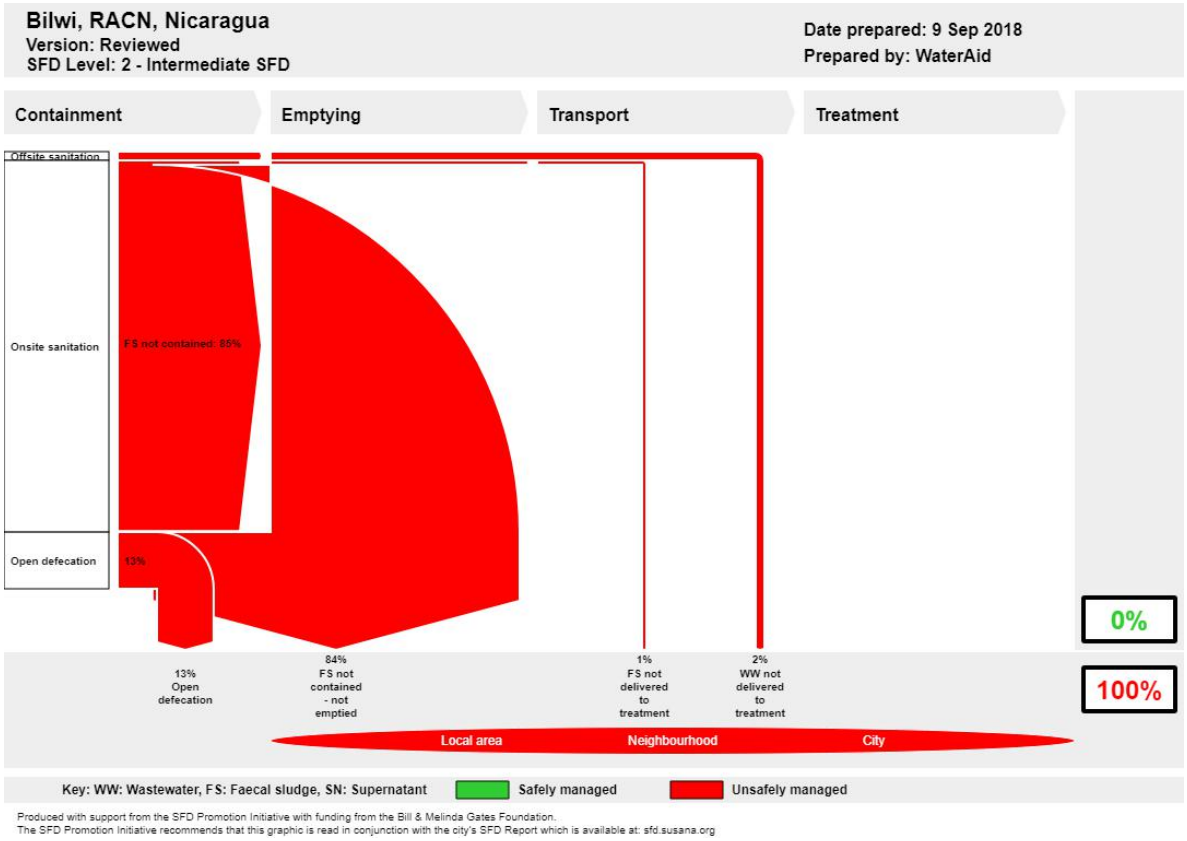

Figure 10: Shit Flow Diagram (SFD) for the city of Bilwi, RACN, Nicaragua (September 2018)

The principal outcomes of the SFD are as follows:

1. 100% of faecal sludge and supernatant is considered unsafely managed.
2. 100% of existing sanitation facilities are on-site solutions.
3. 88% of households have facilities while the remaining 12% of households do not have any facilities and the population either practices open defecation and/or shares on-site sanitation facilities of a neighbour.
4. 64% of households have unlined pit latrines that are neither emptied nor do they contain the faecal sludge.
5. 20% of households have concrete septic tanks with impermeable walls and open bottoms with no outlet or overflow; of these 25% are emptied but the faecal sludge is not delivered to a treatment plant but rather dumped outside of the city limits.
6. 2% of households have pour flush toilets that discharge directly to surface water sources, primarily Bilwi Tigni (a stream that passes through town) or the ocean in the case of coastal households.
7. 1% of households have implemented are lined but not sealed in the bottom and are not emptied systems with plastic tanks for containment that can be emptied on a frequent basis but for which treatment and/or disposal is not available.

8. The groundwater risk assessment is that there is a significant risk due to the close proximity (<20 meters separation) of these unsafely managed onsite solutions to shallow hand dug wells that are also not lined.

3 Service delivery context

3.1 Policy, legislation and regulation

3.1.1 Policy

The legal framework regarding the sanitation service chain in Nicaragua consists of the following laws, decrees, technical guidelines and manuals:

Laws:

- Law 275 Reform of the Law to Create the Nicaraguan Institute for Water Supply and Sewerage (INAA), 1998.
- Law 40 Reform to the Law of Municipalities.
- Law 423 General Health Law.
- Law 479 Law to Create the Nicaraguan Water Supply and Sewerage Company (ENACAL), 2003.

These laws designate the role of urban sanitary sewerage service provision to ENACAL, with regulatory responsibility to INAA primarily for establishing tariffs for the service. The General Health Law faculties the Ministry of Health with the responsibility for ensuring sanitary conditions in the environment while the Law of Municipalities limits the role of the municipality to services with less than 500 connections, essentially equivalent to populations less than 2,500 people.

Decrees:

- 33-95 Contamination Control for Wastewater Discharge.
- 76-2006 Environmental Assessment System (MARENA).

Technical Guidelines (Standards):

- NTON 05 008-98 Standards for Domestic Wastewater Treatment Systems.
- NTON 05 009-98 Design Criteria Standards for Oxidation Ponds.
- NTON 09 002-99 Rural Basic Sanitation Standards.
- NTON 05 027-05 Obligatory Technical Standard for the Regulation of Wastewater. Treatment Systems and Reuse (2006).

These technical guidelines are managed by the regulatory body INAA. For onsite sanitation, the only reference is the Rural Basic Sanitation Standards.

Technical Guidelines and Manuals:

- Technical Guidelines for the Design of Sanitary Sewers and Wastewater Treatment Systems (INAA).
- Manual for the Maintenance of Sanitary Sewerage Systems (INAA), 2005.
- Manual (066) for the Sanitaria Inspection of Water for Human Consumption (MINSA), 2011.

There are no regional nor municipal bylaws, decrees or regulations with regards to sanitation services.

3.1.2 Institutional roles

There are many institutions that play or should play a role with respect to sanitation in Bilwi:

- *Empresa Nicaraguense de Acueductos y Alcantarillados* (ENACAL): state-owned water supply and sewerage utility primarily for urban areas at a national level
- *Instituto Nicaraguense de Acueductos y Alcantarillados* (INAA): regulatory body.
- Ministry of Health (MINSA) and its counterpart in the autonomous region, the Secretariat of Health.
- Ministry of Natural Resources and the Environment (MARENA) and its counterpart in the autonomous region, the Secretariat of Natural Resources (SERENA).
- Municipal Government of Puerto Cabezas.
- North Caribbean Coast Autonomous Regional Government (GRACN) and its Regional Technical WASH Division (UTRASH).

Table 3 presents an analysis of both formal (de jure) and informal (de facto) institutional roles:

Table 3 Institutional roles

Level	Institution	Role(s)	Formal Responsibilities (de jure)	Informal or developed responsibilities (de facto)
National	Ministry of Health (MINSA)	Sanitary Inspection	Sanitary Inspection	
	Ministry of the Environment and Natural Resources (MARENA)	Environmental Inspection	Application of fines for violations	
	National Water Supply and Sewerage Company (ENACAL)	Service delivery	Service delivery of water supply and sewerage services for urban areas (does not include on-site sanitation)	
	National Water and Sewerage Institute (INAA)	Regulatory body	Approval of tariffs / Define national standards	
Regional	Regional Government Council (*Concejo*)	Regional bylaws (autonomy)	Consider and pass regional bylaws	Oversight
	Secretariat for Natural Resources (SERENA)	Environmental Inspection	Application of fines for violations	
	Health Secretariat		Executive role monitoring health services and overseeing regulation	
	Regional Technical WASH Unit (UTRASH)	Regional Policy definition	Inter-institutional coordination	
Local	Municipal Government	Municipal planning, bylaws and financing (7% of treasury cash transfer payments)	None	None

3.1.3 Service provision

Currently there is no formal service provision for the sanitation service chain with no existing sewerage system and no formal nor informal institutional responsibility for on-site sanitation services with respect to containment, transport, treatment, end-use or disposal.

All on-site sanitation services are the responsibility of individual homeowners and the transport and disposal of faecal sludge is also at the discretional responsibility of the homeowner.

Informal services consist of:

- Septic tank emptying services by two local service providers although business is reported to be sparse.
- Pit latrines that are relocated on average every 1 to 3 years.
- Flush toilets with concrete lined pits referred to popularly as '*septic tanks*' sealed on the sides but not on the bottom.
- Hanging latrines/toilets that discharge directly into an existing water body, this being the ocean in some cases where the house is located on the edge of the beach or either one of the two creeks that run through what at one point was the southern limit of the city or across the still existing northern limits of the city.

3.1.4 Service standards

The emptying and dumping of faecal sludge from septic tanks should be subject to a permit from the Environmental Ombudsman based on notification from the Ministry of Health Sanitary Inspectors but this is not carried out even though there are both health and environmental protection standards against which these services could be assessed.

3.2 Planning

Despite the investment project currently underway (see section 3.2.2), there is no existing plan in relation to the sanitation service chain for Bilwi. Beyond the potential connection of as many as 25 – 50% of the population to the sewerage system and treatment plant currently under construction, there is no concept note, strategy or plan for the rest of the population.

Some initial discussions exploring the idea of an inclusive plan for the sanitation service chain have been held between ENACAL, WaterAid, AECID, and the Inter-American Development Bank (IADB) but they have yet to materialize in concrete action.

3.2.1 Service targets

A joint municipal water supply and sanitation project is currently under construction in Bilwi. The water supply component aims to replace entirety the existing service which provides connections to only 14% of the existing households and is intended to provide household connections to 100% of the existing population. The sanitation component aims to provide sewerage services and a wastewater treatment plant for 3,500 domestic connections which represents 22% of the existing lots and potentially 25% of the existing population.

3.2.2 Investments

The investment on the sanitation project in this first stage was initially in the order of US$ 10.9M and is funded by a combined donation from the Spanish Government Cooperation Agency (AECID) and the European Union Latin America Investment Fund (LAIF). The amount of the contract has now been increased to US$12M and there is discussion of increasing it by another US$ 5M with the objective of doubling its reach to as many as 7,000 potential household connections representing almost 50% of the existing population.

The sanitation project has the following scope:

- 19,600 meters of primary sewer mains.
- 25,000 meters of secondary *condominial* sewer networks.
- 3,500 household connections.
- 1 pumping station.
- A waste water treatment plant consisting of (i) pre-treatment, (ii) two anaerobic lagoons, (iii) one facultative lagoon, and (iv) one maturation lagoon.

Construction started in June 2017 and was initially scheduled to be completed by October 2018 but has suffered some delays and, as of July 2017, it is behind schedule by approximately 17% which could mean that it will not be completed until the first quarter of 2019.

3.3 Equity

Currently there are no specific plans and measures to ensure improved and sustainable sanitation services are available for all. The urban poor which represent at least 60% of the population depend in the vast majority, if not all cases, on pit latrines or form part of the 13% of the population with no sanitary services who either practice open defecation or use the services at a neighbouring household.

The sanitation project that is currently under construction aims to provide sewerage services connected to a waste water treatment plant for zones A1 and F. A1 corresponds to an area classified as low poverty according to the poverty map below generated in 2005 while F corresponds to a corridor of high and severe poverty on route to the waste water treatment plant.

The dominant design criteria for the first phase of this project was said to have been the prioritization of households with connections to the existing water supply system and more probably using flush toilets. This translates into a prioritization of the relatively wealthier segments of the local population.

3.3.1 Current choice of services for the urban poor

At present, the affordability of the sanitation service chain is primarily concentrated in the initial capital investment with pit latrines costing in the order of US$100 in building materials (usually wood) and manual labour while flush toilets with septic tanks cost in the order of U$500 for simplified pour flush options with septic drain or leach fields to US$1,500 for toilets with water tanks and large concrete septic tanks.

A total of 13% of the urban population is reported to have no on site option for sanitation and either practices open defecation or borrows these services from a neighbouring household.

For this study it is considered that this percentage continues to practice open defecation even if in some cases they are able to share a neighbours sanitation facilities.

3.3.2 Plans and measures to reduce inequity

Other than the project currently under construction, which addresses the relative inequity of the population of Bilwi and the North Caribbean Autonomous Region from the perspective of the national level, there are no established plans or measures that target the reduction of inequity within the city itself.

3.4 Outputs

3.4.1 Capacity to meet service needs, demands and targets

The capacity to meet service needs, demands and targets is extremely weak both within the institutions and in the private sector.

3.4.2 Monitoring and reporting access to services

Although monitoring and reporting on access to services has been thoroughly carried out by the Ministry of Health Environmental Health Unit, this information is not known to other key stakeholders nor does it form part of a publicly accessible information system.

ENACAL is in the process of conducting a census that includes access to services that is expected to be completed in December 2018. ENACAL does not typically have any involvement with respect to on-site sanitation solutions, limiting itself to sewerage options.

3.5 Expansion

An investment project is currently under way that is aimed to provide sewerage services and a waste water treatment plant to as many as 25 – 50% of the population. The first phase is planned to be completed by June 2019.

3.5.1 Stimulating demand for services

Together with public and private partners and with funding from the Inter-American Development Bank, WaterAid has promoted the campaign *Rayakam Klin* (Healthy Living) to stimulate demand for services using radio, television and visible materials.

3.5.2 Strengthening service provider roles

GIZ and WaterAid are in the early stages of strengthening the role of ENACAL as a service provider in the sanitation service chain.

4 Stakeholder Engagement

Stakeholder engagement for this project started by contacting the Project Manager for the state-owned urban water supply and sewerage company (ENACAL) which is currently in the construction phase of a new municipal water supply combined with the first sanitation project (sanitary sewer and waste water treatment plant for the city of Bilwi).

This led to an initial informational meeting which involved the ENACAL Project Manager together with a GIS-technical assistant assigned by GIZ as part of an institutional strengthening effort focused on the client database.

Key informant interviews were conducted with the Ministry of Health's Environmental Health Department and Sanitation Inspectors, Regional Government Health Secretariat, ENACAL, the municipal government, service providers for the emptying and maintenance of septic tanks.

Interviews were also conducted with the supervision of the municipal sewerage project which is currently under construction and is scheduled to be complete in 2019.

Focus group discussions were also conducted based on WaterAid's local employees representing 50% of the 31 neighbourhoods of Bilwi.

Direct observation was conducted to verify the status of the different on-site technologies.

Table 4 summarizes the key stakeholders identified:

Table 4 Key stakeholders (WaterAid, 2018)

Key Stakeholders	Institutions / Organizations
Public Institutions	ENACAL, Ministry of Health, Regional Government, Municipal Government
Non-governmental Organizations	WaterAid
Private Sector	Ricardo Bonilla (Chackanblack), Lenin Gonzalez
Development Partners, Donors	Spanish Development Agency (AECID), European Union (EU), Inter-American Development Bank (IADB)
Others	Pana Pana (micro finance institution)

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- MINSA (Ministry of Health), particularly Dionisia.
- GRACN (Regional Autonomous Government), particularly Manuel Salas (Health Secretariat), Julio Cesar Chow Sandoval (WASH Technical Unit Coordinator).

- Municipal Government of Puerto Cabezas.
- Ricardo Bonilla, Proprietor Chackamblack.
- Lenin Gonzalez, Propietor.

6 References

No published references were found for this study. However, key information regarding the sanitation options in use in the city was extracted from:

[i] Ministry of Health (MINSA) household survey 2017 with classification of sanitation technologies for 12,205 households.
[ii] Nicaragua National Census, INIDE, 2005.