SFD Lite Report

Port Moresby
Papua New Guinea

This SFD Lite Report was prepared by the University of Leeds based on an Asian Development Bank study in 2020

Date of production/last update: 08/09/2021

1 The SFD Graphic

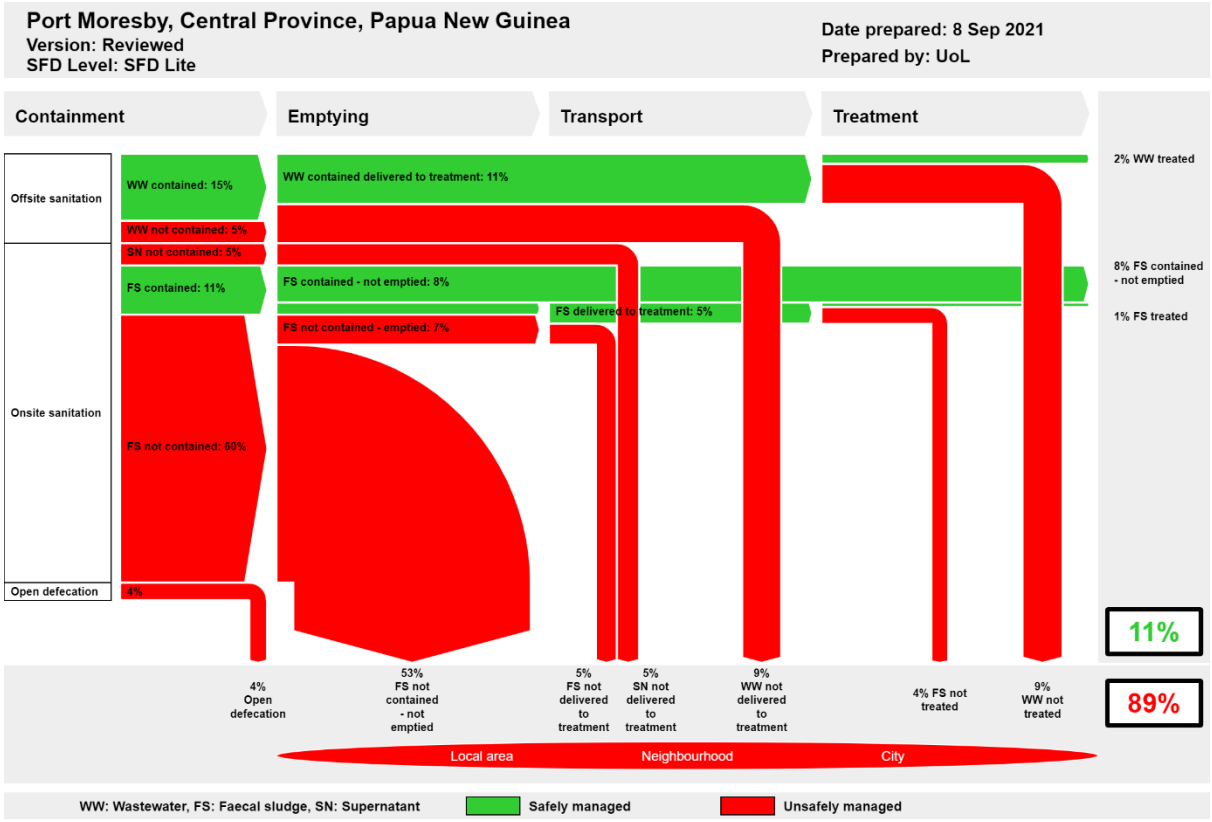

Figure 1: SFD Graphic for Port Moresby

2 SFD Lite information

Produced by:

- The University of Leeds from Asian Development Bank, 2020, Faecal Sludge Management in Port Moresby (ADB, 2020)
- All data presented here are from ADB (2020) except where otherwise noted

Date of production:

- 08/09/2021

3 General city information

This SFD covers the administrative "National Capital District" of Port Moresby, the capital city of Papua New Guinea.

According to the 2011 Census, the population was 364,125 and the population growth rate was 3.3%. The predicted population in 2020 was 503,795, no further census data are available. This is likely to be around 65,800 households. Most of the population growth is within the inland suburbs of Gerehu, Morata, Gordena and Tokara, and more recently on the peninsula near the port.

There is a mixture of planned settlements (20), informal settlements (79) and urban villages (7). Approximately 45% of the population live in the informal settlements.

The lowest part of the city is at sea level, with flat valleys at about 50 meters above sea level, rising to several high ridges at 200 meters above sea level. These ridges are part of the catchment of the Vanapa and Brown Rivers, but the only water bodies within the city are the Boroko Creek and the Waigani Lagoon. This varied topography affects the pattern of settlements.

4 Service outcomes

Table 1 (see over) shows the different sanitation systems in use in Port Moresby and how they are classified under SFD PI methodology used in this report.

4.1 Offsite sanitation

Overview on the offsite technologies and for different sanitation systems through the sanitation service chain is as follows:

4.1.1 Containment and Transport

There are two sewerage networks: the main network, serving most of the households connected with sewer connections, and a smaller coastal network. In total they serve an estimated 15% of the population (T1A1C1 = 15% on Table 1). The sewers receive black water and grey water, including rain run-off, with no regulation of what is discharged from homes and businesses. Many households sweep dirt into drains leading to the sewers, and there is a big problem with blockages caused by silt, fats, detergent and plastic. An estimated 5% of the sewer connections have now failed and these now instead discharge wastewater directly into the open drains, (T1A1C6 = 5% on Table 1). Overall, the sewer networks have had very little work or maintenance done for 50 years and this is reflected in only 75% of the flow reaching the treatment works (W4a).

4.1.2 Treatment

There are several treatment plants and waste stabilisation ponds in the city that are not being managed well and therefore are quite ineffective, but there is some refurbishing work going on. Therefore, taking this into account and for the purposes of this SFD, treatment efficiency is estimated at only 20% (W5a = 20% on Table 1).

Table 1 – Proportion of households using different sanitation systems and SFD PI classification used in this report

ADB system description (see Figure 3)	Proportion of households using this system (%)	SFD PI system description and label (as used on SFD GG matrix)		Proportion of population using this type of system (%)
Flush toilets to sewer	15%	Toilet discharges directly to a centralised combined sewer	T1A1C1	15%
Flush toilets to broken sewer and diverted to open drains	5%	Toilet discharges directly to open drain or storm sewer	T1A1C6	5%
Flush toilets to septic tanks to open drains	10%	Septic tank connected to open drain or storm sewer	T1A2C6	10%
Flush toilets to septic tanks to soak pit	11%	Septic tank connected to soak pit	T1A2C5	6%
		Septic tank connected to soak pit, where there is 'significant risk' of groundwater pollution	T2A2C5	5%
Improved dry pits (covered and replaced)	9%	Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow	T1B7C10	5%
		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	4%
Unsafe dry pits	5%	Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil, no outlet or overflow	T1B7C10	46%
Unimproved service (unsafe pit toilets)	32%			
Limited service (shared sanitation)	9%			
No service (open defecation)	4%	Open defecation	T1B11C7-C9	4%

Table 2 shows the full SFD matrix, and all the percentages used in the generation of the SFD graphic.

Table 2: SFD Matrix for Port Moresby

Port Moresby, Central Province, Papua New Guinea, 8 Sep 2021. SFD Level: SFD Lite
Population: 503795
Proportion of tanks: septic tanks: 50%, fully lined tanks: 100%, lined, open bottom tanks: 100%

Containment										
System type	Population	WW transport	WW treatment	WW transport	WW treatment	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	W4a	W5a	W4c	W5c	F3	F4	F5	S4e	S5e
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in sewer system, which is delivered to centralised treatment plants	Proportion of wastewater delivered to centralised treatment plants, which is treated	Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants	Proportion of wastewater delivered to treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated	Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants	Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated
T1A1C1 Toilet discharges directly to a centralised combined sewer	15.0	75.0	20.0							
T1A1C6 Toilet discharges directly to open drain or storm sewer	5.0			0.0	0.0					
T1A2C5 Septic tank connected to soak pit	6.0					90.0	50.0	20.0		
T1A2C6 Septic tank connected to open drain or storm sewer	10.0					90.0	50.0	20.0	0.0	0.0
T1B11 C7 TO C9 Open defecation	4.0									
T1B7C10 Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow	5.0									
T1B8C10 Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil, no outlet or overflow	46.0									
T2A2C5 Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	5.0					90.0	50.0	20.0		
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	4.0									

4.2 Onsite sanitation

Overview on the onsite technologies and for different sanitation systems through the sanitation service chain is as follows:

4.2.1 Containment

As can be seen in Tables 1 and 2, 21% of the population use ‘septic tanks’. Half of these discharge effluent directly to open storm drains (T1A2C6, 10%) and half discharge the effluent to a soak pit. Of the latter, half are in areas where the local soil has been found to have a low absorption capacity and there is therefore a significant risk of groundwater pollution (T2A2C5 = 5%). The balance are in areas where there is a low risk of groundwater pollution (T1A2C5 = 6%).

Importantly, 32% of the population use sanitation technologies classified by ADB as "unimproved service", 5% use dry pits that have "water in pits" and 9% use "limited service" (which are public/shared toilets) (see Table 1 and Figure 3). For the purposes of this report, these are categorised as "pit latrines that are abandoned once full but not adequately covered with soil" (T1B8C10 = 46%).

Finally, according to ADB, 9% of the population use "improved dry pit toilets" that when full are covered, safely abandoned and replaced. For the purposes of this report, it is estimated that half of these are in areas where there is low risk of groundwater pollution (T1B7C10 = 5%) and half are in areas where this is a significant risk of groundwater pollution (T2B7C10 = 4%).

4.2.2 Emptying and transport

Septic tanks are emptied every 6-9 months in the dry season and every 3-6 months in the wet season; this suggests that the tanks are filling up with liquids due to the ineffective soak pits, meaning the emptiers are mainly removing effluent rather than sludge. Some septic tanks are reportedly never emptied. Therefore, for the purposes of this SFD that the proportion of faecal sludge is emptied (F3) is estimated at 90%.

All of the different tanker operators report dumping all emptied faecal waste at Waigani treatment. However, this would be 20-40 visits a day, which is not reflected in the data reported by the treatment works operator (SOPAC). This suggests that some faecal waste is being dumped unsafely in more convenient locations. For the purposes of this SFD, it is therefore estimated that only half of the faecal sludge emptied is delivered to treatment (F4 = 50% on Table 1).

Both the "improved" and "unimproved" pit latrines (T1B8C10, T1B7C10 and T2B7C10) are not usually emptied at all, there are no available pit emptying services and ADB reports that householders surveyed express resistance to this idea. Therefore, all pits are assumed to be abandoned when full and new pits dug.

4.2.3 Treatment

There are no faecal sludge treatment plants, instead any faecal sludge delivered to treatment is delivered to and co-treated in the waste stabilisation ponds described in section 4.1.2. Therefore, for the purposes of this report treatment efficiency is estimated as 20% (F5 = W5a = 20%).

4.3 Risk of Groundwater Pollution

As shown on Tables 1 and 2, 70% of Port Moresby's sanitation systems are infiltrating effluent into the ground, therefore the groundwater risk is an important consideration. There is limited data available on groundwater use and quality in the city. ADB (2020) reports 60% coverage of piped water delivered to households or local areas. The operator (SOPAC) report 97% of the population with access to piped water, however they do not serve the 45% of the population living in informal settlements (SOPAC, 2007). This could explain a discrepancy with other reported rates of 74% and 89% coverage (ADB 2014, Smets 2013). The coverage figures also do not take account of the intermittent nature of the water supply which may cause people to turn to other water sources to meet their needs.

Additionally, because of the lack of data, it is difficult to ascertain the distances between toilets and water sources, and the depth to the water table. There are no usable aquifers along the coast of Papua New Guinea but since the sprawl of Port Moresby extends up to higher ground, it is likely that this is only the case in part of the city (SOPAC, 2007).

Taking all this into account and for the purposes of this SFD, for all sanitation technologies that are permeable and leach into the ground, it has been assumed that half are in areas where there is a low risk of polluting groundwater used for drinking, and half are in areas where there is significant risk of polluting groundwater used for drinking.

4.4 SFD Graphic

Based on ADB (2020) and the SFD PI methodology (as described above), Figure 2 and the subsequent paragraphs summarise the service outcomes, which indicate only 11% of excreta are safely managed.

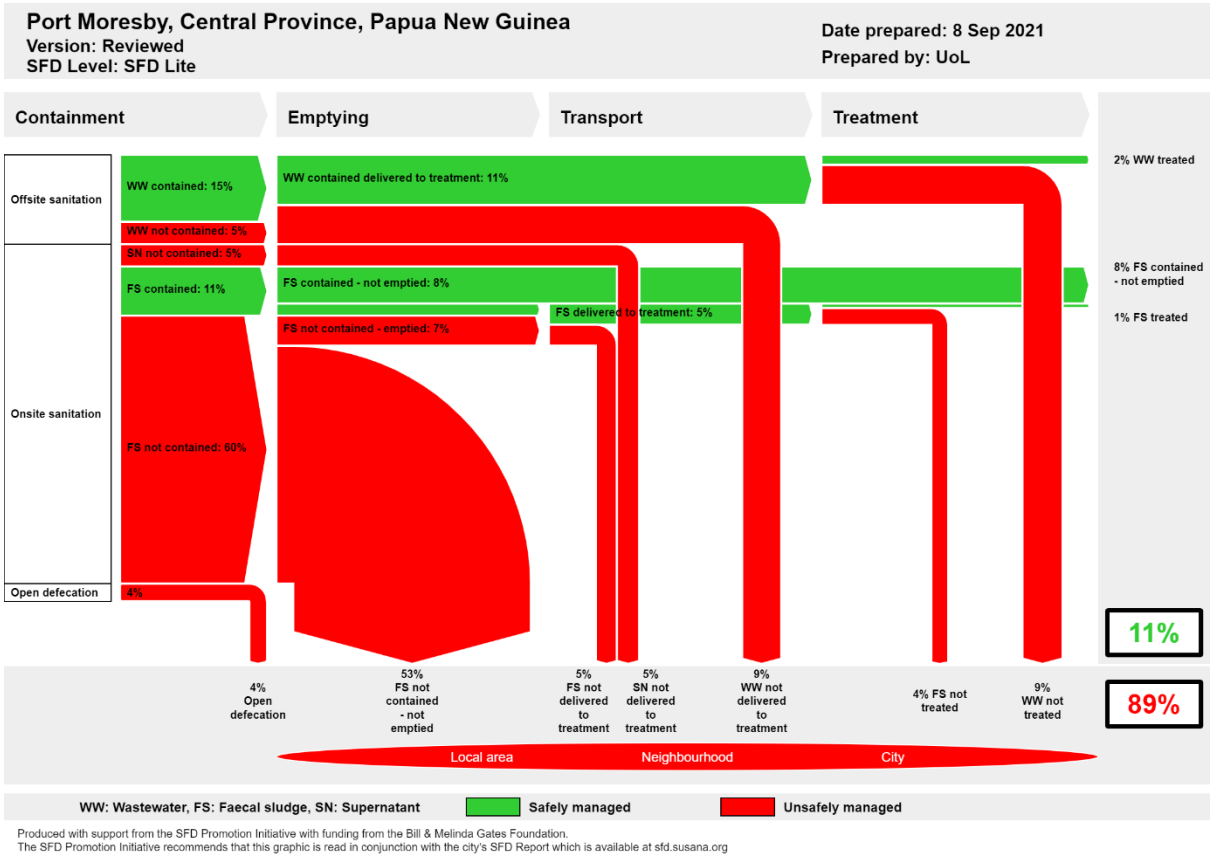

Figure 2: SFD Graphic for Port Moresby, Papua New Guinea

Most of the population use on-site sanitation systems (onsite sanitation = 76% on Figure 2), 20% of the population are connected to offsite sanitation and only 4% practice open defecation.

Just over two-thirds of the safely managed sanitation is faecal sludge that is not emptied and remains safely contained in the pits and tanks (8% FS contained - not emptied on Figure 2). The balance is the small fraction of wastewater that reaches treatment and is treated (2% WW treated on Figure 2) and faecal sludge that reaches treatment and is treated (1% FS treated on Figure 2).

An estimated 89% of the sanitation waste is not safely managed. Importantly, over half of this is from pit latrines which are not emptied but abandoned unsafely when full (53% FS not contained - not emptied on Figure 2). These facilities are rarely covered safely but left open and therefore present a significant hazard. The balance of the unsafely managed sanitation is from faecal sludge, supernatant and wastewater not delivered to treatment (total of 19% on Figure 2); wastewater and faecal sludge delivered to treatment but not treated (9% WW not treated and 4% FS not treated on Figure 2); and 4% is from open defecation.

5 Data and assumptions

ADB (2020) uses data from the WHO/UNICEF Joint Monitoring Programme (JMP), The International Benchmarking Network for Water and Sanitation Utilities (IBNet) and Household Income and Expenditure Survey (HIES), supplemented with primary data from surveys of septic sludge tanker operators, interviews with sector stakeholders and three consultative workshops. The ADB (2020) SFD is shown in Figure 3.

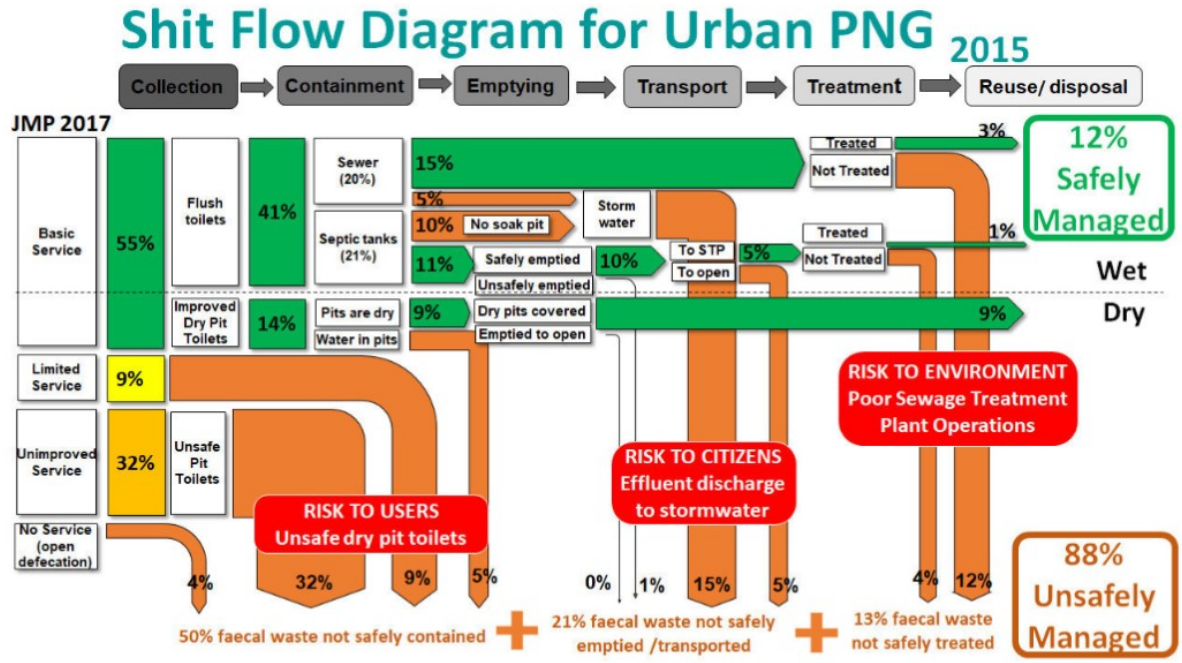

Figure 3 - Original ADB Shit Flow Diagram for Port Moresby (ADB, 2020)

As highlighted, there are differences in the ADB SFD methodology and the SFD PI methodology – particularly in the classification of sanitation technologies and the risk of groundwater pollution from permeable sanitation technologies. However, despite these differences, the resulting percentages for total safely managed sanitation shown on the two graphics are very similar (ADB =12%, SFD PI = 11%). And both graphics highlight the same key unsafely managed sanitation issues – the reliance on potentially unsafely managed dry pit latrines and the lack of safe emptying, transport and treatment of faecal sludge and wastewater.

One difference that it was not possible to mitigate for is that the unit of analysis in the ADB report is the household, while the SFD PI methodology uses populations. For the purposes of

this SFD report, household sizes across the city have been assumed to be homogenous. If populations in different areas of the city are using different sanitation services, this assumption will affect the results. However, both the ADB SFD and this SFD report provide informative overviews of the main sanitation technologies used and the conditions along the sanitation chain that would need to be addressed in order to increase the proportion of the population using safely managed sanitation, and therefore progress towards achieving SDG 6.2.1.

6 List of data sources

Asian Development Bank (ADB), 2020. Faecal Sludge Management in Port Moresby. [online] Adb.org. Available at: <https://www.adb.org/sites/default/files/project-documents/tacr-en.pdf> [Accessed 24 March 2021].

Asian Development Bank (ADB), 2014. Sector Assessment (Summary): Water Supply and Other Urban Infrastructure. [online] Available at: <https://www.adb.org/sites/default/files/linked-documents/cps-png-2016-2020-ssa-04.pdf> [Accessed 24 March 2021].

Smets, S., 2013. *Water Supply and Sanitation in Papua New Guinea: Turning Finance into Services for the Future*. [online] Wsp.org. Available at: <https://www.wsp.org/sites/wsp/files/publications/WSP_EAP_SDA_PNG_Report.pdf> [Accessed 24 March 2021].

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Port Moresby, Papua New Guinea, 2021

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