

Impact of flooding on rural sanitation infrastructure in Fiji.

Presenter: Nabeela Nasim ¹

Main contributors: Pierre Horwitz ², Aaron Jenkins ^{2,3}, Stacy Jupiter ⁴, Timoci Naivalulevu ⁵, Joel Negin ³, and Jacqueline Thomas ¹

1. School of Civil Engineering, The University of Sydney, Darlington, NSW 2008, Australia
2. School of Science, Edith Cowan University, Joondalup, WA, Australia
3. School of Public Health, The University of Sydney, Camperdown, NSW 2008, Australia
4. Wildlife Conservation Society, Suva, Fiji
5. Fiji Institute of Pacific Health Research, Fiji National University, Hoodless House, Suva, Fiji



**WATER
&
WASH** 2023
FUTURES

Achieving SDG6 in a Changing Climate



#WaWF23

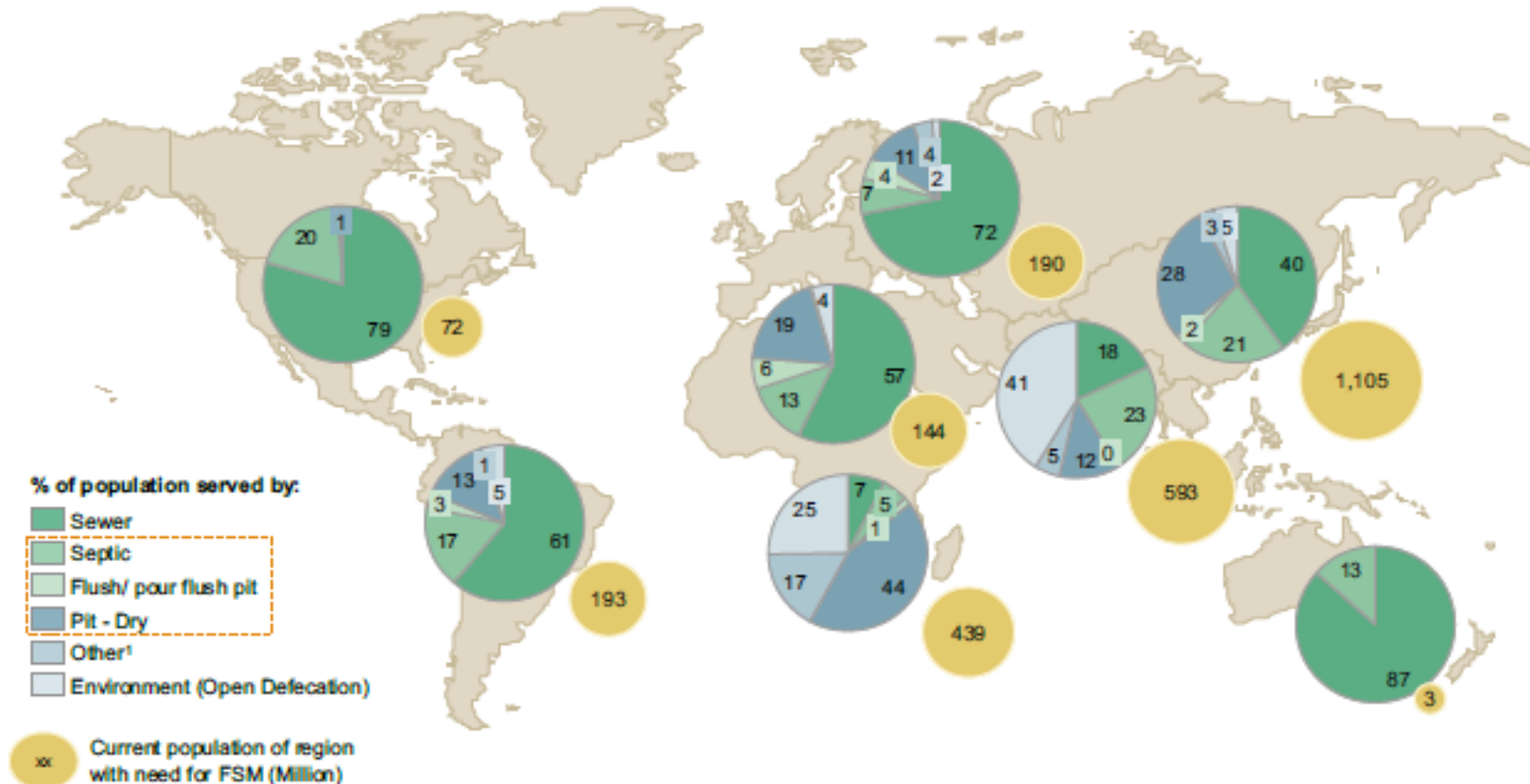
Introduction

- **Doctor of Philosophy in Engineering (Year 3)** – School of Civil Engineering, University of Sydney, Australia
 - **PhD topic:** An investigation of the health and environmental risks from rural sanitation hardware: with case studies from Fiji and Timor-Leste
 - Supervised by Dr. Jacqueline Thomas (Primary) and Prof. Abbas El-Zein
- Master of Engineering (Environment) and Engineering Management – University of Technology, Sydney, Australia
- Bachelor of Science in Civil Engineering – Bangladesh

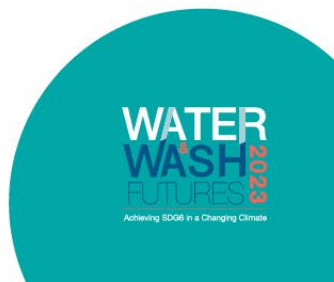


Global Perspective

~2.7 billion people worldwide are served by sanitation methods that need fecal sludge management



Source: (Strande and Brdjanovic, 2014)



Sanitation Challenges in Pacific

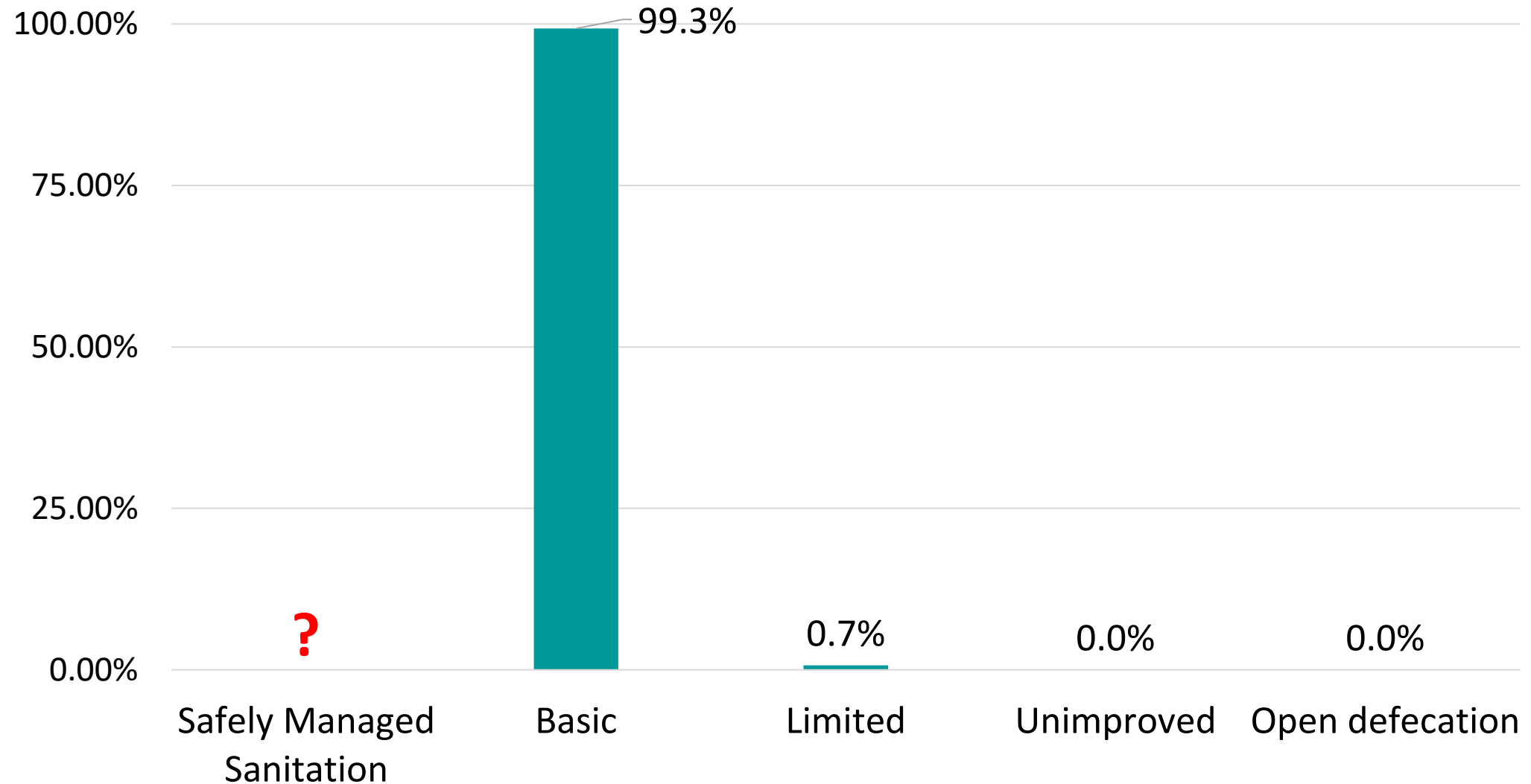
SERVICE LEVEL	DEFINITION
SAFELY MANAGED	Use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite
BASIC	Use of improved facilities that are not shared with other households
LIMITED	Use of improved facilities shared between two or more households
UNIMPROVED	Use of pit latrines without a slab or platform, hanging latrines or bucket latrines
OPEN DEFECATION	Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces, or with solid waste

Note: improved facilities include flush/pour flush to piped sewer systems, septic tanks or pit latrines; ventilated improved pit latrines, composting toilets or pit latrines with slabs.

- Lack of data on safely managed sanitation for Pacific island countries.
- Only 3 countries have estimate of safely managed sanitation (WHO and UNICEF, 2021).

Sanitation Challenges in Fiji

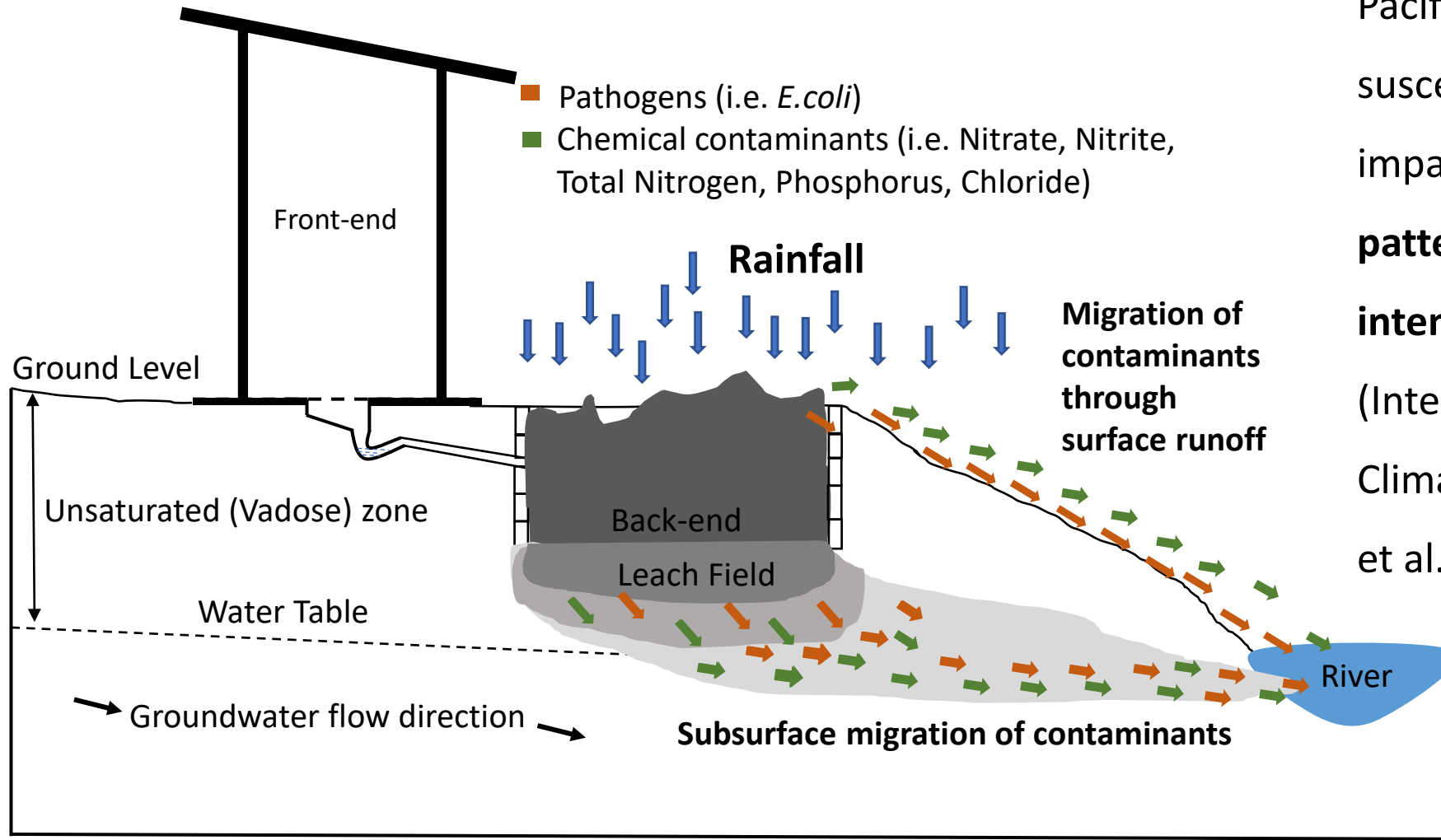
Rural Sanitation Coverage in Fiji (2020)



Source: SDG 2020 data



Flooding Impact on Sanitation

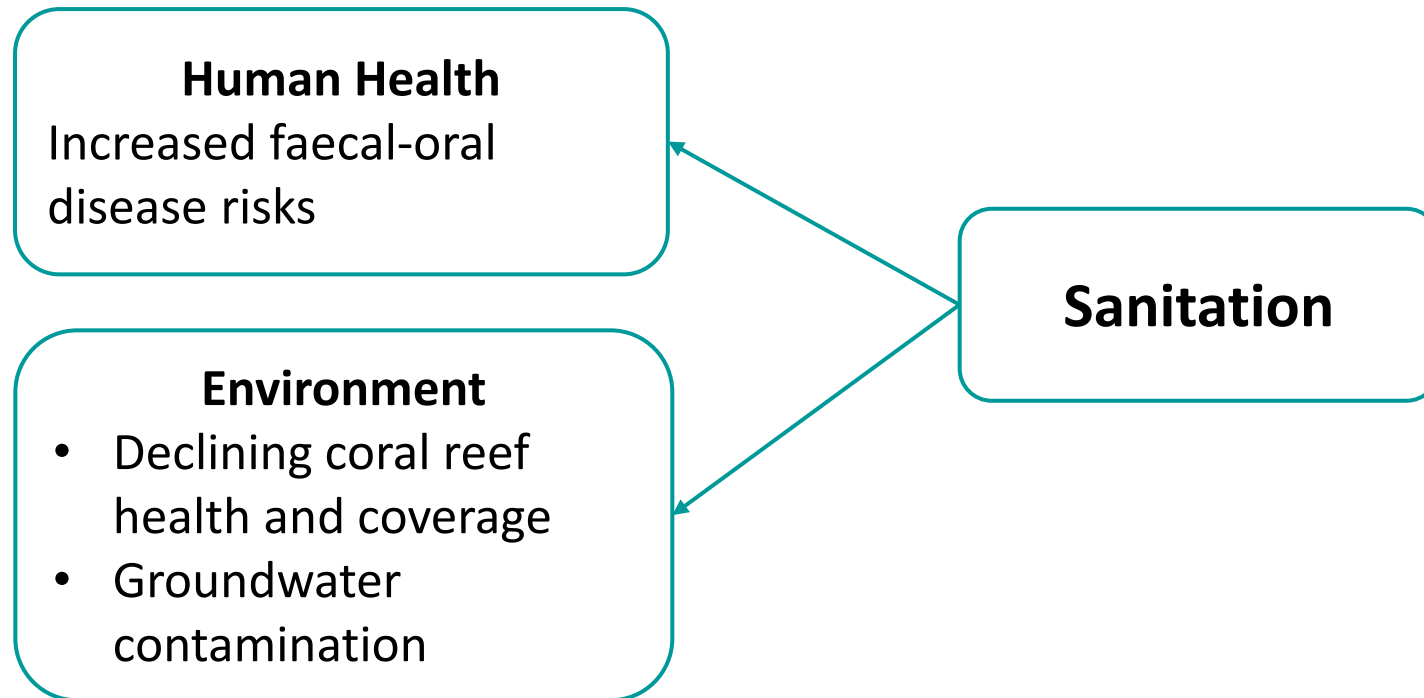


Pacific islands are particularly susceptible to climate change impacts due to **changing weather patterns including increased intensity of rainfall and cyclones** (Intergovernmental Panel on Climate Change (IPCC), 2014; McIver et al., 2016)

Figure: Rainfall and uncontained back-end infrastructure contributing to the contamination of environmental waterbody

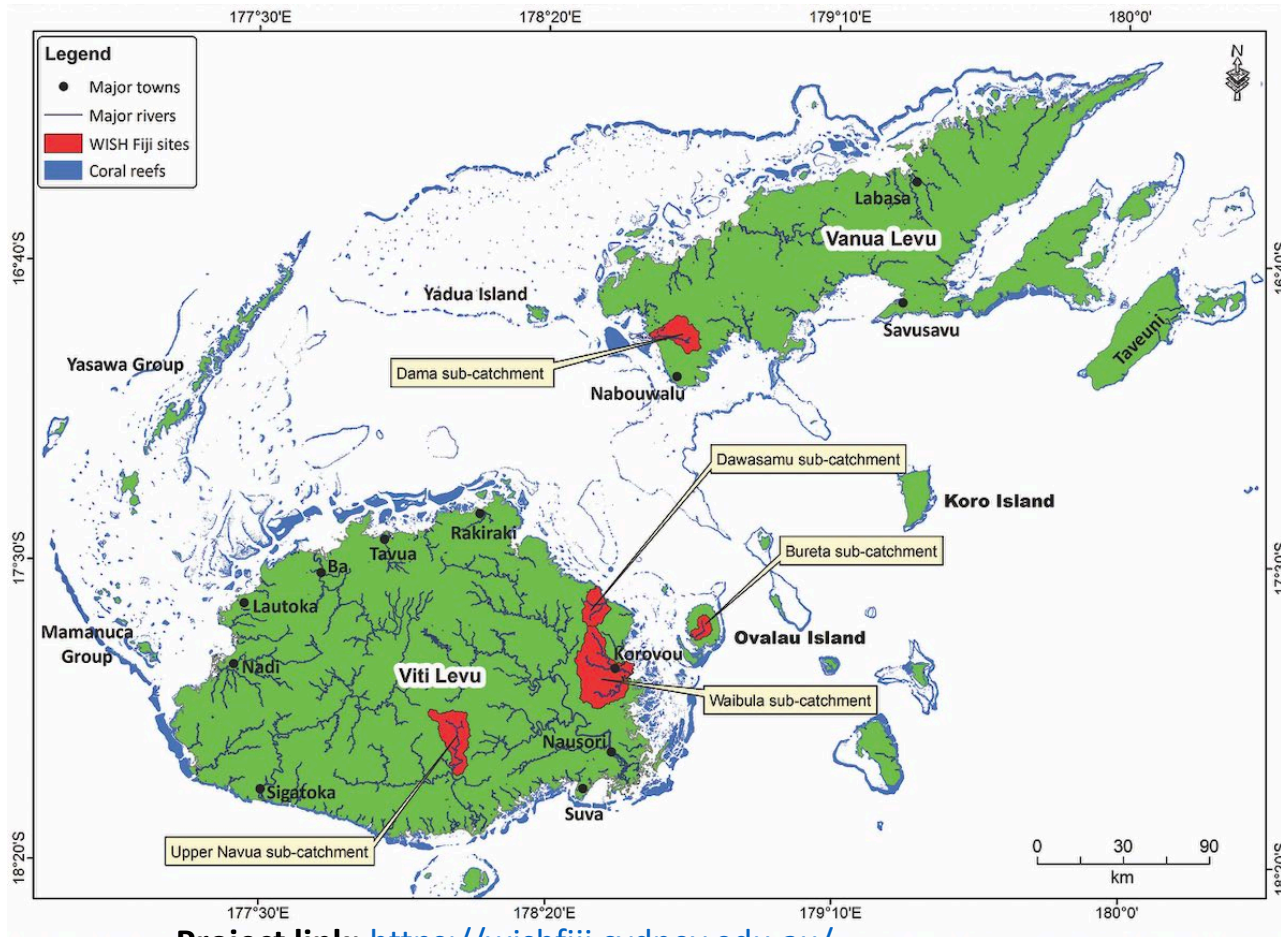
Aim

- Filling the data gaps on the containment safety of sanitation infrastructure and identifying health and environmental risks.
- To understand the impact of flooding on rural sanitation infrastructure.



Case study background

- Part of a project named **Watershed Interventions for Systems Health in Fiji (WISH Fiji)** funded by Australian Government Department of Foreign Affairs and Trade (DFAT) (WISH Fiji, 2022)
- Largest rural sanitation dataset collected for Fiji



Project link: <https://wishfiji.sydney.edu.au/>

Sample Size

29 rural communities across 5 water catchment areas.

- **Baseline Survey and Observation**
Randomly selected **311 households** (20% of the community population)
- **Community-wide Water Safety and Sanitation Planning (WSSP)**
1502 households (includes whole community)

Data collection tools

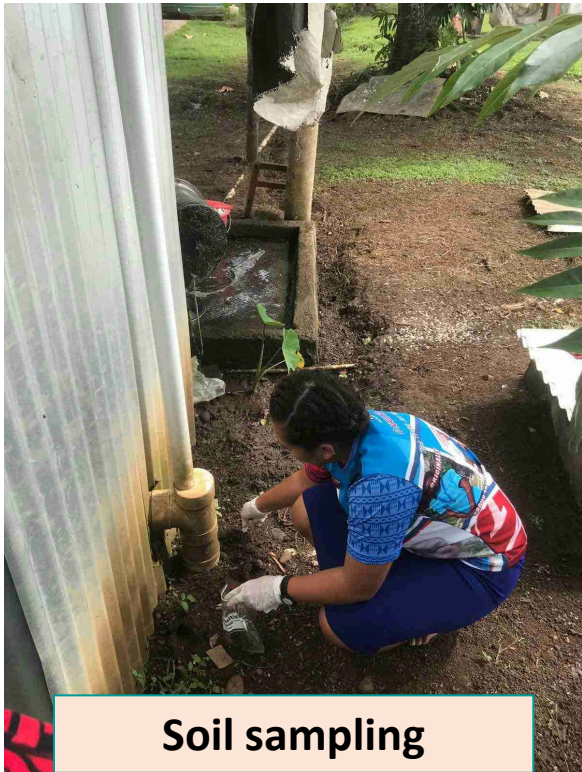
1. Sanitation survey

2. Sanitation observation

311 Households

3. Sampling - Soil near sanitation back-end and creek sediment sampling to measure *E. coli*

99 Households



Soil sampling



Laboratory setup in field

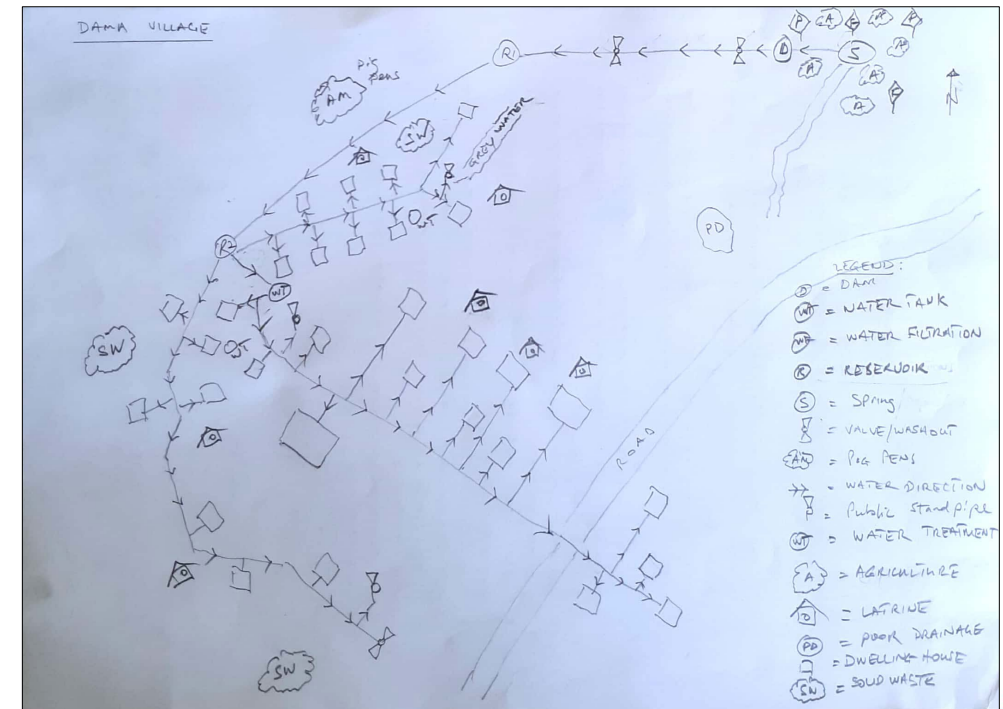


WAGTECH Kit

Data collection tools

4. Water Safety and sanitation planning (WSSP) - Participatory approach to collect community-wide

1502
Households



Sanitation Characterisation – 311 Households

Category 1. Septic System

Septic tank cover visible

Cover material – Concrete or plastic



14%

Category 2. Tank

Permeable tank acting as soak away



6%

Category 3. Other

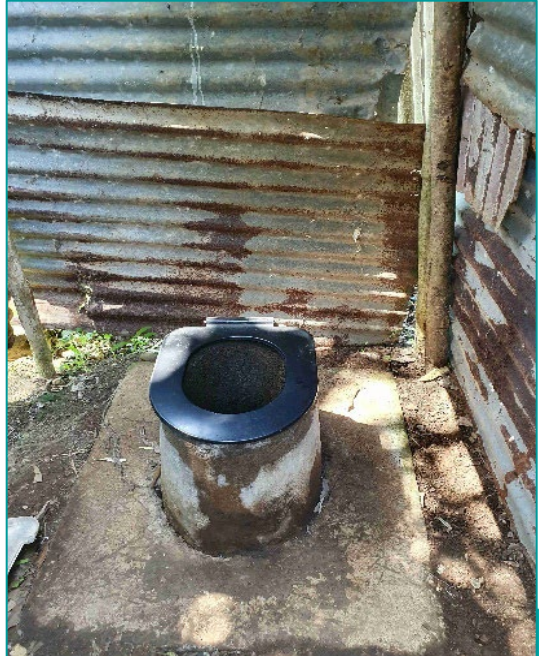
Back-end cover not visible
Likely to be soak aways



52%

Category 4. Pit latrine

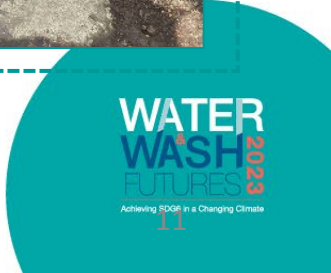
Hole in the ground



16%

68.1% septic systems (SDG 2020)

12% - missing data
(Nasim et al., 2023 - Under review)



Faecal Contamination Comparison

Catchment	Soil <i>E. coli</i> CFU/g soil							
	Latrine back-end leach zone				Creek sediment			
	n	Mean	Min	Max	n	Mean	Min	Max
Bureta	16	2.2×10^4	0	9.8×10^4	9	5.1×10^3	0	3.1×10^4
Dama	18	2.6×10^4	2.0×10^2	3.1×10^5	3	2.1×10^3	4.5×10^2	4.0×10^3
Dawasamu	21	3.7×10^3	0	5.8×10^4	11	1.2×10^3	0	5.3×10^3
Upper Navua	18	1.5×10^4	0	4.1×10^4	11	1.9×10^3	0	6.5×10^3
Waibula	26	1.1×10^4	0	1.8×10^5	8	1.3×10^3	0	8.6×10^3
5 Catchments	99	1.5×10^4	0	3.1×10^5	42	2.3×10^3	0	3.1×10^4

- Faecal contamination, measured as *E. coli* concentrations in near latrine back-end was **6.5 times higher** compared to creek sediment (away from latrine impact)

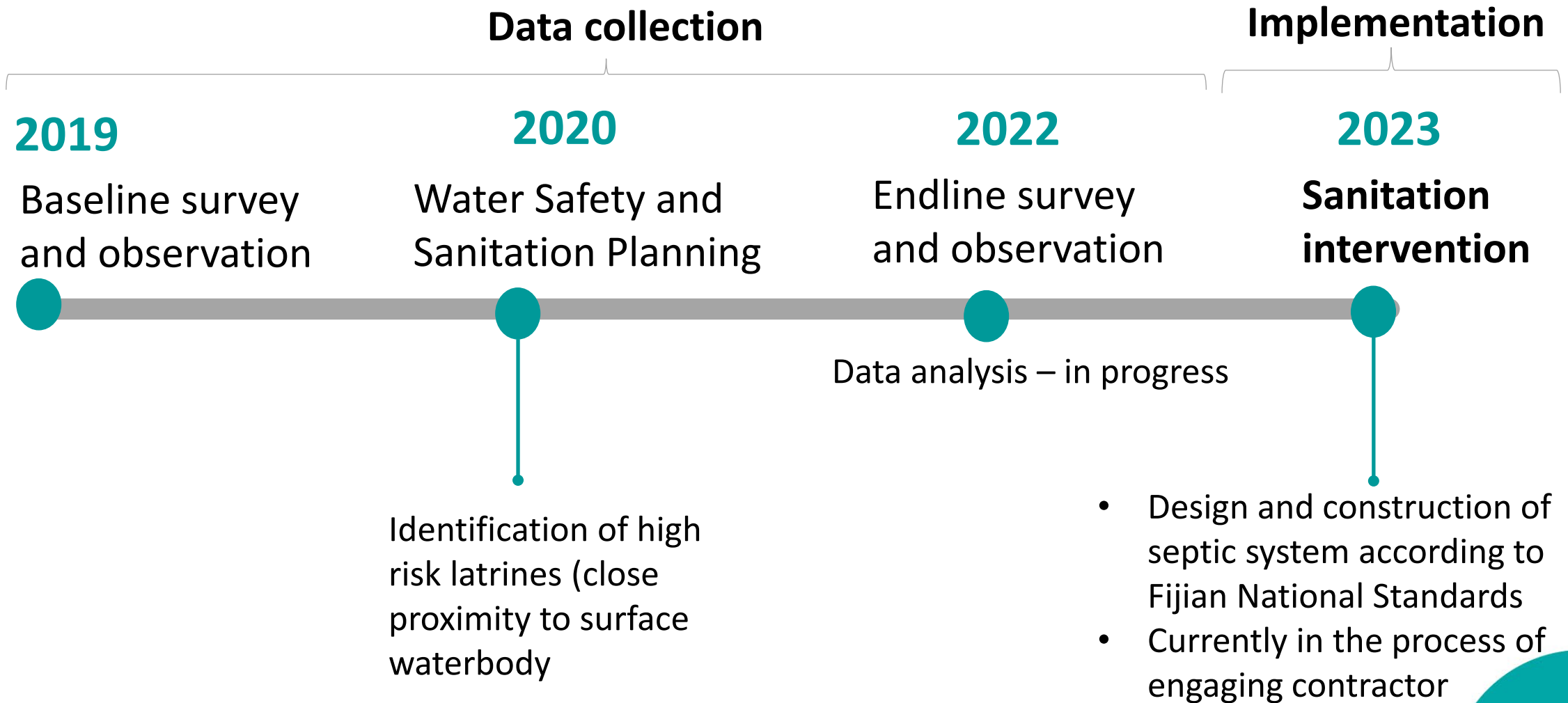
Impacts of flooding

Data from Water Safety and Sanitation Planning (WSSP), conducted in year 2020

Has there been any extreme weather events in the last 12 months?

Catchment	Communities included in the study	Impacted by Cyclone Harold
Bureta	7	5 (71%)
Dama	6	3 (50%)
Dawasamu	5	5 (100%)
Upper Navua	5	4 (80%)
Waibula	6	6 (100%)
5 Catchments	29 communities	23 (79%)

Sanitation Interventions

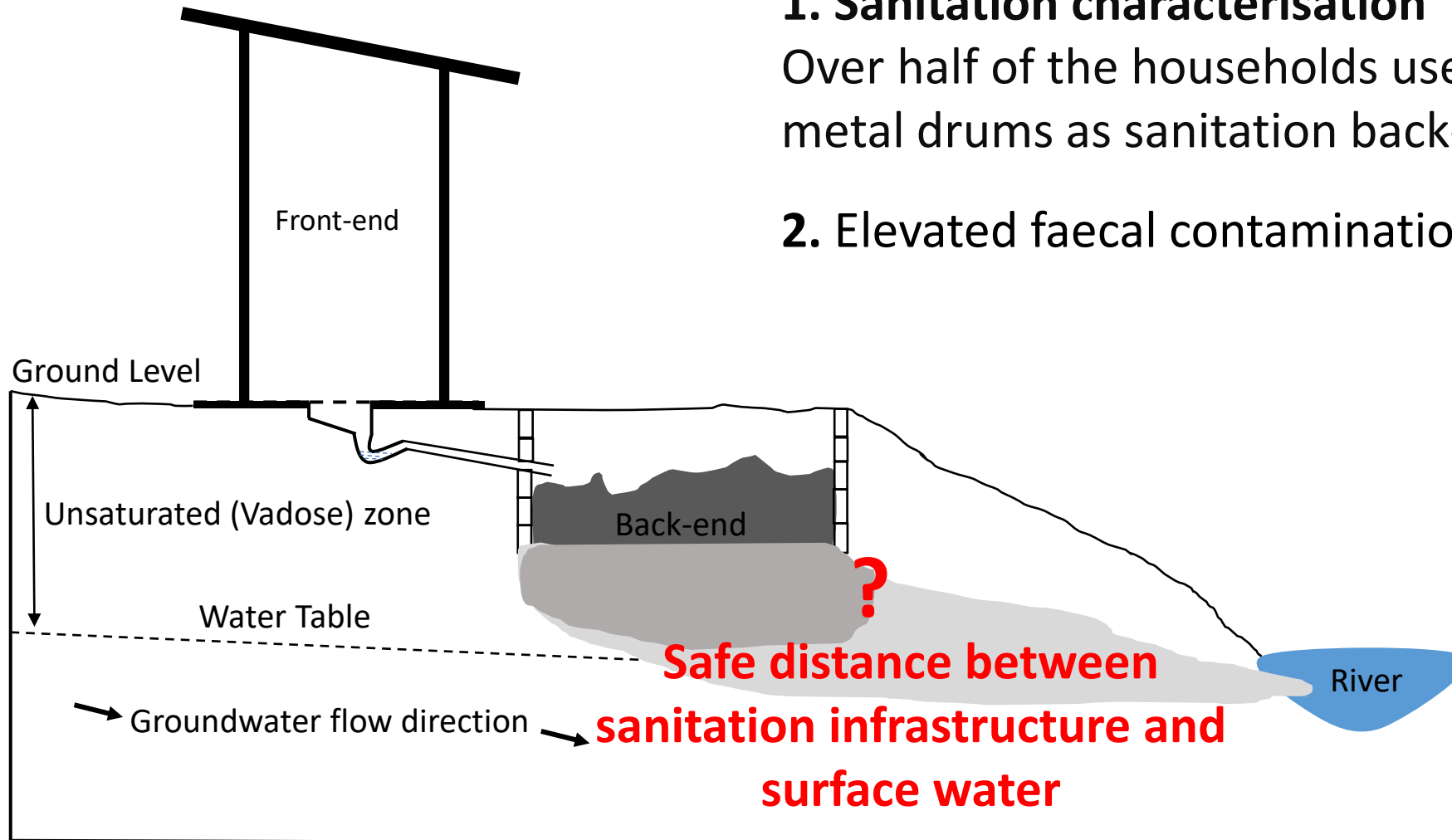


Key Findings

1. Sanitation characterisation

Over half of the households used permeable plastic or metal drums as sanitation back-end.

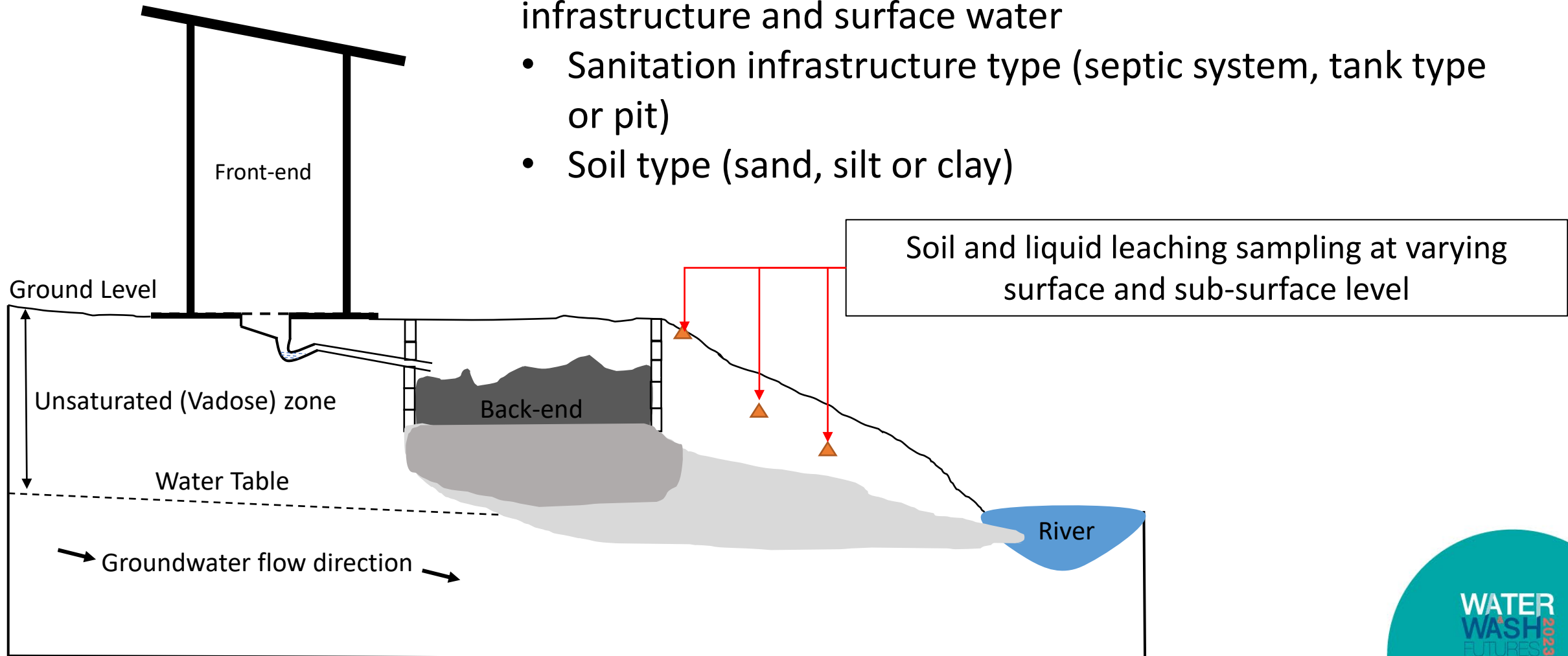
2. Elevated faecal contamination near latrine soil



Ongoing research

Key factors in identifying safe distance between sanitation infrastructure and surface water

- Sanitation infrastructure type (septic system, tank type or pit)
- Soil type (sand, silt or clay)



Key messages

- Lack of reliable data on existing rural sanitation infrastructure and their resilience on flooding, especially for Pacific context.
- Future research need to be conducted to fill current knowledge gap and develop risks remediation strategies.
- Community engagement both in planning and implementation stage.

Thank you

Email: nabeela.nasim@sydney.edu.au

LinkedIn: www.linkedin.com/in/nabeela-nasim

WISH Fiji Project details

link: <https://wishfiji.sydney.edu.au/>



QR Code

WATER
WASH 2023
FUTURES

Achieving SDG6 in a Changing Climate

Workshop... *If you would like to learn more*

Advancing Systems Health Approaches to Achieve WaSH and Conservation Goals

Wednesday PM Room D

