SUMMARY OF FAECAL SLUDGE MANANGEMENT RESEARCH

Centre of Excellence in Water and Sanitation

Mzuzu University • P/Bag 201 • Mzuzu 2, Malawi

MZUZU UNIVERSITY

SELF RELIANCE SERVICE PERFECTION

SRFA Project

WATER RESEARCH COMMISSION

There is both challenges and opportunities to fecal sludge management (FSM) in the east African country of Malawi (Holm et al., 2015). The National Environmental Policy (NEP, 2004) focuses on development of sanitation master plans to district or city councils to improve waterborne sanitation systems and solid waste disposal using appropriate technology. The National Water Policy (NWP, 2005) focuses on equitable access to water supply and sanitation by individuals and entrepreneurs in urban, peri-urban and market centers. The National Sanitation Policy (NSP, 2008) advocates for provision of sanitation facilities at a household level. There is no specific mention of FSM in any of these existing national policies.

Additionally, the institutional architecture for sanitation is spread between Ministry of Irrigation and Water Development, city councils and the Ministry of Health and Population (WRC, 2015). City councils are mandated by the local Government Act of 1998 to provide and manage urban infrastructure and services including sewerage (UN-Habitant, 2011). However, the Water Works Act and the National Sanitation Policy give mandate to water boards (Manda, 2009). This has not materialized, with water boards still focusing on piped water supply services.

The gap in services is occupied by non-governmental organizations and private sector sanitation entrepreneurs (Manda, 2009; UN-Habitant, 2011 and Mzuzu City Council, 2013). The weak legislation on FSM and limited oversight of the private sector has led to reuse of dried and/or untreated FS (Figure 1) directly into area gardens (Nyirenda and Holm, 2015).

On a positive note, the Refuse and Rubble by-laws for Mzuzu city were updated in 2002 and they attempt to address issues of Solid Waste Management (SWM). The management of FS has many similarities to SWM according to Boot and Scott (2008). Integration of linkages between SWM and FSM can potentially improve the urban environment in Mzuzu city.

Figure 1: Use of untreated FS in gardens (a) and privately operated vacuum tanker collecting dry FS previously dumped adjacent to the City sludge ponds for agriculture reuse (b).

PIT LATRINE CHARACTERISATION IN PERI URBAN MZUZU

Mzuzu University is currently field researching FS characterization to fill the knowledge gap through use of a cone penetrometer (Figure 2a) to generate a FS penetration profile (Figure 2b) based on 30 sampled pit latrines in Area 1B, a peri-urban area in the city of Mzuzu.

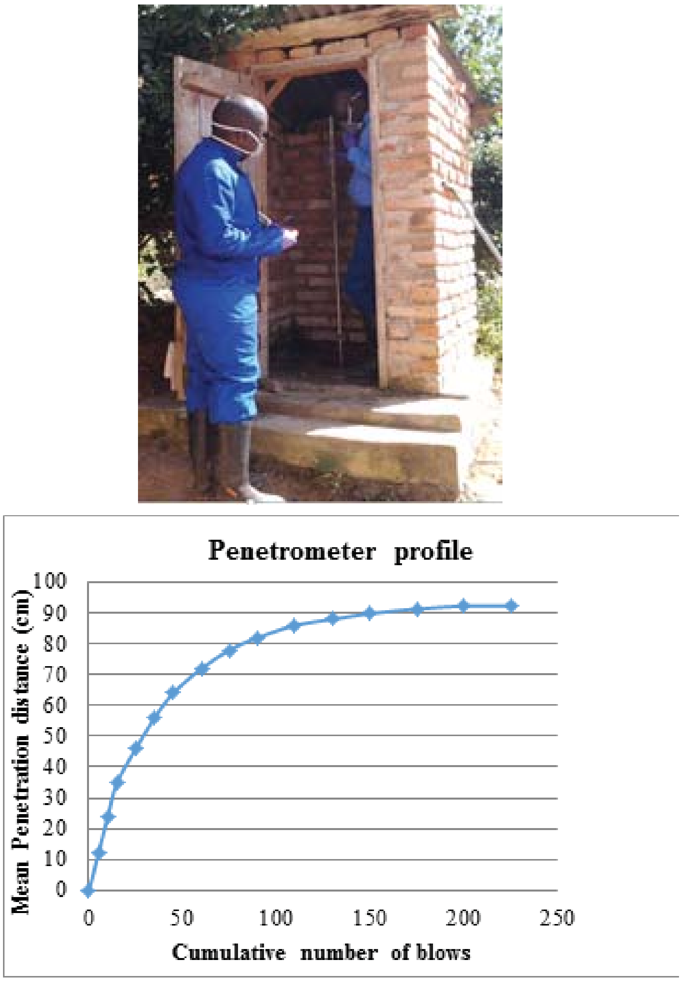

Figure 2: Penetrometer measuring (a) and penetration profile for 30 sampled pit latrines within Area 1B in peri-urban Mzuzu (b).

Using the penetration profile a schematic model of theoretical layers (Figure 3) was developed for local pit latrines.

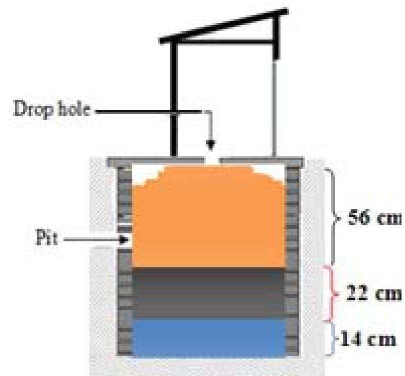

Figure 3: Schematic diagram of FS layers in pit latrines within Area 1B. Source: Chiposa (2015)

These results are similar to studies by Buckley et al. (2008) and Nwaneri et al. (2007). It was found FS with low resistance (56cm) corresponds with the first two sludge layers as proposed in Buckley FS theoretical model of layers. Faecal sludge with medium resistance (22cm) matches with the third layer and sludge with high resistance (14cm) matches with fourth layer.

However, study results are different from findings by Seal (2012) on 110 pit in Kiberia, using a dual cone penetrometer. The study findings included sludge with variable layers such as consistently soft or hard, with hard layers having a water like base. As such, it is critical further sludge characterization is done on a site specific level.

DEVELOPMENT OF DESLUDGING TECHNOLOGY FOR PERI URBAN MZUZU

Mzuzu University is also currently investigating desludging technology options using a pedal powered version of the Gulper technology which was initially developed by Sudgen 2007 (Mikhael et al., 2014; Tucker, 2010 and Boot, 2007). The modified pedal powered gulper design (Figure, 4) developed by a MSc in Sanitation Student, Willy Chipeta, consists of a pedal propelled mechanism using a motorbike chain and crank connected to a flywheel (diameter 600mm). When pedaled motions are imitated the flywheel enables up and down strokes of a connecter handle that attaches to handles at the top of the gulper inside the pit latrine. This technology was fabricated at Mainga Engineering, Mzuzu, at a cost of USD$406.

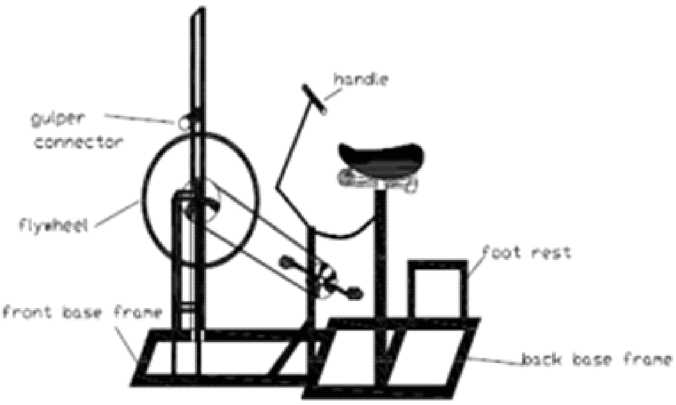

Figure 4: Design schematic of modified pedal powered gulper design

Testing of the modified pedal powered Gulper pump (Figure 5) was successfully undertaken on 5 pit latrines in Area 1B within peri urban Mzuzu.

Figure 5: Modified pedal transmission mechanism being carried inside the pit latrine (a) and attached with the Gulper technology inserted in the sanitation keyhole (b). Source: Chipeta (2015)

The mean flowrate of the pedal powered gulper design with leg muscles of 0.0006 m^3/s is above conventional operation of the gulper with arms of 0.0005 m^3 /s as reported by Mikhael et al. (2014). It is envisioned with further efforts to optimize the power transmission mechanism the design can improve power transfer efficiency to enable higher pumping rates.

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