



# Living with fragile infrastructure: The gendered labour of preventing, responding to and being impacted by sanitation failures

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## ABSTRACT

While infrastructure is often understood to operate ‘in the background’, scholars have increasingly attended to the labour that enables urban material flows. Drawing on empirical material collected through fieldwork and document analysis in Lilongwe, this paper explores how different residents of the city experience and respond to the regular failures of infrastructure. We examine sanitation in one middle- and two low-income areas, considering the contamination of drinking water and the collapse of latrines. Attending to the gendered, embodied, affective, and intimate dimensions of maintenance and repair labours, we develop three interrelated arguments. First, we frame incidents of failure not as individual accidents but as part of persistently fragile infrastructures. Second, we contribute to extending the gaze of infrastructural labours beyond manual work and ‘expert’ knowledge to consider a range of unpaid practices and their role in preventing, responding to, and being impacted by failure. Finally, we show that both the labour and impacts of infrastructural failure disproportionately fall on (low-income) women. Emphasising the ongoing, gendered struggles of keeping sanitation infrastructures functional helps us to see the limits of scholarship that centres clearly identifiable jobs associated with infrastructure’s construction, maintenance and repair. We conclude with reflections on the implications of these arguments for our understanding of the knowledges and labours that keep infrastructures working, and the conditions in which these are performed.

## 1. Introduction

On July 8th, 2017, Madalitso<sup>1</sup>, woke up early in the morning to start her household chores. She opened the tap to fill and drink a glass of water. She followed her typical routine and did not pay much attention to the colour or smell of the water flowing out of the tap. To her disgust, she would later discover that spillage from a burst sewage pipe had made its way into the local water supply network and her and her neighbours’ water taps.

On a different day, Chisomo was using her latrine in the low-income area where she lives. It had rained heavily the night before. She felt the ground moving and suddenly plummeted into a four-metre-deep latrine hole. The latrine platform had fallen with her, protecting her from getting soaked in faeces. She was quickly helped out and taken to the

hospital. She was lucky she only had small wounds.

Building upon these vignettes, this paper uses a feminist framework to examine how these sanitation failures are produced, maintained and unequally experienced. Through our work in Lilongwe, we respond to (Ramakrishnan et al., 2020), 676) prompt to consider “when, why, how, and by whom is infrastructure maintained, repaired, or left to decay.” For while the everyday practices of women with regard to infrastructure have been considered (Kaika, 2004, Truelove, 2011), the gendered dimensions of infrastructure fragility and of the labours of maintenance have been little interrogated.

We build on a burgeoning body of scholarship that takes failure and breakdown as a starting point to explore infrastructures (Star, 1999, Ramakrishnan et al., 2020; Jackson, 2014). We centre the notion of infrastructural fragility to escape notions of infrastructure as ‘durable’

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<sup>1</sup> Participant’s names have been anonymized.

(Furlong, 2014), and push back against literature that tends to frame the challenge of urban sanitation in terms of the absolute presence or absence of toilets (for more on this critique see Lawhon et al., 2018, Satterthwaite, 2016). Viewing infrastructure as fragile also helps us to see the labour that makes infrastructure functional. To understand this infrastructural labour, we draw on recent scholarship on the topic (Anand, 2020, De Coss-Corzo et al., 2019) but also seek to develop a more capacious bounding of ‘what counts’ as infrastructural labour (Stokes and Lawhon, 2022).

In developing our arguments, we draw on empirical material collected through fieldwork and document analysis. To engage with the fragmented, heterogeneous and unjust landscape of sanitation in Lilongwe, we focus on two low-income areas<sup>2</sup> (LIAs) and a middle-income planned neighbourhood connected to the municipal networked sewerage system. By engaging across these literatures and empirical material, the paper extends our understanding of the fragility of infrastructure and its gendered politics and dynamics. We contribute to conceptualisations of infrastructure failures as part of the long-term ordinary life of urban infrastructure, rather than unfortunate exceptions. Building on this perspective, we argue that while fragility is a persistent characteristic of sanitation infrastructures that can be felt in every point of the city, the impacts of living with fragile infrastructure are unequally experienced across and within neighbourhoods and households; to put it succinctly, (low-income) women are disproportionately impacted by the risks and failures of fragile sanitation systems.

We continue this paper with an overview of the geographies of infrastructure and focus on recent contributions to the understanding of infrastructural labours. In the third section, we present our research sites and methods. This is followed by analysis of our two case studies of sanitation failure: collapsing latrines and malfunctioning sewers. For each case, we focus on how these failures have been produced historically on an everyday basis and on the different threats and burdens these sanitation failures pose for different users of infrastructures, including the burden of anticipating, fixing or working around the failure of sanitation. In the final section, we conclude by reflecting on the theoretical implications of our work as well as practical considerations for the politics and practice of sanitation infrastructure.

## 2. Literature review

Scholars in and beyond geography have increasingly attended to infrastructure and how it underpins life in and beyond cities. Infrastructure is viewed not simply as a material form created through technical expertise, but as sociotechnical, shaped by imaginaries, power relation, social norms and contributing to inequality (Anand et al., 2018; Björkman, 2018, McFarlane and Silver, 2016, Lawhon et al., 2023). Rather than examining infrastructure in a linear temporal fashion (from start to finish), scholars have pushed for attention to infrastructure as always incomplete or unfinished, requiring ongoing attention to ensure its functionality (Star and Ruhleder, 1996, Carse and Kneas, 2019, Guma, 2020).

In this section we first review scholarship that pushes back against ideas of infrastructure as durable, instead drawing from scholarship in the global south where infrastructure is particularly dynamic and fragile. We then point to literature that emphasises the centrality of labour both to everyday access as well as to maintenance and repair. Finally, we consider the relationship between gender and infrastructure, and point to gaps in our thinking at the intersection of fragility, failure, labour and gender.

<sup>2</sup> Across the global south, the terminology for different types of urban settlement varies; here we use the term ‘low-income area’ in keeping with the vernacular in Lilongwe. See methodology for more detail on our research sites.

### 2.1. Maintenance and repair of fragile infrastructure

In recent years, scholars have debunked the myth that infrastructures are highly durable, stable and reliable, operating in the background without need for much attention (Appel et al., 2018, Graham and Thrift, 2007, Furlong, 2014, Iossifova et al., 2022). This scholarship has shown that failure, decay and breakdown are part of the ordinary life and politics of urban infrastructures (Anand, 2020, Björkman, 2014, Graham, 2010, Jackson, 2014, Ramakrishnan et al., 2020). In this context, there is growing academic interest in infrastructural maintenance and repair practices (Mattern, 2018, Jackson, 2014).

Approaching infrastructure in this way holds particular salience in the global south. Here, the absence of infrastructure, as well as its dysfunction and disrepair, long dominated academic and political discourse. Scholars have, particularly in the last decade, strongly pushed back against such characterisations, troubling assumptions about the centrality of networked infrastructure, and urging exploration of what lies beyond the grid (Furlong, 2011, 2014, Coutard and Rutherford, 2015, Wamuchiru, 2017). Building on this call, many have written about how services are accessed through ‘informal’ or ‘hybrid’ infrastructure (Biza et al., 2022). Lawhon et al. (2018) reject such binary thinking, instead calling these ‘heterogeneous infrastructure configurations’, framing them as dynamic combinations of social and technical forms and processes that enable the movement of people and things.

While it is clear that repair and maintenance are essential to all infrastructure, they take on particular importance within these oft-changing, fluid and flexible heterogeneous infrastructure configurations. In the global south, HICs are often dynamic, with frequent redundancies, in part precisely because of the unreliability of infrastructure (Lawhon et al., 2018); disruptions are regular and expected (e.g. Silver 2015). Understanding infrastructural configurations this way helps us to shift our understanding of infrastructure: whether due to lack of investment in maintenance or climate change, infrastructure can no longer be seen as inherently and necessarily durable (Furlong 2014). And given the uncertainties of the future, perhaps water and sanitation configurations in particular ought not be ‘fixed’ by making them more static (Lawhon et al. *In review*).

This way of thinking pushes beyond conventional explanations of breakdowns (mechanistic understandings of material dysfunction) that emphasise economic, technical or natural origins (e.g. recurrent maintenance cost are not considered in projects, Daudey, 2018, Foster and Briceño-Garmendia, 2010). Such framings imply isolated events with distinct causes. For example, Cole et al. (2012) observe that floods or weak structures are often identified to explain the collapse of latrines. We certainly do not mean to deny these proximate causes. Instead, here, we emphasise *failure* as a subjective experience of the dysfunction of infrastructure and suggest that viewing infrastructures as fragile—rather than focusing on the particular causes of particular failures—helps us to expand our analysis towards why such infrastructures are fragile, and what makes infrastructure fragile. Further, for our work here, it also points us towards the need for more careful attention to the labour that it takes to overcome or grapple with this fragility.

### 2.2. Infrastructural labour

Within infrastructure studies, there has been a call for greater attention to the different types of human labour that enable the flow of materials (De Coss-Corzo, et al., 2019). This labour is essential, but often invisible and devalued (Fredericks, 2014). Importantly, throughout the wider literature on infrastructure, there has been a focus on labour as a job or employment. For waste, this has meant a focus on those who collect rubbish, usefully spanning beyond waged labour to consider the work of reclaimers (Thieme, 2010, Gutberlet, 2016). For sanitation, this includes not only those who construct and clean particular toilets, but also those who remove faecal sludge from latrines and transport it across the city (Nakyagaba et al., 2021). Much of the scholarship on

maintenance and repair has focused on the knowledges and practices of “expert” fixers who repair and maintain infrastructures, keeping them at work, within the logics of formal or informal income generating activities (e.g. Anand, 2017, Anwar, 2020; Ramakrishnan et al., 2020). For example, studies on water infrastructures have focused on the activities of water network experts such as engineers and plumbers who incessantly open and close valves or mend leakages (Alda-Vidal et al., 2018, Anand, 2017, Bjorkman, 2018, De Coss-Corzo, 2020).

Yet the labours associated with making infrastructure functional often go beyond these expert, or income generating practices, important as they are. In this paper, we build on a wider call for widening what counts as infrastructural labour (Stokes and Lawhon, 2022). For example, Stokes and Lawhon (2022) draw attention to unpaid community work undertaken at the behest of the state (see also Mirafab, 2004). While they focus on the pressure to labour by the state, below we consider the labours to create infrastructure beyond the state, as well as to pressure the state to reduce infrastructure failure. In the next section, we specifically review feminist scholarship that helps us to conceptualise these infrastructural labours as gendered.

### 2.3. Gendered labour and gendered impacts of infrastructural failure

Feminist scholars have widely demonstrated unequal experiences of infrastructure as well as the gendered processes of infrastructures production (Siemiatycki et al., 2020). For sanitation, this includes increased risk and violence associated with travel to toilets, particular needs during menstruation, and differentiated demands for privacy. Further, the negative impacts of infrastructure’s failure are also gendered (Alda-Vidal and Browne, 2021, Caruso et al., 2017, Desai et al., 2014, O’Reilly, 2016, Truelove and O’Reilly, 2020).

Emergent feminist inquiry has revealed the inequalities embedded in infrastructural labour. Some scholars have explored the gendered power relations that render some types of infrastructural work (e.g. repair) or workers (i.e. raced, classed, gendered) invisible and undervalued (Anand, 2020, Mattern, 2018, Alda-Vidal et al. *In review*). Others have documented the unequal reliance of infrastructures on women’s work. In contexts of austerity, infrastructures become labour-intensive in gendered ways; Fredericks (2018) describes how urban waste disposal infrastructure draws on the voluntary work of specific groups of residents such as youth and women. Similarly, Truelove (2011, 2019) demonstrates how water infrastructure relies on the unpaid labour of women to the extent that their bodies often become part of infrastructure (Truelove and Ruszczyk, 2022). This gendered labour is not only physical. Scholars have pointed to unequal emotional burden and suffering embodied by the women labouring water collection. Examples of this are the stress of negotiating the conditions for borrowing water from employers, fear of harassment when collecting water from illegal sources and the frustration of waiting for water tankers who do not come (Truelove, 2011, Sultana, 2011).

The implications of drawing together literatures on fragility, labour and gender are not entirely straightforward. Analytically, of course, it makes sense to call attention to parts of infrastructural configurations that have largely been ignored by scholars (even if not invisible to those who use them, see Davies, 2019), contributing a fuller picture of the many types of work that enable infrastructure and the impacts of its failures. How we frame this labour, and the political implications of calling for attention to these many kinds of labour, are, however, more ambiguous. Some have troubled what can be read as a valorisation of labour, including the work of waste reclaimers (Lawhon et al., 2018); (Yu et al., 2020). As Barnes (2017) argues, in emergent work about infrastructural failure and maintenance there is a tendency to emphasise maintenance as an act of creativity and care and to celebrate the role of those who maintain the infrastructures in recomposing and producing new infrastructures. Further, Stokes and Lawhon (2022) are clear that payment for unpaid infrastructural labour is unlikely given contemporary waste economics; this is surely also true for sanitation, which is

even more difficult to fund. And further, as noted in broader feminist work on the politics of reproductive labour, calls for ‘wages for housework’ are better understood as a political position than an actual economic demand (Weeks, 2011).

For now, we note these ongoing uncertainties and turn to our cases, through which we work to “shed light on the labour enacted by ordinary people to secure connectivity and flows, which often goes unremarked or understudied, but which encapsulates embodied and affective experiences” (Ramakrishnan et al., 2020). We point to uneven responsibilities and burdens in an effort to refuse both the obscuring and celebrating of this labour.

### 3. Study Site & Methods

Infrastructure in Lilongwe is, as in many African cities, deeply interwoven with its unequal history. Lilongwe became the capital in 1975, more than a decade after independence, at the behest of President Banda (in office from 1966 to 1994). Banda had what many consider to be surprisingly close associations with apartheid South Africa, and the design of the new capital city followed an Apartheid inspired order that segregated poor and working-class African residents into high density LIAs (Potts, 1986, Myers, 2003). Over subsequent decades, public authorities failed to ensure housing in planned areas for growing low-income populations, resulting in burgeoning unofficial settlements (Kalipeni, 1997, Mwathunga and Donaldson, 2018).

The current sanitation landscape of Lilongwe consists of a variety of infrastructures providing different levels of service, namely pit latrines (70% of the population), septic tanks (25%), and piped network (5%) (World Bank, 2017). The distribution of these infrastructures reproduces the socio-spatially segregated patterns outlined by discriminatory planning practices (Alda-Vidal et al., 2018, Rusca et al., 2017; Tiwale et al., 2018).

In our work, we focused on Areas 18, 56 and 50. Area 18 is a middle-income neighbourhood, strategically located close to the political centre in the northwest part of Lilongwe. The area was developed by the state-owned housing agency as medium density residential neighbourhood in the 1970s to house government workers at heavily subsidised rents (LCC, 2010; Potts, 1985). The neighbourhood was constructed with access to piped water and sanitation and has remained a privileged exception since. The production of this anomaly should be read as part of Banda’s state-building strategies. These included gaining the support of the “bureaucratic elite of the country” (Anders, 2009, p. 56) and constructing modern infrastructures for national development (Tchuwa, 2018). Area 18 is the only neighbourhood of the city in which all houses are connected to the water grid (Baker, 2016).

Areas 50 and 56, like other LIAs of Lilongwe, were originally small villages located outside the city boundaries and have grown without state oversight over the past few decades. Low-income urban residents responded to housing shortages by acquiring more affordable land from chiefs and constructing homes, often of handmade bricks and corrugated iron roofs (CCODE, 2012a, 2012b Refstie, 2013). The areas were incorporated to the city when its boundaries were extended in the 1990s. Despite the neighbourhood being officially located in urban land, and in principle administered by Lilongwe City Council, infrastructure has generally not been provided by the state. Instead, residents are expected to organise by themselves to provide their own services and upgrade the situation of the area (Refstie and Millstein, 2019). Dug pit latrines, constructed and maintained by residents, constitute the most common form of sanitation infrastructure (World Bank, 2017).

We draw on desktop and field research conducted from September to December 2017 and May to July 2018 in Lilongwe by Author A. The selection of methods responded to a research approach that centred the exploration of the everyday realities of residents as a source of theory making. Data collection included semi-structured interviews with residents (N:20) of LIAs who had experienced the collapse of their latrine (3 men and 13 women), Area 18 who had experienced the sewage

contamination incident (2 women and 2 men), LIAs, Area 18; representatives of the governmental and non-governmental local sanitation sector (N:15, 13 men and 2 women); and sanitation workers (N:20, all men).

Two further methods, field visits and photo-elicitation, helped to deepen the understanding of sanitation failures and the impacts these have on residents. Field visits were done with sanitation workers to observe them at work and elicit further discussion on the everyday challenges of infrastructure maintenance. The method entailed observation, talking while walking and the writing of fieldnotes. Photo-elicitation exercises were conducted with sewer workers (2, all men) and residents of LIAs (5, all women). The method was used to gain more insights into sanitation failures through participant's 'own eyes' After the first set of semi-structured interviews, participants were handed disposable cameras and asked to take photos that were discussed on a subsequent interview.

Interviews were conducted in English or Chichewa and translated to English with the support of local research assistants. Interviews were recorded and transcribed directly from the English translation or summarised from handwritten notes.

All participants were recruited through the networks of contacts and connections of research assistants and were selected to capture a diversity of experiences and perspectives, including with different types of infrastructures (i.e., latrines vs. flush toilets). Most participants in the category 'residents' were women because women were more often at home at the times fieldwork was conducted and because they were more interested in discussing the research topic. Efforts were made to incorporate a few men in the sample in order to understand their experiences. The category 'sanitation workers' included masons involved in the construction of latrines, private plumbers, latrine emptiers, and municipal sewer workers. All sanitation workers we found were men. Some of them were also residents in LIAs and often talked about their own experiences with sanitation failures contributing to our understanding of how these were gendered.

Our interviewees often made gendered observations and stated these as sharp differences. Below, we report on our findings about these differences, mindful that these generalisations may not always hold true (e.g. women are more often unemployed and more often undertake sanitation labour, but there are some women who have employment and some men who clean).

Interview-based data was supplemented with the review and analysis of urban plans, project documents, and other literature about Lilongwe's sanitation sector gathered through archival and desk-based research.

Notably, the sewage contamination incident described in our introduction happened two months before fieldwork started. As we describe in the following sections, residents mobilised to have their concerns redressed by the High Court. The Case was judged in court during the fieldwork period and most of the residents approached did not want to discuss the incident as they feared information disclosed could be used against their case. To work around this limitation, we discuss the social mobilisation and impact of the event as represented by a) media coverage b) public reports, including the High Court Report made public in 2020 (Yankho Phiri and Others, 2020), and c) insights generated by a previous research project conducted on sanitation in Lilongwe in which Author's A collaborated (see Langkau 2016; Baker 2016).

#### 4. Leaking sewers in a middle-income neighbourhood

Area 18 has been suffering recurring problems of blockages and wastewater overflows since the 1990 s (Baker, 2016; Nippon Jogesuido Sekkei, 1994). During the fieldwork, residents of Area 18 continued to complain of blockages and sewage floods and that service providers take a long time to respond. Only one major project to update the sewer network has been conducted in over fifty years. This project did not entail any action in the sewer lines serving Area 18, which have not been upgraded at all since the construction of the network. As a municipal

sewer worker indicated:

*"It is a small pipe engaging a lot of people. That one was constructed a long time ago; it was estimated for the few people who were there at that time. The area has been expanding, more people have come to live in, and they are using the same sewer line"* (Interview, Sewer operator, Man, 2017).

The sewer system is aging and working over capacity. Lack of clarity over responsibilities for the management of the infrastructure and the difficulties to recover costs have been used to justify the underfunding of maintenance. As explained by a municipal engineer:

*"[The collection of fees] has been one of the major challenges. We have been using locally generated funds from other council activities. That is why major rehabilitation has been quite difficult to manage. Mostly, we work on the minor affairs of maintenance"* (Interview, LLC engineer, Man, 2017).

The consequences of this very limited maintenance are experienced by sewer workers and residents on an everyday basis. Sewer workers claim to be under-resourced and overburdened by the amount of work required to sustain the system. Fieldwork observations and interviews confirmed a persistent shortage of personnel and a lack of protective equipment, replacement parts and fuel to drive around the system. Operators perform most of the work manually, often relying on historical knowledge in the absence of infrastructural maps.

The malfunctioning of infrastructure is often blamed on residents and specially on women (Alda-Vidal and Browne, 2020). According to sewer engineers and operators, residents damage the infrastructure by making unauthorised connections, flushing or disposing of waste such as sanitary pads into toilets and manholes, stealing manhole lids, and engaging in unauthorised maintenance and repair practices. In interviews, some male residents report frustration with the slow response of service providers and admit that they often resort to fixing blockages on their own using available tools, such as long sticks or electricity wires, to push the materials blocking the sewerage:

*"It is just that the people cannot stand the sight and the smell. So the best is just to do away with the problem after all when you report they come after a week"* (Interview, Resident Area 18, man, 2018).

At times, these strategies are successful in restoring the flow of wastewater in the system. However, materials blocking the system are often simply pushed further down the sewer pipes, passing on the problem to other neighbours. Tools may get trapped in or break the sewer lines, adding to the disrepair of the system.

Due to recurrent blockages and failure in the wastewater network, some residents of Area 18 have been living in proximity to sewage for many years. Blockage, and resulting sewage spillages, were summarised by a resident:

*"I would say the bursts have been happening for about 10 years now. The problem is how authorities respond to urgent matters and alarms. People have been reporting. They [maintenance workers] come, but provide short-term solutions. It happens again. The same things happen"* (Interview, Resident Area 18, man, 2017).

For some residents, living with wastewater has become a part of their everyday lives to the extent that the drinking water pollution incident described in our introduction did not come as surprise. As a female participant explained,

*"At first, I thought the smell was coming from outside the house. We all thought it was the manhole that was blocked again"* (Interview, Resident Area 18, Woman, 2018).

The persistent presence of raw sewage is experienced in very visceral terms by the residents of the neighbourhood. Given that many residents were reluctant to speak to us directly about their experiences, here we draw on secondary sources that describe residents' experiences. Baker (2016), for examples, tells the experience of a woman who has been affected by recurrent sewage spillages in her backyard in Area 18 for over five years. "The sewage attracts a lot of flies, and the smell is very bad, especially when the wind is blowing, it means that the smell is blowing towards the house. There are faeces outside my house, and I don't feel comfortable with this, it is bad for our health" (as quoted in Baker, 2016p.46).

As the quote shows, the smell and sight of sewer discharges are not only degrading and disgusting, but a health risk. For those in Area 18 who drank water polluted with sewage, the risks suddenly materialized with important health implications. Many families claimed to have suffered bacterial infections that “caused them vomiting, diarrhoea, weakness, fever and abdominal pains” and some were admitted to hospital (Sangala, 2018, para. 5). However, the implications went beyond immediate health problems, provoking new anxieties over sewer and water infrastructures, particularly for women who often bear with the responsibility of both caring for the health of the family and ensuring drinking water is always available in the house. The crisis was described by the residents in visceral terms, “degrading, disgusting, noxious, and incomprehensible to make human beings consume human excreta” (Gwede, 2017, para 3.). Recurrent blockages and sewage spillages acquired a new embodied dimension as they could now be immediately associated to the revulsion and longer-term impacts of drinking sewage.

The water pollution incident was, importantly, not an isolated event, but instead generated new infrastructural labours with gendered implications. The area continues to receive tap water that has been treated, but residents no longer seem to trust that this water is safe. Instead, fear of contamination has resulted in women being pushed to adopt more resource, labour and financially intensive water-related practices. The shift in practices is illustrated in this quote from one of the affected residents included in the Court Judgement:

*“The People within the affected area are still in a shock and cannot trust tap water anymore. Those that can afford are now relying on bottled water, which is too expensive”* (Quoted in Leonard Yankho Phiri & Others 2020, p. 12).

At the time of the interviews, many residents used bottled or boiled water for drinking and other domestic needs. Securing access to water is seen as part of women’s household responsibilities. As the quote below shows, the incident increased the emotional and physical labours attached to securing water:

*“I only drink tap water because I don’t have money to buy from the shops. But to say the truth, I don’t trust tap water. I drink it because I don’t have any option. Boiling water is usually done on a charcoal stove. This eats your time lighting the fire. If it is on electricity, you have to brace for huge electricity bills. Buying the water means that you have to forego another household necessity”* (Interview, Resident Area 18, Woman, 2018).

The physical and emotional hardships produced by the presence of wastewater in yards and streets and the event of water contamination pose an additional toll on women:

*“Normally it is the woman who has the responsibility to take care of the family and the household surroundings. Even when anybody gets sick in the house it is the woman who looks after the sick. So if the whole family took the contaminated water it means the woman would be overwhelmed. If anything, without a proper understanding of what actually happened, people would unfairly apportion the blame of sickness to the woman as being unhygienic”* (Interview, Resident Area 18, woman, 2018).

As the quote suggests, the presence of wastewater in backyards or in tap water not only increases the domestic labours of women but also constrains their ability to fulfil gender subjectivities such as those related to being a good homemaker or mother. A filthy yard, a smelly house or a sick family may be seen as the shameful failure to take care of domestic hygiene, thus creating an additional emotional burden for women.

Residents took the sewage contamination incident as an appalling demonstration of the longstanding lack of attention of public authorities to the decay of the water and sanitation infrastructures in their neighbourhood and decided to finally take action. Women played an important role in igniting the social mobilisation and pressuring for change. Committee meetings were organised, a community spokesman designated, and peaceful demonstrations held. As a resident explained:

*“People protested and went to present a petition to the city council. We want them to take responsibility for their negligence and apologise with compensation”* (Interview, Resident Area 18, woman, 2018).

Social mobilisation attracted media attention and the support of (MHRC, undated). Legal and human rights language and procedures were mobilised and the incident was presented as one in which “people’s rights to clean and safe drinking water, right to good health and right to human dignity were violated” (Longwe, 2018 para. 8). A public hearing was held, and the case was taken to the High Court of Malawi.

The women’s long-standing neighbourhood relationships were key in facilitating the collective action. This reliance on the bonds between women in the community was anecdotally illustrated in the High Court Report on the incident:

*“I got out of the bathroom and narrated to my wife the experience. My wife then communicated to her fellow women around the area through a WhatsApp group women created to communicate to each other within the area”* (Quoted in Yankho Phiri and Others, 2020 p. 12).

These connections are, importantly, not naturally occurring, but forged through investments made by women. Further, turning these connections into pressure on the state took time and labour, labour that was disproportionately undertaken by women. For, as noted by the Malawi Human Rights Commission (MHRC), “most of the complainants that approached the Commission were women” (MHRC, undated p.2).

The collective mobilisation propelled important changes. Water tests were conducted immediately after the event (Public Health Institute of Malawi, Undated). A task force was constituted by Malawi’s president and given the mandate to complete an investigation (Office of the President and Cabinet, 2017). Area 18 was designated as priority area for maintenance activities. In 2020, the High Court of Malawi ruled in favour of the residents affected by the contamination incident and awarded damages (Yankho Phiri and Others, 2020).

In this case, reasserting the neighbourhood’s rights to a well-maintained sewerage system required significant individual and collective effort, effort that was disproportionately undertaken by women. As we describe here, this included mobilising time and labour (to participate in meetings and other activities), economic resources (to engage in legal action) and social networks. The presence of these elements in Area 18 was instrumental to the concretisation and success of the collective action. However, it cannot be taken for granted elsewhere.

## 5. Latrines at the brink of collapse in low-income areas

As per the Local Government Act of 1998, the Lilongwe City Council is responsible for sanitation in LIAs located within the city limits. However, in these areas the involvement of the local government and most NGOs working on water and sanitation is mostly restricted to hygiene education and monitoring. Recently, however, these activities have expanded, and a few NGOs have started microfinancing schemes or built toilets in schools.

While the local government is responsible for sanitation, officials do not understand this to mean that the state is responsible for providing toilets. Instead, as demonstrated in the quotes below, construction or maintenance of latrines is framed as the responsibility of each household according to their financial conditions:

*“As engineering department... our mandate doesn’t go as far as pit latrines are concerned, our main mandate [in LIAs] is monitoring and providing standards. We leave the process to run itself... as the town expands, people see also the need to come up with better structures than what they are using”* (Interview, LCC representative, Man, 2017).

*“This is their responsibility. If there is someone who was able to construct a house with a whole family sleeping [in it], why should they fail with the latrine? They should be able to construct the latrine that they can afford. If it collapses, they should be able to construct another one”* (Interview, District government representative, Man, 2017).

This approach is aligned with the dominant view in the international sanitation sector that discourages the widespread provision of free-of-cost latrines because it leads to poor use and maintenance (World Bank, 2019).

Residents also perceive sanitation as their responsibility, and

construct and maintain their own infrastructures. This is illustrated in the low percentage of households in LIAs with no access to sanitation (NSO, 2018). However, most households cannot afford to construct a toilet using durable materials:

*“Most of the people have pit latrines but not slab or cement. Most of us, we are low-income earners. We cannot afford to construct a toilet using permanent materials. Even in our houses, we cannot spend more money in the toilet than in the house”* (Interview, Resident Area 56, man, 2018).

To avoid costs, residents use local materials and engage in self-construction practices. While the actual building of structures is often undertaken by men, women reported also participating in the work of building the latrines. As a woman from the area explained:

*“I dug the toilet pit and my brother finished with the construction. Most of us who do it alone, it is because we don’t have the money to hire help”* (Interview, Resident Area 56, woman, 2018).

These strategies to reduce the costs of construction and maintenance produce weak structures that easily collapse, especially during rains.

While men and women might contribute to the creation of a latrine, the everyday maintenance of latrines in LIAs is understood by interviewees to be part of the women’s domestic labour: “It is done by females on the compound. The tenants in that house are all bachelors and bachelors don’t participate because this is culturally considered work for women” (Resident Area 56, woman 2017). This responsibility users, and particularly women, have in maintenance of latrines to ensure safe sanitation is reminded by the community health workers, who regularly discuss domestic hygiene matters with female household members when visiting houses, and at paediatric clinics and mother’s groups.

*“For those without a toilet, we advise them on the benefits of having one. For those with mud floors, we advise them to buy slabs, this is important to avoid accidents of people falling into toilets. We further advise on how to clean toilets using chlorine”* (Interview, Government health worker Area 56, woman, 2017).

Common maintenance tasks include keeping the roof and walls (often constructed with locally available materials) in good condition. As a woman explained, this is important to ensure the long life of the latrine as well as for the privacy of women:

*“The toilet faces the road but does not have a door, just a sack cloth. Some naughty people would position themselves out there so that they have a better view when we enter the toilet. It was shameful and embarrassing. During the last harvest season, we collected the corn stalks to erect this temporary wall, but it is worn out already”* (Photo-elicitation exercise, Resident Area 56, Woman, 2017).

Other maintenance strategies, specifically directed to avoid the filling-up of latrines and the associated costs of emptying or replacing them, include digging holes as deep as possible and the regular flushing of water. As a resident explained, with the water, *“the urine and the faeces go deeper and are washed away”* (Interview, Resident Area 50, Man, 2017). This can be done by regularly adding water manually: *“every week you have to pour three 20 L buckets of water”* (Interview, Resident Area 56, woman, 2017). However, this practice may be time-consuming, as women need to collect water from local sources (e.g., wells, kiosks) at high prices. A different way of getting water into the latrine is by connecting the outlet of the bathroom *“so the water you use in the bathroom goes to the pit”* (Interview, Toilet constructor, man, Area 56, 2017).

While these maintenance strategies are considered very effective by residents, they have negative implications for the environmental health of the neighbourhood and the safety of latrines. They contribute to the contamination of nearby water sources and weaken the inner structure of the latrines, thus compromising their stability and increasing the likelihood of collapse. For example, a woman explained that the practice of flushing water into the latrine to avoid it filling backfired because it affected the stability of the pit:

*“It brought more problems because the pit walls softened up and that will force us to construct another toilet”* (Interview, Resident Area 50, woman, 2018).

The collapse of Chisomo’s toilet described in the introduction was not an isolated incident. In fact, some of the residents told us they faced this challenge on numerous occasions:

*“This is not the first time it [the toilet] has collapsed. When it first happened, we tried to construct the floor with wood planks, metal bars and burnt bricks, but here we are, it also collapsed. Of course, not all of it. We still use it by carefully squatting so that we don’t further weaken the side that was already affected. At first, we were afraid to use it, but now we are used [to it]”* (Interview, Resident Area 56, woman, 2018).

Using a latrine at the brink of falling poses an obvious bodily threat. Chisomo was only injured, but the incident could have been fatal. Residents, particularly the women participants, are well aware of these bodily risks, having had previous experiences themselves or heard of neighbours who were injured: *“Many people had their toilets collapsing. I know me and my neighbour who had toilets collapse while we were inside”* (Resident Area 50, woman, 2018). The continuous exposure to this bodily threat produces frustrations and anxieties. For example, a woman whose toilet was affected by recent floods describes her emotions:

*“I would have loved to dig another hole, that is, if I had the money. You know this one is scary because a lot of water got inside during the floods. But no, I will have to use the same hole, though I know it can still sink”* (Interview, Resident Area 56, woman, 2018).

Not all residents experience fragile infrastructures in the same way. Gendered norms increase vulnerability for many low-income women, preventing them from investing in a new toilet in advance of failure. For example, women are often the ones who know when a toilet requires maintenance as *“the mother is the one who knows whatever happens and is needed around the house since the father is always away to work”* (Interview, Resident Area 50, woman, 2018). However, decisions on when to invest in a toilet are often made by men: *“It’s the husband [decision]. He also ensures people are hired to dig the pit and to do the actual construction”* (Resident Area 56, woman, 2017). Furthermore, because they often have to outsource the labour typically borne by male family members, female-headed or women-only households experience greater difficulties in reconstructing a collapsed latrine. As a resident put it: *“Most women have husbands who can dig the pits, but I don’t”* (Interview, Resident Area 56, woman, 2018). This imbalance in sanitation decision-making results in women having to use unsafe toilets.

Having to use a facility that can sink unexpectedly produces emotional reactions and decisions that impact the body. This is illustrated in the story of one of the women we interviewed, whose latrine sunk while she was using it:

*“I was traumatised with the experience. In fact, it got a point that I never wanted to visit a toilet. If anything, I would go only two times in a week”* (Interview, Resident Area 50, woman, 2018).

Apart from the discomfort and potential health implications of holding bodily needs, her fear meant she had to find an alternative solution for herself and her children. This is particularly challenging for low-income women as gender inequalities in mobility and employment restrict their access to safe alternatives. For example, during discussions, women commented that men in the neighbourhood are able to access safer toilets when at work in the planned areas of the city, an alternative that is not available for many of the women who are unemployed. They explained that other strategies used by men, such as sneaking into someone else’s toilet without permission, are impracticable for women due to gendered social norms about (night-time) mobility, modesty and privacy.

Because of these gender inequalities, low-income women have fewer options, leaving them more exposed to physical risks and emotional hardship. Women are either limited to the continued use of at-risk sanitation facilities at home or to arranging extended access to a neighbour’s toilet. Interviews show that the sharing of toilets with neighbours in need is a frequent practice that often emerges as a temporary solution when a toilet collapses and extends in time due to challenges to construct a new facility. This was the case for one of the interviewees whose family had been using a friend’s toilet for over a

year:

*“Our toilet collapsed because of heavy rains in 2017 and we sought permission to use our neighbours’ toilet”* (Interview, Resident Area 56, woman, 2018).

The practice of sharing a toilet depends on bonds between female neighbours and norms of solidarity and reciprocity. Among other reasons to allow neighbours access to one’s latrine, residents mentioned kinship and friendship connections. Some residents granted access because they were *“helped by other people”* in the past (Interview, Resident Area 56, woman, 2018) or because they thought that they may *“need a toilet in the future”* (Interview, Resident Area 56, woman, 2017). However, implying both the moral dimension as well as the possibility of exclusion, a woman emphasized that *“it is just as good neighbours you allow them to use [your toilet] but not a rule”* (Interview, Resident Area 50, woman, 2017). Instantiating this, a resident reported of a neighbour who, to avoid them using it, started *“locking his toilet”* as soon as their neighbour’s latrine collapsed (Interview, Resident Area 50, woman, 2018).

Gaining extended access to someone else’s toilet requires established social networks and is therefore not an option for everyone. As one woman explained, *“it is a problem if you don’t have friends or relatives in the area”* (Interview Resident Area 56, woman, 2018). Arrangements often depend on sustaining good relations with the owners of the ‘borrowed’ toilet. This requires emotional and physical labours that are often gendered as women tend to have fewer alternatives and feel greater distress when latrines become dysfunctional.

Furthermore, those borrowing a toilet have to deal with the constant worry that the owners *“would eventually get fed up and tell them to construct their own”* (Resident Area 56, woman, 2018). As a woman explained, *“you should expect to be accommodated for not more than a week, otherwise you become a nuisance”* (Interview, Resident Area 56, woman, 2018). The cleanliness of the facilities, a task in which women play a major role, is a common source of conflict and anxiety:

*“We have a big role in cleaning to show appreciation for being granted permission of use”* (Interview, Resident Area 56, Man, 2018).

At times, residents have to walk long distances to use the toilet of a friend or relative, highlighting that borrowed access to latrines depends on social relations and expectations about what a physically and emotionally safe sanitation experience entails. A woman explained that when her toilet collapsed, she

*“couldn’t go to the nearest neighbour because they sell alcohol, and we are not even friends. There are a lot of drunkards there”* (Interview, Resident Area 50, woman, 2018).

The quote points to how borrowing a friend’s toilet often increases gendered vulnerabilities. Women may have to enter someone else’s private space or walk at night. This was the case for a resident who arranged for her family to use a friend’s toilet along the same road after her latrine collapsed. However, at night:

*“We use tins which we empty in the morning. Because we are afraid to come out at night. We live along the road. Anything can happen”* (Interview, Resident Area 56, woman, 2018).

In sum, these two examples draw attention to the fragility of sanitation infrastructure: while there are surely proximate causes for these failures, we have sought to show that these experiences ought to be understood not as single incidents, but part of a wider configurations which are built in contexts of constraint. Rather than celebrating maintenance as an act of creativity and care and the role of maintainers in recomposing and producing new infrastructures (Barnes, 2017), we show the maintenance practices of residents in Lilongwe reproduce a sanitation configuration in which individual nodes are routinely on the brink of failure. We demonstrate that the maintenance and repair practices of residents fix failing infrastructures only partially or temporarily, and that these practices exacerbate risks associated with infrastructure. Maintenance here follows a logic of endurance and survival, of quick fixes and short-term adaptation. As illustrated by the example of residents in Area 18, using improvised tools to displace

blockages further down the sewer lines, maintenance can become a self-serving act, displacing the problems and risks associated with a sewage-flooded-bathroom or yard. These actions are, however, accompanied by political mobilisation in the hopes of more systemic change. In LIAs, residents engage in a range of maintenance practices to avoid the filling-up of their latrines. These practices may erode the material infrastructure in the long run. They work in the short term as ways to manage health and safety as well as the time, labour and income invested in the construction of the facilities. Here, the state is seen as at best disinterested, putting responsibility onto citizens to comply with regulation, rather than providing assistance.

## 6. Conclusion

This paper has demonstrated three interwoven arguments. First, by drawing attention to the everyday practices of women as they attempt to fix, workaround or fight the fragility of Lilongwe’s sanitation systems, we contribute to “expand the realm of fixers beyond the “experts” (Ramakrishnan et al., 2020) and show the often-gendered nature of maintenance labour. A feminist analysis extends an understanding of maintenance labours to include the various physical and emotional labours required to combat infrastructural fragility such as requesting information, organising social mobilisations, or building relations with neighbours. As we show, the most visible maintenance tasks (i.e., those performed by sewer workers) are conducted by men. However, sanitation systems require many other types of maintenance activities. These more quotidian tasks often intersect with women’s gendered subjectivities (e.g., good hygienic homemaker) and amplify the emotional and physical burden already borne by (low-income) women (Alda-Vidal & Browne, 2021, Sultana, 2009, Van Houweling, 2016). In LIAs, the everyday maintenance of latrines is considered part of women’s everyday domestic chores. When latrines collapse, the burden of finding and negotiating access to alternative infrastructures more frequently falls on women. Even where taps are present, gendered roles can be revived: the contamination of the water supply in Area 18 increased the infrastructural labour of women. Women put to work their social networks and mobilised to combat infrastructural neglect. Women laboured to ensure a safe supply of water through a new set of chores, such as boiling tap water or finding alternative sources. These gendered activities are often not considered part of maintenance in research studies on the topic, nor are they talked about as labour by many involved in water and sanitation governance and maintenance. Through these empirical insights, we extend the work of feminist scholars who have shown the fundamental role of women in maintaining and restoring household connections to (waste)water flows (Sultana, 2020, Truelove, 2021).

Second, we have shown the value of exploring failure from a framework of infrastructural fragility rather than as accidental one-off events or endpoints in the life of infrastructures. Questioning how infrastructural break down, such as the collapse of a latrine or a wastewater leakage, are produced, experienced and fought against through historical and the everyday scales, in the short- and long-term, highlights fragility as a persistent rather than a temporary condition of infrastructures. In Lilongwe, fragility can be seen and felt across the city in different ways. Our case studies highlight that as soon as infrastructures are newly constructed or repaired, they begin to decay and require continuous care and maintenance to be functional. The sewer system of Area 18 requires constant attention to fight the aging of pipes and to catch up with population growth and increasing water demand. Blockages may be cleared from one point, but they soon reappear in the same or in a different location. In LIAs, where latrines are precarious structures that may leak, collapse or fill at any time, maintenance strategies should be carefully considered from the very moment in which they are constructed. Approaching failure as an ongoing possibility also reveals the long-term effects suffered by residents that may otherwise be ignored. The collapse of a latrine or the pollution of drinking water are clear illustrations of one-off instances of failure with immediate and

obvious corporeal consequences, such as the diseases produced by drinking contaminated water or the injuries or fatalities caused by a latrine sinking. However, as we show, the effects of living with infrastructures on the brink of failure are also experienced in the long run. Anxieties and stress are suffered by residents who have to live with the revolting smell of wastewater, and with ongoing uncertainty that their drinking water be contaminated, or that the latrine they are using can sink at any moment.

Finally, our paper shows that women bear the burden when this work is done, as well as when this work is not done. For, as our case studies reveal, sanitation failures are more severely experienced by women: income and class intersects with gendered experiences of fragile infrastructures to produce different outcomes in different neighbourhoods. For example, the stress of living close to sewage poses a greater (emotional and physical) hardship for women in Area 18 who are seen as responsible for keeping the domestic environment clean and ensuring access to clean water. However, infrastructural fragility poses a different hardship for the low-income women of LIAs as it exacerbates the multiple gendered sanitation insecurities they experience on a day-to-day basis. For example, gendered inequalities increase low-income women's exposure to the risk of latrines collapsing, while the use of alternatives, such as using a neighbour's toilet, may increase women's labours and exposure to violence. A feminist analysis of fragile infrastructures shows that when the continuous responsibilities for care, maintenance and repair are not assumed by sanitation sector actors, the vulnerability of infrastructures becomes a never-ending struggle for residents and in particular for low-income women. In this context, the work of keeping sanitation infrastructures functional "becomes created" as women's work.

From a sanitation policy and practice perspective, the paper highlights the significance of considering sanitation costs and labour beyond its construction phase. This matters for donors who fund projects and well as states that expect residents to construct and take care of their own facilities. Donors have long preferred to fund projects rather than ongoing maintenance, and governments across the north and south have struggled to keep up with the costs of infrastructural maintenance. For both the sewer and the latrines, this has led to fragility and failure. The paper also affirms that the complexities of access to water and sanitation in Lilongwe cannot be captured in metrics focused on whether a household has a tap or a toilet. This simplistic metrics conceal that even when a toilet is present, access to sanitation may be challenged by multiple risks and moments of failure such as the risk of collapse of latrines, and even when a tap is present, water may be irregular or contaminated.

Furthermore, this paper highlights the need for a more critical consideration in policy and practice of the gendered labour that keeps water and sanitation infrastructures working and of the conditions in which these are performed. As this paper has revealed, in Lilongwe, women play a crucial role in the maintenance of sanitation infrastructures. Women often get drawn into these activities through their association with particular notions of femininity (e.g. good hygienic housewife). To avoid the overburdening of women, water and sanitation actors should start by making visible the reliance of sanitation services on women's work. There is no easy solution here, as we can learn from wider feminist discussions of wages and reproductive labour (Weeks, 2011). At the very least, recognition is a first step towards a more open discussion of how these unpaid activities can be conducted in safe and just conditions.

#### CRedit authorship contribution statement

**Cecilia Alda-Vidal:** Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **Mary Lawhon:** Writing – original draft, Writing – review & editing, Supervision. **Deljana Iossifova:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision. **Alison**

**L. Browne:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Data availability

Data will be made available on request.

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