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IMPROVING WATER QUALITY AMONG SMALL, LOCAL PROVIDERS IN NAIROBI

Phase I Research Plan

December 2023

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ACRONYMS

CBO	Community-Based Organization
DCE	Discrete Choice Experiment
DMM	Delegated Management Model
FGD	Focus Group Discussion
KII	Key Informant Interview
LIA	Low-Income Area
MoWSI	Ministry of Water, Sanitation, and Irrigation
NCWSC	Nairobi City Water and Sewerage Company
NGO	Nongovernmental Organization
SDI	Slum Dwellers Institute
SLP	Small, Local Provider
TWG	Technical Working Group
URBAN WASH	Urban Resilience by Building and Applying New Evidence in Water, Sanitation, and Hygiene
USAID	United States Agency for International Development
WASREB	Water Services Regulatory Board
WRA	Water Resources Authority
WSP	Water Service Provider

EXECUTIVE SUMMARY

Urban, low-income households tend to receive water services from small, local providers (SLPs) (also known as “water vendors”) as opposed to regulated water utilities. Understanding how to improve water safety among SLPs who serve low-income populations would thus help promote a more equitable access to clean water.

In Kenya, the Water Services Regulatory Board has mandated that utilities oversee water vendors within their jurisdiction. Nairobi City Water and Sewerage Company (“Nairobi Water”) is undertaking a licensing process for water vendors, and the development of a new Water Safety Plan for the whole city that will incorporate oversight of SLPs. In parallel, Nairobi City County’s Public Health Office has been conducting water quality testing and SLP capacity-building at the community level. Despite these complementary initiatives, Nairobi Water and the County Public Health Office have not actively streamlined their activities to improve water quality among SLPs.

United States Agency for International Development Urban Resilience by Building and Applying New Evidence in Water, Sanitation, and Hygiene is partnering with Nairobi Water and Nairobi City County to understand how best to improve water quality among SLPs. This implementation research aims to address the following question and sub-questions:

What are successful approaches (e.g., institutional arrangements, incentives, enforcement, monitoring) to promote water safety among small-scale suppliers (including formal and informal entities), who typically serve the poorest households in cities?

1. How can the utility and the county, in collaboration with other government actors, incentivize SLPs to improve water safety?
2. How can the utility and the county leverage existing initiatives and strengthen linkages to monitor SLPs effectively?

The research will follow a phased approach. Phase I will examine ongoing initiatives to formalize and monitor Nairobi SLPs and collect data on evidence gaps required to co-design approaches to improve water quality. We will summarize these findings in a research brief and then begin designing Phase 2, during which we will test specific approaches to improving water quality. Phase 2 will be co-designed with local stakeholders (identified in the report) and will have a dedicated inception report. The outcomes of this research will strengthen the evidence base for how to improve water quality among SLPs in Kenya and in other countries where SLPs fill the gap between official supply and local demand for water. This report summarizes learnings from the formative research and lays out a research plan for Phase I.

I.0 BACKGROUND

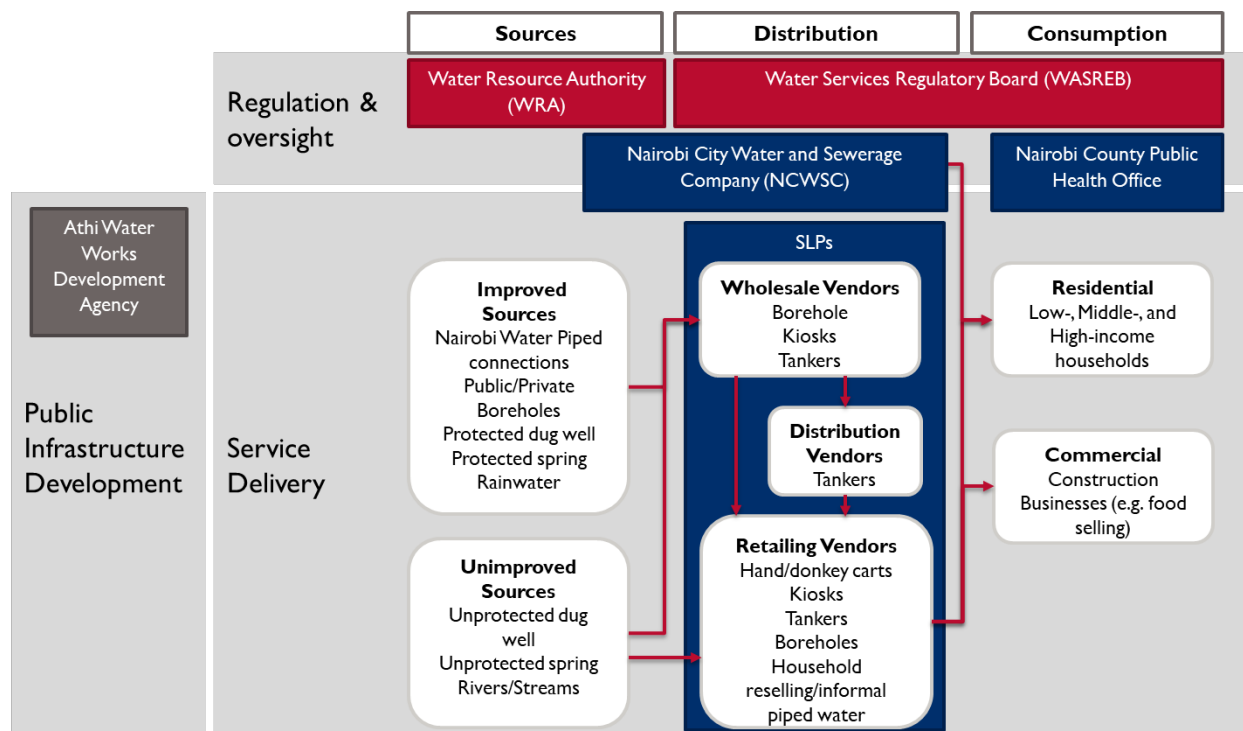
I.1 INSTITUTIONAL FRAMEWORK FOR WATER SECTOR IN NAIROBI

Nairobi has become one of the fastest growing cities in the East African region, with an estimated population of over 4.5 million that is projected to reach 15 million by 2050 (Water Services Regulatory Board [WASREB] 2010; WASREB 2022; Water and Sanitation for the Urban Poor 2018). Much of Nairobi's urban growth has been unplanned, with recent estimates suggesting that over 60 percent of the city's population live in informal settlements (Mallory et al. 2022).

Responsibilities for water service provision in Nairobi reflect Kenya's national institutional framework defined by the Water Act 2002 (revised in 2012 and 2016) and the 2010 Constitution. These actions devolved water service provision responsibilities from national agencies to county governments (the duty bearers), and established water sector reforms to minimize duplication of roles and enhance efficiency. The Ministry of Water, Sanitation, and Irrigation (MoWSI) remained the sector lead with respect to the development of legislation, policy, and strategy, while the WASREB was entrusted with the regulation of water service providers (WSPs). The Water Sector Trust Fund was given the mandate to provide conditional and unconditional grants to counties and assist in financing the development and management of utility services in marginalized and underserved areas. The Water Resources Authority (WRA) was mandated to ensure proper regulation and use of all national water resources, including surface and groundwater. At the county level, the Water Works Development Authority is responsible for the development, maintenance, and management of national public waterworks and for the provision of technical services and capacity building to county governments and WSPs within their jurisdiction. WSPs are responsible for water service provision within their licensed area (United States Agency for International Development [USAID] REAL Water 2022; WRA 2022).

In Nairobi, the WSP is the Nairobi City Water and Sewerage Company (NCWSC), which is a subsidiary of the Nairobi City County Directorate of Water, Sanitation, Environment and Energy. How this subsidiary relationship plays out in practice is not well documented and will be explored further in the study. Athi Water Works Development Agency is responsible for development of infrastructure (Athi Water 2020). See Figure 1 for a summary of institutional responsibilities for water service delivery in Nairobi.

Figure 1: Summary of water regulation and delivery in Nairobi County



1.2 REGULATION OF SMALL, LOCAL PROVIDERS (SLPS) IN NAIROBI

In 2019, Kenya’s national regulatory agency, the WASREB, published *Guidelines on Water Vending* to regulate the quality of water supplied by all other actors beyond WSPs. The guidelines provide hazard analysis, proposed controls, and regulation measures for small-scale vendors. They define vendors in four categories: tankers, water kiosks, hand and donkey carts, and private boreholes. They also segment vendors along the chain of distribution into three categories: wholesale, distribution, and retailing vendors. Wholesale vendors (boreholes, kiosks, or tankers) sell their water in bulk to other vendors, distribution vendors (mostly tankers) buy from wholesalers and sell to other vendors, and retailing vendors buy from either wholesale or distribution vendors and sell directly to customers. Studies of specific low-income areas (LIAs) in Nairobi suggest that WASREB’s categories might not sufficiently capture certain types of vending like household resellers and informal piped networks (Sarkar 2020). See Figure 1 for a summary of water vendors that would fall under the new regulation.

In early 2023, WASREB required utilities to begin identifying water vendors within their jurisdiction. WASREB views identification of vendors, or vendor discovery, as the first step toward improved oversight. WASREB’s preliminary goals are to register and license at least 60 percent of the large vendors, although it is important to note that the total number of vendors operating in Nairobi remains unknown. Many utilities have not yet begun the vendor discovery process or are still in the early stages of trying to do so, which is why WASREB is attempting to fill the gap with their own study to identify vendors. The geographic scope of this study is unknown, but WASREB suggests that results will be published by the end of 2023.

In line with the regulator’s guidelines, Nairobi Water issued a public notice in January 2023 requiring water vendors to register and license themselves with the utility before February 28, 2023. In practice, the utility allowed vendors to continue registering even after the deadline. While the utility began

carrying out registration, it was unable to issue licenses due to disagreements between WASREB, the WSPs, and the counties around tariffs. Tariffs will need to be developed by the utility and presented to WASREB for approval before vendor licenses can be issued (NCWSC 2023).

During registration, Nairobi Water collected identification information from vendors. As of April 2023, over 780 vendors (mostly kiosks) tried to register with Nairobi Water, and around 300 had submitted all the required documentation. Among those, only 13 private boreholes registered. Interviews with Nairobi Water staff revealed that vendors who did not complete the registration process typically hesitated to provide tax IDs and were unable to provide exact GPS coordinates of their locations. Formative interviews with 14 SLPs across three low-income neighborhoods in Nairobi indicated a hesitation among SLPs to register. SLPs did not understand the benefits associated with registering and saw licenses as cost burdens, as licensing would mean that SLP tariffs will be regulated and approved by WASREB, which might affect their revenue margins. Notably, when presented with the list of vendor requirements for registration with Nairobi Water, only one of 14 SLPs answered that they would be able to meet all the requirements on the list. Table 1 summarizes the breakdown of compliance with registration among different SLP types interviewed during formative research.

In terms of enforcement, WASREB’s guidelines do not specify enforcement mechanisms for the regulatory requirements. Conversations with WASREB suggest that they are in favor of a punitive mechanism to enhance enforcement of the guidelines; however, these punitive measures have not been proposed or implemented yet. Formative research reveals that the Nairobi Police likely play a role in how and where SLPs can operate, but the details of these relationships and what governs them is unknown. Nairobi Water has suggested that reducing harassment from police could be an incentive for SLPs to register themselves, as police can harass those carrying out illegal or unregulated activities. In contrast, if SLPs are registered, they are no longer seen as illegal or unregulated operators and are therefore less likely to be harassed and threatened by the police.

In addition to punitive measures and penalties, WASREB is also interested in investigating self-regulation of SLPs, i.e., SLPs that are able to organize themselves. WASREB’s assumption is that SLPs that can organize themselves by, for example, demarcating service areas and therefore reducing the number of SLPs operating in one area, will result in fewer vendors that need to be monitored by authorities at any given time. Conversations with a community-based organization (CBO) (Muungano wa Vanavijiji) reveal that SLPs in Nairobi are often members of vendor groups or associations, and a recent study of Mathare and Kayole-Soweto settlements in Nairobi confirmed that water vendors respect “selling territories” and assist each other financially when necessary (Sitoki et al. 2020). Formative research for this study also found that six out of 14 SLPs interviewed reported being members of vendor groups (see Table 1). However, beyond these anecdotes, very little is known or documented about how vendor groups form, and what impact they have, if any, on water quality.

Table 1: Summary of findings from interviews with 14 SLPs in three LIAs of Nairobi*

SLP Type	Permits/Registration	Self-governance	Water Quality Practices
Kiosks (5)	Some attempted to register with Nairobi Water, while others found the requirements/fees too expensive.	Three out of five were members of vendor groups and the others operated independently	One chlorinated water in the storage tank, but the rest did not identify any particular practices.
Hand Drawn Carts (7)	None registered with Nairobi Water.	One out of seven was a member of a vendor group.	One cleaned their jerry cans, but the rest did not identify any particular practices.

SLP Type	Permits/Registration	Self-governance	Water Quality Practices
Tankers (2)	One registered and the other attempted to register but found it too expensive.	Both were members of vendor groups.	One treated water (practice not specified) and the other did not.

* Kawangware, Korogocho, and Viwandani

I.3 ONGOING INITIATIVES TO MONITOR AND IMPROVE WATER QUALITY AMONG SLPS IN NAIROBI

Although Nairobi Water’s new Water Safety Plan acknowledges the new responsibilities of the WSP to oversee and monitor SLPs, the utility is still determining the best way to do so. As of April 2023, the draft Water Safety Plan only stated the following: “*Other informal water providers who have come in to fill the demand supply gap, in form of private water tankers, hand carts, private boreholes and water from unknown sources need to be regulated*” (NCWSC WSP Team 2021).

Beyond Nairobi Water, there are two other stakeholders that play a role in improving water quality among SLPs. The WRA plays a role in drinking water quality by requiring that all new boreholes be licensed and tested for water quality before receiving permits for use. This includes public boreholes (operated and maintained by Nairobi Water) and private boreholes. Approval for digging boreholes requires ownership documents and land title deeds (WRA 2022; Nyakundi et al. 2021).

In addition, the Nairobi City County’s Public Health Office has a legal mandate to conduct surveillance monitoring of drinking water quality at the community and household level, according to the Water Act, the Public Health Act (Ch 242), and the Food Safety Act (Ch 254). As part of this mandate, the Public Health Office can issue food safety permits to vendors and conduct quarterly water quality tests at community water points and households. However, formative interviews with SLPs suggest that very few (one out of 14 vendors) actually have a food safety permit from the county. Additionally, the county also conducts rapid water quality tests at point of use, cleans and disinfects shared water points, and strengthens SLP capacity. The county administration is split into 17 sub-counties, with each sub-county having its own public health officers (NCC Public Health 2023). Based on conversations with the Public Health Office, communications between the Public Health Office and Nairobi Water are triggered when county staff discover illegal connections or other hazards in the water distribution system that could compromise water quality.

Based on the results from sampling and testing, or in response to outbreaks in particular areas, the county participates in awareness creation and behavior change activities to promote water safety. Sometimes, these actions are targeted at households to improve handling and storage of water. Other times, these are targeted at SLPs, such as through the Rapid Response Initiative, which attempted to improve behavior among hand carts in an area that had suffered from a cholera outbreak (NCC Public Health 2023). The county has also facilitated the formation of community water committees to manage and maintain community water points.

I.4 SELECT INSIGHTS FROM EFFORTS TO REGULATE SLPS ELSEWHERE

A separate Urban Resilience by Building and Applying New Evidence in Water, Sanitation, and Hygiene (URBAN WASH) report thoroughly documents efforts to regulate SLPs in low-income countries (USAID URBAN WASH 2022). In this section, we present examples from select locations that provide insight into the importance of accounting for diverse SLP interests and challenges when designing water quality interventions.

Other sub-Saharan cities have attempted to formalize and/or regulate SLPs. In Abidjan, Côte d'Ivoire, the utility (*Société de Distribution d'Eau de Côte d'Ivoire*) began attempting to license informal resellers of its piped water in the early 1980s (Collignon, Taisne, and Kouadio 2000; Water Utility Partnership 2003; Collignon and Lane 2002). These efforts were not particularly effective, at least in part because licensing came with limited benefits for small-scale operators' costs and profitability, since there was no reduction in bulk water tariffs or subsidies for connection. Beyond demand for better profits, resellers also lobbied for greater incentives associated with licensing and formalization, including better working conditions (Water Utility Partnership 2003). A study of SLPs from Maputo, Mozambique, similarly reiterated that profit is not the only driver for all SLPs, and that a diversity of other factors might incentivize improved service delivery. These factors include the desire to meet daily subsistence needs, acquiring informal social insurance, and enhancing social connections (Zuin, Ortolano, and Davis 2014).

A well-documented example of SLP formalization comes from Kisumu, Kenya, which implemented a delegated management model (DMM), or service contracts, between the utility and formerly informal water vendors. Literature suggests that the DMM has improved access, affordability, service quality, and reliability of water supply for customers and benefits to the public utility and SLPs in terms of revenue, cost, efficiency, and satisfaction. However, the DMM has challenges and risks. These include regulatory issues, such as navigating complex regulations and standards; contract issues, such as establishing and enforcing agreements between parties; coordination and communication issues, which can lead to misunderstandings or conflicts; capacity issues, such as lack of technical expertise or resources; cost issues, where the expenses of implementing and maintaining the DMM may be high; and interest issues, where stakeholders may have differing priorities or objectives (Nzengya 2018; Castro 2009). Some of these experiences and lessons are similar to those from Manila, Philippines, where select SLPs are integrated into the private utilities network and others are excluded. A study of that context revealed positive outcomes for utilities that were able to increase cost recovery through the use of contracted SLPs, and mixed outcomes for the communities that felt they were still being charged more for water or did not understand why they could not directly connect to the network (Cheng 2014).

1.5 CHALLENGES WITH IMPROVING WATER QUALITY AMONG SLPS

Literature review, conversations with local stakeholders, and formative interviews with SLPs suggest that improving water quality requires addressing a range of challenges, including the following: insufficient monitoring of source water, contamination risks along the supply chain, operational disincentives to improving water quality, and demand disincentives.

1. **Insufficient Monitoring of Source Water:** Authorities attempt to monitor SLP water quality by tracking water sources that SLPs use, since the use of illicit sources introduces contamination risks. However, authorities have struggled to keep up with the growth and diversity of sources that SLPs are using. Studies of SLPs in Nairobi as far back as 2011 and 2013 report insufficient monitoring of borehole water with high concentrations of fluoride, possibly contributing to the high incidence of dental fluorosis in the adult population (UNDP 2011; Muzee 2013; Nyakundi et al. 2021). Recent conversations with county and utility officials confirmed that the number of unknown private boreholes in Nairobi has significantly increased over the years as rationing in the piped water network has led households and SLPs to look for alternative sources of water. Formative research with SLPs also suggests that seasonal changes in water availability result in SLPs using sources inconsistently.
2. **Contamination Risks Along the Delivery Chain:** Even if the safety of source water is confirmed and monitored, contamination can still take place during delivery, which varies based on SLP type. SLPs that rely on small piped water networks are at risk of contaminating water if

they run low-quality pipes through drains or open garbage (UNDP 2011). SLP types that rely on jerry cans and tankers for transporting water are also at risk of contamination if their containers and vessels for transporting are not kept clean. A study of vendors in Mathare, Nairobi in 2020 and Umoja estate in 2021 reported that 20 percent of vendors never cleaned their jerry cans, and most did not wash their jerry cans regularly (Nyakundi et al. 2021; Sarkar 2020). One study from Northern Nigeria that collected primary water quality data along the delivery chain confirmed an increasing presence of total coliforms between three samples taken from a commercial drinking water source, a jerry can, and a household storage container (Bichi and Amatobi 2013). Another study from Kisumu, which collected primary data on water quality along the delivery chain, demonstrated that minimizing delays between collection and delivery of water can result in less contamination (Ayalew et al. 2014).

3. **Operational Disincentives:** There are several operational and financial challenges that can disincentivize SLPs from investing in better water quality. Nyakundi et al. (2021) reported that 50 percent of borehole owners, hand carts, and tankers in one settlement of Nairobi do not chlorinate water before supplying it due to high costs for chemicals and labor to wash tanks and jerry cans (Nyakundi et al. 2021). Formative research with SLPs in 2023 substantiates that claim and elaborates on other cost burdens competing with water treatment, such as the high cost of government permits and licenses, high maintenance costs associated with repairing vandalized infrastructure, and expensive storage infrastructure required to combat rationing (particularly for kiosks).
4. **Demand Disincentives:** Formative research with SLPs demonstrates that SLPs currently perceive that their revenue from clients is lower than their overall costs, which creates a disincentive for SLPs to invest in improved quality in the absence of increased demand. SLPs face challenges with inconsistent demand, seeing a dip in their customer base during the wet season. Even in dry seasons, there is high competition for household demand due to the number of SLPs that are operating within the same area. Demand is also impacted by a lack of trust and awareness among customers who may doubt the quality, legitimacy, and accountability of SLPs (Blomkvist et al. 2020). Ayalew et al. (2014) shows that the attributes that determine a household's selection of a primary water source vary across locations. In LIAs of Kisumu, distance to a water source was the most common cited decision factor, followed by water quality and safety, and cost. In Addis, in contrast, water quality was not among the top three decision factors (Ayalew et al. 2014).

2.0 KNOWLEDGE GAPS

There is a need to better understand what types of levers, including incentives, are most effective for encouraging small-scale providers to organize, formalize, and improve water quality. A 2022 study by URBAN WASH documented case studies of cities in low- and middle- income countries that have formalized SLPs (USAID URBAN WASH 2022). However, general evidence gaps remain regarding how to improve water quality of SLPs across institutional and market contexts. One example of this gap is the dearth of primary data collection (water sampling and testing) along the water delivery chain to identify and quantify risks that different SLP types face during water delivery.

In Nairobi, while there have not been comprehensive attempts to regulate SLPs city-wide, several studies tried to understand challenges among SLPs. Some took place prior to the most recent institutional reforms and government interventions (Oenga and Kuria 2006; Muzee 2013; UNDP 2011), while others focused on mapping informal markets and understanding perceptions of water quality but did not deeply explore relationships between SLPs and local authorities (Sarkar 2020; Ochungo et al. 2019). Finally, some have attempted to understand relationships between SLPs but have not considered water quality impacts or identified incentives for improving water quality based on existing SLP relationships (Sitoki et al. 2020). Table 2 summarizes the remaining knowledge gaps relative to water quality improvements among SLPs in Nairobi.

Table 2: Summary of knowledge gaps relative to water quality among SLPs in Nairobi

Theme	Challenges with or among SLPs	Literature Gaps
Market Information	SLPs operate informally and therefore are difficult to monitor. Current estimates suggest only one-third or one-fourth of SLPs are known in Nairobi. Recent studies have focused on specific LIAs within the city such as Kibera, Mathare, Embakasi, Mukuru, and Umoja. Only one study has focused on a mixed income sub-county (Langata).	There is currently no city-wide comprehensive information on the market share of different types of SLPs, such as hand carts, kiosks, tankers, and boreholes, and between wholesalers, distributors, and retailers and how the market differs, if at all, between low-, middle-, and high-income areas.
Monitoring	WRA and Nairobi Water attempt to monitor water quality by tracking water sources SLPs use. However, rationing in the piped water network and seasonal changes in water availability leads to SLPs using multiple sources, which can be difficult to track consistently.	There is no accounting for the diversity of water sources used by SLPs or SLP knowledge of source water quality. Additionally, there is a lack of regulatory direction on cleaning and disinfection of storage and safety practices during transportation of water.
Incentives	SLPs face operational or financial challenges (e.g., cost of permits and electricity bills, risk of vandalism, disruption from urban development, and losses from leaks), which can disincentivize SLPs from investing in improving water quality.	There is minimal explanation for how partnerships between SLPs and utilities address or utilize incentives for both parties. Additionally, there is a gap in understanding if and how households consider water quality when making decisions about water, and whether improving water quality could incentivize SLPs by possibly increasing their customer base.
Governance	Many SLPs currently govern themselves and the impacts of this structure on water quality is unknown.	There is a significant gap in understanding how SLPs self-govern through existing associations or cooperative networks, and how sectors

Theme	Challenges with or among SLPs	Literature Gaps
	The assignment of regulatory mandates across different authorities creates inefficiencies or lack of coordination, particularly in regard to boreholes. SLPs can face harassment from local officials and/or police.	beyond water, sanitation, and hygiene (e.g., public transport or pharmaceutical) offer lessons for regulating informal vendors. There is a need to understand the most effective institutional arrangements and coordination mechanisms for monitoring water quality among SLPs.
Gender	Female-led SLPs can also face specific challenges, such as harassment or lack of support, which could create further disincentives or barriers to improving water quality.	There is little documentation of how gender dynamics could impact initiatives to improving water quality among SLPs.

Based on the evidence gaps highlighted above, this implementation research aims to address the following question and sub-questions:

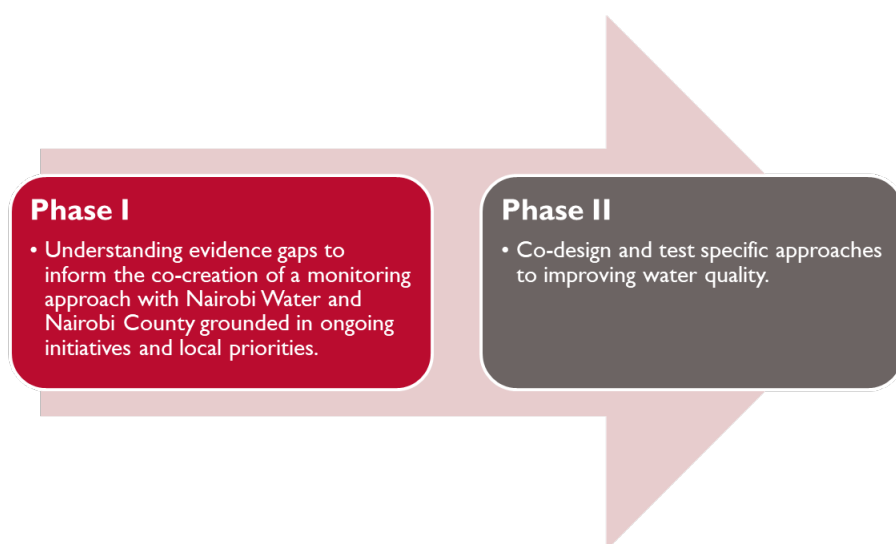
What are successful approaches (e.g., institutional arrangements, incentives, enforcement, monitoring) to promote water safety among small-scale suppliers (including formal and informal entities), who typically serve the poorest households in cities?

1. How can the utility and the county, in collaboration with other government actors, incentivize SLPs to improve water safety?
2. How can the utility and the county leverage existing initiatives and strengthen linkages to monitor SLPs effectively?

3.0 RESEARCH DESIGN

The research will follow a phased approach. Phase I will examine ongoing initiatives to formalize and/or monitor Nairobi SLPs, understand regular surveillance activities to ensure public health, and collect data on evidence gaps required to co-design approaches to improve water quality. We will summarize these findings in a research brief and then begin designing Phase 2, during which we will test specific approaches to improving water quality. Phase 2 will be co-designed with local stakeholders (detailed in Section 4) and will have a dedicated inception report. The outcomes of this research will strengthen the evidence base for how to improve water quality among SLPs in Kenya and in other countries where SLPs fill the gap between official supply and local demand for water. This section lays out a research plan for Phase I.

Figure 2: Phased research approach



3.1 PHASE I RESEARCH QUESTIONS

Designing interventions to improve water quality among Nairobi SLPs will require first answering the following priority questions during Phase I:

1. On what types and segments of SLPs should interventions to address water quality focus?

To answer this question, we seek to identify SLP types that have the highest market penetration, the largest room for improvement in water quality, the financial ability to make these improvements, and a favorable governance structure. We will also identify customers that value water quality over other attributes and/or customers that value attributes held by specific SLP types.

2. What SLP pain points can be turned into levers to incentivize improved water safety?

To answer this question, we will examine SLP's financial, operational, and regulatory challenges and identify whether any of those could be addressed as part of a water safety intervention. Understanding how households would like water quality information communicated may also highlight opportunities for SLPs to improve marketing and customer retention.

3. What lessons can be learned from ongoing initiatives and regular surveillance activities?

To answer this question, we will investigate the extent to which ongoing initiatives in Nairobi have improved SLPs service quality in the water sector, as well as other sectors such as transport and pharmaceuticals. We will also investigate the relationship between the utility and the county and whether it can be strengthened to achieved desired outcomes.

3.2 PHASE I STUDY AREAS

According to stakeholders, SLPs operate across Nairobi and are not limited to specific areas of the city. However, informal settlements, or LIAs, have historically been ignored in the provision of piped water services, creating greater potential for SLPs to operate (Oenga and Kuria 2006). As previously stated, recent estimates suggest that 60 percent of Nairobi’s population lives in the city’s 45+ LIAs. Based on learnings from the co-design workshop with the Nairobi local working group, the following community characteristics can impact SLP operations in LIAs:

- Household income,
- Population density,
- Land tenure arrangement (government owned vs. privately owned land),
- Presence of the Nairobi Water piped network,
 - Metered vs. unmetered connections
 - Water supply volume/intermittency
- Presence of non-piped drinking water sources (e.g., Nairobi Water boreholes, private boreholes, surface water bodies), and
- Presence of other government or nongovernmental organization (NGO) projects (e.g., road and drainage construction, informal settlement upgradation).

URBAN WASH will select five low-income communities to conduct primary data collection. We aim for the five study communities to capture the full range of SLP types, as well as some of the diversity in LIA characteristics found in Nairobi, listed above. We will use multiple data sources to select study communities. Nairobi Water’s database of registered vendors will be our first resource and will allow us to shortlist up to 10 communities capturing multiple SLP types. Next, we will consult with our community partners and may conduct transect walks to profile community characteristics and identify where SLP types not represented in Nairobi Water’s database operate.

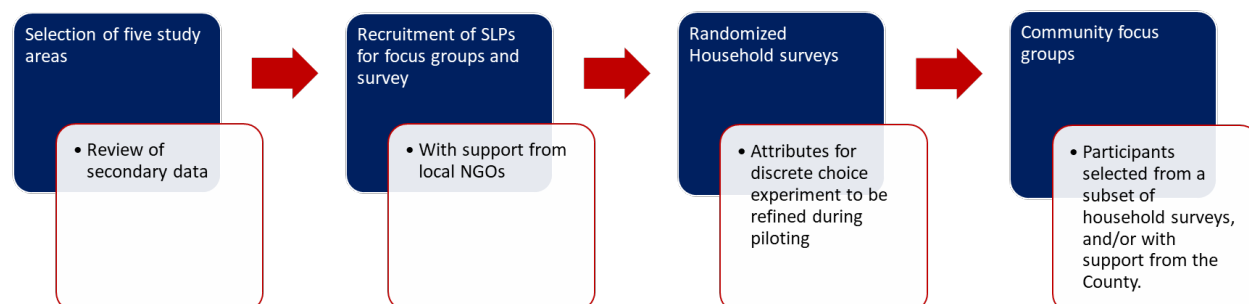
We aim to identify (1) communities from which vendors participated in Nairobi Water’s vendor registration initiative and/or (2) communities where the county implemented water safety improvements such as capacity building workshops for water vendors or distribution of Aqua tabs to combat health outbreaks. Communities with past or ongoing initiatives are most likely to be prioritized for interventions in Phase 2. We may also include a community with no history of such initiatives for comparison.

3.3 PHASE I DATA COLLECTION

Data collection will proceed in steps, with each step informing the next. We will first collect secondary data that will inform the selection of study areas, and then proceed with 10 SLP focus group discussions (FGDs), 50 SLP surveys, 270 household surveys, and five community FGDs. Key informant interviews (KIIs) and case studies will ideally take place early in the process, though in practice they may occur in parallel, as we will have little control over scheduling. The information gathered during data collection

will inform several decision points, as depicted in Figure 3. The rest of this section describes data collection activities in detail.

Figure 3: Sequence of data collection activities, with each step informing the next



Secondary Data and KIIs with Nairobi Stakeholders: To understand how ongoing or one-off interventions to improve water services to non-piped customers have impacted SLPs, the team will first need to understand where and when local stakeholders have implemented monitoring actions and interventions. URBAN WASH will request and analyze data from our partners and other relevant stakeholders to determine the extent of these ongoing actions. The complete list of data requests and KIIs is described in Table 3. Data requests include water quality reports, databases of registered SLPs, locations of sampling, documented intervention processes and outcomes, and private water enterprise customers. Some of these requests have already been submitted and the stakeholders have confirmed that the data is available for sharing.

KIIs with utility and county staff will provide more details on how and why certain interventions took place, outcomes or challenges from ongoing initiatives, and how the utility and county interact with each other regarding water safety.

Table 3: Summary of secondary data requests and KIIs for Phase I

Stakeholder	Data to be Requested	Key Informant Interviews
Nairobi Water	<ul style="list-style-type: none"> Map of piped network Registered vendor data Locations of pre-paid dispensers, and chamber meters Water quality sampling points and reports 	<ul style="list-style-type: none"> 3-5 KIIs with Community Development Assistants who work in informal settlements and coordinate with kiosk operators or community leaders as needed
Nairobi County Public Health Office	<ul style="list-style-type: none"> Household and community water quality sampling points Water quality reports Rapid Response Initiative communities/cholera affected communities Community water committee locations 	<ul style="list-style-type: none"> 2 KIIs with Public Health Officers at the subcounty, ward, and/or village level who conduct routine sampling and oversee water points 1 KII with a county lab technician who tests water quality samples
WASREB	<ul style="list-style-type: none"> Household and/or SLP water quality surveillance monitoring points and results in Nairobi 	<ul style="list-style-type: none"> N/A
Private Water Enterprises (e.g.,	<ul style="list-style-type: none"> Service areas Number of customers 	<ul style="list-style-type: none"> 1-2 KIIs with water operators employed by these enterprises

Stakeholder	Data to be Requested	Key Informant Interviews
Powwater, Shofco, Wonderkid)	<ul style="list-style-type: none"> Water quality assurance practices 	<ul style="list-style-type: none"> 1 KII with relevant staff who conducts water safety planning for the enterprise
Nairobi water SLP associations	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> 1-2 KIIs with association leaders 1-2 KIIs with association members
Nairobi Transportation Sector	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> 1 KII with Nairobi public transportation regulator/expert 1 KII with bus operator or owner
Nairobi Pharmaceutical Sector	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> 1 KII with pharmaceutical regulator/expert 1 KII with vendor

Case studies of SLP professionalization/formalization: To understand if there are lessons that could be transferred from other sectors that have improved the performance of informal SLPs, the team will review case literature and interview key informants (listed in Table 3). Specifically, local stakeholders in Nairobi have expressed a desire to learn from sectors outside water, such as the Kenyan transportation sector, which organized informal matatus (buses) under savings and credit cooperative organizations, and the Kenyan pharmaceutical sector, which improved informal vendor performance through publicly available customer feedback. Table 3 details the KIIs that will supplement a literature review of these case studies.

Ten FGDs with SLPs: This activity will allow the research team to better understand the relationships that exist between different types of SLPs and local authorities such as the water utility, the county, and the local police. SLPs will also share information on how they currently govern themselves. Finally, in areas where interventions have already taken place (e.g., where vendors have registered with Nairobi Water or where the county has water committees), the FGDs will reveal how those initiatives have impacted vendor activity and operations, especially as related to water quality. We will conduct one to two FGDs per SLP type across the four categories recognized by WASREB’s guidelines (hand and donkey carts, kiosks, tankers, and boreholes), as well as categories that are not captured by WASREB’s guidelines (household resellers and small piped networks). If we can identify multiple members of SLP associations, we will reserve at least one FGD for association members, in addition to the KIIs listed in Table 3. We also intend to conduct a female-only FGD to better understand barriers to improving water quality among female vendors specifically. FGDs will cut across study communities (i.e., participants of a FGD may come from any of the five study communities); organizing FGDs by SLP type rather than geographic location will allow the study to identify perspectives and experiences common to each SLP type. FGDs will not be separated by SLPs that registered with Nairobi Water or not.

We will work with two local NGOs, Muungano wa vanawijiji (Kenyan federation of slum dwellers and urban poor people) and Slum Dwellers International Kenya, to recruit FGD participants. We will seek to include both male and female SLPs, as well as SLPs with and without prior interactions with the utility and county. Each FGD will have no more than six participants.

Fifty in-depth surveys of SLPs, including water sampling and testing: To understand existing water safety practices among SLPs and identify levers that could incentivize improvements in water quality, quantitative surveys will collect the following information:

- SLP water sources;
- SLP behavior related to water quality (storage and handling, treatment);

- SLP adherence to water quality regulatory guidelines;
- SLP knowledge of water quality (e.g., types of contaminants that could be found in water);
- SLP interactions with utility, county, and police authorities; and
- SLP operational structures, costs, revenues, and financing opportunities.

In addition to answering survey questions, the team will collect two water samples from each SLP. One at the SLP water source and one at an SLP water distribution point. Samples will be tested for chlorine and *E. coli*. This will reveal the quality of the water that SLPs draw and distribute, as well as the likelihood of contamination during transportation or storage of water.

We plan to conduct eight to nine surveys with each of the six SLP types (hand and donkey carts, kiosks, tankers, boreholes, household resellers, and small piped networks), across study areas. Survey respondents will be chosen from FGDs conducted earlier. FGDs will allow enumerators to establish trust with SLPs before conducting in-depth surveys and collecting water samples from selected survey participants. The goal of these surveys is to obtain a detailed and representative profile of each SLP type (regardless of their actual prevalence and market share).

A total of 270 household surveys: Conversations with non-piped customers through household surveys will help achieve the following objectives:

1. Understanding the market penetration of different SLP types among households in study areas to prioritize which SLPs should be targeted for interventions; and
2. Understanding decision tradeoffs that households make when choosing which SLP to source water from, including if and how households prioritize water quality compared to other attributes.

As summarized in an earlier section, literature suggests that multiple attributes can contribute to household decision-making related to water sources, and that water quality is considered among those attributes. Beyond water quality, decision-making attributes include price, reliability, convenience, availability of alternate sources, purpose/use, and more. Discrete choice experiments (DCEs) will allow us to understand how households value and rank perceived water quality compared to other attributes when making decisions about which SLP to use. These results can then be used in two ways:

1. To target specific SLPs for water quality interventions. For example, if the majority of households value convenience more than other attributes, policy makers should focus water safety improvement interventions among SLP types who offer door-to-door delivery service.
2. To persuade SLPs to improve their water quality. If results show that a non-negligible percent of sampled households value water quality (or a proxy of it, such as certification) over other attributes, this would indicate that SLPs investing in water quality improvements have an opportunity to increase their customer base and market share.

The DCE will be designed to compare four high-priority attributes, while all other attributes will be assumed constant across the choices presented to respondents. Possible attributes include convenience (i.e., door-step delivery vs. not), reliability and availability (i.e., available every day on demand vs. less frequently), social bonds (prior experience or referrals vs. unknown SLPs), perceived water quality, and quality certification. Price will be excluded from the attributes due to existing evidence that price plays a role in household decision-making. SLP focus groups may highlight other important attributes. Pre-testing in the field will inform the final list of attributes and their descriptors.

Household surveys will be proportionally distributed across study areas based on community population. Survey households will be selected using a random sampling approach within study areas,

which is the best method to determine market penetration of different SLP types. The proposed sample size will allow determining the market share of each SLP type with a 5 percent margin of error and 90 percent confidence.

Five community FGDs: Community FGDs will serve a range of objectives. Given the diversity of objectives that community FGDs can serve, each kind of FGD will require a different participant selection approach, as described below:

- Understanding challenges and priorities specific to CBOs that own or manage water kiosks through community water committees. This will deepen our understanding of lessons from the county’s ongoing community water committee initiative, which has attempted to improve water service delivery (including water quality) through community management. Participants will be selected from community water committees in selected study areas identified by the county during secondary data collection.
- Further investigating and interpreting responses from the household surveys. Participants will be selected from a subset of surveyed households.
- Gathering customer feedback on scenarios for future SLP interventions. Participants will be selected from a subset of surveyed households.
- Validating results from SLP surveys (e.g., price of water charged by SLPs, quality of service), if surveyed SLPs are willing to share customer information for participant selection.

3.4 PHASE I DATA ANALYSIS

Each of the data collection tools listed in the previous section contributes to the three research questions in Section 3.1 in different ways. Table 4 summarizes the expected analytical outcomes from each of the data collection activities and how they map to the research questions described earlier. The remainder of this section describes the analytical methods in further detail.

Table 4: Summary of data analysis steps relevant to each research question

Research Question	Aspects of Data Analysis Relevant to the Research Question
On what types and segments of SLPs should interventions to address water quality focus?	<ul style="list-style-type: none"> • Households (%) relying on each category of SLP (i.e., SLPs’ respective market share). <i>From household survey.</i> • Households (%) placing value in water quality over other attributes, representing an increase in market share for SLP types who can improve their water quality. <i>From household survey.</i> • Type(s) of SLP most sensitized to water quality and water safety management. <i>From SLP survey.</i> • Type(s) of SLP with the most severe water quality issues. <i>From SLP survey and secondary data if relevant.</i> • Type(s) of SLP with the highest profit margin and therefore greatest ability to invest in actions that improve water quality. <i>From SLP survey.</i> • Type(s) of SLPs who demonstrate attributes that households value most, and among whom a water quality intervention might result in more significant impact. <i>From household survey.</i> • Type(s) of SLPs that are members of SLP associations, and/or operate under CBO management. <i>From SLP survey and KIIs with Nairobi stakeholders.</i>
What SLP pain points can be turned into	<ul style="list-style-type: none"> • Top three pain points reported by surveyed SLPs, disaggregated by SLP gender. <i>From SLP survey and SLP FGDs.</i>

Research Question	Aspects of Data Analysis Relevant to the Research Question
levers to incentivize improved water safety?	<ul style="list-style-type: none"> • Highest expenditure categories for SLPs, disaggregated by SLP gender. <i>From SLP survey.</i> • Summary statistics and additional information on SLP access to loans or other financing mechanisms, disaggregated by SLP gender. <i>From SLP survey and SLP FGDs.</i> • SLP, community, and key informant feedback on possible interventions. <i>From community FGDs, SLP FGDs, and KIIs with SLP associations.</i>
What lessons can be learned from ongoing initiatives and regular surveillance activities?	<ul style="list-style-type: none"> • Summary of lessons learned from formalization efforts in other sectors in Nairobi. <i>From KIIs with sector experts and case literature.</i> • Summary of lessons learned from existing initiatives and challenges to formalize and improve water service delivery by the utility and the county, including through community-based management. <i>From KIIs with Nairobi stakeholders and community FGDs.</i> • Description of existing coordination/engagement mechanisms between the utility and the county and opportunities to strengthen them. <i>From KIIs with Nairobi stakeholders.</i>

As stated earlier, secondary data analysis will lead to confirmation of study areas and increased understanding of ongoing actions taken by the utility and the county. KIIs with utility and county staff will supplement and deepen the understanding regarding ongoing initiatives, challenges government officials face in working with SLPs, and existing coordination mechanisms between the utility and the county. In parallel, the case studies of SLP formalization in other Kenyan sectors will highlight lessons and risks to SLP regulation that might be relevant or applicable to improving service quality among water SLPs in Nairobi. Learnings from the case studies or ideas for future interventions can be added to SLP FGD questionnaires to elicit SLP feedback.

To analyze data from **SLP FGDs**, we will review transcripts first using deductive coding, using a list of three to five themes relative to the main pain points found through literature review and formative research. We will conduct a second analysis using inductive coding, i.e., identifying new themes that strongly emerge from the transcripts. We will summarize each theme (the three to five themes used for deductive coding plus the inductively identified themes) with key takeaways and illustrative quotes. We will also summarize how SLPs reacted to preliminary intervention ideas stemming from ongoing county and utility activities and case studies of SLP formalization.

We will analyze **SLP surveys** with a focus on identifying their pain points (i.e. their greatest challenges), identifying their existing knowledge of water safety practices and requirements, and identifying potential levers to improve their water safety management practices. Specifically, we will:

- Identify the three pain points most commonly self-reported by surveyed SLPs that create barriers to improving water quality or could serve as incentives to improving water quality, making sure to disaggregate findings by SLP gender.
- Identify the percentage of SLPs (broken down by type and segment) that are using unimproved or untreated water sources.
- Compute the percentage of SLPs who report taking some sort of measure to protect water quality and summarize these measures (e.g., cleaning of storage containers, chlorination).
- Identify the top reasons for SLPs taking water quality improvement measures.
- Assess existing water quality knowledge among SLPs, including knowledge of common contaminants found in water sources and indicators SLPs use to determine if water is safe to drink (e.g., turbidity).

- Compute an estimate of their monthly margin and identify their highest expenditure categories, allowing identification of which SLPs might find it easiest to invest in actions that improve water quality.
- Compute the percentage of SLPs who have taken loans in the past, those who would like to, and the median loan amount. This relates to the ease of accessing additional investment to improve water quality.
- Examine whether the above characteristics differ according to SLP type, the age and size of business, management and ownership structure (SLP association member, CBO operated, personal business, etc.), or gender.
- Compute the percentage of water samples with detectable *E. coli* (≥ 1 CFU/100 mL) and insufficient chlorine residual (< 0.2 mg/L) at each SLP water source and SLP water distribution point.

Our analysis of **household surveys** will focus on (1) estimating the market share of each SLP category and (2) understanding the extent to which households prioritize perceived water quality or water quality proxy (e.g., quality certification) in their choice of SLP. Specifically, we will:

- Compute the percentage of households who rely on each category of SLP (carts, kiosks, boreholes, etc.). This will indicate the relative market penetration of each SLP type among households that use SLPs.
- Compute the percentage of households satisfied with water quality from SLPs and examine whether this varies across SLP categories and use type (e.g., drinking versus domestic water use).
- Review DCE responses and compute the percentage of scenarios in which households chose the SLP offering higher water quality and what other characteristics they were willing to sacrifice in those instances (e.g., proximity/home delivery, trusted/recommended SLP). If the percentage is non-negligible (e.g., > 15 – 20 percent), this will indicate that improving and advertising water quality may provide a competitive advantage to SLPs, as long as the price remains constant.
- Examine whether households who are more likely to prioritize water quality in their decisions have specific characteristics (e.g., demographic, wealth quintile) or rely on a specific type of SLP.
- Summarize how surveyed households indicated wanting to receive water quality information. This will help identify which communication strategies SLPs could use to advertise water quality (e.g., SMS, official endorsement by County Public Health Office, radio show).
- Based on the above results, we will identify two to three possible interventions to gather feedback on during community FGDs.

We will analyze **community FGD** transcripts using a similar approach as SLP FGDs, i.e., with deductive coding followed by inductive coding. Deductive codes will include the SLP service features tested in the DCE (proximity, trust, water quality, etc.). We will also look for information justifying the decision tradeoffs identified via the DCE (e.g., why households may value a specific feature much more than others). We will summarize all themes (deductive and inductive) with key takeaways and illustrative quotes. We will also summarize how the community focus groups reacted to the two to three intervention scenarios presented.

3.5 PHASE I FIELDWORK MANAGEMENT, QUALITY ASSURANCE, AND ETHICAL CONSIDERATIONS

SLP FGDs will include up to six participants each and will be facilitated by a member of our community partner, Muungano wa wanavijiji. The facilitator will be trained on the FGD interview question guide

prior to the discussions during which the research lead will also ensure proper translation of interview questions into Kiswahili. The discussions will be recorded, and a member of the URBAN WASH team will take notes during the discussion. The facilitator will explain the purpose of the focus groups and request consent prior to the beginning of each discussion. Participants will then sign consent forms if they agree to participate.

A data collection team comprising of three enumerators and one supervisor will conduct SLP and household surveys. It is expected that each enumerator will be able to complete four surveys a day (including sampling). Enumerators will collect data on Android phones/tablets using ODK survey software. The supervisor will be responsible for logistics, spot checking data, and community communications.

Quality controls measures for this study include the following:

- Using a small data collection team;
- Piloting the survey prior to the start, and adjusting questions as needed;
- Daily data reviews; and
- Supervisor spot checks on a minimum of 10 percent of surveys.

URBAN WASH will obtain ethical research approval from necessary institutions, including Amref and the National Commission for Science, Technology and Innovation. All data collected in this study will be kept confidentially and will only be accessible by URBAN WASH staff on password-protected computers. No identifiable information will be used in the outputs of this study.

4.0 ENGAGEMENT

URBAN WASH has formed two technical working groups (TWGs) for the duration of this research. One group consists of national-level stakeholders (“National-Level Steering Committee”) who ensure that both FA1 and FA2 research is relevant and accessible to policy makers across the country. The second TWG (“Nairobi Working Group”) consists of city-level stakeholders who co-design research questions, provide feedback, and ensure relevance of outcomes for the utility, regulator, city authority, and CBOs. Members of both groups are listed in Table 5.

During formative research, URBAN WASH conducted workshops with the National-Level Steering Committee in July 2023 and the Nairobi Working Group in September 2023. Both groups provided feedback on the following discussion questions, which informed the Phase I plan:

- Are there ongoing initiatives to improve water quality among SLPs in Nairobi?
- How are SLPs self-organized (if at all), and does that play a role in improving water quality among SLPs?
- Are there success stories of improving water quality among SLPs that are applicable to the Nairobi context?
- What is the role of stakeholder collaboration in improving water quality among SLPs?
- Are there knowledge gaps [presented during the workshop] that have not been captured by URBAN WASH?
- What are the benefits and challenges to addressing these knowledge gaps?
- Do the tentative research questions proposed by URBAN WASH address stakeholder priorities?

Table 5: Summary of stakeholder engagement groups and members

National-Level Steering Committee	Nairobi Local Working Group
MoWSI	WASREB
Water Sector Trust Fund	NCWSC
Water Service Providers Association	Nairobi City County Public Health Office
WASREB	Slum Dwellers Institute Kenya/Muongano wa vanawijiji (Kenyan federation of slum dwellers and urban poor people)
Kenya Water Institute	Athi Water Works Development Agency (Pending)
Kenyan Water and Sanitation Civil Society Network	
USAID Kenya	

4.1 CO-DESIGN WORKSHOPS BEFORE PHASE II

After the completion of Phase I data collection and analysis, URBAN WASH will host a co-design workshop with the Nairobi Working Group, which includes the utility, the county, the regulator, and community organizers. If, during data collection activities, the team identifies vendor associations or groups, members of those groups will also be invited to the workshop and potentially added to the TWG. The purpose of the workshop will be to share findings from Phase I, and codesign possible interventions based on those findings. The results of the workshop will determine the scope of activities to be tested under Phase II of the research.

Another workshop will take place in June 2024 to collect feedback on the inception report for Phase II. Engagement after June 2024 will be finalized in the Phase II inception report.

5.0 DELIVERABLES AND TIMELINE

URBAN WASH will produce a presentation and a research brief highlighting the findings from Phase I by April 2023. Findings will include SLP water quality results, operational and financial challenges, existing governance structures, and relationships with local authorities, among different categories of SLPs and especially between those who have participated in ongoing initiatives and those who have not.

The team will develop the inception report between April and July 2024.

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