The Vetiver Latrine

The rural sanitation market across eight counties of western Kenya

Learning Brief 3 of 4 | August 2026

Prepared by Opero Services and Centre for Affordable Water and Sanitation Technology

2.35m households across the eight counties	**81%** of them use a pit latrine	**333,000** use an uncovered pit	**37%** state they would pay to upgrade

About this brief

This brief describes the market conditions the Vetiver Latrine would face in western Kenya. It covers the eight counties where the USAID Western Kenya Sanitation Project (WKSP) operated: Bungoma, Busia, Homa Bay, Kakamega, Kisii, Kisumu, Migori and Siaya and examines the size of the market, customer characteristics, and how toilets are selected, financed and constructed.

This brief was developed through a collaboration between Opero Services and the Centre for Affordable Water and Sanitation Technology (CAWST) as part of the ongoing development of the Vetiver Latrine. It draws on six external sources alongside Opero's field research. Sample sizes and data collection dates are provided to help readers assess the strength and relevance of the evidence. Where sources report different figures, these are presented and explained. Any figures recalculated from published data are clearly identified, together with the methods used, to ensure transparency and allow independent verification.

This is the third in a series of four learning briefs. Brief 1 presents lessons from the pilot and identifies research gaps, while Brief 2 examines household toilet preferences. Full details of the sources, including their coverage, sample sizes and collection dates, are provided in the reference section.

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1 Sanitation coverage across the eight counties



The eight counties surveyed—Bungoma, Busia, Homa Bay, Kakamega, Kisii, Kisumu, Migori and Siaya—had a combined total of 2,351,856 households at the time of the 2019 census. Table 1 estimates the number of households using each type of sanitation facility by applying each county's published sanitation percentages to its recorded household count. Based on this calculation, approximately 1.90 million households, or 81 per cent of the total, used some form of pit latrine. Pit latrines therefore dominate the market and are the main option against which any new toilet must compete.

Covered pit latrines serve approximately 1.56 million households, while uncovered pits serve a further 333,000. Together, they account for about four-fifths of the market. Ventilated improved pit latrines serve approximately 253,000 households and septic tanks about 60,000, jointly representing less than 14 per cent of households. Cesspools, bucket latrines and biodigesters have a much smaller presence, serving approximately 16,000 households in total.

Sewer connections serve only 33,367 households, representing 1.4 per cent of all households across the eight counties. Kisumu accounts for 43 per cent of these connections. Excluding sewer-connected households leaves 2,318,489 households that rely on onsite sanitation, which forms the main market examined in this brief. In every county except Kisumu, fewer than 2 per cent of households have access to a sewer connection.

Figure 1. Study area: the eight counties of western Kenya covered by this brief

Sewer expansion is not keeping pace with population growth, leaving continued dependence on onsite sanitation. The Water Services Regulatory Board reported that sewer coverage in regulated utility service areas fell from 16 per cent in 2023 to 15 per cent in 2024, despite approximately 319,000 additional people gaining access. Over the same period, the average number of people served per connection rose from 11 to 12. These figures cover utility service areas and are not directly comparable with the 1.4 per cent household sewer coverage reported for the eight counties in Table 1. Nevertheless, they suggest that onsite sanitation will remain the main solution for the foreseeable future, rather than a temporary measure while households await sewer connections

An estimated 92,687 households, representing 3.9 per cent of all households across the eight counties, practised open defecation in 2019. The highest rates were recorded in Homa Bay, at 10.2 per cent of households, followed by Migori at 9.4 per cent and Siaya at 6.0 per cent. These households are already included in the total of 2.35 million households and should therefore not be added separately when estimating the overall sanitation market.

Households	Bungoma	Busia	Homa Bay	Kakamega	Kisii	Kisumu	Migori	Siaya	Total
All households	358,796	198,152	262,036	433,207	308,054	300,745	240,168	250,698	2,351,856
Sewer connection	3,588	1,189	2,882	3,466	5,853	14,436	1,201	752	33,367
Septic tank	10,046	4,359	3,144	10,397	6,469	18,345	4,083	3,510	60,353
Ventilated improved pit	39,109	21,995	26,466	53,284	33,886	26,165	24,737	27,075	252,717
Covered pit latrine	246,134	134,743	162,462	317,974	183,600	196,687	149,384	172,731	1,563,715
Uncovered pit latrine	52,743	29,525	38,519	41,155	73,009	31,578	36,025	30,084	332,638
Other facility	2,153	1,387	1,835	2,166	2,465	2,707	2,162	1,504	16,379
Open defecation	5,023	4,954	26,728	4,765	2,772	10,827	22,576	15,042	92,687
Not on a sewer	**355,208**	**196,963**	**259,154**	**429,741**	**302,201**	**286,309**	**238,967**	**249,946**	**2,318,489**

Derived by Opero using county-level sanitation shares and household counts from KNBS (2019), Volume II, and Table 2.2. "Other facility" includes cesspools, bucket latrines and biodigesters and also accounts for rounding differences. Each county column adds up to its published household total, although the sanitation shares were rounded to one decimal place. The final row subtracts sewer-connected households from the total and represents the estimated onsite sanitation market.

Table 1. Household sanitation facilities across the eight counties, 2019

Using the WHO/UNICEF Joint Monitoring Programme service ladder, approximately 1.91 million households, or 81 per cent, use improved sanitation facilities. A further 333,000 use uncovered pit latrines, while about 93,000 practise open defecation. However, the 81 per cent figure may give an overly positive impression because an improved facility qualifies as a basic sanitation service only when it is not shared between households. The WKSP household survey found that 29 per cent of households shared a toilet (n = 2,328). If this proportion is applied as an estimate across households using improved facilities, only about 1.36 million households, or 58 per cent of all households, would have basic sanitation or better. Those using shared improved facilities would instead be classified as having limited sanitation services.

2 Condition of the installed base

Coverage figures record how many households have a facility, not whether that facility is safe or serviceable. Interviewers on the WKSP household survey physically assessed each toilet and recorded concrete slabs in 63 per cent, mud in 14 per cent and logs in 13 per cent (n = 2,328). Applied to the 2.26 million households in the study area that have a facility, this indicates roughly 316,000 toilets with a mud slab and around 610,000 with a slab of mud or logs, both of which are unwashable and neither of which can be cleaned to the standard households say they want.

Structural failure is the more pressing defect. The survey in Homa Bay, Busia and Kakamega found that nearly half of households reported their toilets collapsing within five years of construction. The main causes were unstable soils, flooding and rotting timber components. The same study found that 67 per cent of toilets had been built within the previous five years (WASHPaLS, 2021). This short lifespan means that many households are repeatedly forced to decide whether to repair, replace or upgrade their toilets, even when they had not planned to make such an investment.

Emptying is close to absent as a service across most of the study area The WKSP landlord survey found that only 10.2 per cent of landlords had ever emptied a pit latrine or septic tank, while 89.4 per cent had never done so. The remaining respondents did not answer the question (n = 236 across the eight counties). Analysis of census returns across 25 other Kenyan counties puts the equivalent figure at 94 per cent never emptied, attributed to services being unavailable, facilities being structurally unsafe to empty, and cost (World Bank, 2025); the census carries the same question for the eight counties covered here, and extracting a county specific figure is a small piece of analysis that has not yet been done.

Emptying where containment holds liquid

The picture changes where households have containment that fills with liquid rather than a dry pit. A study of eight low income areas of Kisumu found that 40 per cent of households had emptied their underground containment at least once in the previous twelve months and 16 per cent within the previous three months, with households in flood prone areas emptying as often as every one to two months. They paid a median of KES 3,000 for a single emptying, and 62 per cent used informal manual emptiers rather than vacuum truck operators.

These households use systems that are more comparable to the Vetiver Latrine than conventional dry pits. The findings suggest that demand for emptying services can develop when the type of containment requires regular emptying and that households may pay for the service themselves. However, the study was limited to urban areas in Kisumu County. It therefore shows that an emptying market can develop but does not demonstrate that such services are currently available throughout the eight counties.

Implication for product positioning

The largest potential market is not households without toilets, but those using facilities with mud or timber slabs and the much larger number whose toilets are likely to collapse within five years of construction. These households may be forced to repair, upgrade or replace their toilets sooner than planned. A product competing on structural durability and a washable interface addresses demand that already exists, rather than demand that has to be created.

3 Household characteristics and water availability

Opero recorded a mean household size of six members among the households visited during our 2024 field research, against a census average of between 4.1 and 4.6 persons per household across the eight counties. Most households interviewed named rainwater harvesting as their primary water source and described water as a resource allocated across competing domestic uses including livestock, laundry and cooking. However, these findings come from a small, non-random sample and should be treated as observations from the pilot counties rather than estimates for the entire region. WASHPaLS associates the use of rainwater and surface-water sources in western Kenya with relatively wealthier households. This difference in interpretation should therefore be investigated before water-source information is used to identify or target potential customers.

The Vetiver Latrine is designed to use one litre of water per flush. However, actual flush volumes have not been measured at either pilot site, and Opero has not collected household water-use data for comparison. Section 7 sets out the measurement that would close the gap.

Problems households report with existing facilities

Table 2 summarizes the complaints recorded during Opero field visits and interviews in 2024. Because the findings come from a small sample, they should not be interpreted as representative failure rates. However, they are consistent with the challenges identified in the larger western Kenya and WASHPaLS studies. They are included because they highlight the main performance requirements that any replacement toilet should address.

Near capacity	The pit is close to full, requiring either emptying, for which no service is reliably available, or construction of a replacement
Hygiene	Flies and cockroaches present in and around the facility
Structural damage	Deterioration of walls, floor and superstructure requiring repeated repair and recurrent cost
Waterlogging	Ingress of groundwater during the rainy season, reported by households in low lying areas
Odour	Persistent odour affecting the facility and the surrounding compound
Outdated design	Absence of washable surfaces, ventilation, handwashing provision and a comfortable user interface
Emptying	Households have generally never emptied the pit and consider the question only once it is close to full

Table 2. Problems with existing facilities reported to Opero during 2024 field research

4 How households specify, finance and build toilets

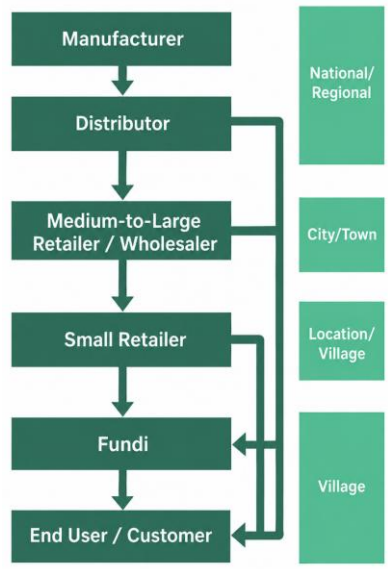


Figure 2. Sanitation supply chain serving rural households

The fundi as the specifying actor

Most households rely on a **fundi**—a mason or artisan—to design and construct their toilet because they lack the technical knowledge to specify it themselves. WASHPaLS distinguishes between part-time and full-time fundis. Part-time fundis spend about 50 to 80 days a year on masonry and earn roughly a quarter of their annual income from this work. Full-time fundis earn about 90 per cent of their income from masonry, with sanitation construction contributing approximately 55 per cent of that income. This reliance on sanitation work is unusually high in western Kenya compared with other Kenyan markets, where it is generally a secondary activity for masons.

This distinction has important commercial implications. Full-time fundis are more likely to invest time in learning a new toilet design because sanitation represents a substantial part of their income. Part-time fundis are more numerous but often lack the technical skills required to construct durable facilities. Training and certifying full-time fundis may therefore provide the most effective route to achieving consistent construction quality.

Households do not uniformly trust fundis. Focus group participants in Kakamega described masons as unqualified and requiring supervision throughout the job (WASHPaLS, 2021). A specified, repeatable design with a documented bill of quantities addresses that distrust directly, because it gives the household something against which to check the work.

The role of hardware retailers

Hardware retailers stock in response to customer requests and do not promote unfamiliar products, or teach customers how to use them, or give construction advice. Their main role in the purchasing process is to refer customers to fundis who can carry out the construction work. Sanitation contributes less than 15 per cent of revenue for most hardware retailers, giving them little incentive to promote unfamiliar products. Simply stocking a new toilet product is therefore unlikely to generate demand without additional promotion (WASHPaLS, 2021).

Seasonality of construction

Demand for toilet construction is concentrated in the post-harvest period at the end of the calendar year. Seventy two per cent of masons surveyed across the eight counties identified December as the peak month, associated with the return of family members working elsewhere and with household investment during the festive period. January is the lowest month, as remaining resources are directed to school fees (WKSP supply chain assessment, 2023). Any pilot sales or demonstration programme should be timed against this cycle rather than against the project calendar.

Consumer finance

Few low income households can meet the full cost of a latrine at once, and instalment based credit for water, sanitation and hygiene is emerging to bridge that gap. Opero has identified Elphrods LLP, a microcredit provider serving low income households and private schools, as a prospective financing partner for Vetiver Latrine customers. WASHPaLS records that households in the poorer segments have access to savings groups and cooperatives but are reluctant to borrow for sanitation because it does not generate income, so the availability of credit does not by itself resolve affordability.

5 Ability and willingness to pay

Stated intention to upgrade is far more widespread than stated willingness to pay for the upgrade. Across the WKSP household survey, 70.9 per cent of households said their toilet required upgrading, while 37.1 per cent said they were willing to pay for that upgrade and 48.8 per cent said they could not afford to (n = 2,328). Willingness rises to 62.2 per cent when a long term payment arrangement is offered, which identifies financing rather than product preference as the binding constraint for a large part of the market.

Question	Households (n = 2,328)	Landlords (n = 236)
Toilet requires upgrading	70.9%	75.4%
Willing to pay for the upgrade	37.1%	53.9%
Cannot afford the upgrade	48.8%	41.0%
Willing to pay if long term payment is arranged	62.2%	54.4%
Upgrade sought is a new construction	31.7%	29.2%
Upgrade sought is a pour flush or flush toilet	17.1%	42.7%

Source: WKSP market sizing and segmentation assessment, 2022. Household and landlord instruments differ, and the pour flush figure is reported separately from flush in the landlord instrument; the higher landlord figure combines both. Upgrade type rows come from multiple response questions and do not sum to 100.

Table 3. Stated demand for toilet upgrading and willingness to pay

Stated willingness to pay routinely exceeds actual purchase, so these figures set an upper bound rather than a forecast. Against them, WASHPaLS recorded that 27 per cent of households planning a future toilet construction stated a willingness to invest USD 200 or more. Prices in the market span a wide range with few gaps in it, from traditional toilets with unlined pits and mud or timber floors at KES 8,000 to pour flush toilets with septic tanks at KES 100,000 in 2021 prices.

Option	Indicative price	Approximate USD	Source
Traditional toilet, unlined pit, mud or timber floor	from KES 8,000	from 73	WASHPaLS, 2021
Safi lined pit latrine, marketed price	KES 40,000 to 50,000	364 to 455	SNV, undated
Pour flush toilet with septic tank, upper end	KES 100,000	909	WASHPaLS, 2021
Vetiver Latrine substructure, Busia pilot	USD 251	251	Opero, 2024
Vetiver Latrine complete build, Busia pilot	USD 778	778	Opero, 2024

Conversions are indicative only, applied at approximately KES 110 to the dollar, the rate prevailing when the 2021 prices were collected. Prices are not adjusted for inflation and the shilling has since depreciated, so a 2026 buyer faces higher shilling costs than these figures show. The two Vetiver Latrine figures are single pilot construction costs rather than market prices. The Busia superstructure specification is well above a basic shelter, so the USD 251 substructure figure is the appropriate basis for comparison with containment options. Capital costs are compared here across products with different service lives, which is a limitation addressed in section 7.

Table 4. Indicative prices for household toilet options in rural Kenya

6 Implications for the Vetiver Latrine

The market described above is large, poorly served and dominated by a single product type, which is a favourable structure for a new entrant. It is also price constrained, reluctant to borrow, and served by a channel that does not promote unfamiliar products. Table 5 sets the Vetiver Latrine against the requirements the evidence identifies, separating what the pilots support from what remains untested.

Odour control	Met, on limited evidence. No odour was reported by users at either pilot over the monitoring period, and odour is among the most frequently cited complaints in this market. The pilot monitoring is reported in Brief 1
Structural durability	Partly met. The barrel and bed configuration avoids the unlined pit that causes most reported collapse, and the households facing collapse within five years of building are the natural first segment. Durability of the barrels themselves over a full service life has not been observed
Washable interface	Met by design. The specification addresses the roughly 610,000 toilets in the study area with a slab of mud or logs
Water demand	Unverified. The one litre flush is a design specification and has not been metered, and Opero has not measured household water consumption alongside it, so the water cost of the system to a household is not established
Price	The current design does not yet meet the market's affordability requirements. Its USD 251 substructure exceeds the USD 200 maximum that 27 per cent of households planning to construct a toilet said they were willing to pay. At USD 778, the complete facility is also at the upper end of the prices observed in the market. Reducing the cost, offering suitable financing, or combining both approaches will therefore be necessary to reach the mass market
Solids management	Not met. Brief 1 identifies onsite management of accumulated barrel sludge as the principal unresolved question. Across the study area, 89 per cent of landlords report never having emptied a facility, so a product requiring periodic desludging depends on a service that is largely absent. The Kisumu evidence in section 2 shows that such a service can emerge where the technology creates demand for it
Channel fit	Untested. The design requires a fundi to learn a new method and to source vetiver planting material. Full time fundis derive the majority of their masonry income from sanitation and are the plausible training target, but no fundi outside the pilot has yet built the system unsupervised

Table 5. The Vetiver Latrine against requirements identified by the market evidence

The priority market segment

The evidence points to a specific beachhead rather than to the market as a whole. Households whose pits collapse or waterlog, and who are therefore replacing a facility rather than choosing to upgrade one, face a decision that a conventional pit does not solve. Within that group, the segment WASHPaLS identifies as having high ability to pay, roughly 54 per cent of households across five of its nine segments, is the part that could meet the current cost without subsidy.

Two conditions would have to be satisfied before that segment could be served at scale. Solids management needs a resolved onsite answer or a serviceable emptying route, since neither exists across most of the study area today. Substructure cost needs to come down toward the USD 200 mark, or an instalment product needs to bridge the gap, since stated willingness to pay rises from 37 per cent to 62 per cent when payment is spread. Whether the flood prone lakeside areas sit inside or outside that beachhead is an open question, because neither the buried containment nor the subsurface bed has been observed through a full flood season at either pilot.

7 Open questions and how partners could address them

Five questions limit what can be concluded about the Vetiver Latrine as a market proposition, and each has a defined and affordable study attached to it. They are listed in the order in which their resolution would most change the

commercial case. Opero would welcome approaches from research partners interested in any of them, and can provide access to the pilot installations in Busia and Kisumu together with the monitoring data collected to date.

- **Onsite solids management.** The principal unresolved question for the technology and the one with the least existing evidence. A study would characterise what accumulates in the containment, establish whether it can be managed at the household without a collection service, and test any onsite treatment or drying option against a defined safety standard.

  Disciplines: sanitary engineering and microbiology. Scale: bench and field testing across both existing pilots,twelve to eighteen months.

- **Service life and durability.** No product in this market can be costed without a service life, and the comparison in Table 4 is between capital costs for products that last different lengths of time. A study would establish expected life for the barrels, the bed media and the vetiver stand under field conditions, and convert capital cost to an annualised figure per household.

  Disciplines: materials and lifecycle costing. Scale: instrumented monitoring of existing units plus accelerated testing, twelve months.

- **Cost and willingness to pay.** Opero holds no willingness to pay data for the Vetiver Latrine specifically, and the figures in Table 3 are stated preferences from 2021 and 2022. A study would place a physical demonstration unit in each of the four pilot counties and test purchase at a real price rather than a hypothetical one, alongside a repriced bill of quantities in current shillings.

  Disciplines: market research and development economics. Scale: at least 300 households, six to nine months.

- **Pathogen removal and effluent quality.** No indicator organism data has been collected at either pilot, so the treatment performance of the vetiver bed is inferred from the literature rather than observed in Kenya. A study would establish indicator organism and nutrient concentrations in the bed effluent against the parameters that county and national regulators apply.

  Disciplines: environmental microbiology and water quality. Scale: repeated sampling at both pilots across wet and dry seasons, twelve months.

- **Household water use.** The flush volume is a design specification and has not been metered, and Opero holds no measurement of household water consumption that can be set against it. A study would meter water into the pilot units alongside a household water use diary, and would test the Basic Drop variant as the alternative where water is scarce.

  Disciplines: WASH monitoring. Scale: three to six months at existing sites.

8 In summary

The eight counties contain 2,351,856 households, of which 81 per cent use pit latrines, including 14 per cent using uncovered pits. Only 1.4 per cent have sewer connections, leaving approximately 2.32 million households outside the sewer network. These census figures establish a substantial potential market for improved onsite sanitation

The binding constraints are price, channel and service. Under two fifths of households state they would pay for an upgrade at present prices, rising to under two thirds when payment can be spread; the channel that specifies toilets is an artisan network that does not currently know the design; and no emptying service exists across most of the study area to support a product that accumulates solids. The Vetiver Latrine addresses the odour, floor and structural failures that this market reports most consistently, and its route to scale runs through cost reduction, an instalment offer, a resolved onsite solids answer and a trained fundi network.

References

Source	Coverage and sample	Data collected
Kenya National Bureau of Statistics (2019) 2019 Kenya Population and Housing Census, Volume II: Distribution of Population by Administrative Units. Nairobi: KNBS	Full enumeration, all 47 counties; household counts by county	2019
Kenya National Bureau of Statistics (2019) 2019 Kenya Population and Housing Census: distribution of households by main mode of human waste disposal, by county	Full enumeration, all 47 counties; sanitation facility type by county	2019
Kenya National Bureau of Statistics (2024) 2023/24 Kenya Housing Survey Basic Report. Nairobi: KNBS	National household survey, all 47 counties	March to May 2024
Water Services Regulatory Board (2025) IMPACT: A Performance Report of Kenya's Water Services Sector 2023/24, Issue 17. Nairobi: WASREB	All 92 regulated water service providers; covers utility service areas only, not the rural population as a whole	2023 to 2024
B&M Consult Limited (2022) Household Market Sizing and Segmentation Assessment for Sanitation and Hygiene in Western Kenya. Final Draft Report submitted to RTI International, 23 January 2022	Household survey n = 2,328 and landlord survey n = 236 across the eight counties	2021 to 2022
USAID (2021) Research and Learning for Rural Sanitation in Kenya, Part 2: Deep Dive Market Assessment at a County Level. Washington, DC: Water, Sanitation, and Hygiene Partnerships and Learning for Sustainability (WASHPaLS) Project. Authored by R. Agarwal, A. Khanna and S. Chennuri, FSG	Household segmentation, focus groups and value chain interviews; Busia, Kakamega and Homa Bay as representative of rural western Kenya	2021
USAID Western Kenya Sanitation Project (2023) Sanitation Supply Chain Assessment Report. Revised report submitted to RTI International, January 2023	Masons, pit emptiers, hardware retailers and public toilet operators across the eight counties	2022
Opero Services (2024) Market Research Report: The Green Vetiver Latrine Project. Kisumu and Kisii Counties	School and household visits in Kisumu and Kisii; non probability sample	2024
Opero Services (2024) Deliverable 2: Assessment and Design Report. Submitted under the USAID Western Kenya Sanitation Project	44 households across Kisii, Migori, Busia and Siaya; nine focus groups of five to nine participants	2024
Peletz, R. et al. (2020) Faecal sludge management in eight low income areas of Kisumu, as cited in B&M Consult Limited (2022)	Household survey, urban Kisumu; not consulted in the original by Opero	2020
World Bank (2025) Non Sewered Sanitation Market Sizing Assessment across 25 Counties in Kenya. Final Report, 30 May 2025	25 counties, none of which are the eight covered by this brief; cited for comparison only	2025
WHO and UNICEF (2021) Progress on Household Drinking Water, Sanitation and Hygiene 2000 to 2020. Geneva: Joint Monitoring Programme for Water Supply, Sanitation and Hygiene	Global monitoring definitions and the sanitation service ladder used in section 1	2021

Dates given are of data collection rather than publication. The census predates six years of Community Led Total Sanitation programming and county investment, so present coverage is likely to be higher and the toilet deficit lower than the 2019 figures shown. Price and willingness to pay questions in the 2022 assessment have not been repriced since. Opero's own household research used non probability sampling, so those findings describe what was observed in the counties visited rather than what holds across the region.