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November 13, 2026

Title Household Waste Survey and Characterisation in Gulu City, Uganda

Version 1.0.0

Description Field data of a household solid waste study in Gulu City, northern Uganda, in September and October 2026: a socio-economic household survey of 424 households in six areas of the two city divisions, covering housing, income and expenditure bands, waste storage and disposal, the collection service, payment for collection and willingness to pay for an improved service, and a seven day waste characterisation of 95 households with the weights of 16 sorted fractions, the per capita generation rate and the bulk density.

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`guluswm_survey` *Household survey on solid waste management in Gulu City, Uganda, 2026*

Description

One row per household interviewed in the socio-economic household survey of the Gulu City household solid waste study, 23 to 26 September 2026: household characteristics, housing and utilities, income and expenditure bands, the types of waste generated, storage and disposal, the collection service, payment for collection, willingness to pay for an improved service and awareness of by-laws. The 424 households live in six areas of the two divisions of Gulu City. The table also holds the survey weight by division and the wealth index computed by the study team. At the authors' decision, the household coordinates (the consent did not cover locations) and the free text answers of the questionnaire are not published, and the enumerators are coded.

Usage

```
guluswm_survey
```

Format

A tibble with 424 rows and 46 variables

household_id Identifier of the interviewed household as assigned by the study team: the enumerator code (E1 to E5, replacing the enumerator's initials used in the field), the survey date as day and month (2309 for 23 September 2026) and a running number per enumerator, for example E1-2309-001.

enumerator Code of the enumerator who conducted the interview, E1 to E5; the codes replace the mWater user names and are shared with guluswm_waste.

survey_date Date of the interview, between 23 and 26 September 2026.

area Study area in which the household lives: Limo, Vanguard or Highland (Laroo-Pece Division), Kanyagoga, Pabbo Quarters or Goans Quarters (Bardege-Layibi Division). Only two interviews were completed in Highland. The raw file spells Pabbo Quarters as Pabwo Quarters in this sheet.

division Administrative division of Gulu City in which the household lives: Bardege-Layibi or Laroo-Pece.

household_size Number of people living in the household.

respondent_is_head Whether the respondent is the head of the household (Yes or No).

education_head Highest level of education of the household head, in rising order: None (no formal education), Primary, Secondary, Tertiary/vocational, University and above.

livelihood Main source of livelihood of the household: Trading/business, Casual labour, Salaried employment, Remittances/Donations or Other.

income_band Monthly household income in Ugandan shillings, in six bands from None/no regular income to Above UGX 1,000,000.

income_class Income class derived from income_band: Low (no regular income or below UGX 300,000), Middle (UGX 300,000 to 600,000) or High (above UGX 600,000). The proportions of these classes set the cut points of wealth_index_class.

expenditure_band Monthly household expenditure on basic needs in Ugandan shillings, in five bands from Below UGX 100,000 to Above UGX 1,000,000.

wall_material Main material of the walls of the dwelling: Mud/wattle, Unburnt bricks, Burnt bricks, unplastered, Burnt bricks, plastered or Other.

roof_material Main material of the roof of the dwelling: Grass thatch, Iron sheets (old/rusted), Iron sheets (new) or Tiles/permanent.

piped_water Whether the household has access to piped water (Yes or No).

electricity Whether the household has access to electricity (Yes or No).

waste_types Types of waste the household generates, as named by the respondent: Food preparation waste, Food leftovers, Plastic, Paper, Glass or Other; several answers are separated by a semicolon.

disposal_container Container in which the household stores its waste before disposal: Kavera (a polyethylene bag), Sack, Bucket or Bag; several answers are separated by a semicolon.

disposal_method How the household disposes of its waste: Burning, Collected by service provider, Taken to collection point/skip, Backyard dumping, Rubbish pit, Roadside dumping, Open drain, Burying, Garden/compost or Other; several answers are separated by a semicolon.

waste_collector Who collects the household's waste: City/Division Council, Private Operator, Informal Collector, Community Group, Self (household), No one or Other; asked of households with a collection arrangement.

preferred_frequency Collection frequency the household would prefer: Daily, More than once a week, Three times a week, Twice a week, Weekly or Other; the answer Collection points every month was recorded under Other as an open answer.

preferred_time Time of day the household considers best for collection: Morning, Day time, Evening, No specific time or Other.

service_reliable Whether the household considers waste collection in its area reliable (Yes or No). The question was independent of waste_collector: some households whose waste is not collected take it to the municipal skips.

irregular_collection_problem Main problem the household experiences from irregular collection: Dirty neighborhood, Unhealthy environment, Spread of diseases, Bad reputation of the area or Other; asked of households that call their service unreliable.

enough_collection_points Whether the household considers the number of skips or collection points in its area enough (Yes or No).

distance_disposal_point Distance from the household to the nearest disposal point, in bands: Less than 50 Metres, 50 - 100 Metres, 200 - 300 Metres or More than 500 Metres.

pays_for_collection Whether the household pays for waste collection (Yes or No).

current_fee_band Monthly fee the household pays for collection in Ugandan shillings, in five bands from Below UGX 1,000 to UGX 15,000 and above; asked of paying households.

current_fee_rating How the household rates the fee it pays: Affordable, Manageable or Expensive; asked of paying households.

payment_channel How the household pays for collection: Direct to City/Division Council, Through the landlord or Other. The question was shown to every household; for households that do not pay (pays_for_collection is No) the answer is not applicable, and for paying households Other covers channels not listed.

payment_schedule How often the household pays for collection: Daily, Whenever collected, Biweekly or Monthly. The question was shown to every household; for households that do not pay (pays_for_collection is No) the answer is not applicable.

willing_to_pay Whether the household is willing to pay for an improved and regular collection service, or to pay more than now if it pays already (Yes or No).

reason_willing Main reason for being willing to pay: Desire for a cleaner environment, Reduced risk of disease, Convenience/saves time, Improves property value or Other.

reason_not_willing Main reason for not being willing to pay: Income is too low/irregular, Government/City should bear the cost, Already pay enough / rent includes it, Current service is unreliable so won't pay more, or Other.

wtp_band Monthly amount the household is willing to pay in Ugandan shillings, in five bands from Below UGX 1,000 to UGX 15,000 and above; asked of willing households.

preferred_payment_structure Payment structure the household prefers: Flat monthly fee, Pay-per-visit/per-collection, Pay-per-bag/per-bin collected, Included in property rent/rates or No preference.

participates_cleanups Whether the household takes part in community clean-up exercises (Yes or No).

ever_complained Whether the household has ever complained about solid waste management (Yes or No).

complained_to To whom the household complained: LCI Chairman (the chairperson of the Local Council I), Land Lord, City/Division Council, Private Operator or Other.

receives_swm_information Whether the household receives information on solid waste management from the City (Yes or No).

aware_of_bylaws Whether the household is aware of any solid waste management by-law (Yes or No).

swm_challenges Challenges of solid waste management in the area, coded by the study team from the respondent's answer; several codes are separated by a semicolon.

improvement_themes Improvements suggested by the respondent, coded by the study team from the free text answer; several codes are separated by a semicolon.

survey_weight Post-stratification weight by division: the division's share of the population of Gulu City divided by its share of the sample. Bardege-Layibi 0.680 (population 93,848, sample 251) and Laroo-Pece 1.465 (population 139,423, sample 173), population figures from UBOS (2024).

wealth_index_score Wealth index score computed by the study team: the first principal component of five standardised household indicators (roof of new iron sheets or tiles, plastered burnt brick walls, electricity, head with tertiary/vocational or university education, salaried employment as main livelihood); higher values mean wealthier. Missing for 18 households with a missing indicator.

wealth_index_class Wealth class from wealth_index_score: households ranked by score and cut into Low, Middle and High in the proportions of income_class (63.4, 25.2 and 11.4 percent). Ties were ranked by their order in the raw file, so 33 households with the same score of 0.4246 are split between Low (4) and Middle (29). Missing for 18 households.

Source

Field data of Ivan Feni, Abubakar Batte, James Omal and Charles B. Niwagaba (Makerere University, University of Stuttgart and Gulu City Council), collected with the mWater platform from 23 to 26 September 2026, and shared with openwashdata as a workbook in October and November 2026. The fieldwork was funded by Integers Company Limited.

Examples

```
head(guluswm_survey)
# households paying for collection, by area
table(guluswm_survey$area, guluswm_survey$pays_for_collection)
```

`guluswm_waste` *Seven day household waste characterisation in Gulu City, Uganda, 2026*

Description

One row per household in the waste characterisation study of the Gulu City household solid waste study. Each household stored the waste it generated over seven consecutive days in bags provided by the study team; the bags were weighed on 1 to 3 October 2026 and the waste was sorted by hand into 16 fractions adapted from ASTM D5231. The table holds the total weights, the per capita generation rate, the bulk density measured with a 10 litre bucket and the weight of every fraction before and after the deduction of the container weight, for 95 households of which 94 are included in the averages of the study. The waste records cannot be linked to the households of guluswm_survey.

Usage

```
guluswm_waste
```

Format

A tibble with 95 rows and 55 variables

record_id Identifier of the characterisation record: CH, a batch number and a running number, for example CH-1001-001.

enumerator Code of the enumerator who recorded the measurement, one of the codes E1 to E5 shared with guluswm_survey.

measurement_date Date on which the household's waste was weighed and sorted, between 1 and 3 October 2026, at the end of the storage period.

area Study area of the household after correction by the study team: Limo, Vanguard, Highland, Kanyagoga, Pabbo Quarters or Goans Quarters.

area_recorded Study area as recorded on the field form. The field kept the previous entry when two enumerators switched areas; the study team corrected 14 records against the enumerators' daily area logs and the field supervision records (see area).

division Administrative division of Gulu City in which the household lives: Bardege-Layibi or Laroo-Pece.

household_form_id Household number written on the field form and the bags, for example HH-01, used for field supervision; it restarts per enumerator and area and is not unique, record_id identifies the household.

occupants Number of people living in the household.

people_home_daytime Number of household members at home during the day.

days_stored Number of days over which the household stored its waste in the bags provided: 7 for every household but one in the test run, which stored for 14 days.

person_days Occupants multiplied by days_stored, the denominator of the per capita generation rate.

weight_recorded_kg Total weight of the household's waste as recorded in the field, in kilograms, before the correction of keying errors.

weight_fractions_sum_kg Sum of the weights of the 16 sorted fractions after the container deduction, in kilograms.

weight_used_kg Total weight of the household's waste used for the generation rate, in kilograms: the recorded total, except for one keying error (CH-1001-012, grams entered as kilograms), where the sum of the sorted fractions is used.

mass_balance_diff_pct Difference between the recorded total weight and the sum of the sorted fractions, as a percentage of the recorded total weight. Differences come from container weights, moisture loss and spillage during sorting; no record was excluded because of it.

generation_kg_cap_day Per capita waste generation rate in kilograms per person and day: weight_used_kg divided by person_days.

generation_excl_inert_kg_cap_day Per capita waste generation rate without the inert fines (sand, soil and stones), in kilograms per person and day: weight_used_kg minus inert_fines_kg, divided by person_days.

included_in_averages Whether the household is included in the averages of the study: the rule of at most 2.0 kilograms per person and day was applied to every record, and only one household exceeded it (No (outlier > 2.0)).

bucket_empty_kg Weight of the empty 10 litre bucket used to measure the bulk density, in kilograms; one bucket was used and cleaned between households.

bucket_filled_kg Weight of the 10 litre bucket filled loosely with the household's mixed waste before sorting, in kilograms; the mean of at least three weighings.

bulk_density_kg_m3 Bulk density of the loose waste in kilograms per cubic metre: the weight of waste in the 10 litre bucket divided by its volume.

container_deduction_kg Total weight deducted for the containers (weighing basins and bags) in which the fractions were weighed, in kilograms, summed over the fractions.

container_weight_per_fraction_kg Container weight deducted from each fraction with a recorded weight, in kilograms. Where the raw fractions summed to more than the recorded total, the study team estimated it as the excess divided by the number of fractions weighed.

food_kitchen_kg Weight of food and kitchen waste, in kilograms, after the container deduction.

garden_kg Weight of garden, yard and park waste (green waste), in kilograms, after the container deduction.

wood_kg Weight of wood and wood products, in kilograms, after the container deduction.

textiles_kg Weight of textiles and wool, in kilograms, after the container deduction.

paper_kg Weight of mixed paper and pulp, in kilograms, after the container deduction.

plastics_kg Weight of mixed plastics, in kilograms, after the container deduction.

rubber_leather_kg Weight of rubber and leather, in kilograms, after the container deduction.

glass_kg Weight of glass, in kilograms, after the container deduction.

metals_kg Weight of metals, in kilograms, after the container deduction.

diapers_kg Weight of disposable diapers (recorded as Pampers), in kilograms, after the container deduction.

polyethylene_bags_kg Weight of polyethylene bags, in kilograms, after the container deduction.

cardboard_kg Weight of cardboard, in kilograms, after the container deduction.

ewaste_kg Weight of electronic waste, in kilograms, after the container deduction.

aluminium_kg Weight of aluminium, in kilograms, after the container deduction.

inert_fines_kg Weight of inert fines (sand, soil and stones from compound sweeping, recorded as inorganic non combustible), in kilograms, after the container deduction. In Limo and Vanguard, sand and soil first entered as miscellaneous waste were moved here in the re-export of 30 October 2026.

miscellaneous_kg Weight of miscellaneous waste (residual fine material that could not be sorted further), in kilograms, after the container deduction.

food_kitchen_raw_kg Weight of food and kitchen waste as weighed in the field, in kilograms, before the container deduction.

garden_raw_kg Weight of garden, yard and park waste (green waste) as weighed in the field, in kilograms, before the container deduction.

wood_raw_kg Weight of wood and wood products as weighed in the field, in kilograms, before the container deduction.

textiles_raw_kg Weight of textiles and wool as weighed in the field, in kilograms, before the container deduction.

paper_raw_kg Weight of mixed paper and pulp as weighed in the field, in kilograms, before the container deduction.

plastics_raw_kg Weight of mixed plastics as weighed in the field, in kilograms, before the container deduction.

rubber_leather_raw_kg Weight of rubber and leather as weighed in the field, in kilograms, before the container deduction.

glass_raw_kg Weight of glass as weighed in the field, in kilograms, before the container deduction.

metals_raw_kg Weight of metals as weighed in the field, in kilograms, before the container deduction.

diapers_raw_kg Weight of disposable diapers (recorded as Pampers) as weighed in the field, in kilograms, before the container deduction.

polyethylene_bags_raw_kg Weight of polyethylene bags as weighed in the field, in kilograms, before the container deduction.

cardboard_raw_kg Weight of cardboard as weighed in the field, in kilograms, before the container deduction.

ewaste_raw_kg Weight of electronic waste as weighed in the field, in kilograms, before the container deduction.

aluminium_raw_kg Weight of aluminium as weighed in the field, in kilograms, before the container deduction.

inert_fines_raw_kg Weight of inert fines (sand, soil and stones, recorded as inorganic non combustible) as weighed in the field, in kilograms, before the container deduction.

miscellaneous_raw_kg Weight of miscellaneous waste (residual fine material) as weighed in the field, in kilograms, before the container deduction.

Source

Field data of Ivan Feni, Abubakar Batte, James Omal and Charles B. Niwagaba (Makerere University, University of Stuttgart and Gulu City Council), measured from 1 to 3 October 2026, and shared with openwashdata as a workbook in October and November 2026. The fieldwork was funded by Integers Company Limited.

Examples

```
head(guluswm_waste)
# per capita generation of the 94 analysed households, kg per person and day
summary(guluswm_waste$generation_kg_cap_day[guluswm_waste$included_in_averages == "Yes"])
```

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