WASTE WISE CITIES TOOL
DATA TO ACTION BASED ON
SDG FRAMEWORK

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2 billion ppl w/o waste collection

3 billion ppl w/o access to controlled waste disposal

Business-as-usual: 8 – 10 % of global GHG emissions

WASTE SDG INDICATORS

Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable

Targets		Indicator
11.6	By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.	Proportion of municipal solid waste collected and managed in controlled facilities with regards to the total waste generated by the city

Goal 12: Ensure sustainable consumption and production patterns

Targets		Indicator
12.3	By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.	Food loss Index Food Waste Index
12.4	By 2030, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.	Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment
12.5	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.	National recycling rate, tons of material recycled

Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development
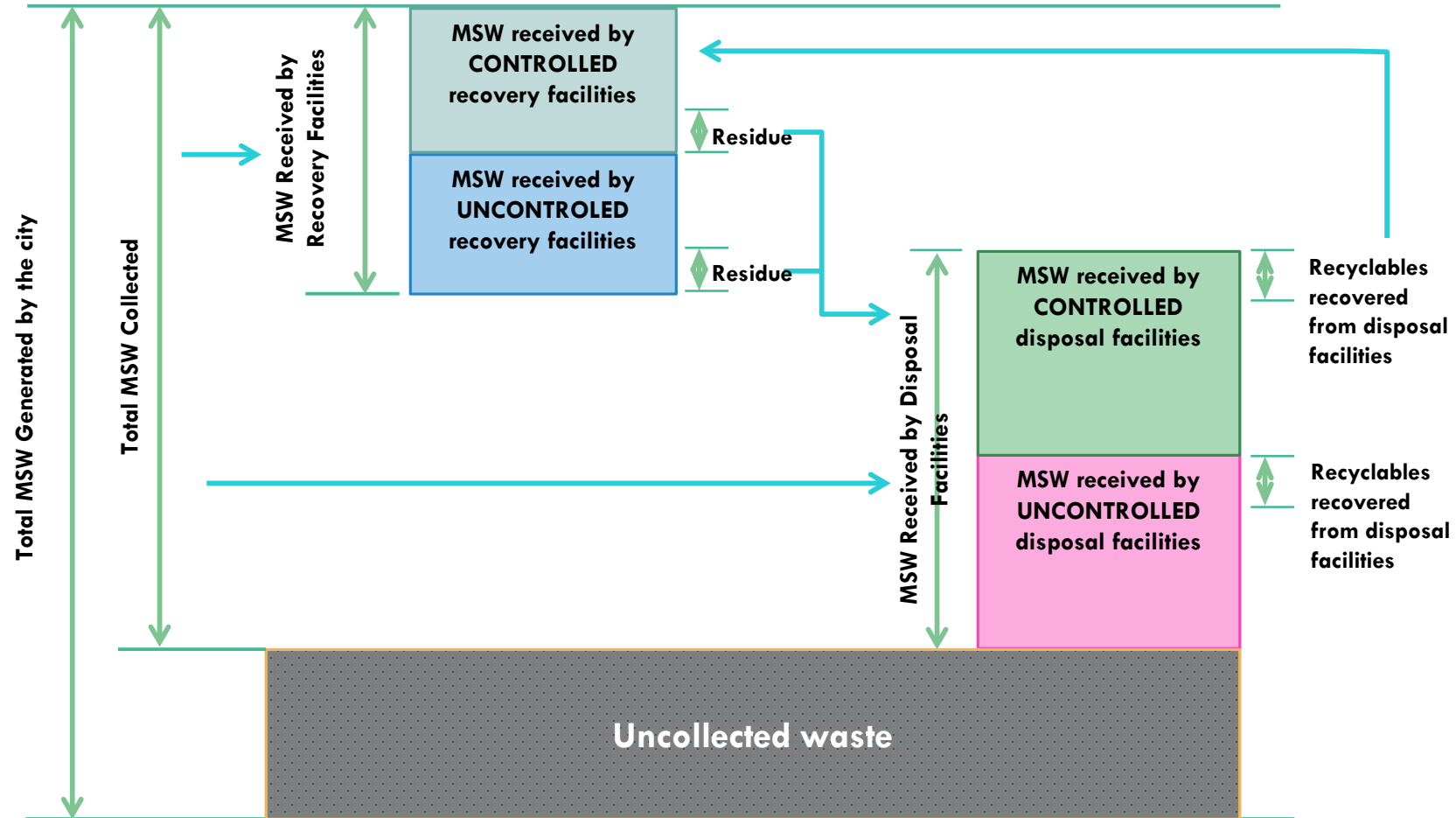
Targets		Indicator
14.1	Index of coastal eutrophication and floating plastic debris density	Index of coastal eutrophication and floating plastic debris density

% of MSW collected and managed in controlled facilities out of total MSW generated by the city

KEY DEFINITIONS

MSW and MSW Generation

Municipal Solid Waste includes waste generated from: households, commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). It also includes bulky waste (e.g. white goods, old furniture, mattresses) and waste from selected municipal services, e.g. waste from park and garden maintenance, waste from street cleaning services (street sweepings, the content of litter containers, market cleansing waste), if managed as waste. The definition excludes waste from municipal sewage network and treatment, municipal construction and demolition waste.
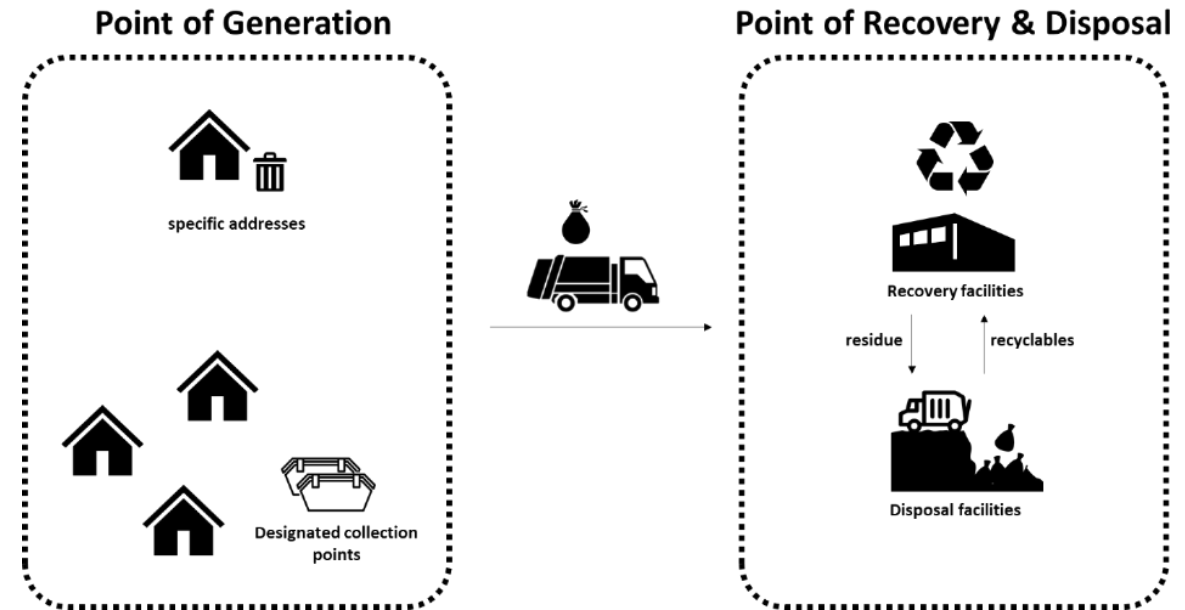
Total MSW Generated by the City is the total MSW generated by the population and their economic activities within the defined system boundary.

KEY DEFINITIONS

MSW Collection

Total MSW Collected refers to the amount of MSW generated that is moved from the point of generation, such as specific addresses or designated collection points, to facilities where the waste is recovered or disposed, regardless of collection modality (e.g. by municipal governments, non-state actors or informal sector). The remaining share of MSW generated is considered "uncollected".

The proportion of Population with Access to Basic MSW Collection Services is the proportion of the population who receive waste collection services that are either basic, improved or full, defined by the service ladder of MSW collection service. It considers aspects of frequency, regularity and proximity of the collection points. This aspect is measured under the SDG indicator 11.6.1 assessment but it is reported through a different indicator, SDG 1.4.1. on access to basic services.

Point of Generation

specific addresses

Designated collection points

Point of Recovery & Disposal

Recovery facilities

residue   recyclables

Disposal facilities

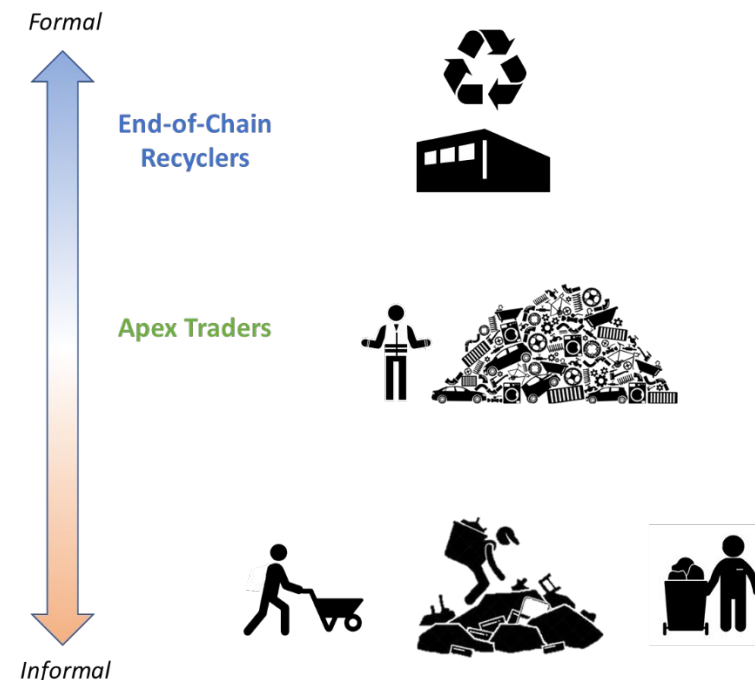| SERVICE LEVEL	DEFINITION
Full	☐ Receiving door-to-door MSW collection service with basic frequency and regularity and MSW is collected in three or more separate fractions; or ☐ Having a designated collection point within 200m distance served with basic frequency and regularity and without major littering and MSW is collected in three or more separate fractions
Improved	☐ Receiving door-to-door MSW collection service with basic frequency and regularity and MSW is collected in a minimum of two, separate fractions (eg. wet and dry fractions) ☐ Having a designated collection point within 200m distance served with basic frequency and regularity and without major littering and MSW is collected in a minimum of two, separate fractions (eg. wet and dry fractions)
Basic	☐ Receiving door-to-door MSW collection service with basic frequency and regularity or ☐ Having designated collection point within 200m distance served with basic frequency and regularity
Limited	☐ Receiving door-to-door MSW collection service without basic frequency and regularity; ☐ Having a designated collection point within 200m distance but not served with basic frequency and regularity; or ☐ Having designated collection point in further than 200 m distance.
No	☐ Receiving no waste collection service
Note: Basic frequency and regularity: served at least once a week for one year	

KEY DEFINITION

MSW Recovery

Recovery means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the facility or in the wider economy.

Recovery facilities include any facilities with recovery activities defined above including recycling, composting, incineration with energy recovery, materials recovery facilities (MRF), mechanical biological treatment (MBT) facilities, etc.

Recycling value chain usually involves several steps of the private recycling industry which purchase, process and trade materials from the point a recyclable material is extracted from the waste stream until it will be reprocessed into products, materials or substances that have market value. In many low and low-to-middle income countries, this involves informal waste pickers, intermediate traders, apex traders and end-of-chain recyclers.

Apex traders collect recyclable materials from different sources and suppliers (sometimes including materials from different cities and countries) and supply them to different end-of-chain recyclers (sometimes after pre-processing such as sorting, washing and bailing).

End-of-chain recyclers purchase recyclable material from suppliers such as apex traders, and reprocesses them into products, materials, or substances that have market value.

Formal

End-of-Chain Recyclers

Apex Traders

Informal

Example of Plastic

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KEY DEFINITIONS

Disposal

Disposal means any operation whose main purpose is not the recovery of materials or energy even if the operation has as a secondary consequence the reclamation of substances or energy.

MSW Managed in Controlled Facilities refers to MSW collected and transported to recovery and disposal facilities that are operated under basic, improved or full control according to the Ladder of waste management facilities' control level (Table 2). The Ladder can be used as a checklist for assessing the level of control of a particular recovery or disposal facility. The facility should be classified by going through the decision making tree attached in the Annex. . Note that the emphasis is on operational control rather than engineering/design. A facility that is constructed to a high standard, but not operated in compliance with Level 3 (or above) standard is not regarded as a controlled facility.

LADDER OF CONTROL LEVEL – RECOVERY FACILITIES

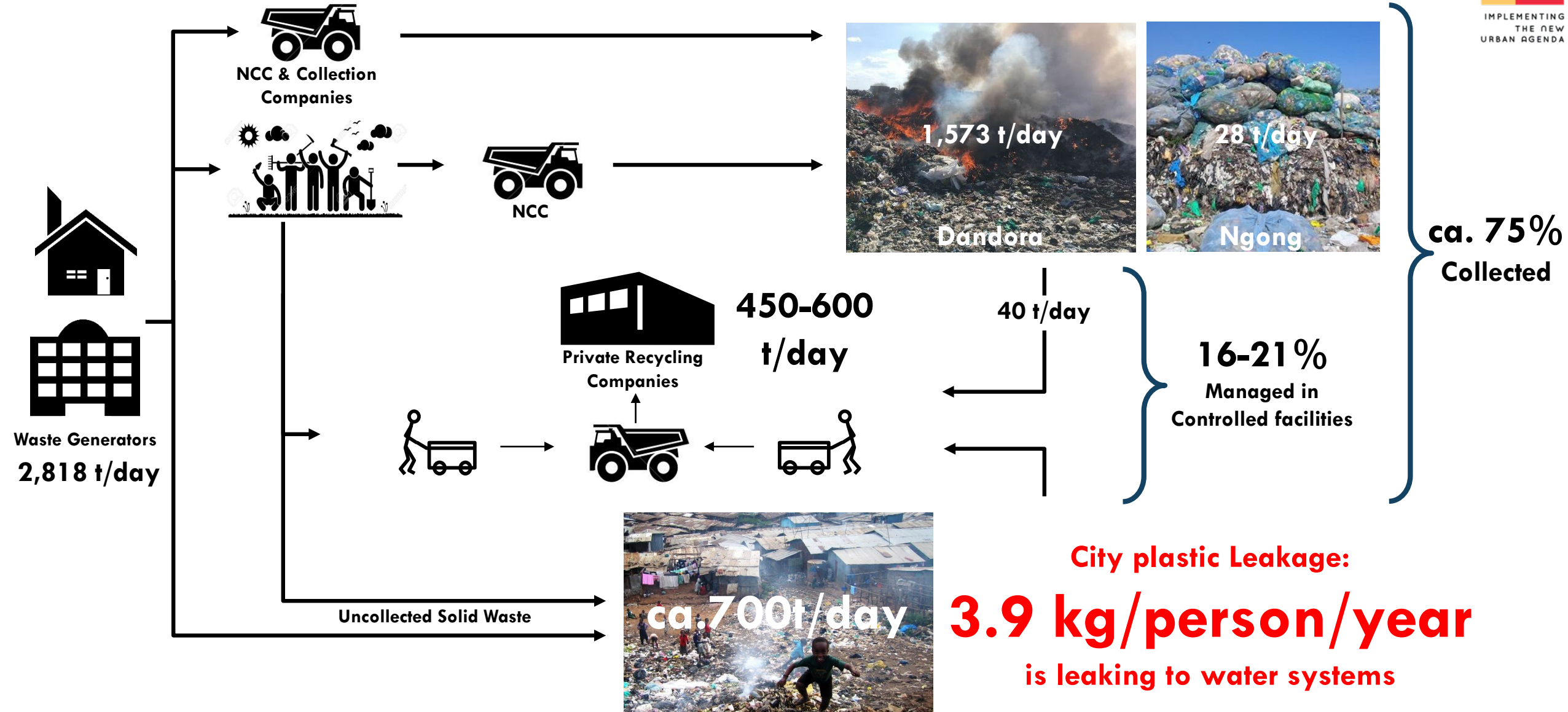| CONTROL LEVEL	Incineration with energy recovery	Other recovery facilities
Full Control	☐ Built to and operating in compliance with current national laws and standards including stringent stack and GHG emission criteria ☐ Emission controls are conducted compliant to environmental standards and results of tests are accessible and transparent to citizens/users ☐ Fly ash managed as a hazardous waste using the best appropriate technology ☐ Weighing and recording conducted ☐ A strong and robust environmental regulator inspects and monitors emissions ☐ Protection of workers' health and safety	☐ Built to and operating in compliance with current national laws and standards ☐ Pollution control compliant to environmental standards ☐ Protection of workers' health and safety ☐ The nutrient value of biologically treated materials utilized for separate organic waste (e.g. in agriculture/horticulture) ☐ Materials are extracted, processed according to market specifications, and sold to recycling markets ☐ Weighing and recording of incoming loads conducted ☐ All outgoing loads registered by weight and type of destination
Improved Control	N/A	☐ Engineered facilities with effective process control ☐ Pollution control compliant to environmental standards ☐ Protection of workers' health and safety ☐ Evidence of materials extracted being delivered into recycling or recovery markets. ☐ Weighing and recording of incoming and outgoing loads conducted
Basic Control	☐ Emission controls to capture particulates ☐ Trained staff follow set operating procedures ☐ Equipment maintained ☐ Ash management carried out ☐ Weighing and recording conducted	☐ Registered facilities with marked boundaries ☐ Some environmental pollution control ☐ Provisions made for workers' health and safety ☐ Weighing and recording of incoming and outgoing loads conducted
Limited Control	N/A	☐ Unregistered facilities with distinguishable boundaries ☐ No environmental pollution control ☐ No provisions made for workers' health and safety ☐ Weighing and recording conducted
No Control	☐ Uncontrolled burning ☐ No air/water pollution control	☐ Unregistered locations with no distinguishable boundaries ☐ No provisions made for workers' health and safety ☐ No environmental pollution control

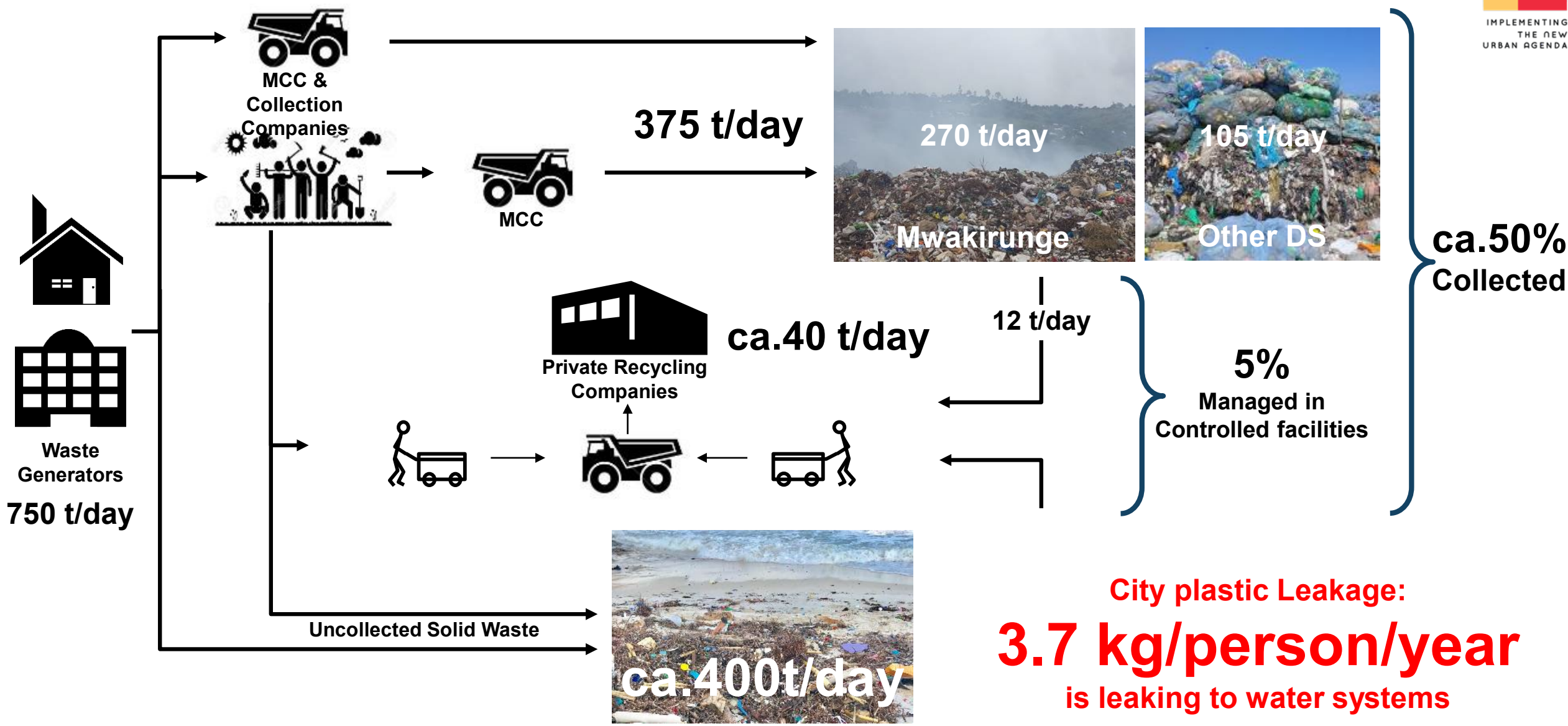# LADDER OF CONTROL LEVEL – DISPOSAL FACILITIES

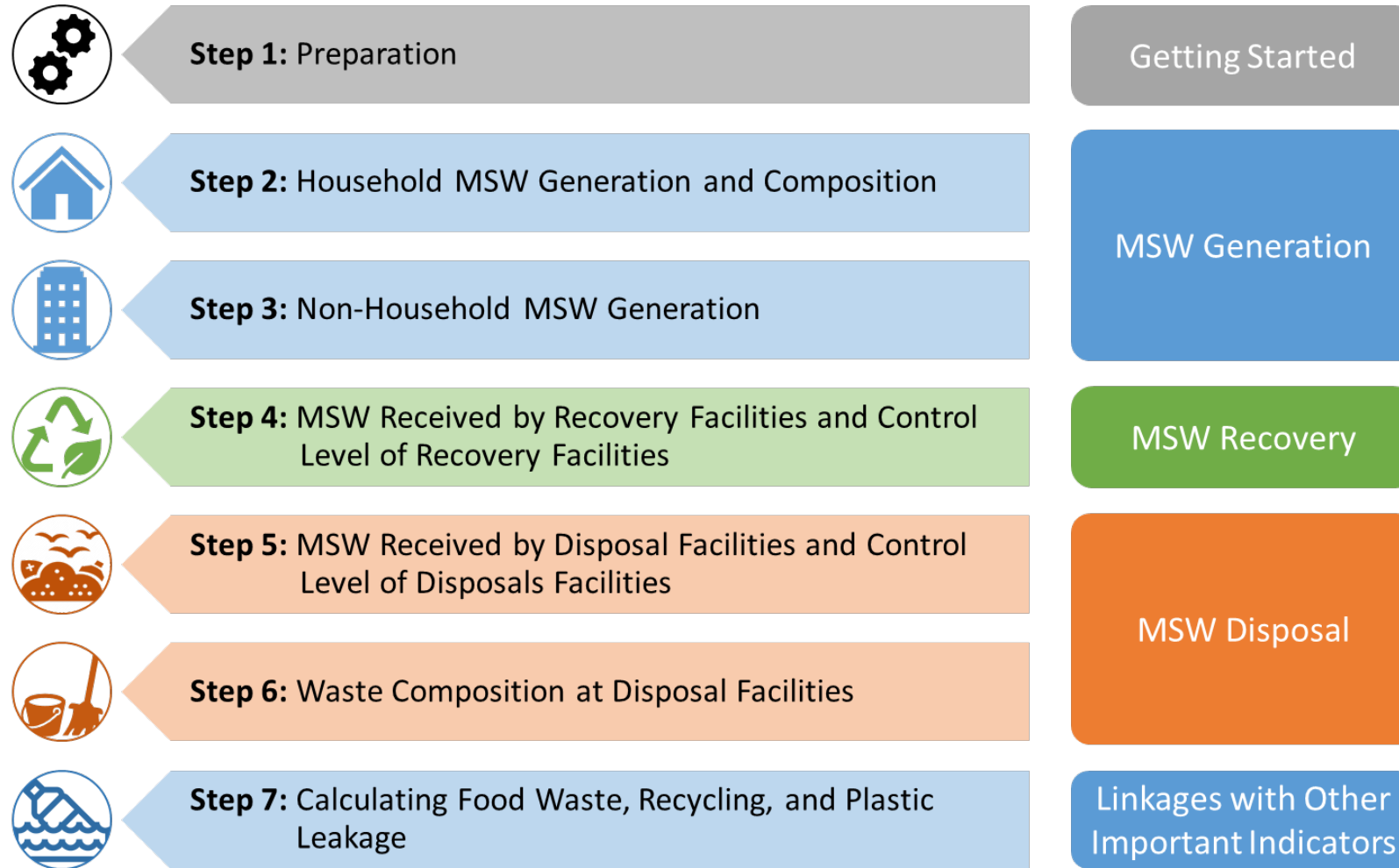| CONTROL LEVEL	Disposal Facilities		
Full Control	☐ Waste daily covered ☐ Waste compacted ☐ Site fenced and full 24-hour control of access ☐ Properly sited, designed and functional sanitary landfill ☐ Leachate containment and treatment (naturally consolidated clay on the site or constructed liner)		☐ Landfill gas collection and flaring and/or utilization ☐ Site staffed; ☐ Post closure plan ☐ Weighing and recording conducted ☐ Protection of workers' health and safety
Improved Control	☐ Waste periodically covered ☐ Waste compacted ☐ Site fenced and control of access ☐ Leachate containment and treatment		☐ Landfill gas collection (depending on landfill technology) ☐ Site staffed ☐ Weighing and recording conducted ☐ Protection of workers' health and safety
Basic Control	☐ Some use of cover ☐ Waste compacted ☐ Sufficient equipment for compaction ☐ Site fenced and control of access ☐ No fire/smoke existence		☐ Site staffed ☐ Weighing and recording conducted ☐ The slope of the landfill is stable, landslides not possible ☐ Protection of workers' health and safety
Limited Control	☐ No cover ☐ Some compaction ☐ Some equipment for compaction ☐ Some level of access control/fencing ☐ No leachate control		☐ Some fire/smoke existence ☐ Site staffed ☐ Weighing and recording conducted ☐ The slope of the landfill is unstable with high possibility of a landslide
No Control	☐ No cover ☐ No compaction ☐ No/ limited equipment ☐ No fencing		☐ No leachate control ☐ Fire/smoke existence ☐ No staff ☐ The slope of the landfill is unstable with high possibility of a landslide

NCC & Collection Companies

NCC

1,573 t/day

Dandora

28 t/day

Ngong

ca. 75% Collected

450-600 t/day

Private Recycling Companies

40 t/day

16-21% Managed in Controlled facilities

Waste Generators 2,818 t/day

Uncollected Solid Waste

ca.700t/day

City plastic Leakage:

3.9 kg/person/year

is leaking to water systems

IMPLEMENTING THE NEW URBAN AGENDA

SDG 11.6.1 MONITORING STEPS

Step 1: Preparation — Getting Started

Step 2: Household MSW Generation and Composition — MSW Generation

Step 3: Non-Household MSW Generation — MSW Generation

Step 4: MSW Received by Recovery Facilities and Control Level of Recovery Facilities — MSW Recovery

Step 5: MSW Received by Disposal Facilities and Control Level of Disposals Facilities — MSW Disposal

Step 6: Waste Composition at Disposal Facilities — MSW Disposal

Step 7: Calculating Food Waste, Recycling, and Plastic Leakage — Linkages with Other Important Indicators

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- Gain political and senior management endorsement and support from the city

- Establish a working team (20-30 members who are dedicated full-time for 2-3 weeks and led by 2-3 well trained experts, better if from the waste management/environmental office of the city). Small teams of 2/3 people will be assigned to each neighborhood to survey. Nominate a team leader for each small team.

- With support of team leaders/experts select:
  - 9 neighborhoods to survey (3 per economic segment: low, middle, high) and
  - 10 households to survey (inform them about the survey and make sure about their participation before the survey starts)

- Obtain necessary data from statistics office or relevant offices that will help to conduct the survey and data analysis process (e.g. population, population according to income levels)

- Waste sampling from 10 household from 3 survey areas per income groups (high, middle and low income groups)

- To obtain representative sample, 7 days' sample from each household to be collected

- Collected samples weighed to obtain average waste generation per capita

- After weighing, waste composition is measured for each income groups
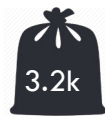
Family 4 members

Day 1 — Discard!
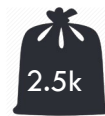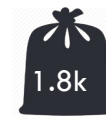Because ppl put accumulated waste in the bag making the sample not representative

$$\frac{2.4k + 3.2k + 2.5k + 1.8k + 1.5k + 2.1k + 2.7k}{7 \times 4} = 0.57kg/day/person$$

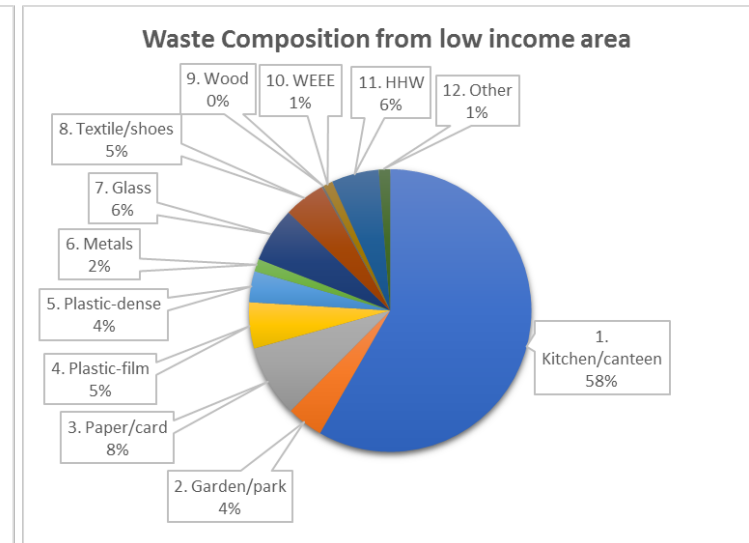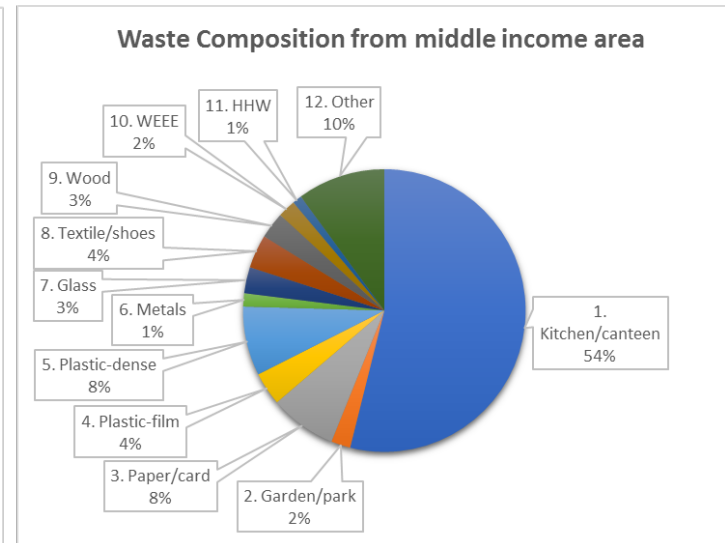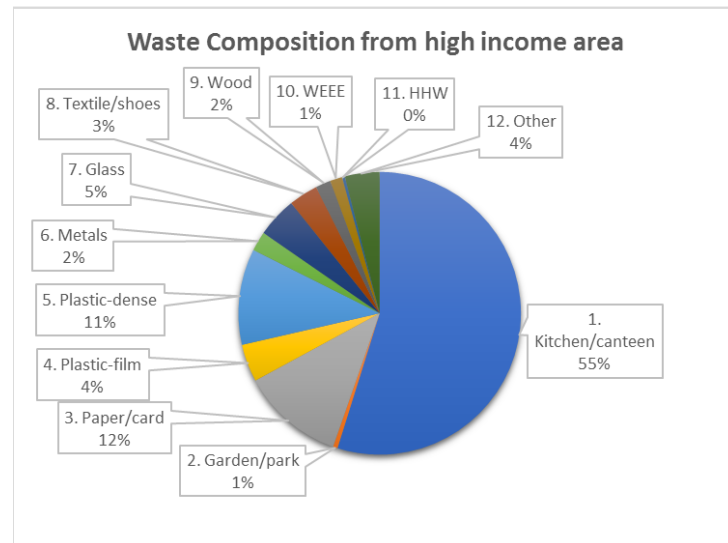Day 2 Day 3 Day 4 Day 5 Day 6 Day 7 Day 8
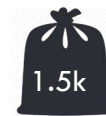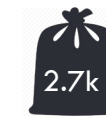
WASTE CHARACTERIZATION INTO 12 TYPES

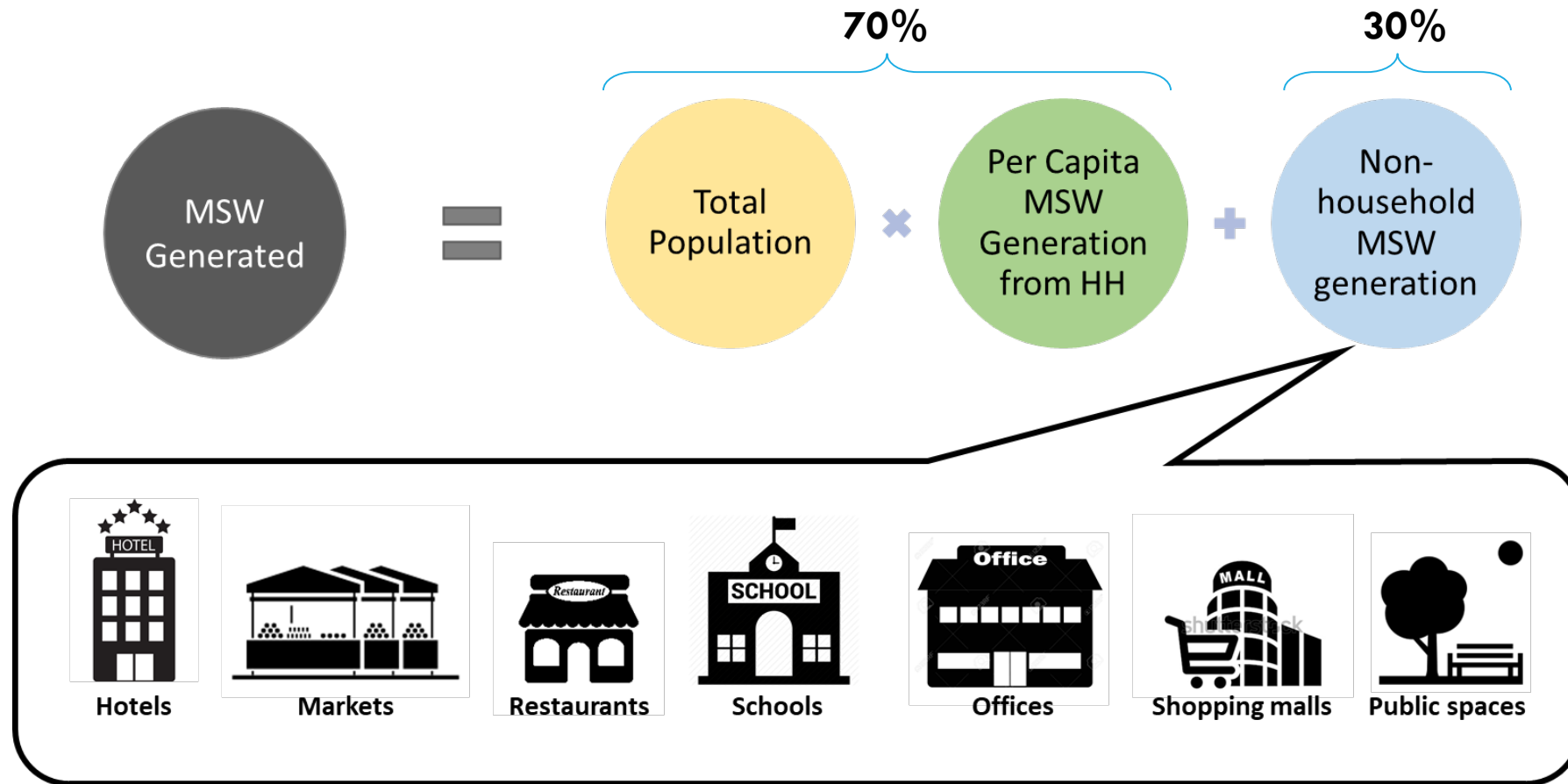| Categories	Examples
Kitchen / Canteen Waste	Bread, coffee grinds, cooked or uncooked food items, food leftovers, fruit and vegetables, meat and fish, pet foods, tea bags
Garden / Park Waste	Flowers; Fruit and vegetable garden waste; Grass Cuttings; Hedge trimmings; Leaves; Pruning; Tree branches; Weeds
Wood	Bottle corks, Cork packaging, Untreated Pallet, Solid timber and timber fragments, Wood from DIY, Wood furniture or toys
Paper / Cardboard	Brochures, magazines, newspapers, cereal packets, Cleaning product cartons, Cards, Books, Tissue Paper, Writing papers
Plastic Film	Biscuit wrappers, Cling film, Compost/peat bags; Crisp packets; Frozen food bags; Cellotape; Shopping Bags, Tarpalins
Plastic Dense	All plastic bottles/jars, Plastic bottles, Food packing trays, Roll on deodorant bottles, Bottle tops, Toothpastes, Plastic toys
Glass	Alcoholic and non-alcoholic drinks bottles, Food jars, Medicine bottles, Cookware, Flat glass, Light bulbs, Mixed broken glass
Textiles	Trousers; Skirts; Socks; Stockings; Tights; Balls of wool; Blankets; Braids; Carpets; Ropes; Rugs; Sheets; Threads; Towels
Metals	Biscuit containers; Packaging for carbonated drinks, Fish, Pet food etc; Aluminium foil sheets; Shoe polish cans; Soft drinks;
Hazardous Household Waste	Batteries/Accumulators;
Complex Products	Composite/Complex Packaging such as Aluminium Foil-coated card, liquid containers e.g. milk; fruit juice; Appliance parts
Other	Boulders; Bricks; Gravel; Pebbles; Sand; Soil; Stones; Ceramics; Clay plant pots; Crockery; Stone/ceramic floor and wall tiles; Children's disposable nappies; Ashes; Sand; Small fragments <10mm of all above categories

Income level	MSW Generation per capita (kg/capita/day)	Population	Population rate	MSW Generation from each income level (t/day)
High Income	0.62	607,174	13%	378
Medium Income	0.89	1,629,660	35%	1,450
Low Income	0.19	2,408,719	52%	462
Total	N/A	4,645,553	100%	**2,290**

Types	Recyclable waste generation from HH (t/day)
Food waste	1,259
Plastic film	96
Plastic dense	176
Paper and cardboard	198
Glass	90
Total	**1,820**

Waste Composition from high income area

Waste Composition from middle income area

Waste Composition from low income area

70% 30%

MSW Generated = Total Population × Per Capita MSW Generation from HH + Non-household MSW generation

Hotels Markets Restaurants Schools Offices Shopping malls Public spaces

$$Total\ MSW = \frac{Total\ MSW\ from\ households}{70\%}$$

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• Identify recovery facilities during the preparation phase (STEP 1)

• Arrange visits and interviews with identified recovery facilities (Annex 5 of WaCT Step by Step Guide)

• Evaluate the level of control of recovery facilities based on the ladder environmental level of control (ladder provided in to WaCT Step by Step Guide)

• Compile the collected information (in provided file)
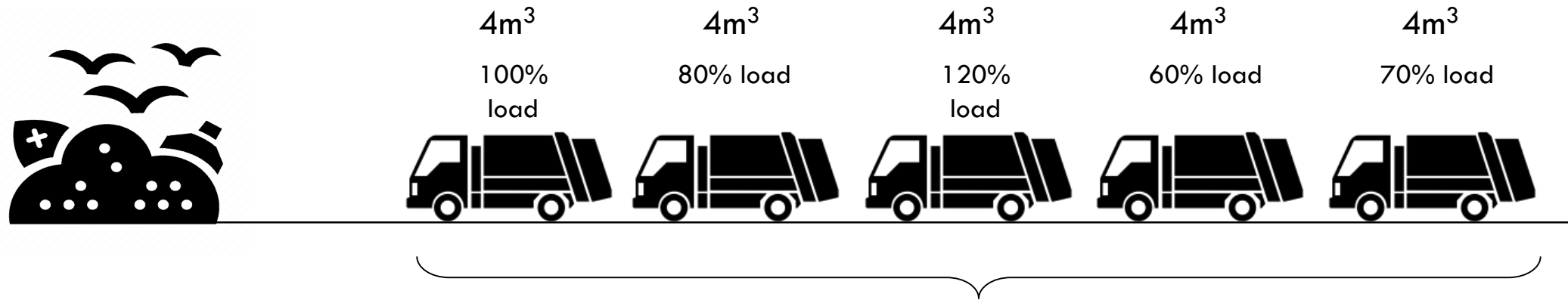
• Identify disposal facilities

• Arrange visits and interviews with identified disposal facilities

  • Obtain records of waste received (weigh bridge record or counting the number of truck)

  • Interview waste pickers (average daily amount of recyclables recovered by one waste picker and the approximate number of waste pickers in the disposal site)

• Evaluate the level of control of disposal facilities

• Compile the collected information (in provided file)

Count the number of trucks! And get the average density of the waste!

$4m^3$ — 100% load

$4m^3$ — 80% load

$4m^3$ — 120% load

$4m^3$ — 60% load

$4m^3$ — 70% load

$$4 + 4 \times 0.8 + 4 \times 1.2 + 4 \times 0.6 + 4 \times 0.7 = \mathbf{17.2m^3}$$

Waste density:
100 litter bin full of garbage is 75kg.
75kg ÷ 100 litre ($0.1m^3$) = **750kg/m³**

$$750kg \times 17.2m^3 = 12,900kg = \mathbf{12.9t}$$

Preparation

- Hire and train workers (8-10 people)
- Acquire necessary equipment
- Prepare site for the audit

Waste sampling & composition analysis

- Select trucks for waste sampling from each income level (a minimum of 3 trucks, one each from low, medium and high-income service areas)
- Take a 200-300kg sample from the truck
- In total 600-900kg of waste sample is obtained per income level
- Use quartering technique to get a sample
- Sort the waste into 12 types
- Weigh the waste fractions

$$HH\ FWI = \frac{\text{Total MSW generated (t/day) x proportion of food waste (\%)}}{\text{Total population}}\ x\ 365\ \left(\frac{kg}{person}/day\right)$$

Quantity of material recycled from the MSW stream

$$= \sum \text{Amount of recycled products sold by each of the recovery facilities}$$

1) Quantifying plastic leakage from every stage of the MSWM system
2) Determining the fates of each flow in the environment (i.e. retained on land, water systems, storm drains or burnt).

https://plasticpollution.leeds.ac.uk/projects/

CAPACITY DEVELOPMENT PLAN

- Dissemination of Waste Wise Cities through city networks such as Waste Wise Cities and African Clean Cities Platform

- Online course on Waste Wise Cities Tool application + waste management action planning

- Capacity development training through African Clean Cities Platform

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