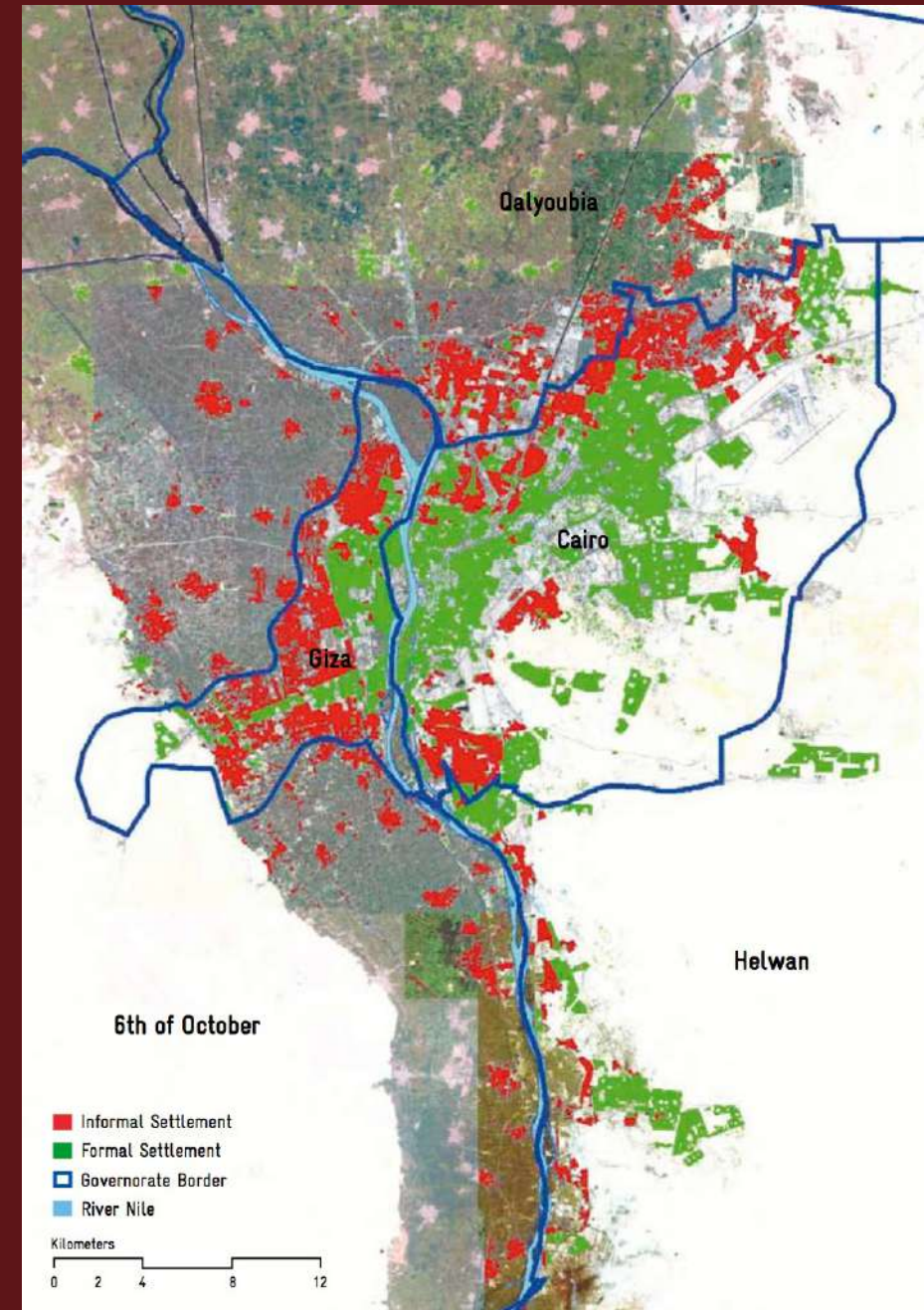


The Story of Formal and Informal Recycling in Cairo: Visual Observations along the Value Chain

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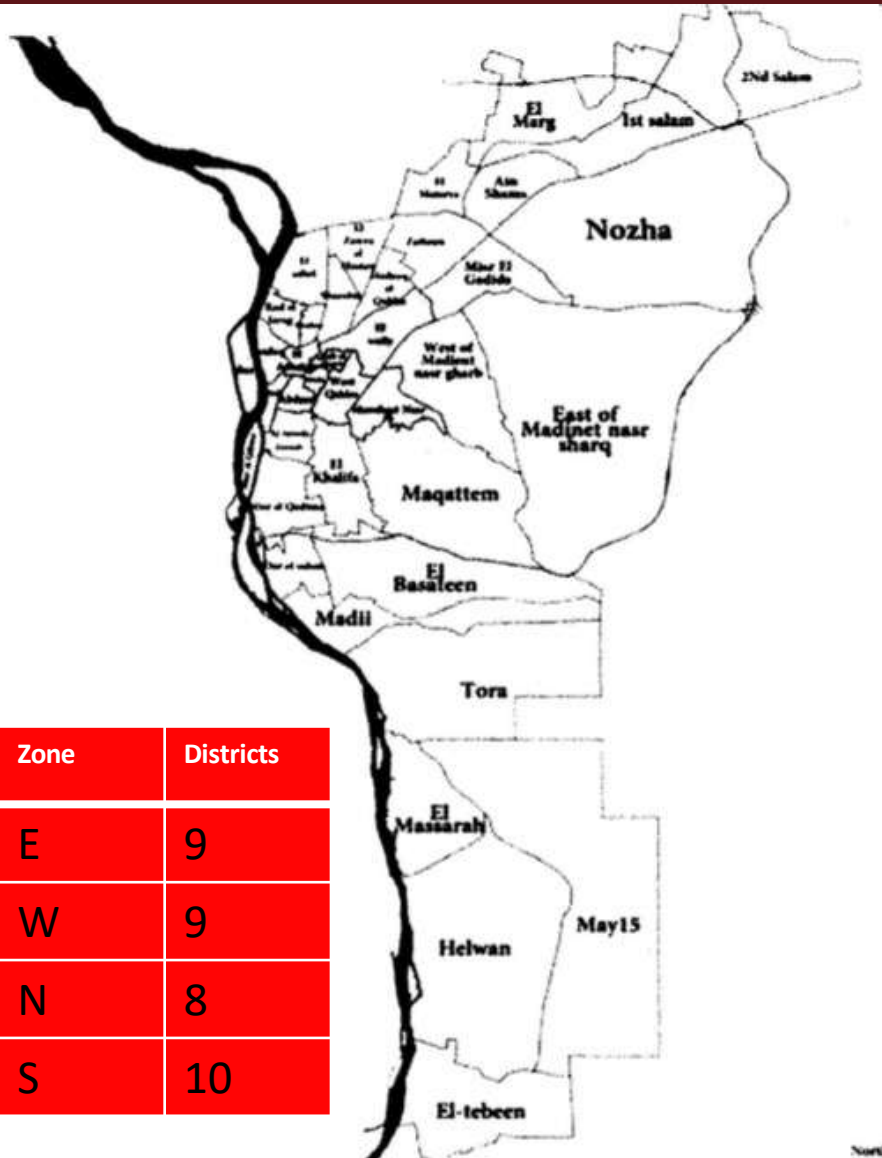
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Outline

1. Cairo MSW Generation and Composition
2. Cairo MSW System Description
3. Recycling by the Formal Sector: Focus on 15th of May
Integrated Facility
4. Recycling by the Informal sector: Focus on Manshiet Nasser

1. Cairo MSW Generation and Composition



Year	Population	Area, square km
1996 (census)	6,789	
2006 (census)	7,772	
2015 (official estimate)	8,982	3,085
2017	9,600	

Cairo zones, districts and MSW generation rates (ton/day)

Zone	Districts	ton/day (2014)	ton/day (2015)
Eastern zone (9 Districts) (population 3,4 m)	East Nasr city, west Nasr city, El Nozha, Heliopolis, Ain Shams, Al Salam (1), Al Salam (2), El Matariya, and El Marg	5,540	5,600
Western zone (9 Districts) (population 0.9 m)	West Cairo, Bab El-Shaaria, Abdeen, El Azbakeya, Al Moski, central Cairo, El Waily, Bulaq, and Mansheit Nasser	2,515	2,550
Northern zone (8 Districts) (population: 1.9 m)	El Sahel, El Shrabia, Shubra, Road El Farag, El Zawia ElHamra, Hadaeq El Qobba, El Zaitoun, and El Amiriyah	2,345	2,600
Southern zone (A) (5 Districts) (population A+B: 2.7 m)	El Saieda Zainab, Mesr El Oadima, El Khalifa, El Mokattam, Dar El Salam, and El Basatin	3,565	5,800
Sothern zone (B) (5 Districts)	El Maadi. Torah, El Masarah, Helwan, and El Tebin	2,230	
Total, ton/day (total population, 2015: 8.982 millions)		16,195	16,550

Cairo MSW generation rate compared with published generation rates,

No.	Classification according to income	MSW generation rate kg/cap/day
1	High income countries	2.1
2	Upper middle countries	1.2
3	Lower middle countries	0.79
4	Lower income countries	0.60
5	Cairo	1.80

Generation rate in Cairo (2015):

MSW daily generation: 16,000 ton
Population: 8.9 millions

Per capita generation rate = $\frac{16,000}{8.9}$
= 1.80
kg/cap/day
(!!!)

Composition of Municipal Solid Waste in Cairo compared with published data

Fraction	MSW Composition, %				
	Cairo	High income countries	Upper middle countries	Lower middle countries	Low income countries
Organic	50-60	28	54	59	64
Paper/ Cardboard	8-12	31	14	9	5
Plastics	10-15	11	11	12	8
Glass	1-3	7	5	3	3
Metals	1.5-2	3	3	2	3
Others	13-21	17	13	15	17

Sources: Cairo data taken from the 2016 EBRD Cairo pre-feasibility study
Other data as published in the World Bank What a Waste study, 2012

Relative density of MSW is estimated at 0.3 ton/cu m, Corresponding humidity is 30 - 40%,
Calorific value is estimated at 1,500 kcal/kg.

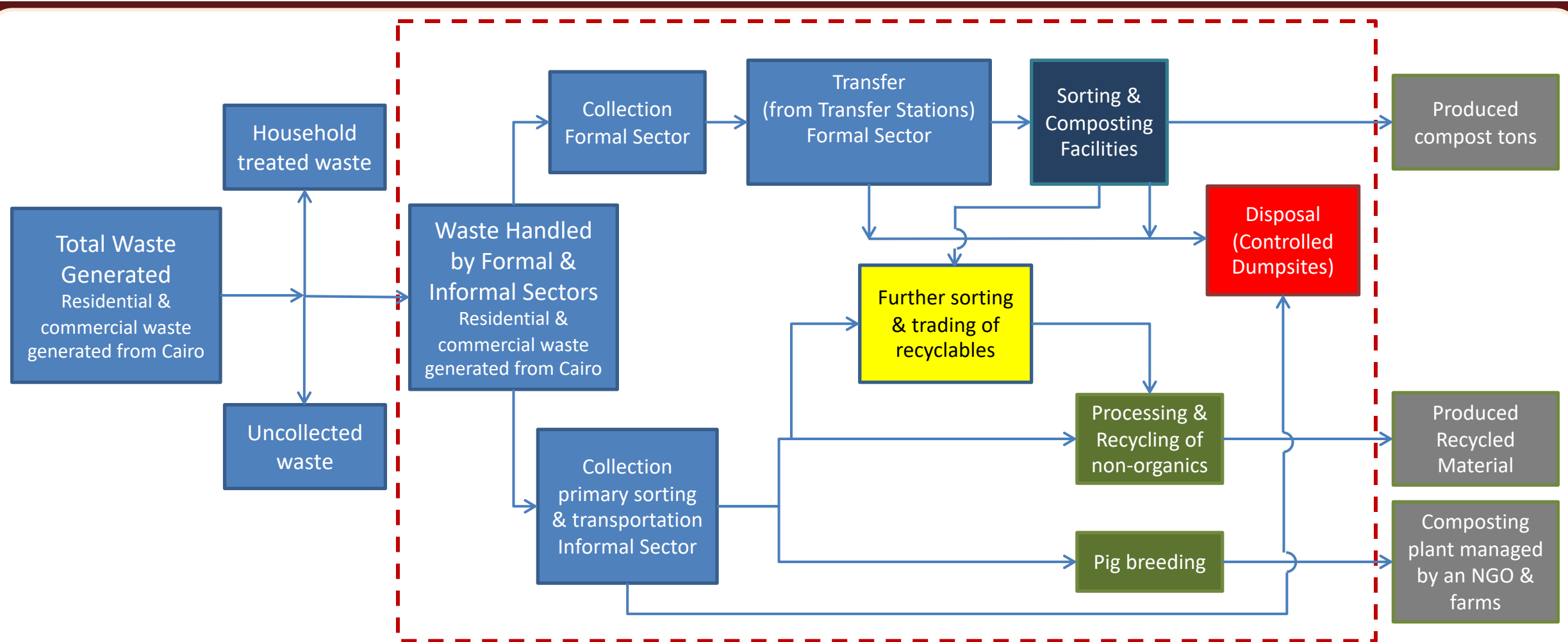
2. Cairo MSW System Description

Cairo

Formal and informal sectors

Process flow diagram used to prepare Mass Balance for the SWM system, 2006

Process Flow Diagram for the system



Cairo MSW Management System

1. The pre-feasibility study conducted in 2016 has described the complexity of solid waste management in Cairo Governorate, with waste collection, treatment and disposal services provided by a mix of international and national private companies and local contractors; The informal sector plays a significant role in the collection, recovery and sorting of dry recyclable materials from the Cairo's household and commercial solid waste.

2. Solid waste management is a major problem for Cairo Governorate due to the rapid increase in the Governorate's population, the rapid spread of informal settlements, handling the growing volumes of waste accumulations , and the corresponding increased demand for responsive solid waste services.

3. The informal sector is playing a significant role in Cairo's waste collection and recycling services for decades. As a result of the inefficient service delivered by the formal waste collection programs. Such informal service comes with serious drawbacks represented by waste scavenging , open sorting at waste collection boxes and littering.

Cairo MSW Management System

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Cairo MSW Rate of Collection and Treatment

No.	Zone/CG	Estimated waste Generation (Ton/day)	Collected Waste (Ton/day)	Waste Collection Coverage (%)	Composted Waste (Ton/day)	Composted Waste (%)	
1	Eastern	5,600	2,130	38.04	115	2.05 ^A	5.40 ^B
2	Western	2,550	1,300	50.98	640	12043 ^A	21.33 ^B
3	Northern	2,600	1,700	65.38			
4	Southern (A) and (B)	5,800	3,877	66.84	462	7.97 ^A	11.92 ^B
	Cairo, total	16,550	9,007	54.42	1,217	7.35^A	13.51^B

A Calculated as a ratio % of the generated waste.

B Calculated as a ratio % of the collected waste.

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3. Recycling by the Formal Sector: Focus on 15th of May Integrated Facility

MSW Sorting and Composting Plants Operating in Cairo Governorate

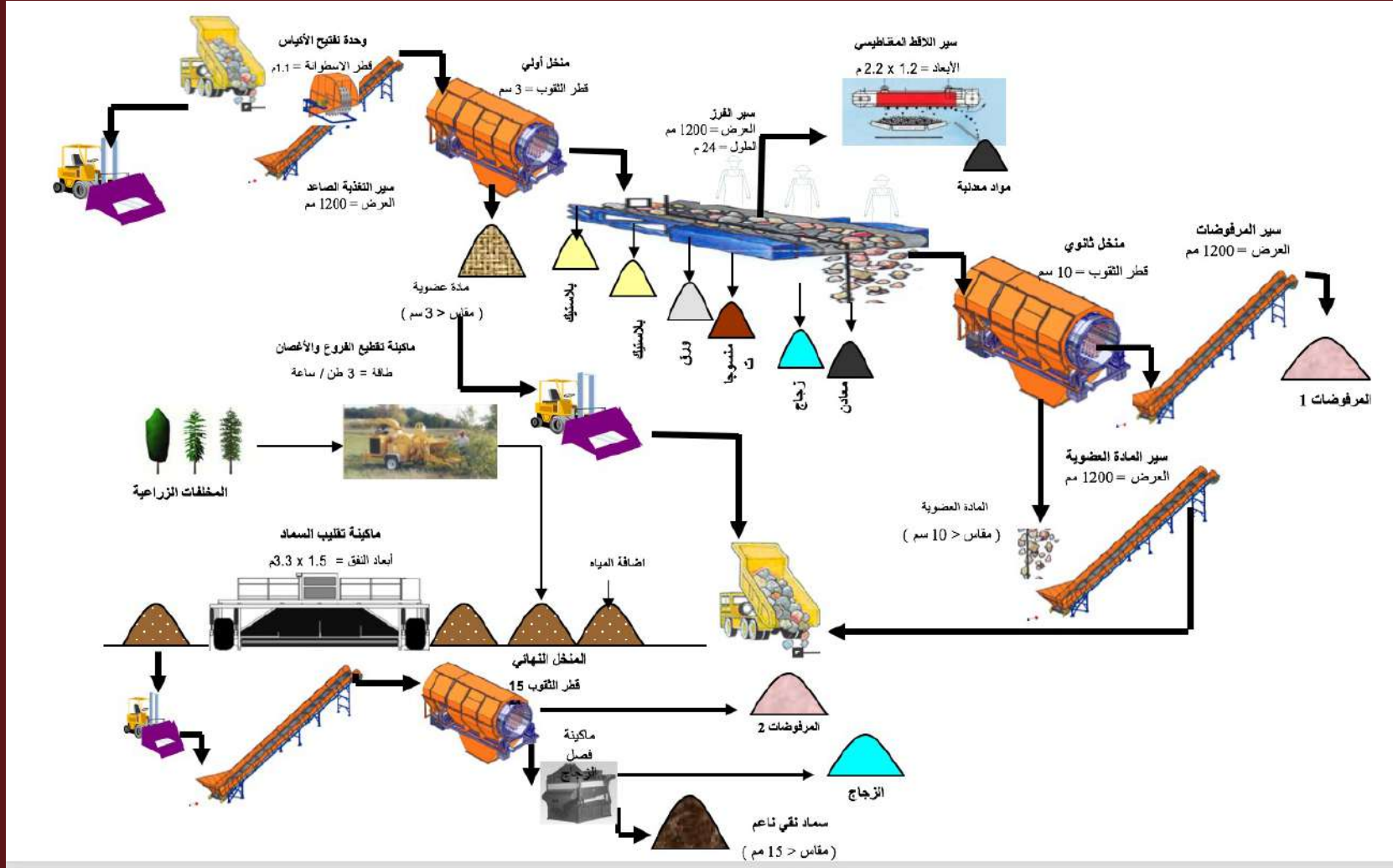
Location	Served Zone(s)	Date Established	Operating Entity	Design Capacity (ton/day)	Average Treated Waste (ton/day)
Al Salam	Eastern	1987	FCC	115	240
Katameya	Northern & Western	(modified on 2000)	AAEC	640	1,000
15 th May	Southern	2000	ECARU	462	1,600

Sources: The annual reports of the concerned companies for 2015



15th of May Sorting, Composting, RDF and Landfill Integrated Facility

15th of May Simplified Equipment Flow Diagram





Reception area and feeding system in 15th of May Facility

Manual sorting in one of the lines in 15th of May Facility





Aerobic Composting using windrow turning machine for mixing and aeration in 15th of May Integrated Treatment and Disposal Facility



De-stoning unit used in 15th of May facility to improve the quality of the compost product



Packaging of product compost in 15th of May facility

**RDF process in
15th of May
Integrated
Treatment and
Disposal Facility**

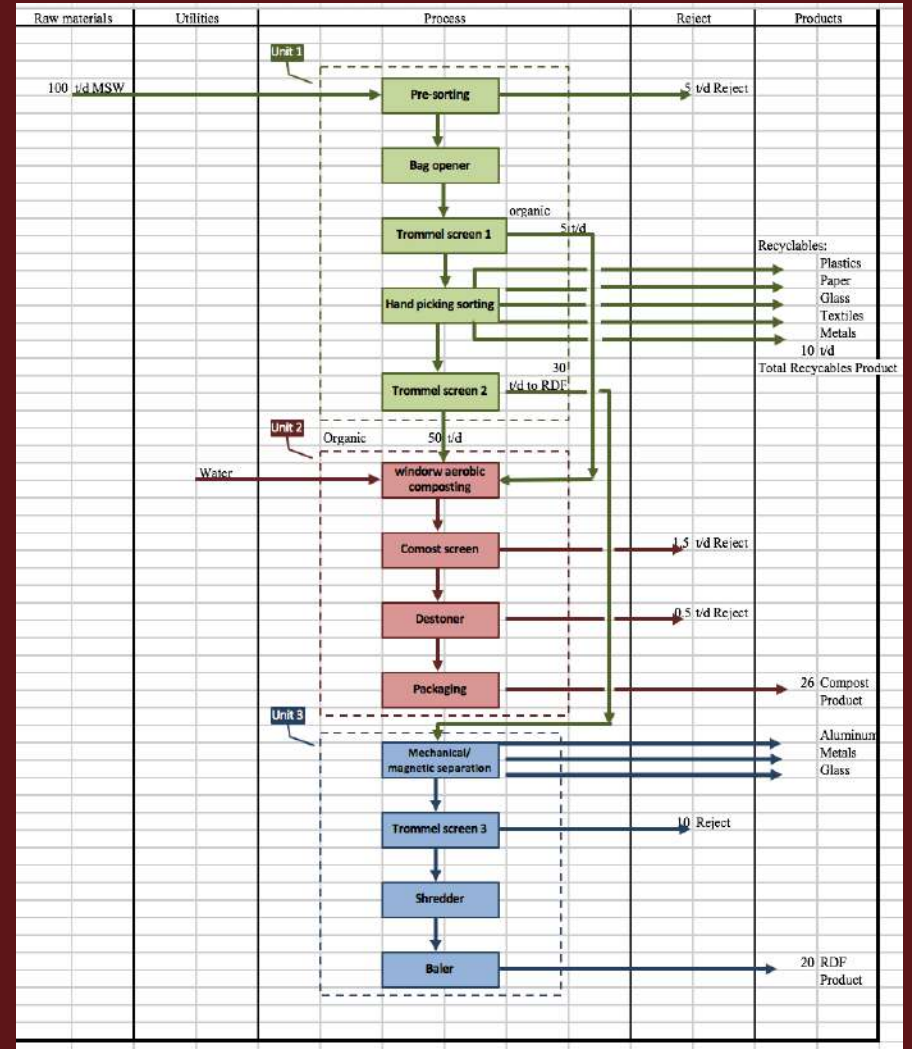


**Sorted and Compacted
Recyclables in the 15th of May
Facility**



Material Balance Block Flow Diagram

Material Balance:
 Basis: 100 ton/day
 Mixed MSW
 Recyclables content: 10%



Final Waste Disposal Sites in Cairo Governorate

No.	Landfill/Dumpsite	Location Served Area of the Governorate	Area (Feddan)	Operating Entity	Remarks
1	Al Wafaa Wal Amal landfill	Al Wafaa Wal Amal/Eastern zone	100	FCC Company	At the end of FCC contract, the disposal site will be closed and converted to a public garden, in 2017
2	Katameya semi-controlled dumpsite	Katameya/northern and western zones	35	AAEC	
3	15 th May controlled disposal site	South 15 th May city/southern zone	65	ECARU	Used for construction and demolition waste only Will be closed shortly Used for construction and demolition waste only
4	Shak El Teban dumpsite	Shak El Teban area (torah district)	55	CCBA	
5	El Nahda (Al Salam) dumpsite	Al Salam city/eastern zone	38	CCBA	
6	Al Handasa dumpsite	Helwan district	40	CCBA	



15th of May Landfill Disposal Site

4. Recycling by the Informal Sector: Focus on Manshiet Nasser

Cairo Informal Recycling Sector

1. The informal recycling sector (IRS) sorts and recovers dry recyclable materials from household and commercial solid waste in Cairo Governorate.
2. It has been estimated that, in 2015, Zabbaleen transferred about 3,000 ton/day of Cairo's mixed household waste to Mansheit Nasser area for sorting and recycling.
3. Moreover, about 2,000 ton/day of dry sorted waste, from mixed household waste, is transported from different locations in Greater Cairo to Mansheit Nasser for recycling.
4. This quantity of dry waste is sorted by both the Zabbaleen and waste pickers, Moreover, waste pickers separate and collect selective recyclable materials, such as paper, cardboard, plastics, metals, glass and rags from street Containers, composting plants and dumpsites.
5. In 2005, Zabbaleen of Mansheit Nasser collected about 1,500 ton/day of mixed waste, which they sorted manually, traded, and remanufactured into final products. The neighborhood hosts about 420 family owned recycling enterprises at the SMEs business size, of which about 60% are plastics recycling workshops.

Cairo Informal Recycling Sector

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Cairo Informal Recycling Sector

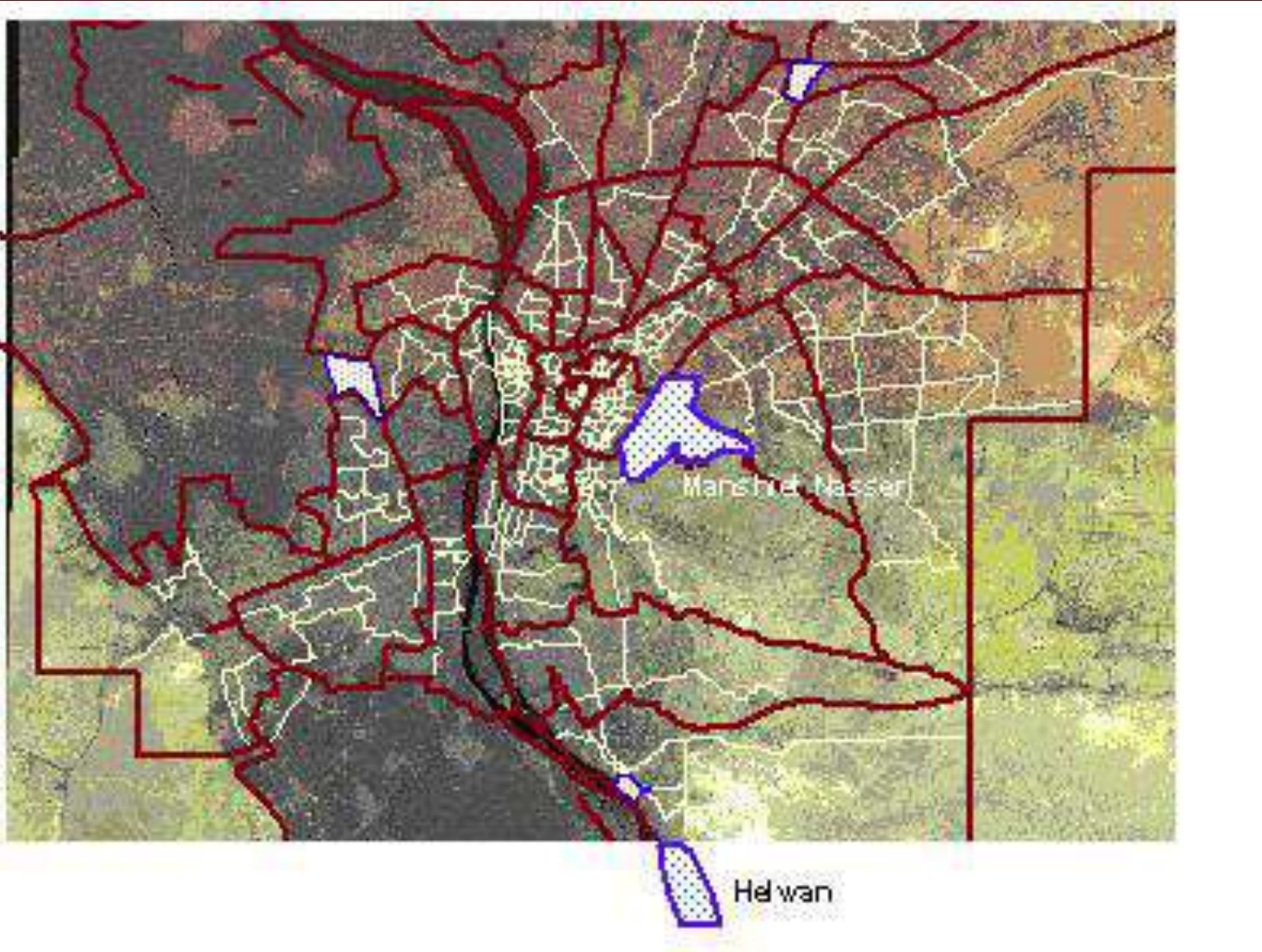
Focus
2

- Moreover, about 2,000 ton/day of dry sorted waste, from mixed household waste, is transported from different locations in Greater Cairo to Mansheit Nasser for recycling.
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Cairo Informal Recycling Sector

Focus
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Zabbaleen neighborhoods in Greater Cairo:

1. Mokattam - with an estimated population of 20.000
2. El Baragiil - estimated population of 3.000
3. Tora - estimated population of 2.000
4. Ezbet el Nakhl - with an estimated population of about 8.000.

Zabbaleen neighborhoods around the city of Cairo

IRS occupational categories:

1. **Collectors** of household and commercial waste based on a door to door, daily collection system.
2. **Middle men and Intermediary Buyers/dealers.** These live in and outside of the garbage collectors' neighborhood. Some used to be garbage collectors themselves. They were able to accumulate capital to acquire space to store large quantities of recyclables.
3. **Wholesale Merchants of recyclables from Roamers.** These buy in bulk from small merchants who roam the streets of Cairo and from the middlemen who live in low income and garbage neighborhoods. They are large-scale dealers, own warehouses and often specialize in one type of recyclables.
4. **Recycling Workshops and Enterprises.** This is where the recyclables are processed into final recycled products, or intermediate materials for further value chain purchase. Most are unlicensed, small, family owned MSEs, who function as buyers of source segregated waste, a critical input for their businesses. These, in turn, depend on their customers in the supply chain to large industries
5. **Other minor informal sector operators** include: scavengers, Roamers (Sarreeha), Robabekia and Saxonia Merchants.

IRS occupational categories:



Focus

1.Collectors

2.Middle men and Intermediary Buyers/dealers.

3.Wholesale Merchants of recyclables from Roamers.

4.Recycling Workshops and Enterprises.

5.Other minor informal sector

Waste Collected by Zabbaleen at Cairo Governorate and the National Level

The Zabbaleen are responsible for the informal waste collection in major cities with major concentration in Cairo and Giza cities. A recent UNESCO study estimated that the Zabbaleen collectively manage about 10% of the country's waste and 25% of Cairo waste. The table shows the estimated collected waste by Zabbaleen from Cairo and nationwide, in the period 2004 - 2009.

Year	Collected Waste in Cairo Governorate (%)	Collected Waste Nation Wide (%)
2004	10	7.8
2005	14	2.08
2006	21	5.4
2007	19	4.32
2008	34	11.97
2009	25	10.3

Estimated Inventory of the Recyclable Waste Streams in Cairo Governorate

End of Year	Generated Waste		Recyclable Waste (Ton/Year)					
	Ton/day	Ton/Year	Organic	Paper and Gerdboard	Plastics	Glass	Metals	Rag
2014	16,195	5,911,175	3,251,146	591,118	768,453	118,223	88,668	118,223
2015	16,550	6,040,750	3,322,412	604,075	785,298	120,815	90,611	120,815

Consumption and Market Growth Rate of Plastics in 2012

Plastic Type	Consumption (Tons)	Balance	Growth Rate
Polyethylene (PE)	555,000	65% imported	7%
Polyethylene Terephthalate (PET)	220,000	Totally imported	6%
Polypropylene (PP)	440,000	60% imported	7%
Polyvinyl Chloride (PVC)	270,000	70% imported (Resin + compound)	5%
Polystyrene (PS)	110,000	Totally imported	6%

Manshiet Nasser



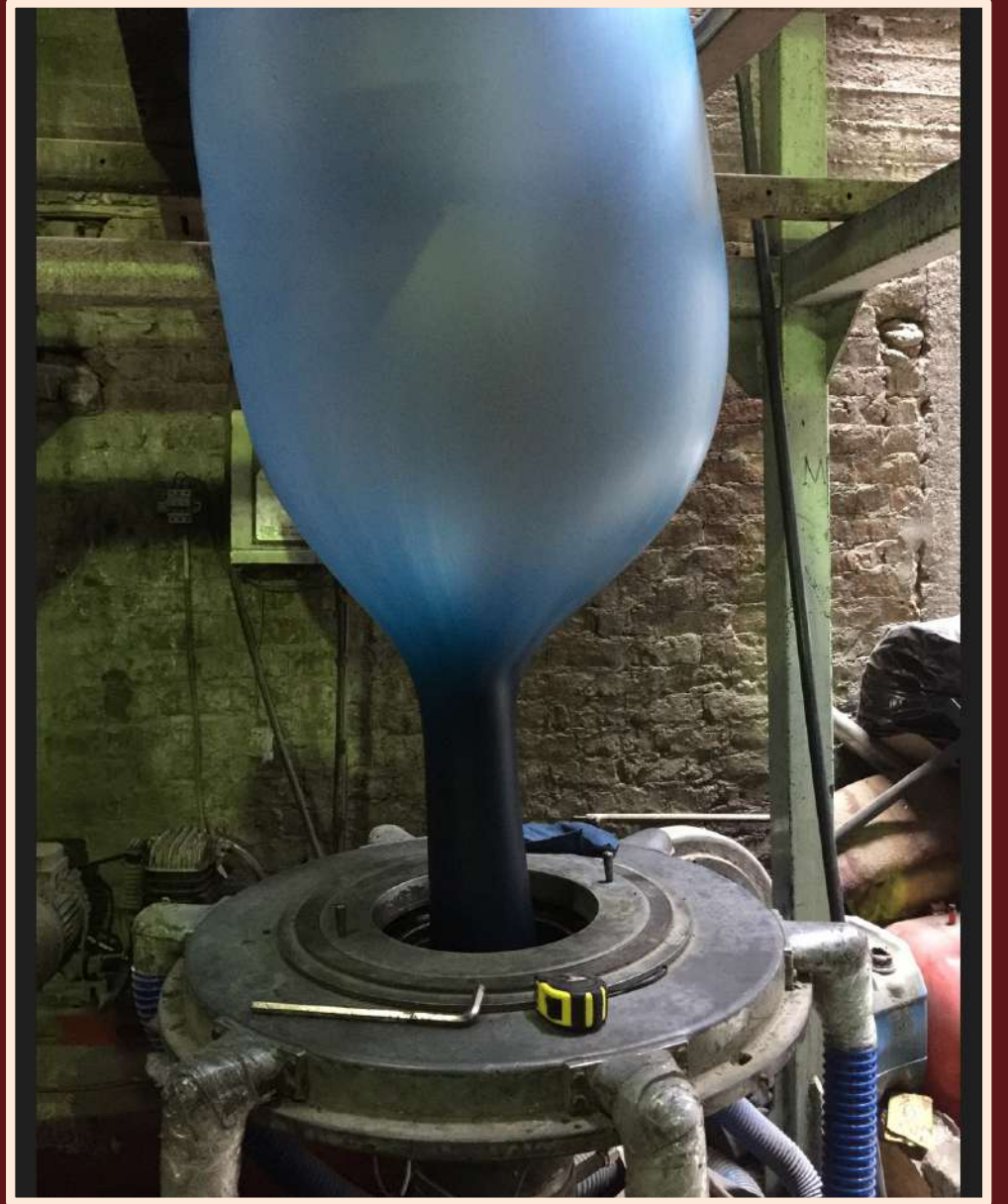
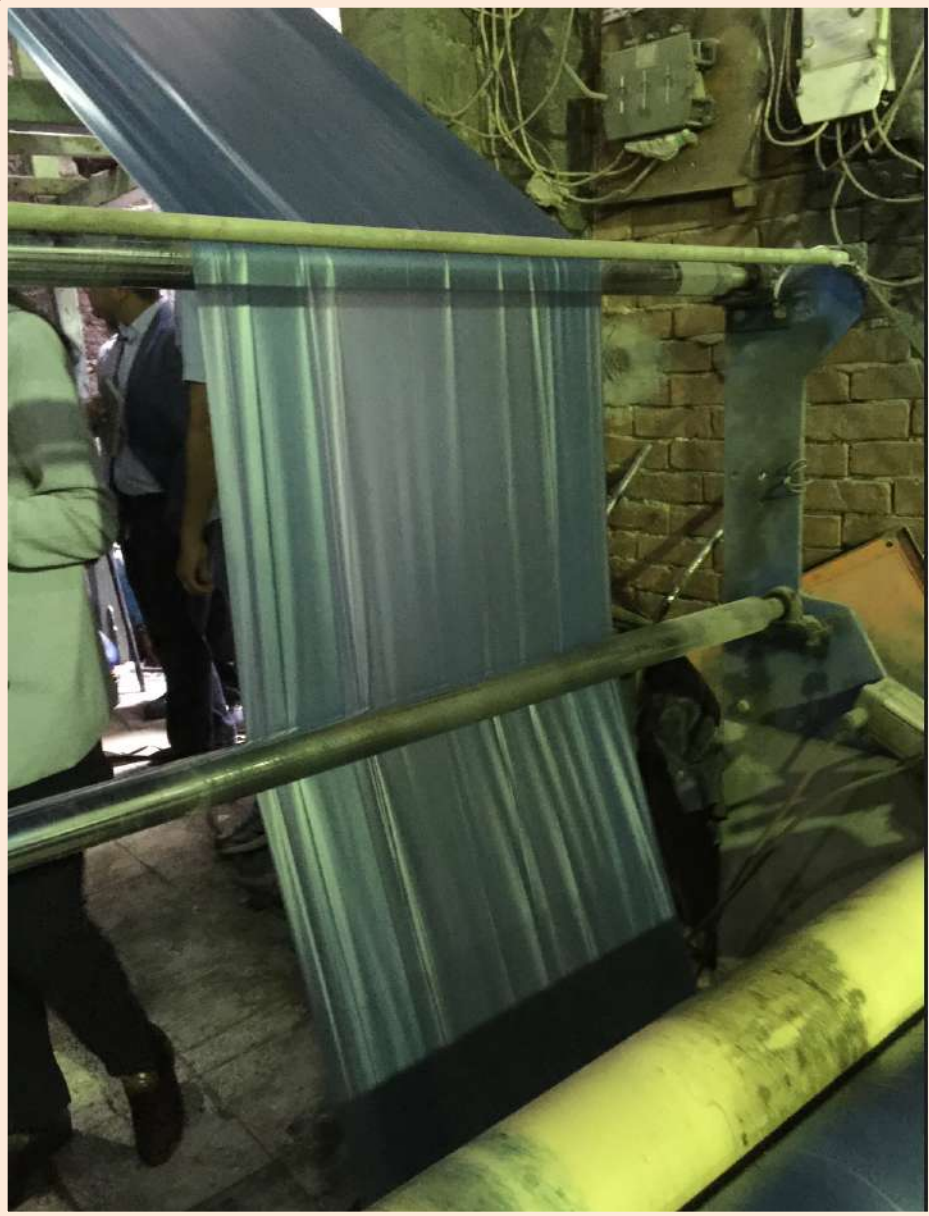
























Mansheit Nasser Recycling Geography

1. Mansheit Nasser district is considered the largest center for plastic waste trading and recycling in Egypt. Moreover, plastic waste (especially polypropylene and polyethylene) is widely recycled in many cities in Egypt;
2. Recovered polyvinyl chloride (PVC) is sold to the recyclers in Besous in Dakahlia Governorate, and Shubra Al kheima in Qaliobiya Governorate , where most of the PVC recycling activities take place. Besous is considered the largest center for recycling rigid PVC in Egypt. Recovered soft PVC is recycled at factories and workshops in Shubra El Kheima in Qaliobiya;
3. Recovered metals are transported mainly to the factories and workshops at Mit Ghamr in Dakahlia Governorate , Mansheit Nasser in Cairo, Arab Abu Saed in Giza and Abu Zaabal in Qaliobia as well as the new industrial cities;
4. Waste paper and cardboard are sold for recycling in the 6th October and 10th of Ramadan industrial cities, in addition to Racta factory in Alexandria;
5. Waste glass is recycled in workshops in Mansheit Nasser, Moharam Bek in Alexandria, and Qaliobiya;
6. Rag grinding workshops exist in Cairo, Qaliobiya, Fayoum, Bani Sweif and Alexandria Governorates . Recycled textile is mostly used as fill material in bed mattresses and sofas in popular areas; and
7. Bones are recycled in Mansheit Nasser and Qaliobiya to produce glue and other products.

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Average Price of Some Recovered Recyclables in Egypt

Recovered Material	2005 Selling Price (EGP/ton)	2016 Selling Price (EGP/ton)
White paper	400	600-1,000
Newspaper	100-150	200-250
Cardboard	150-200	200-400
Mixed plastics	1,200-1,500	2,000-2,500
Low and high density polyethylene plastics	900-1,800	-
Low density polyethylene	-	500
High density polyethylene	-	1,000-1,500
polyethylene terephthalate (PET) bottles	1,500-3,000	2,500-3,000
Glass	210	100
Aluminium	1,200-8,000	6,000
Copper	5,000-5,500	20,000-21,000
Iron	800-1,000	750-1,000
Brass	-	18,000
Rags	100-300	50

Source: Based on market survey conducted by the authors of the EBRD Cairo solid waste feasibility report, 2016