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On behalf of:

Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

of the Federal Republic of Germany

KABADIWALLA CONNECT®

DOWN THE STREAM

A baseline study report to identify hotspots of plastic waste and open drains along the Adyar and Cooum Rivers in Chennai

As a federally owned enterprise, GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.

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Registered offices
Bonn and Eschborn

Circular Economy Solutions Preventing Marine Litter in Ecosystems (CES)
GIZ Office New Delhi
A2/18, Safdarjung Enclave
New Delhi 110 029 India
T: +91 11 4949 5353
F: + 91 11 4949 5391
E: info@giz.de
I: www.giz.de/india

Responsible
Dr Rachna Arora
Team Lead, CES Project, GIZ India
E: rachna.arora@giz.de

Author
Kabadiwala Connect, Chennai

Editors
Rachna Arora, Team Lead, CES Project, GIZ India
Preetha J, Technical Expert, CES Project, GIZ India
Vivek J M, Technical Expert, CES Project, GIZ India

Design and Layout
Nandhini S., Communications Consultant, CES Project, GIZ India

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German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer protection (BMUV)

CONTENTS

1. INTRODUCTION

GIZ India partnered with Kabadiwalla Connect (KC), an award winning waste management services provider based in Chennai, to undertake a baseline study which identifies hotspots of plastic waste and open drains along the streams of the Adyar and Cooum rivers. The study is carried out under the Indo-German development cooperation project 'Circular Economy Solutions Preventing Marine Litter in Ecosystems (CES)' that Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH implements on behalf of the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) in close cooperation with the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India. The project aims at demonstrating technological solutions in riverine and marine ecosystems to close material cycles of marine litter in the states of Kerala, Tamil Nadu and Uttar Pradesh. Under the CES project, GIZ India is supporting the Department, Climate Change and Forest (DoECCF), Tamil Nadu and the Green Climate Company (TNGCC), Government of Tamil Nadu on initiatives aimed at creating awareness on the ban on single-use plastics and providing alternative solutions to stakeholders in the plastic value chain.

The company, Kabadiwalla Connect was contracted to study the underlying causes of the plastic leakage along the streams of Adyar and Cooum and propose remedial measures in consultation with all major stakeholders. During the initial inception meeting, it was further communicated to focus on the specific areas of the Koyambedu bus stand, Koyambedu vegetable market and the Pattinapakkam fish market in Chennai and develop process flows that depict the movement of waste at these sites. In this final baseline study, a summary of primary data collected is provided. A data analysis section provides a Waste Flow Diagram (WFD) that depicts the recovery rate and leakage of plastic through the formal and informal waste collection system in wards surrounding the Adyar and Cooum rivers. The WFD is based on primary data collected in 15 wards along the Adyar and Cooum rivers, and a detailed breakdown of ward wise infrastructure. The final section of the data analysis considers the potential of the informal sector to collect more plastic waste generated from municipal neighborhoods, especially post-consumer Polypropylene (PP), Polyethylene (PE) and low value Multi-layers Plastics (MLP) which would help reduce the amount of mismanaged plastic waste entering the marine environment in Chennai.

The next section of the report provides details of a plastic hotspot mapping exercise conducted around the Adyar and Cooum rivers, as well as information regarding major producers of plastic waste found at these sites, estimated through transect analysis. The penultimate section of the report describes the waste material flows in the three sites of interest and then concludes by highlighting major issues that contribute to marine plastic leakage into the Adyar and Cooum rivers in Chennai, and potential solutions for redressal.

2. SUMMARY OF WORK COMPLETED

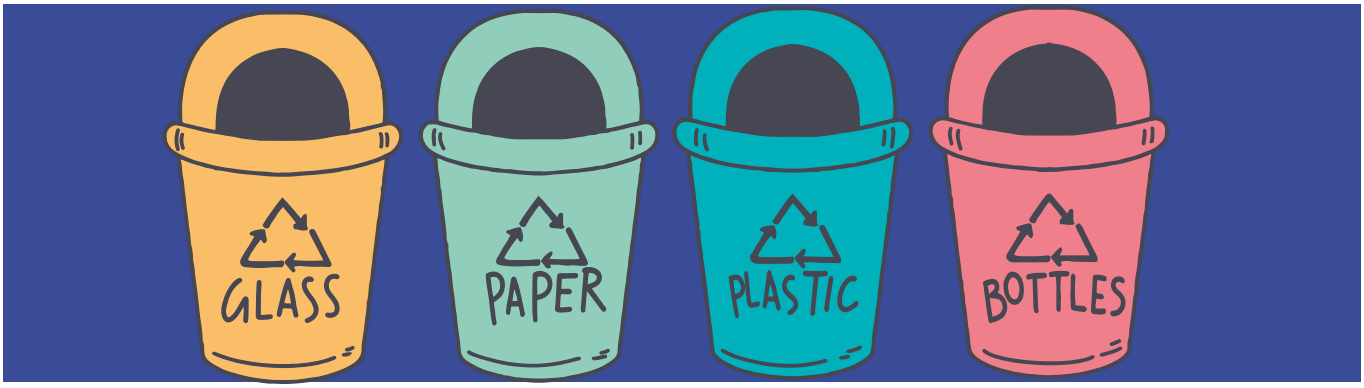
Primary surveys completed at the time of submission of this final report are provided in Table 1.

While in the inception report it was contended that the company could collect formal and informal data from all the 66 wards identified along the Adyar and Cooum river, due to constraints in time, it reduced the scope of data collection to 15 out of the 66 wards.

The wards where primary data was collected is presented in Map 1.

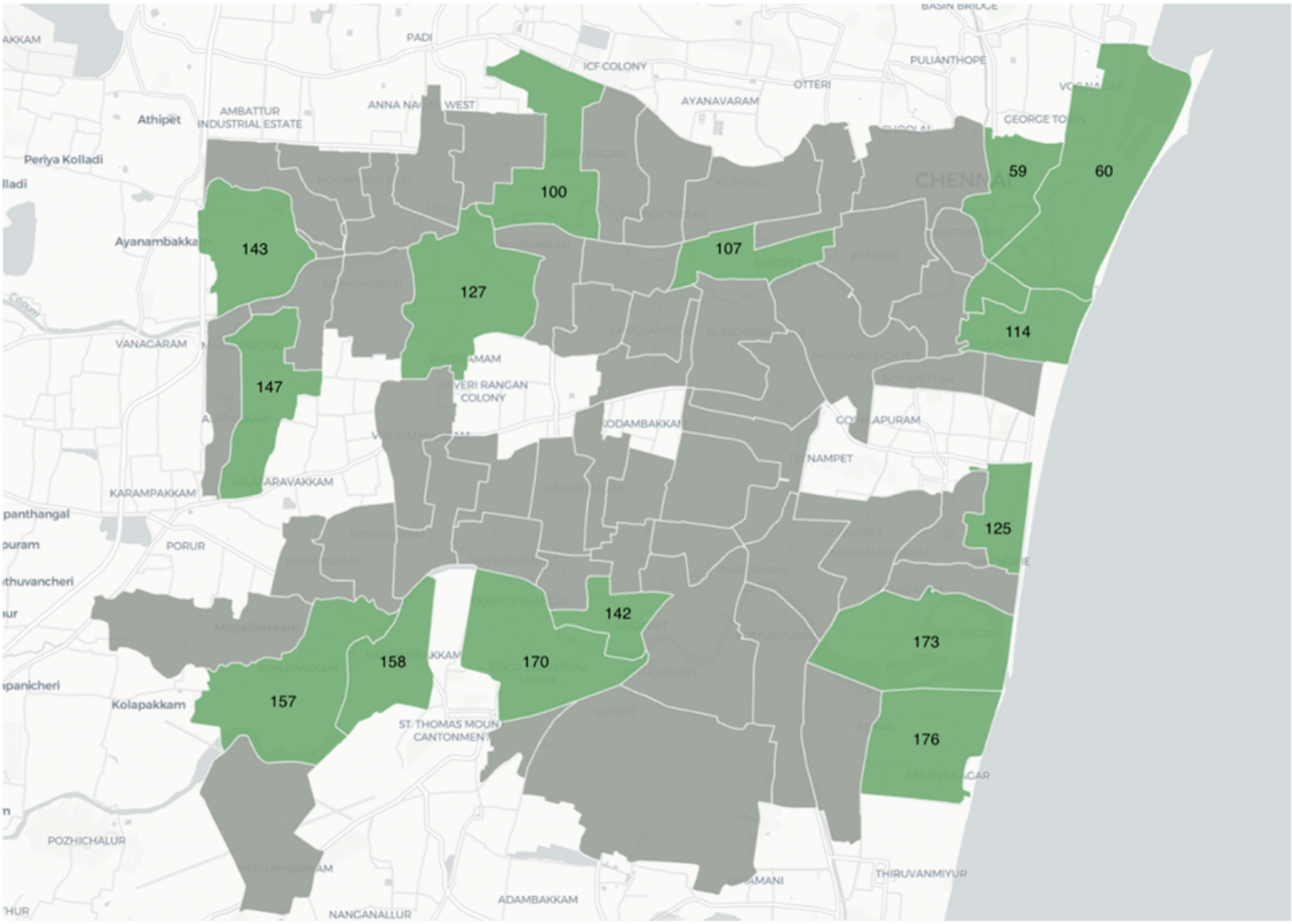
Table 1: Survey list and major locations sampled.

Location	Survey	Survey Target	Survey Progress
Adyar and Cooum River banks in the Chennai Metropolitan Area	Plastic Hotspot Mapping	100-200 hotspots estimated	214
Ward 125 and Ward 127	Transect Mapping for large hotspots identified in ward boundaries	10-20 hotspots estimated	6
	Stakeholder interviews to identify major causes of waste hotspots	10-20 stakeholder interviews estimated	0
	Stakeholder interviews to identify waste generation characteristics and collection practices in three sites of interest	10-20 stakeholder interviews estimated	6
	Waste-picker survey	30-50 stakeholder interviews estimated	31
	Level 1 Aggregator Survey (Kabadiwalla shops)	20 stakeholder interviews estimated	34
	Level 2 Aggregator Surveys (large informal aggregators)	5 stakeholder interviews estimated	3
	Microcomposting Centres	2 data points estimated	3



Location	Survey	Survey Target	Survey Progress
Ward 125 and Ward 127	Ward Offices	2 data points estimated	2
	Resource Recovery Centres	2 data points estimated	3
	Material Recovery Centres	2 data points estimated	1
	Transfer Stations	2 data points estimated	1
Wards identified along Adyar and Cooum Rivers (15 wards sampled)	Resource Recovery Centres	15 data points estimated	4
	Material Recovery Facilities	15 data points estimated	3
	Transfer Stations	15 data points estimated	2
	Segregation Sheds	-	7
	Microcomposting Centres	-	15
	Level 1 Aggregator Survey (Kabadiwalla shops)	15 data points estimated	110
	Level 2 Aggregator Surveys (large informal aggregators)	-	0

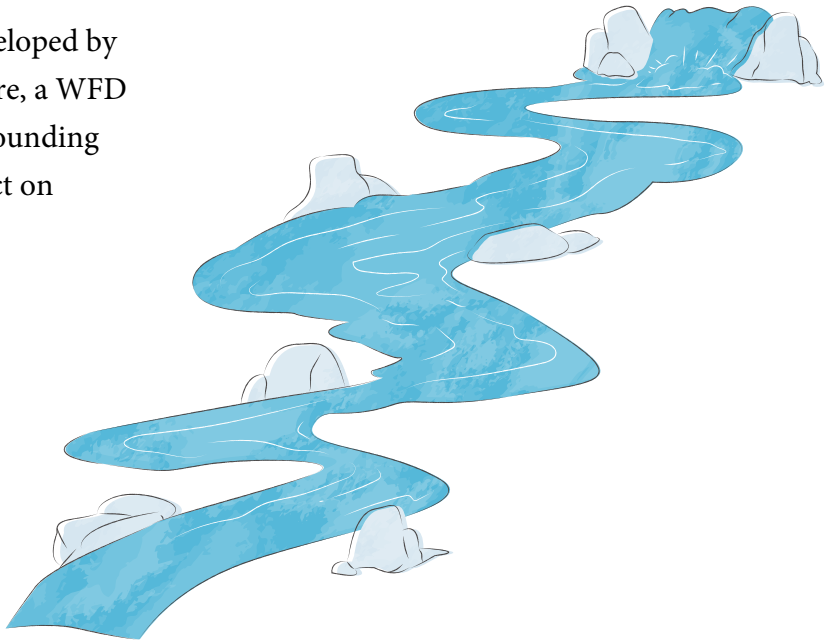
3. DATA ANALYSIS



Map 1: Wards where primary data collection was undertaken
(Source: Compiled by Kabadiwalla Connect using QGIS)

4.WASTE FLOW DIAGRAM

Based on the Waste Flow Diagram (WFD) tool developed by GIZ, the University of Leeds, Eawag and Wasteaware, a WFD and a sankey map was generated for 66 wards surrounding the Adyar and Cooum rivers to determine its impact on plastic leakage into the Adyar and Cooum Rivers.



Plastic collection and leakage data were collected via primary surveys in 15 wards mentioned in Map 1 and extrapolated for the 66 wards to arrive at the overall volumes.

In total it was estimated that:

744,411 tonnes of Municipal Solid Waste (MSW) was generated every year in these wards.

267,961 tonnes were unmanaged (~ 36%)

168,070 tonnes were sorted for recovery (~23%)

308,379 tonnes were retained at disposal sites (~41%)

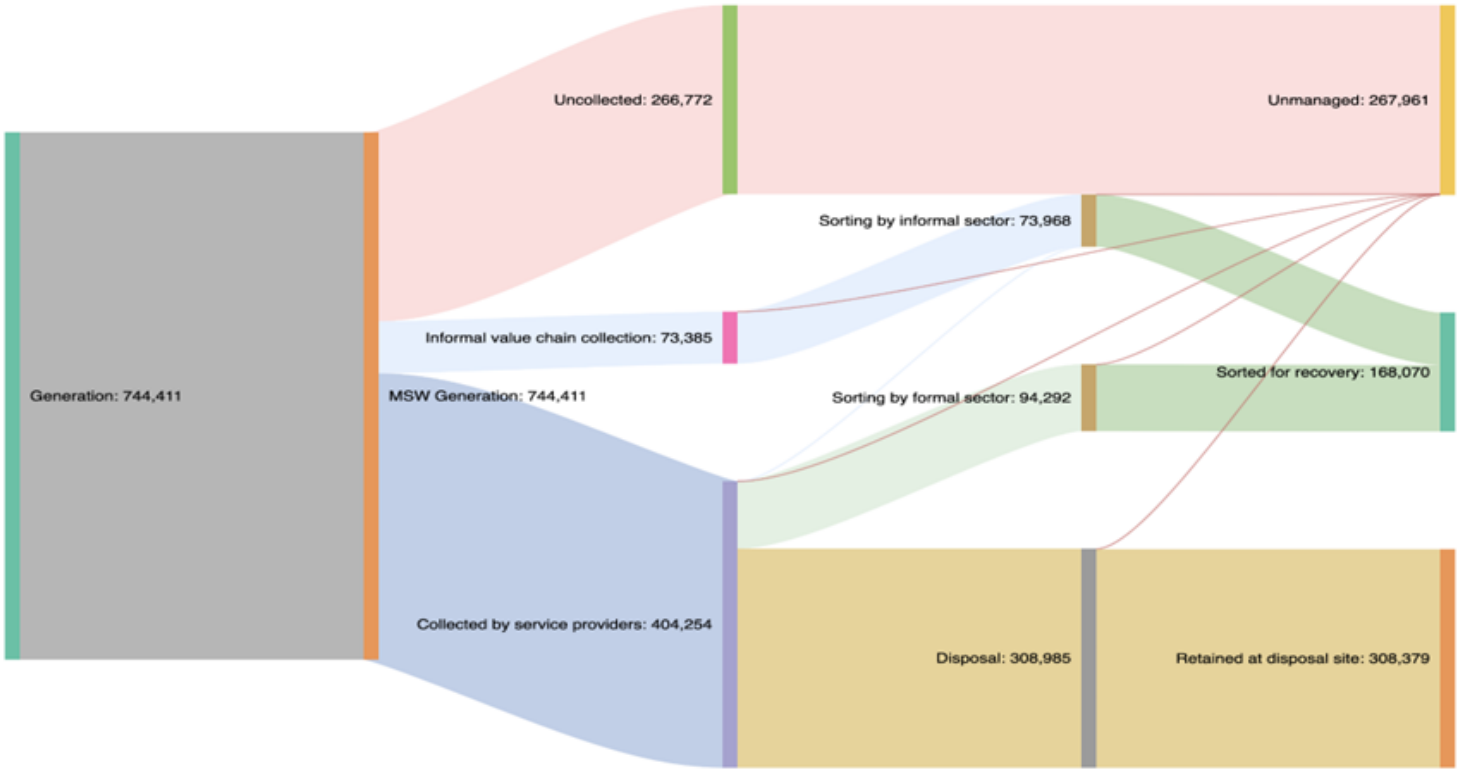


Image 1: Sankey map showing MSW generation and end destinations in wards of interest

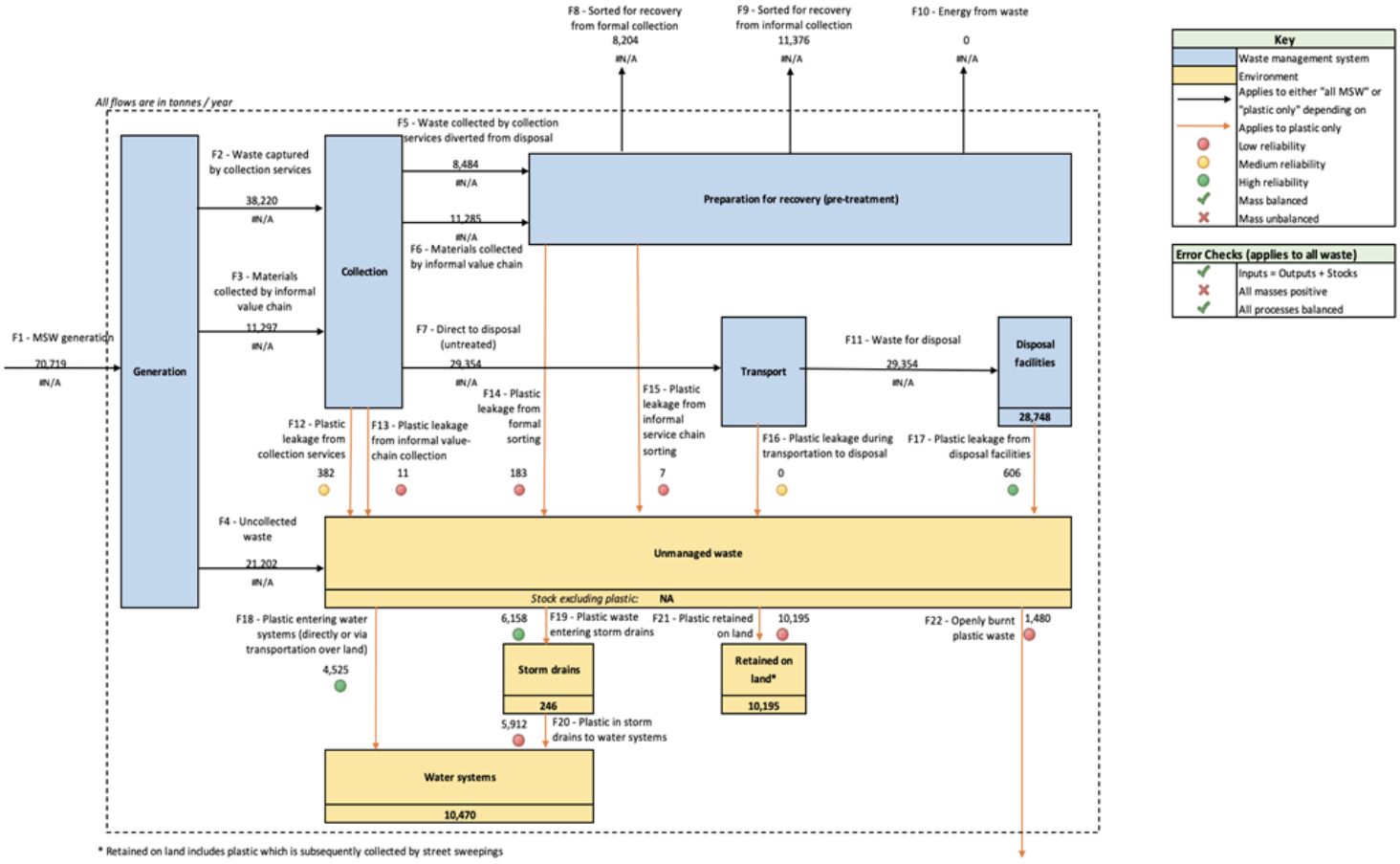


Image 2: Waste flow diagram of plastic generation and final destinations in wards of interest

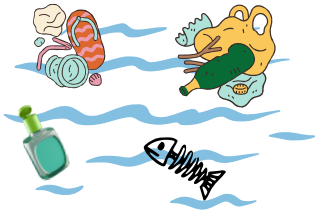
Based on the Waste Flow Diagram tool, it was estimated that the total plastic waste generated every year in the 66 wards surrounding the Adyar and Cooum rivers was around 70,719 tonnes annually.

Of the waste generated, 38,220 tonnes were collected by the formal system (~54%) while the informal system of waste-pickers and scrap-shops were responsible for the collection of 11,297 tonnes annually (~16%). This meant that around 21,202 tonnes of plastic waste every year was left unmanaged, and combined with another 1,189 tonnes estimated to be leaked during formal and informal collection the total plastic leakage from these wards into the Adyar and Cooum rivers was found to be 22,391 tonnes annually (~32%).

Of the total leakage, the model estimates that around 10,470 tonnes of plastic waste leaked into the water systems (~47%), 10,195 tonnes are retained on land (~46%), 246 tonnes were leaked into storm drains (~1%) and 1,480 tons were openly burnt (~6%).

For more details, refer to Image 2.

70,719 tonnes of plastic waste generated every year in the Adyar and Cooum rivers.



Annually, 22,391 tonnes of waste is unmanaged and leaked during formal and informal collection.

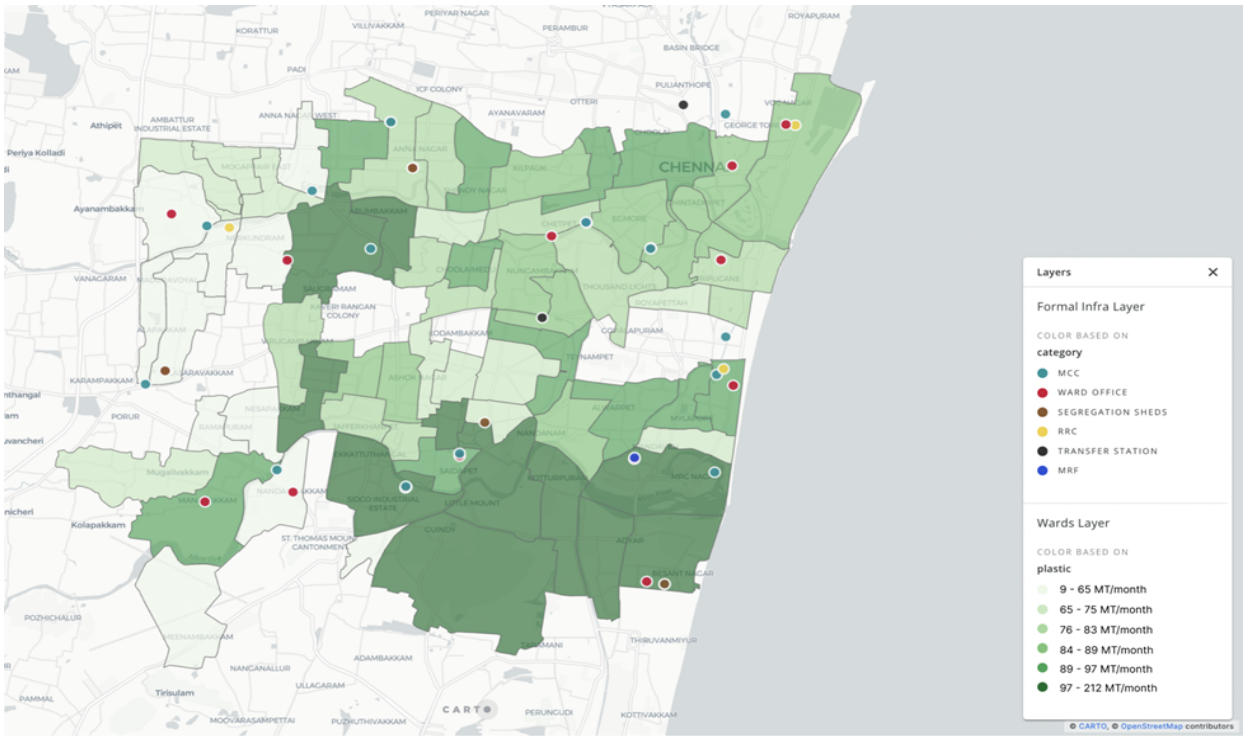
5. PRIMARY DATA COLLECTION

The data inputted into the waste flow model was based on primary data collection in15 wards sampled from the 66 wards of interest surrounding the Adyar and Cooum rivers. The wards sampled were 59, 60, 100, 107, 114, 125, 127, 142, 143, 147, 157, 158, 170, 173 and 176 (refer map 1). Data on formal infrastructure available for the collection and storage of waste as well as informal activity was captured through surveys deployed on smartphones by the KC team. A total of 225 data points were collected on micro-composting centers, ward offices, resource recovery centers, material recovery facilities, transfer stations, segregation sheds, retail oriented scrap-shops (Level 1 aggregators) and large informal material recovery facilities (Level 2 aggregators). Apart from these data points a further 218 plastic hotspots were identified and mapped along the Adyar and Cooum river and 10 transect walks were conducted to identify major brands associated with plastic leakage.

10 transect walks conducted to identify major brands associated with plastic leakage.

218 plastic hotspots identified and mapped along the Adyar and Cooum Rivers

In this section, data on formal infrastructure is presented, followed by summaries on informal activity. Map 2 presents the locations of formal sites available for waste storage and handling in the sampled wards. Table 2 presents summaries of reported waste handling per ward by municipal officials.



Map 2: Locations and inventory of formal infrastructure available in sampled wards
(Source: Compiled by Kabadiwalla Connect using QGIS)

© Kabadiwalla Connect

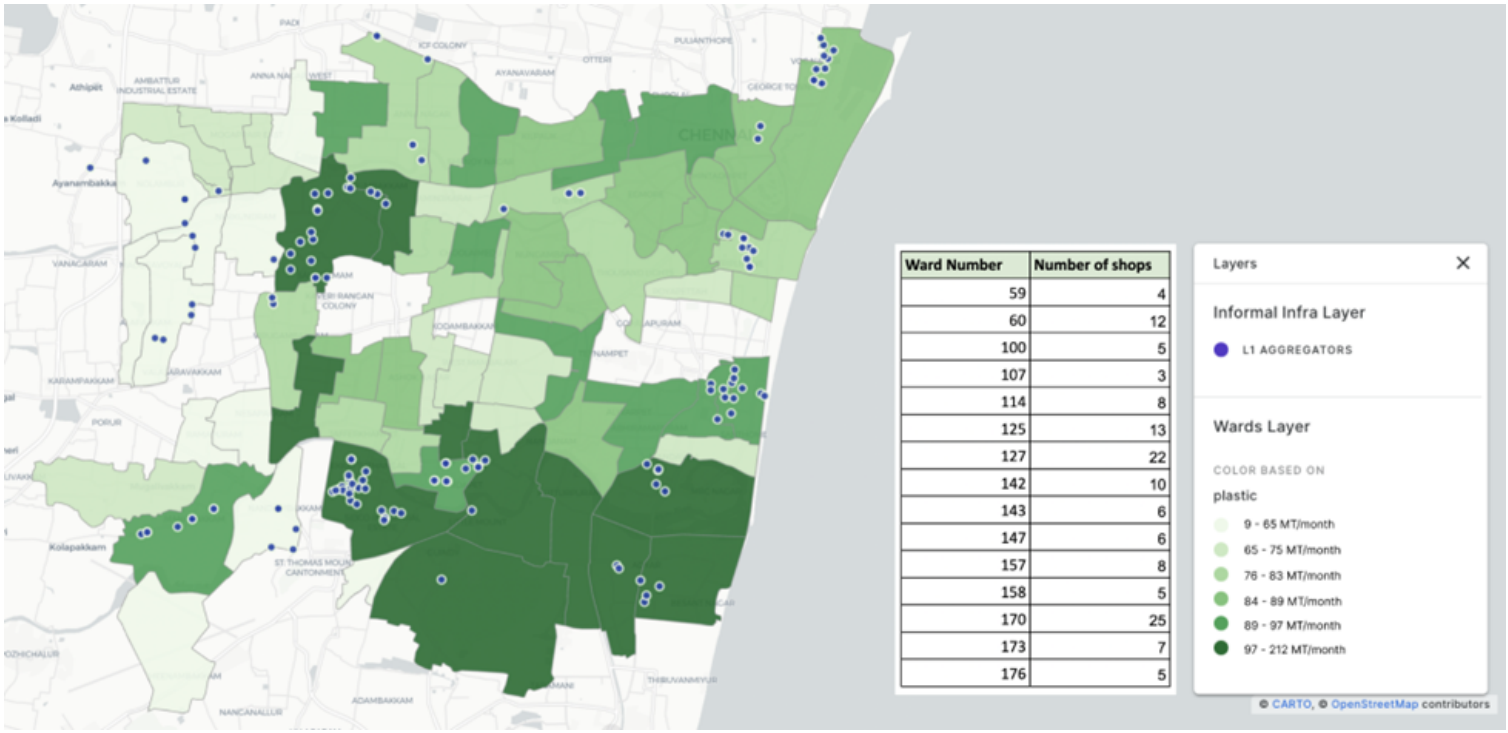
Wards	Waste Collection Reported (TPM)	Collection Vehicles (door-to-door)	MCC	MRF	Segregation Shed	RRC	RRC	Transfer Station
59	450.00	13	1	0	1	0	1	0
60	600.00	10	1	0	0	1	1	0
100	1110.00	37	1	0	1	0	1	0
107	600.00	23	1	1	0	0	1	0
114	960.00	32	1	0	1	0	1	0
125	285.00	28	1	1	0	0	1	0
127	330.00	35	2	0	0	1	1	0
142	300.00	32	1	0	1	0	1	0
143	510.00	12	1	0	0	1	1	0
147	360.00	25	1	0	1	0	1	0
157	105.00	10	0	0	0	0	1	0
158	300.00	10	1	0	0	0	1	0
170	360.00	31	1	0	1	0	1	0
173	960.00	24	1	1	0	0	1	0
176	300.00	29	1	0	1	0	1	0
Total	7530.00	351	15	3	7	3	15	0

© Kabadiwalla Connect

Table 2: Waste collection reported by formal sector in sampled wards.

Wards	Waste Generation (estimated in TPM)	Waste Collection (reported in TPM)*	Total Amount of Mismanaged Waste (TPM)	Total Amount of Mismanaged Plastics (in TPM)	Wet Waste Recovered by Formal Sector (in TPM)	Dry Waste Recovered by Formal Sector (in TPM)	Mixed waste handled by formal sector (sent to landfill)
59	921.9	450.00	471.9	44.8	97.5	18.0	334.5
60	891.3	600.00	291.3	22.7	150.0	15.0	435.0
100	852.4	1110.00	-	-	180.0	30.0	900.0
107	813.8	600.00	213.8	20.3	45.0	15.0	540.0
114	875.8	960.00	-	-	60.0	60.0	840.0
125	953.0	285.00	668.0	63.5	112.5	28.5	144.0
127	1043.7	330.00	713.7	67.8	120.0	28.5	181.5
142	937.6	300.00	637.6	60.6	90.0	30.0	180.0
143	518.1	510.00	8.1	0.8	127.5	27.0	355.5
147	667.3	360.00	307.3	29.2	127.5	27.0	205.5
157	947.5	105.00	842.5	80.0	0.0	0.0	105.0
158	349.3	300.00	49.3	4.7	105.0	24.0	171.0
170	1523.2	360.00	1163.2	110.5	75.0	30.0	255.0
173	2030.4	960.00	1070.4	101.7	45.0	15.0	900.0
176	1606.9	300.00	1306.9	124.2	60.0	15.0	225.0
Total	**14932.3**	**7530.00**	**7744.0**	**735.7**	**1395.0**	**363.0**	**5772.0**

A total of 139 scrap-shops were identified in the sampled wards who, on an average, were responsible for the collection of about 215 tonnes of post-consumer plastic waste every month (refer Map 3). The highest recovery rate of the informal sector was observed to be in wards 127 and 125 with a recovery rate of 57% and 42% respectively. It is important to note that given the amount of space available at each shop we estimate that a lot more material could be potentially handled by this sector, the storage capacity of the informal sector estimated for each ward is presented in Table 3.



Map 3: Locations and number of informal scrap-shops enumerated in sampled wards.
(Source: Compiled by Kabadiwalla Connect using QGIS)

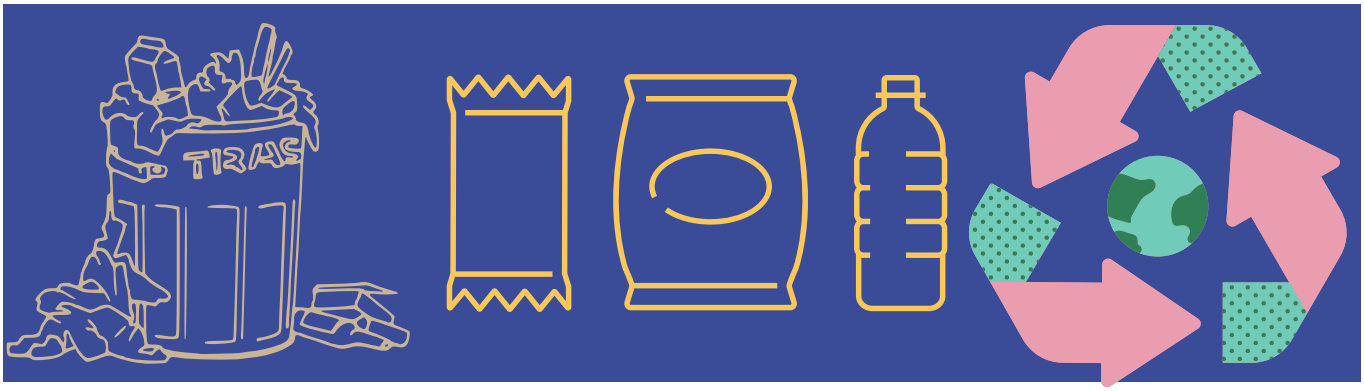


Table 3: Plastic recovery and estimated capacity of informal scrap shops in sampled wards

Ward Number	Plastic Waste Generation (in TPM)	Informal Plastic Recovery (in TPM)	Recycling %	Estimated Capacity (in TPM)
59	87.6	13.3	15.15%	234
60	84.7	12.8	15.15%	703
100	81.0	11.1	13.71%	293
107	77.3	11.7	15.15%	176
114	83.2	4.2	5.05%	469
125	90.5	38.8	42.86%	762
127	99.2	56.6	57.08%	1,289
142	89.1	13.5	15.15%	586
143	49.2	3.6	7.31%	352
147	63.4	11.3	17.82%	352
157	90.0	8	8.89%	469
158	33.2	2.8	8.44%	293
170	144.7	21.9	15.15%	1,465
173	192.9	3.5	1.81%	410
176	152.7	1.8	1.18%	293
Total	**1418.6**	**214.9**	**15.99%**	**8,144**

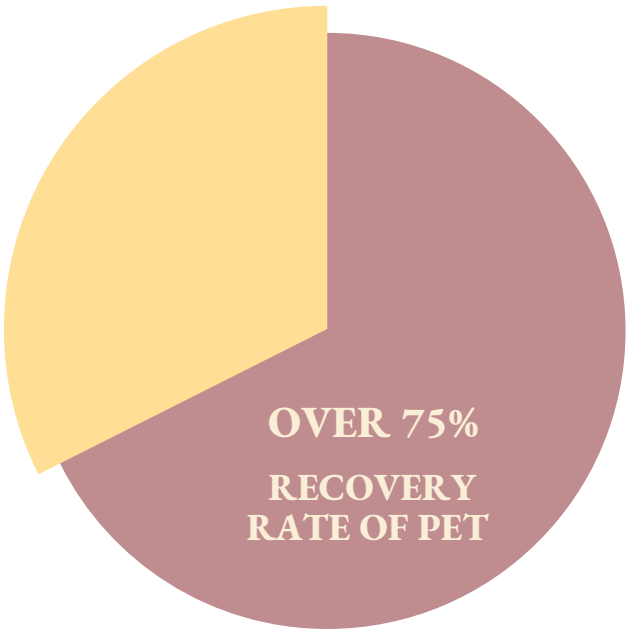
6. POTENTIAL OF INFORMAL SECTOR IN PLASTIC WASTE MANAGEMENT

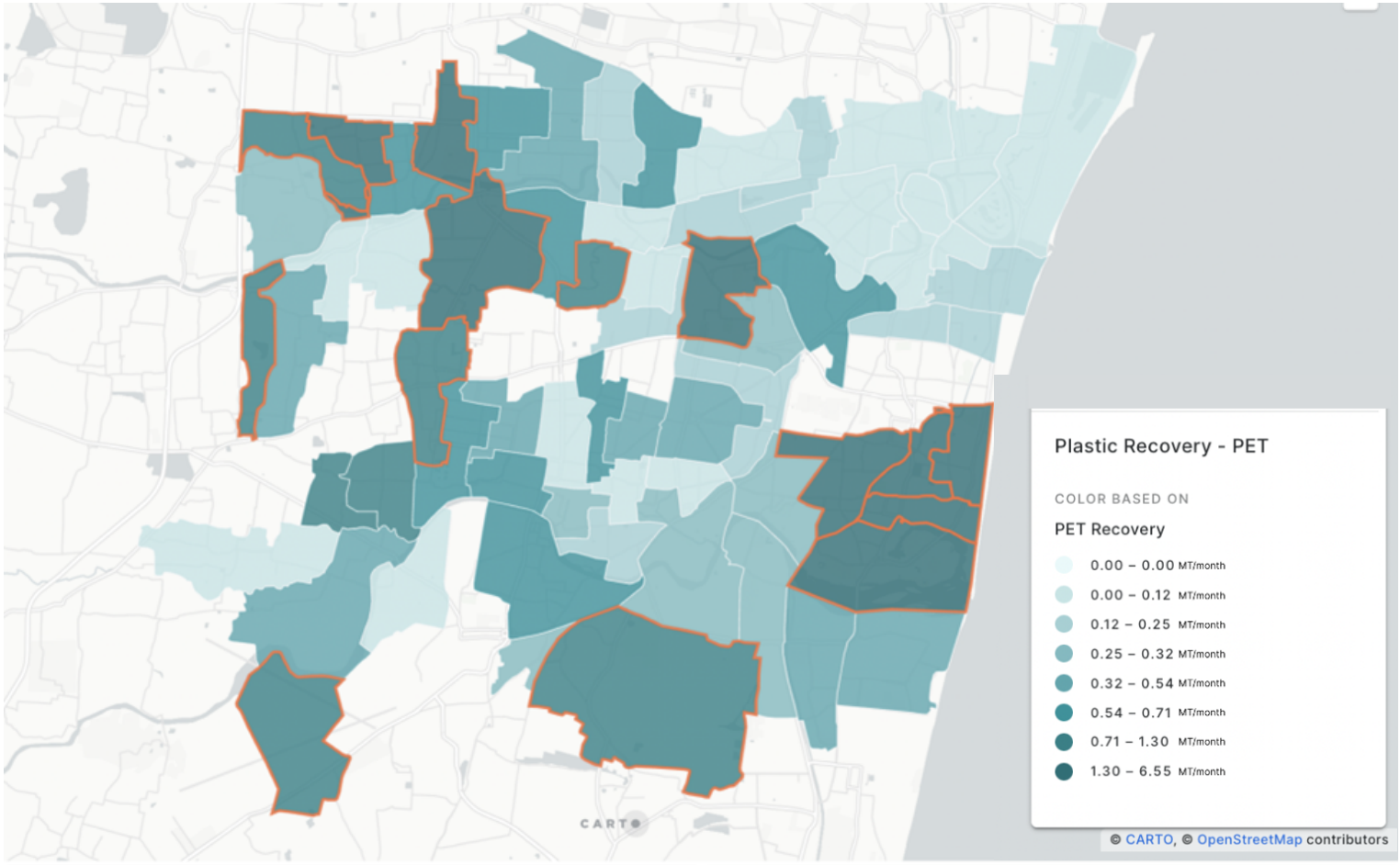
Given the space available for additional handling of materials, and the fact that all volumes collected by this sector are prioritised for recycling (the formal sector), there is an unique opportunity for the Chennai municipality to leverage this supply-chain in the additional collection of plastic materials which would prevent it from entering the waterways or being retained on land.

PET for example, which is supported by the presence of large formal processors in India, sees a very high collection rate in the city. In wards highlighted in Map 4 we see a recovery rate of over 75% of PET when compared to what is generated within its administrative boundary by the local population.

However, when considering PP/PE and MLP, there is much scope for improvement in the collection of these materials by the informal sector, which isn't happening at the moment due to the absence of established processors and back integration with the informal supply chain.

Maps 5 and 6 illustrates this issue, with regards to MLP, very low volumes are collected through this supply chain.





Map 4: PET generation and recovery in wards of interest
(Source: Compiled by Kabadiwalla Connect using QGIS)

Wards across Adyar River

Ward No.	PET Generated (TPM)	PET Collected (TPM)	Ward No.	PET Generated (TPM)	PET Collected (TPM)
171	8.7	2.3	132	3.5	0.4
174	8.0	9.3	122	3.4	1.1
173	7.9	12.5	138	3.4	1.8
172	7.5	2.1	128	3.4	2.7
175	7.2	2.8	139	3.3	0.9
176	6.3	2.0	126	3.1	5.7
170	5.9	3.2	135	3.1	1.1
140	4.4	0.0	136	3.0	1.0
137	4.1	2.6	133	2.9	1.8
117	3.9	0.6	141	2.8	0.1
123	3.8	24.8	156	2.7	0.2
125	3.7	12.8	155	2.4	1.7
157	3.7	1.3	154	2.2	1.6
124	3.7	9.4	160	1.4	0.4
142	3.7	0.8	158	1.4	0.0
131	3.5	1.5	159	0.4	0.4

Total PET waste generation = 128.2 MT/month

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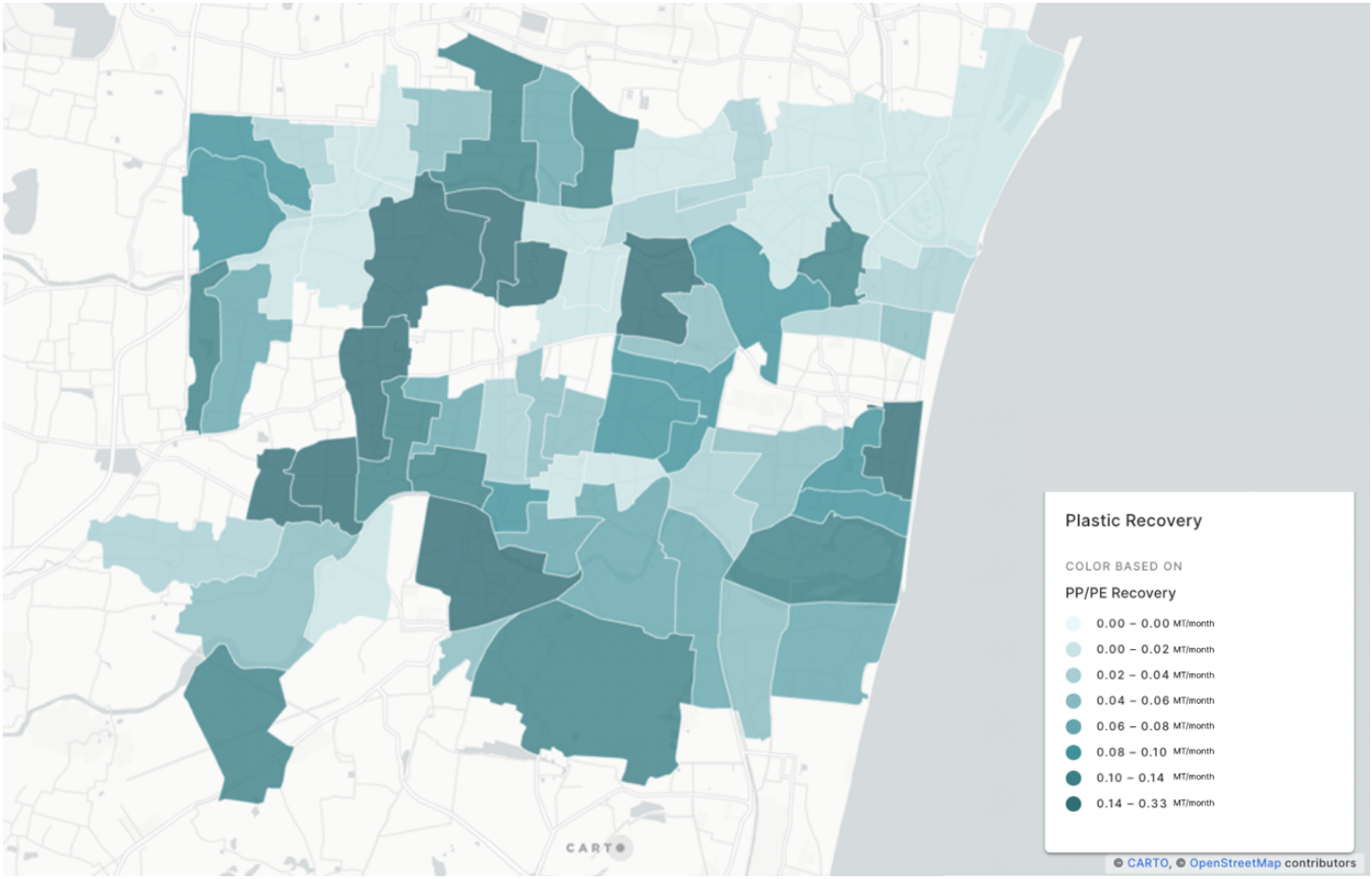
Wards across Cooum River

Ward No.	PET Generated (TPM)	PET Collected (TPM)	Ward No.	PET Generated (TPM)	PET Collected (TPM)
105	4.3	2.4	111	3.3	1.8
127	4.1	6.5	100	3.3	1.2
99	4.0	2.3	108	3.2	2.7
102	3.9	2.6	107	3.2	0.6
104	3.8	0.6	112	3.1	0.6
58	3.8	0.3	101	3.1	0.7
109	3.8	0.0	106	3.0	0.0
110	3.6	6.4	115	3.0	0.3
59	3.6	0.0	93	2.8	1.5
62	3.6	0.0	91	2.7	3.2
61	3.5	0.0	92	2.7	3.5
63	3.5	0.0	146	2.6	2.3
103	3.5	0.0	90	2.6	4.9
60	3.5	0.0	147	2.6	0.9
113	3.5	1.0	145	2.6	0.0
114	3.4	0.4	143	2.0	0.6
116	3.4	0.8	144	1.7	0.0

Total PET waste generation = 110.2 MT/month



Map 5: PP/PE generation and recovery in wards of interest.
(Source: Compiled by Kabadiwalla Connect using QGIS)

Wards across Adyar River

Ward No.	PP/PE Generated (TPM)	PP/PE Collected (TPM)	Ward No.	PP/PE Generated (TPM)	PP/PE Collected (TPM)
171	156.4	11.7	132	62.8	1.0
174	143.6	18.2	122	61.8	2.0
173	142.6	18.6	138	61.6	7.6
172	134.6	7.8	128	61.3	11.2
175	129.4	5.3	139	59.8	5.2
176	112.8	6.9	126	55.6	4.6
170	107.0	19.7	135	55.1	2.8
140	79.3	0.0	136	54.5	4.8
137	74.4	8.4	133	52.1	2.7
117	70.2	5.9	141	51.2	0.4
123	68.3	3.3	156	48.6	0.8
125	66.9	20.9	155	42.5	5.8
157	66.5	2.9	154	39.6	5.7
124	65.9	5.2	160	25.8	1.0
142	65.8	4.2	158	24.5	0.0
131	63.4	3.8	159	6.6	0.8

Total PP/PE waste generation = 2310.6 MT/month

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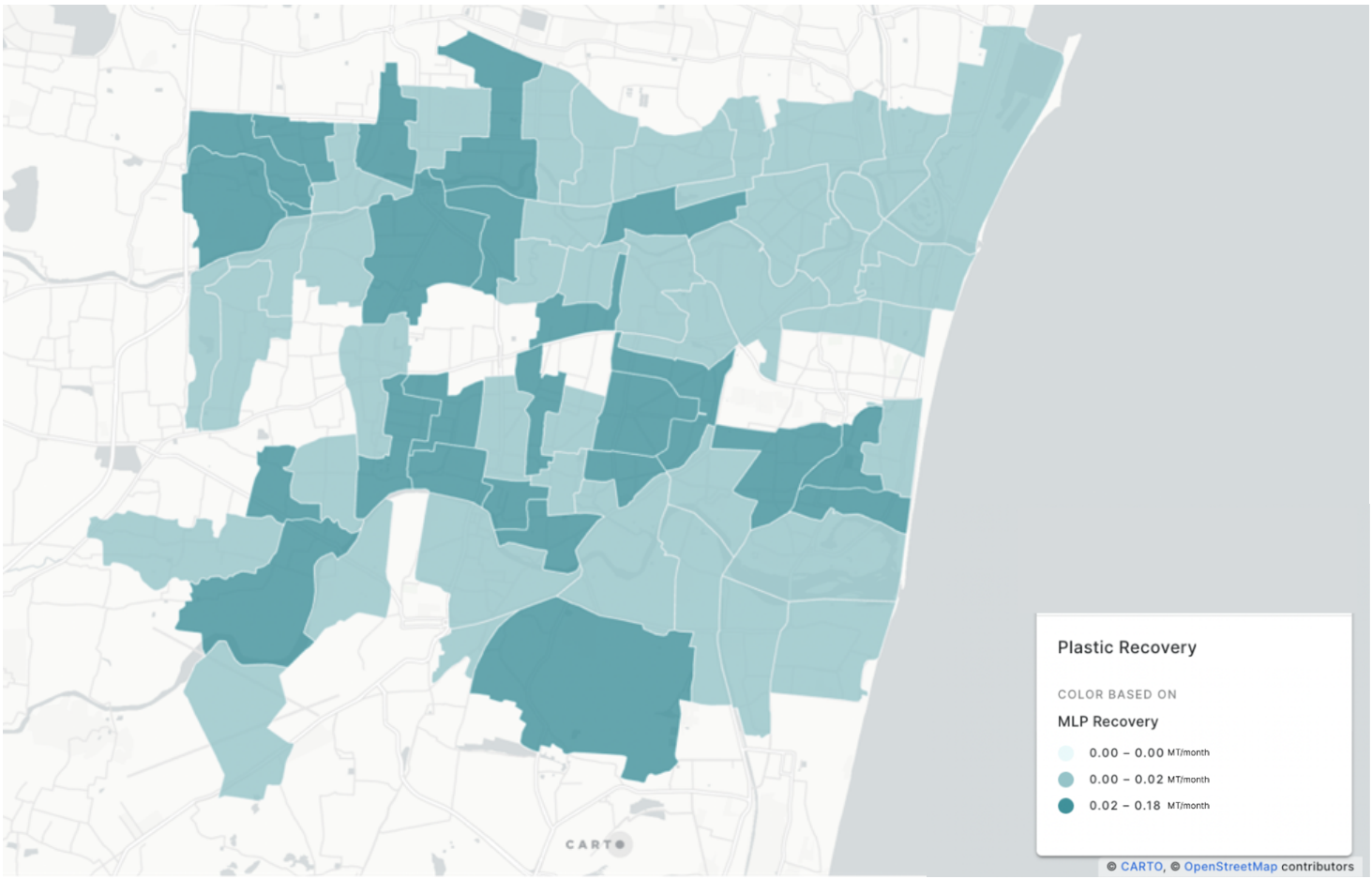
Wards across Cooum River

Ward No.	PP/PE Generated (TPM)	PP/PE Collected (TPM)	Ward No.	PP/PE Generated (TPM)	PP/PE Collected (TPM)
105	76.6	11.5	111	60.2	5.6
127	73.3	24.4	100	59.9	5.8
99	71.3	3.6	108	58.3	10.3
102	69.8	6.8	107	57.1	1.0
104	69.1	2.4	112	56.3	0.0
58	69.0	0.8	101	56.0	3.4
109	68.2	0.0	106	54.4	0.3
110	65.7	13.2	115	53.2	0.8
59	64.7	0.0	93	50.3	0.0
62	64.7	0.0	91	49.5	3.8
61	63.3	0.0	92	48.1	0.8
63	62.8	7.8	146	47.1	4.7
103	62.7	0.0	90	47.0	0.0
60	62.6	0.0	147	46.9	2.8
113	62.4	2.6	145	46.1	0.0
114	61.5	1.2	143	36.4	3.2
116	60.7	2.4	144	30.8	0.0

Total PP/PE waste generation = 1986 MT/month



Map 6: MLP generation and recovery in wards of interest
(Source: Compiled by Kabadiwalla Connect using QGIS)

Wards across Adyar River

Ward No.	MLP Generated (TPM)	MLP Collected (TPM)	Ward No.	MLP Generated (TPM)	MLP Collected (TPM)
171	33.9	0.1	132	13.6	0.0
174	31.1	0.7	122	13.4	0.0
173	30.9	0.0	138	13.3	0.7
172	29.1	0.0	128	13.3	0.2
175	28.0	0.0	139	13.0	0.7
176	24.4	0.0	126	12.0	0.3
170	23.2	0.1	135	11.9	0.2
140	17.2	0.0	136	11.8	0.3
137	16.1	0.7	133	11.3	0.3
117	15.2	0.4	141	11.1	0.2
123	14.8	0.4	156	10.5	0.0
125	14.5	0.0	155	9.2	0.0
157	14.4	0.3	154	8.6	0.4
124	14.3	0.3	160	5.6	0.0
142	14.3	0.9	158	5.3	0.0
131	13.7	0.3	159	1.4	0.0

Total MLP waste generation = 500.1 MT/month

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Wards across Cooum River

Ward No.	MLP Generated (TPM)	MLP Collected (TPM)	Ward No.	MLP Generated (TPM)	MLP Collected (TPM)
105	16.6	1.0	111	13.0	0.0
127	15.9	1.3	100	13.0	0.4
99	15.4	0.1	108	12.6	0.1
102	15.1	0.0	107	12.4	0.4
104	15.0	0.0	112	12.2	0.4
58	14.9	0.0	101	12.1	0.1
109	14.8	0.0	106	11.8	0.0
110	14.2	0.1	115	11.5	0.0
59	14.0	0.0	93	10.9	0.0
62	14.0	0.0	91	10.7	0.5
61	13.7	0.0	92	10.4	1.5
63	13.6	0.0	146	10.2	0.0
103	13.6	0.0	90	10.2	1.8
60	13.5	0.0	147	10.1	0.0
113	13.5	0.0	145	10.0	0.0
114	13.3	0.0	143	7.9	0.4
116	13.1	0.0	144	6.7	0.0

Total MLP waste generation = 429.9 MT/month

7. PLASTIC HOTSPOT MAPPING IN ADYAR AND COOUM RIVERS

This section provides more information on the plastic hotspot mapping activities conducted on the banks of the Adyar and Cooum rivers during the project period. A total of 218 hotspots were mapped and identified out of which 126 were found to have significant amounts of plastic waste.

In the methodology defined by KC, hotspots were mapped according to its length and 45 locations were identified with length of over 10 meters. Refer to Map 7 for the locations of identified plastic waste hotspots.

HOTSPOT MAPPING SUMMARY

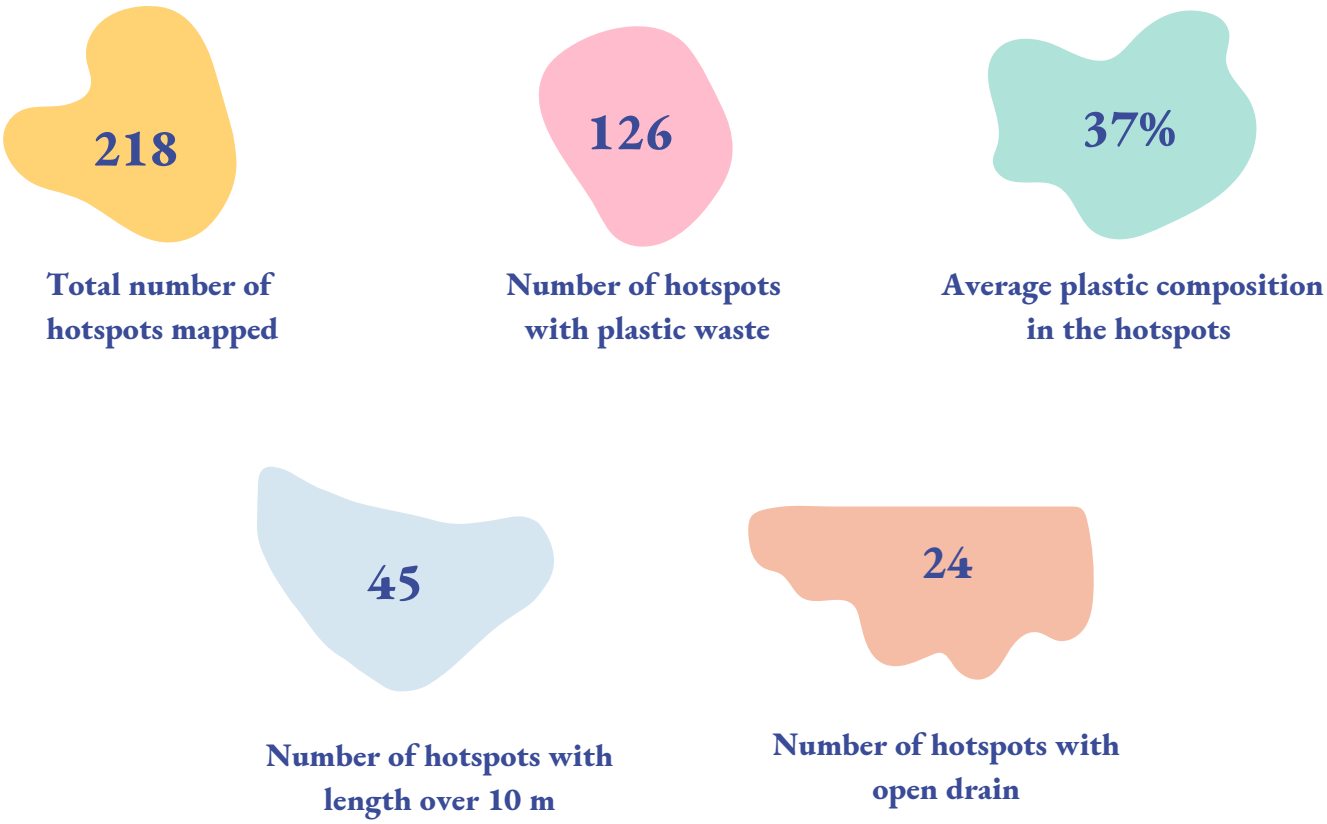
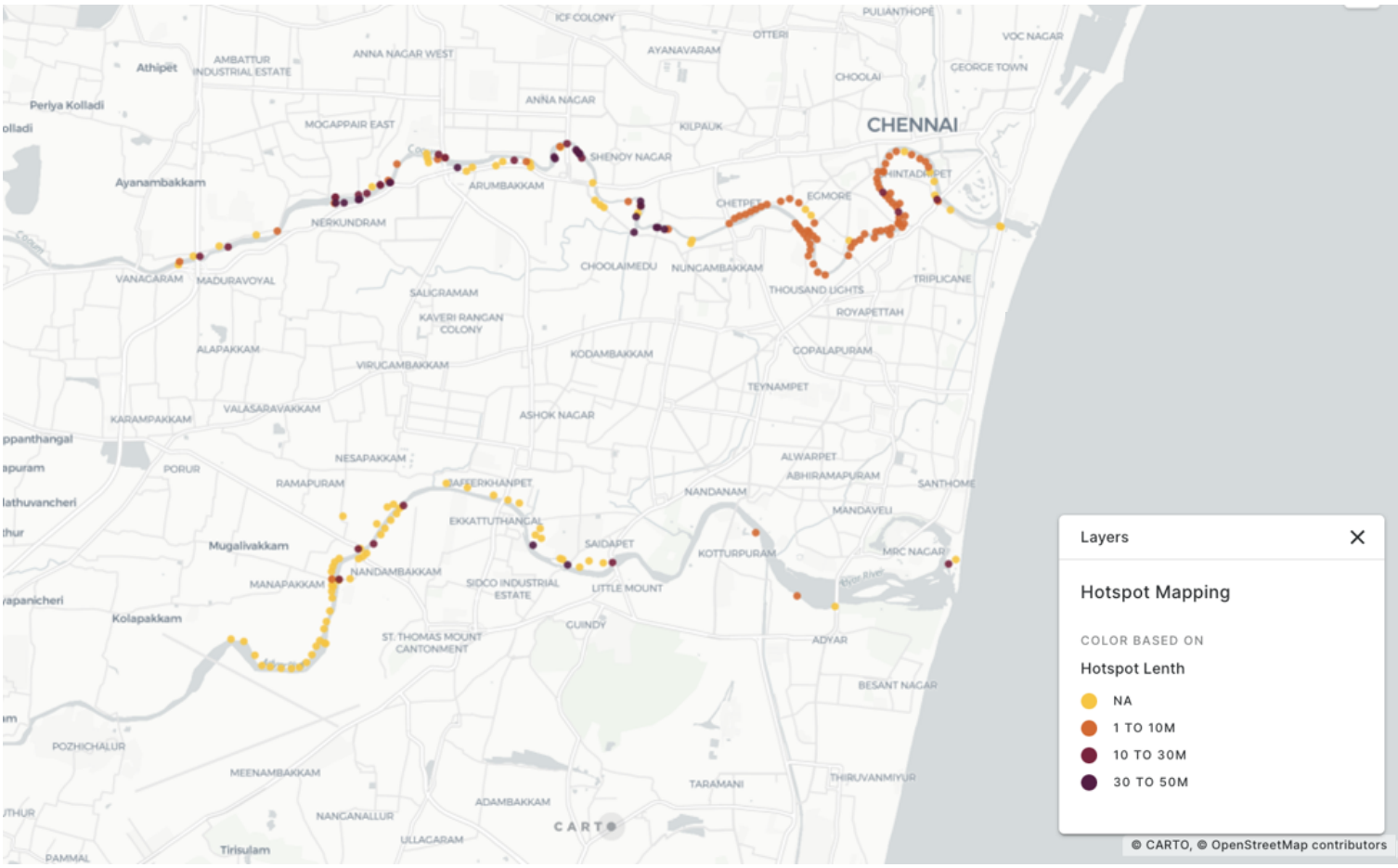


Image 3 :Plastic hotspot mapping summary



Map 7: Locations of plastic hotspots mapped (Source: Compiled by Kabadiwalla Connect using QGIS)

Image 4 provides more context to the nature of hotspots found along the rivers. It can be seen that plastic build up across the rivers is a serious issue in most locations sampled. The Adyar and Cooum rivers are extremely stressed riverine systems due to the high amounts of municipal waste pollution, wastewater and sewage discharge from various areas into these water systems.

Image 4 : Examples of plastic hotspots found

TRANSECT ANALYSIS

A transect analysis in certain hotspots revealed the major companies and brands associated with plastic pollution along the Adyar and Cooum rivers. In total, 10 transect samples were taken with a total of 863 plastic waste pieces collected and enumerated. 142 unique brands were identified in the transect analysis and the major companies whose items were found are presented in Image 6 and Table 4.

SUMMARY

10

Number of hotspots analysed

341

Total number of unique items found

863

Total number of pieces of plastics collected

142

Number of unique brands found

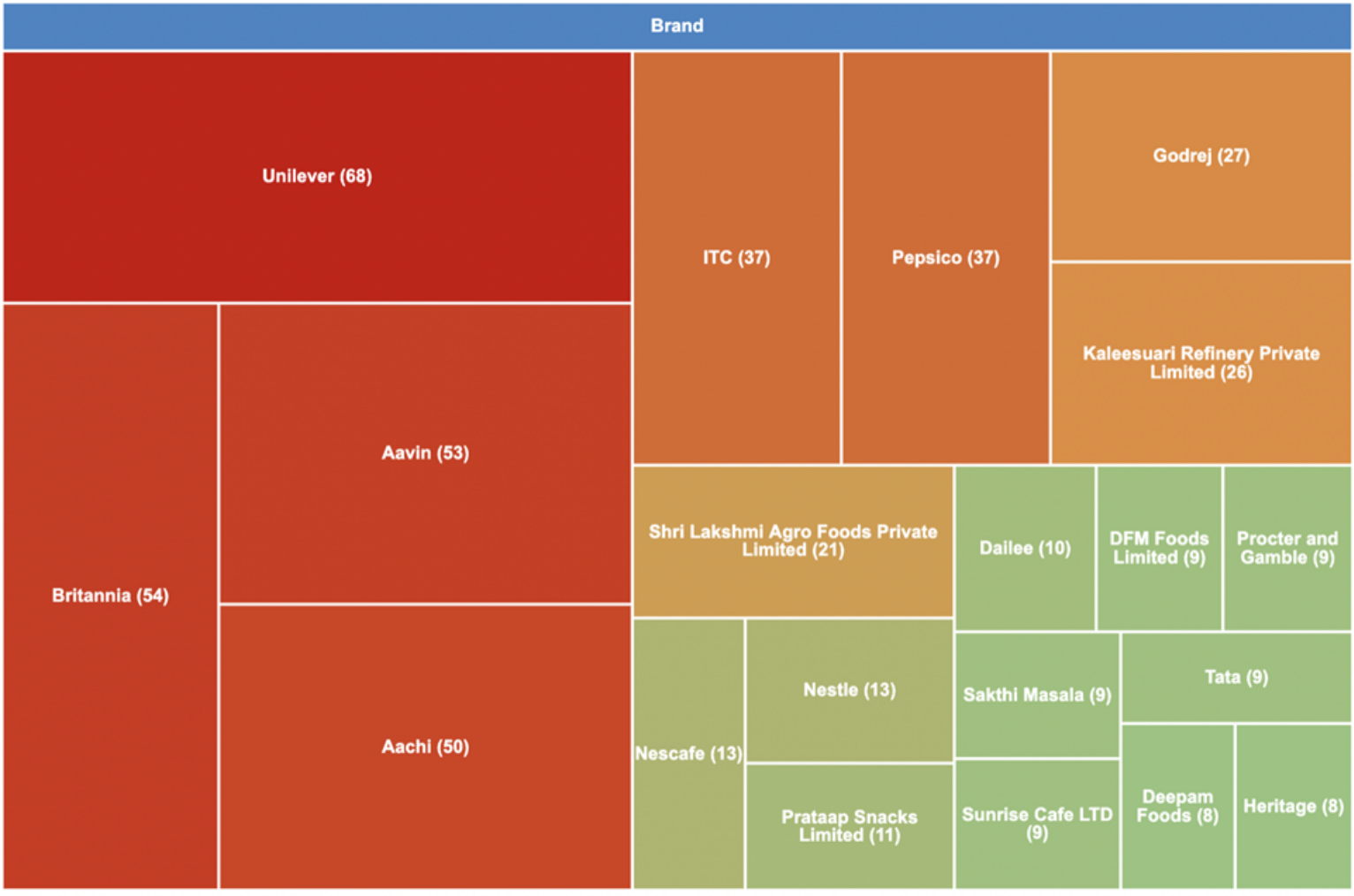
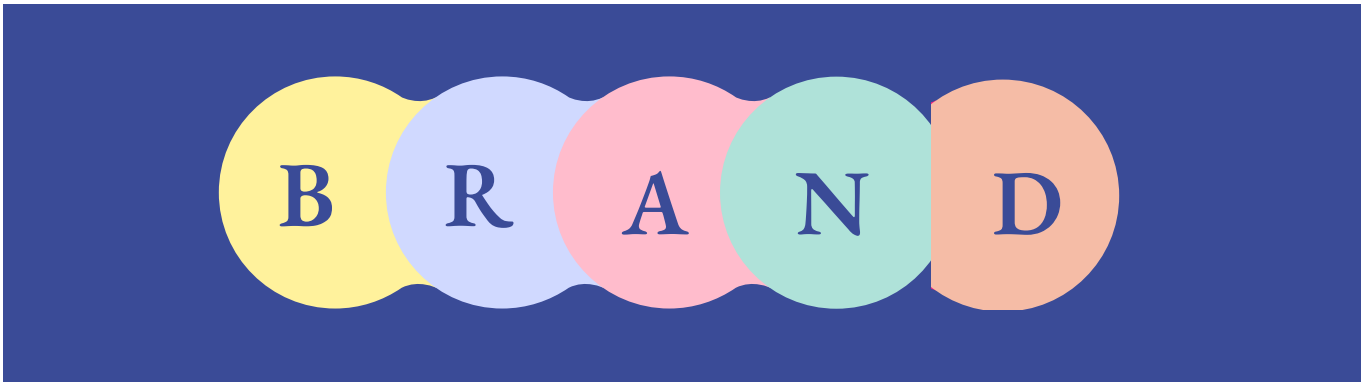


Image 6 :Tree map of major brands enumerated during transect analysis



Unilever, Britannia, Aavin and Aachi Masala were the major brands present while examining the plastic waste found in the transect study. ITC, PepsiCo and Godrej were other major companies identified. Other well known brands identified include Nestle, Shakthi Masala, Procter and Gamble, Tata and Heritage foods. Image 7 provides information about the major consumer categories of materials found during the analysis. Overwhelmingly, products found belonged to the food and beverage category (84%), followed by household utilities (9%) and personal care products (4%).

Table 4: Inventory of major brands enumerated during the transect analysis

Company Name	Count
Unilever	68
Britannia	54
Aavin	53
Aachi	50
ITC	37
Pepsico	37
Godrej	27
Kaleesuari Refinery Private Limited	26
Shri Lakshmi Agro Foods Private Limited	21
Nescafe	13
Nestle	13
Prataap Snacks Limited	11
Dailee	10
Murali Krishna Soap Works	10
Murali Krishna Soap WOrks	10
DFM Foods Limited	9
Sakthi Masala	9
Sunrise Cafe LTD	9
Tata	9
Procter and Gamble	9
Deepam Foods	8
Heritage	8
Naga Limited	8
Wipro	8
Aashirvaad	7

Company Name	Count
Hatsun	7
Raj Traders	7
AVT	5
Cadbury	5
Marico	5
Srirangam Milk products	5
SuperStar	5
Annachi	4
GRB	4
Nabati	4
Parle	4
Roobini oil	4
Saravana Stores	4
Thai Preserved food factory	4
Arasan	3
Delmonte	3
Haldirams	3
Lavian	3
Power	3
Rin	3
Surf excel	3
Thirumala dairy Products	3
Cavinkare	3
Adyar Ananda Bhavan	2
Amudham Mango Pulp Ltd	2

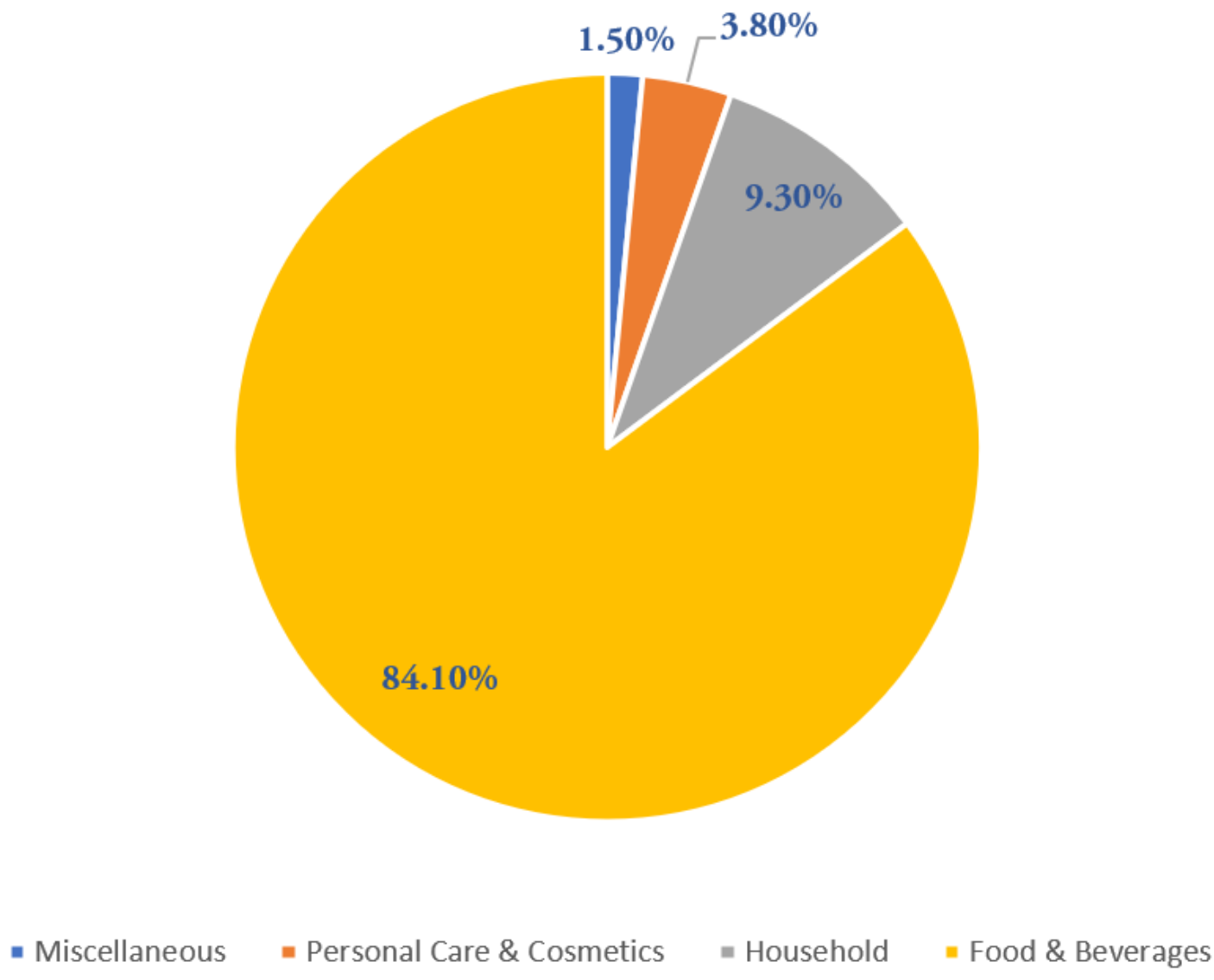


Image 7: Breakup of major consumer categories enumerated during transect analysis

8. WASTE FLOW ASSESSMENTS FOR THE THREE SITES OF INTEREST

Koyambedu market and the Koyambedu bus stand fall within Ward 127, while the Pattinapakkam fish market falls under Ward 125. Image 8 showcases the locations of these wards and the sites of interest. Image 9, 10 and 11 showcase the waste process flows of these sites respectively.

Koyambedu vegetable market which is known as one of the largest fruit and vegetable markets in Asia, unsurprisingly generates a lot of organic waste daily, with peripheral amounts of recyclable material generated in the form of carton boxes and plastics.

Material generated is transferred to an intermediate dumping ground behind the premises, after which it is taken to the Kodungaiyur landfill. A bio-methanation plant used to support the processing of this organic waste daily, however at the time of surveying it was noted that it had been closed down due to the closure of contract with the service provider.

It is estimated that around 3,00,000 to 4,00,000 lakh visitors, at the Koyambedu bus stand, are the major generators of plastic waste, apart from the retail shops on the sites of interest. Plastics generated at the bus stand are collected and sold to the informal sector through an aggregation facility present on the periphery of the property. The mixed waste is collected and sent to the Kodungaiyur landfill as is the case with the vegetable market.

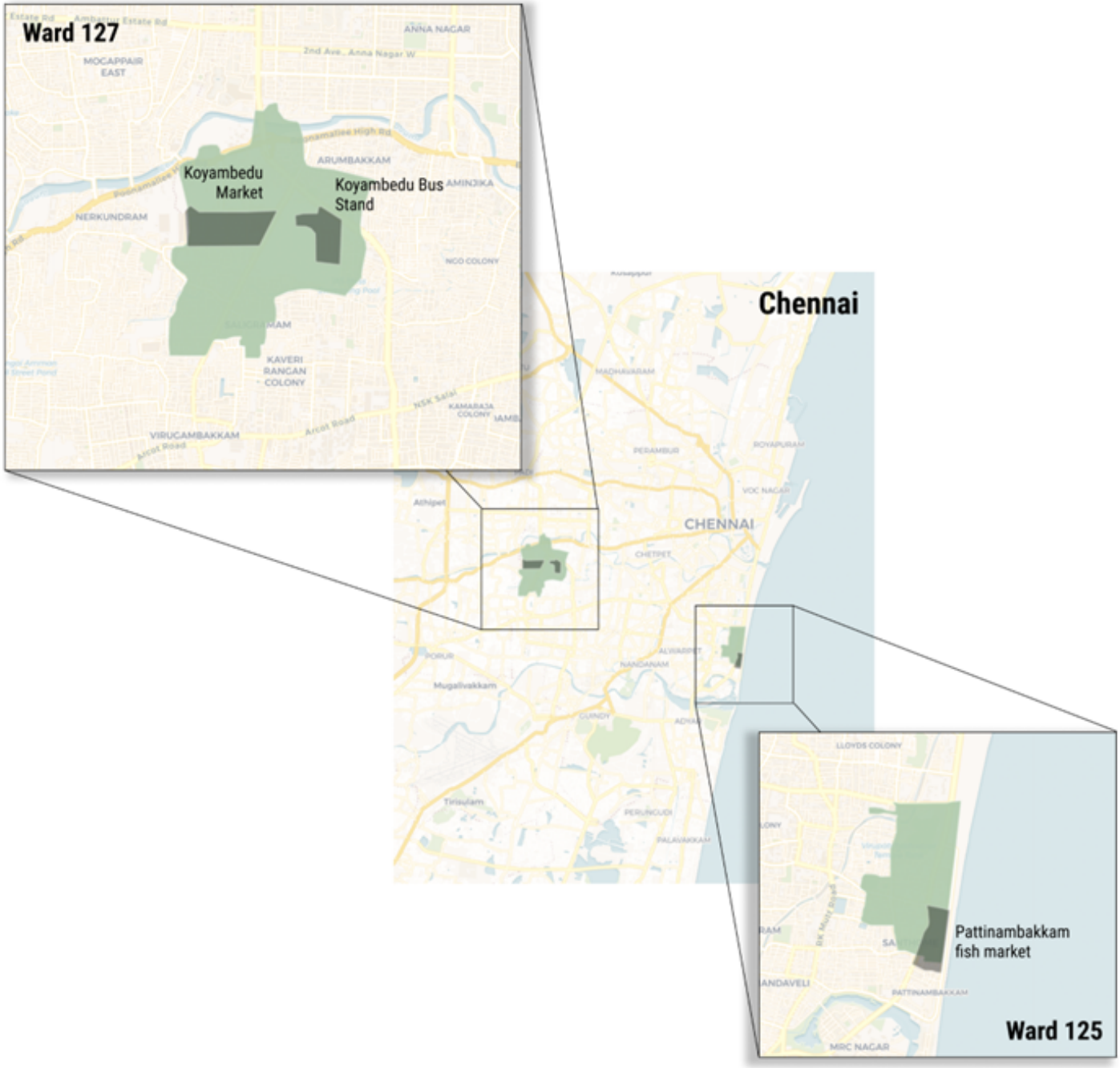


Image 8: Locations of wards 125 and 127 and the three sites of interest
(Source: Compiled by Kabadiwalla Connect using QGIS)

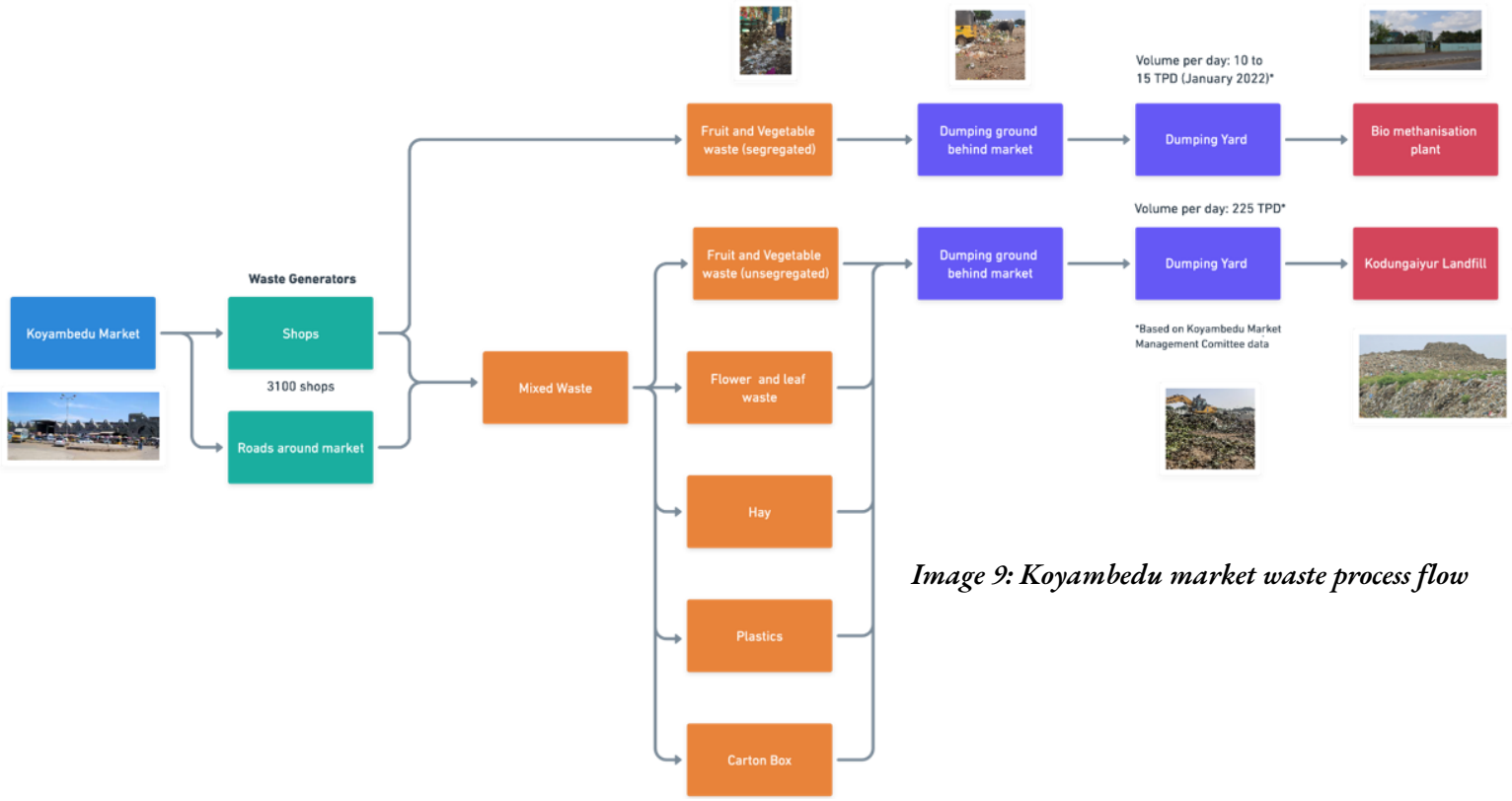


Image 9: Koyambedu market waste process flow

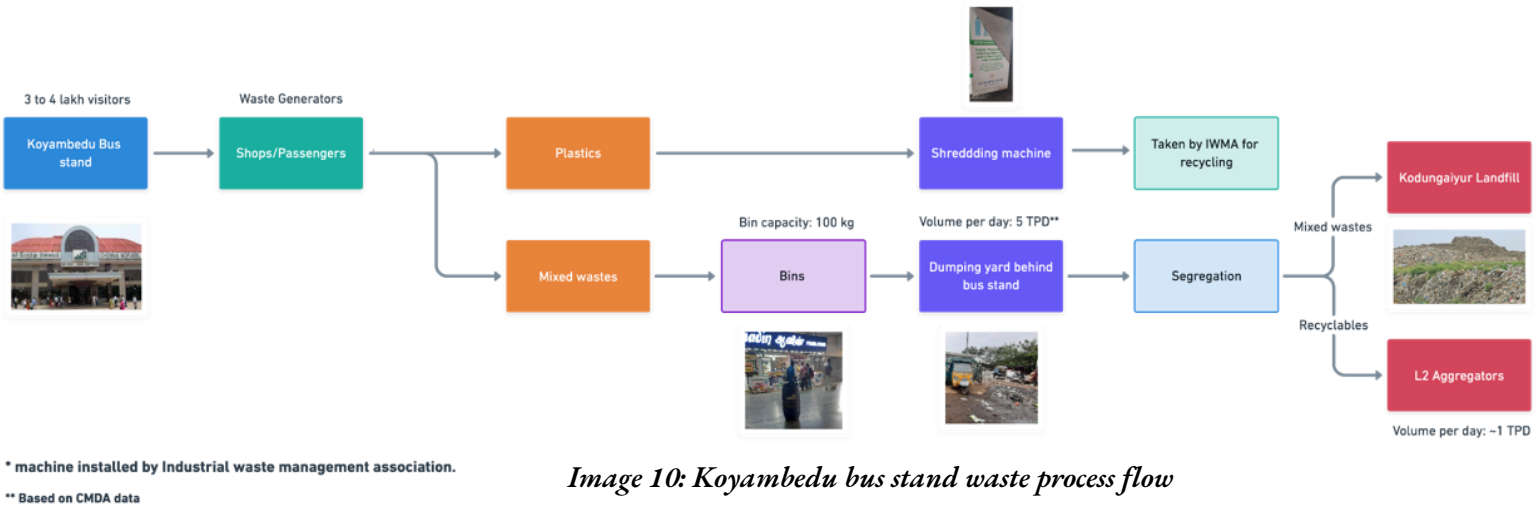


Image 10: Koyambedu bus stand waste process flow

With regards to the pattinapakkam fish market, there are around 300 shops present in the property who mainly generate fish waste and mixed waste. Fish waste is stored separately in corporation bins, which are then provided to prawn and chicken farms as feedstock, while the mixed waste is collected and sent to the Perungudi landfill.

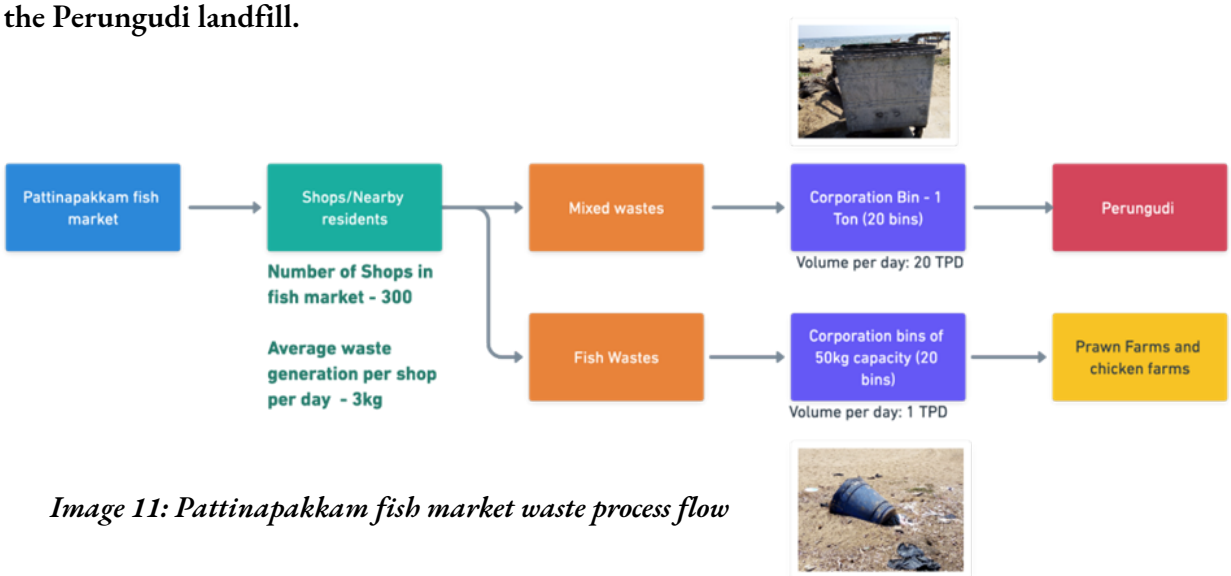


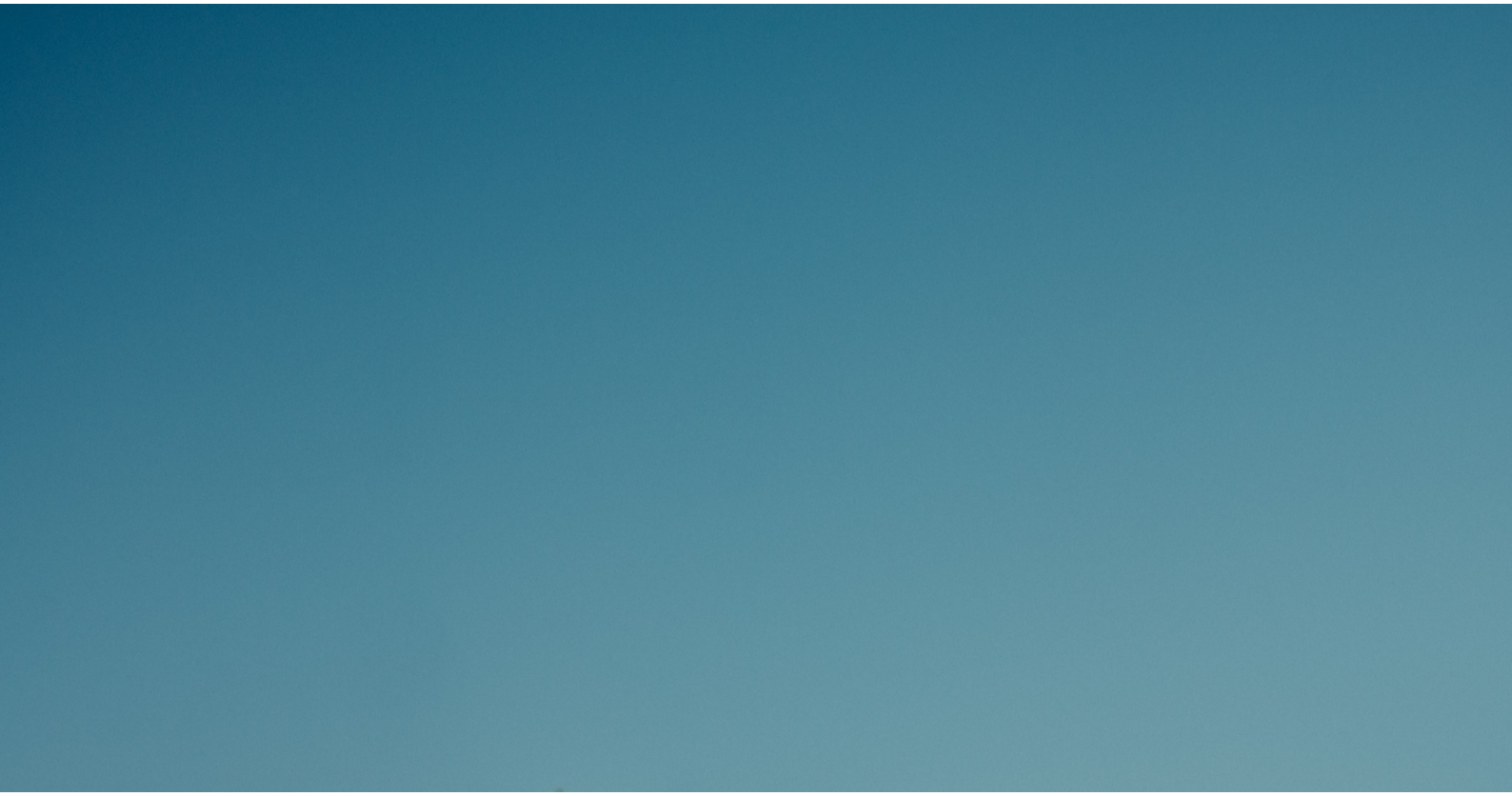
Image 11: Pattinapakkam fish market waste process flow

9. CONCLUSION

The purpose of the project was to identify and understand the pathways for plastic waste leaking into the Adyar and Cooum rivers from the city of Chennai. Plastic waste hotspots where waste could be seen going into the water bodies were also identified in the study. Significant contributions of the informal sector in managing plastic waste in the city were also observed. This calls for multi-stakeholder approach in enhancing the waste collection and recovery if informal sector is involved with the formal waste management systems and services. This will reduce the overall cost of waste collection from households, bulk-waste generators, dumpsites, street sweeping and river clean-ups. The study has yielded significant results with respect to the aspects of developing holistic value chain for plastic waste management in the selected locations of the city.

Multi-layer plastics packaging were found to have the highest fraction amongst various plastic categories based on the state of current segregation within the study area. Aligning to the Extended Producer Responsibility (EPR) framework for plastic packaging introduced in the country under the Plastic Waste Management (Amendment) rules 2022, producers, importers and brand owners (PIBOs) operating in the city of Chennai has the obligation to comply to these rules with set targets for reuse, minimum recycling and use of recycled plastic content. Guidelines/ framework for implementation of EPR could be formulated in the state which would make the manufacturers responsible to collect and manage the plastic packaging which are introduced in the market by them.

A mass balance based material traceability system, investments in cost-effective plastic waste management technologies and an EPR certification system will support effective waste management in the city so as to reduce the amount of plastic waste entering the Adyar and Cooum rivers.



Deutsche Gesellschaft für
Internationale Zusammenarbeit
GmbH

A 2/18, Safdarjung Enclave
New Delhi, 110029, India

T: + 91 11 49495353
E: info@giz.de
W: www.giz.de/india