Feasibility study of cluster level dry waste management

A Case of Maharashtra

Research Study - 2018-19

RCUES Mumbai

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1. INTRODUCTION

1.1 BACKGROUND

Under Swachh Bharat Mission Urban and in accordance with the SWM Rule 2016, it is mandated that all the urban local bodies (ULBs) in India should achieve 100% segregation of waste, primarily into wet waste and dry waste. As a result of various Government initiatives and interventions, extensive awareness generation and ULB level actions, it is observed that ULBs have begun with segregation of waste. Although 100% segregation is not achieved, it is partially achieved with methods adopted for segregating waste. Methods for treating and/or disposing the wet waste are proven and are well known to the ULBs given the extensive capacity building carried out for Urban Local Bodies in the various states across the country.

Wet waste processing and composting is well known to the ULBs and most of them have already started doing the same. However, dry waste which is being sorted further into various categories like paper, plastic, glass, metals etc., many a times does not find a proper destination. While every ULB is making an effort to increase the percentage of segregation and sorting of waste, it is necessary that they are provided with adequate options for managing the sorted dry waste.

Given the financial constraints of the Urban Lcoal Bodies, management of dry waste by a single ULB may not be a financially viable option. Hence, a cluster based model for management of dry waste may be explored. This report therefore, attempts to understand the feasibility of a cluster level management of dry waste of Urban Local Bodies. A comprehensive and tailor-made research outline and methodology are required which are elaborated below.

1.2 RESEARCH OUTLINE

1.2.1 AIM

The aim of the study is to assess the feasibility of dry waste management for Urban Local Bodies at cluster level.

1.2.2 HYPOTHESIS

Cluster level dry waste management is a feasible model to manage dry waste of Urban Local Bodies.

1.2.3 OBJECTIVES

➢ To identify parameters that affect feasibility of cluster level dry waste management

➢ To identify probable cities and industries that can be integrated to form clusters

➢ To identify issues and challenges in implementing cluster level dry waste management

1.2.4 SCOPE AND LIMITATIONS OF THE STUDY

Solid waste data is largely unreliable. Due to lack of availability of primary data on per capita waste generation, inadequate data on waste characteristics and influence of informal sectors, various studies on the subject provide different and sometimes contradicting values and projections. Due to these inconsistencies in data recording, definitions, collection methods, and seasonal variations, the reference data procured for the current study can only be considered approximate, albeit more accurate than most.

In addition, considering the vast extent to which this study can be applied, to ensure that proper scale is maintained, a sample study area of Maharashtra state has been considered. Since all the categories of dry waste generated in the city cannot be included in the study, commonly segregated categories as identified by the ULBs have been selected for the study. Alternatives of dry waste processing technologies available in the market are immense. Hence, technologies which are viable in Indian context have been considered.

It is to be noted that a lot of recyclable dry waste is taken away by rag pickers involved in MSW management of the city through either informal or formal system. Hence, the considered quantity and quality of dry waste which needs to be processed by ULB is as per the information provided by the city.

Study Scope: Maharashtra

1.3 RESEARCH METHODOLOGY

In line with the established aim and objectives, the study has been envisaged to adopt a combination of select primary and secondary research methods. Critical observations from this endeavour have also complimented in spatial representation of the surveyed areas.

Secondary Research	Primary Research	Assessment	Inference
• Literature Review • Fact & Figures • Case Studies & Best Practices	• Stakeholder interviews • Surveys & Site Visits	• Data Analysis • Spatial Analysis • Identification and assessment of clusters	• Comments on various feasibility parameters
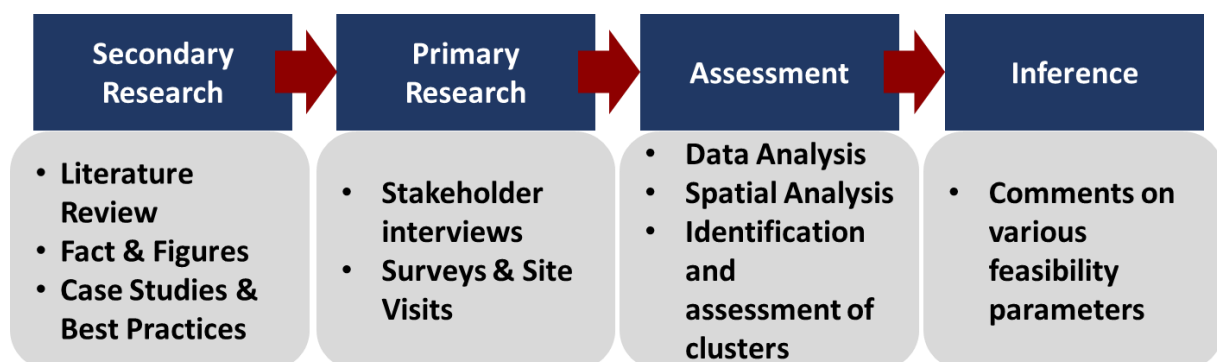
1.3.1 SECONDARY DATA

Literature Review: A thorough review of available literature has been conducted which referred wide range of sources including but not limited to various government reports and acclaimed publications. The secondary sources of data collection also included government websites and journal articles.

Desk Review: A thorough analysis was carried out with the help of data on the segregation and dry waste processing scenario of Maharashtra provided by **Swachh Maharashtra Mission (SMM)** team. Further, selection of cities for site visit was carried out in consultation with them.

Case studies: They are an essential resource, as the research study is an in-depth investigation of the current scenario of the ULBs in Maharashtra which are recycling their dry waste post segregation and generating revenue for themselves and therefore, a review of available examples is fundamental to the study.

Successful cases of cluster level dry waste management in India have been reviewed to identify the good practices and parameters based on which the cluster level management can be done successfully. These case studies would highlight the management model, stakeholder involvement, financial considerations etc. that is required for the different models. Currently cluster level SWM is carried out in two states in the country, namely, Goa and Madhya Pradesh.

1.3.2 PRIMARY RESEARCH

The primary methods chosen are questionnaires, field observations and interviews with stakeholders. Division wise visits to cities having more than 80% segregation were carried out to understand the existing situation of waste types, their availability, quantity and quality. The recycling industries in Maharashtra were approached and interviewed based on their willingness to work with the ULBs in recycling municipal waste. The ULBs having more than 80% segregation and located within 100 km of the industries were approached in order to understand their willingness to be part of a cluster, share the transportation cost to transfer their dry waste to the industries for recycling.

1.4 REPORT STRUCTURE

This section elucidates the report layout that has been adopted as per the study and research conducted. It is expected that the intended format helps the urban local bodies in identifying the potential for managing their dry waste with the help of recycling industries and thus successfully manage their waste at a cluster level.

Chapter 1 INTRODUCTION of this report, which is the current chapter, provides a brief outline of the research study, its aim and objectives with a brief methodology.

Chapter 2 OVERVIEW OF MUNICIPAL SOLID WASTE MANAGEMENT IN INDIA reviews the current status overview of MSW management in India. The chapter also includes the national and state Policies, programmes and legal framework for processing of MSW in India. It also gives a broad

overview of the components and composition of municipal solid waste, and the different components of dry waste found in municipal waste.

Chapter 3 MUNICIPAL SOLID WASTE MANAGEMENT IN MAHARASHTRA gives an overview of the current scenario of MSW management in Maharashtra and details out the generation of MSW at the state and division level. It also gives the scenario of various dry waste categories sorted at the division level identifying the divisions which have the potential to be a part of the research study based on their level of segregation of dry waste. This chapter also gives current scenario of the ULBs in Maharashtra which are recycling their dry waste post segregation and generating revenue for themselves, thus are good practice examples for the current study.

Chapter 4 CLUSTER LEVEL MANAGEMENT OF DRY WASTE gives an outline about the need for cluster level dry waste management and the approach to implement the same. This chapter also looks into cases where cluster level solid waste management is undertaken in India, namely, the Goa and Madhya Pradesh model, to identify the parameters of feasibility of such cluster-based management in Maharashtra.

Chapter 5 CLUSTER LEVEL APPROACH identifies the divisions of Maharashtra where the primary survey for feasibility of cluster level management of dry waste can be conducted based on the level of segregation of waste. It further gives an overview of the plastic recycling industries which are willing to collaborate with the ULBs to initiate cluster level dry waste management.

Chapter 6 SELECTION OF CITIES FOR CLUSTER FORMATION elaborates on the selection of ULBs in the division-wise (Pune, Konkan, Nashik and Nagpur) for the cluster level waste management, based on their level of dry waste generation, segregation, and willingness to be a part of the cluster. The feasibility is checked on the parameters identified through secondary research and route maps are created based on the distances from the industries and the total generation of the waste (daily).

Chapter 7 INFERENCES & WAY FORWARD analyses the viability of such a cluster level dry waste management in state of Maharashtra and suggests a way forward for the ULBs in managing dry waste.

2. OVERVIEW OF MUNICIPAL SOLID WASTE MANAGEMENT IN INDIA

This chapter gives an outline of MSWM in context of India. It gives references of various publications and describes the MSW composition and value chain as seen in Indian context. It reviews the national and state level policies in MSW management and status of MSW management in India. It also gives a broad overview of the components and composition of municipal solid waste, and the different components of dry waste found in municipal waste.

2.1 CURRENT STATUS IN INDIA

Since the study of Solid Waste Management needs exact and overall picture of the existing conditions prevailing in the region, hence, this chapter begins by looking into the statistics and key observation of MSWM in India. This is then supplemented by the overview of MSWM components and its life cycle, the existing policies, Programs and Legal Framework of MSWM in RCUES mandated cities of Maharashtra, Rajasthan, Goa, Gujarat, Assam, and Tripura.

2.1.1 MUNICIPAL SOLID WASTE IN INDIA

The increase in quantity of solid waste generation is directly proportional to the rate of urbanization and migration of rural masses to urban areas. Also, the composition of solid waste is hugely dependent on consumer patterns, citizen lifestyle and food habits.

According to Central Pollution Control Board Report (CPCB, 2015)[1], About 337 million (Census, 2011)[2] of India's Urban Population, that is 31% of total population generates 1,43,449 metric tons per day and 62 million tons of municipal solid waste per annum of Municipal Solid (Planning Commission Report, 2014)[3]. Further adding to the problem, the generation of Municipal Solid waste has increased by 2775 (MoUD, 2016)[4] within a decade, due to increase in the total number of Statuary and census towns from 5161 in 2001 to 7936 in 2011.

Municipal Solid Waste Management (MSWM), is a critical element towards sustainable development, which comprises of segregation, collection storage, relocation, transportation, processing, and disposal of solid waste to minimize its adverse impact on environment. MSWM, if not done properly, may lead to innumerable ailments. (Kumar, 2009)[5].

The management of municipal solid waste in India proved to be a severe problem not only due to its environmental and aesthetics but also the vast population of India, which resulted in enormous quantity of waste generated every day.

As per the annual review report of CPCB 2015-16, a total quantity of 1, 35,198 TDP is generated out of which 1, 11,028 is collected, 25, 572 is treated and 47, 456 TDP is landfilled (CPCB Report, 2016)[6]. The MSW collected for the year 2015-16 accounts for approximately 82% of the total MSW generated while as per annual report for the period of 2014-15, a total quantity of 1, 41,064 TDP was generated out of which 1, 27,531 was collected. It is noted that about 34, 752 TDP was treated and 4, 515 was landfilled (CPCB, 2015). The MSW accounts to approximately 90% of the total waste generated.

The Figure 2.1 below reflects the scenario of MSW Management for the last three years:

Figure 2-1 Scenario of Waste Generation, Collection and Treatment

Source: (CPCB, 2016); (CPCB, 2015); (CPCB Report, 2014)
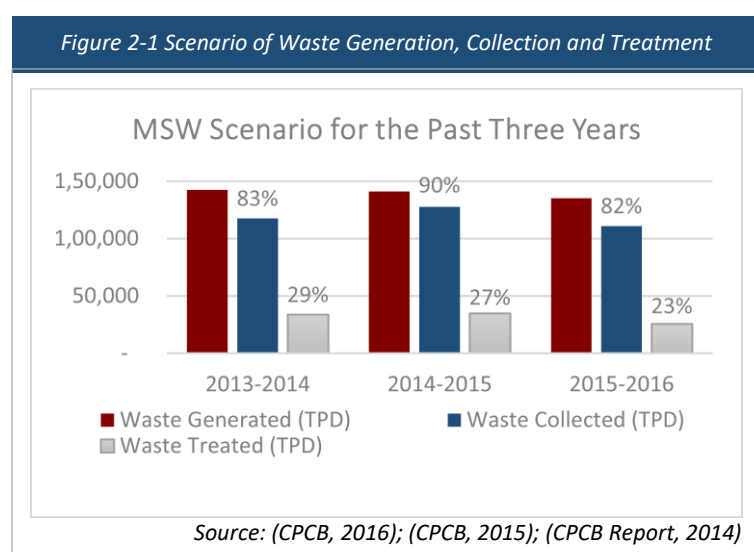
The adjacent statistics depict considerable decrease in waste collection from year 2014-15 to 2015-16, questioning the applicability and implementation of solid waste management rules in the country.

The amount of waste treated has also shown disappointing figures of reduction over past 3 years. Involvement of Government, NGOs and Private companies has increased drastically in the past few decades. However, land filling is still the leading solid waste management option for India. (Agarwal, Chaudhary and Singh, 2015)[8].

2.1.2 NATIONAL AND STATE POLICIES, PROGRAMMES AND LEGAL FRAMEWORK

The management of municipal solid waste is one of the main functions of all ULBs in the country. The Ministry of Environment Forests and Climate Change (MoEFCC), The Ministry of Urban Development (MoUD), the National Environmental Engineering Research Institute (NEERI), Central Pollution Control Board (CPCB), State Pollution Control Board (SPCB) govern regulatory and administrative responsibilities of Waste Management in the country. While the ground level implementation responsibilities lies with ULB (Joshi & Ahmed, 2016). All ULBs are required to methodly plan, implement and monitor all systems of urban service delivery especially that of Municipal solid waste. (MoUD, 2016).

Way back in 1960s, Government of India first intervened MSWM. The table below provides chronological order for the national policies that were identified (MoUD, 2016)

Table 2-1 Important policy level landmarks and initiatives by GoI on Solid Waste Management

Year	Rules, Policies, Schemes, Financial Plans
1989	The Hazardous Waste (M&H) Rules
1994– 95	MSWM strategy paper by NEERI
1994- 95	J.S. Bajaj Committee (The High Powered Committee on Urban Solid Waste Management)
1998	Bio-medical Waste (M&H) Rules
1998	Supreme Court appointed Barman Committee
2000	MSW (M&H) Rules
2000	CPHEEO Manual on MSW
2005	Report of the Technology Advisory Group on SWM
2005	JNNURM (2005‑2012)–40 MSW projects costing Rs. 2,186 Cr sanctioned from a total of 65 cities covered

2005	UIDSSMT (2005‑2012)–51 MSW projects costing Rs. 327 Cr sanctioned from a total of 632 cities covered
2005	12th Finance Commission (2005‑2010)–Rs. 2,500 Cr for 423 Class I cities
2006	Strategy and Action Plan-Use of compost in cities
2007	11th Five-Year Plan (2007‑2012)–Rs. 2,210 Cr for MSWM
2008	National Urban Sanitation Policy (NUSP)
2008	Service Level Benchmarks (SLBs) in MSWM
2008	Hazardous Waste (Management, Handling & Transboundary Movement) Rules
2008	National Mission on Sustainable Habitat (NAPCC)
2010	13th Finance Commission (2010–2015)—Establishing standards for delivery of essential services
2011	Plastic Waste (M&H) Rules
2011	E-Waste (M&H) Rules
2011	Draft Bio-medical Waste (M&H) Rules
2014	Swachh Bharat Mission, October 2014
2016	Waste Management Rules
2016	2016 comprising of Solid Waste Management Rules
2016	Plastic Waste Management Rules
2016	Bio-Medical Waste Management Rules
2016	E-Waste Management Rules
2016	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016
2016	Construction and Demolition Waste Management Rules, 2016.

2.1.3 COMPONENTS AND COMPOSITION OF MUNICIPAL SOLID WASTE

Municipal solid waste mostly consists of everyday items. There are many factors which influence waste composition. Factors like Economic Development, Geographical Location, Cultural norms, Energy sources and climate. Country's consumption of inorganic materials (i.e) Plastics, paper and aluminum increases while the relative organic fraction decreases as the Urbanization increases and people become wealthier. Usually, low income and middle income countries have a high percentage of organic matter ranging from 40% to 85% of the total urban waste stream. In middle and high-income countries, Paper, plastic and metal fractions increase in the waste stream (World Bank, 2012)[9].

Table 2-2 Categorization of Municipal Solid Waste

Types	Categories	Source
Wet Waste	Biodegradable Waste	Food and kitchen waste, green waste (vegetables, flowers, leaves, fruits) and paper
Dry Waste	Recyclable Material	Paper, glass, bottles, cans, metals, certain plastics, etc
	Inert Waste Matter	C&D, dirt, debris
	Composite waste	Waste clothing, Tetra packs, waste plastics such as toys
	Domestic Hazardous Waste	Waste medicine, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, and shoe polish

Source: (Joshi & Ahmed, 2016)[10]

2.1.3.1 DIFFERENT COMPONENTS OF DRY WASTE

In India, MSWM now focuses on Dry Waste area and it begins by identifying the dry waste categories generated from commercial and household activities. This is followed by a narrowed down choice of classes and a few background of how the corresponding waste is recycled along with their characteristics, key facts and figures wherever applicable. This background setting is important for the next sections of the study and this report specially wherever the study areas in Maharashtra are known and also the necessary investigation along with analysis has taken place in line with the categorization of dry waste.

- **Plastic** - Plastic recycling is an important part of our step towards innovation and sustainability. Recycling has been drastically developed in the area of plastic. Most of the plastics (PE-Polyethylene, PP-Polypropylene, PVC Polyvinyl Chloride, PET-Polyethylene Terephthalate) etc. could be recycled via mechanical route.
- **Paper** - Informal sector - 95% of the collection of waste paper in India is mainly performed through door-to-door collectors, kabadi system, and waste pickers.
- **Glass** - Reuse of glass containers is preferable to recycling. The glass component in municipal waste is usually made up of bottles, broken glassware, light bulbs and other items (AGI, 2011)[5].
- **Metals** – It can be recycled repeatedly without degrading its properties, which is why it's an important waste commodity. Scrap metal value motivates people to collect it for sale to recycling operations (LeBlanc, 2016).
- **Thermocol** – Styrofoam or Thermocol is an excellent material for packaging goods especially electronic goods. Since it is light in weight and has insulating properties, it is also used in construction and decorating industries.
- **Textile** – Waste from textiles constitutes to approximately 1% of the MSW composition Clothing is rarely discarded, Owing to significant social meaning held by textiles. Instead, it is frequently recycled for both the domestic and global markets.
- **Shoes and Footwear** - There has been negligible response of the footwear industry to the increasing problems associated with shoe waste.

3. MUNICIPAL SOLID WASTE MANAGEMENT IN MAHARASHTRA

3.1 CURRENT MUNICIPAL SOLID WASTE SCENARIO

The previous sections of the report have research along with the methodology of the study. Current set up and status of MSWM in India is explained by the same. Such literature covers way for identification of the dry waste categories that will form the root of the present study. This forms the background and measures for the focus areas in Maharashtra starting with the Administrative Profile with state, revenue level statistics followed by the MSW statistics at revenue division level. An increasing analysis and findings also been provided.

3.1.1 ADMINISTRATIVE PROFILE

According to 2011 census the population of Maharashtra is about 11, 23, 74, 333 which includes 5.08 crore Urban population. Maharashtra, second largest State in India in terms of size of population and shares 9.29 percentage of total India's population.

The state has 6 Revenue Divisions, 36 Districts and 394 ULBs, which comprises 27 Municipal Corporations, 228 Municipal Councils, 10 Cantonment Boards and 129 Nagar Panchayats. The 228 Municipal Councils are further categorized into 11 A Class Councils, 60 B Class Councils and 157 C Class Councils. The table below captures the number of ULBs in each revenue division as per the hierarchy of the ULBs.

Table 3-1 Hierarchy Wise Spatial Representation of all the ULBs

Sr. No.	Divisions	Districts	Municipal Corporations	A Class Councils	B Class Councils	C Class Council	Nagar Panchayats
1	Amravati	5	2	2	11	25	17
2	Aurangabad	8	4	2	10	38	27
3	Nagpur	6	2	2	11	16	41
4	Nasik	5	5	1	11	23	20
5	Konkan	7	9	1	6	15	20
6	Pune	5	5	4	11	28	17
Total		36	27	11	60	157	129

Urban Status of many Local bodies has been updated by Maharashtra Government. For e.g. Panvel Municipal Council has been updated from 'A' Class Council to Municipal Corporation, 125 Gram Panchayats have been given urban status etc. Therefore, all the secondary data affecting to solid waste segregation and treatment is given for the 262 Local bodies. The latest report of MPCB published in 2016 on Implementation of Solid Waste Management Rules, 2016 for the state Of Maharashtra (2015-16), also captures data for 262 Local Bodies' (comprising of 26 Municipal Corporations, 13- 'A' Class Municipal Council, 57- 'B' Class Municipal Council, 151- 'C' Class Municipal Council, 09- Nagar Panchayat, 06-Cantonment Board). The below table displays the comparison of the distribution of ULBs before the GR and after the GR.

Map 1 Spatial Representation of all the ULBs in Maharashtra State

Source: Created through GIS, 2017
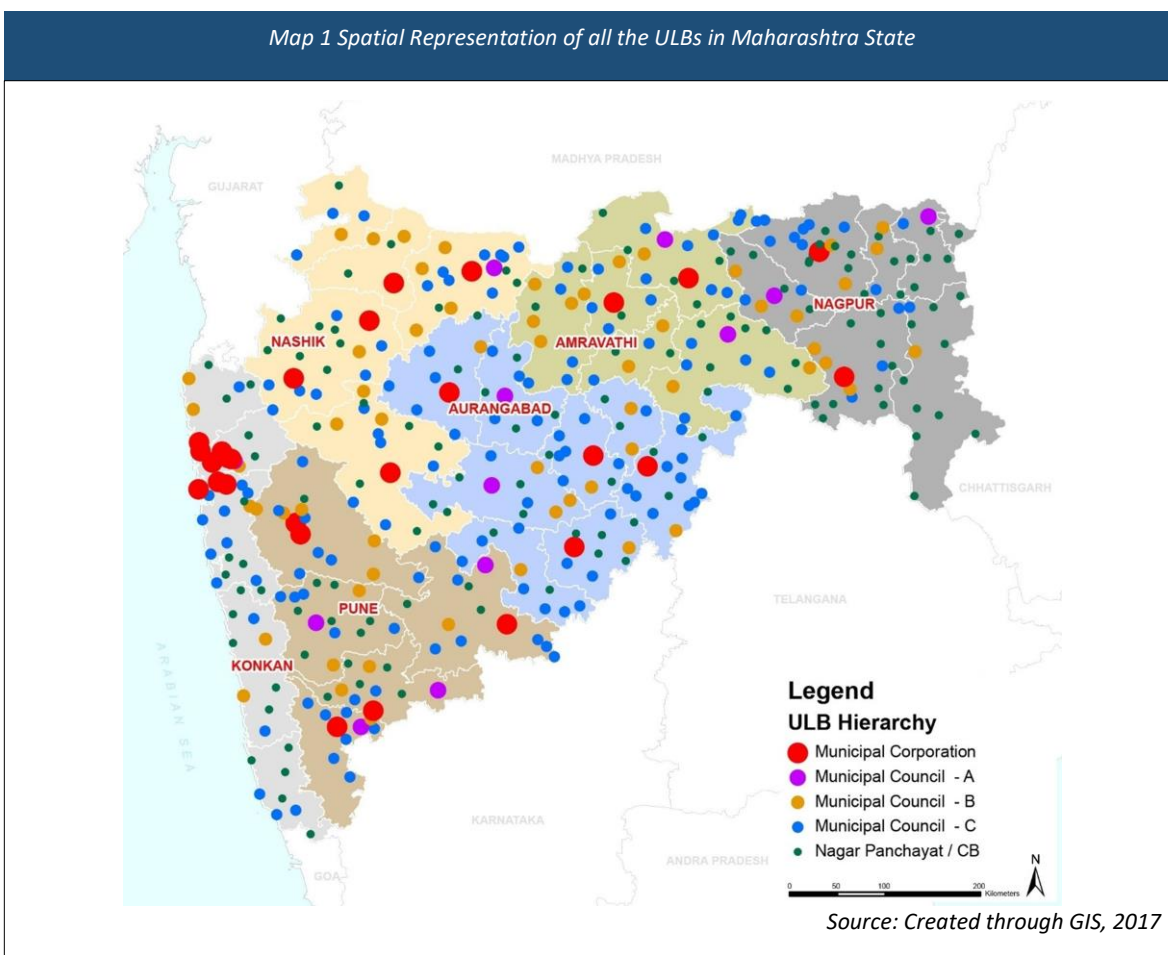
3.1.2 DEMOGRAPHIC PROFILE

According to population distribution across all the 6 divisions of the State, the Konkan Division has the maximum population at 26.2% and Nagpur Division has the lowest population with 9.88%. However, the household distribution shows Pune Division has the highest no. of households at 46.55% and Amravati Division has the least no. of households at 5.73%.

Table 3-2 Revenue Division Profile of Maharashtra

Sr. No.	Division	Population	Area (sq km)	Density (persons/ sq km)	Households
1	Amravati	11,266,653	46062.59	244.59	569,977
2	Aurangabad	18,731,872	65663.38	285.27	905,185
3	Nagpur	10,665,939	30690.14	347.54	894,718
4	Nasik	18,571,611	51598.73	359.92	1,014,945
5	Konkan	28,739,397	56449.85	509.11	1,934,910
6	Pune	19,973,761	57090.93	349.86	4,632,194
Total		**1,07,949,233**	**307555.62**	**350.99**	**9,951,929**

Source: (Census, 2011)

3.1.3 MUNICIPAL SOLID WASTE GENERATION

3.1.3.1 STATE LEVEL

2017 population calculation shows that, all the 384 ULBs in the state of Maharashtra, generates MSW of about 29, 748.16 MT/day. This is around 27.35% increase from the total waste generated by Urban Maharashtra in the year 2016-17 according to the MPCB report, which is 23,359.66 MT/day. It is observed that this number is for the 256 ULBs only which includes (Municipal Corporations, Municipal Councils: A, B, C, Nagar Panchayats). The total waste generated in the year 2016-17 including the 6 Cantonment Boards is 23, 449.66 MT/day.

The below table tabulates the total waste generated in Maharashtra according to the MPCB report (2016-17) and the current waste generated in the city in 2017 respectively.

Table 3-3 2016-17 M Corp .Municipal Council Nagar Panchayats Total

Sr.no.	M Corp.	Municipal Councils			Nagar Panchayats	Total
		A Class	B Class	C Class		
No. of local bodies	26	13	57	151	09	256
Waste generated in MT/day	20,334	675	1,281	992	78	23,360
	87.05%	2.89%	5.48%	4.25%	0.33%	

Source: (Annual Report on Implementation of Solid Waste Man, 2016-17)

Table 3-4 MSW Statistics ULB Type Wise: calculated as per 2017 population

2017	M Corp.	Municipal Councils			Nagar Panchayats	Total
		A Class	B Class	C Class		
No. of local bodies	27	11	60	157	129	384
Waste generated in MT/day	25,227	849	1,655	1,634	383	29,748
	84.80%	2.85%	5.56%	5.49%	1.29%	

Source: (2017, p. Calculated based on 2017 population)

The waste generation varies across its 6 revenue divisions and 36 districts. The below section details out the variations.

3.1.3.2 REVENUE DIVISION LEVEL

According to MPCB Report, 2016 and the calculations for the current waste generation in 2017 for all the 6 divisions shows that, Konkan division generates the highest amount of waste and Amravati division generates the least. The main reason behind Konkan division generating the highest quantity of waste could be attributed to the existence of 9 Municipal Corporations with a population of 28,739,397 (as per Census 2011) which is 26.2% of the total population and has a coastal line with beautiful beaches attracting a lot of tourist population which in turn increases to the waste generated.

Below tabulates the total waste generated in the year 2016-17 by the 256 ULBs and the current waste being generated by the 384 ULBs.

Table 3-5 Solid Waste Statistics Revenue Division Wise

Sr.no.	Division	MSW Generated (MT/day) 2016	MSW Generated (MT/day) 2017	% Increase
1	Amravati	786	1,320	67.93
2	Aurangabad	1,549	1,989	28.47
3	Nagpur	1,570	1,865	18.75
4	Nashik	1,741	2,927	68.14
5	Konkan	13,726	16,329	18.97
6	Pune	3,988	5,318	33.35
Total		23,360	29,748	27.35

Source: Annual Report on Implementation of Solid Waste Management Rules, 2016, For the State of Maharashtra, 2016-17, MPCB and calculations based on 2017 population)

It is observed that, the percentage of waste generation in Nagpur and Konkan Division to the total MSW generation of the state has decreased from 6.72% to 6.27% and from 58.76% to 54.89% respectively from the year 2016-17 to 2017.

The table also displays the percentage increase in total solid waste generation for the state from the year 2016-17 to the year 2017, which is almost 27.35%. Amravati Division shows the highest percentage increase in solid waste generation with 67.93% and Nagpur Division shows the least percentage increase with 18.75%.

Below map shows the solid waste generated as per 2017 population across the revenue divisions.

Map 2 Revenue Division Wise Solid Waste Generated

Source: Created through GIS, 2017

FEASIBILITY STUDY OF CLUSTER LEVEL DRY WASTE MANAGEMENT
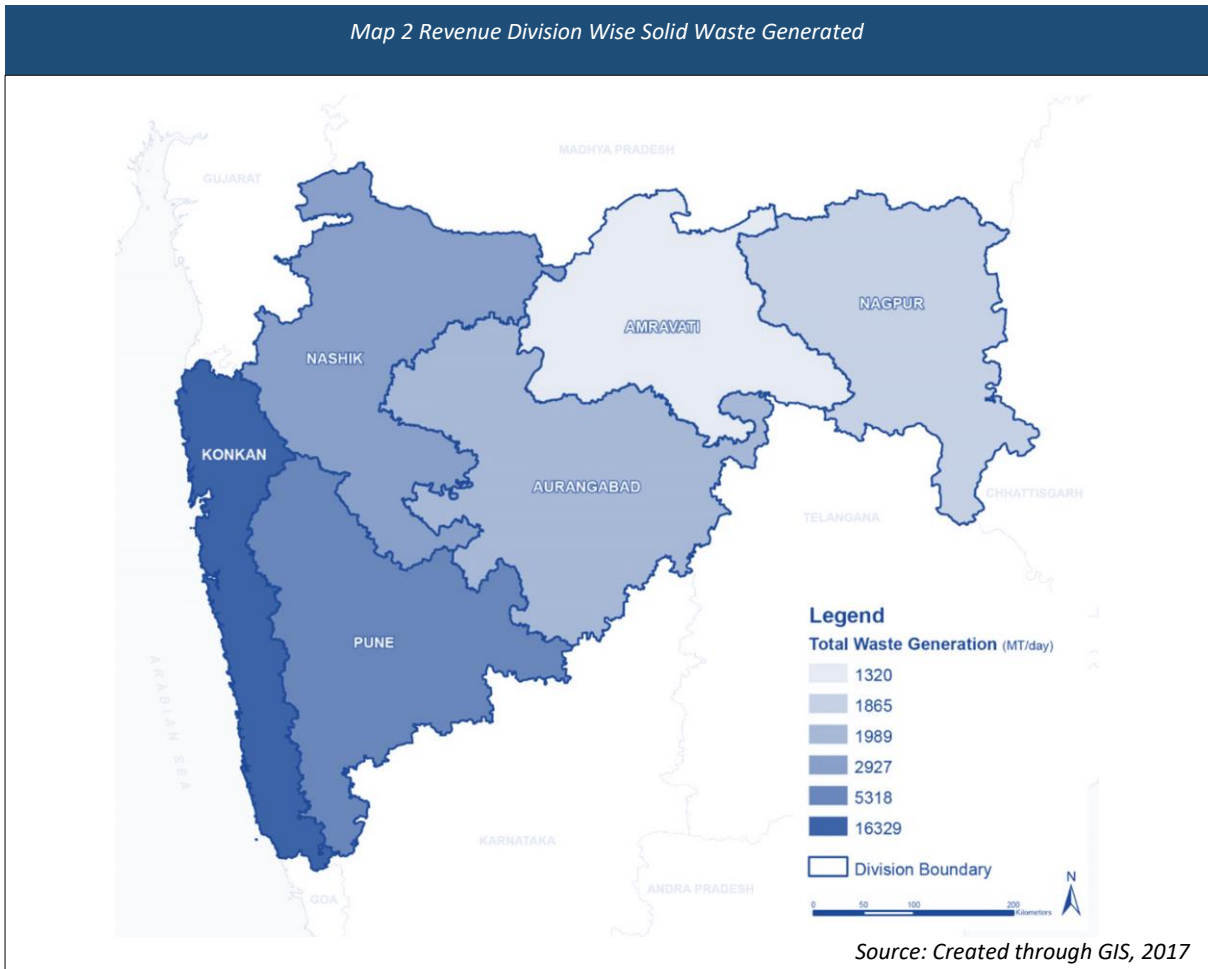
3.2   DRY WASTE SCENARIO

3.2.1 STATE LEVEL

As per the calculations based on 2017 population and an assumption that Western India generates recyclables - dry waste of about 21.44%[1] of the total MSW, the 384 ULBs in the state of Maharashtra, generate dry waste of about 6, 378 MT/day. The below table shows the total dry waste generated in Maharashtra in 2017

Table 3-6 ULB type wise- dry waste generated in Maharashtra

2017	M Corp.	Municipal Councils			Nagar Panchayats	Total
		A Class	B Class	C Class		
No. of local bodies	27	11	60	157	129	**384**
Dry Waste generated in MT/day	5409	182	354	350	82	**6378.01**
	84.80%	2.85%	5.56%	5.49%	1.29%	

Source: (Calculated based on 2017 population, 2017)

3.2.2 CATEGORY WISE DRY WASTE SORTED BY ULBS IN MAHARASHTRA

According to a recent research study carried out by RCUES All India Institute of Local Self Government, it has been observed (as per the primary surveys conducted) that the ULBs are sorting the dry waste manually and are able to sort dry waste into different categories including, plastic which is the major contributor of dry waste in various types such as bottles, polythene bags, wrappers, packaging material etc.,. About 5.56% of the total dry waste arriving at the dump yard constitutes of plastics. Paper and Cardboard together is the next major contributor of the municipal dry waste, which comprises of about 4.56% of the total dry waste. The following table elaborates the quantities of dry waste arriving at dump yard across types of ULBs in the eight categories that are majorly being sorted currently in Maharashtra.

Table 3-7 7 Category wise quantity of dry waste sorted at dumping site

Divisions	Plastic	Glass	Thermocol	Paper	Cardboard	Cloth	Footwear	Metal
Amaravati	14.27	1.39	0.54	7.34	4.36	1.64	1.46	0.39
Aurangabad	21.51	2.09	0.81	11.07	6.58	2.48	2.21	0.58
Nagpur	20.17	1.96	0.76	10.37	6.17	2.32	2.07	0.54
Nashik	31.65	3.07	1.20	16.28	9.68	3.64	3.24	0.85
Konkan	176.59	17.15	6.67	90.83	53.99	20.33	18.10	4.76
Pune	57.51	5.59	2.17	29.58	17.58	6.62	5.90	1.55
Total	321.70	31.24	12.15	165.48	98.36	37.03	32.98	8.68
Total	707.63							

Source: (Calculated based on 2017 population, 2017)

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[1] Annepu R (2012), Sustainable Solid Waste Management in India by Ranjith Kharvel Annepu, Columbia University in the City of New York, Waste-to-Energy Research and Technology Council (WTERT), Columbia University – Earth Engineering Center

Glass waste contribute 0.54% of the total dry waste. Glass waste includes both glass bottles and broken glass pieces. Metal waste includes 0.15% of the total dry waste.

The remaining categories include Hair (0.47%), Cloth (0.64%), Footwear (0.57%), Rexin Bags (1.1%), Thermocol (0.21%) and Rubber tubes/tyres (0.82%) which are considered as others.

Due to the absence of required sorting machineries, the ULBs, in spite of sorting 8 categories, are still left with a major portion of dry waste, which is considered as mixed dry waste and constitutes of 85.38% of the total dry waste.

Figure 3-1 Percentage wise distribution of dry waste categories being sorted by ULBs in Maharashtra

Glass, 31.24, 0% Metal, 8.68, 0%
Paper & Cardboard, 263.84, 5%
Other, 220.45, 4%
Plastic , 321.7, 6%
Mixed Waste, 4940.12, 85%
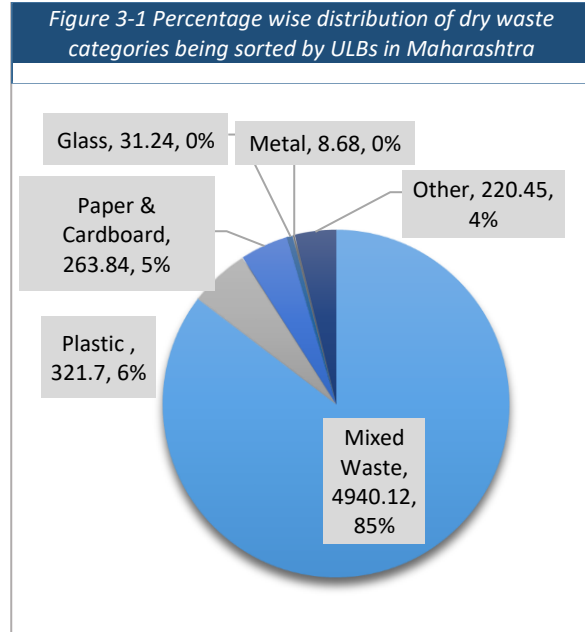
Source: (Calculated based on primary data collected through, 2017)

3.2.3 MAHARASHTRA STATE POLICIES & GOVERNMENT REGULATION FOR DRY WASTE MANAGEMENT

I. Maharashtra Non-Biodegradable Garbage (Control) Act 2006

The special enactment entitled Maharashtra Non-biodegradable Garbage (control) Act 2006 has been legislated by State government of Maharashtra to regulate the non-biodegradable municipal solid waste generated in the urban areas. As per Maharashtra Municipal Solid Waste Rules 2006, notified under this Act; no person, by himself or through another shall knowingly or otherwise throw/ cause to throw any non-biodegradable garbage, Construction debris or any biodegradable garbage in any drain, ventilation shaft, pipe & fittings, sewage lines, natural or manmade lake, wetlands; which is likely to interrupt the drainage & sewage system, interfere with the free flow or affect the treatment & disposal of drain & sewage contents, be dangerous or cause a nuisance or be prejudicial to public health and damage the lake, river water & wetland. Also no person shall knowingly or otherwise, place or permit to place any biodegradable or non-biodegradable garbage in any public place or open to public view.

The act also states that, it shall be the duty of the owners and occupiers of every land and building to store and segregate the waste generated by them into a minimum of two receptacles one for biodegradable waste and one for non-biodegradable waste (ADB, 2016).

II. Maharashtra Plastic Carry Bags (Manufacture and usage) Rules 2006

State government issued Maharashtra plastic Carry Bags (Manufacture and Usage) Rules 2006 under Maharashtra Non-biodegradable Garbage Control Act 2006 to minimize the environment and health impact of plastic waste. To control plastic waste generation, manufacturing (and stocking, distributing or selling) plastic carry bags made of virgin or recycled plastic of thickness less than 50 micron and of the size 8 x 12 inches are banned in the State (ADB, 2016).

Certain states and cities have initiated implementing municipal solid waste management in more strategized way, thus streamlining the entire supply chain of MSW. Paragraphs below explains such cases from states/cities in India.

III. Maharashtra Plastic bottles Manufacture

The Maharashtra State Government has stipulated water bottle manufacturers to set up a reverse supply mechanism and recycling plants, failing which a complete plastic ban will be enforced. Effective March 2018, a ban on plastic water bottles will be implemented in government and corporate offices and in 5-star hotels.

The move is aimed at extending the responsibility of the plastic item manufacturers of getting the plastic back from the consumer. Some of the significant requirements of this initiative are as follows:

- ✓ Adopt a Buy-back mechanism
- ✓ Must have the capacity to reuse and recycle
- ✓ System based on a reverse supply chain in which they collect used plastic bottles have been set-up by the manufactures

In addition, restrictions on all unauthorized plastic bottle manufacturers have been planned by the government. Within the same initiative, there will be a complete ban on usage of plastic.

A widespread ban on plastic bags will also be brought into effect. If shopkeepers found using plastic bags, there will be a heavy penalties levied and possible imprisonment on them. To ensure the ban is also applied on dairy industry, plastic milk packets will make way for glass bottles.

Four study groups have been formed to survey in Bangalore, Sikkim, Madhya Pradesh and Himachal Pradesh in an attempt to adopt their methods on the plastic ban implementation.

IV. Maharashtra Plastic and Thermocol Products (Manufacture, Usage, Sale, Transport, Handling and Storage) Notification, 2018

The Environment Department of the Government of Maharashtra has recently issued the Maharashtra Plastic and Thermocol Products (Manufacture, Usage, Sale, Transport, Handling and Storage) Notification, 2018 ("Plastic Ban Notification") through which the manufacture, transport, distribution, wholesale and retail sale, usage, storage and import of certain plastic products has been prohibited. The Plastic Ban Notification has been issued by the Government of Maharashtra by virtue of the powers derived from clauses (1) and (2) of section 4 of the Maharashtra Non-Biodegradable Garbage (Control) Act, 2006. The Government of Maharashtra has issued the aforesaid Plastic Ban Notification on 23.03.2018 thereby providing a one month period for compliance and safe disposal of the banned plastic products by all concerned including manufacturers/ producers, sellers/ retailers/ traders, users as well as local bodies. Thereafter as per the powers provided under section 12 of the Maharashtra Non-Biodegradable Garbage (Control) Act, 2006 fines may be imposed on the violators.

The reason cited for imposing a ban on such plastic products is the threat imposed on the environment due to the leaching of chemicals from plastic and the threat it imposes on humans and wildlife. Such prohibited products are those which contain high polymer and include plastic bags and pouches,

disposable cutlery, plates and containers made of plastic and thermocol, non-woven polypropylene bags, plastic wraps, plastic and thermocol decorative items and plastic packaging for food items besides others. While the Plastic Ban Notification seeks to regulate all kinds of plastic products, it excludes compostable plastic bags, plastic used for packing medicines, plastic bags and products for export and food grade virgin plastic bags above 50 micron thickness.

3.2.4 ULB LEVEL INITIATIVES- BEST PRACTICES IN MAHARASHTRA

3.2.4.1 PLASTIC RECYCLING INDUSTRY: PLASTO CARE UPCYCLING AGENCY, WARORA, CHANDRAPUR DISTRICT, NAGPUR DIVISION

The Plasto Care Upcycling Agency is a newly set up small scale recycling industry set up in Warora. It is an innovative industry that recycles plastic waste to manufacture garden benches, manhole covers, tree guards, fencing poles etc. The recycling industry can accept waste up to 1000 Kg/day. The innovation is an idea of Dr. Balmukund Paliwal, who belongs to Chandrapur and has guided the agency. The machinery is also locally designed to suit the experiment and is yet to receive permission from MPCB.

Currently, these recycled items have been put to different type of tests such as kept in open under the sun at 50 degrees centigrade, heavy weights have been placed on them to check their strength and durability, and no issues have been found. Many such benches have been put up at Warora and Chandrapur in public areas.

Figure 3-2 Innovative recycled products manufactured at Warora

Different types of sitting benches

Manhole Cover   **Tree Guard**

Source: Primary Survey Conducted, 2018

WARORA MUNICIPAL COUNCIL

The council has encouraged an innovative plastic recycling industry to set up its unit in the Council's dump yard by providing a shed for machinery. The recycling industry, in turn, uses all the plastic waste that is being sorted from the segregated dry waste in Warora. Warora Council is expecting to finish all its plastic waste, segregated and collected in last 2-3 months, effectively in the next three months. Warora Council is not generating any revenue by giving its plastic waste to Plasto Care Upcycling Agency. However, it is helping them clear off their dump yard.

Map 3 Existing Network of ULBs and Proximity of other ULBs to Plasto

Source: Created through GIS, 2017
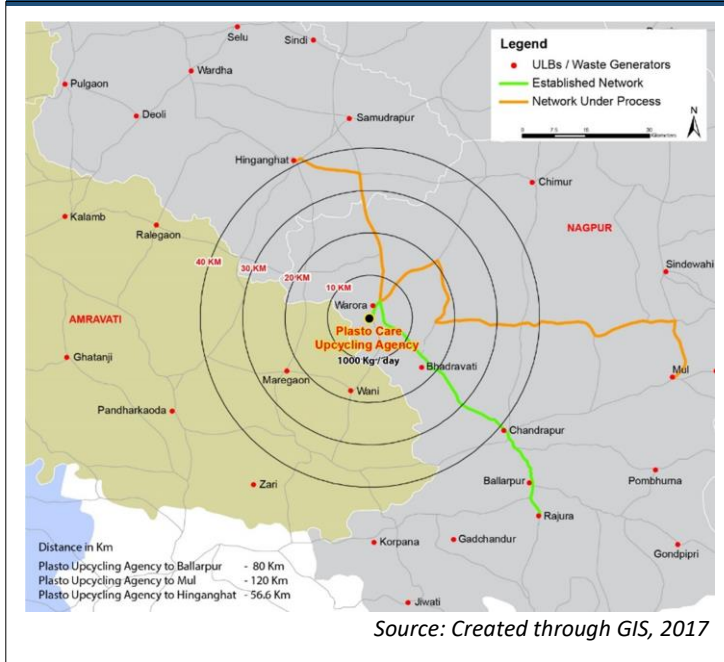
3.2.4.2 PLASTIC RECYCLING INDUSTRY: MANORAMA INFRASTRUCTURE PVT. LTD., BALLARPUR, CHANDRAPUR DISTRICT, NAGPUR DIVISION

Similar to Plasto Case Upcycling Agency and under the guidance of Dr. Balmukund Paliwal, Manorama Infrastructure Pvt. Ltd., is also a newly set up small scale recycling industry set up in Ballarpur. It is an innovative industry that recycles plastic waste to manufacture garden benches, manhole covers, tree guards, fencing poles etc. The recycling industry can accept waste up to 800 Kg/day. The innovation is an idea of Dr. Balmukund Paliwal, who belongs to Chandrapur and has guided the agency. The machinery is also locally designed to suit the experiment and is yet to receive permission from MPCB.

Currently, these recycled items have been put to different type of tests such as kept in open under the sun at 50 degrees centigrade, heavy weights have been placed on them to check their strength and durability, and no issues have been found.

Ballarpur has placed 50 such manhole covers in different areas of the city. Since, these are made of recycled plastic, fear of breaking and theft is nil unlike the cement manhole covers and is helping Ballarpur Council save an amount of Rs. 30 Lakhs.

Figure 3-3 Innovative recycled products manufactured at Ballarpur

| Sitting benches | Manhole Cover | Tree Guard |

Source: Primary Survey Conducted, 2018

BALLAPUR MUNICIPAL COUNCIL
- The council has encouraged an innovative plastic recycling industry to set up its unit in the Council's dump yard by providing a shed for machinery. The recycling industry, in turn, uses all the plastic waste that is being sorted from the segregated dry waste in Ballarpur.
- Ballarpur Council is expecting to finish all its plastic waste, segregated and collected in last 6 months, effectively in the next three months.
- Ballarpur Council is not generating any revenue by giving its plastic waste to Manorama Infrastructure Pvt. Ltd. However, it is helping them clear off their dump yard.

Map 4 Existing Network of ULBs and Proximity of other ULBs to Manorama Infrastructure Pvt. Ltd, Ballarpur

Source: Created through GIS, 2017
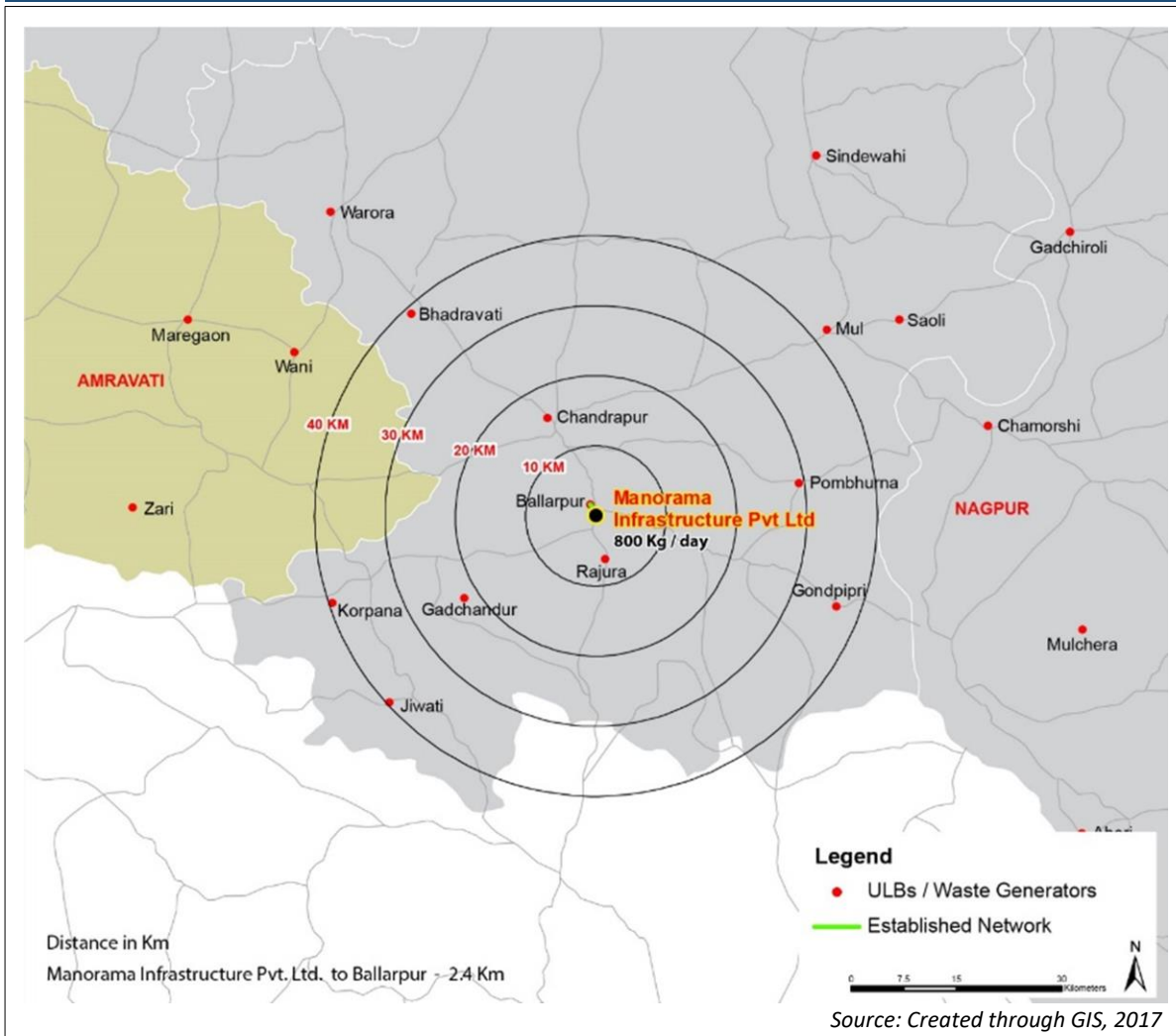
3.2.4.3   DEMAND SUPPLY SCENARIO OF PLASTIC WASTE AT STATE LEVEL

As per the calculations based on 2017 population and an assumption that Maharashtra generates plastic waste of about 5.56% of the total dry waste, it is calculated that the 384 ULBs in the state of Maharashtra generates plastic waste of about 322 T/day. This implies that all the 384 ULBs in Maharashtra can supply plasic waste of about **322 T/day.**

On the other hand, the 74 MPCB registered plastic recycling industries can accept upto **241 T/day.**

Therefore, in this scenario, supply is more than demand, and in this case, it is 81 T/day. The remaining 81 T/day of platic waste can be consumed by the 386 formally registered plastic recycling industries.

3.2.4.4 PAPER & CARDBOARD WASTE RECYCLING INDUSTRY: PADMAVATI PULP & PAPER MILLS, AMBERNATH, THANE DISTRICT, KONKAN DIVISION

The Padmavati Pulp & Paper Mills is a manufacturing unit located in Ambernath, which recycles cardboard waste. Currently, they import cardboard from the UK. They are extremely willing to collaborate with the ULBs and consume all types of paper and cardboard waste, if quality is maintained. They accept waste of about 50 TPD.

Map 5 Proximity of ULBs to Padmavati Pulp & Paper Mills,

Source: Created through GIS, 2017
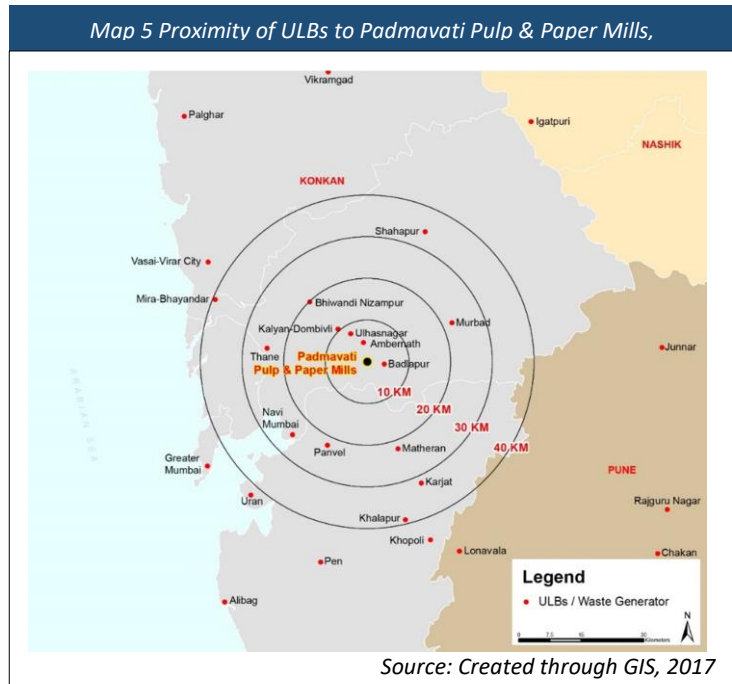
Figure 3-4 Cardboard waste stored for recycling

3.2.4.5 DEMAND SUPPLY SCENARIO OF PAPER AND CARDBOARD WASTE AT STATE LEVEL

As per the calculations based on 2017 population and an assumption that Maharashtra generates paper and cardboard waste of about 4.56% of the total dry waste, it is calculated that the 384 ULBs in the state of Maharashtra generates plastic and cardboard waste of about 264 T/day. This implies that all the 384 ULBs in Maharashtra can supply plastic and cardboard waste of about **264 T/day.**

On the other hand, some of the extremely willing paper and cardboard recycling industries can accept up to **522 T/day.**

Therefore, in this scenario, supply is less than demand, and in this case, it is 258 T/day excess demand.

There are total 54 paper and cardboard recycling industries mapped in this study for Maharashtra. If the remaining industries can be convinced about the quality of plastic and cardboard waste being sorted at the dump yard, many of the ULBs will be benefitted in terms of distance and access.

3.2.4.6   THERMOCOL WASTE RECYCLING INDUSTRY: G D ENVIRONMENTAL PVT. LTD., PUNE DISTRICT, PUNE DIVISION

The G D Environmental Pvt. Ltd. is recycling industry set up in Pune District. It is an innovative industry that uses thermocol waste as a raw material in aglo form (substance formed after dissolving thermocol in the solvent) which is made from a solvent and in turn use it to manufacture fuel from plastic. The recycling industry, manufactures the required solvent as well that can dissolve thermocol. One liter solvent can dissolve up to 1 kg thermocol. The Cost of this solvent is Rs. 52/liter. They can accept waste up to 100 Kg/day. Currently, the recycling unit is accepting thermocol waste from the surrounding villages at free of cost. However, they are willing to accept thermocol waste from the ULBs as well.

Modus Operandi: The recycling industry sends the solvent in a barrel in which thermocol needs to be dissolved and once dissolved it manufactures aglo, which the ULBs are supposed to send back. This aglo is further used in manufacturing plastic to oil.

Map 6 Proximity of ULBs to G. D. Environmental Pvt. Ltd., Pune District

Source: Created through GIS, 2017
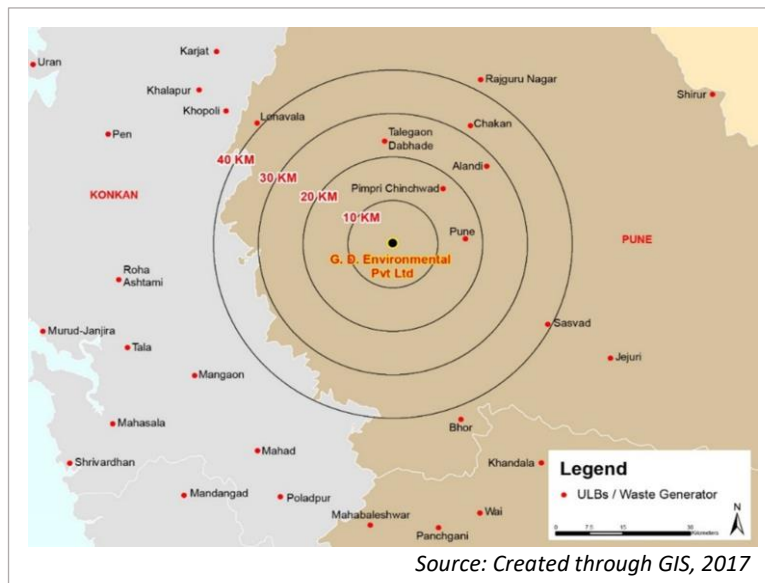
3.2.4.7   THERMOCOL WASTE RECYCLING INDUSTRY: MANE GROUP OF COMPANIES, PUNE, PUNE DISTRICT, PUNE DIVIION

Mane Group of Companies, Pune was started in 1993 by Mr. Ramdas Mane, to essentially build thermocol machines. Mr. Mane has also been given a patent for the thermocol recycling machine and his company makes toilets out of thermocol with cement coating, in two hours. His toilets are supplied all over the country and has supplied over 22,000 toilets. The business of building toilets is run on no loss, no profit basis.

Figure 3-5 Innovative recycled products manufactured at Pune
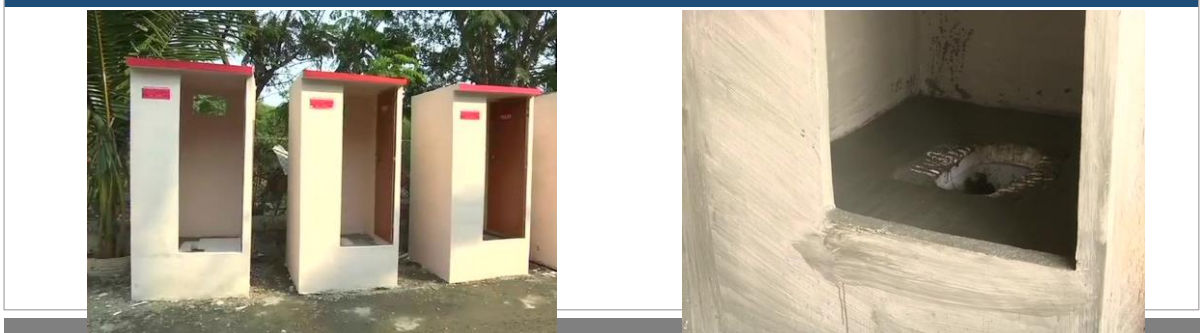
Toilets made of Thermocol

3.2.4.8 FOOTWEAR WASTE RECYCLING OPTION: GREENSOLE, NAVI MUMBAI, RAIGARH DISTRICT, KONKAN DIVISION

Greensole is an innovative company, which recycle old shoes and refashion into trendy slippers that are also eco-friendly, and donate them to the unshod. They are based out of Navi Mumbai, Raigad District. Greensole's business model is to help the underprivileged with footwear and also save the environment from carbon emissions.

Greensole has tie-ups with schools, sports clubs, and organizations who provide them with discarded shoes. They purchase recycled ropes from suppliers to make the upper part of the chappals. They have placed drop boxes at public places in Mumbai, Ajmer and Siliguri, where people can donate their old shoes. One can also courier the old shoes to them.

Map 7 Proximity of ULBs to Greensole, Navi Mumbai

Source: Created through GIS, 2017

The discarded shoes go through a cleaning process before getting a new look at Greensole's unit. The ULBs in and around Navi Mumbai could definitely explore this option of sending their footwear waste to Greensole.
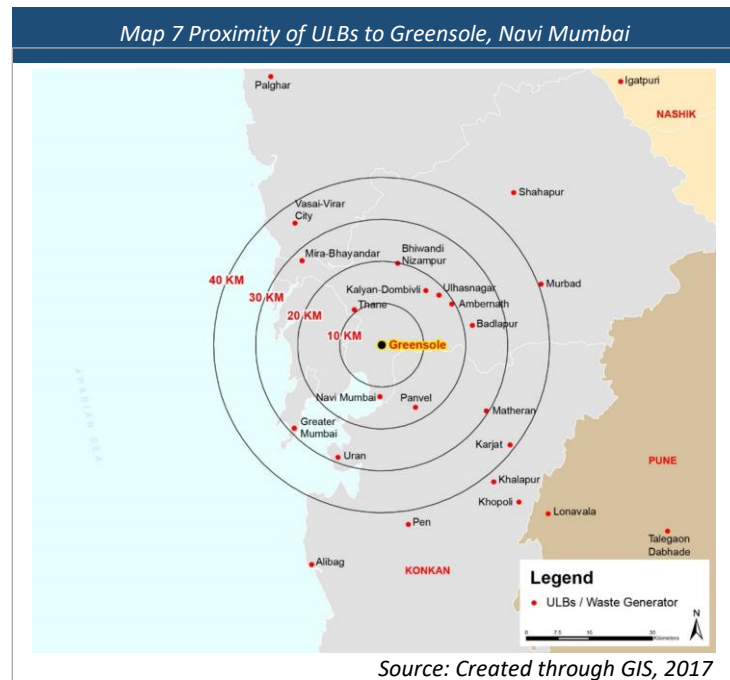
4. CLUSTER LEVEL MANAGEMENT OF DRY WASTE

4.1 BACKGROUND

This chapter gives an outline about the need for cluster level dry waste management and the approach to implement the same. According to a recent research study carried out by All India Institute of Local Self Government in collaboration with National Solid Waste Association of India (NSWAI) titled, "Identifying Market Potential for Recyclable Solid Waste in Maharashtra", it was observed that even though Urban Local Bodies have started segregation of wet and dry waste and wet waste is processed through composting in many cities, dry waste largely remain unattended except for informal recycling carried out by waste pickers in the city. Waste pickers collect and sort the good quality recyclable dry waste including clean plastic bags, glass, metal, paper and cardboard etc. and sell the same to scrap dealers or intermediaries who have the space to further clean, sort and store the waste in lieu of a suitable price given to the waste pickers.

The intermediaries further sell the material to merchants who have sufficient means of transport, who then resells it in bulk to the recycling industries. However, in the entire process, although a part of the dry waste gets managed so as to not reach the dumpsite, the ULB does not earn any revenue out of it. Therefore, it was observed that if ULB takes the initiative to control the activity, it could be a revenue generating process.

The amount of dry waste generated in Urban Local Bodies is limited considering dry waste comprises of 20% to 40% of the Municipal Solid Waste. Currently, wet waste in Indian ULBs is managed mostly through composting or waste to energy, however, dry waste recycling has multiple components and requires handling by multiple industries based on available technologies. Therefore, given the limited quantity of dry waste and the cost of installation of multiple recycling options to be borne individually by each ULB, this kind of arrangement may not be viable for ULBs given their financial condition. As opposed to this, if a cluster of ULBs engage in the management of dry waste, the model becomes implementable not only in terms of cost but also in terms of the quantity of waste. Over and above this, the ULBs may also earn revenue out of it possibly through the rates offered by the industries in lieu of the waste received.

4.2 CASE STUDIES- CLUSTER LEVEL SOLID WASTE MANAGEMENT

Cluster level solid waste management is a fairly new concept in India. In few countries abroad, regional level solid waste management plans and committees are formed. This chapter looks into cases where cluster level solid waste management is undertaken in India. These case studies would highlight the management model, stakeholder involvement, financial considerations etc. that is required for the different models. Currently cluster level SWM is carried out in two states in the country, namely, Goa and Madhya Pradesh.

4.2.1 PLASTIC WASTE MANAGEMENT- GOA

Goa is a state in western India with coastlines stretching along the Arabian Sea. Due to the state being long the coastal region it has many beaches which makes the city one of the top tourist destinations of the country. The state is divided into two districts: North Goa and South Goa. Each district is administered by a district collector, appointed by the Indian government. Panji is the headquarters of North Goa as well as the capital of Goa and Margao is the headquarters of South Goa district.

As per census 2011, total population of the state is 17, 31, 031. For the wet waste generated, the state has set up processing units in different cities. Being a major tourist destination, dry waste generation of the state is very high. Goa Waste Management Corporation (GWMC) has signed a MoU with Vasavadatta cement factory of Karnataka for recycling of plastic waste. The MoU intimates all the ULBs in the state to send their plastic waste to the cement factory. The GWMC has identified collection and bailing points across the state. ULBs send their segregate dry waste to one of the nearest centers, where it undergoes further segregation by the persons appointed by the cement factory. The segregated plastic waste is then bailed for transportation.

Roles and responsibilities of the stakeholders:

Goa Waste Management Corporation (GWMC)
- The GWMC is responsible for developing a strategy for the collection, segregation and transportation of plastic waste to the industry.
- GWMC is responsible of identifying locations (dry waste collection centers) where waste from nearby ULBs will be collected, segregated and bailed, which will be further transported to the cement factory.
- The corporation is also responsible of bearing the cost and risk of transportation of the waste to the industry.
- The GWMC has to make sure that only segregated plastic waste it sent to the industry.
- GWMC to take back consignment which contains banned items at their **own cost and risk** to an appropriate place for disposal.

Vasavadatta cement factory
- The cement factory is responsible for appointing contractor for undertaking segregation and bailing of plastic waste at the locations identified by GWMC.
- They have to appoint a representative to oversee collection and segregation of plastic waste.
- To provide bailing machines at the locations identified by GWMC.
- They have to make necessary arrangements for receiving and storage of plastic waste sent by GWMC.
- The cement factory has to weight the waste received at their factory and maintain the records for maintenance purpose.

Urban local bodies:
- The ULBs have to ensure that segregated waste is sent to the locations identified by GWMC.

> ## Summary of cluster level plastic waste management- Goa model
>
> - **State level MoU** signed with the cement factory mandates all ULBs to segregate plastic waste.
> - **Monitoring at state level (GWMC)** ensures proper functioning of the system.
> - GWMC is responsible for **providing land** for dry waste collection centers.
> - **Cost of transportation** of waste till the cement factory is borne by GWMC.
> - GWMC is giving plastic waste to the cement industry **without any monetary returns**.
> - The cement factory is responsible of appointing contractor for segregation and bailing of plastic waste. Hence, the **quality of plastic waste is maintained**.

4.2.2 INTEGRATED SOLID WASTE MANAGEMENT- MADHYA PRADESH

The State of Madhya Pradesh (MP) in India is the fifth most populous State of the country and has 379 Urban Local Bodies (ULB). As per the CPCB report as per February 2016, total solid waste generated in the state is 6,678 MT out of which 4,351 is collected. State Government Vision 2018 emphasizes on implementation of Solid Waste Management in all ULBs of the State. During that time none of the 379 ULBs had Integrated Solid Waste Management system (ISWM) comprising of all components as per Solid Waste Handling & Management Rules 200/ 2016. Inadequate man-power, lack of technical know-how and insufficient finances were some of the issues faced by the ULBs while implementing the SWM. To address these issues the Government of Madhya Pradesh has decided to implement integrated SWM in all the ULBs of the state by forming clusters of the ULBs through involvement of private sector.

Approach for forming clusters:

- **Feasibility study of the clusters** was prepared by a third party based on the geography, culture, waste generation, administrative jurisdiction etc.
- The clusters have been formed wherein a larger ULB has been chosen as **lead member** where the regional processing facility will be developed.
- **Smaller ULBs within the distance of 50-80 kms** from the lead member city are made part of the cluster.
- MSW from the smaller cities will be transported to the regional processing facility.
- To optimize waste collection, clusters have been formed so that **total waste is around 150 TPD**.
- Total of 26 clusters have been formed to cover all 379 ULBs of the State.

Approach for cluster management:

- **Implementing Authority**

- All ULBs of the cluster to sign an Inter ULB agreement authorizing the larger ULB to act as lead member.
- ULBs to authorize Commissioner, UAD/ State Mission Director -SBM to conduct the bidding process till the selection of the bidder
- Monitoring Committee to be formed comprising of CMOs of all the ULBs of the cluster headed by lead member, for taking decision for monitoring of the project.

- **Long term PPP**

  Leveraging on the financial support, technical and management experience of the private sector concession period of 21 years i.e. 19 years of O&M with 1.5-2 years if implementation period has been considered.

- **User charges**

  Based on the economic status and commercial activities present in the city, affordable user charges will be levied.

Project funding:

Figure 4-1 Project funding pattern for Madhya Pradesh cluster level Integrated SWM

Source: 1 Integrated SWM (cluster basis) plan for the state on regional landfill concept by Directorate, Urban Administration & Development
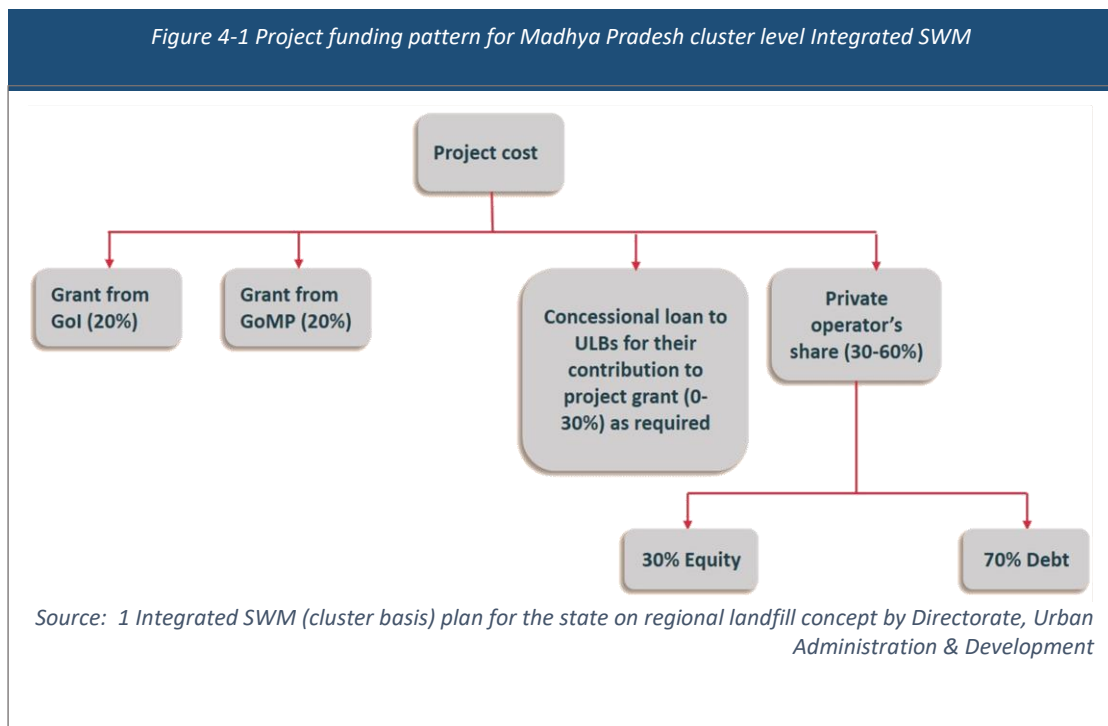
Current status: Out of 26 clusters work for 12 clusters has started

Summary of cluster level Integrated SWM - Madhya Pradesh model

- Formation of clusters and feasibility study of the same is undertaken by the State through a third party.
- Since, a **single contractor is appointed for the entire value chain**, increases accountability and hindrances arising due to improper implementation of one of the agency is avoided.
- **Long term contracts** make the project viable for the private agency.
- **Factors considered for formation of cluster are**-
    - Distance between towns
    - Quantity of waste
    - Project Cost
    - Economies of Scale
    - Affordable user charges

4.3   CONCEPT OF A CLUSTER AND APPROACH

A cluster could comprise of a group of 4-5 ULBs handing over a substantial amount of segregated dry waste to a recycling industry which would collect the waste at an agreed frequency. The clusters hence formed would be based on the following criteria-

1. **Quantity** of segregated dry waste stored in the ULBs
2. **Quality** of segregated dry waste
3. **Capacity** of the industry
4. **Segregation** levels of ULBs and
5. **Distance** from the city to the recycling industry
6. **Willingness** of the ULB and the industry to be part of the cluster

The above criteria stands true for all the dry waste categories- plastic waste, paper and cardboard waste, glass waste, metal waste, thermocol waste, cloth and other textile waste and footwear waste.

The following section talks in detail about the specific clusters depending up on each waste type and location of respective industry.

5. CLUSTER LEVEL APPROACH

5.1   SCENARIO OF WASTE SEGREGATION IN MAHARASHTRA

According to a recent research study carried out by RCUES All India Institute of Local Self Government, it has been observed (as per the primary surveys conducted) that the ULBs are sorting the dry waste manually and are able to sort dry waste into different categories including, plastic which is the major contributor of dry waste in various types such as bottles, polythene bags, wrappers, packaging material etc.,. About 5.56% of the total dry waste arriving at the dump yard constitutes of plastics. Paper and Cardboard together is the next major contributor of the municipal dry waste, which comprises of about 4.56% of the total dry waste.

Table 5-1 Category wise quantity of dry waste sorted at dumping site

Divisions	Plastic	Glass	Thermocol	Paper	Cardboard	Cloth	Footwear	Metal
Amaravati	14.27	1.39	0.54	7.34	4.36	1.64	1.46	0.39
Aurangabad	21.51	2.09	0.81	11.07	6.58	2.48	2.21	0.58
Nagpur	20.17	1.96	0.76	10.37	6.17	2.32	2.07	0.54
Nashik	31.65	3.07	1.20	16.28	9.68	3.64	3.24	0.85
Konkan	176.59	17.15	6.67	90.83	53.99	20.33	18.10	4.76
Pune	57.51	5.59	2.17	29.58	17.58	6.62	5.90	1.55
Total	321.70	31.24	12.15	165.48	98.36	37.03	32.98	8.68
Total	**707.63**							

Source: (Calculated based on 2017 population, 2017)

The state of Maharashtra comprise of 384 Urban Local Bodies (ULB). As a mandate under Solid Waste Management Rules 2016, many ULBs have already started to segregate their waste in to wet waste and dry waste. Segregation is the foremost important criteria for waste processing. Therefore, in order to implement recycling of plastic in a clustered manner, it is important to understand the segregation levels of cities. Higher segregation levels would ensure increased efficiency of recycling because of good quality of raw material which is also a requirement from the industries point of view. The folowing map shows ULBs in Maharashtra which have 80% and above levels of segregation. They account for 18% (71 ULBs) of the total number of ULBs (384).

It is observed that Konkan, Nashik, Pune and Nagpur have the highest number of ULBs having 80% and above levels of segregation of waste. Considering the scope of time for the study, clusters around Konkan and Pune division have been explored further on a pilot basis for plastic waste recycling. The following chapter discusses in detail how these clusters have been worked out.

Map 8 71 ULBs having 80% and above levels of segregation
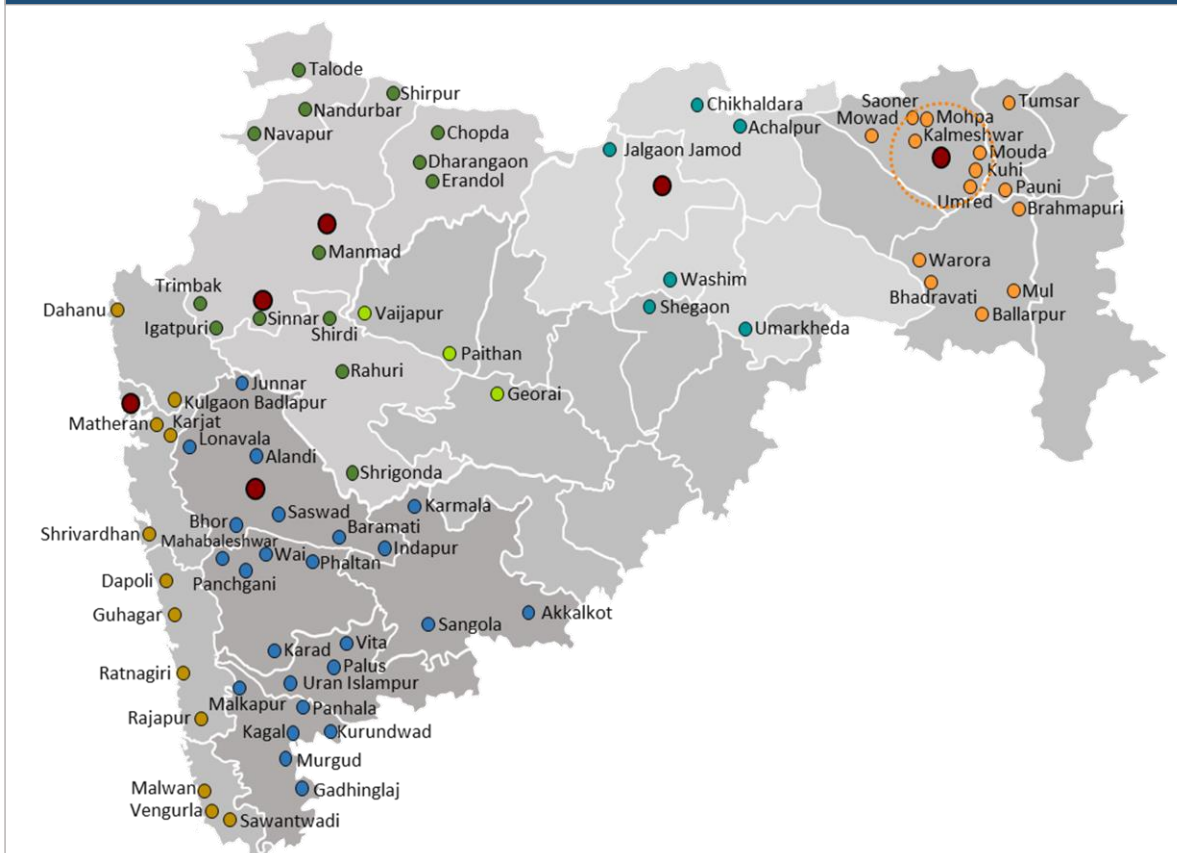
According to a recent research study carried out by RCUES All India Institute of Local Self Government, it has been observed that totally 384 ULBs in Maharashtra are primarily sorting 11 types of different dry waste categories which account for 21.44% (6378 MT/ day) (Annepu, 2012) of the total MSW generated (29,748 MT/day). Of this total amount of dry waste, about 5.56% of the waste arriving at the dump yard, constitutes of plastics. The plastic waste largely comprises of PET bottles, polythene bags, wrappers, packaging material etc.

5.2 SCENARIO OF PLASTIC RECYCLING INDUSTRIES IN MAHARASHTRA

The above stated report identifies close to 386 industries which recycle plastic waste in the state. Out of these industries, 74 are MPCB (Maharashtra Pollution Control Board) registered industries. Most of the industries are located in Konkan and Pune division and some are located around Malegaon city in Nashik division.

Map 9 Type and location of plastic recycling industries in Maharashtra
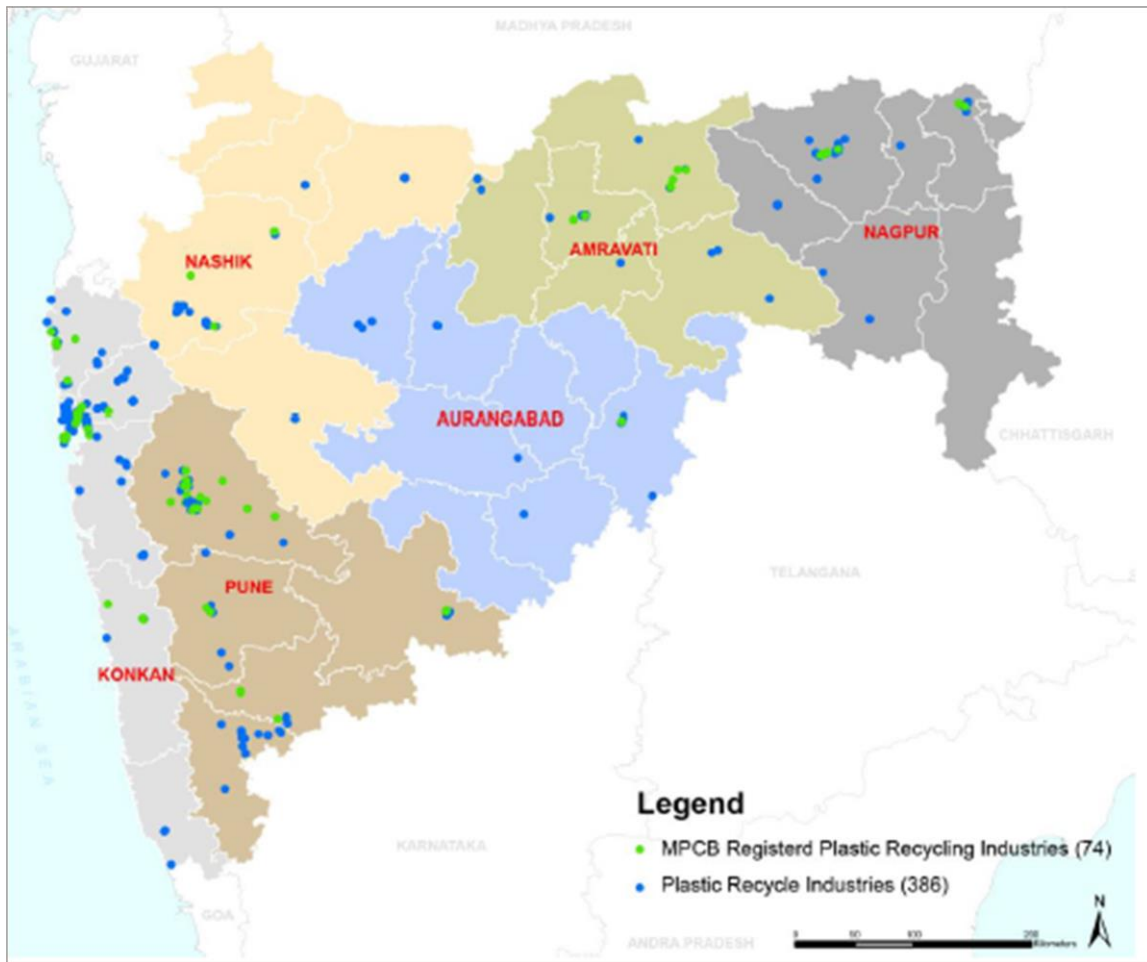
Source: 2 Identifying market for recyclable dry waste in Maharashtra, by RCUES Mumbai

For this study only MPCB registered industries are considered. Discussion with these 74 industries were conducted to understand the willingness and possibility of the industry to be included in the cluster. Based on discussions with 74 MPCB registered industries, following observations were recorded.
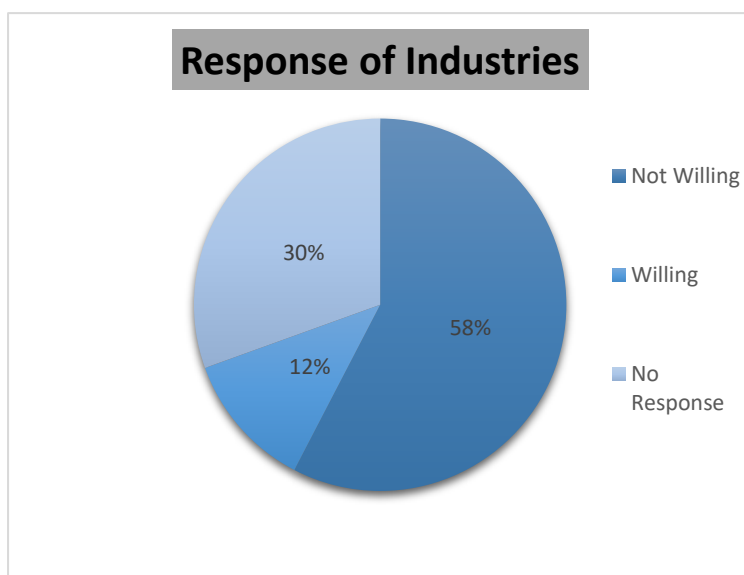
Response of Industries

- Not Willing — 58%
- Willing — 12%
- No Response — 30%

These 12% industries comprise of the 9 industries which are willing to accept plastic waste from the ULBs. They are spread of the 4 revenue divisions of the state- Konkan, Nashik, Pune, Amravati and Nagpur. The following map shows the spatial spread of the industries.

Map 10 Industries willing to accept plastic waste from ULBs for recycling

M/S. SWASTIK PLASTO, SINNAR- NASHIK DIVISION

M/S. PRAKASH PLASTICS, MALEGAON- NASHIK DIVISION

JJ PLASTIC, MUMBAI- KONKAN DIVISION

RECYCLEKARO, MUMBAI- KONKAN DIVISION

G D ENVIRONMENTAL, PUNE- PUNE DIVISION

M/S. RAVI PACKAGING, AMRAVATI- AMRAVATI DIVISION

M/S. SUDARSHAN PLASTIC, NAGPUR- NAGPUR DIVIDION

Source – RCUES Study on Dry Waste 2017-18
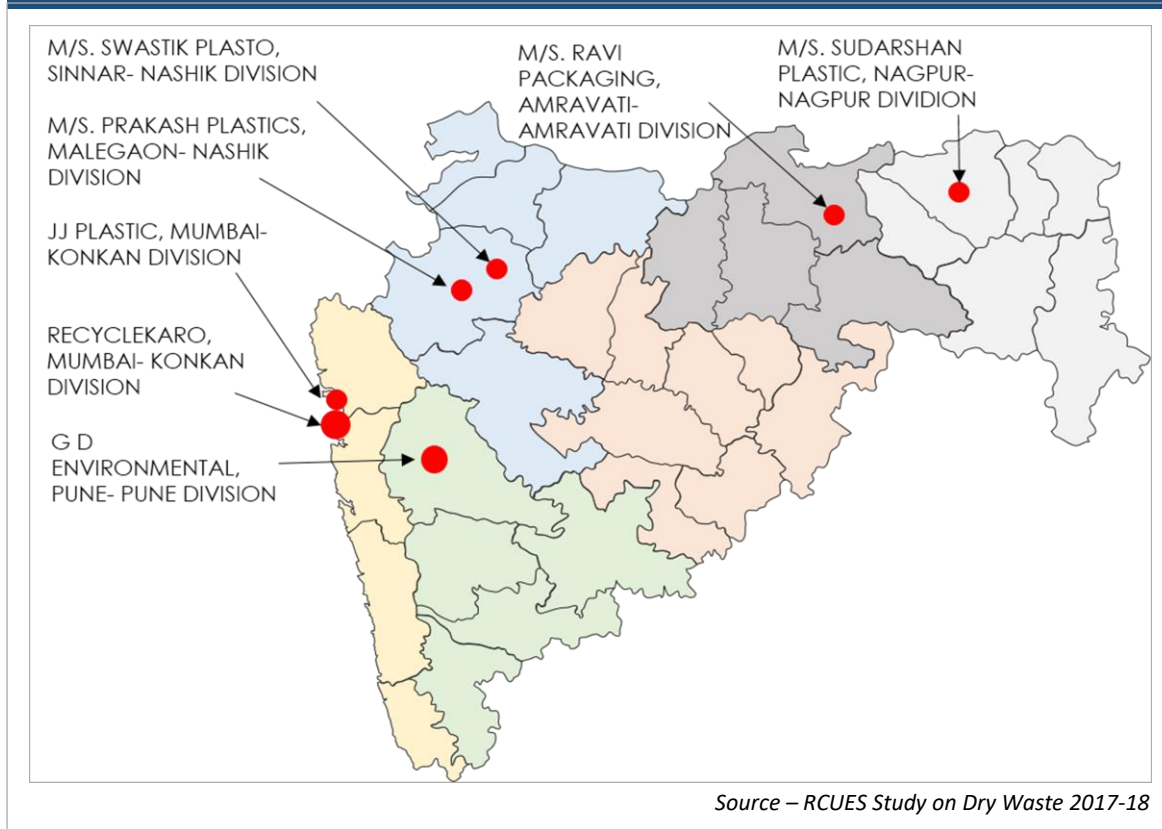
5.3   CRITERIA OF INDUSTRIES

The approach to cluster level dry waste management was shared and discussed with the above-mentioned 9 industries which are willing to accept plastic waste from Urban Local Bodies (ULBs). Detailed interviews/ meetings were conducted with these 9 recycling industries to identify the criteria to be considered for identifying clusters.

Following are the extracts of the discussions held with these recycling industries followed by the summary of criteria of the industries to be part of cluster level dry waste management.

Konkan Division:

1. **J. J. Plastics, Mumbai**

Q- What is the **capacity** of your recycling unit?

  A- 1.1 MT/day

Q- What **type of plastic waste** do you recycle?

  A- LDPE plastic

Q- What is the type of processing undertaken? What is the end product of the processing?

  A- XXX

Q- At present from where do you take plastic used as raw material?

  A- There are many sources like local dealers, agents, private companies etc.

Q- At what **rate** do you take plastic waste from these sources?

A- Generally it is at around Rs.30 /kg For PET bottles and Rs. 15-20/ kg for LDPE plastic depending on the quality of the waste.

Q- Is there any specific requirement in terms of the quality for intake of plastic waste?

A- Yes, the waste has to be well segregated. Since generally waste is collected in mixed form and segregated on dumping ground, the LDPE plastic waste gets contaminated. Hence ULBs need to give us washed plastic.

Q- Considering that collection routes will be fixed between cities to industries, are you ready to bear the transportation cost associated to it?

A- Yes, if favorable amount of plastic waste is collected in that route.

Q- How much distance would be feasible for you for collecting waste from cities?

A- That would again depend on the quantity of waste, but considering the proximity of cities in Konkan division and travel distance, around 60-100 kms could be possible.

Q- Are you willing to collaborate with cities to be part of cluster level dry waste management?

A- Sure. If cities are able to give us good quality of segregated LDPE plastic waste we would be happy to be part of it. But a fixed amount of waste should be collected in one collection drive. Coordination between cities is crucial and a monitoring authority should be in place to make sure adequate amount of waste of good quality is sent to us.

2. **Recyclekaro, Mumbai**

Q- What is the **capacity** of your recycling unit?

A- 3 MT/day

Q- What **type of plastic waste** do you recycle?

A- PET plastic

Q- What is the type of processing undertaken? What is the end product of the processing?

A- Plastic is converted into granules which is further sold to industries.

Q- At present from where do you take plastic used as raw material?

A- We have tie-ups with many MNCs.

Q- At what **rate** do you take plastic waste from these sources?

A- Rs. 6-16/ kg for PET bottles

Q- Is there any specific requirement in terms of the quality for intake of plastic waste?

A- None just that only PET bottles and no other kind of plastic should be sent to the industry.

Q- Considering that collection routes will be fixed between cities to industries, are you ready to bear the transportation cost associated to it?

A- Yes, if it is financially viable.

Pune Division:

3. **J. Kay Plastics, Pune**

Q-What is the **capacity** of your recycling unit?

   A- 2 MT/day

Q-What **type of plastic waste** do you recycle?

   A- LDPE plastic

Q- What is the type of processing undertaken? What is the end product of the processing?

   A- Plastic is converted into granules which is further sold to industries.

Q- At present from where do you take plastic used as raw material?

   A- Various agents.

Q- At what **rate** do you take plastic waste from these sources?

   A- Approximately Rs. 15-20/kg for LDPE plastic. It depends on the quality of the material.

Q- Is there any specific requirement in terms of the quality for intake of plastic waste?

   A- Plastic should be clean and free of any excess contamination. Also, it should be bundled together so as to optimize space of the transportation vehicle.

Q- Considering that collection routes will be fixed between cities to industries, are you ready to bear the transportation cost associated to it?

   A- Depends on the quantity of waste to be collected per route. If the quantity is too less the other party will have to share the transportation cost.

Q- How much distance would be feasible for you for collecting waste from cities?

   A- That would again depend on the quantity of waste, but we can travel around 150-200 kms.

Q-Are you willing to collaborate with cities to be part of cluster level dry waste management?

   A- Yes, but the cities have to make sure that they give good quality of clean plastic waste.

The following table includes the requirements of the industries in terms of capacity, type of waste, form of waste, willingness to bear/ share the transportation cost and type of waste processed.

NAME OF THE INDUSTRY	DIVISION	CAPACITY (MT/day)	TYPE OF WASTE	FORM OF WASTE	WILLINGNESS TO PAY TRANSPORT COST (Y/N)
JJ PLASTIC	Konkan	1.1	LDPE	Washed plastic	Yes
RECYCLE KARO		3	PET bottles		Yes
JJ PLASTIC	Pune	2.8	LDPE	Washed plastic	Yes
INSTROL RENEWABLE ENERGY PVT. LTS.	Pune			Bailed plastic	Depends on waste qty.
SWASTIK PLASTO	Nashik	1.2	HDPE, LDPE	Washed plastic	
PRAKASH PLASTIC		1	HDPE and LDPE		
RAVI PACKAGING	Amravati	1	All type of washed plastic		
SUDARSHAN PLASTIC	Nagpur	1	PP and HM		

Based on discussion with industries, few criteria critical to accepting plastic waste from Urban Local Bodies (ULBs) were as follows-

➢ Good quality plastic which is not soiled by organic waste or are washed because few industries are not equipped with washer facility
➢ Plastic should be segregated in to PET bottles, HDPE, LDPE, PP and HM
➢ Assured quantity of plastic at an agreed frequency of collection
➢ Bailed plastic to fit in more quantity for collection
➢ Industry is ready to bear the transportation cost subjected to a certain quantity of waste which would be assured by the ULB

➢ Some industries like Instrol Renewable Energy Pvt. Ltd. also asked for land (approx. 650 sqmt. Inclusive of storage space) to be given by the ULB for them to set up their plant

➢ Some industries are willing to accept plastic waste at an offered rate. The rates are as follows-
  ✓ Low grade- Rs. 15/- to 18/- kg
  ✓ Medium grade- Rs. 25/- kg
  ✓ High grade- Rs. 30/- kg
  ✓ PET Bottles- Rs. 33/- kg

The following map shows the location of industries with respect to the location of ULBs with more than 80% segregation.

Map 11 Location of Industries and ULBs with more than 80% segregation

Name of Division	No. of ULBs with >80% segregation	No of industries in the division
Konkan	12	2
Pune	28	1
Nagpur	14	1
Nashik	15	2
Amravati	6	1
Aurangabad	3	0

Source: Primary Survey Conducted, 2018
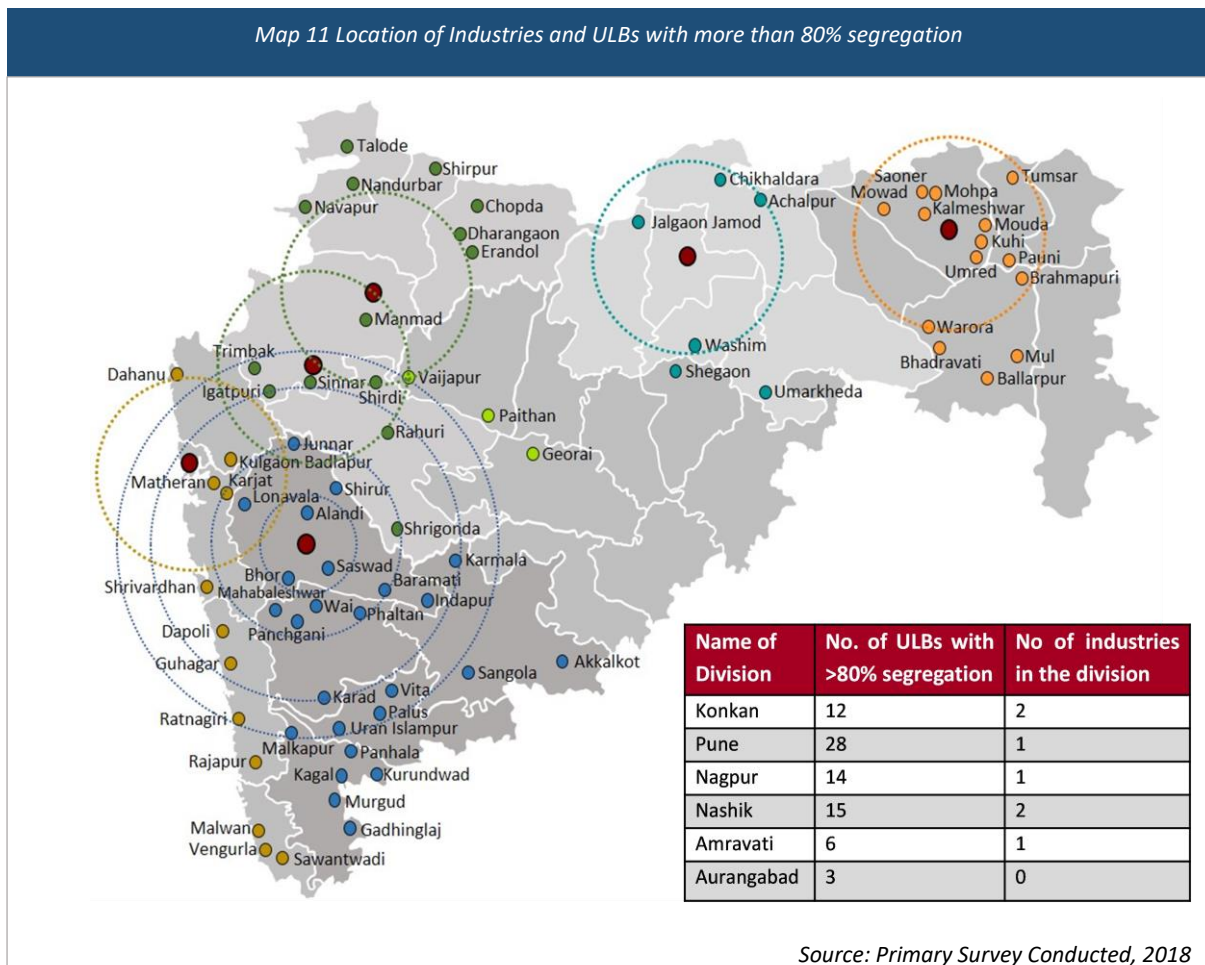
6. SELECTION OF CITIES FOR CLUSTER FORMATION

6.1   IDENTIFICATION OF CLUSTERS IN PUNE DIVISION

The revenue division of Pune has close to 69 Urban Local Bodies. The Municipal Corporations have been excluded due to the scale of complexity of waste management and generation. JJ plastic Private Limited located in the Pune division is willing to accept plastic waste from the ULBs for recycling. They are.

The above industry accept good quality and unsoiled LDPE, HDPE, and PET bottles. The capacities of the industry is 2.8 TPD. Following map shows the location of the industry along with ULBs having 80% and above segregation and proximity of the industries to ULBs.

Map 12 ULBs with 80% and above segregation

Source- Data from Divisional Coordinator (as on July 2018) and preliminary interaction with ULBs
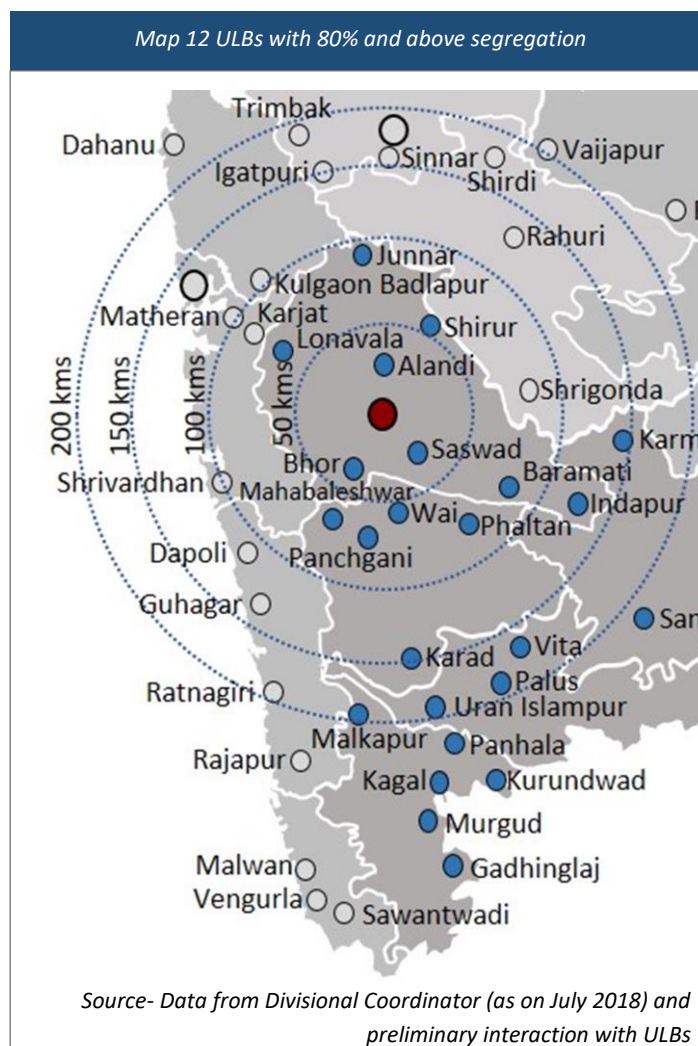
Table 6-1 Plastic Generation and segregation of ULB under 200 kms buffer of industries

SR NO.	ULBS WITH >80% BUFFER (200 KMS BUFFER)	SEGREGATION (%)	PLASTIC WASTE GENERATION (MT)	MONTHLY PLASTIC WASTE GENERATION (MT)
1	Junnar	100	0.099	2.97
2	Alandi	80	0.125	3.75
3	Lonavala	100	0.236	7.08
4	Sasvad	100	0.131	3.93
5	Bhor	90	NA	0
6	Baramati	95	0.454	13.62
7	Phaltan	90	0.193	5.79
8	Wai	85	0.161	4.83
9	Indapur	80	0.106	3.18
10	Karmala	85	0.091	2.73
11	Karad	100	0.304	9.12
12	Vita	90	0.208	6.24
13	Palus	100	0.061	1.83
14	Ashta	90	0.136	4.08
15	Uran Islampur	100	NA	0
16	Malkapur	100	0.019	0.57
17	Sangole	95	0.144	4.32
18	Vadgaon	90	0.112	3.36
19	Panhala	100	0.015	0.45
Total			**2.6**	**77.85**

Upon discussion with the industries, it was inferred that the industries can collect plastic waste from cities up to a radius of 200 kms. Thus, from the above map we see that close to 19 ULBs having 80% and above segregation fall under the proximity radius of 200 kms from the location of industries. The following table shows the list of these 18 ULBs along with their assumed quantities plastic waste generation both on a daily and monthly basis.

Table 6-2 Initial assessment of ULBs

SR NO.	ULBS WITH >80% BUFFER	SEG (%)	INITIAL ASSESSMENT
1	Junnar	100	PET bottles taken away by waste pickers. Plastic waste given to an industry free of cost
2	Alandi	80	Contractor appointed rag pickers segregate and store dry waste
3	Lonavala	100	bhangarwalas sell recyclables, profit to ULB
4	Bhor	90	Tie ups with companies which take away recyclables and profits are given to ULB
5	Wai	85	Contractor appointed rag pickers segregate and store dry waste
6	Karad	100	Rag pickers sort waste and sell it. ULB in talks with a plastic recycling industry
7	Vita	90	Tie ups with companies which take away recyclables and profits are given to ULB
8	Palus	100	Rag pickers sell the sorted waste. 50% still remains on site, ULB doesn't earn
9	Uran Islampur	100	Rag pickers sell the sorted waste. ULB in talks with a plastic recycling industry
10	Malkapur	100	Waste pickers segregate and store waste in dumpsite
11	Panhala	100	Waste pickers segregate and store waste in dumpsite
12	Mahabaleshwar	100	Plastic is used in road construction
13	Panchgani	100	Plastic is used in road construction
14	Sasvad	100	Contractor sells dry waste. ULB willing to be part of cluster.
15	Baramati	95	Contractor appointed rag pickers segregate and store dry waste
16	Phaltan	90	Waste pickers segregate and store waste in dumpsite
17	Indapur	80	Rag pickers sell the sorted waste. ULB doesn't earn
18	Karmala	85	Plastic waste is bundled and stored

Further discussion with the above ULBs revealed that 6 ULBs from these 19 ULBs have good quality plastic waste segregated and stored either in their dump site or a dedicated space. Also, the proximity of these ULBs to the industries offer an added advantage. The 6 ULBs include- Junnar, Alandi, Saswad, Karad Uran Islampur and Panhala. The 6 cities were visited to gather information about the method of segregation, further dry waste segregation if any, scenario of dry waste collection, infrastructure and resources available for collection and sorting and overall potential and challenges. The following section talks about the cities and their dry waste management scenario in detail.

JUNNAR

Background

- **Location:** Pune district, 100 kms from the recycling industry
- **Population (census 2011) :** 25,315
- **Total waste generation:** 6 TPD
- **Dry waste generation:** 2 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-1 Dry waste management scenario in Junnar

Dry waste is segregated by ULB workers and stored in the dump site. This is further segregated in to **LDPE, HDPE, shoes, bags and clothes**. The city has not given any formal recognition to the waste pickers. However, the waste pickers in the dumpsite usually take away PET bottles. The quantity of plastic waste (based on assumption) is close to 0.1 TPD. Currently, plastic waste is given to an industry free of cost. The transportation cost is borne by the ULB.

Total waste generation: **6** TPD

Dry waste generation: **2** TPD

At source segregation: 100%

Secondary segregation: by ULB workers

Rag-pickers not integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste stored at dumping site
- LDPE plastic Given to a recycling industry free of cost
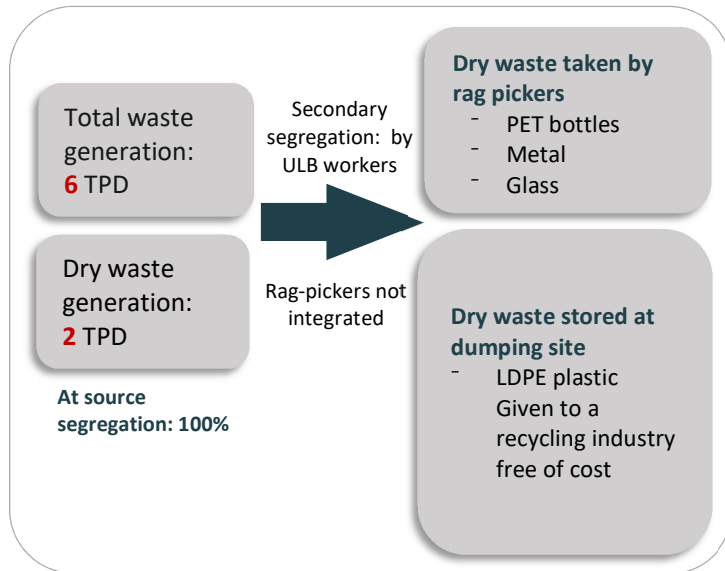
Figure 6-2 Types of dry waste segregated and stored at processing site at Junnar

Plastic waste stored near processing site

PET bottles taken by waste pickers

Cloth waste is stored to be given to brick kilns located nearby

POTENTIAL TO BE PART OF CLUSTER

1.	Segregation	Yes at 100% segregation at source
2.	Involvement of stakeholder	
	a. Contractor	Nothing exists
	b. Rag-pickers	Reason: since they are not integrated in the system they take away recyclable dry waste
3.	Existing forward linkages established	Currently dry waste is being given away for free
4.	Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5.	Willingness to share transportation cost	Willing to share/ bear transportation cost of waste collection.

ALANDI

Background

- **Location:** Pune district, 20 kms from the recycling industry
- **Population (census 2011):** 28,645
- **Total waste generation:** 20 TPD
- **Dry waste generation:** 9 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-3 Dry waste management scenario in Alandi

Dry waste is segregated by ULB workers and stored in the dump site. This is further segregated in to **LDPE, HDPE, shoes, bags and clothes**. The city has not given any formal recognition to the waste pickers. However, the waste pickers in the dumpsite usually take away PET bottles. The quantity of plastic waste (based on assumption) is close to 0.1 TPD. Currently, plastic waste is given to an industry free of cost. The transportation cost is borne by the ULB.

Total waste generation: **20** TPD

Dry waste generation: **9** TPD

At source segregation: 100%

Secondary segregation: by ULB workers

Rag-pickers not integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste stored at dumping site
- LDPE plastic
- Given to a recycling industry free of cost
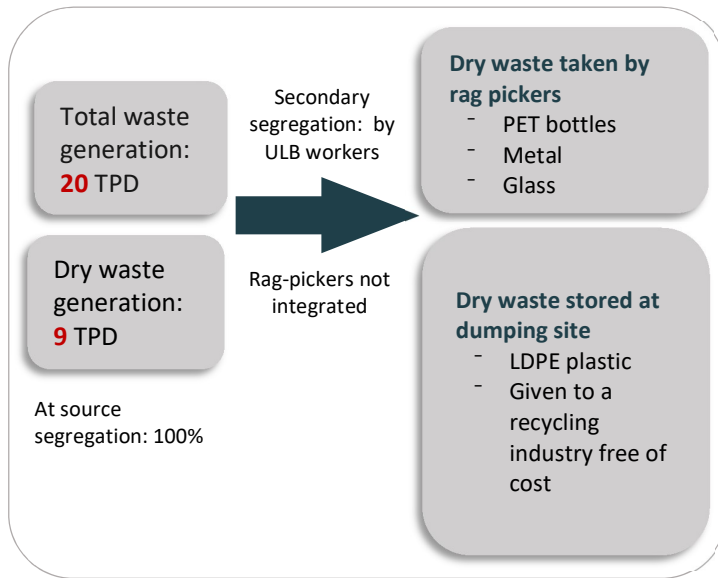
Figure 6-4 Types of dry waste segregated and stored at processing site at Alandi

Plastic waste stored near processing site

Footwear waste stored at processing site

Plastic waste stored near processing site

POTENTIAL TO BE PART OF CLUSTER

1. Segregation	Yes at 100% segregation at source
2. Involvement of stakeholder	
a. Contractor	Nothing exists
b. Rag-pickers	Reason: since they are not integrated in the system they take away recyclable dry waste
3. Existing forward linkages established	Currently dry waste is being given away for free
4. Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5. Willingness to share transportation cost	Willing to share/ bear transportation cost of waste collection.

SASWAD

Background

- **Location:** Pune district, 33 kms from the recycling industry
- **Population (census 2011) :** 31,821
- **Total waste generation:** 12 TPD
- **Dry waste generation:** 5.3 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-5 Dry waste management scenario in Saswad

Dry waste is segregated by ULB workers at the processing site in to PET bottles, LDPE and HDPE plastic. Waste pickers help in secondary segregation of dry waste. This waste is sold by the waste collection contractor presently. The quantity of plastic waste (based on assumption) is close to 0.13 TPD. The city has not given any formal recognition to the waste pickers. However, the waste pickers in the dumpsite usually take away PET bottles. Currently, plastic waste is sold to contractor. The transportation cost is borne by the ULB.

Total waste generation: **12** TPD

Dry waste generation: **5.3** TPD

At source segregation: 100%

Secondary segregation: by ULB workers

Rag-pickers not integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste stored at dumping site
- LDPE plastic Given to a recycling industry free of cost
- Cloth Given to a brick kiln free of cost
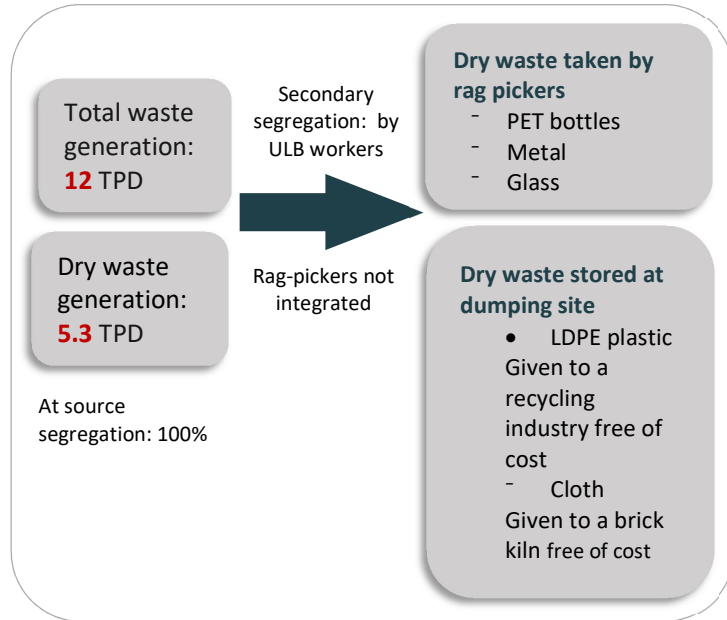
Figure 6-6 Types of dry waste segregated and stored at processing site at Saswad

LDPE plastic stored at processing site

PET bottles stored at processing site

Mixed dry waste at processing site

POTENTIAL TO BE PART OF CLUSTER

1.	Segregation	Yes at 100% segregation at source
2.	Involvement of stakeholder	
	a. Contractor	Contractor buys the plastic waste
	b. Rag-pickers	Reason: since they are not integrated in the system they take away recyclable dry waste
3.	Existing forward linkages established	Currently dry waste is being sold to contractor
4.	Willingness of the ULB to be part of cluster	ULB is earning out of the current system
5.	Willingness to share transportation cost	Willing to share/ bear transportation cost of waste collection.

URAN – ISLAMPUR

Background

- **Location:** Pune district, 200 kms from the recycling industry
- **Population (census 2011) :** 67,391
- **Total waste generation:** 18 TPD
- **Dry waste generation:** 12 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-7 Dry waste management scenario in Uran Islampur

Dry waste is segregated by ULB workers at the processing site in to PET bottles, LDPE and HDPE plastic. Waste pickers help in secondary segregation of dry waste. Currently, the ULB is in talks with an industry for setting up a processing plant which produces paver blocks out of plastic waste on a land provided by the ULB on a pilot basis. The quantity of plastic waste (based on assumption) is close to 0.27 TPD

Total waste generation: **18** TPD

Secondary segregation: by ULB workers

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste generation: **12** TPD

Rag-pickers integrated

Dry waste stored at dumping site
- LDPE plastic Stored at dumpsite along with other waste

At source segregation: 100%
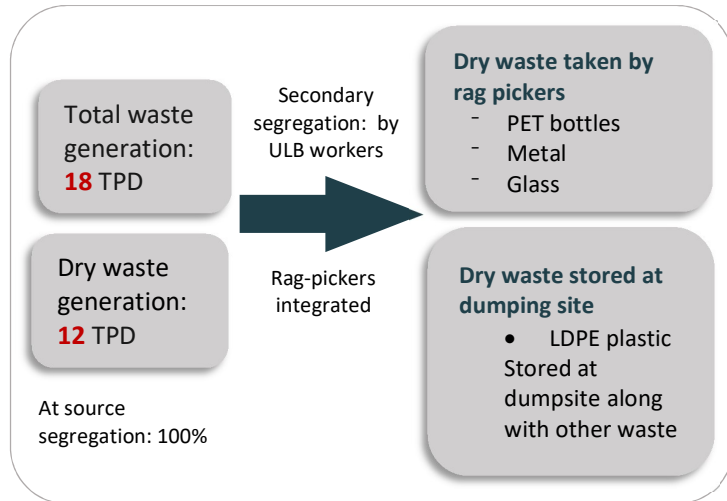
Figure 6-8 Types of dry waste segregated and stored at processing site at Uran Islampur

Plastic waste bundled to be taken away by waste pickers

Mixed dry waste bundled to be taken away by waste pickers

POTENTIAL TO BE PART OF CLUSTER

1. Segregation	Yes at 100% segregation at source
2. Involvement of stakeholder	
a. Contractor	Nothing exists
b. Rag-pickers	Since they are integrated in the solid waste management system
3. Existing forward linkages established	Currently dry waste is stored on dumping ground
4. Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5. Willingness to share transportation cost	Willing to share/ bear transportation cost of waste collection.

KARAD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-9 Dry waste management scenario in Karad

Dry waste is segregated by ULB *worker*s at the processing site in to PET bottles, LDPE and HDPE plastic. Waste pickers help in secondary segregation of dry waste. LDPE plastic is stored in a segregated manner but the quantity is small & the dumpsite waste is not quantified. Currently, the ULB is in talks with an industry for setting up a processing plant. Plastic waste has been previously sold to an industry in the MIDC area. The quantity of plastic waste (based on assumption) is close to 0.3 TPD.

Total waste generation: **38** TPD

Dry waste generation: **13** TPD

At source segregation: 100%

Secondary segregation: by ULB workers

Rag-pickers integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste stored at dumping site
- LDPE plastic Stored at dumpsite along with other waste
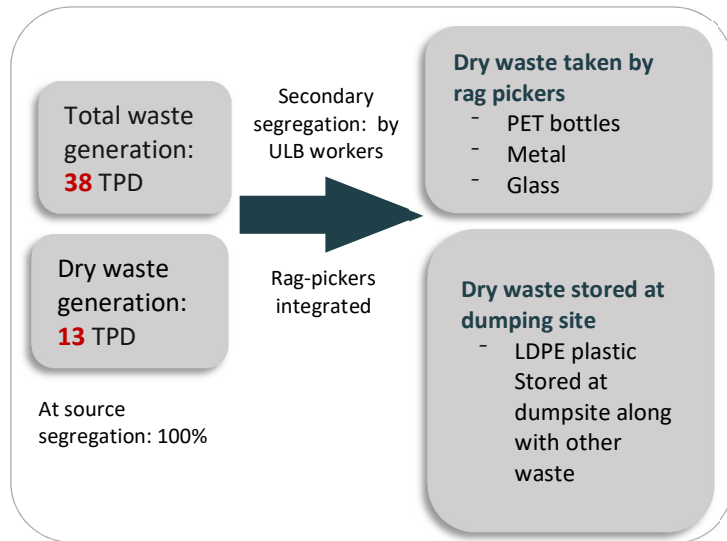
Figure 6-10 Types of dry waste segregated and stored at processing site at Karad

Dry waste bundled to be taken away by waste pickers

Cardboard waste bundled to be taken away by waste pickers

LDPE plastic waste bundled to be taken away by waste pickers

POTENTIAL TO BE PART OF CLUSTER

1. Segregation	Yes at 100% segregation at source
2. Involvement of stakeholder	
a. Contractor	Nothing exists
b. Rag-pickers	Since they are integrated in the solid waste management system
3. Existing forward linkages established	Currently dry waste is stored on dumping ground
4. Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5. Willingness to share transportation cost	Willing to share/ bear transportation cost of waste collection.

PANHALA

Background

- **Location:** Pune district, 250 kms from the recycling industry
- **Population (census 2011) :** 31,821
- **Total waste generation:** 1 TPD
- **Dry waste generation:** 0.5 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-11 Dry waste management scenario in Panhala

Dry waste is segregated by ULB workers at the processing site in to PET bottles, LDPE and HDPE plastic. Waste pickers help in secondary segregation of dry waste. Dry waste is segregated by waste pickers (who have been given ID cards) at the dumping site in to glass bottles, PET bottles, LDPE plastic, footwear and leather. The quantity of plastic waste (based on assumption) is close to 0.25 TPD. The ULB is willing to be a part of the cluster and is also willing to share/ bear the transportation cost of waste collection.

Total waste generation: **1** TPD

Dry waste generation: **0.5** TPD

At source segregation: 100%

Secondary segregation: by ULB workers

Rag-pickers integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste stored at dumping site
- LDPE plastic given to a recycling industry free of cost
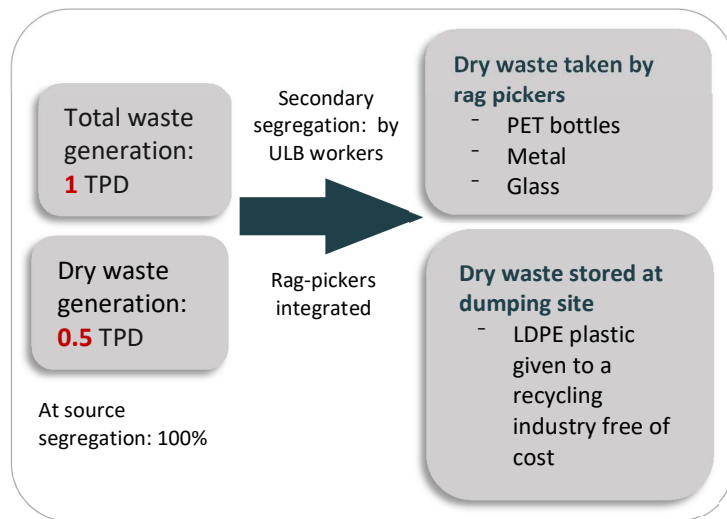
Figure 6-12 Types of dry waste segregated and stored at processing site at Panhala

Footwear waste segregated at processing site

Glass waste segregated at processing site

LDPE plastic waste segregated at processing site

POTENTIAL TO BE PART OF CLUSTER

1. Segregation	Yes at 100% segregation at source
2. Involvement of stakeholder	
a. Contractor	Nothing exists
b. Rag-pickers	Since they are integrated in the solid waste management system
3. Existing forward linkages established	Currently dry waste is stored on dumping ground
4. Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5. Willingness to share transportation cost	Willing to share/ bear transportation cost of waste collection.

6.1.1.7 COMPARATIVE ANALYSIS OF CITIES VISITED OF PUNE DIVISION

	Dry waste generation (MT/day)	Seg (In %)	Availability of manpower for segregation	Available infrastructure	Type of segregated dry waste available	Current management of dry waste	Willingness of ULBs to be part of cluster	Willingness to share transport cost	Potential to be included in cluster
JUNNAR	2	100	ULB workers segregate waste	Shed -sorting and storage	Secondary segregation is not undertaken	PET bottles taken away by waste pickers. Plastic waste given to an industry	Yes	No	Yes
ALANDI	9	83	Rag pickers integrated in the system segregate waste	Shed -sorting and storage	LDPE, PET bottles, clothes, footwear	Waste pickers sort waste. Contractor pays them	Yes	Yes	Yes
SASWAD	5.5	100	ULB workers segregate waste	Shed -sorting and storage	PET bottles and LDPE plastic	Rag pickers sort waste which is sold by contractor	Yes	No	May be
URAN ISLAMPUR	2.5	100	Waste pickers segregate waste	Shed -sorting and storage	Secondary segregation is not undertaken	Rag pickers sell the sorted waste. ULB in talks with a plastic recycling industry	Yes	Yes	May be
KARAD	13	100	Rag pickers segregate waste	Shed -sorting and storage	Secondary segregation is not undertaken	Rag pickers sort waste and sell it. ULB in talks with a plastic recycling industry	Yes	No	Maybe
PANHALA	0.5	100	Rag pickers integrated in the system segregate waste	Shed -sorting and storage	glass bottles, PET bottles, LDPE plastic, footwear and leather	Rag pickers segregate and store waste in dumpsite	Yes	Yes	Yes

Table 6-3 Comparative analysis of cities visited

6.1.1.8 OBSERVATIONS FROM SITE VISITS

From the analysis of field visits, following observations were made-

➢ **Involvement of rag pickers:** In 4 of the 6 ULBs, it was observed that waste is primarily segregated by rag pickers either in the dumping site or the processing site. Further, in most of the cases, this sorted waste which is good quality recyclables having high value in monetary terms are sold off by them. In cases, where waste collection contractors pay waste pickers, waste is only sorted and kept stored. Thus, it may be understood that waste pickers form an integral part of the waste management process. If they are formally integrated in to the system, their skill set may be utilized for sorting of waste in to various categories.

➢ **Segregation of dry waste:** It was observed that the predominant types in which waste is segregated in the cities include plastic segregated in to LDPE, HDPE and PET bottles, cloth waste and footwear waste.

➢ **Availability of storage space:** 2 out of 6 cities visited do not have sheds for storing segregated dry waste. Hence the dry waste segregated is contaminated.

➢ **Cities with highest potential to be part of the cluster:** From the above analysis, it was found that Alandi and Junnar are the two cities having the highest potential to be a part of cluster management of dry waste. These cities have 100 % segregation of wet and dry waste. Dry waste is further segregated in to HDPE, LDPE, PET bottles, footwear and clothes. The stored waste is clean and hence of good quality. They have manpower and infrastructure available for waste segregation. Further, they are willing to be a part of cluster and are also willing to share/ bear the transportation cost of waste collection by industries if required.

6.1.2 COLLECTION ROUTES AND FREQUENCY

Depending upon the site visits and discussion with the ULBs and industries, 3 critical criteria were identified which influence the formation of clusters. They were- waste quantity, segregation, proximity and capacity of the industries. Based on these criteria, 3 clusters were identified which are characterized by route and frequency of waste collection. The following map shows the 3 clusters spatially on a map.

Map 13 Clusters in Pune Division

Source – Primary Survey of ULBs
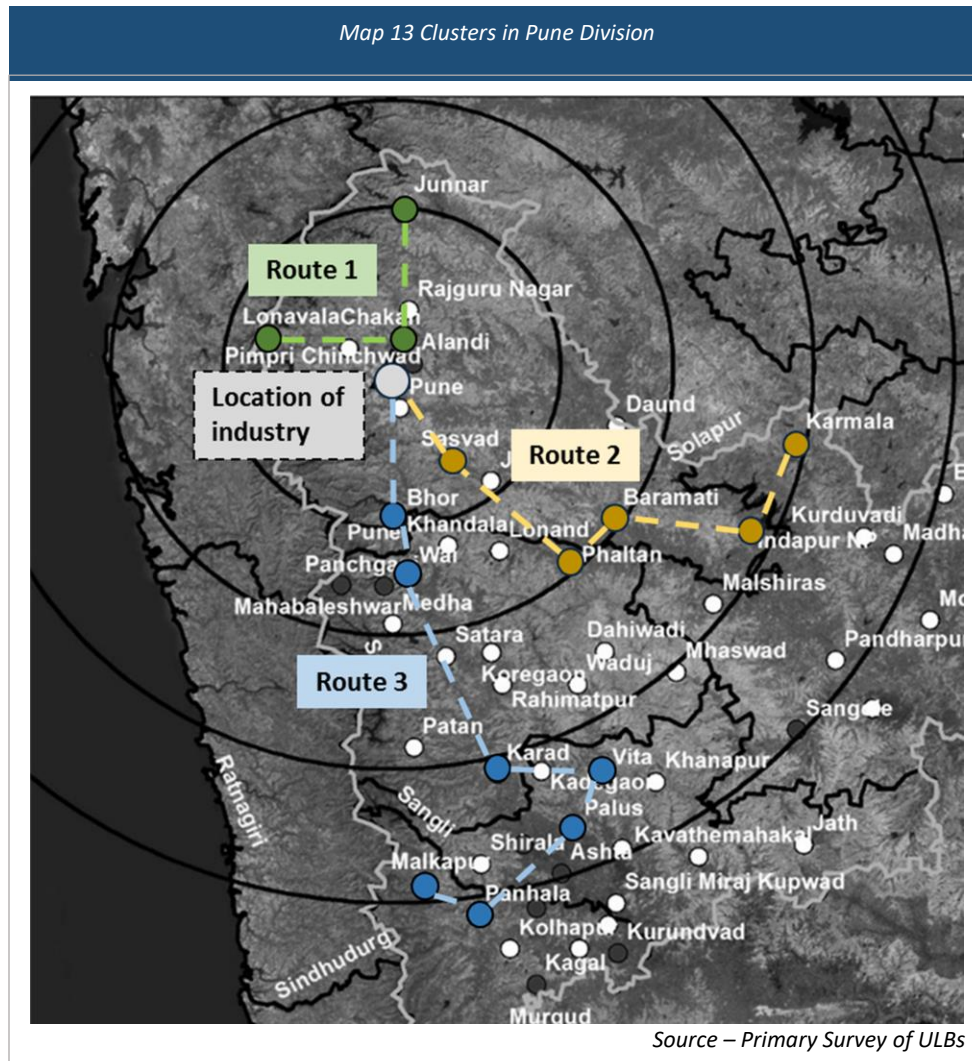
6.1.2.1 CLUSTER 1

Map 14 Cluster 1 Route Mapping
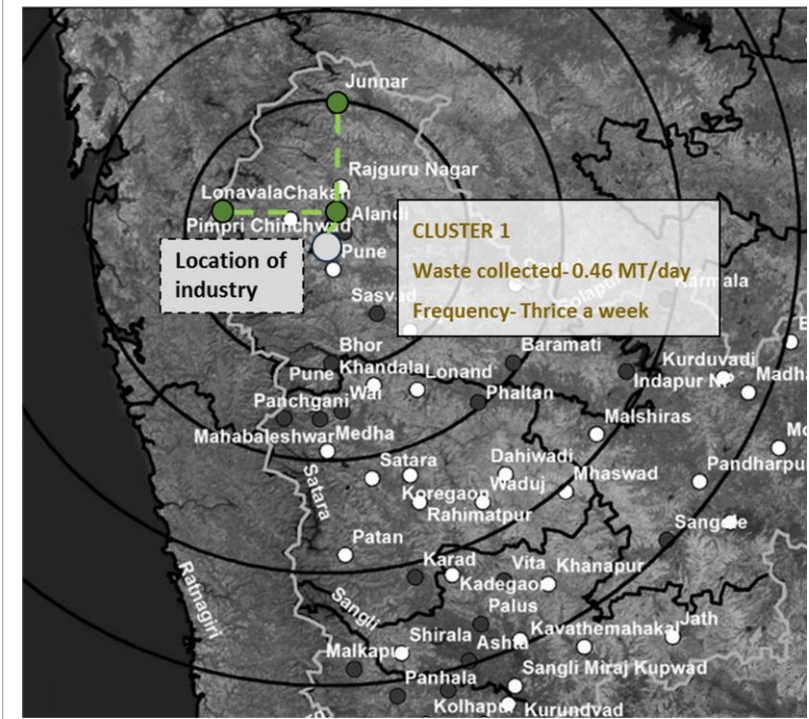
CLUSTER 1
Waste collected- 0.46 MT/day
Frequency- Thrice a week

Location of industry

Source – Primary Survey of ULBs

The above cluster comprises of 3 cities which have been selected based on waste generation, segregation and proximity to the industry (100 kms). They are- Junnar, Alandi, Lonavala. The total plastic waste generation over a week comes to 3.22 MT. Depending upon the capacity of the industry (capacity of JJ Plastic- 2.8 TPD), frequency of waste collection has been considered thrice a week. The following table contains details about the cluster.

Table 6-4 Details of Cluster 1

SR NO.	ULBS WITH >80% seg. Within 100 Kms buffer	SEG (%)	PLASTIC WASTE GENERATION (MT/day)	PLASTIC WASTE GENERATION (MT/ week)
1	Junnar	100	0.099	0.69
2	Alandi	80	0.125	0.88
3	Lonavala	100	0.236	1.65
	Total		**0.46**	**3.22**

6.1.2.2   CLUSTER 2
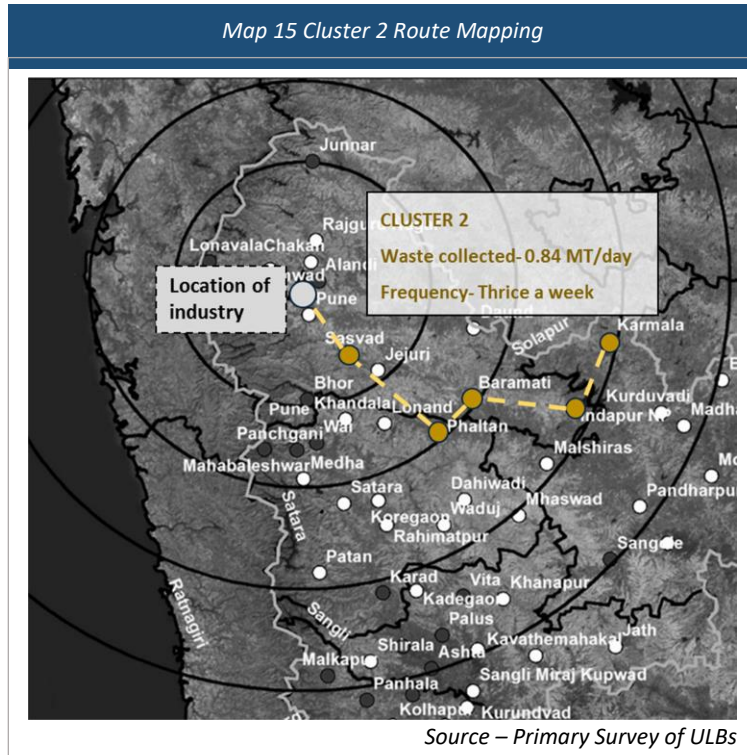
Map 15 Cluster 2 Route Mapping

Source – Primary Survey of ULBs

The above cluster comprises of 4 cities which have been selected based on waste generation, segregation and proximity to the industry (150 kms). They are- Baramati, Phaltan, Indapur and Karmala. The total plastic waste generation over a week comes to 6 MT. Depending upon the capacity of the industry (capacity of JJ Plastic – 2.8 TPD), frequency of waste collection has been considered thrice a week. The following table contains details about the cluster.

Table 6-5 Details of Cluster 2

SR NO.	ULBS WITH >80% seg. Within 150 Kms buffer	SEG (%)	PLASTIC WASTE GENERATION (MT/day)	PLASTIC WASTE GENERATION(MT/ week)
1	Sasvad	100	0.131	0.92
2	Baramati	95	0.45	3.18
3	Phaltan	90	0.19	1.35
4	Indapur	80	0.11	0.74
5	Karmala	85	0.09	0.64
Total			0.84	6.0

6.1.2.3 CLUSTER 3

Map 16 Cluster 3 Route Mapping
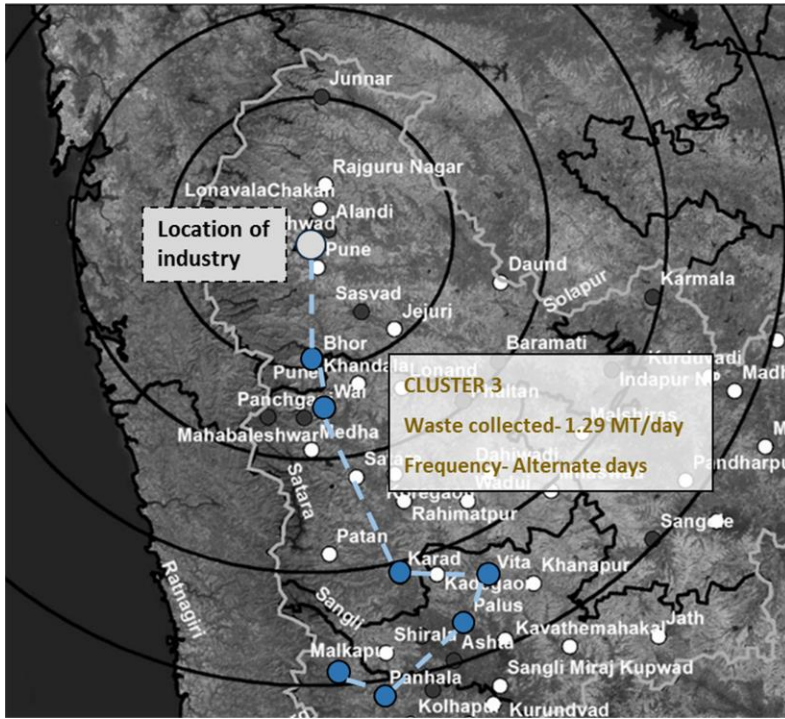
Source – Primary Survey of ULBs

The above cluster comprises of 8 cities which have been selected based on waste generation, segregation and proximity to the industry (200 kms). They are- Karad, Vita, Palus, Ashta, Uran Islampur, Malkapur, Vadgaon and Panhala. The total plastic waste generation over a week comes to 6 MT. Depending upon the capacity of the industry (capacity of JJ Plastics- 2.8 TPD), frequency of waste collection has been considered alternate days. The following table contains details about the cluster.

Table 6-6 Details of Cluster 3

SR NO.	ULBS WITH >=80% SEGREGATION inside 200 km buffer	SEG (%)	PLASTIC WASTE GENERATION (MT/day)	PLASTIC WASTE GENERATION (MT/ week)
1	Karad	100	0.304	2.13
2	Vita	90	0.208	1.46
3	Palus	100	0.061	0.43
4	Ashta	90	0.136	0.95
5	Uran Islampur	100	NA	NA
6	Malkapur	100	0.019	0.13
7	Vadgaon	90	0.112	0.78
8	Panhala	100	0.015	0.11
	Total		**0.86**	**6**

6.2 IDENTIFICATION OF CLUSTERS IN KONKAN DIVISION

The revenue division of Konkan has close to 52 Urban Local Bodies. The Municipal Corporations have been excluded due to the scale of complexity of waste management and generation. There is one recycling industries, namely JJ plastic, located in the Konkan division which is willing to accept plastic waste from the ULBs for recycling.

The above industry accepts good quality and unsoiled LDPE plastic. The capacities of the industries is 1 TPD. Following map shows the location of this industries along with ULBs having 80% and above segregation and proximity of the industries to ULBs.

Map 17 ULBs with 80% and above segregation

Source- Data from Divisional Coordinator (as on July 2018) and preliminary interaction with ULBs

Upon discussion with the industry, it was inferred that the industry can collect plastic waste from cities up to a radius of 100 kms. Thus, from the above map we see that close to 10 ULBs having 80% and above segregation fall under the proximity radius of 100 kms from the location of industries. The following table shows the list of these 10 ULBs along with their assumed quantities plastic waste generation both on a daily and monthly basis.

Table 6-7 Data of 10 ULBs on segregation and plastic waste generation

SR NO.	ULBS WITHIN 100 KMS BUFFER	SEG	PLASTIC WASTE GENERATION (MT/day)	PLASTIC WASTE GENERATION (MT/week)
1	Matheran	90	0.01	0.07
2	Karjat	90	0.11	0.77
3	Khalapur	NA	0.022	0.154
4	Khopoli	70	0.29	2.03
5	Shahapur	NA	0.026	0.182
6	Murbad	NA	0.055	0.385
7	Badlapur	85	1.17	8.19
8	Uran	40	0.11	0.77
9	Pen	70	0.15	1.05
10	Alibag	60	0.074	0.518
Total			2.01	14.14

Further discussion with the above ULBs revealed that 5 ULBs from these 10 ULBs have good quality plastic waste segregated and stored either in their dump site or a dedicated space. Also, the proximity of these ULBs to the industries offer an added advantage. The 5 ULBs include- Matheran, Khopoli, Alibaug, Pen and Mahad.

The 5 cities were visited to gather information about the method of segregation, further dry waste segregation if any, scenario of dry waste collection, infrastructure and resources available for collection and sorting and overall potential and challenges. The following section talks about the cities and their dry waste management scenario in detail.

Table 6-8 Initial assessment of ULBs

SR. NO.	NAME OF THE ULB	% OF SEGREGATION ACHIEVED	INITIAL ASSESSMENT
1	Kulgaon Badlapur	85	Rag pickers take away recyclable waste
2	Matheran	90	Plastic waste is bundled and stored
3	Karjat	90	Plastic is used in road construction
4	Dahanu	80	N.A.
5	Shriwardhan	80	Dry waste collection and disposal is undertaken by contractor
6	Dapoli	80	No waste processing is undertaken- Quantity generated is very less
7	Guhaghar	90	No waste processing is undertaken- Quantity generated is very less
8	Ratnagiri	80	Dry waste disposal and processing is undertaken by contractor
9	Rajapur	90	Tie ups wiith bhangarwalas which take away recyclables
10	Malvan	80	Tie ups wiith bhangarwalas which take away recyclables
11	Vengurla	95	Plastic waste processing is undertaken
12	Sawantwadi	80	Plastic shredder is installed. Rag pickers take away plastic waste

MATHERAN

Background

- **Location:** Pune district, 33 kms from the recycling industry
- **Population (census 2011) :** 4393
- **Total waste generation:** 5 TPD
- **Dry waste generation:** 2.5 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 5-20 Dry waste management scenario in Matheran

Dry waste is segregated by ULB workers at the processing site in to PET bottles, LDPE and HDPE plastic. Matheran being a tourist destination, plastic waste generation is more i.e. approximately 1.5-2 TPD. Plastic waste is shredded, bundled and stored at the shed on the dumping site. The city has not given any formal recognition to the waste pickers, they collect waste from the city and not the dumping site. The ULB sells plastic waste to local bhangarwala

Total waste generation: **5** TPD

Dry waste generation: **2.5** TPD

At source segregation: 100%

Secondary segregation: by ULB workers

Rag-pickers not integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste at dumping site
- Plastic waste is shredded, bundled and stored at the shed on the dumping site
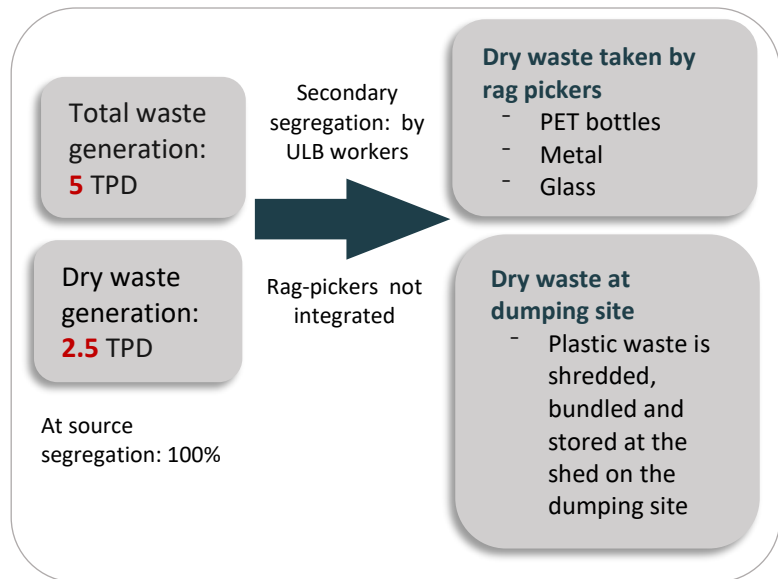
Figure 5-21 Type of dry waste segregated and stored at processing site in Matheran

Plastic waste segregated and stored at processing site

Glass and leather waste segregated and stored at the processing site

POTENTIAL TO BE PART OF CLUSTER

1.	Segregation	Yes at 100% segregation at source
2.	Involvement of stakeholder	
	a. Contractor	Nothing exist
	b. Rag-pickers	Since they are not integrated in the system they take away recyclable dry waste
3.	Existing forward linkages established	Currently dry waste is being sold to bhangarwala
4.	Willingness of the ULB to be part of cluster	ULB is earning out of the current system
5.	Willingness to share transportation cost	not willing to share/ bear transportation cost of waste collection.

KHOPOLI

Background

- **Location:** Pune district, 33 kms from the recycling industry
- **Population (census 2011) :** 70,141
- **Total waste generation:** 28 TPD
- **Dry waste generation:** 16 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 5-22 Dry waste management scenario in Khopoli

Dry waste is segregated by ULB workers at the processing site in to PET bottles, LDPE and HDPE plastic. LDPE plastic is shredded and stored at dumping site. The ULB is considering using LDPE plastic for road construction. The city, has made temporary arrangements for the storage of other type of segregated dry waste. The city has identified 10-15 rag pickers ward wise, Rag pickers take away PET bottles, cardboard and bags. Hence, the quantity of these types of dry waste arriving at dumping site is negligible.

Total waste generation: **28** TPD

Secondary segregation: by ULB workers

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste generation: **12** TPD

Rag-pickers integrated

Dry waste at dumping site
- LPDE to be used for road construction
- Rag pickers operate in the city, not dumping ground

At source segregation: 100%
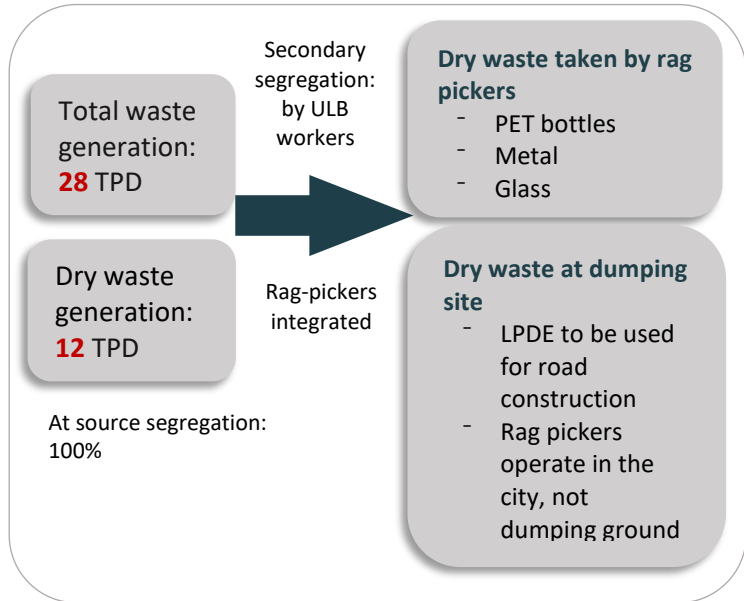
Figure 5-23 Type of dry waste segregated and stored at processing site at Khopoli

LDPE plastic waste segregated and stored at processing site

Temporary provision for storing segregated dry waste

POTENTIAL TO BE PART OF CLUSTER

1.	Segregation	Yes at 100% segregation at source
2.	Involvement of stakeholder	
	a. Contractor	Nothing exist
	b. Rag-pickers	They are integrated in the system and they take away recyclable dry waste
3.	Existing forward linkages established	Currently dry waste is being taken away by rag pickers
4.	Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5.	Willingness to share transportation cost	not willing to share/ bear transportation cost of waste collection.

ALIBAUG

Background

- **Location:** Mumbai district, 33 kms from the recycling industry
- **Population (census 2011) :** 20,743
- **Total waste generation:** 7 TPD
- **Dry waste generation:** 4-4.5 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 5-24 Dry waste management scenario in Alibaug

MSW generated in the city is directly dumped at an unauthorized dumping site without going any further processing. Alibag being a tourist destination, plastic waste generation is more. The ULB has identified a temporary space for storage of segregated plastic waste. At present around 200-300 kgs of plastic waste (HDPE & LDPE) is stored. The city has identified 6-7 rag pickers take away PET bottles, metal, thermocol and glass. Hence, the quantity of these types of dry waste arriving at dumping site is negligible

Total waste generation : **7** TPD

Dry waste generation : **4-4.5** TPD

At source segregation: 60%

Secondary segregation: by ULB workers

Rag-pickers not integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Thermocol

Dry waste at dumping site
- 200-300 kgs of Plastic waste is stored in the city.
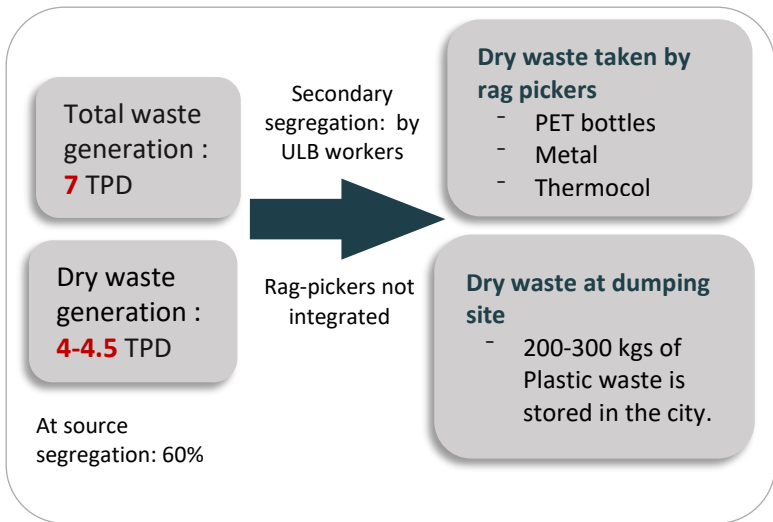
Figure 5-25 Dry waste segregation and processing scenario at Alibag

Unauthorized dumpsite

Temporary dry waste storage space identified

Rag pickers bundle waste near dumpsite and sell it to nearby Bhangarwalas

POTENTIAL TO BE PART OF CLUSTER

1.	Segregation	Yes at 60% segregation at source
2.	Involvement of stakeholder	
	a. Contractor	Nothing exist
	b. Rag-pickers	They are integrated in the system and they take away recyclable dry waste
3.	Existing forward linkages established	Currently dry waste is being taken away by rag pickers
4.	Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5.	Willingness to share transportation cost	Not willing to share/ bear transportation cost of waste collection.

PEN

Background

- **Location:** Mumbai district, 33 kms from the recycling industry
- **Population (census 2011) :** 37,852
- **Total waste generation:** 15 TPD
- **Dry waste generation:** 8-10 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 5-26 Dry waste management scenario in Pen

MSW generated in the city is directly dumped at a dumping site without going any further processing. The city has identified 8-10 rag pickers take plastic. The quantity of these types of dry waste arriving at dumping site is negligible. MSW collected is directly dumped on site and does not go further segregation. Rag pickers take away dry waste before it reaches dumping site, hence the ULB has to take measures to segregate and quantify dry waste received at dumping site.

Total waste generation: **12** TPD

Dry waste generation: **5.3** TPD

At source segregation: 70%

Secondary segregation: by ULB workers

Rag-pickers not integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Thermocol

Dry waste stored at dumping site
- MSW is directly dumped at the site

POTENTIAL TO BE PART OF CLUSTER

1.	Segregation	Yes at 60% segregation at source
2.	Involvement of stakeholder	
	a. Contractor	Nothing exist
	b. Rag-pickers	They are integrated in the system and they take away recyclable dry waste
3.	Existing forward linkages established	Currently dry waste is being taken away by rag pickers
4.	Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5.	Willingness to share transportation cost	Willing to share/ bear transportation cost of waste collection.

MAHAD

Background

- **Location:** Mumbai district, 33 kms from the recycling industry
- **Population (census 2011) :** 27,400
- **Total waste generation:** 11 TPD
- **Dry waste generation:** 4 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 5-27 Dry waste management scenario in Mahad

MSW generated in the city is directly dumped at a dumping site without going any further processing. The city has identified rag pickers to take plastic. The quantity of these types of dry waste arriving at dumping site is negligible. MSW collected is directly dumped on site and does not go further segregation. Rag pickers take away dry waste before it reaches dumping site, hence the ULB has to take measures to segregate and quantify dry waste received at dumping site.

Total waste generation: **11** TPD

Dry waste generation: **4** TPD

At source segregation: 70%

Secondary segregation: by ULB workers

Rag-pickers not integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste stored at dumping site
- MSW is directly dumped at the site

POTENTIAL TO BE PART OF CLUSTER

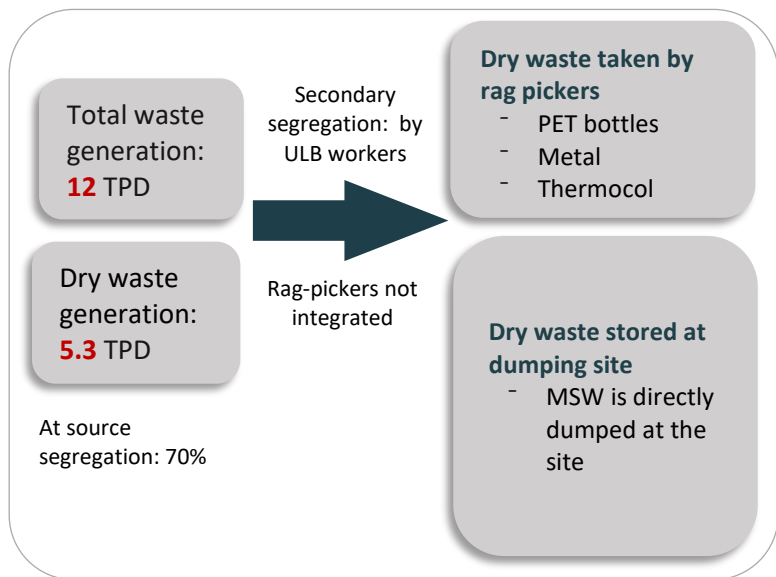|	
1. Segregation	Yes at 60% segregation at source
2. Involvement of stakeholder	
a. Contractor	Nothing exist
b. Rag-pickers	They are integrated in the system and they take away recyclable dry waste
3. Existing forward linkages established	Currently dry waste is being taken away by rag pickers
4. Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5. Willingness to share transportation cost	Willing to share/ bear transportation cost of waste collection.

6.2.1.6   COMPARATIVE ANALYSIS OF CITIES VISITED OF KONKAN DIVISION

	Dry waste generation (MT/day)	Seg (In %)	Availability of manpower for segregation	Available infrastructure	Type of segregated dry waste available	Current management of dry waste	Willingness of ULBs to be part of cluster	Willing to share transportation cost	Potential to be included in cluster
MATHERAN	2.5	100	ULB workers segregate waste	Shed for sorting and storage	LDPE, HDPE, glass and clothes	PET bottles are sold to local vendors. Other type of dry waste stored at dumping site	Yes	No	Yes
KHOPOLI	16	70	ULB workers segregate waste	Temporary shed is used	LDPE, PET bottles, clothes and footwear	Rag pickers sell recyclable dry waste	Yes	No	Yes
ALIBAG	4.5	60	Required manpower is not available	Unauthorized dumping site is currently in use	Secondary segregation is not undertaken	Rag pickers sell recyclable dry waste	Yes	Yes	Maybe
PEN	10.5	70	Required manpower is not available	Shed for sorting and storage	Secondary segregation is not undertaken	Rag pickers sell recyclable dry waste	Yes	Yes	Yes
MAHAD	4	70	Required manpower is not available	Shed for sorting and storage	Secondary segregation is not undertaken	Rag pickers sell recyclable dry waste	Yes	No	Yes

6.2.1.7 OBSERVATIONS FROM SITE VISITS

From the analysis of field visits, following observations were made-

➢ **Availability of manpower for dry waste segregation:** In 3 of the 5 ULBs, it was observed that the required manpower is not available for complete segregation of dry waste. In the other ULBs, waste is being segregated by ULB workers at in the dumping site or the processing site.

➢ **Involvement of rag pickers-** In most of the cases, segregated waste which is good quality recyclables having high value in monetary terms are sold off by rag pickers. In cases, where waste collection contractors have appointed rag pickers, waste is only segregated and stored. Thus, it may be understood that waste pickers form an integral part of the waste management process. If they are formally integrated in to the system, their skill set may be utilized for sorting of waste in to various categories.

➢ **Segregation of dry waste:** It was observed that cities have recently started further segregation of dry waste in to various categories. It was observed that the predominant types in which waste is segregated in the cities include plastic segregated in to LDPE, HDPE and PET bottles, cloth waste and footwear waste.

➢ **Availability of storage space:** 3 out of 5 cities visited do not have sheds for storing segregated dry waste. Hence the dry waste segregated is contaminated.

➢ **Cities with highest potential to be part of the cluster:** From the above analysis, it was found that Matheran and Khopoli are the two cities having the highest potential to be a part of cluster management of dry waste. These cities have 100 % and 70% segregation, respectively, of wet and dry waste. Dry waste is further segregated in to HDPE, LDPE, PET bottles, footwear and clothes. The stored waste is clean and hence of good quality. They have manpower and infrastructure available for waste segregation. Further, they are willing to be a part of cluster and are also willing to share/ bear the transportation cost of waste collection by industries if required.

6.2.2 COLLECTION ROUTES AND FREQUENCY

Depending upon the site visits and discussion with the ULBs and industries, 3 critical criteria were identified which influence the formation of clusters. They were- waste quantity, segregation, proximity and capacity of the industries. Based on these criteria, 3 clusters were identified which are characterized by route and frequency of waste collection. The following map shows the 3 clusters spatially on a map.

Map 18 Clusters in Konkan Division

Source – Primary Survey of ULBs

6.2.2.1 CLUSTER 1

Map 19 Cluster 1 Route Mapping

Source – Primary Survey of ULBs

The above cluster comprises of 4 cities which have been selected based on waste generation, segregation and proximity to the industry (60 kms). They are-Matheran, Karjat, Khalapur and Khopoli. The total plastic waste generation over a week comes to 3.02 MT. Depending upon the capacity of the industry (capacity of JJ Plastic- 1.1 TPD), frequency of waste collection has been considered thrice a week. The following table contains details about the cluster.

Table 6-9 Details of Cluster 1

SR NO.	ULBS WITHIN 60 KMS BUFFER	SEG (%)	PLASTIC WASTE GENERATION (MT/day)	PLASTIC WASTE GENERATION (MT/week)
1	Matheran	90	0.01	0.07
2	Karjat	90	0.11	0.77
3	Khalapur	NA	0.022	0.154
4	Khopoli	70	0.29	2.03
Total			**0.43**	**3.02**
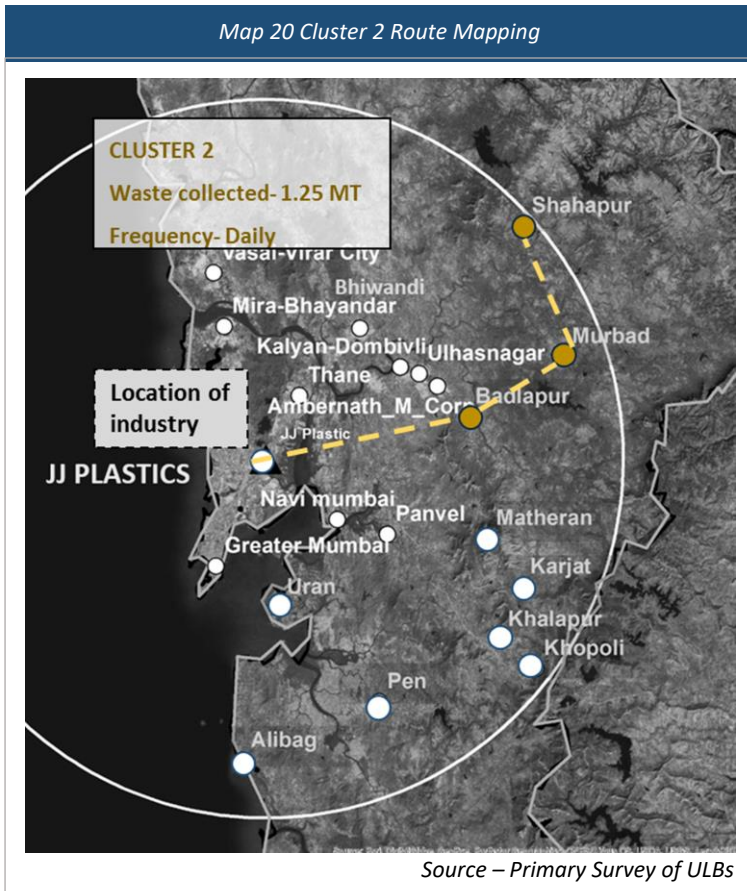
Source- Data from Divisional Coordinator (as on July 2018) and preliminary interaction with ULBs

6.2.2.2 CLUSTER 2

Map 20 Cluster 2 Route Mapping

Source – Primary Survey of ULBs

The above cluster comprises of 3 cities which have been selected based on waste generation, segregation and proximity to the industry (60 kms). They are- Shahpur, Murbad, and Badlapur. The total plastic waste generation over a week comes to 8.7 MT. Depending upon the capacity of the industry (capacity of JJ Plastic- 1.1 TPD), frequency of waste collection has been considered daily. The following table contains details about the cluster.

Table 6-10 Details of Cluster 2

SR NO.	ULBS WITHIN 60 KMS BUFFER	SEG (%)	PLASTIC WASTE GENERATION (MT/day)	PLASTIC WASTE GENERATION (MT/week)
1	Shahapur	NA	0.026	0.182
2	Murbad	NA	0.055	0.385
3	Badlapur	NA	1.17	8.19
Total			1.25	8.7

6.2.2.3 CLUSTER 3
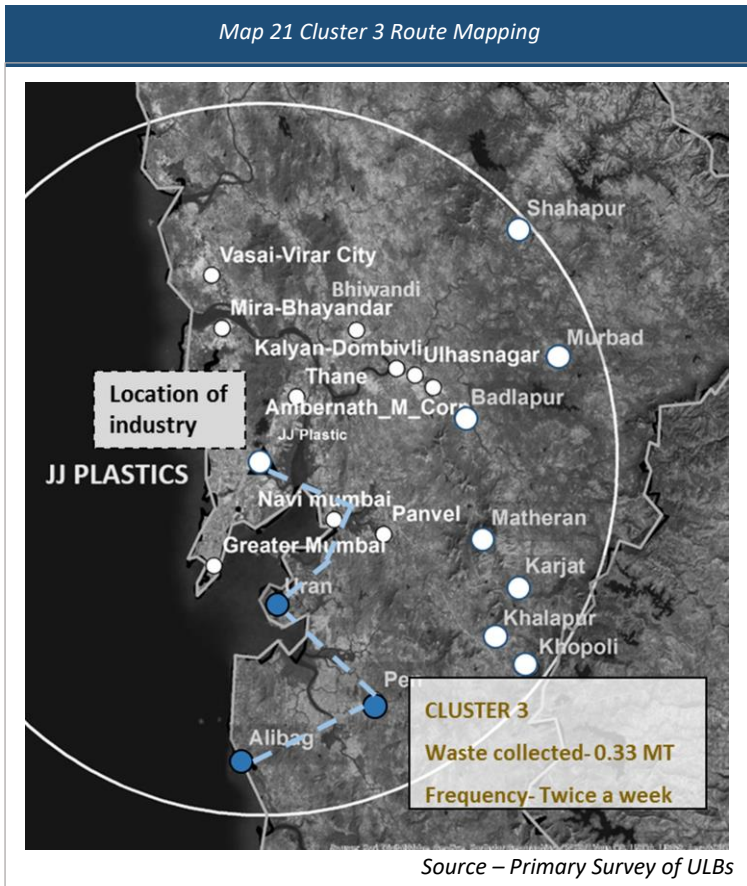
Map 21 Cluster 3 Route Mapping

Source – Primary Survey of ULBs

The above cluster comprises of 3 cities which have been selected based on waste generation, segregation and proximity to the industry (60 kms). They are- Uran, Pen, and Alibaug. The total plastic waste generation over a week comes to 2.33 MT. Depending upon the capacity of the industry (capacity of JJ Plastic- 1.1 TPD), frequency of waste collection has been considered twice a week. The following table contains details about the cluster.

Table 6-11 Details of Cluster 3

SR NO.	ULBS WITHIN 60 KMS BUFFER	SEG (%)	PLASTIC WASTE GENERATION (MT/day)	PLASTIC WASTE GENERATION (MT/week)
1	Uran	40	0.11	0.07
2	Pen	NA	0.15	0.77
3	Alibag	60	0.074	0.154
Total			0.33	2.33

6.3   IDENTIFICATION OF CLUSTERS IN NASHIK DIVISION

The revenue division of Nashik has close to 62 Urban Local Bodies. There are two industries which are located in the Nashik division and are willing to accept plastic waste from the ULBs for recycling. They are Swastik Plasto and Prakash Plastic Private Limited.

The above industry accept good quality and unsoiled LDPE, HDPE, and PET bottles. The capacities of the industries are 2.2 TPD. Following map shows the location of the industry along with ULBs having 80% and above segregation and proximity of the industries to ULBs.

Map 22 ULBs with 80% and above segregation

Source- Data from Divisional Coordinator (as on July 2018) and preliminary interaction with ULBs
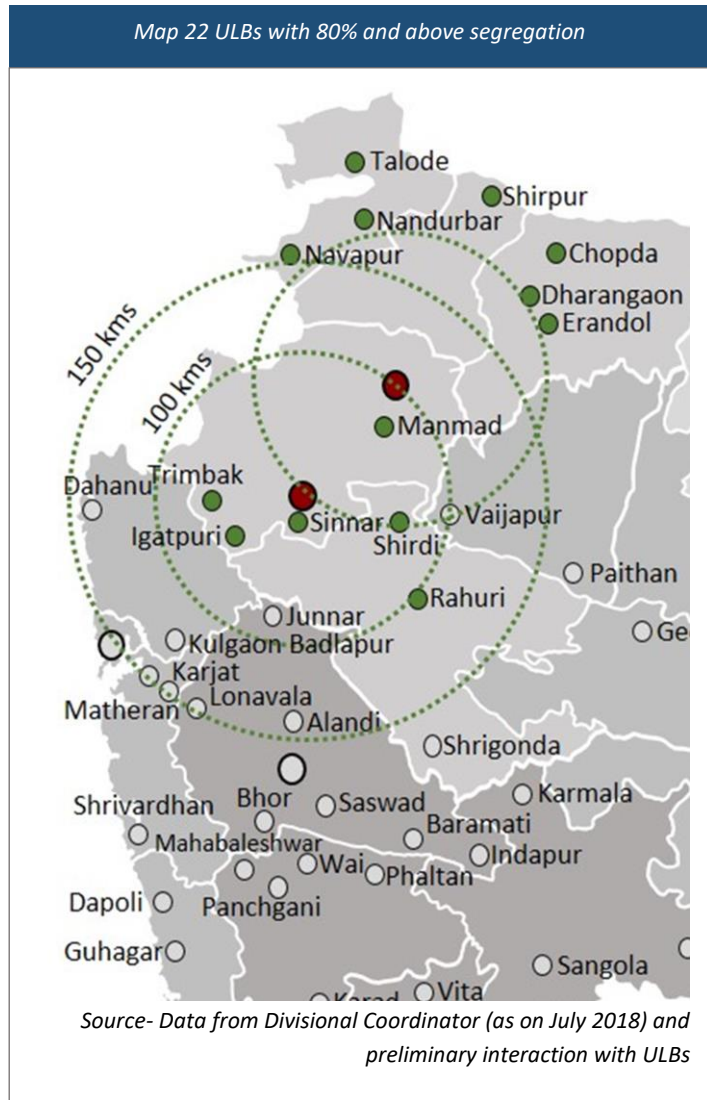
Table 6-12 Plastic Generation and segregation of ULB under 200 kms buffer of industries

SR NO.	ULBS WITH >80% BUFFER WITHIN THE 200 KM BUFFER	SEG (%)	PLASTIC WASTE GENERATION (MT)	PLASTIC WASTE GENERATION (MT/week)
1	Trimbak	100	0.52	0.36
2	Igatpuri	80	0.11	0.77
3	Shirdi	80	0.082	0.57
4	Sinnar	80	0.28	1.96
5	Manmad	85	0.38	2.66
6	Chopda	100	0.3	2.1
7	Nandurbar	95	0.49	3.43
8	Rahuri	80	0.15	1.09
9	Erandol	90	0.13	0.94
10	Shrigonda	80	0.13	0.91
11	Navapur	80	0.13	0.91
12	Taloda	90	0.1	0.7
13	Dharangaon	90	0.14	0.98
	Total		**2.48**	**17.39**

Further discussion with the above ULBs revealed that 4 ULBs from these 10 ULBs have good quality plastic waste segregated and stored either in their dump site or a dedicated space. Also, the proximity of these ULBs to the industries offer an added advantage. The 4 ULBs include- Sinnar, Shirdi, Trimbak and Igatpuri.

The 4 cities were visited to gather information about the method of segregation, further dry waste segregation if any, scenario of dry waste collection, infrastructure and resources available for collection and sorting and overall potential and challenges. The following section talks about the cities and their dry waste management scenario in detail.

Table 6-13 Initial assessment of ULBs

SR NO.	ULBS WITH >80% BUFFER	SEG (%)	INITIAL ASSESSMENT
1	Trimbak	100	Dry waste is further segregated and stored at dumping site Plastic is crushed and sold to industries in Malegaon
2	Igatpuri	80	Plastic is segregated and stored
3	Shirdi	80	Dry waste disposal and processing is undertaken by contractor
4	Sinnar	80	Recyclable waste is sold to bhangarwalas
5	Manmad	85	Rag pickers take away most of the recyclable waste
6	Chopda	100	Rag pickers take away most of the recyclable waste
7	Nandurbar	95	Rag pickers take away most of the recyclable waste
8	Rahuri	80	Plastic is used in road construction
9	Erandol	90	Rag pickers take away most of the recyclable waste
10	Shrigonda	80	Rag pickers take away most of the recyclable waste
11	Navapur	80	Dry waste is further segregated and stored at dumping site
12	Taloda	90	Rag pickers take away most of the recyclable waste
13	Dharangaon	90	-

TRIMBAK

Background

- **Location:** Nashik district, 33 kms from the recycling industry
- **Population (census 2011) :** 12,056
- **Total waste generation:** 6 TPD
- **Dry waste generation:** 2 TPD

Figure 6-21 Dry waste management scenario in Trimbak

Trimbak being a religious destination, plastic and cloth waste is generated in the city. The appointed contractor is responsible for dry waste segregation, processing and disposal. Currently, dry waste is further segregated in to PET bottles, paper, thermocol, cloth and glass by the ragpickers integrated in to the system. The segregated waste is then sold to a recycler situated in Malegon, Nashik. The city has also used waste plastic bottles for landscaping of the dumping ground.

Total waste generation: **6** TPD

Dry waste generation: **2** TPD

At source segregation: 100%

Secondary segregation: by ULB workers

Rag-pickers integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass
- Thermocol

Dry waste stored at dumping site
- Segregated waste is sold to a recycler situated in Malegaon
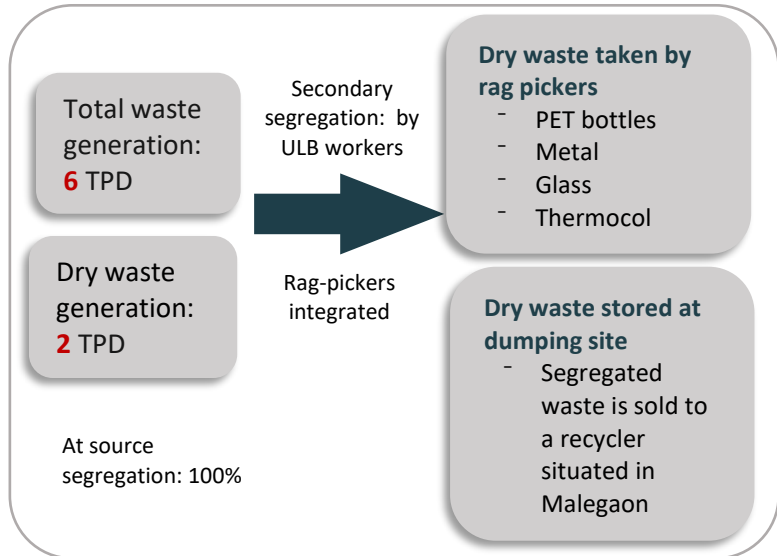
Figure 6-22 Dry waste segregation and processing scenario in Trimbak

PET bottles used for landscaping of dumping ground

Dry waste segregated and bundled to be take to the recycling industry

POTENTIAL TO BE PART OF CLUSTER

1.	Segregation	Yes at 100% segregation at source
2.	Involvement of stakeholder	
	a. Contractor	A contractor is appointed for segregation
	b. Rag-pickers	They are integrated in the system
3.	Existing forward linkages established	Currently dry waste is bailed and sold to agency
4.	Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5.	Willingness to share transportation cost	Willing to share/ bear transportation cost of waste collection.

SHIRDI

Background

- **Location:** Nashik district, 33 kms from the recycling industry
- **Population (census 2011) :** 36,004
- **Total waste generation:** 22 TPD
- **Dry waste generation:** 14.5 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-23 Dry waste management scenario in Shirdi

Shirdi being a religious destination, generation of PET bottles in the city is more. For dry waste processing and disposal, contractor appointed is responsible. Rag pickers have been integrated in to the system by the contractor wherein they segregate the dry waste on dumping site in to PET bottles, cardboard, paper, thermocol, glass and cloth. The contractor sends the plastic waste to his recycling industry in Kopargaon.

Total waste generation: **22** TPD

Dry waste generation: **14.5** TPD

At source segregation: 100%

Secondary segregation: by ULB workers

Rag-pickers not integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste stored at dumping site
- Contractor sends plastic waste to recycling industry in Kopargaon
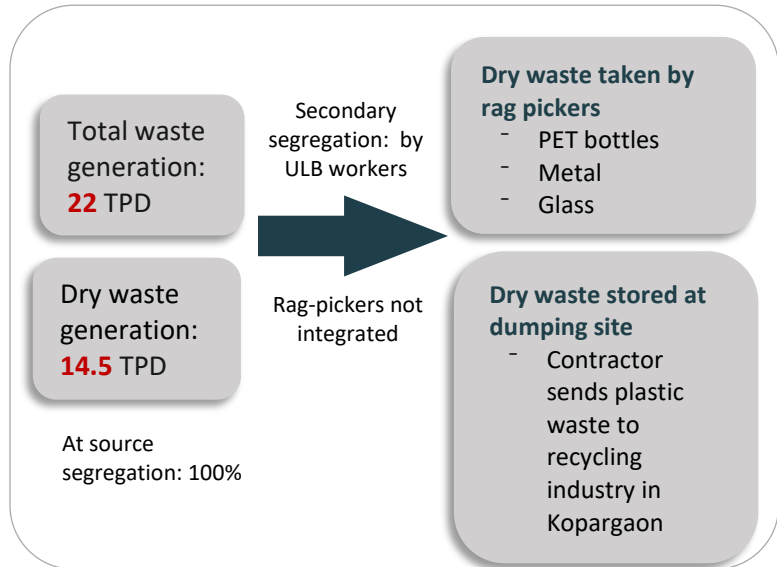
Figure 6- 24 Dry waste segregation and processing scenario at Shirdi

Dry waste received at the dumping ground

Plastic bottles segregated and stored at dumping site

Dry waste being segregated by rag pickers on the dumping site

POTENTIAL TO BE PART OF CLUSTER

1.	Segregation	Yes at 100% segregation at source
2.	Involvement of stakeholder	
	a. Contractor	A contractor is appointed for segregation
	b. Rag-pickers	They are integrated in the system
3.	Existing forward linkages established	Currently dry waste is bailed and sold to contractor
4.	Willingness of the ULB to be part of cluster	ULB is earning out of the current system
5.	Willingness to share transportation cost	Willing to share/ bear transportation cost of waste collection.

SINNAR

Background

- **Location:** Nashik district, 33 kms from the recycling industry
- **Population (census 2011) :** 65,299
- **Total waste generation:** 22 TPD
- **Dry waste generation:** 8 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-25 Dry waste management scenario in Sinnar

The dry waste generation in the city is around 8 TPD. Dry waste received at the dumping site gets further segregated. Sinnar has achieved 90% segregation of waste. Rag pickers who are not integrated formally sort the waste arriving at dumping site and take away recyclable dry waste. The ULB is willing to be part of the cluster and ready to bear the transportation cost. The city needs to integrate the rag pickers so that recyclable dry waste can be collected to be sold to the recycling industry.
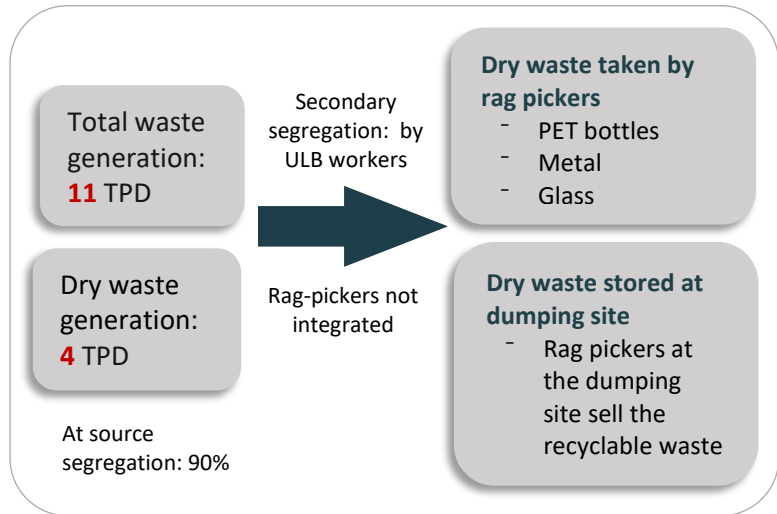
Total waste generation: **11** TPD

Secondary segregation: by ULB workers

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste generation: **4** TPD

Rag-pickers not integrated

Dry waste stored at dumping site
- Rag pickers at the dumping site sell the recyclable waste

At source segregation: 90%

Figure 6-25 Dry waste management scenario in Sinnar

Rag pickers sorting recyclable dry waste

Dry waste bundled to be taken by rag pickers
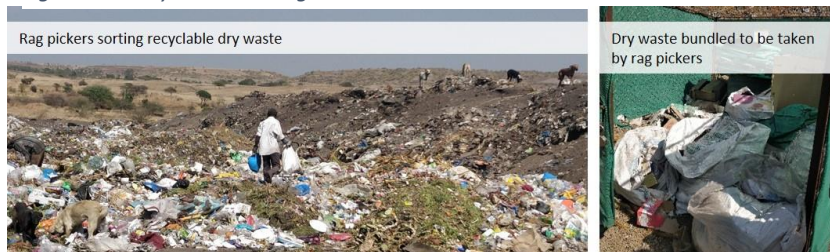
POTENTIAL TO BE PART OF CLUSTER

1. Segregation	Yes at 90% segregation at source
2. Involvement of stakeholder	
a. Contractor	Nothing exist
b. Rag-pickers	They are integrated in the system
3. Existing forward linkages established	Currently dry waste is being taken away by rag pickers
4. Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5. Willingness to share transportation cost	Willing to share/ bear transportation cost of waste collection.

IGATPURI

Background

- **Location:** Pune district, 33 kms from the recycling industry
- **Population (census 2011) :** 31,572
- **Total waste generation:** 6 TPD
- **Dry waste generation:** 2 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-27 Dry waste management scenario in Igatpuri

The dry waste generation in the city is around 2 TPD. The city has recovered around 2MT of LDPE plastic through bio mining of old waste. Rag pickers segregate recyclable waste from the waste arriving at the dumping site. The quantity of dry waste left at the dumping site is negligible. A new shed for material recovery is built at the dumping site but is not yet operational. As currently, recyclable waste is taken away by the rag pickers.

Total waste generation: **6** TPD

Dry waste generation: **2** TPD

At source segregation: 100%

Secondary segregation: by ULB workers

Rag-pickers not integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste at dumping site
- Rag pickers segregate recyclable waste from the waste arriving at the dumping site
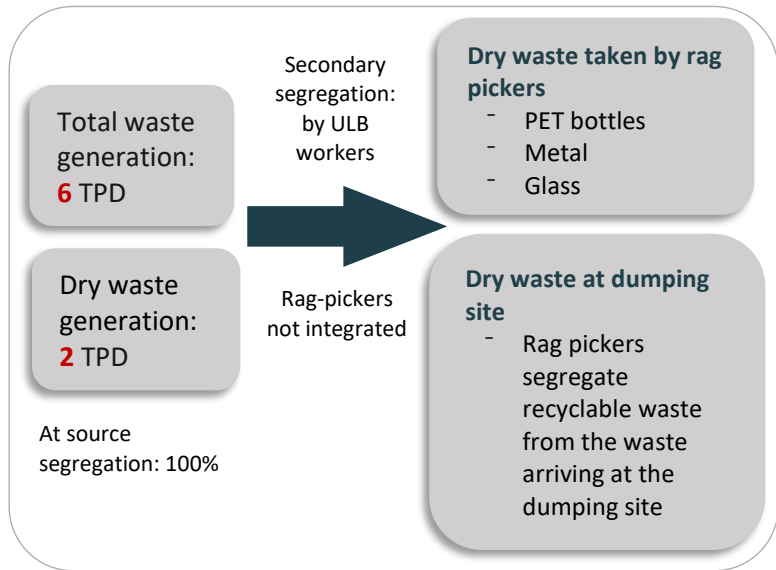
Figure 6-28 Dry waste segregation and processing scenario at Igatpuri

LDPE plastic recovered from biomining

New Material Recovery Facility built at the dumping site-yet to be operational

POTENTIAL TO BE PART OF CLUSTER

1.	Segregation	Yes at 100% segregation at source
2.	Involvement of stakeholder	
	a. Contractor	Nothing exist
	b. Rag-pickers	They are not integrated in the system and they take away recyclable dry waste
3.	Existing forward linkages established	Currently dry waste is being taken away by rag pickers
4.	Willingness of the ULB to be part of cluster	ULB is not earning out of the current system
5.	Willingness to share transportation cost	Willing to bear transportation cost of waste collection.

6.3.1.5 COMPARATIVE ANALYSIS OF CITIES VISITED OF NASHIK DIVISION

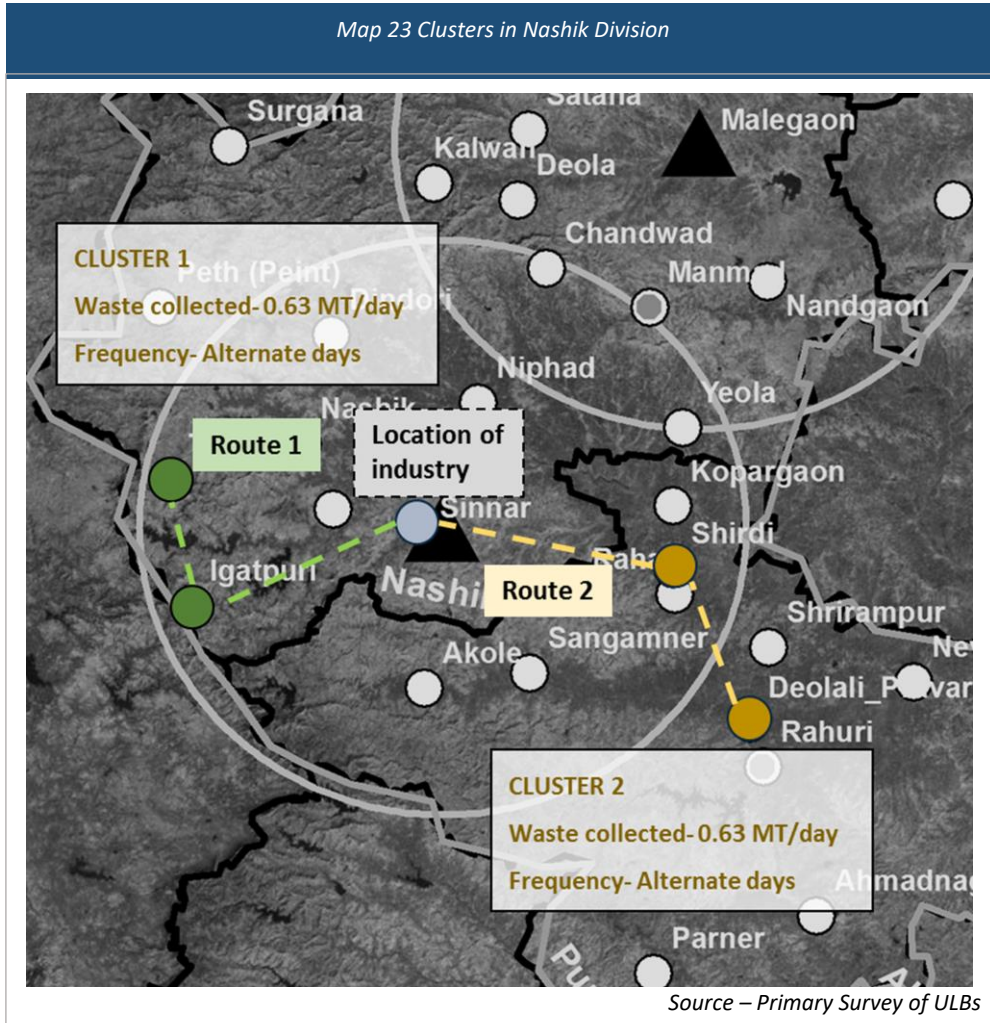|	Dry waste generation (MT/day)	Seg (In %)	Availability of manpower for segregation	Available infrastructure	Type of segregated dry waste available	Current management of dry waste	Willingness of ULBs	Transport cost	Potential to be included in cluster
TRIMBAK	2	100	Rag pickers integrated in the system segregate waste	Shed for sorting and storage	LDPE, HDPE, PET bottles, paper, thermocol, cloth and glass	ULB sells recyclable dry waste to a recycler in Malegaon. Plastic waste is shredded & sent to Malegaon for sale	Maybe	No	Maybe
SHIRDI	14.5	100	Rag pickers integrated in the system segregate waste	Separate enclosures for storage of different types of dry waste	LDPE, PET bottles, clothes, cardboard, paper, thermocol, and glass	Contractor sells recyclable waste to processing plant in Pune owned by BVG (Contractor) Plastic bottles are recycled at Kopargoan	Maybe	No	Maybe
SINNAR	8	90	Waste pickers (not integrated) collect and sell recyclable waste	Shed for storage	PET bottles and LDPE plastic, rubber	Waste pickers collect and sell all recyclable dry waste. Dry waste is not further segregated at the Dumping site	Yes	Yes	Yes
IGATPURI	2.5	80	Waste pickers (not integrated) collect and sell recyclable waste	Shed for sorting and storage (not yet operational)	PET bottles, LDPE	LDPE plastic is recovered through bio mining. Rag pickers sell recyclable dry waste. Recyclable dry waste arriving at dumping site is very less.	Yes	Yes	Yes

6.3.1.6 OBSERVATIONS FROM THE SITE VISITS

From the analysis of field visits, following observations were made-

➢ **Involvement of rag pickers:** In cities like Sinnar and Igatpuri, where rag pickers are not integrated in the system the good quality recyclables having high value in monetary terms are sold off by them. In case of Trimbak and Shirdi, it was observed that waste is primarily segregated by rag pickers who have been integrated into the system who sort the dry waste at the dumping site or the processing site. In cases, where waste collection contractors pay waste pickers, waste is only sorted and kept stored. Thus, it may be understood that waste pickers form an integral part of the waste management process. If they are formally integrated in to the system, their skill set may be utilized for sorting of waste in to various categories.

➢ **Involvement of the contractor:** In cities like Shirdi and Trimbak the contractor appointed for MSWM is responsible for undertaking dry waste processing. Hence, the dry waste is further segregated and sold by the contractor itself.

➢ **Categories in which dry waste is segregated:** It was observed that the predominant types in which waste is segregated in the cities include plastic segregated in to LDPE, HDPE and PET bottles, cloth waste and thermocol waste.

➢ **Availability of storage space:** Only 1 out of 4 cities visited does not have sheds for storing segregated dry waste.

Cities with highest potential to be part of the cluster: From the above analysis, it was found that Sinnar and Igatpuri are the two cities having the highest potential to be a part of cluster management of dry waste. These cities nearly 80-90% segregation of wet and dry waste. Dry waste is further segregated in to HDPE, LDPE, PET bottles. They have the infrastructure available for waste segregation. Further, they are willing to be a part of cluster and are also willing to share/ bear the transportation cost of waste collection by industries if required.

6.3.2 COLLECTION ROUTES AND FREQUENCY

Depending upon the site visits and discussion with the ULBs and industries, 3 critical criteria were identified which influence the formation of clusters. They were- waste quantity, segregation, proximity and capacity of the industries. Based on these criteria, 2 clusters were identified which are characterized by route and frequency of waste collection. The following map shows the 3 clusters spatially on a map.

Map 23 Clusters in Nashik Division

Source – Primary Survey of ULBs

6.3.2.1 CLUSTER 1

Map 24 Cluster 1 Route Mapping

CLUSTER 1
Waste collected- 0.63 MT/day
Frequency- Alternate days

Source – Primary Survey of ULBs

The above cluster comprises of 2 cities which have been selected based on waste generation, segregation and proximity to the industry (100 kms). They are Igatpuri and Triambak. The total plastic waste generation over a week comes to 4.41 MT. Depending upon the capacity of the industries in Nashik- 1 TPD, frequency of waste collection has been considered alternate days. The following table contains details about the cluster.

Table 6-14 Details of Cluster 1

SR NO.	ULBS WITH >80% seg. Within 100 Kms buffer	SEG (%)	PLASTIC WASTE GENERATION (MT/day)	PLASTIC WASTE GENERATION (MT/ week)
1	Trimbak	100	0.52	3.64
2	Igatpuri	80	0.11	0.77
		Total	**0.63**	**4.41**

6.3.2.2 CLUSTER 2
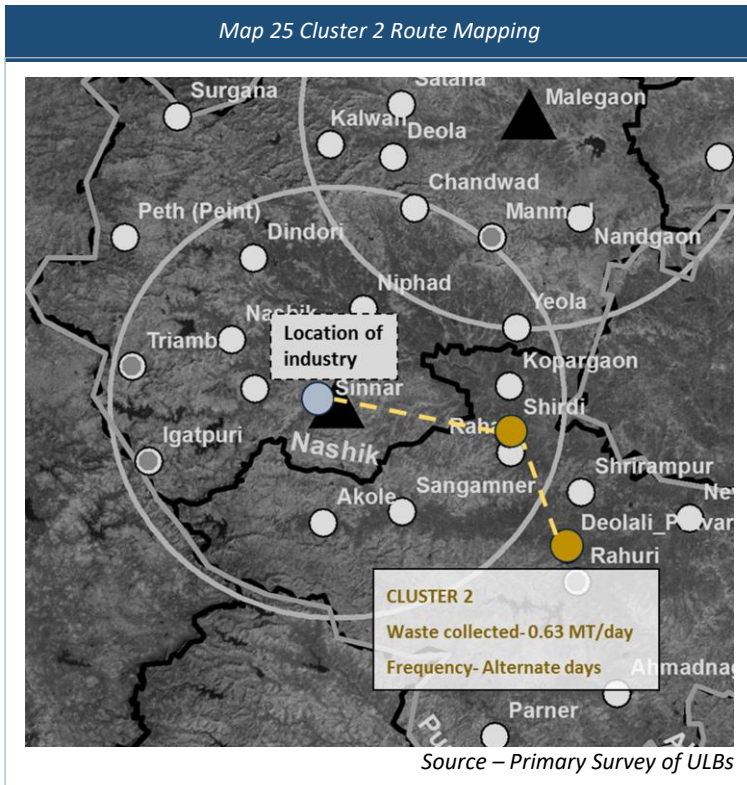
Map 25 Cluster 2 Route Mapping

Source – Primary Survey of ULBs

The above cluster comprises of 2 cities which have been selected based on waste generation, segregation and proximity to the industry (100 kms). They are Sinnar, Shirdi and Rahuri. The total plastic waste generation over a week comes to 5.39 MT. Depending upon the capacity of the industries in Nashik- 1 TPD, frequency of waste collection has been considered alternate days. The following table contains details about the cluster.

Table 6-15 Details of Cluster 2

SR NO.	ULBS WITH >80% seg. Within 60 Kms buffer	SEG (%)	PLASTIC WASTE GENERATION (MT/day)	PLASTIC WASTE GENERATION (MT/ week)
1	Sinnar	100	0.131	0.92
2	Shirdi	95	0.45	3.18
3	Rahuri	90	0.19	1.35
Total			0.77	5.39

6.4 IDENTIFICATION OF CLUSTERS IN NAGPUR DIVISION

The revenue division of Nagpur has close to 74 Urban Local Bodies. The plastic recycling industry Sudarshan Plastic, located in the Nagpur division is willing to accept plastic waste from the ULBs for recycling.

The above industry accept good quality and unsoiled LDPE, HDPE, and PET bottles. The capacities of the industries are 1 TPD. Following map shows the location of the industry along with ULBs having 80% and above segregation and proximity of the industries to ULBs.

Source- Data from Divisional Coordinator (as on July 2018) and preliminary interaction with ULBs
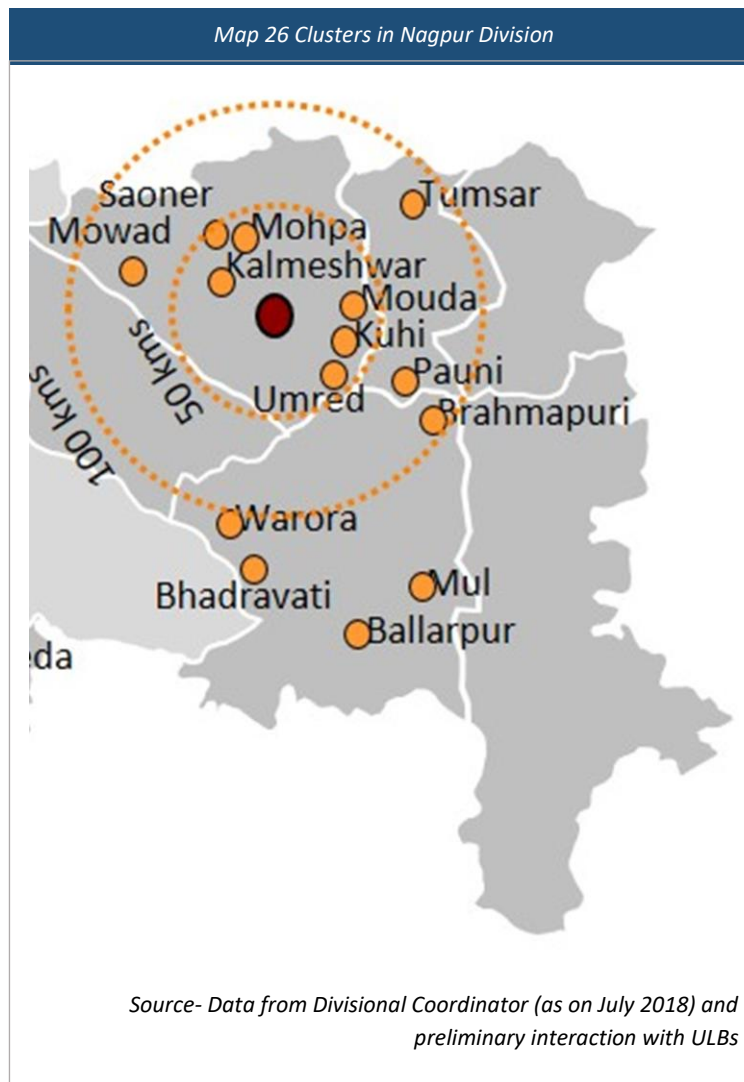
Table 6-16 Plastic Generation and segregation of ULB under 200 kms buffer of industries

SR NO.	ULBS WITH >80% SEGREGATION	SEG (%)	PLASTIC WASTE GENERATION (MT)	PLASTIC WASTE GENERATION (MT/week)
1	Mohpa	80	0.029	0.203
2	Kalmeshwar	80	0.076	0.532
3	Mouda	100	0.33	2.31
4	Kuhi	80	0.02	0.14
5	Umred	95	0.208	1.456
6	Saoner	100	0.14	0.98
7	Tumsar	80	0.179	1.253
8	Brahmapuri	100	0.14	0.98
9	Pauni	90	0.083	0.581
10	Mowad	90	0.031	0.217
11	Warora	85	0.17	1.19
12	Mul	80	0.09	0.63
13	Ballarpur	95	0.31	2.17
14	Bhadrawati	90	0.23	1.61
	Total		**2.03**	**14.25**

 Upon discussion with the industries, it was inferred that the industries can collect plastic waste from cities up to a radius of 100 kms. Thus, from the above map we see that close to 14 ULBs having 80% and above segregation fall under the proximity radius of 100 kms from the location of industries. The following table shows the list of these 14 ULBs along with their assumed quantities plastic waste generation both on a daily and monthly basis.

Table 6-17 Initial assessment of ULBs

SR NO.	ULBS WITH >80% SEGREGATION	SEG (%)	INITIAL ASSESSMENT
1	Saoner	100	Dry waste is segregated and stored at dumping site
2	Kalmeshwar	80	In talks with recycler from Nagpur
3	Mohpa	80	Waste is sold to bhangarwalas
4	Mowad	90	Waste is segregated and stored at dumping site
5	Brahmapuri	100	Dry waste is segregated and auctioned
6	Pauni	90	Dry waste processing is not undertaken
7	Mouda	100	Plastic, Paper, Glass & Rubber is sold to recyclers based in Nagpur
8	Umred	95	
9	Kuhi	80	
10	Warora	85	In talks with ambuja cement factory
11	Mul	80	
12	Tumsar	80	
13	Ballarpur	95	Have tie-ups with ambuja cement factory for dry waste
14	Bhadrawati	90	Plastic is used in road constrution

WANADONGRI

Background

- **Location:** Pune district, 15 kms from the recycling industry
- **Population (census 2011) :** 17,150
- **Total waste generation:** 14 TPD
- **Dry waste generation:** 5.02 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-29 Dry waste management scenario in Wanadongri

The dry waste generation in the city is close to 5.02 TPD. Dry waste is segregated by ULB workers and stored in the dump site. This is further segregated in to **LDPE, HDPE, glass bottles, shoes and clothes**. Currently, plastic waste is bailed, bundled and stored at dumping site. The city has given formal recognition to the rag pickers. As per the mutual agreement between the ULB and the rag pickers, they collect rest of the segregated waste from the dumping site. Currently, plastic waste which is bundled is being put up for sale and ULB is looking for contractors to sell the plastic waste as done previ

Total waste generation: 14 TPD

Dry waste generation: 5.02 TPD

At source segregation: 80%

Secondary segregation: by ULB workers

Rag-pickers integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass
- Thermocol

Dry waste at dumping site
- Currently, plastic waste is bailed, bundled & stored at the shed on the dumping site.
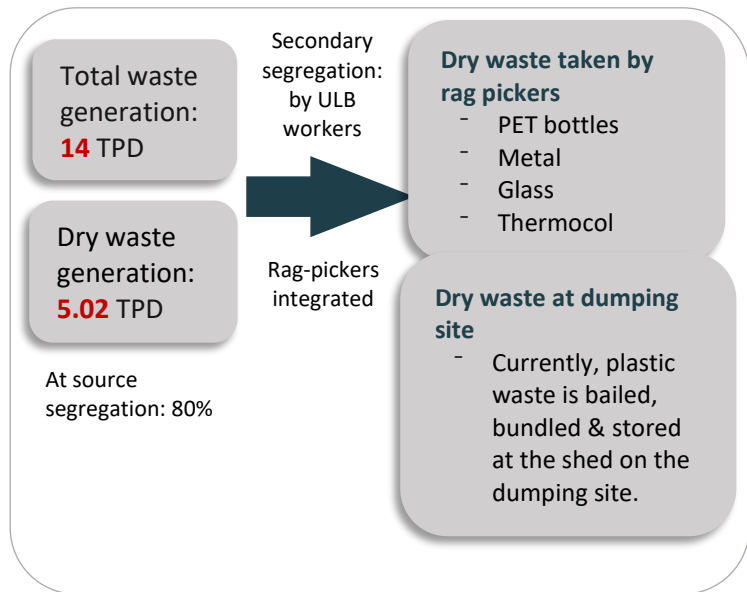
Figure 6-29 Dry waste management scenario in Wanadongri

POTENTIAL TO BE PART OF CLUSTER

1. Segregation	Yes at 80% segregation at source
2. Involvement of stakeholder	
a. Contractor	None
b. Rag-pickers	As they are integrated in the system rag pickers take away all recyclable dry waste except plastic
3. Existing forward linkages established	Rag pickers sell recyclable dry waste, except plastic
4. Willingness of the ULB to be part of cluster	Yes
5. Willingness to share transportation cost	Yes

SAONER

Background

- **Location:** Nagpur district, 40 kms from the recycling industry
- **Population (census 2011) :** 42,000
- **Total waste generation:** 7 TPD
- **Dry waste generation:** 2.5 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-31 Dry waste management scenario in Saoner

The dry waste generation in the city is around 2.5 TPD. The level of segregation in the city is 80%. Dry waste is collected in the segregated manner by ULB workers and stored on the dump site. This is further segregated in to LDPE & HDPE plastic, footwear, glass and cloth waste by the rag pickers. The city has identified rag pickers who are paid on monthly basis to segregate waste at the dumping site. These rag pickers segregate waste and store them in specific allocated sheds

Total waste generation: **7** TPD

Dry waste generation: **2.5** TPD

At source segregation: 80%

Secondary segregation: by ULB workers

Rag-pickers integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste at dumping site
- Dry waste is collected in the segregated manner by ULB workers and stored on dump site.
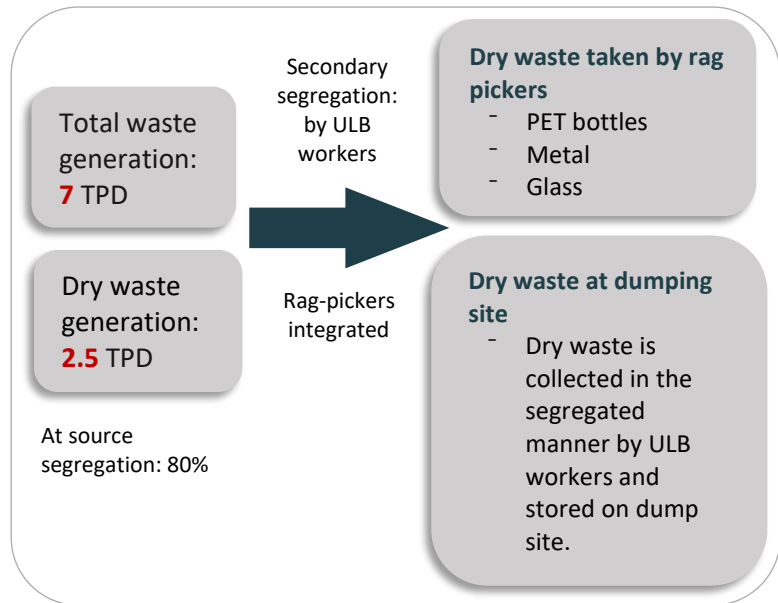
Figure 6-32 Dry waste processing and storage scenario at Saoner

Infrastructure provision made in Saoner for storage of segregated dry waste

POTENTIAL TO BE PART OF CLUSTER

1.	Segregation	Yes at 80% segregation at source
2.	Involvement of stakeholder	
	a. Contractor	Contractor is not responsible for dry waste processing
	b. Rag-pickers	They are integrated in the system and they take away recyclable dry waste
3.	Existing forward linkages established	Currently dry waste is being taken away by rag pickers
4.	Willingness of the ULB to be part of cluster	Yes. Since ULB is not earning out of the current system
5.	Willingness to share transportation cost	Yes

MOHPA

Background

- **Location:** Nagpur district, 35 kms from the recycling industry
- **Population (census 2011) :** 7,066
- **Total waste generation:** 2 TPD
- **Dry waste generation:** 0.8 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-33 Dry waste management scenario in Mohpa

The dry waste generation in the city is around 0.8 TPD. Dry waste is collected in segregated manner by ULB workers. This is further segregated in to LDPE, HDPE, footwear, glass and cloth waste. The city, has made permanent arrangements for the storage of segregated dry waste. The ULB has identified rag picker to take away metal, thermocol and glass whereas plastic is only stored in the shed. Mohpa being a small town the quantity of plastic waste generated is negligible.

Total waste generation: **2** TPD

Dry waste generation: **0.8** TPD

At source segregation: 100%

Secondary segregation: by ULB workers

Rag-pickers integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass
- Thermocol

Dry waste at dumping site
- Mouda being a small town the quantity of plastic waste generated is negligible.
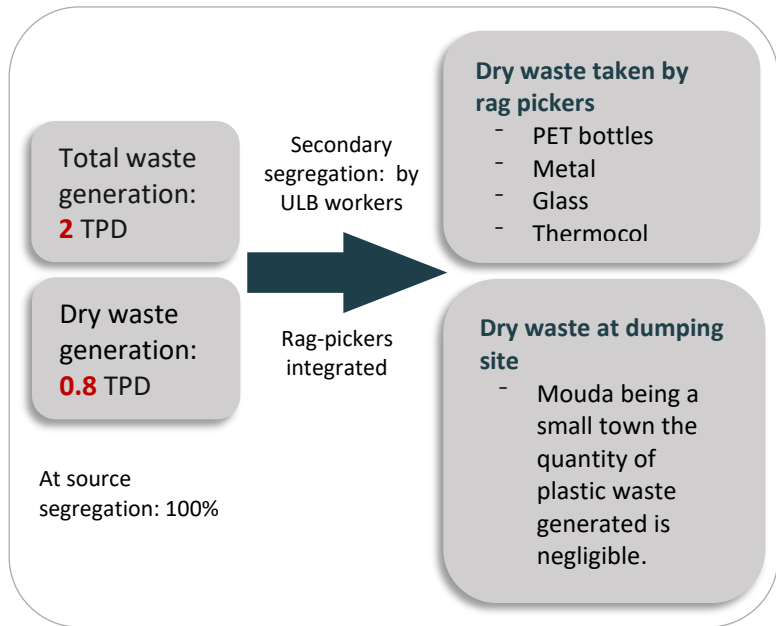
Figure 6-34 Dry waste segregation and processing scenario at Mohpa

Plastic waste bundled and stored

Other kind of dry waste stored to be taken away by rag pickers

POTENTIAL TO BE PART OF CLUSTER

1. Segregation	100% segregation at source
2. Involvement of stakeholder	
a. Contractor	Contractor is not responsible for dry waste processing
b. Rag-pickers	They are integrated in the system and they take away recyclable dry waste
3. Existing forward linkages established	Currently dry waste is being taken away by rag pickers
4. Willingness of the ULB to be part of cluster	Yes. Since ULB is not earning out of the current system
5. Willingness to share transportation cost	Yes

KALAMESHWAR

Background

- **Location:** Nagpur district, 22 kms from the recycling industry
- **Population (census 2011) :** 17,241
- **Total waste generation:** 5.2 TPD
- **Dry waste generation:** 2 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-35 Dry waste management scenario in Kalmeshwar

The dry waste generation in the city is around 2 TPD. Dry waste is segregated by ULB workers and stored in the dump site which is further segregated in to LDPE, HDPE, footwear, glass and cloth waste. The city, has made permanent arrangements for the storage of segregated dry waste. The city has identified 13 rag pickers to segregate dry waste at the dumping site. Plastic is stored in temporary shed and sold off to the contractor in a gap of 2 months.

Total waste generation: 5.2 TPD

Dry waste generation: 2 TPD

At source segregation: 85%

Secondary segregation: by ULB workers

Rag-pickers not integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste at dumping site
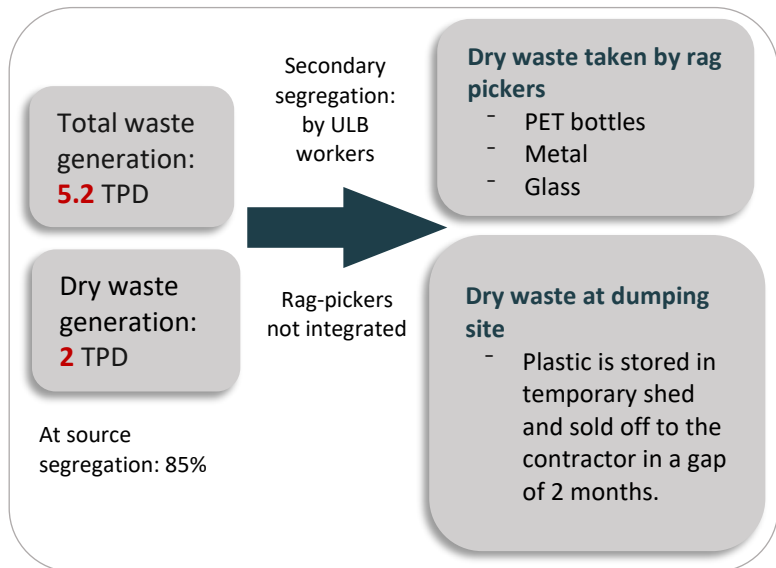- Plastic is stored in temporary shed and sold off to the contractor in a gap of 2 months.

Figure 6-36 Dry waste segregation and processing scenario at Kalmeshwar

Dry waste segregated and bundled at the dumping site

POTENTIAL TO BE PART OF CLUSTER

1.	Segregation	Yes at 85% segregation at source
2.	Involvement of stakeholder	
	a. Contractor	Contractor in agreement with ULB
	b. Rag-pickers	They are integrated in the system and they take away recyclable dry waste
3.	Existing forward linkages established	Currently dry waste is being taken away by contractor
4.	Willingness of the ULB to be part of cluster	ULB is earning out of the current system
5.	Willingness to share transportation cost	Willing to bear transportation cost of waste collection.

MAUDA

Background

- **Location:** Nagpur district, 37 kms from the recycling industry
- **Population (census 2011) :** 20,000
- **Total waste generation:** 2.5 TPD
- **Dry waste generation:** 0.8 TPD

DRY WASTE MANAGEMENT SCENARIO

Figure 6-37 Dry waste management scenario in Mauda

The dry waste generation in the city is around 0.8 TPD. Dry waste is segregated by ULB workers and stored on the dumping site. This is further segregated in to **LDPE, HDPE, footwear, glass and cloth waste**. The city, has made temporary shed arrangements for the storage of segregated dry waste. The city has identified 4 rag pickers to segregate dry waste. Plastic is stored in temporary shed and sold off to the contractor while rest of the dry waste is currently just stored as forward linkages for the same is yet to be established.
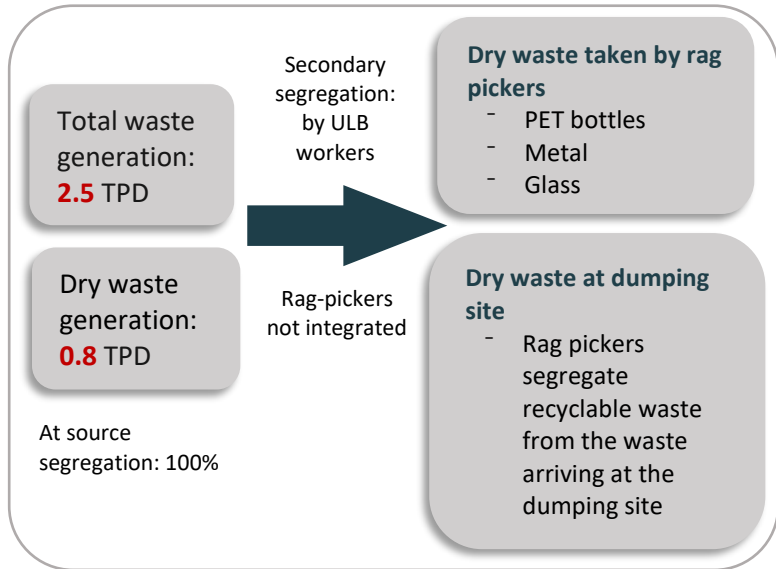
Total waste generation: **2.5** TPD

Dry waste generation: **0.8** TPD

At source segregation: 100%

Secondary segregation: by ULB workers

Rag-pickers not integrated

Dry waste taken by rag pickers
- PET bottles
- Metal
- Glass

Dry waste at dumping site
- Rag pickers segregate recyclable waste from the waste arriving at the dumping site

Figure 296-38 Dry waste segregation and processing scenario at Mauda

Temporary shed constructed for storage of segregated dry waste

POTENTIAL TO BE PART OF CLUSTER

1. Segregation	Yes at 85% segregation at source
2. Involvement of stakeholder	
a. Contractor	Contractor in agreement with ULB
b. Rag-pickers	They are integrated in the system and they take away recyclable dry waste
3. Existing forward linkages established	Currently dry waste is being taken away by contractor
4. Willingness of the ULB to be part of cluster	Yes. Since ULB is not earning out of the current system
5. Willingness to share transportation cost	Willing to bear transportation cost of waste collection.

6.4.1.6   COMPARATIVE ANALYSIS OF CITIES VISITED OF NAGPUR DIVISION

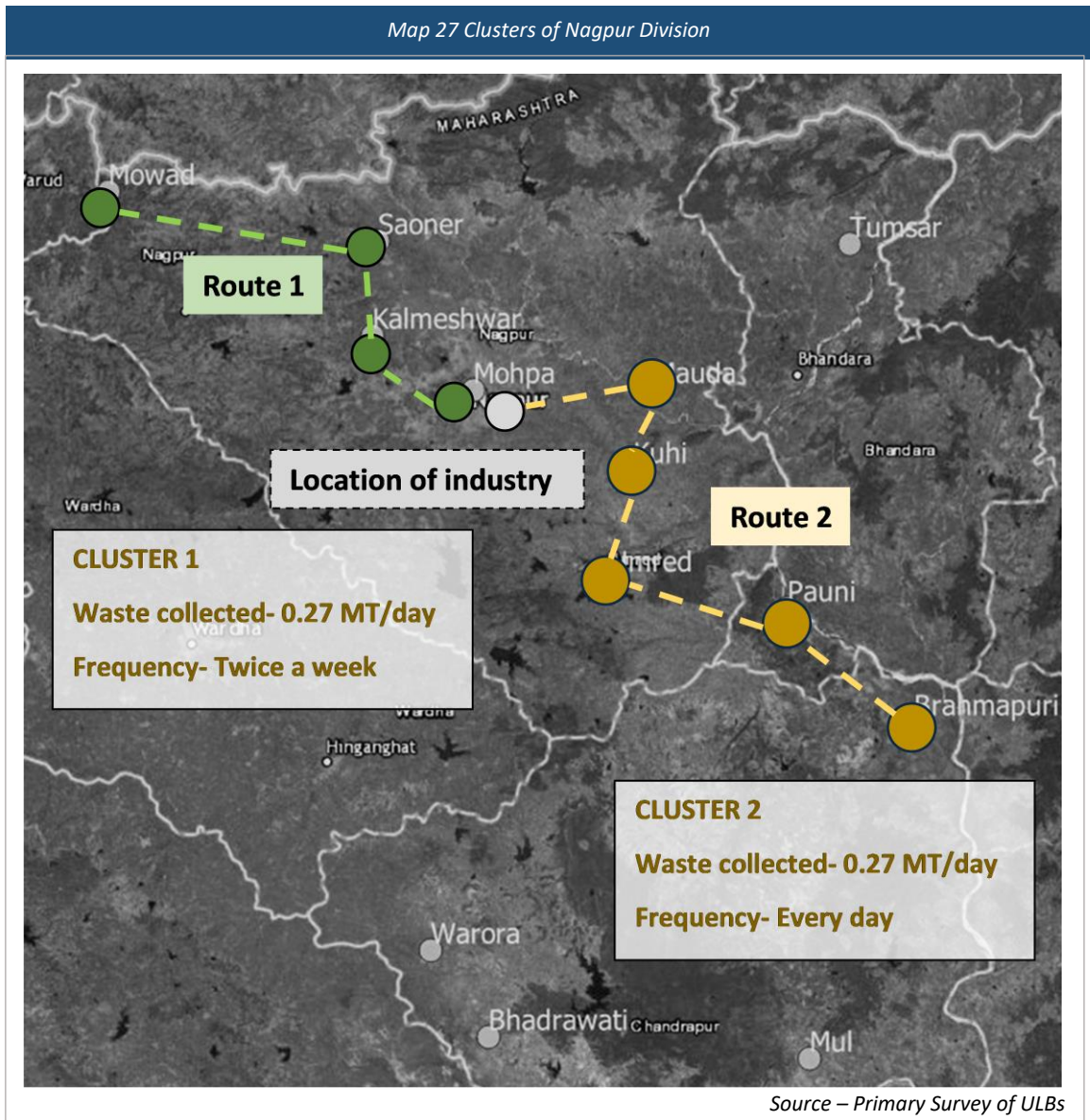|	Dry waste generation (MT/day)	Seg (In %)	Available manpower for segregation	Available infrastructure	Type of segregated dry waste available	Current management of dry waste	Willingness of ULBs to be part of cluster	Willingness to share transport cost	Potential to be included in cluster
SAVNER	2.5	80	ULB workers undertake secondary segregation	Separate enclosures for storage of different types of dry waste	LDPE, PET bottles, paper, thermocol, and glass	Rag pickers sell recyclable dry waste	Maybe	Yes	Maybe
MOHPA	0.8	100	ULB workers undertake secondary segregation	Shed for storage	PET bottles, Thermocol, paper and cloth	Rag pickers sell recyclable dry waste	Maybe	Yes	Maybe
MOUDA	0.8	100	Rag pickers have been identified which segregate dry waste at dumping site	Temporary sheds have been constructed	LDPE, PET bottles, paper and thermocol	ULB appointed contractor sells plastic waste. Rag pickers identified sell other kinds of recyclable dry waste	Yes	Yes	Yes
KALAMESHWAR	2	85	Rag pickers have been identified which segregate dry waste at dumping site	Temporary sheds have been constructed	Plastic, paper, cardoard	ULB appointed contractor sells plastic waste. Rag pickers identified sell other kinds of recyclable dry waste	Maybe	Yes	Maybe

6.4.1.7 OBSERVATIONS FROM SITE VISITS

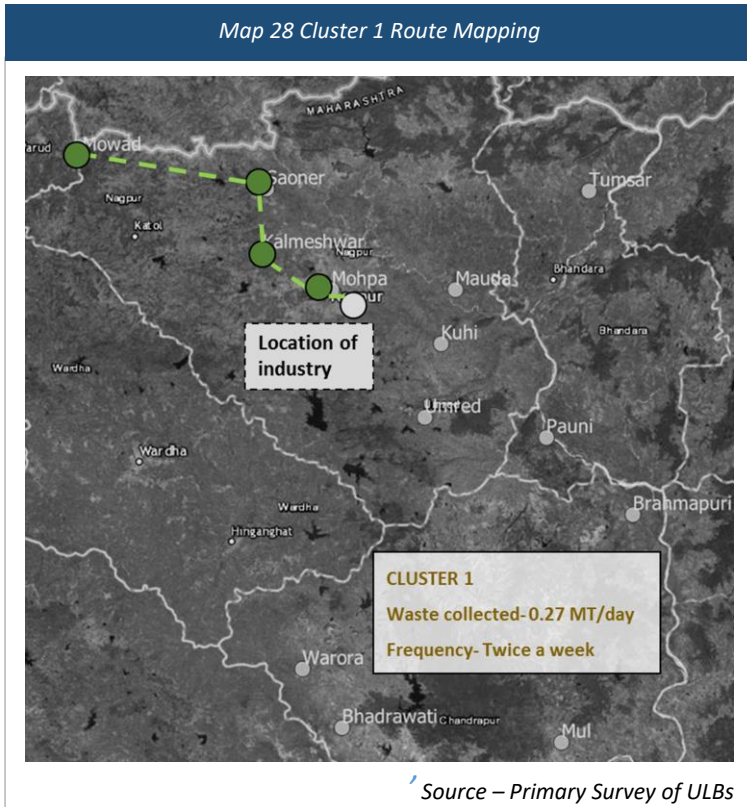From the analysis of field visits, following observations were made-

➢ **Involvement of rag pickers:** In 2 of the 4 ULBs, rag pickers have been deployed for segregation of dry waste wherein the rag pickers identified sell recyclable dry waste. In cases, where waste collection contractors pay waste pickers, waste is only sorted and kept stored. Thus, it may be understood that waste pickers form an integral part of the waste management process. If they are formally integrated in to the system, their skill set may be utilized for sorting of waste in to various categories.

➢ **Involvement of contractor:** in 2 out of 4 ULB visited ULB appointed contractor sells recyclable dry waste.

➢ **Categories in which dry waste is segregated:** It was observed that the predominant types in which waste is segregated in the cities include plastic segregated in to LDPE, HDPE and PET bottles, cloth waste and footwear waste.

➢ **Cities with highest potential to be part of the cluster:** From the above analysis, it was found that Mohpa and Mouda are the two cities having the highest potential to be a part of cluster management of dry waste. These cities have 100 % segregation of wet and dry waste. Dry waste is further segregated in to HDPE, LDPE, PET bottles, footwear and clothes. The stored waste is clean and hence of good quality. They have manpower and infrastructure available for waste segregation. Further, they are willing to be a part of cluster and are also willing to share/ bear the transportation cost of waste collection by industries if required.

6.4.2 COLLECTION ROUTES AND FREQUENCY

Depending upon the site visits and discussion with the ULBs and industries, 3 critical criteria were identified which influence the formation of clusters. They were- waste quantity, segregation, proximity and capacity of the industries. Based on these criteria, 2 clusters were identified which are characterized by route and frequency of waste collection. The following map shows the 3 clusters spatially on a map.

Map 27 Clusters of Nagpur Division

Source – Primary Survey of ULBs

6.4.2.1 CLUSTER 1

Map 28 Cluster 1 Route Mapping

CLUSTER 1
Waste collected- 0.27 MT/day
Frequency- Twice a week

Source – Primary Survey of ULBs

The above cluster comprises of 4 cities which have been selected based on waste generation, segregation and proximity to the industry (100 kms). They are Kalmeshwar, Mohpa, Saoner and Mowad. The total plastic waste generation over a week comes to 1.93 MT. Depending upon the capacity of the industries in Nagpur-1 TPD), frequency of waste collection has been considered alternate days. The following table contains details about the cluster.

Table 6-18 Details of Cluster 1

SR NO.	ULBS WITH >80% seg. Within 100 Kms buffer	SEG (%)	PLASTIC WASTE GENERATION (MT/day)	PLASTIC WASTE GENERATION (MT/ week)
1	Kalmeshwar	80	0.076	0.532
2	Mohpa	80	0.029	0.203
3	Saoner	100	0.14	0.98
4	Mowad	90	0.031	0.217
		Total	**0.27**	**1.93**

6.4.2.2 CLUSTER 2

Map 29 Cluster 2 Route Mapping

CLUSTER 1

Waste collected- 0.27 MT/day

Frequency- Every day
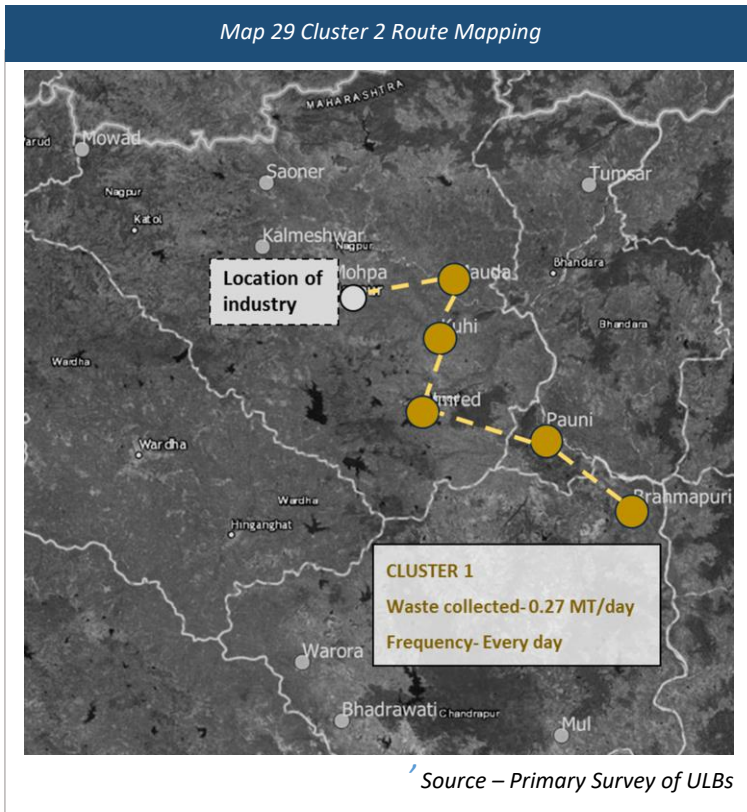
' Source – Primary Survey of ULBs

The above cluster comprises of 5 cities which have been selected based on waste generation, segregation and proximity to the industry (100 kms). They are Brahmapuri, Pauni, Mouda, Umred and Kuhi. The total plastic waste generation over a week comes to 5.46 MT. Depending upon the capacity of the industries in Nagpur-1 TPD), frequency of waste collection has been considered daily. The following table contains details about the cluster.

Table 6-19 Details of Cluster 2

SR NO.	ULBS WITH >80% seg. Within 100 Kms buffer	SEG (%)	PLASTIC WASTE GENERATION (MT/day)	PLASTIC WASTE GENERATION (MT/ week)
1	Brahmapuri	100	0.14	0.98
2	Pauni	90	0.083	0.581
3	Mouda	100	0.33	2.31
4	Umred	95	0.208	1.456
5	Kuhi	80	0.02	0.14
Total			**0.78**	**5.46**

7. INFERENCE AND WAY FORWARD

As per the discussions with the industries and the initial assessment of the cities certain parameters were identified which would affect the potential of the city to be part of the cluster. During the site visits conducted following observations were made

Division	Name of the city	Dry waste generation (MT/day)	Seg (In %)	Availability of manpower for segregation	Type of segregated dry waste available	Current management of dry waste	Willingness of ULBs to be part of cluster	Willing to share transportation cost	Potential to be included in cluster
Konkan	Matheran	2.5	100	Green	Green	Green	Green	Red	Green
	Khopoli	16	70	Green	Green	Red	Green	Red	Green
	Alibag	4.5	60	Red	Red	Red	Green	Green	Red
	Pen	10.5	70	Red	Red	Red	Green	Green	Red
	Mahad	4	70	Red	Red	Red	Green	Red	Red
Pune	Junnar	2	100	Green	Red	Green	Green	Red	Red
	Alandi	9	83	Green	Green	Green	Green	Green	Green
	Saswad	5.5	100	Green	Green	Red	Green	Red	Green
	Uran islampur	2.5	100	Red	Red	Green	Green	Green	Green
	Karad	13	100	Green	Green	Green	Green	Red	Green
	Panhala	0.5	100	Green	Green	Green	Green	Green	Green
Nashik	Trimbak	2	100	Green	Green	Red	Red	Red	Red
	Shirdi	14.5	100	Green	Green	Red	Red	Red	Red
	Sinnar	8	90	Red	Green	Red	Green	Green	Green
	Igatpuri	2.5	80	Red	Green	Red	Green	Green	Green
Nagpur	Savner	2.5	80	Green	Green	Red	Green	Green	Red
	Mohpa	0.8	100	Green	Green	Red	Green	Green	Red
	Mouda	0.8	100	Green	Green	Red	Green	Green	Green
	Kalameshwar	2	85	Green	Green	Red	Red	Green	Red

During the initial discussions held with the industries follower by the discussions held on the observations of the site visit, certain parameters were identified which are crucial for the implementation of the cluster level dry waste management. These criterias need to be addressed by multiple stakeholders of the system like the ULBs and State. The parameters that affect the feasibility of the cluster, assessed during site visits and discussions held with the industry with the necessary interventions from the ULB and the State are as follows:

Parameters	Concerns	Interventions needed	
		The ULB	The State
Availability of required infrastructure	Requirement of industry for accepting waste- **Unsoiled and washed plastic**	• Plastic washer has to be procured • To get good quality (unsoiled) plastic, cities need to implement at source segregation for plastic waste. • Activities like separate collection drives to be conducted. • The city has to make sure plastic waste is collected separately	Facilitating procurement of plastic washer by the ULBs
	Shed for segregation and storage of dry waste - 10 cities of total 19 visited do not have appropriate space for storage of segregated dry waste	• Need to expedite construction of sheds for storage of dry waste. • ULBs should build temporary structures for the time being for storage of dry waste. E.g. Mouda and Kalameshwar	
Involvement of stakeholders	**Contractor-** In **5 cities** out of 19 visited contractor is undertaking dry waste processing and disposal. Saswad, Shirdi, Mouda, Kalmeshwar and Trimbak		The cities are willing to be part of the cluster but need State's directives on the continuation of the existing system of dry waste processing
	Rag pickers- In **8 cities** out of 19 visited cities rag pickers take away recyclable dry waste. Junnar, Uran Islampur, Karad, Savner, Mohpa, Khopoli,, Alibag, Pen, Mahad, Sinnar and Igatpuri	• ULBs need to integrate rag pickers for segregating waste on dumping site	

Parameters	Concerns	Interventions needed	
		The ULB	The State
Working of the cluster	**Appointment of a monitoring authority** To act as a link between the cities and the industry		To monitor smooth functioning of the cluster and facilitate coordination between the cities and the industry
	Identification of collection point at cluster level	• The city chosen as a collection point has to make provisions for storage of dry waste arriving from cities	• Identification of a city that will function as a regional facility for storage of plastic waste. • Development of the city to work as a regional facility.
	Assurance of dry waste management mechanism The industries already have tie-ups for the intake of plastic waste for recycling. For the industries to be part of the cluster level system, the industries need assurance for the same.		• To formally identify the industries which will be part of the cluster level management • MoU to be signed between the industry and the state asking the identified cities to send their plastic waste to the industries.
Quantity and quality of waste	**Industries need assurance of the quality and quantity of the waste to be collected**	• Need to calculate weekly average quantity of plastic waste received at dumping site	To instruct ULBs to conduct quantification of plastic waste arriving at the dumping site.
Willingness to share transportation cost	8 cities of total 19 visited are not willing to share transportation cost. Matheran, Khopoli, Mahad, Junnar, Saswad, Karad, Trimbak and Shirdi		ULBs which alaready have some forward linkages are not willing to share the transportation cost - State's directives on the same are needed.