

Project Cost
2585.15 Lakh



DETAILED PROJECT REPORT FOR DHULE MUNICIPAL CORPORATION

Submitted to –

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MAHARASHTRA URBAN DEVELOPMENT MISSION

SWACHH MAHARASHTRA MISSION

Under

SWACHH MAHARASHTRA MISSION (Urban)



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LIST OF ABBREVIATIONS

C&D	Construction and Demolition
CEO	Chief Executive Officer
CPHEEO	Central Public Health and Environmental Engineering Organisation
DPR	Detailed Project Report
DTD	Door to Door
GIS	Geographical Information System
Gol	Government of India
GoM	Government of Maharashtra
GPCD	Grams per Capita per Day
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
M&E	Monitoring & Evaluation
MIS	Management Information System
MLD	Million Liters per Day
MoUD	Ministry of Urban Development
MUDM	Maharashtra Urban Development Mission
MSWM	Municipal Solid Waste Management
NGO	Non-Government Organization
O&M	Operation & Maintenance
P&D	Processing and Disposal
PHED	Public Health Engineering Department
PMU	Project Management Unit
PPP	Public Private Partnership
PWD	Public Works Department
RWA	Resident Welfare Association
SLB	Service Level Benchmark
SLF	Sanitary Landfill
SMM	Swachh Maharashtra Mission

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SPCB	State Pollution Control Board
ToR	Terms of Reference
TPD	Tonnes per Day
ULB	Urban Local Body
WTE	Waste to Energy

Chapter 1. Introduction to the Project

1.1 Definition of MSWM

Municipal Solid Waste (MSW) is the trash or garbage that is discarded day to day in a human settlement. According to MSW Rules 2000 MSW includes commercial and residential wastes generated in a municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes. Waste generation encompasses activities in which materials are identified as no longer being of value (being in the present form) and are either thrown away or gathered together for disposal. Municipal Solid Waste consists of the following kinds of waste.

Figure 1-1: Sources of MSW Generation



The other kinds of waste found in urban settlements are;

- 1) Industrial or Hazardous Waste and
- 2) Bio-Medical or Hospital Waste and
- 3) E-Waste.

The Industrial hazardous waste is managed through Hazardous Waste (Management and Handling) Fourth Amendments Rules 2010. Hazardous waste is typically identified with properties of ignitability, corrosivity, reactivity and toxicity. Hence urban local bodies must ensure that industrial waste in their command area does not get mixed with the municipal solid waste stream, failing which will result in heavy environmental impacts and economic losses (as hazardous waste treatment costs much more higher than the municipal solid waste) and health & safety hazards (Contaminants like heavy metals, chromium, mercury, etc. when found in the municipal waste stream will contaminate the compost produced by the city).

According to the Hazardous Waste Management Rules 2010, the onus of managing and treating hazardous wastes lie with the waste generator, and the urban local body has to ensure that such waste does not contaminate municipal waste stream in their area of authority.

1.2 Project Background and Scope (SBM & SMM)

Rapid urbanization in the last few decades has led to significant increase in municipal solid waste generation in India. Municipal Solid Waste Management (MSWM) has always been a great challenge to the urban local bodies (ULBs) in India. Public health, environment and quality of life in urban areas have a direct bearing on the efficiency with which the SWM service is provided by ULBs. In most cities of India, solid waste management is inefficient as systems adopted are primary, tools and equipment are out-dated and inadequate & manpower productivity is low. A significant portion of the population does not have access to primary waste collection service and only 50 to 70% of waste collected is transported for disposal. Processing and treatment of waste is limited and final disposal is in unscientific dumpsites, posing problems of ground and water contamination and air pollution.

Maharashtra is the second largest state in India, both in terms of geographical area and population. It is a highly urbanized state. Maharashtra has 35 districts, divided into six revenue divisions for administrative purposes including Konkan, Pune, Nashik, Aurangabad, Amravati and Nagpur.

As per Central Pollution Control Board (CPCB), Maharashtra generates 22,570 Tons per day (TPD) of waste including Mumbai out of which about 5,927 TPD (26%) of waste is treated as per the requirement of MSW Rules.

The main objective of this study is "Preparation of Detailed Project Reports (DPRs) under Swachh Maharashtra Mission (Urban) for ULBs in the State of Maharashtra. In order to complete the DPR preparation and implementation process in mission time ULBs in state are divided into 6 Divisions. DPRs for each ULB are to be prepared separately. Nashik Division is one such division.

1.3 Project Formulation Justification

1.3.1 Swachh Bharat Mission (SBM)

The "Swachh Bharat Mission-Urban" (SBM-U) is a major initiative of Government of India. The mission seeks to attain the vision of Mahatma Gandhi; 'Clean India' by his 150th birthday in 2019. Expected to cost over Rs. 62,000 crore, it is a national campaign covering 4041 statutory towns.

Modern and scientific Solid Waste Management (SWM) is one of the key components of the SBM-U and it was felt that urban bodies face challenges in zeroing down methods of collection and transportation, treatment technology selection and disposal methods.

As a first step, under the Swachh Bharat Mission ULB's are required to prepare Detailed Project Report (DPR) for solid waste management of their city and get it approved from the State High Power Committee.

1.3.2 Swachh Maharashtra Mission

The Government of Maharashtra has proposed to strengthen the entire MSWM system in all the Urban Local Bodies (ULBs) in Maharashtra so as to comply with the Solid waste management Rules 2016, Service Level Benchmarks of the Government of India & achieve the objectives of Swachh Bharat Mission by 2019. For achieving the objectives of the SBM, Government of Maharashtra has launched "Swachh Maharashtra Mission" (SMM) at the state level. SMM in urban areas is being implemented by Urban Development Department (UDD) through a dedicated SMM.

1.3.3 Project Objective

The main objective / output of this project is “Preparation of Detailed Project Reports (DPRs) for Solid Waste Management” under Swachh Maharashtra Mission (Urban) for ULBs in the State of Maharashtra. In order to complete the DPR preparation and implementation process in mission time ULBs in state are divided into 6 Divisions. This report is for the Nashik Division which has 57 ULBs in it. DPRs for each ULB would be prepared separately. This DPR is for Dhule ULB.

After the DPRs are prepared and approved, implementation of projects would be taken up for achieving the objectives of the Swachh Maharashtra Mission.

1.3.4 Structure of the Report

This “Detailed Project Report” is prepared by taking into consideration the ground realities, local conditions, and assessment of the present solid waste management situation in the city. It includes the details of existing door to door waste collection and transportation and disposal of solid waste. The report also includes an analysis of the ULB legal framework and byelaws, financial analysis of the ULB, data on key public and environmental health, user charges etc.

The report has been structured into 12 chapters, as follows:

- Chapter 1 covers the project background; scope of work and objective
- Chapter 2 incorporates brief background of the city and its area in the context to familiarise with the character of the city and its boundary conditions. All the special features of the city having direct or indirect impacts on the city’s SWM system are described in this chapter
- Chapter 3 and 4 provides the detailed information about the existing solid waste management situation in the city. A detailed assessment of the existing solid waste management situation of ULB area including the final analysis of the baseline data, and projection of demand for SWM. Solid waste management system is described in detail, here. The gaps have been highlighted in this chapter
- Chapter 5 cover the project definition, scope of work and approach & methodology
- Chapter 6 presents a detailed proposed municipal solid waste management system. Each component of the integrated solid waste management system has been calculated and presented
- Chapter 7 presents a detailed institutional aspects and capacity building of ULB
- Chapter 8 talks about status of community participation in SWM and proposed strategies about community awareness and public participation in SWM
- Chapter 9 covers the operation and maintenance aspects of proposed integrated solid waste management system
- Chapter 10 provides the detailed information about cost estimation proposed integrated solid waste management system
- Chapter 11 provides the information about project financial structuring and feasibility of the project
- Chapter 12 provides annexures for reference

Chapter 2. City Profile

2.1 Geographical and Climatic Conditions

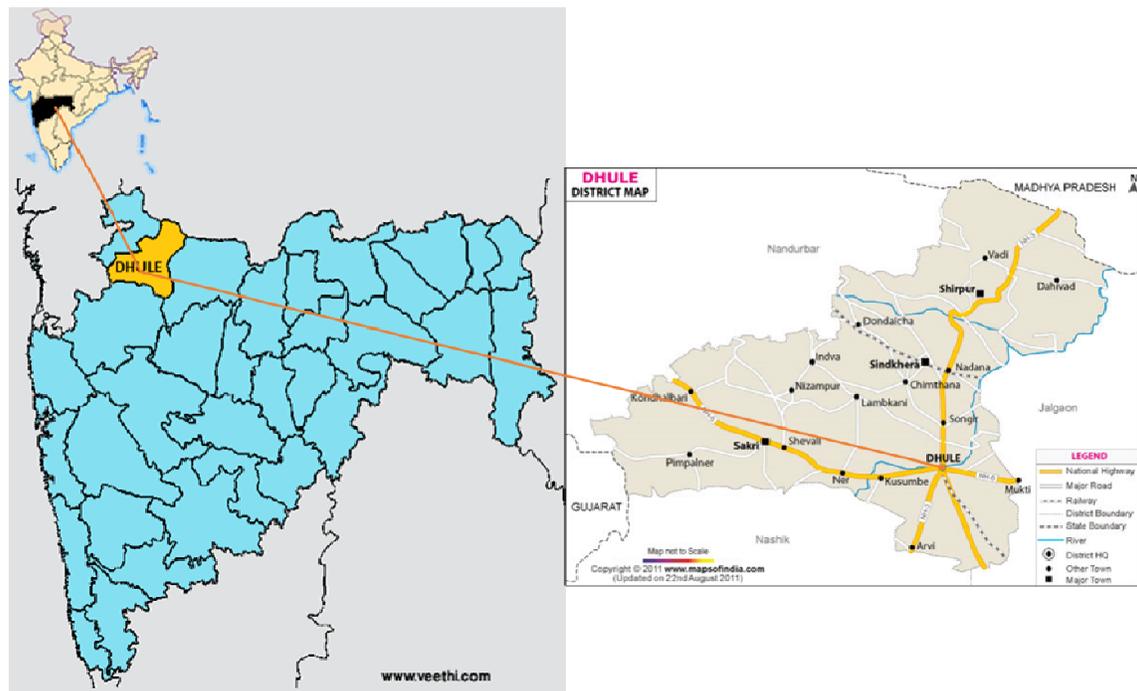
Dhule is largely emerging as one of the biggest upcoming hubs of textile, edible oil, and power-looms across the state and has gained a strategic advantage for being on the junction of three National Highways viz. NH-3, NH-6, and NH-211 and on most anticipated Manmad - Indore Rail Project. Dhule city is also a part of Delhi Mumbai Industrial Corridor Project, India's most ambitious infrastructure program, aiming to develop new industrial cities as 'Smart Cities' and converging next generation technologies across infrastructure sectors. Dhule city is well known across the state for its quality education institutes.

Satpuda Range of mountains is running from east to west and in the north eastern part of Dhule district. River Tapti and small and sub rivers flow through this region. There are mountains all around in the district. River Panzara also flows through the southern hilly side of the district. Dams have been constructed in the district and waster is mainly used for irrigation purposes in the region. As a result this region is very fertile.

Dhule is located at 20.9°N 74.78°E and has an average elevation of 319 metres. The climate of the district is on the whole dry except during the south-west monsoon season. The year may be divided into four seasons. The cold season from December to February is followed by the hot season from March to May. The south-west monsoon season which follows thereafter, lasts till September. October and November constitute the post-monsoon season. The average annual rainfall in the district is 670.mm.

2.2 Location and Extent

Map 2-1 Location Map of Dhule City



2.3 Population

As per the provisional reports of Census India, population of Dhule in 2011 was 375,559; of which males and females were 193,446 and 182,113 respectively. The sex ratio of Dhule city is 941 females per 1000 males. Child sex ratio of girls is 886 per 1000 boys. In education, total literates in Dhule city are 290,569 of which 154,810 are males while 135,759 are females. Average literacy rate of Dhule city is 87.86 percent of which male and female literacy rate was 91.24 and 84.30 percent respectively.

2.3.1 Population Projections

Huge investment is taking place in Dhule therefore the city has good scope of growth in terms of financial as well as in population. Based on the discussion with state government, mean of arithmetic and incremental increase method has been considered for the future population estimation.

Table 2-1 Population Projection 2011-2041

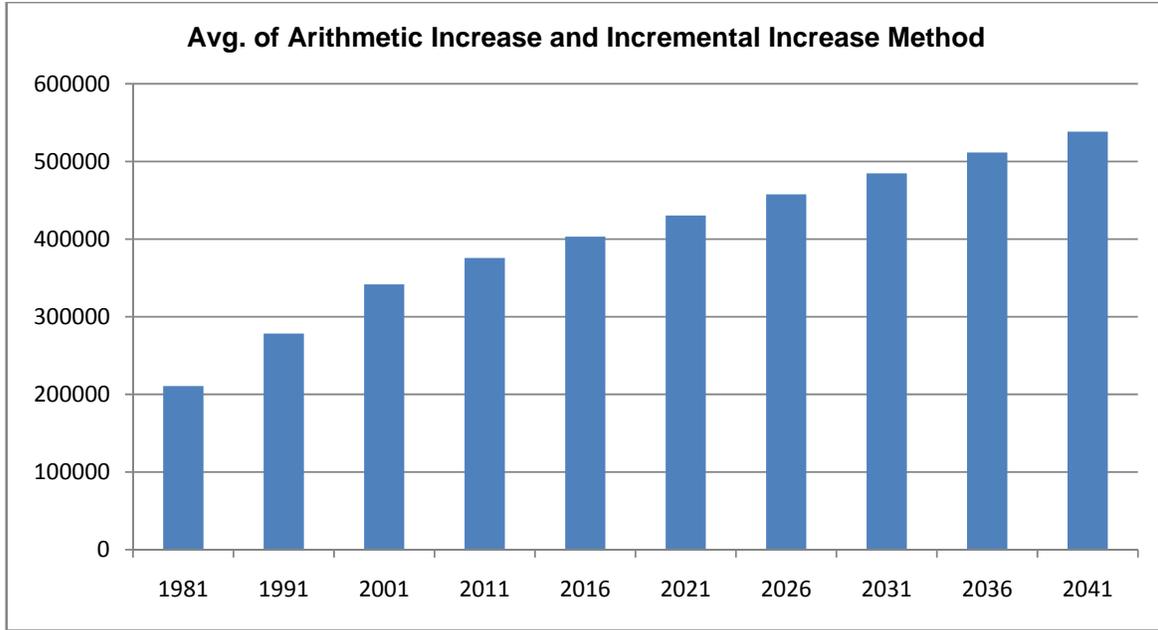
Summary of Dhule Population Forecasts								
Year	Arithmetic increase method	Incremental increase method	Geometrical increase method	Simple graph method	Semi-Log method	Decadal growth method	2nd order degree Polynomial Method	Average of Arithmetic Increase and Incremental increase method
1981	210759	210759	210759	210759	210759	210759	210759	210759
1991	278317	278317	278317	278317	278317	278317	278317	278317
2001	341755	341755	341755	341755	341755	341755	341755	341755
2011	375559	375559	375559	375559	375559	375559	375559	375559
2016	403226	402810	423636	417382	496052	430535	465250	403018
2021	430892	429784	477868	446879	569696	493558	508470	430338
2026	458559	456481	539043	476375	654272	565806	553274	457520
2031	486225	482901	608049	505872	751404	648631	599661	484563
2036	513892	509045	685888	535369	862957	743580	647632	511468.5
2041	541559	534911	773693	564865	991070	852427	697186	538235

Based on the past decade trend, the average of arithmetic increase and incremental increase methods have been taken for population projections.

Year	Arithmetic increase method	Incremental increase method	Average of Arithmetic Increase and Incremental increase method
1981	210759	210759	210759
1991	278317	278317	278317
2001	341755	341755	341755
2011	375559	375559	375559
2016	403226	402810	403018
2021	430892	429784	430338
2026	458559	456481	457520
2031	486225	482901	484563

2036	513892	509045	511468
2041	541559	534911	538235

Graph 2-1: Population Projection Chart



2.3.2 Population Density

The total area of the city is around 46.46 sq.km and the city population was around 375559(2011). Hence, the density of the city is 8083 person per Sq.km.

2.3.3 Floating Population

On the occasion of mela and yatra about 2,00,000 people from nearby places visit the town in March-April for duration of 15 days. Therefore the daily floating population in the city is around 15000 comprising of mela and yatra visitors and daily visitor for the work, commercial activities and recreational purposes.

2.4 Settlements in City

Dhule has been traditionally, an agriculture based place, surrounded by dense forests and mountains. With the urban development taking place industrial activity at medium and small scale has been happening. Primarily, Dhule remains an agricultural activity based backward city, thus rural type profile is predominant.

2.4.1 Number of Households, Shops, Commercial Establishments and Institutions

The city has 72,076 (2011) households and it has 8 areas for commercial activities. It has 6504 commercial shops, 372 schools and 35 degree colleges. There would be 5.21 family members approximately per house.

2.4.2 Number of Hotels, Restaurants, Banquet Halls

Dhule city has several attractions including temples; Ekvira & Samratha Vagdevata, museums and historical monuments. As a result people from nearby places come to visit Dhule. There are several small and medium sized restaurants and hotels in the city. There are 19 numbers of gardens, 12 playgrounds and 103 open spaces in the city.

2.4.3 Number of Markets

There are 6 main markets in the city, 16 vegetable, 19 fruit markets and 23 chicken/fish/mutton small markets.

2.4.4 Slums and Other Informal Settlements

Total no. of slum households in the city are 17,762 in which population of 86,219 resides. This is around 23% of total population of Dhule city.

2.4.5 Industries and their Profile

Dhule is primarily agriculture based with crops like sugarcane, onion, grapes and pomegranate are harvested. The life style is rural like. There are stone mines in the district and thus stone mining is very prevalent. Other than these there are oil mills, textiles and cotton mills, in the city. Small scale industries of copper & brass pots, mud pots and wooden materials are operating in the city. According to estimates, there are 820 small industries in the city.

2.4.6 Healthcare Establishments

The city has 5 hospitals, 14 government and 297 private dispensaries, 2 family welfare centres, 1 child and maternity hospital one nursing home and 478 non-government medical shops.

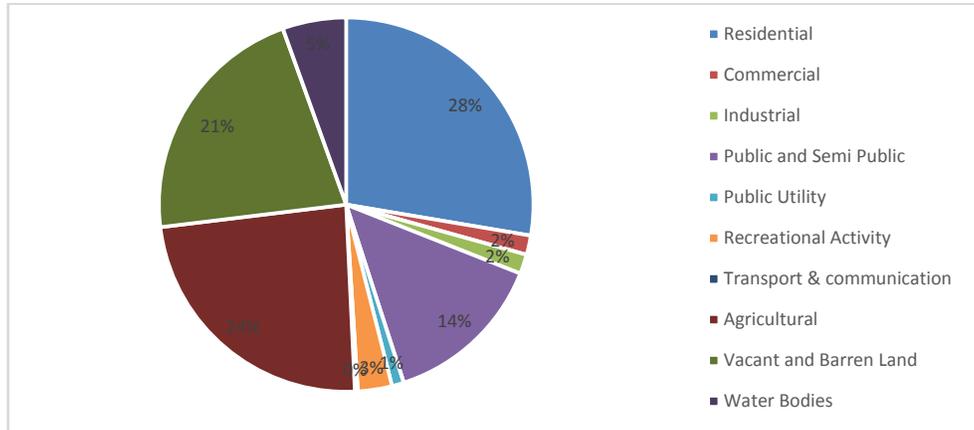
2.5 Land-Use

The city landuse is divided into residential commercial, industrial public and semi-public etc. Around 48% area is developed and 52% areas is under agriculture, vacant land and barren land.

Table 2-2: Land-use Detail

Land-Use	Area in Hectare
Residential	1284.58
Commercial	77.43
Industrial	78.36
Public and Semi Public	651.28
Public Utility	48.23
Recreational Activity	136.7
Transport & communication	11.8
Agricultural	1106.47
Vacant and Barren Land	995.56
Water Bodies	255.32
Total	4646.00

Chart 2-1: Share of Land-use



2.6 Physical infrastructure

2.6.1 Roads

Dhule is one of the few cities in the Maharashtra State which is located on the junction of three National Highways, these being NH-3, NH-6 and NH-211. Through the Asian Highway project, portions of NH3 and NH6 passing through Dhule have been converted into numbered Asian Highways AH47 & AH46 respectively. The total road length in the city is around 468.475 km. The city has four main roads.

- Bombay-Agra Road
- Sakri Road
- Nagpur-Surat Highway
- Aurangabad-Dhuliya Road

2.6.2 Storm Water Management

There are 5 natural drains in the city and their length is 340 kms. As there are no compound walls and slopes, almost all open drainage in the city drains in the natural drainage.

2.6.3 Sewage Management

Open drainage network in the city is 187 kms and only 10% households are connected to the sewerage network, almost all outlets of septic tanks are connected to the open drainage. Around 6.57% households toilets are attached to the drainage.

2.6.4 Water Supply

At present 64 MLD water is being supplied in the city. Water is supplied on every alternate day in some areas of the city and other 2 alternate days in the remaining parts of the city. At present 130 litres per capita of water is being supplied.

2.6.5 Electricity

Around 84% (60342) households have electricity connections. There are 60,342 numbers of domestic connections, 1912 numbers of industrial connections and 8240 numbers of commercial connections.

2.7 Urban Economy

Dhule city is classified under “D” category and got converted to a Municipal Corporation in the year 2003. Although still a backward city it has emerged as one of the biggest edible oil, power-loom, and textile clusters in the state. There are various agro, forest, plastic, chemical, and oil based industries in MIDC area. Dhule is well known for purest ‘milk-ghee’ production, maximum cultivable land, and production of groundnut, foremost in agro-based industries, leader in wind power generation.

It is expected that the growth of MSMEs will boost up in and around Dhule district due to its connectivity to the Delhi-Mumbai Industrial Corridor Project.

Groundnut is the district’s main crop. The district is also a major producer of ground nut, leading in the state in groundnut production. Sorghum, Spiked Millet, Sesame, Cotton, green gram are also cultivated in the district. Fruits like Banana, Guava, Papaya and melon are also cultivated.

2.8 Information about ULB

2.8.1 Political Setup

Dhule city is governed by a Municipal Corporation and a Mayor and 70 ward members. The city elections are held every 5 years.

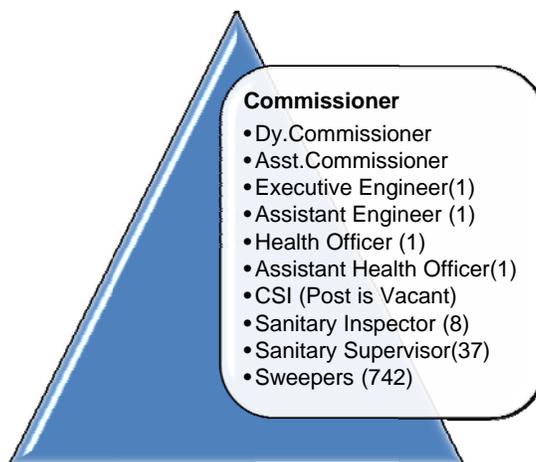
2.8.2 Administrative Setup of Dhule Municipal Corporation

Figure 2-1: Administrative Setup of Municipal Corporation-Dhule



2.8.3 Administrative Setup of Sanitation Department of Dhule Municipal Corporation

Figure 2-2: SWM Administrative Setup of Municipal Corporation-Dhule



2.8.4 Financial Status of ULB

Total planned deposits of Dhule Municipal Corporation is 10.70 crore rupees and the total expenditure is 10.66 crore rupees. The city has received 1.5 billion Rs. as Mahanagarpalika cess and 1.44 billion as grant. Total Rupees 60 crore come from property tax.

Table 2-3: Budget (2016-17) of Municipal Corporation Dhule

Budget 2016-17	INR, Crores
Total expenditure planned	10.66
Total deposits	10.70

Table 2-4: Total Deposits in Municipal Corporation Dhule

Deposits	INR, in Crore
Initial Balance	13.86
MNC tax	144.15
Special Act	30.30
Property Tax	5.86
Grant	14.50
Miscellaneous	2.70
Budget and Capital Accumulation	63.84
Total Deposits	434.51

2.8.5 Administrative and Financial Aspects of MSWM

The total expenditure on SWM was Rupees 5.55 crore in 2013-14 and the expense on GhantaGadi was rupees 4 crore which implies that a total of 72% SWM budget was spent on GhantaGadi.

Table 2-5: SWM Expenditure

SWM Expenditure	INR, in Lakh
Solid Waste Technical Advice	5
Cleaning Contract	125
Drain Cleaning	25
GhantaGadi Rent	400
IEC Activities	0.5
Total expenditure	555.5

Graph 2-2: Expenditure on SWM

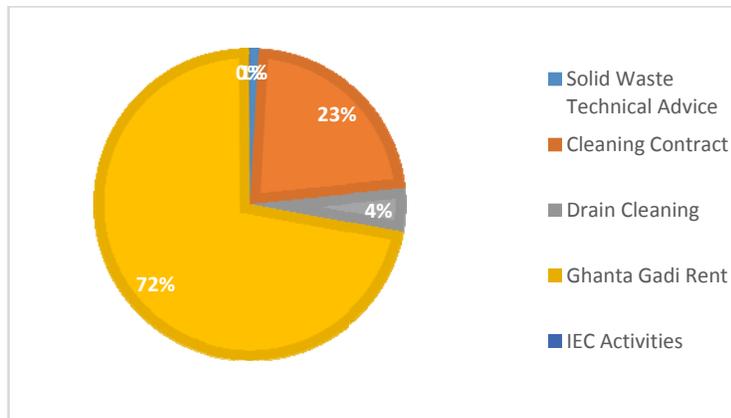
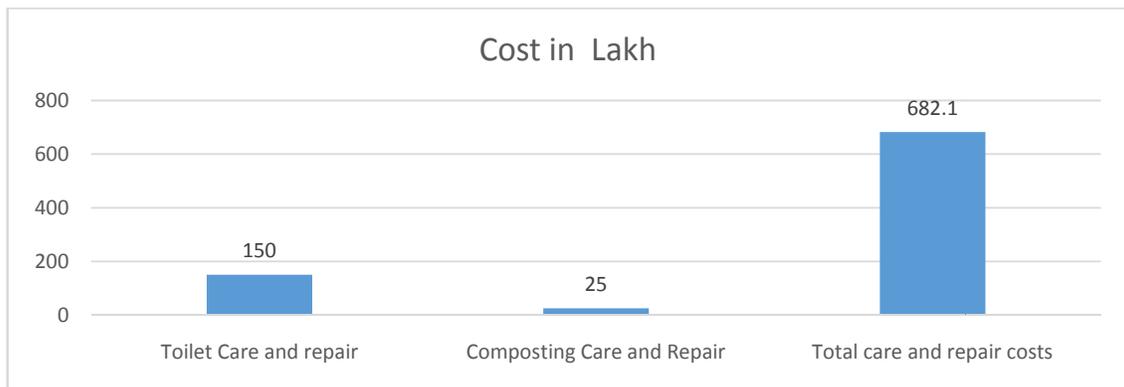


Table 2-6: SWM O & M Cost

Daily Care and Repair Costs	INR, in Lakh
Toilet Care and repair	150
Composting Care and Repair	25
Total care and repair costs	682.1

Graph 2-3: SWM O&M Cost



Chapter 3. Status of Existing Solid Waste Management in the City

3.1 Waste generation

Municipal solid waste in a typical town of India is residential waste which is around 70-80% of the total waste. Other waste generation sources are commercial units, markets, hotels & restaurants, institutions including schools, colleges, offices, street sweepings, drain silt and green area including park, gardens.

The major sources of generation of municipal solid waste in Dhule are:

- Households
- Markets for fresh vegetables & fruits, meat and chicken
- Parks & open spaces
- Temples
- Shops and commercial establishments
- Others

Most of the solid waste is generated by the households and then the markets and commercial areas. All kinds of waste including biomedical, E-waste and construction & demolition wastes are being mixed in the municipal stream of waste. There are no slaughterhouses in the city.

Based on the survey done in the year 2007 by eco pro, the waste generation rate, per capita waste generation considered for Dhule city is **403 GPCD**.

The total waste generated in the city is estimated around **165 TPD**.

DhuleMahanagarPalika	Initial meetings/discussions with ULB Officials
	

3.1.1 Approach adopted for estimation of waste generation

The current system has been analyzed with the point of view to highlight the key issues in the city. The data collected from questionnaire, individual field visit, and interaction with the communities, its people gives a fair idea of what exists on-ground. A detailed study was carried out regarding the methods of practices associated with sources, quantity generated, collection, transportation, storage, treatment and disposal of solid waste and its compliance to the SWM rules 2016 in conjunction with the recommended guidelines of the Swachh Bharat Mission.

There is segregation taking place at source, i.e., household level as wet waste and dry waste. Wet waste consists of primarily the organic waste. All the waste is collected by the vehicles and dropped

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at the dumpsite. There is no transit storage. The recyclables get picked by the waste-pickers, inerts, soiled non-degradable and the organics are remaining at the dumpsite.

Waste was measured from the vehicles collecting wastes from the households and other sources of waste.

Waste has been considered in 3 streams for ease of quantification and analysis; wet (biodegradable/organic), dry (inorganic/recyclables) & inerts.

3.1.2 Residential areas – colonies, apartment complexes

The waste from residential areas includes the wastes from 72076 households categorised into HIG, MIG and slum areas/LIG. The total waste from residential areas constitutes to 107 TPD which is around 80% of the total waste. Out of this waste, 24% is dry waste and 65% is wet waste and 11 % is inert waste.

3.1.3 Commercial establishments, malls

The waste from commercial establishments includes the wastes from commercial areas; office complexes, theatres/cinema halls, institutions, vegetable and meat markets and industrial areas. The total waste generated in commercial areas is 18 TPD.

3.1.4 Hotels, restaurants, banquet hall



There are 38 hotels, 30 marriage halls and 16 guesthouses. The total waste from hotels is 8 TPD. This constitutes to 5% of the total waste generated.

3.1.5 Institutional areas- offices, schools, universities



There are 10 hostels, 35 colleges, 372 schools, 6 cinema halls and 6 theatres. The waste generated from these institutions has been included in commercial waste.

3.1.6 Fruit and vegetable markets, fish and meat markets



There are 16 vegetable markets and 19 fruit markets and 23 chicken/fish/mutton small markets. There are 19 gardens, 12 playgrounds and 103 open spaces in the city. The waste generated from these markets is considered under the commercial waste.

3.1.7 Hospitals and nursing homes (excluding biomedical waste)

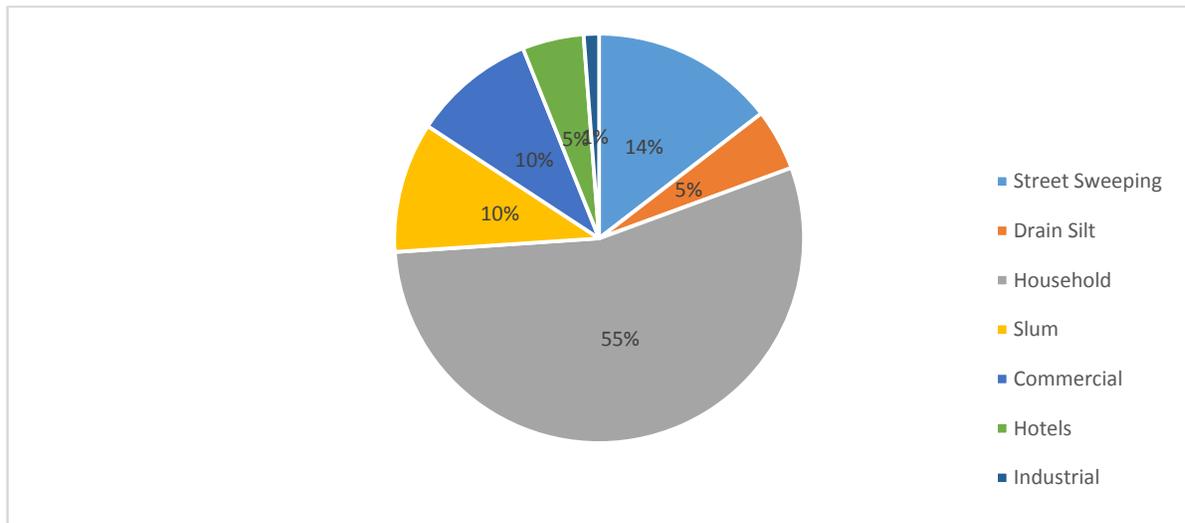


The city has 5 hospitals, 14 government and 297 private dispensaries, 2 family welfare centres, 1 child and maternity hospital one nursing home.

Table 3-1: Sources of Solid Waste in Dhule

Source	Solid Waste in (TPD)
Household	90
Slum	17
Commercial	16
Hotels	8
Industrial	2
Street Sweeping	24
Drain Silt	8
Total	165

Graph 3-1: Sources of Solid Waste in Dhule



3.2 Quantification & Characterization of Waste

Estimation of quantum of solid waste generated and its characteristics assume great significance for efficient design of waste collection, transportation, treatment and disposal options. For the assessment of the waste generation trends & its composition, an integrated approach comprising desk review of various similar kind of studies carried out in the past, CPHEEO guidelines for waste generation rate and representative waste sampling in the cities having more than 1 lakh population within the project area has been adapted.

The methodology adopted for waste sampling is outlined below:

- Identification of different areas of the city, like High Income Group (HIG), Middle Income Group (MIG), Low Income Group (LIG), Slums, Commercial and Institutional areas, Vegetable and mutton, fish and chicken market etc. was done in consultation with the administrative staff of ULB. Waste from these areas was getting dropped in separate vehicles at the vermi composting site/dump site. Samples were collected from this site and the other site where the waste was coming from other sources. Samples were collected immediately from the vehicles when they were being unloaded at the sites.
- Waste was weighed and unloaded on clean plastic sheets. Quartering method was used to achieve the required sample size. For Quartering more than 100 Kg of waste from each sector, such as HIG, MIG, and LIG etc. was collected and about 10Kg of sample by quartering method in adherence to the SWM Manual was done. Representative samples were packed in front of municipal authorities and were taken for laboratory analysis.
- Quantitative analysis was carried out for the waste from different areas, representative samples. The waste thus received was segregated in different components, viz. Recyclables (Plastic, metal & glass), Inert and Organic material etc. Separate Physical & Chemical Analysis was performed.
- The samples are taken for qualitative and chemical analysis to an accredited approved testing laboratory.



3.2.1 Sampling Criteria

Based on discussions with the client, detailed sampling was done in Dhule. The directions given in the manual was followed.

3.2.2 Physiochemical Characteristic of MSW

I. Physical Assessment:

Physical components of waste like food, paper, plastics, polythene bags, glass and inert material shall be identified. This physical assessment is carried out at site itself. The tables below define the parameters to be studied.

Table 3-2: Test Results for Physical Testing of MSW in Dhule City

Sr. No	Parameter	Unit	HIG	MIG	LIG/Slu m	Average of Residential	Commercial	Dumpsite
1	pH		7.8	7.56	7.69	7.6	8.29	6.38
2	Bulk Density	MT/cu m	0.491	0.474	0.443	0.469	0.390	0.544
1	Plastic, Plastic bags, etc.	%	8.62	8.3	7.58	8.16	21.1	6.77
2	paper	%	11.32	5.53	6.5	7.78	16.62	4.26
3	glass & metals	%	0.27	0.24	0.1	0.20	0.49	0.19
4	leather, rubber	%	0.14	0.12	0.14	0.13	0.21	0.12
5	tetra packs	%	2.3	1.85	0.59	1.58	3.74	0.26
6	clothes	%	7.8	6.4	3.64	5.94	8	1.25
7	food waste	%	58.82	69.21	53.26	60.43	30.33	24.34
8	horticulture waste	%	5.98	5.12	2.94	4.68	13.10	14.48
9	misc, inert, silt	%	4.75	3.23	25.24	11.07	6.40	48.32
	Total		100.00	100.00	100.00	100.00	100.00	100.00

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II. Chemical Assessment:

After physical assessment, the samples were stored in a zip locked bag and brought to laboratory for analysis. All the analysis is carried out within 24 hours of sample collection. The parameters selected for chemical analysis and their methodology is given in the table below.

Table 3-3: Chemical Testing of MSW in Dhule City

S No.	Parameter	Unit	HIG	MIG	LIG/Slum	Average of Residential	Commercial	Dumpsite
1	Moisture	%	35.98	30.24	32.48	32.9	24.54	20.24
2	Ash Content	%	24.96	21.75	21.13	22.61	27.31	60.99
3	Total volatile content (LOI)	%	23	22.66	22.01	22.55	17.91	34.44
4	Total Organic Carbon (TOC)	%	13.25	16.3	23.52	17.69	21.64	25.83
5	Calorific value	cal/gm	1310	1179	1021.94	1170.46	1926.08	813.7
6	C/N Ratio	-	18.68	19.78	21.95	20.13	12.21	17.45
7	Total Nitrogen	mg/kg	0.71	0.82	1.07	0.86	1.77	1.48
8	Total Phosphates as P2O5	mg/kg	0.63	0.63	0.71	0.65	0.57	3.95
9	Total Potassium as K2O	mg/kg	3.95	6.97	3.16	4.69	3	1.89
10	Arsenic (As)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
11	Nickel (Ni)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
12	Zinc (Zn)	mg/kg	15.76	14.49	15.96	15.40	16.66	2.96
13	Cadmium (Cd)	mg/kg	3.83	3.77	3.66	3.75	6.25	3.67
14	Copper (Cu)	mg/kg	12.43	27.14	13.89	17.82	12.5	14.83
15	Chromium (Cr+6)	mg/kg	5.62	4.77	2.53	4.30	0.86	<0.1
16	Lead (Pb)	mg/kg	3.45	1.71	<0.1	2.58	<0.1	0.28
17	Mercury (Hg)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

The results of physical and chemical analysis are within the permissible limits as specified by the regulatory authorities and also within limits for composting (Ref.: "Compost Standards").

Average Waste Composition:

It has been assessed that 80% of the waste is generated from residential and 20% from commercial and shops including Vegetable markets and horticulture. The average waste composition in Dhule city has been found out as under:

Table 3-4: Average Waste Composition

Waste Composition	Average (%)
Plastic, Plastic bags, etc.	7.29
Paper,cardboard	6.93
glass & metals	0.25
leather, rubber	0.14
tetra packs	1.66
Clothes	5.36
food waste	49.92
horticulture waste	7.91
misc, inert, silt	20.54
Total	100

3.3 MSW Projections

As per our primary field study, discussions with different stakeholders, the estimated waste generation in Dhule in 2017 is about 168 tons/ day from all sources. The waste generation rate is about 403 grams/ capita/ day. This rate of generation is similar to other cities of India of similar size.

The waste generation estimate and its projection is important step for long term waste management strategy and planning for the city. Therefore, the waste generation estimate for Dhule is carried out in similar way as of population projection.

The future waste generation estimates have been carried out on following assumptions:

- Increment in waste generation rate at the rate of 1.40% per annum
- Floating population is considered to be 15000 in numbers comprising of mela and yatra visitors and daily commuters for commercial work and recreational purposes.
- Waste generation for Dhule for year 2017 is taken as 0.403 kg/ capita/ day.

Table 3-5: Waste Projection Estimate

Year	2017	2022	2027	2032	2037	2041
City Population	408493	435786	462940	489956	516832	538235
Floating Population	15000	16500	18150	19965	21962	24158
Waste Generation Per Capita in Grams per day	403	432	464	497	533	564
Total MSW Qty, TPD	168	192	218	247	280	308

3.4 Existing MSW Collection System

3.4.1 Primary Waste Collection System

The primary waste collection system comprises door-to-door collection by 30 Ghantagadis of 3 ton capacity and 1 tractor trolley. Ghantagadi has 2 sections for wet and dry wastes. The collection of waste is carried out once in a day from residential areas and twice a day from commercial areas. There are 5 agencies involved in door-to-door collection of waste. Also, a tender has been floated to appoint a new agency. There are 658 departmental labourers and 220 contractual labourers involved in this work. Also, there are 84 labourers on daily wages to carry out the primary waste collection and street sweeping. There is no user fee charged.

The agencies involved in door-to-door waste collection are as follows:

1. AdityaBachat Gat
2. Jai JogeshwariBachat Gat
3. AlpsankhyankBachat Gat
4. ShyamBachat Gat
5. Bachat Gat

3.4.2 Primary Waste Storage at Generation

In very few houses there are 2 bins at the household level for residential waste for wet and dry streams. The segregation at source is not efficient and it can be assumed that primary waste storage is mixed. There is 80% Door-to-door (DTD) collection of solid waste in all the 35 wards by the private agencies who are made responsible by the DMC for collection of waste within the municipal limits.

Some bins were also placed in the residential areas earlier, before these agencies were employed. However, quite a few of these bins have been shifted to the commercial areas. The basis of placing these bins was one bin for every 500 families.

3.4.3 Secondary Waste Collection System

The secondary waste collection is carried out by a dumper placer that takes 2 trips/day and 41 tractor trolleys of 1 T capacity. These vehicles collect waste from the bins & containers placed in the commercial areas and other waste deposited in the city.

Picture 3-1: Existing Dumper Placer in the city



3.5 Street Sweeping & Drain Cleaning

It is estimated that approximately 24 MT/day of street sweeping and around 8 MT/day of waste from cleaning of drains, silt is generated in the city. This waste is considered under inerts.

3.6 MSW Secondary storage system

There are 40 numbers of secondary storage containers of capacity 1.5 tons placed at different locations in the city. Waste from other than residential areas is stored in these containers. However, few bins are also there in the residential areas too.

The bins are conveniently placed in the commercial areas.

Picture 3-2: Existing Secondary storage/Community bins



3.7 MSW Transportation System

There are 30 Ghantagadis, 41 Tractor trolleys and 1 dumper placer involved in collection and transportation of waste. All these vehicles collect waste from the city and drop it to the waste processing and the dumpsite.

Picture 3-3: Existing SWM Transportation Vehicles

Ghantagadis for DTD Collection of solid waste in Dhule

Tractor Trolley for waste transportation



3.8 Existing MSW Processing System

3.8.1 Recyclable Waste

The dry waste constitutes to 21.63% of total waste generated.

The saleable fraction of the dry waste is segregated at the household level and sold off to the informal waste collectors, which further finds its way into the market for recycling or reuse. The recyclable fraction includes paper, plastic, glass, cardboard, metals, etc.

The dry waste reaching the dump-site is further sorted and the recyclables are sold off by the informal sector. There is no revenue generated by the ULB for the dry recyclable waste collected.



3.8.2 Bio-Degradable Waste

Approximately 60% of the waste is biodegradable.

Bio-degradable waste constitutes the organic waste that can be decomposed to produce rich quality manure and soil conditioner.

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The ULB has taken initiative to process bio-degradable waste to compost by the process of Vermicomposting in the city at Survey No. 207, Verkhedi Road. The facility has 36 pits and a capacity 20 TPD. However, this plant functions erratically and there is hardly any compost being produced. Whatever little is produced it is given away to the farmers. There is no revenue being generated from this plant. The processing plant is lying idle and there are mounds of waste around this waste.



3.8.3 Non-Biodegradable Waste

The non-biodegradable waste constitutes to 21.63% dry waste and 20.54% inert out of total waste. Thus, Dhule generates a total of 36 TPD of dry waste and 17 TPD inert waste.

3.8.4 Construction & Demolition waste

Approx. 20 MT/day of C&D waste is estimated to be generated in the city. This waste is collected by the ULB if found openly dumped and if generated by an individual owing to construction or any demolition activity, then the concerned person is being charged for its disposal. At present this waste finds its way into the low-lying areas.

This waste becomes a part of the inert waste stream.



3.8.5 Any Other Waste (Domestic Hazardous, Sanitary Waste)

Separate storage or collection mechanism for domestic hazardous or sanitary waste does not exist at present in the city.

3.9 Existing Infrastructure for SWM

3.9.1 Manpower

Table 3-6: Existing SWM Administrative Set-up

Designation	Present Status
Health officer	1
Assistant health officer	1
Sanitation Inspector	8
Sanitation supervisor	32 permanent, 5 temporary
Sweeper	742

3.9.2 Equipment/Vehicles

To operate the solid waste management in the city, the ULB has a vehicle inventory of 30 Ghanta-Gadi, of which 10 numbers were purchased in 2008 by the ULB and the rest 20 by the appointed Contractor. It also possesses 41 tractor trolleys and 1 dumper placer.

There is no equipment repair facility in the city.

3.10 Status of Present & Proposed Landfill Site

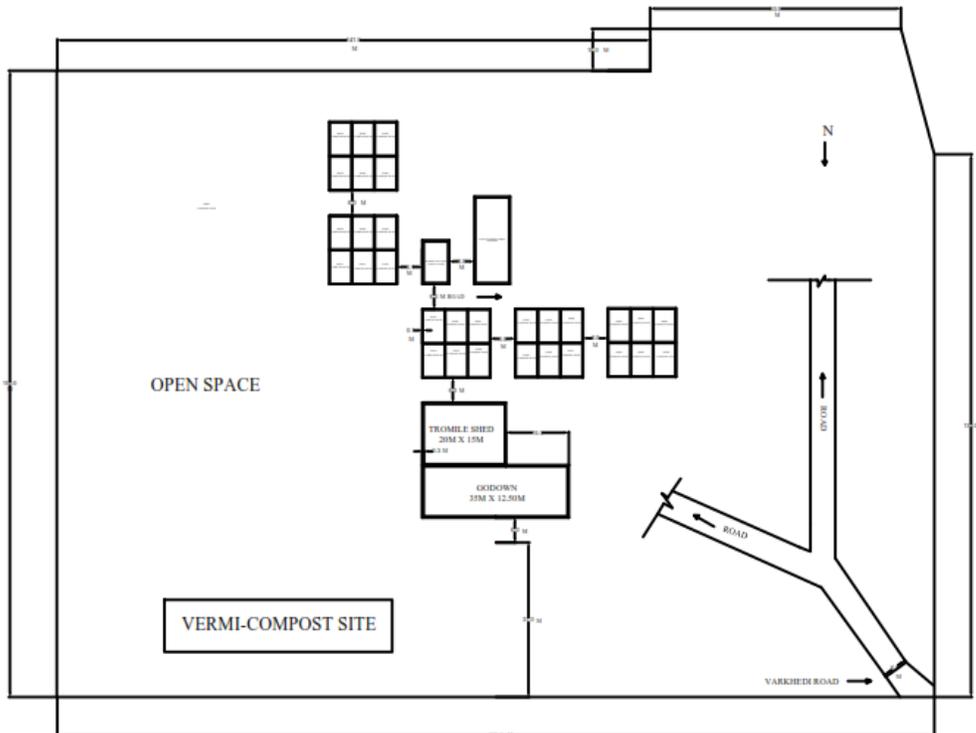
At present, all the waste generated from the city is dumped at the 2 dumping sites which are between 3- 5 km from the city at Varkhedi Road. One site at Survey No. 207, Varkhedi Road is 3 ha in size and has a vermi compost plant in it. All the waste from the households is dropped here. Non bio-degradable, C & D waste and inert wastes are dumped at old dumping site: Survey no. 61, 62 on Varkhedi Road. The 2 sites are nearby. Open burning of waste is a common practice here.

The waste disposal sites are more of open dumpsites as they have not been developed scientifically. Although the sites have been allocated and registered by the ULB, no proper site suitability assessments have been done. No environmental or social impact assessments have been conducted.



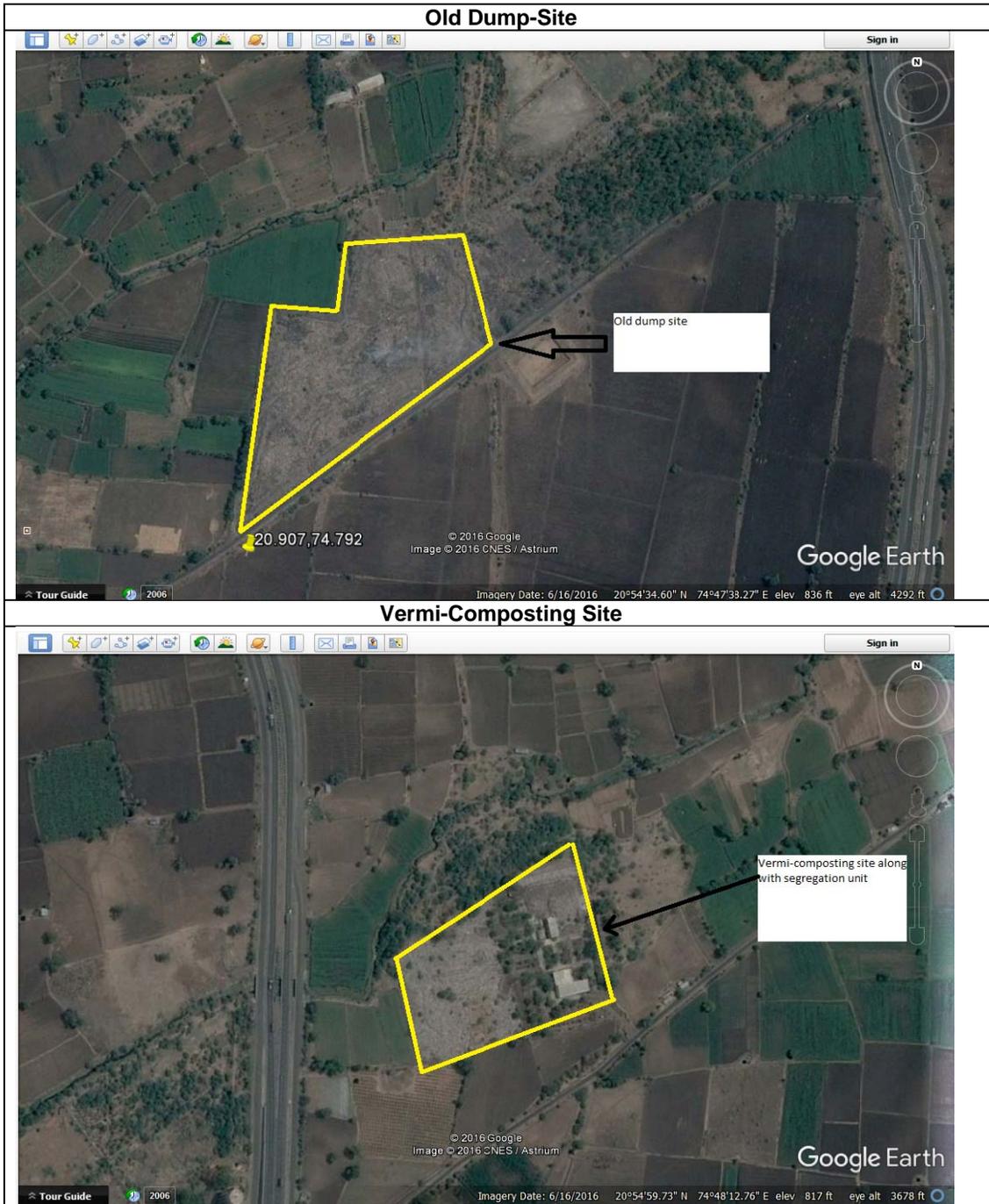


3.10.1 Vermi-Composting site present layout



SCALE 1:1000

Map 3-1: Location of old dump site and present vermi-composting site



3.10.2 Site Suitability Assessment of Proposed Landfill site

The proposed site for the landfill would be the same one where the inorganic waste is being dumped, currently is located on Varkhedi road. The site is around 4 hectares land and approximately 5 km away from the Dhule city. The site is observed to be an open area, allotted for landfill sites where only inerts will be disposed off. The proposed processing facility would be combined at the site where vermi compost plant is already functioning. This dumpsite is not enough for future landfilling and a waste processing facility.

Both the proposed sites for processing and landfilling are along the same road and with have the same features. The necessary environmental approval has been obtained for the waste processing facility/site including the consent to establish and operate.

Table 3-7: Site suitability Assessment for Proposed landfill site

Sr. No.	Features	Details of Dhule
1	Land use (residential, agricultural, industrial, forest, etc)	Allotted for waste disposal
2	Major crops in the study area	wheat, cotton etc.
3	Nearest Highway	Nagpur Surat Highway
4	Access Road detail, if any, length (km) & width (m)	6 m wide road
5	Nearest Railway Station, distance in m/km	Dhule Railway Station
6	Nearest Airport, distance in m/km	Aurangabad Airport, 133 km
7	Nearest Town/City, names & distance	Deopur at 1.5 kms, varkhede at 2.7 kms, balapur at 2.8 kms
8	Major Settlements	None
9	Minor settlements	None
10	Water bodies and dams, canals	Nakane Lake, 14 km
11	Hills and Mountains (within or around the area)	None
12	Reserved or protected forests	No forest within 2 kms
13	Ecologically sensitive zones(within 10 km)	No zones
14	Archaeological/ heritage Monuments (within 10 km)	None
15	Sensitive Receptors	No
16	Socio-economic factors	No
17	Major important industries within 10 km	No

Table 3-8: Proposed Site assessment as per CPHEEO Manual

Sr. No.	Criteria	CPHEEO Manual	Description of the proposed site_Dhule
1	Lake/Pond	200 m away from the Lake/Pond	1.5 kms away, there is a small pond
2	River/streams	100 m away from the river/stream	River flows at 1km from the site
3	Flood plain	No land fill within a 100 year flood plain	No flood plain
4	Highway	Away from 200 m NHAI/State	400m from the site
5	Public parks	300 m away from public parks	1.2 kms which is inside the city
6	Wet lands	No landfill within wet lands.	No wet land
7	Habitation	500 m away from the notified habitation area	Presently major habitation is 800 m away from the site
8	Ground water table	Ground water table > 2m.	20m
9	Critical habitat area	No landfill within the Critical habitat area. It is defined as the area in which 1 or more endangered species live.	No critical habitat found
10	Air ports	No landfill within 20 km	nearest airport is a small airport in Aurangabad at 133 kms
11	Water supply schemes/wells.	Minimum 500 m away	a small irrigation canal is passing close to the site
12	Coastal regulatory zone	Should not be sited	No coast nearby
13	Unstable zone	No landfill	No unstable zone
14	Buffer zone	As prescribed by regulatory	NA

The sites are compliant to the requirements of CPHEEO and other regulation.

3.11 Overall Compliance of SWM Rules

There are several rules and regulation which have been formulated pertaining to SWM. Relevant ones for Dhule are:

3.11.1 Salient features of MSW Rules, 2016

These rules apply to every ULB, outgrowths in urban agglomerations, and the census towns, notified areas, notified industrial townships, areas under the control of Indian Railways, airports, airbases, Ports and harbours, defence establishments, special economic zones, State and Central government organisations, places of pilgrims, religious and historical importance as may be notified by respective State government. The main highlights of the Rule are:

- The waste generator should segregate and store the waste in three separate streams i.e. bio-degradable, non-biodegradable and domestic hazardous wastes

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- Store separately construction and demolition waste
- Waste generator cannot burn the waste
- The waste generators shall pay user fee for solid waste management
- All gated communities, institutions and RWAs shall ensure segregation of waste at source level

Key duties of the waste generators:

- Segregate, store and handover separately the waste generated by them in three separate streams namely bio-degradable or wet waste, non-bio-degradable or dry waste and domestic hazardous wastes. All gated communities, institutions and RWAs shall ensure segregation of waste at source level
- No waste generator shall throw the waste generated by him/her on the street, open spaces, drain or water bodies; or burn the waste in open
- Pay user fee or charge or fines as may be specified in the bye-laws of the urban local bodies

Key Duties of Commissioner or Director of Municipal Administration or Director of Local Bodies:

- Ensure implementation of MSW rules by all urban local bodies falling under his/her control.
- Undertake training and capacity building of urban local bodies for management of solid waste.
- Facilitate establishment of common regional sanitary landfill for a group of cities and towns falling within a radial distance of fifty kilometres or more from the regional facility on a cost sharing basis and ensure professional management of such sanitary landfills.

Key Duties and Responsibilities of Urban Local Bodies:

- Prepare a solid waste management plan as per State Policy And Strategy on Solid Waste Management within six months from the date of notification of state policy
- Frame bye-laws, incorporating the provisions of these rules and ensure timely implementation.
- Prescribe and collect user fee from waste generators.
- Develop infrastructure for segregation, collection, transportation, storage, processing and disposal of solid waste in their respective jurisdiction either at its own or through public private partnership mode.
- Provide easy access to waste pickers and recyclers for collection of segregated recyclable waste.
- Facilitate construction, operation and maintenance of solid waste processing facilities and associated infrastructure in house or with private sector participation using best suited technologies.
- Undertake in house or through any other authorised agency, construction, operation and maintenance of Sanitary landfill
- Make adequate provision of funds for capital investments as well as operation and maintenance of solid waste management services in the annual budget
- Close down, remediate wherever feasible and cap the existing dumpsites, which are not engineered landfill sites as per the provision of these Rules
- Prepare and submit annual report on the status of compliance of these rules during the calendar year on or before the 30th April of the succeeding year to the Commissioner or Director Municipal Administration

- Create public awareness through Information, Education and Communication (IEC) campaign

Key Duties of the Operator of Solid Waste Processing and Treatment Facilities:

Identification and notification of land for setting up the solid waste processing and treatment facilities shall be the responsibility of the ULB. However the criteria for setting up of solid waste processing and treatment facilities and key responsibilities of the operator are:

- Design and set up the facility as per the technical guidelines issued by the Central Pollution Control Board in this regard from time to time and the manual of Central Public Health and Environmental Engineering Organisation, New Delhi
- Obtain the approval from the State Pollution Control Board or Pollution Control Committee
- Ensure safe and environmentally sound operations of the solid waste processing and treatment facility and its closure and post closure phase as per the guidelines issued by Central Pollution Control Board from time to time and the Manual of Central Public Health and Environmental Engineering Organisation, New Delhi.
- Submit annual report in the prescribed form

3.11.2 Maharashtra Plastic Carry Bags (Manufacture and Usage) Rules, 2006

- Prohibition of usage of carry bags-trade of recycled plastics
- No vendor shall use carry bags or containers made of recycled plastics less than 50 microns for storing, carrying, dispensing, or packaging of foodstuffs.

3.11.3 Regulatory Aspects/Provision of MSW Landfills:

Under section 6 (3) of the MSW (M&H) Rules, 2000 State Pollution Control Board or Pollution Control Committee shall issue authorization in Form-III to the municipal authority or an operator of a facility within forty-five days stipulating compliance criteria and standards as specified in Schedule II, III and IV including such other conditions, as may be necessary. SPCBs/PCCs, after the receipt of application from the municipal authority or the operator of a facility including landfills, shall examine the proposal taking into consideration the views of other agencies like the State Urban Development department, the Town and Country Planning department, Airport or Air Base authority, the ground Water Board or any such other Agency prior to issuing the authorization

Site selection

- Landfill identification shall be done by 'Development Authorities' for the area falling under 'Development Authority', otherwise it shall be done by the concerned Municipal authority.
- The site selection shall be done based on examination of environmental issues. The landfill site shall be planned and designed with proper documentation of a phased construction plan as well as a closure plan.
- The landfill facility shall be nearby waste processing plant or an integral part of it. The landfill site shall be designed for 20-25 years.
- The proposed landfill site should be away from habitation clusters, forest areas, water bodies, monuments, national Parks, Wetlands and places of important cultural, historical or religious interest. Also, approval shall be taken from the concerned authorities in case the landfill site is located within 20 km from the airport/airbase.

Facilities at Site

- The landfill shall be fenced with proper gate at entrance for monitoring incoming wastes/vehicles, to prevent entry of cattle, to keep record movement of vehicles and wastes, etc.
- Provision of weigh-bridge may be made for assessing quantum of wastes
- Drinking water and other sanitary facilities and other safety measures including health check-up shall be provided to workers.

Water quality monitoring

Ground water quality should be monitored within 50 m periphery of landfill site. Also, ground water quality data to be generated before construction of landfill site for future reference.

Ambient air quality monitoring

Installation of landfill gas control system including gas collection system shall be made at landfill site to minimize odour generation, prevent off-site migration of gases and to protect vegetation planted on rehabilitated landfill surface.

Chapter 4. Gap Analysis

4.1 Current gaps in Segregation system

Moving forward from understanding the status of existing solid waste management in Dhule has been elaborated in Chapter-3, we have now identified the issues and gaps that persist in the city at present.

Essentially, this chapter focuses on assessing these gaps against the Solid Waste Management Rules 2016 in an attempt to formulate a sustainable solid waste management plan for Dhule.

4.2 Current Gaps in Segregation system

Source segregation of waste has been mandated in the SWM rules, 2016 in order to channelize the waste to wealth by recovery, reuse and recycle. Bulk and institutional generators, market associations, event organizers and hotels and restaurants have been made directly responsible for segregation and sorting the waste and manage in partnership with local bodies.

MSW Management Aspect	MSW Rules 2016 Requirement	Gap / Current Status
Segregation at Source	<p>Every waste generator shall: Segregate and store the waste generated by them as follows:</p> <p>1) Households wet waste in green bins; dry waste in white bin and domestic hazardous waste in black bins</p> <p>2) Sanitary waste (diapers, sanitary pads etc.) should be wrapped securely and shall be placed in the same bin meant for dry waste</p> <p>3) C & D waste, as and when generated should be stored separately in own premises and shall be disposed off as per C&D waste mgt. rules 2016</p> <p>4) Horticulture & garden waste generated shall be stored separately at own premises and disposed off as per the directions of the local body from time to time.</p> <p>5) No person shall organise an event or gathering of more than one hundred persons at any unlicensed place without intimating the local body, at least three working days in advance and such person or the organizer of such event shall ensure segregation of waste at source and handing over of segregated waste to waste collector or agency as specified by the local body.</p> <p>6) Every street vendor shall keep suitable containers for storage of waste and deposit at waste storage depot or</p>	<p>Segregation at source is practiced at the household level. However, segregation at source is not very effective. Wet waste, dry waste and household sanitary waste is mixed.</p> <p>Almost 100% of the waste is segregated into wet and dry wastes at the household level. However, all waste is mixed at the dumpsite.</p>

	<p>container or vehicle as notified by the local body.</p> <p>7) RWA's, market associations, hotels, restaurants and all gated communities & institutions with more than 5,000 sqm area, in partnership with the local body shall ensure segregation of waste at source, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorized waste pickers or the authorised recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or biomethanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.</p>	
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4.3 Current gaps in Collection & Transportation

MSW Management Aspect	MSW Rules 2016 Requirement	Gap / Current Status
Primary Collection	<p>No person shall organize an event or gathering of more than one hundred persons at any unlicensed place without intimating the local body, at least three working days in advance and such person or the organizer of such event shall ensure segregation of waste at source and handing over of segregated waste to waste collector or agency as specified by the local body;</p> <p>All resident welfare and market associations shall, in partnership with the local body ensure segregation of waste at source by the generators as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorized waste pickers or the authorized recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body;</p> <p>All gated communities and institutions with more than 5,000 sqm area shall, in partnership with the local body, ensure collection of segregated waste in separate streams, handover recyclable material to</p>	<p>Door-to-door collection system is prevalent in all the wards of the ULB jurisdiction. Waste is collected from 100% of the households.</p> <p>There are events held quite frequently in the town but there is no compliance to this requirement.</p>

	<p>either the authorised waste pickers or the authorized recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body;</p> <p>All hotels and restaurants shall, in partnership with the local body facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorised recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local.</p>	
<p>Secondary Storage</p>	<p>The town planning department of the State and local bodies will ensure that a separate space for segregation, storage, decentralized processing of solid waste is demarcated in the development plan for group housing or commercial, institutional or any other non-residential complex exceeding 200 dwelling or having a plot area exceeding 5,000 square meters;</p> <p>To the extent possible, the waste storage area should be covered. If, such storage is done in an open area, it shall be provided with impermeable base with facility for collection of leachate and surface water run-off into lined drains leading to leachate treatment and disposal facility;</p> <p>Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be printed white and those for storage of other wastes shall be printed black</p> <p>Set up covered secondary storage facility for temporary storage of street sweepings and silt removed from surface drains in cases where direct collection of such waste into transport vehicles is not convenient. Waste so collected shall be collected and disposed of at regular intervals as decided by the local body;</p> <p>Provisions for setting up of centers for collection, segregation and storage of segregated wastes, are incorporated in building plan while granting approval of building plan of a group housing society or</p>	<p>There are 40 bins placed in the city for the wastes other than household wastes to be stored. Secondary storage of waste is not very effective. There are no colour demarcations or markings for the type of waste to be put in these.</p>

	market complex;	
Secondary Collection & Transportation	<p>MSW should be transported in covered vehicles, necessary measures should be taken to avoid littering during transportation;</p> <p>Provisions for parking, cleaning, washing of transport vehicles carrying solid waste shall be provided. The wastewater so generated shall be treated to meet the prescribed standards.</p>	<p>Waste is transported in covered vehicles and tempos.</p> <p>The GhantaGadis are deployed by the contractor on rental basis and around 35% of GhantaGadis are purchased by the ULB.</p> <p>The tractor trolley are deployed by the contractor on rental basis.</p>

4.4 Current gaps in Treatment & Disposal

MSW Management Aspect	MSW Rules 2016 Requirement	Gap / Current Status
Processing & Disposal	<p>1) MSW must be processed in a scientifically sound manner so that only inerts are to be landfilled whereas biodegradable and recyclable components are processed for reuse;</p> <p>2) Town planning department of the State to ensure that master plan of every city in the State or Union territory provisions for setting up of solid waste processing and disposal facilities except for the cities who are members of common waste processing facility or regional sanitary landfill for a group of cities;</p> <p>3) The town planning department of the State and local bodies will also ensure that a separate space for segregation, storage, decentralized processing of solid waste is demarcated in the development plan for group housing or commercial, institutional or any other non-residential complex exceeding 200 dwelling or having a plot area exceeding 5,000 square meters;</p> <p>4) The developers of Special Economic Zone, Industrial Estate, and Industrial Park shall earmark at least five percent of the total area of the plot or minimum five plots or sheds for recovery and recycling facility.</p> <p>5) Establishment of common regional</p>	<p>There is no scientific waste processing and disposal happening in the city. There is a vermi composting facility of 20 TPD in the city. However, it is not entirely functional. Wastes from selected locations are sent for treatment on the vermi composting site.</p> <p>Land has been allocated for a new landfill site. The site plan is being developed for this land.</p> <p>Recycling of waste is carried out by the informal sector which is also negligible.</p> <p>However, it is being attempted that the treatment technology; composting is such that optimum amount of rejects are disposed off at the SLF. Rejects from composting and from direct sources in the city would be tried to be kept around 25%, which would be reduced further in compliance to the Rule.</p> <p>Concept of zero landfilling has not been successful in India as yet. More pragmatic approach would be to keep to reduce the amount of rejects.</p>

	<p>sanitary land fill for a group of cities and towns falling within distance of 50 km (or more) from the regional facility on a cost sharing basis and ensure professional management of such sanitary landfills;</p> <p>6) A buffer zone for the solid waste processing and disposal facilities of more than five tons per day in consultation with the State Pollution Control Board should be made;</p> <p>7) Start a scheme on registration of waste pickers and waste dealers.</p> <ul style="list-style-type: none"> • setting up solid waste processing facilities by all local bodies having 100000 or more population: within two years • census towns below 100000 population, setting up common or standalone sanitary landfills by or for all local bodies having 0.5 million or more population and setting up common or regional sanitary landfills by all 	
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4.5 Gaps in awareness among the city residents and civic authorities

MSW Management Aspect	MSW Rules 2016 Requirement	Gap / Current Status
Awareness among city residents and civic authorities	<p>1) Create public awareness through information, education and communication campaign and educate the waste generators on the following; namely:-</p> <p>(i) not to litter;</p> <p>(ii) minimize generation of waste;</p> <p>(iii) reuse the waste to the extent possible;</p> <p>(iv) practice segregation of waste into bio-degradable, non-biodegradable (recyclable and combustible), sanitary waste and domestic hazardous wastes at source;</p> <p>(v) practice home composting, vermi-composting, bio-gas generation or community level composting;</p> <p>(vi) wrap securely used sanitary waste as and when generated in the pouches provided by the brand owners or a suitable wrapping as prescribed by</p>	There are no evidences found for awareness amongst city residents for solid waste management.

	<p>the local body and place the same in the bin meant for no biodegradable waste;</p> <p>(vii) storage of segregated waste at source in different bins;</p> <p>(viii) handover segregated waste to waste pickers, waste collectors, recyclers or waste collection agencies;</p> <p>and</p> <p>(ix) pay monthly user fee or charges to waste collectors or local bodies or any other person authorized by the local body for sustainability of solid waste management.</p> <p>(x) stop land filling or dumping of mixed waste soon after the timeline as specified in rule 23 for setting up and operationalization of sanitary landfill is over;</p> <p>(xi) allow only the non-usable, non-recyclable, non-biodegradable, non-combustible and non-reactive inert waste and pre-processing rejects and residues from waste processing facilities to go to sanitary landfill and the sanitary landfill sites shall meet the specifications as given in Schedule-I, however, every effort shall be made to recycle or reuse the rejects to achieve the desired objective of zero waste going to landfill;</p>	
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4.6 Gaps in Institutional Structure

MSW Management Aspect	MSW Rules 2016 Requirement	Gap / Current Status
Institutional Structure	Institutional focus on solid waste management	There is an availability of Health Officer and Assistant Health Officer and Sanitation Inspectors.

4.7 Gaps in capacity building for ULB

MSW Management Aspect	MSW Rules 2016 Requirement	Gap / Current Status
Capacity Building	<p>1) Provide training on solid waste management to waste-pickers and waste collectors;</p> <p>2) Educate workers including contract workers and supervisors for door to door</p>	Regular capacity building sessions are not carried out

	<p>collection of segregated waste and</p> <p>3) Transporting the unmixed waste during primary and secondary transportation to processing or disposal facility</p> <p>4) Investigating and analyzing all old open dumpsites and existing operational dumpsites for their potential of bio mining and bio-remediation and whosoever feasible, take necessary actions to bio-mine or bio-remediate the sites;</p> <p>5) In absence of the potential of bio-mining and bio-remediation of dumpsite, it shall be scientifically capped as per Landfill capping norms to prevent further damage to the environment.</p>	
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4.8 Gap Assessment

Parameters	SLB (%)	Existing in (%)	Gap(%)
Household level coverage of solid waste management services.	100	100 (72076)	0
Efficiency of collection of municipal solid waste.	100	70	30
Extent of segregation of municipal solid waste (at HH)	100	0	100
Extent of municipal solid waste recovered – recyclables only	80	0	100
Extent of scientific disposal of municipal solid waste.	100	0	100
Efficiency in redressal of customer complaints.	80	No system on customer complaints	100
Extent of cost recovery in SWM services.	100	0	100
Efficiency in collection of SWM charges.	90	No user fee charged	100

Chapter 5. Project Definition

5.1 Project Objectives

The proposed concept Project aims to develop a waste management system in the city of Dhule for the next 25 years in guidance with the Municipal Solid Waste Management & Handling Rules of 2000 and 2016.

The proposed project includes the planning, infrastructure requirements, quantities, and corresponding cost estimates for the entire systems broadly based on 4R Environmental Protection Rules (Reduce, Recycle, Reuse, and Recovery) for Dhule. All the components of waste would be utilised effectively, especially the high content inerts.

An Integrated Municipal solid waste management typically involves timely collection of waste; its temporary stocking if required, and transportation; its treatment to render it inoffensive, and reduce volume; and ultimately safe disposal. An effective ISWM system is based on the specific local conditions and is developed with due considerations to protection of public health, environment and aesthetics. Infrastructure components comprise fleet and containers for primary collection, fleet and transfer station for long haul, a treatment facility and a sanitary landfill site with all necessary safeguards. In addition to the requirements of an adequate infrastructure, active community participation and a robust monitoring & evaluation system are also very essential for a successful and sustainable ISWM system.

In addition, a robust MSW management system requires a ULB to take proactive initiatives towards community participation through sustained IEC for awareness generation, behaviour change, cooperation and compliance. Continuation of solid waste treatment and disposal sites in particular is

affected by the 'NIMBY Syndrome' (Not in My Back Yard) and to that effect the ULB needs to have effective communication and build partnerships as well as offer some incentives to the affected community. It is to be recognised that an effective municipal solid waste management is about managing material, manpower and machinery and it involves significant expenses. Therefore, the implementing institution needs to have all the necessary systems and process in place for measurement, human resources management, and maintenance of equipment.

Following main considerations have been made for designing the concept for solid waste management of the Dhule city:

- Compulsory segregation of waste at the source into wet and dry waste or recyclables and bio-degradable fractions to achieve maximum recovery of resources
- Design of the system in accordance with the requirements of the MSW regulation which is to provide treatment and disposal facilities for MSW and restrict landfilling to only inerts and rejects from waste processing that are not suitable for either recycling or processing.
- Establishing an efficient door-to-door waste collection with maximum participation among the communities and the waste generators
- 100% collection and transportation of the waste generated
- Reduction of manual handling of waste by automating the entire waste collection and transportation system to the maximum. For example, coverage of waste collection by tricycles is considered as 15% in the design aspect.
- Priority is given to "ease of access" to waste generators and handlers by provision of an effective and efficient waste



collection system and appropriate transportation infrastructure such as providing one bin per km in densely populated areas

- Daily transportation of waste to the regional facility and optimization of the same such as restricting one vehicle trip time to 6-8 hrs thus, increasing the life of vehicles and reducing its O& M cost
- Effective monitoring system in place to ensure the sustainability of the proposed system

A well-managed waste management project seeks to transform the waste into a form that is more manageable reduce the volume or reduce the toxicity of the waste, thus, making the waste easier to dispose off. Treatment methods would be selected based on the composition, quantity, and form of the waste material. Various technologies would be evaluated for processing of waste in an environmentally sound manner.

5.2 Scope of Project

The scope of the proposed ISWM Project would be to develop a robust solid waste management system in compliance to the SWM Rules.

Broadly, the waste generated at various sources would be segregated and then collected. It is proposed that the overall system should be based on 3 Rs Principle; reduce, recycle and reuse. Awareness could be created by display material and presentations to generate less waste and recycling.

Then the objective should be to use the most optimum technology for processing to further reduce the size and convert the waste into a reusable product like compost or methane to use as fuel. The final leftovers or the rejects which have no further use or value should be transferred to the landfill site.

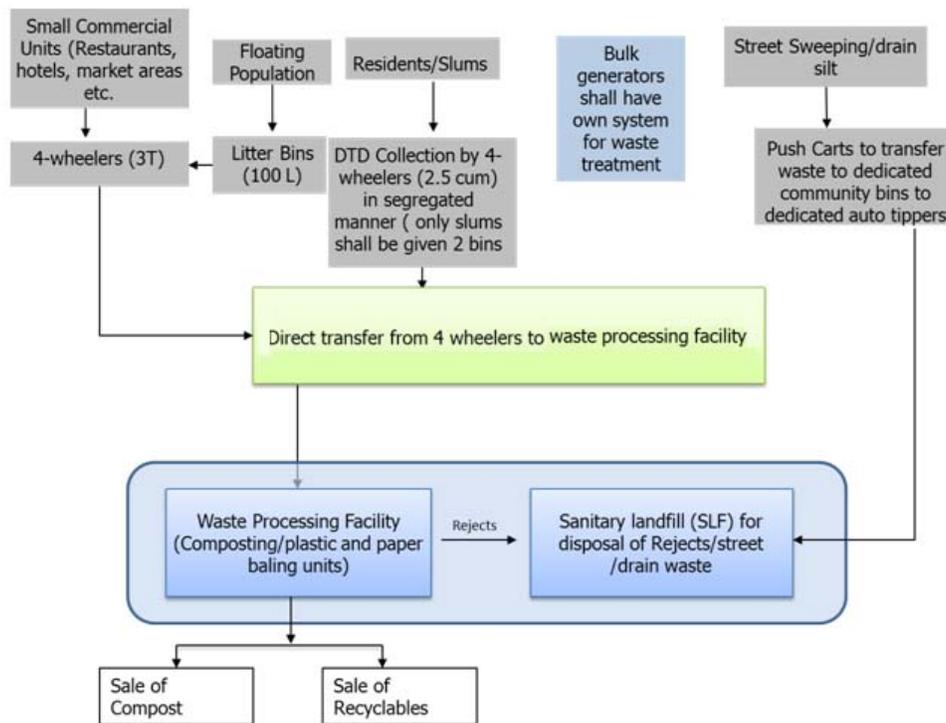
5.3 Approach & Methodology

The broad approach to the solid waste management in Dhule would be that of an integrated system. MSWM system is basically a six stage process: generation, segregation, collection, storage, transportation and disposal. A typical waste management system in a low- or middle-income country like India and Dhule would include the following elements:

- Population data
- Projected populations for the design period based on CPHEEO manual
- Spread of the town
- Current MSW quantities as per Eco Pro MSW survey data
- Current and projected per-capita waste
- Characterization of waste
- Existing waste collection transportation and disposal practices

Broad flow of the integrated solid waste management system would look like the following:

Picture 5-1: Proposed SWM system for Dhule city



5.3.1 Segregation and Storage

Source segregation is the setting aside of inorganic and organic waste at their point of generation by the generator. Separating waste at source ensures that organic and inorganic waste is less contaminated and can be collected and transported for further treatment. Segregation of waste also optimizes waste processing and treatment technologies.

5.3.2 Biodegradable Waste

The biodegradable waste includes food waste, fruits & vegetable waste, paper & pulp, paper admixturing with food waste etc. Food material resulting from the processing, storage, preparation, cooking, handling or consumption of food including discarded meat scraps, dairy products, egg shells, fruit or vegetable peels, and other food items from homes, stores, and restaurants etc. constitute biodegradable waste, others includes leaves, grass, twigs and other plant materials.

5.3.3 Recyclables

Recyclable material includes paper, plastic, glass & metals. Paper material includes cardboard such as shipping and moving boxes, computer packaging cartons, and sheets and pieces of boxes and cartons. Paper Bags including paper grocery bags, fast food bags, department store bags.

Metal includes Tin/Steel Cans like canned food and beverage containers, empty metal paint cans, empty spray paint and other aerosol containers, and bimetal containers with steel sides and aluminum ends.

Plastic includes plastic containers including HDPE containers like milk jugs, water jugs, detergent bottles, toiletries bottles, empty motor oil, empty antifreeze, and other empty vehicle and equipment

fluid containers, PET Containers like soft drink and water bottles, some liquor bottles, cooking oil containers, and aspirin bottles.

5.3.4 Inerts& Others

This includes waste from street sweeping, hazardous waste, ash etc. which cannot be considered both in biodegradable & recyclable waste.

Miscellaneous materials like textiles, leather items, rubber items, tyres, thermocol and tetrapacks are also included in this category.

5.3.5 Collection & Transportation

The system would designed for maximum segregation and 100% collection and transportation and similar collection efficiency. Waste would be segregated into organic, inorganic and recyclable streams.

5.3.6 Waste Processing

Bio-degradable waste shall be processed, treated and disposed off through composting (home or community composting) or bio-methanation with the premises as far as possible. Preference shall be given to decentralized processing to minimize transportation cost and environmental impacts.

There are various technologies available for processing of waste in an environmentally sound manner. However, a technology suitable for one may not be appropriate for others. Following technology assessment criteria has been used to propose appropriate technologies for processing of waste being generated in the project:

- Technology Reliability: Reliable technologies that could be considered without reservations for processing of waste generated in the project area
- Waste Suitability: Technologies that are suitable for the given waste characteristics and that require value addition of the MSW chain for sustainability.
- Higher organic content, low moisture content, low inert content and a reasonable calorific value of the waste are promising indicators for use of thermal processing technology in this project. Further, after segregation of the waste, some of the biodegradable content of the waste can be suitably treated through biological process of biomethanation
- The waste composition indicates that some of the recyclable content of the waste has high economic value and could be recovered and sold in the market

5.3.7 Sanitary Landfilling

Sanitary landfills are facilities for final disposal of Municipal Solid Waste on land, designed and constructed with the objective of minimizing impacts to the environment. The Municipal-Solid Waste (Management and Handling) Rules 2000 and draft revised Rules 2013 provide comprehensive regulations on the siting, design and operation of sanitary landfills. "Landfilling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Landfilling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Landfilling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, landfilling shall be done following proper norms.

Overall it would be seen that the SWM system is sustainable and feasible on long term basis. The model for charging a user fee and penalisation would also be recommended. The system would be

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kept simple and easy to adapt technology would be recommended. Also, decentralised approach for processing would be kept in consideration. Material recovery facility would also be recommended. Maximum saving on the land would be another focus. If there is no land available then possibility of forming a cluster approach and sharing the land with an adjoining ULB would be explored. Maximum recovery from the old landfill would be aimed for.

Chapter 6. Proposed Municipal Solid Waste Management

6.1 Segregation

The proposed segregation plan draws its reference from the MSW Rules 2016 and CPHEEO Manual which state that there has to be compulsory segregation of waste at the source into wet or biodegradable waste and dry or recyclables to achieve maximum recovery of resources with separate provision for domestic hazardous waste, sanitary waste.

6.1.1 Methods for segregation at source

- Waste generators shall not throw any solid waste in their neighborhood, on the street, open spaces, and vacant plots or into drains;
- At household level, kitchen waste or biodegradable waste, non-bio degradable non-toxic waste and domestic hazardous waste must be stored separately in green, white and black colored bins respectively;
- To facilitate segregation at source, bins shall be initially procured by Dhule Municipal Corporation for the first time for residential units where door to door service is proposed. Subsequent purchase of bins for primary storage shall be done by the individual generators;
- Non-residential units such as hotels, restaurants, shops, institutions etc. shall purchase bins on their own expense

Average household size in Dhule is 5.2 members/family. At per capita waste generation of 0.403kg/person/day, 10 litre bins for wet and dry waste would be adequate. Two types of bins shall be provided to each slum household:

- o One 10L green colored bin with pedal lid system (since waste is putrescible) - daily collection
- o One 10L white colored bin for inorganic- non-hazardous waste - daily collection
- o One 5L black colored bin for domestic hazardous waste - weekly collection

It is proposed that 2 bins shall be distributed only to the slums and weaker sections of the society to segregate the waste through the financial support of CSR activity of local/regional industrial/corporate sectors with the interventions of the ULB and the state government. All other citizens of the society including their commercial establishments shall arrange bins through their own resources.

Table 6-1: Proposed household bins in the city

Year	Number of Households	Number of Slum Households	Number of bins required for slums
2017	78556	17762	35524
2022	83805	19446	38892

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2027	89027	20657	41314
2032	94222	21863	43726
2037	99391	23062	46124

Vegetable & Fruit Markets

There are 6 main markets in the city, 16 vegetable, 19 fruit markets. As per SWM rules 2016, it is recommended to provide covered four-wheeled, HDPE, injection or roto molded, international standard, UV tested bins/containers placed along the roadside to facilitate easy handling and transfer of waste to the disposal site. The size of the container should be adequate to hold the waste, that normally generate in 24 hours with 200% spare capacity to meet unforeseen delay in clearance or unanticipated shock loads. It is proposed to place community bins of 1.1 cum capacity along the roadside in these markets to facilitate easy handling and transfer of waste to municipal collection system.

Bulk generators: Hotels & Restaurants, Shops, Offices, Institutions etc.

As per MSW rules, 2016 requirements, bulk generators have to arrange themselves for 4-wheeled, HDPE, injection or roto molded, international standard, UV tested bins or metal bins of atleast 240 l capacity, with separate bins for wet & dry waste and handover recyclable material to either the authorized waste pickers or the authorized recyclers.

Since, most of the bulk generators in the city fall under the category of less than 5000 sqm area, their responsibility would be mainly to store the waste in a segregated manner (3 bin system), with separate provision for sanitary waste and bio medical waste , if any, which shall be collected by the designated staff of ULB on daily basis.

Marriage Halls, Community Halls, etc.

1. Not to throw any solid waste in their neighborhood, on the streets, pen spaces and vacant lands, into the drains or water bodies.
2. The facilities with less than 5000 sqm area, organizing an event or gathering of >100 persons, shall make own arrangements of storing the waste in the adequately sized, suitably coloured bins and the waste shall be handed over to waste collector or agency as specified by the local body.
3. RWA's, market associations, hotels, restaurants and all gated communities & institutions with more than 5,000 sqm area, in partnership with the local body shall ensure segregation of waste at source, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorized waste pickers or the authorized recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or biomethanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.
4. Street food vendors: As per the MSW Rules, 2016, no street food vendor is allowed to throw any waste on the street, pavement or open spaces. They should keep adequate size, suitably coloured bin or bags (green for wet waste and white for dry waste) for the storage of waste that generates during street vending activity. These bags are to be handed over to the waste collector assigned by the ULB on daily basis.

Construction & Demolition (C&D) waste

1. Not to deposit construction waste or debris on the streets, foot paths, pavements, open spaces, water bodies etc.
2. Store the waste within the premises or with permission of the authorities just outside the premises without obstructing the traffic preferably in a container if available through the local body or private contractors, as per MSW rules, 2016.

Currently, the C & D waste of the town is around 15-20 tons with no system in place for its disposal. As a result, there is very high tendency of it getting mixed with the municipal waste. It is proposed to handle and manage C&D waste separately by the bulk generators. The ULB needs one tipper truck dedicated to collect the C&D waste from the generator’s premises on pay basis. The generated C&D waste can be utilized as daily soil cover at the sanitary landfill.

Floating Population

The daily floating population of the city is around 15000. It is proposed to install 100 litres capacity litter bins at the market places and in areas expected with high foot-falls e.g. railway stations, bus stops, markets, religious places, etc. Litter bins shall be installed at a spacing of 250-500m on either side of all the main roads as well as at public places to facilitate easy disposal of trash. The collection should be segregated into wet and dry waste. Around, 327 number of litter bins are proposed for the city in the first year.

6.1.2 Street sweeping and drain cleaning

The street sweepings are expected to contain lot of soil waste. Hence, a separate system of street sweeping is suggested comprising daily sweeping by the sanitary workers to collect the street waste in wheelbarrows. The collected street waste shall be stored in the suitably placed road side community bins of 1.1cum capacity.

Currently, the city’s street waste and drain silt waste is around 20% of the total generated waste. However, with the 100% door to door collection system and a separate C&D waste management system, it expected that this waste will reduce to around 10%. The requirement of wheel barrows and community bins for 10% of the city’s waste is as follows:

Table 6-2: Proposed wheelbarrows

Year	Estimated street waste & drain silt quantity @10% of total waste, TPD	Volume of waste @0.6t/cum (mainly silt & dust)	Number of Wheelbarrows required @0.1cum capacity, 2 daily trips per unit, 20% extra for repair & maintenance
2017	16.5	27.4	166
2022	18.8	31.4	188
2027	21.5	35.8	215
2032	24.4	40.6	244
2037	27.6	45.9	276
2041	30.4	50.6	304

Bins available with corporation to be utilised. No new bins to be purchased. Since complete door to door will be practised, bins will not be required .

6.2 Collection & transportation

The mechanism for door-to-door collection of waste is proposed through a combination of motorized vehicles (4 wheeler- ghantagadi). The waste collection & transportation vehicles shall be either dedicated vehicles or with separate compartments for dry and wet waste. Since, the proposed site for development of integrated SWM (ISWM) facility is around 5 km from one end of the city and around 15km from the extreme end of the city, the city areas upto 7km distance comprising around 35% of the households can directly take up the waste to the processing site in three trips. For the remaining 65% households it is proposed that ghantgadis shall collect the waste and transfer to the processing facility in two trips. At a later stage, the ULB may utilize compactors for transportation of waste from area more than 7 kms.

Map 6-1: Door to door waste collection - coverage map



Table 6-3: Proposed system for Door to door waste collection & transportation

Type of Vehicle	% of total waste to be collected	Distance from SLF (Km)	No. of trips to be made per day	Proposed System
4 wheeler - waste carrying capacity of 2.5 cum@2trips/day, endurance life 5years	For 35% household @ 1200-1500 per HH	upto 7 km	3	To Processing Site
4 wheeler - waste carrying capacity of 2.5 cum @3trips/day, endurance life -5years	For 65% household @ 1200-1500 per HH	7km-15km	2	To Processing Site

6.2.1 Type of vehicles proposed

The collection of segregated waste from the households will be carried out by motorized waste collection vehicles i.e. ghanta-gadi of capacity 2.5 cum to facilitate segregated waste collection from the households as well as commercial units, covering around 1500 households per vehicle including commercial establishments.

Life of the above motorized vehicles has been assumed as **5 years**.

The door to door collection of waste will be done daily in the morning hours preferably between 6 am to 10 am by a dedicated waste collector, who will arrive at a pre-scheduled time.

The worker will then pick up the waste from the household and load it into separate containers meant for collecting segregated wet and dry waste. From the point of view of aesthetics, it is imperative to prevent overflowing of bins.

Table 6-4: Number of Vehicles Proposed

C&T Vehicles Summary	2017	2022	2027	2032	2037	2041
Population	408493	435786	462940	489956	516832	538235
No. of households	78556	83805	89027	94222	99391	103296
No. of commercial units	6504	6939	7371	7801	8229	8570
Total 4 wheelers to be procured for waste collection	79	84	89	95	100	103

Please note that we have not considered the existing vehicle as they are on rent basis provided by the contractor which is costing higher operation and maintenance to the corporation.

6.2.2 Specifications and capacity of vehicles

Table 6-5: Vehicle Specifications

Vehicle	Capacity	Technical specifications
4 wheeler with 2.5 cum capacity, separate compartment for wet and dry waste, covering 1500 households as well as commercial units	2.5 cum	provided in Annexure 12
Supply of Wheel Barrow/ Hand Cart with 4 PVC Bins each of 30 LTS. Capacity of 16 gauge Cr sheet and fitted with solid PVC/Iron wheels for garbage Collection.	0.1 cum	

6.2.3 Cost of vehicles proposed

Table 6-6: Cost of Proposed Vehicles

Year	2017	2022	2027	2032	2037	2042
Total Auto Tippers required by ULB	79	84	89	95	100	103
cost of four wheel auto tippers @ Rs 625000 per unit, Rs lakh	493.75	525	556.25	593.75	625	643.75
Hand carts requirement	166	183	201	221	243	267
Cost of containerized Hand Cart for garbage Collection @ Rs 9600/ per unit, Rs lakh	15.9	17.5	19.3	21.2	23.3	25.7
Road side litter bins	400	440	484	532	586	644
Total Road Side Twin litter bins required for commercial area @Rs.6332 per unit, Rs.Lakh	25.33	27.86	30.65	33.71	37.08	40.79
TOTAL (Rs, lakh)	535.01	570.39	606.18	648.67	685.41	710.21

6.2.4 Segregated MSW Transport system and secondary collection

As already mentioned above, the gphantagadis (4-wheelers) from household located within 7km distance from the waste processing facility shall directly transfer the waste to the processing facility and shall carry 3 trips a day. However, for the remaining 65% households, located farther than 7km, it is proposed that 4 wheeler auto tippers carry waste in two trips. Also, it is proposed that every vehicle shall have separate compartment for wet and dry waste, to collect both streams of waste separately. Details of the Refuse compactors needed are as below:

6.3 Action plan for recycling and recovery

The city already has an existing system for wet waste processing of 20 tonnes per day vermin-composting facility at Varkhedi road however same is not properly maintained or monitored.

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It is recommended to upgrade the vermin composting facility with additional facility to cater the waste of next 10 years especially in terms of handing over the operations to a private party who can manage these facilities in the sustainable manner and also, develop material recovery facility of 60 TPD capacity at same location along with the composting facility having capacity of 100 tonnes per day. As the quantity of city's waste is a sizable, it is recommended to provide a single waste processing facility comprising composting plant for wet waste and MRF for recovery of recyclables from dry waste at the existing 3.79 hectare plot on Varkhedi road, Khasra no. 207.

Table 6-7: Average Waste Composition

Waste Composition	Average (%)
Plastic, Plastic bags, etc.	7.29
Paper,cardboard	6.93
glass & metals	0.25
leather, rubber	0.14
tetra packs	1.66
Clothes	5.36
food waste	49.92
horticulture waste	7.91
misc, inert, silt	20.54
Total	100

Further, the waste composition analysis has indicated that city's waste has 21.63% dry waste, 57.83% wet waste and 20.54% inert/silt. This implies that there is a good potential of recovery of the waste through a properly design material recovery facility.

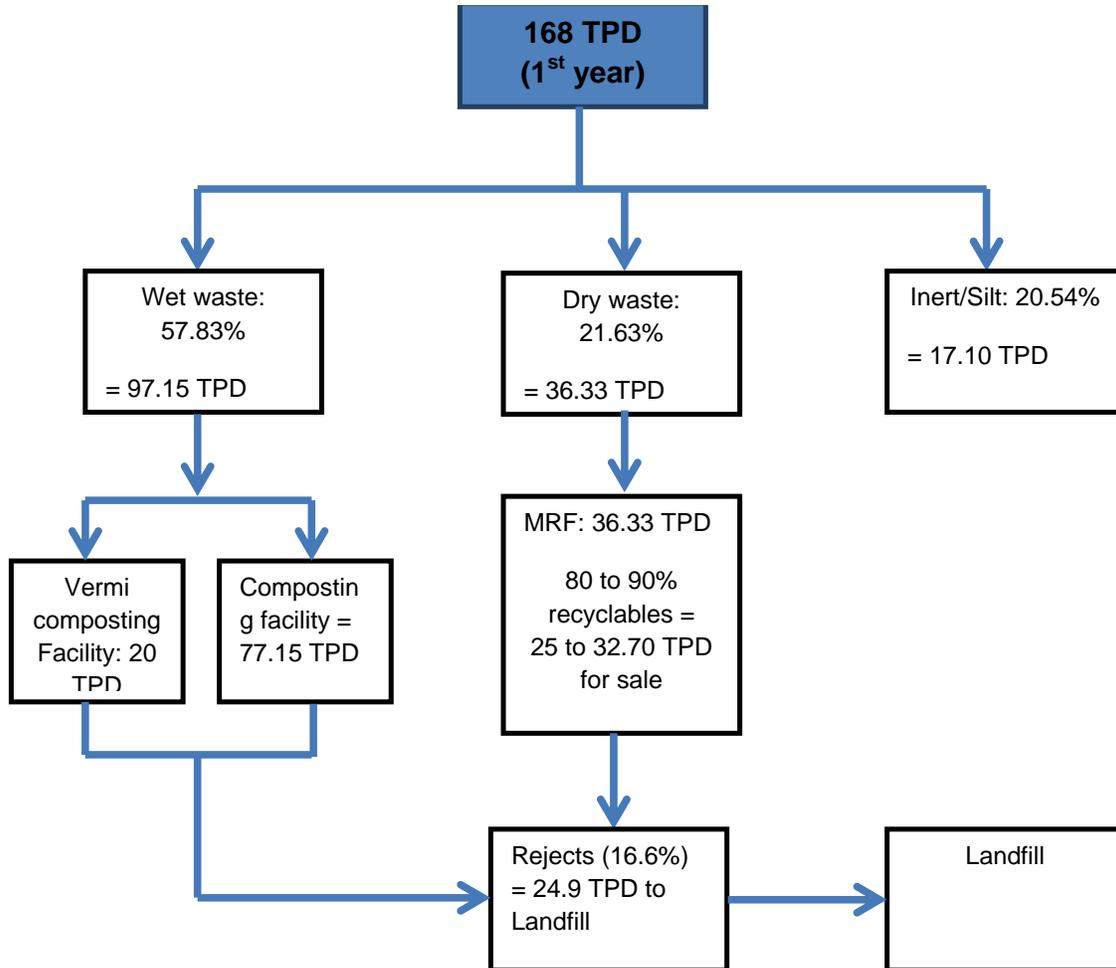
The city's total waste quantity generated is currently 167.76 TPD which is expected to increase to 415.41 TPD in the next 25 years.

Table 6-8: Waste Projection for next 25 years

Year	2017	2022	2027	2032	2037	2041
City Population	433967	489521	552187	622876	702613	773693
Total MSW Qty, TPD	167.76	202.56	244.65	295.53	357.05	415.41
Wet waste, TPD @ 57.83%	97.02	117.14	141.48	170.90	206.48	240.23
Dry waste, TPD @ 21.63%	36.29	43.81	52.92	63.92	77.23	89.85
Inerts/silt etc, TPD @20.54%	34.46	41.61	50.25	60.70	73.34	85.33

Average waste quantity for the city for the next 10 years would be around 200TPD. It is proposed to construct composting facility of 100 TPD capacity and MRF of 60 TPD capacity in existing 3.79 hectare adjoining the vermin-compost facility to fulfil the city's need for first 10 years. The material balance chart for the first year is provided below:

Figure 6-1: Material Balance (1st year)



In the 10th year, the facility capacity is proposed to increase by 30 TPD for compost plant and 15 TPD for MRF.

Action plan to Promote “Reduce, Re-use and Re-cycle (R-R-R)” of waste

Reduce:

Everyone is concerned with the growing problems of waste disposal in urban areas with the scarce availability of land for processing and disposal of waste and environmental remediation measures becoming ever more expensive. It is therefore necessary to not only think about effective ways and means to seriously consider how to avoid or reduce the generation of waste in the first place and to consider ways to re-use and recycle the waste, so that the least quantity of waste needs to be processed and disposed off.

While the quantity of food waste generated per capita has remained almost static, the quantity of packaging waste material and non-bio-degradable waste is going up alarmingly every year. This increases the burden on local bodies to deal with the problem of non-biodegradable and non-recyclable components of waste landing up at processing and disposal sites.

The following measures are therefore proposed to be taken to Reduce, Reuse and Recycling of waste by all concerned:

- All manufacturers producing a variety of domestic and non-domestic products, food as well as non-food should be persuaded to seriously endeavour to use re-usable packaging materials so that after the delivery of goods, the packaging materials could be collected back and used over and over again. They could also consider minimizing or avoiding use of unnecessary packaging materials by innovative methods.
- Incentives and product discount should be given to consumers for the return of packaging or bottling materials in good condition, to the waste producers or retailers to promote re-use.
- The cost of packed articles and article without the packaging material could be kept different with a choice to the consumers to take the article without the packaging materials at low cost.

Re-use:

One person's waste can be useful material for others. Efforts should therefore be made to encourage collection of such re-usable material through waste collectors, waste producers, NGOs and private sector instead of allowing reusable waste to land up on the disposal sites. Bottles, cans, tins, drums and cartoons can be reused.

Re-Cycling:

In the era of excessive packaging materials being used, a lot of recyclable waste material is generated. All-out efforts are necessary to retrieve recyclable material from the households, shops and establishments and fed to the recycling industries through intermediaries such as waste purchasers, waste collectors/NGOs, etc.

6.3.1 Provision for MRF in ULB

It is recommended to upgrade the existing vermin-composting facility especially in terms of handing over the operations to the local NGOs / private player who can manage these facilities in the sustainable manner and also, develop material recovery facility of 60 TPD capacity along with the composting facility of 100 TPD where, rag-pickers and local NGOs can be involved. The MRF facility shall be of 60TPD capacity in first phase and will be upgraded to 80TPD in the 11th year.

6.3.2 Involvement of informal sector

The city has few waste-pickers involved in collections of recyclables for the waste. There are few NGO's also in the city that are keen to get involved in the solid waste management of the city. It is recommended to involve the private party, NGOs and waste-pickers for operations and maintenance of the composting and material recovery facility across the city.

- ULB may mobilize voluntary organizations, Non – Governmental organizations (NGOs) or co – operatives to take up the work of organizing street rag – pickers and elevate them to door step “waste collections” by motivating them to stop picking up soiled and contaminated solid waste from streets, bins or disposal sites and instead improve their lot by collecting

recyclable clean materials from the doorstep at regular intervals of time. Local bodies may, considering the important role of rag pickers in reducing the waste and the cost of transportation of such waste, even consider extending financial help of NGOs and co – operatives in providing some tools and equipment to the rag pickers for efficient performance of their work in the informal sector.

- Local bodies may actively associate resident associations, trade & industry associations, Community Based Organizations (CBOs) and NGOs in creating awareness among the people to segregate recyclable material at source and hand it over to a designated waste collector identified by NGOs. The local body may give priority to the source segregation of recyclable wastes by shops and establishments and later concentrate on segregation at the household level.
- The upgraded rag pickers on becoming doorstep waste – collectors, may be given an identity card by the NGOs organizing them so that they may have acceptability in society. The local body may notify such an arrangement made by the NGOs and advise the people to cooperate.

This arrangement could be made on “on payment on either side basis” or people may, negotiate payment to such waste collectors for the doorstep service proved to sustain their efforts.

6.4 Secondary transfer station

The city does not need any transfer station as the existing waste processing facility is located within the city with the maximum one way travel distance from any point of the city not more than 15km. However, two plastic baling centres are proposed to be developed within the city for carrying out plastic baling in the decentralised manner for atlas 5% of the waste.

6.5 Processing of MSW

6.5.1 Criteria for selection of processing technology

Waste treatment techniques seek to transform the waste into a form that is more manageable, reduce the volume or reduce the toxicity of the waste thus, making the waste easier to dispose off. Treatment methods are selected based on the composition, quantity, and form of the waste material. There are various technologies available for processing of waste in an environmentally sound manner.

Based on the expected quantity and composition of MSW, various technology options for MSW treatment and volume reduction, currently available in India, are as follows:

Table 6-9: List of Identified MSW Processing Technologies

Waste Processing Technology	Processes
Thermal Processing Technologies	Incineration (Mass burn)
	Pyrolysis
	Plasma Arc Gasification
Biological Processing Technologies	Aerobic Digestion (Composting)
	Anaerobic Digestion (Biomethanation)
Physical Processing Technologies	Refuse-Derived Fuel (RDF)
	Densification / Palletization

Incineration (Mass burn): It can be defined as a combustion process which uses an excess of oxygen and/or air to burn the solid waste at high temperature (>700°C). It is the most common thermal technology for waste processing with minimal pre-processing of waste at the facility. Though, this method involves high cost of investment (~INR 16cr for processing 100 tons of mixed MSW), it is very effective in significant volume reduction (<10% ash production).

Gasification: It is a process that converts organic or fossil based carbonaceous materials into carbon monoxide, hydrogen and carbon dioxide. This is achieved by reacting the material at high temperatures (>700 °C), without combustion, with a controlled amount of oxygen and/or steam. The resulting gas mixture is called syngas or producer gas and is itself a fuel. The technology is still in its nascent stage as far as operational experience with MSW is concerned.

Pyrolysis: Pyrolysis uses heat to break down combustible polymeric materials in the absence of oxygen, producing a mixture of combustible gases (primarily methane, complex hydrocarbons, hydrogen, and carbon monoxide), liquids and solid residues. The products of pyrolysis process are: (i) a gas mixture; (ii) a liquid (bio-oil/tar); (iii) a solid residue (carbon black). Relatively low temperatures (400-900°C, but usually about 650°C) are employed compared to gasification. Similar to gasification, this technology is also yet to be proven for the mixed municipal solid waste.

Plasma gasification: A high-temperature pyrolysis process whereby the organics of waste solids (carbon-based materials) are converted to a synthesis gas while inorganic materials and minerals produce a rock-like glassy by-product, called vitrified slag. The high temperature of this process is created by an electric arc in a torch whereby a gas is converted into plasma. The process containing a reactor with a plasma torch processing organics of waste solids (carbon-based materials) is called plasma arc gasification. The reactor for such a process typically operates at 4000°C - 7000°C. The plasma pyrolysis method can be used efficiently for municipal solid waste and plastic waste also. However, this technology is extremely expensive and requires very high degree of sophistication and process control and rarely used for mixed MSW.

Composting: It is a process of decomposition of organic matter known as organic waste (leaves, food waste, paper etc.) in presence of microorganisms. It requires proper measured inputs of water, air, and carbon- and nitrogen-rich materials. The decomposition process is aided by shredding the plant matter, adding water and ensuring proper aeration by regularly turning the mixture. In comparison to thermal treatment methods, this method is less expensive but requires more land. Further, due to operational nuisance related to composting, high volume of rejects generations (~30% of incoming waste) and lack of market for sale of compost, this method is now not preferred for mixed MSW in India.

Anaerobic Composting (Biomethanation): Anaerobic digestion is the natural biological process which stabilizes organic waste in absence of air and transforms it into bio-fertilizer and biogas. Anaerobic digestion is a reliable technology for the treatment of wet, organic waste.

RDF: The MSW is subjected to various physical processes that reduce the quantity of total feedstock, increase its heating value, and provide a feedstock. It may be densified or palletized into homogeneous fuel pellets and transported and combusted as a supplementary fuel in utility boilers. Decision about adapting a particular technology for processing of waste for a city is mainly governed by the following criteria:

1. **Technology Reliability:** Reliable technologies that could be considered without reservations for processing of waste generated in the city and which have been used successfully in the past for similar kind of waste and is also in compliance with the MSW handling and management rules, 2000.

2. **Waste Suitability:** Technologies that are suitable for the given waste characteristics and composition that require value addition of the MSW chain for sustainability.
3. **Economic Viability:** Technologies which are affordable to the local municipality and sustainable economically with respect to the scale of capital investment and operational costs considering the prevailing local conditions.
4. **Environment & Social Impacts:** Technologies that have minimum environmental and social impacts, and conforms to the regulatory requirements (MSW Rules, 2000)

6.5.2 Recommendation of the Processing Technology

Dhule is a medium size city generating on an average 168 tons of waste on daily basis. As proposed the wet stream which is essentially biodegradable be converted to compost and the dry stream of recyclables would be recovered in MRF. The composting process would produce around 15% biodegradable rejects that cannot be composted. The inerts would be landfilled. The recyclables would be screened in the MRF to separate out paper, plastic, glass and metals. Around 11% rejects would be produced in this process and would be included in the inert stream. Total of 25% inerts/rejects are estimated to be disposed at the landfill.

In addition to the main facility of windrow composting & MRF for processing of city's waste at a centralized location, it is also suggested to explore the possibility to setup the decentralised system of community level composting and material recovery units across the city which would take care of around 5-10% of the waste.

For a city like Dhule generating such quantity of waste, composting would be ideal for the organic/ wet waste and recovery of recyclables for dry waste. Suggested system is also in compliance with the MSW rules, 2016 recommendations that mandates disposal of only rejects and inerts in the landfill. This kind of system would help in reducing the content of landfillable waste to not more than 25%.

Composting technology is a well-established technology in India for smaller and medium size projects and it will also generate employment for the local people which will be beneficial to the ULB, as well. The O&M costs of composting are also reasonable in comparison to other technologies available in the country and abroad.

As the volume of total waste is quite less, technologies especially incineration will not be viable because of very high capital investment and special needs in terms of waste segregation. However a Biomethanation plant can be sustainable as completely segregated waste from hotels and vegetable market can make it feasible. **Therefore, in this project the technology of composting for wet waste for bulk quantity, a 5 TPD biomethanation plant, and recovery of recyclable component for the dry waste is recommended.** As per our analysis, the waste generation in Dhule town is estimated to increase from 168 TPD in 2017 to about 416 TPD in the horizon year 2041.

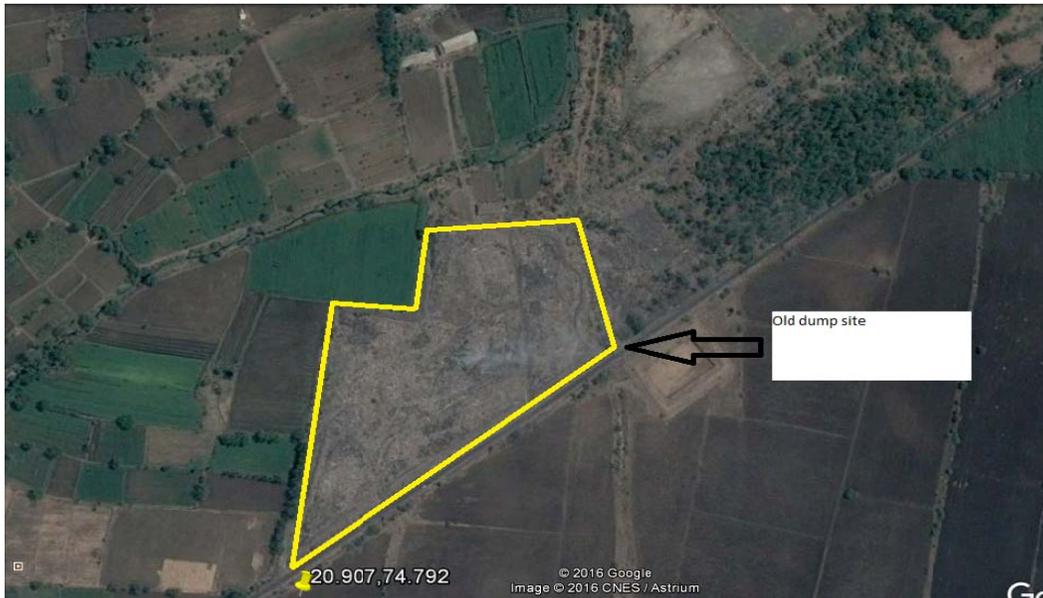
6.5.3 Availability of land

There are 2 lands available with the ULB. One land with area 9.4 acres has 1 acre already covered with vermi-composting facility. About 8.5 acre of land is available for waste processing facility which is adequate for the next 25 years to develop waste processing facility of 100 TPD capacity and material recovery facility of 60 TPD in addition to existing 20 TPD vermin-composting facility for first 10 years to be further upgraded on 11TH Year, 21st year and so on to accommodate the respective year waste.

Map 6-2: Location of processing facility



Map 6-3: Location of old dump site



6.5.4 Process design for proposed processing plant

Solid waste collected by ULB will be delivered at the plant site regularly after arrival the material is passed through the pre-processing section of the plant for separating the inorganic material from the waste, if any. It need special mention that inspite of recommendation of waste segregation system at source, it is anticipated that the processing facility might receive waste in mixed form. The suggested system is robust enough to receive the mixed waste, as well. The +120mm screen material shall be sent to MRF and -120mm screen material shall be sent for composting.

-120 mm screen garbage coming out of pre-sorting section is than sprayed with inoculants and water (from maintaining desired moisture level) and the treated garbage will be stacked in the form of a

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windrow. Separate windrows will be formed for each day's collection. The reject coming out of the pre-cleaning section is passed on to a sorting belt. Where the organic material, if any coming out with the reject is sorted and then sent back to windrow found with the garbage. These windrows will be turned once in a week for proper aeration, so that aerobic process continues uninterrupted. First stage of composting will be completed within 30-35 days.

After this the digested garbage is transferred to the rain shed where further digestion will take place. From here the digested garbage will be fed by a feeder into the coarse segregation section which consists of series of trammel which separate the digested garbage on the basis of size. Each trammel is sent to landfill site directly. The reject coming out of the second and third screen can be sent back to windrows for further digestion.

Material coming out of the last screen is transferred through a series of conveyor to curing area, where further curing of the digested garbage (compost) takes place. Various nutrients such as rock phosphate etc. can be added to the compost therefore enhancing the quality of the finished product. This material is then fed into a drag chain feeder, which transfers it to a rotary screen through a bucket elevator, this rotary screen separates the material on the basis of size. So that the digested compost coming out of it is acceptable in the market.

Screened material coming out of the rotary screen is fed to a gravity separator, which separates materials such as Glass, metal etc. from the compost.

The reject material coming out of the rotary screen can be sent back to the curing area for further digestion, compost, free from all major external impurities will be lifted through another bucket elevator and discharged into a add- mixer and inoculums containing various useful microbes like Azetobactor, PSB, Rhizobium and micro nutrients etc. will be sprayed into the mixer inquired proportion for enriching the compost enriched organic manure, which will have 20 – 25% moisture, is then weighed and packed and distributed. Samples will be drawn at regular intervals from different stages for quality control.

Preferably as it is fast, exothermic and free from odour. Aerobic also help to eliminate Pathogenic bacteria weed seeds, larvas etc. as a result of high temperature developed during the process.

6.5.5 Design of processing plant and leachate management

There are four stages in the scientific treatment and processing of bio solid waste through controlled accelerated bioconversion technology. These stages are as following:

STAGE 1- SANITISATION:

Under hot weather organic waste rich in minerals, proteins and carbohydrates are quickly invaded by rot inducing pathogenic microorganisms and starts generation of mal-odors. These wastes are also great source for multiplication of flies, which becomes the carriers for pathogenic bacteria. Therefore under the tropical and sub-tropical conditions municipal waste must be given a sanitization treatment with natural herbal extracts and bio-enzymes. Use of insecticides and chemical disinfectants is prohibited as these chemicals interfere with natural bioconversion process and may leave high levels of toxic residues.

Several preparations of herbal extracts are now available in the market as waste sanitizers and bio-stabilizers such as BIO-KLEEN, ECO-KLEEN, ECOLOGIC, CITRUS CLEAN, ECOLO, WASTE TREAT, RAPIDCOM. Spraying of these formulations as per the label direction ensures sanitary treatment of wastes and restricts the multiplication of pathogenic microorganisms.

STAGE 2- BIOCONVERSION:

This process involves generation of mesophilic [400C] and thermophilic [>600C] temperature by fast multiplication of desirable bacteria, fungi, and actinomycetes. The exothermic heat generated by introduced micro-organisms is useful to kill several pathogenic bacteria as well as speed up the biochemical breakdown of the complex organic matter to simpler forms of minerals, humus, growth promoting substances as well as food source for beneficial micro-organisms in the soil. The bioconversion process is compressed into 4 - 5 weeks' time cycle instead of usual 4 to 6 months. In this process waste volume is reduced by 45 to 50% and the stabilized biomass becomes usable compost after screening.

STAGE 3- FORTIFICATION & VALUE ENHANCEMENT:

Compost as some time misunderstood as refused derived product is not correct. In fact it is the composted form of carbon energy as humus material and transferred nutrient elements in readily absorbable form by the crop plants.

Therefore during the bio conversion process addition of enriching materials such as fibres, blood meal, slaughter house waste compost liquors, oil cakes, spoiled food grains, milk powders etc. These can ideally be combined in the first or second turning or sometimes even at the initial stage of windrow forming. Care is taken that such added materials are pressed through bio stabilization of 3 weeks.

Fortified batches can be separately processed as high value organic soil enricher or special grade organic fertilizer for a particular crop or soil conditions.

Total bioconversion cycle must last for 35 to 42 days.

STAGE 4- MECHANICAL PROCESSING:

After completion of the bio conversion cycle and bringing down moisture (around 20% level) for free flowing into machines, the material passes through 4 stage online screening system having series of conveying, rejection handling and rotary sieves / vibro sieves. The sieve size configurations are changeable as per the requirement of end product quality.

Usually a free flowing coarse powder entirely passing through 3 mm sieve size (rules specify 90% material passing through 4 mm sieve size) is recovered. This powdery material can be furthered processed into granules or pelletised form for mechanized application in horticulture crops.

SEGREGATION PLANT:

Following are the basic component required for a Segregation plant:

i) Segregation plant – Consisting of standard equipments used in production of Organic Manure from Municipal Solid Waste such as Trommel, Chain Belt Conveyors, Hydraulic Power Pack etc.

- Design capacity of 100 Tons per day of digested municipal solid waste.
- Number of working days per annum – 300 days.

ii) Refinement plant - Consisting of standard equipment used in production of organic manure from municipal solid waste such as Vibro screen, Bulk density separator, Aspirator system, Bucket elevator etc.

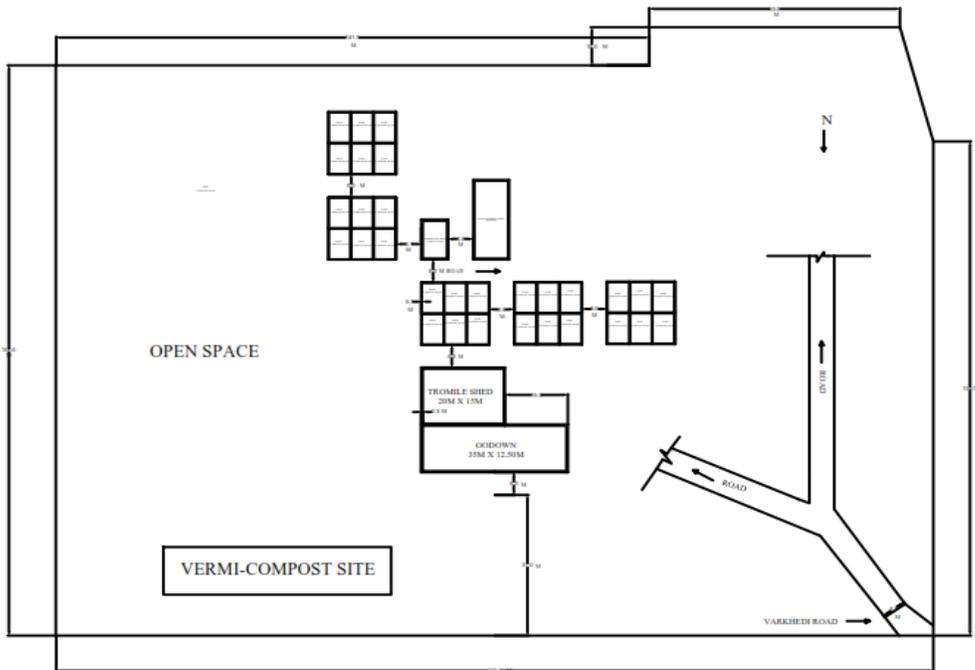
- Design capacity of 40 Tons per day of cured municipal solid waste.

6.5.6 Required infrastructure and equipment for compost plant

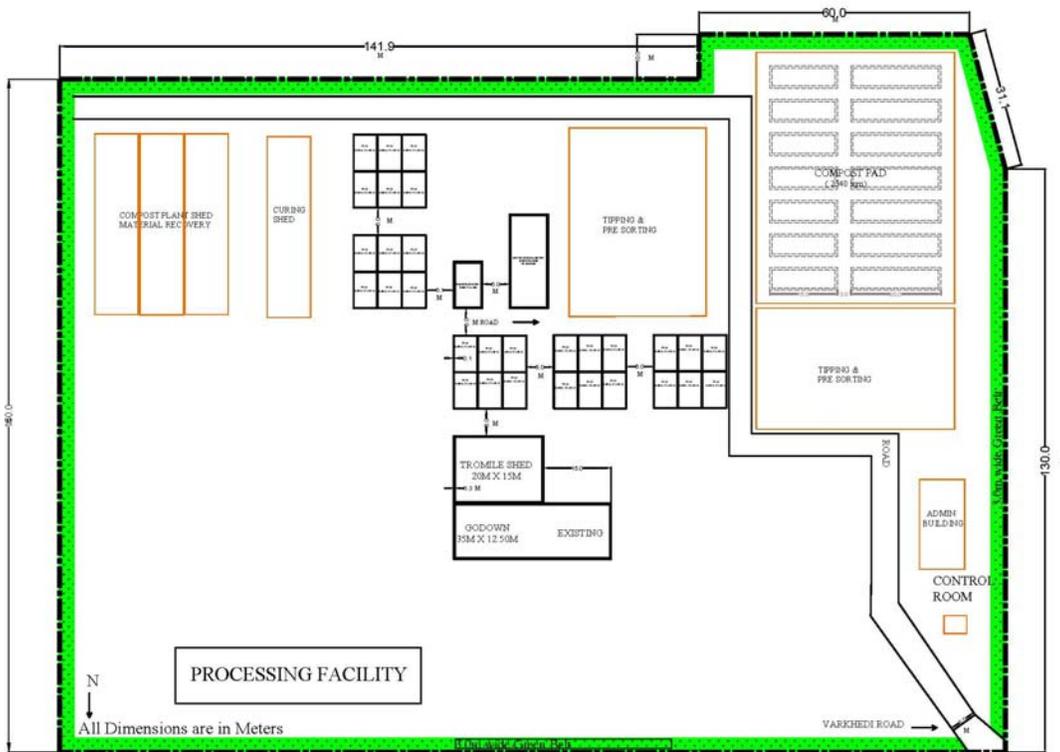
Table 6-10: Required Infrastructure and Equipment for Compost Plant

S. No.	Equipment	Qty.	Purpose
1	SEGREGATION PLANT		
i)	Feeder	1 No.	For feeding material at controlled rate.
ii)	Dual Trommel 35/14	1 No.	For Screening
iii)	Process Conveyor	1 No.	For feeding material to next Trommel
iv)	Reject Conveyor	1 No.	For removal of rejection off-line.
2	REFINEMENT PLANT		
i)	Drag Chain Feeder	1 No.	For feeding material at controlled rate.
ii)	Bucket Elevator	1 No.	For lifting material & feeding it to rotary screen.
iii)	Vibro Screen	1 No.	For Screening
iv)	Gravity Separator with Aspirator	1 No.	For separation of heavy impurities.
v)	Packing Elevator	1 No.	For lifting material & feeding it to add-mixer.
vi)	Packing Spout	1 No.	Two-way for packing material.
3	CONTROL PANEL		
i)	Hydraulic Power Pack & Control Panel	1 Set	Push button station along with hydraulic system to improve efficiency and safety of equipments against continuously fluctuating load.

Figure 6-2: Vermi-Compost Plant Layout



SCALE 1:1000



6.5.7 Design of Material Recovery facility

Dry or recyclable waste, which would be 60 TPD for Dhule would be fed into the material recovery facility which would segregate them further. Recyclables form a separate stream of waste which can be further utilized and sold as source of revenues.

It is proposed to set up MRF to separate the mixed dry waste into the following:

- Paper
- Plastic
- Glass
- Metals
- Others

MRF would be critical for reducing the waste going to the landfills, and/or to achieve reduction by maximizing processing as well as recycling. The objective of integrating an MRF in the system would be to remove the bulk inert material, recover the marketable products and produce a stream of waste with high organic content. Recyclables like paper, plastics and metals have organised recyclers all over the country.

The various equipments which would be used in the MRF would be:

- Size reduction
- Trommel screen
- Air-density separator
- Magnetic separator
- Shredder
- Conveyor

Size reduction is the process by which the collected materials are mechanically reduced in size. Objective is to obtain a uniform final product that is reduced in size potentially reducing storage and shipping course.

Shredders include hammer mill, flail mill and shear shredder and usually involve metal parts revolving against one another.

Trommel Screen

Screening is a unit operation used to separate mixtures of materials of different sizes into two or more size fractions by means of screen surfaces. Objective is to:

- Remove oversized material
- Remove undersized material
- Separate into light (combustible, paper) and heavy (non-combustible, glass) fractions.

Density Separation (Air Classification)

It is the unit process used to separate light materials such as paper and plastic from heavy materials such as metals based on weight difference in the air stream. In solid waste the light fraction is typically organic while the heavy fraction is typically inorganic. It is used to separate glass from plastic in a commingled situation.

Magnetic Separation

It is the operation by which ferrous metals are separated from the waste stream utilizing magnetic principals. This is used to separate tin cans from aluminum in a commingled situation.

Conveyors

Transfer wastes from one location to another and include hinge, belt drag and pneumatic. Conveyors are used in the manual sorting of MSW. Belt is about 4' wide and move at 15-90 ft./min. with a thickness of waste of 6".

Table 6-11: Separation Efficiency of MRF

Material	Recovery efficiency
Paper	90%
Plastic	80 - 95 %
Glass	70 – 80%
Metals	80 - 95 %

Source: UNEP SWM report (<http://www.unep.org/ietc/Portals/136/SWM-Vol1-Part2.pdf>)

6.5.8 Plant Layout and Design

Waste Receiving Area

Tipping area is required to receive and pre-segregate material from local bodies. Fresh garbage is unloaded and then screened. The reject material, which primarily contains inorganic matter, is directly sent to landfill site.

Total waste generated (average 10 years) = 200 MT/day = 444.4 cum/day

Keeping height of waste for sorting etc. = 1.00 m

Area required = 444.4 sq. m

Area for 2 days storage = 888.8 Sq. m

Provide 40 x 25 M Size = 1000 sq. m

Waste receiving area should be strong enough to bear the weight of loaded vehicle and their movements.

Therefore 200 MM thick 1:1.5:3 C.C. floor with skin reinforcement over 1: 4: 8 bases P.C.C has been proposed.

Pre- Segregation Shed = 1200 Sq. m.

Windrow Platform

An impervious concrete platform scientifically designed with proper gradient to accommodate the garbage. The concrete platform is provided with peripheral drain to collect the Leachate and rainwater over flow.

Waste generation rate (10year average) = 200T/day

Organic component 63.62% = 116 TPD

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Volume @ 0.45t/cum	=258 cum/day		
Height of windrow	= 2.5 M		
Width	= 5.00 M		
Shape of Windrow	= Parabolic		
Volume of windrow per RM	= 12.5 cum		
Length of windrow required/day	~ 21 M,		
Duration of one cycle	= 30 days		
Total length of windrow required	= 30 x21	=	630 M
Arranging 5x 6 rows,			
Width of windrow	= 5 x 8	=	40.00 M
Space Between each windrow	= 4 x 3.5	=	14.00 M
Working Space at ends	= 2 x 3.0	=	6.0 M
Total width of windrow pad	= 60.00 M		
Total length of windrow	= 6 x 21	=	126 M
Width of road	= 5 x 3.0	=	5 M
End Roads	= 2 x 2.5	=	5 M
Total Length of windrow pad	= 136 M		
Size Provided	= 60 x 136 M		
Area Required	= 8160 Sq. m		

As per recommendation of IPNM 30% of the windrow area shall be covered to serve as monsoon shed and 70% area will be uncovered. Therefore,

- 1) Covered area = 2448 sq. m

Monsoon Shed

A 8 mts. high open shed covered with C.G.I. sheet roof has been provided, It enables to operate the plant during rainy season.

Monsoon Shed Area Covered = 2448 Sq. Mts. As worked out above.

Factory Shed

Machine Shed for Coarse Segregation Section:

A 6 Mts. high RCC shed with AC sheet roof. Properly ventilated to accommodate coarse segregation section refuse removal. Necessary side cuts to facilitate disposal of reject material.

Compost Machine Shed Area = 25 x 10m x 3 nos = 750 Sq. Mts.

Control Room

A RCC control panel room is to be constructed at strategic position to supervise and operate the Machines efficiently.

Control Room Area = 5 x 4m = 20 Sq. m.

Curing Shed

9 Mts. RCC closed shed with AC sheet roof provided for intermediate storage and curing of semi-finished material. The shed is also provided with hanging platform for storage conveyors.

Curing Shed Area = 30 x 10m = 300 Sq. Mts.

Refinement Area

A RCC Structure of 10 mts. X 12 mts. And floor height of 8.00 mts. is provided for installation of finishing section machinery.

Refinement Shed = 10 x 12m = 120 Sq. m

Finish Product Godown:

A RCC structure with AC sheet roof is provided to store the finished product.

Finishing Section Area = 20 x 10m = 200 Sq. m

Bag Storage Shed = 30 x 10m = 300 Sq. m

Segregation & Processing Machinery

Pre-processing Section

This section has a trammel with 100 mm screen along with a feeder, rejection conveyor and processing conveyor. The screened material is sent to compost pad and reject is passed through sorting belt for manual picking of recyclable and/or biodegradable material. Final rejects are sent to sanitary landfill site.

Coarse Segregation Section

This section comprises of two screens of size 35 mm & 14 mm with feeder, hopper & conveyor, conveyor belts with distribution system to store the semi-finished products in curing area. Also two conveyor belts for compost rejects from the trammel screens are provided. The entire preparatory section machines operate on Hydraulic System with centralized control panels.

Refinement Section

This section consists of screens of size 6 mm, 5mm, & 3 mm for screening the semi-finished& cured material & rejects, gravels, glass, metal & other inert materials. Two vibrating sand separators are to be provided. An admixture is also provided to control moisture levels & no add required micronutrients for specific purpose. The final product is packed on packing spout in 50 kg. bags.

Office Building & Laboratory

A RCC single story structure is to be constructed for administrative office with facilities for Laboratory, Store Room & Canteen Room. Laboratory must be well equipped with all necessary provisions for monitoring of process as oven, muffle furnace, balance, spectrophotometer, different chemicals glassware etc.

Roads & Other Facilities

Roads of proper sizes are to be provided. Other facilities like Toilet, Washing Place, Store Room, Supervisor Room have been provided adjacent to the coarse segregation section.

Water Supply & Sprinkling System

One OHT having capacity of 10000 liters at 8m staging has been proposed with provision of pump house & tube well for campus water supply system, one water sump of 1000 lts capacity for spraying of culture slurry & water for the treatment of Garbage on the compost pad has also been provided near windrow platform.

Electric Power

A HT/LT Electric power connection has to be obtained from State Electricity Boards.

Power for Processing Machine	=	350K.W.
Power for other amenities	=	50 K.W.
Power Connection Required	=	400 K.W.

Weigh Bridge

An Electronic Weigh bridge of 30 tons capacity is to be installed at the entrance to monitor the quantity of garbage delivered at the plant and outgoing goods weighing. Beside, weigh bridge room of size 3 x 3m is also provided.

6.5.9 Environment monitoring and control

The design and operating parameters of the processing facility shall be able to take care of the following:

- i. Mal-odor neutralisation and pathogen control
- ii. Combination of fed stocks for C:N ratio adjustment
- iii. Use of microbial inoculants, nutrient minerals and other additives
- iv. Windrow formation with necessary dressing up
- v. Aeration through in site turning or lifting and dropping
- vi. Spray mist fortified with odor neutralisers for control of bio aerosols
- vii. Moisture addition / management at optimum level for rapid microbial activity
- viii. Prevention of nutrient wash out or leaching
- ix. Leachate contaminant, tapping and re circulating
- x. Maintenance of windrow structure for required porosity and aerobic conditions
- xi. Control of flies, rodents, vultures
- xii. Prevention of high oxidation losses(O.C and nutrient loss)
- xiii. Conservation of nutrients
- xiv. Control of pH and EC acceleration of curing maturation and formation of humified substances
- xv. Moisture reduction and drying for ease of mechanical separation & grading.
- xvi. Positive charge of agriculturally useful bacteria-fungi-actinomycetes for value addition and to protect compost from pathogens.
- xvii. Formulation of product grades for different crop user-ship, soil conditions and application techniques.
- xviii. Quality control parameters following laid down specifications.
- xix. Bagging and despatch or storage in loose and bagging at the time of dispatch.

Table 6-12: Environment Monitoring and Control

Groundwater quality monitoring	Unit	Value
Number of locations	No.	2
Frequency of monitoring	No/year	4
Leachate water quality testing		
Number of samples (1 in each quarter at 2 locations)	No	2
Frequency of monitoring	No/year	4

For control of environment in compost plant, main focus areas are prevention of ground water contamination by leachate and any kind of odour issue. The generated leachate shall be re-circulated into the windrows to accelerate the process of composting and regular turning of windrows is necessary to prevent any kind of odour generation with regular sprinkling of inoculant.

It is also recommended to monitor the ground water quality at upstream and downstream ends of the facility to detect any kind of water contamination during plant operational life.

Table 6-13: Estimation of Waste Generation and its Components, Year-wise

Year	Population as per Census and Projected	Floating Population	Per Capita Solid Waste Generation in the city (gm)	Per Capita solid waste generation from Floating Population	Total solid waste generation (MT)	Wet Waste, 60.77%	Dry Waste, 29.06%
2017	408493	15000	403	202	168	102	49
2018	413962	15000	409	204	172	105	50
2019	419427	15000	414	207	177	108	51
2020	424885	15000	420	210	182	111	53
2021	430338	15000	426	213	187	114	54
2022	435786	15000	432	216	192	117	56
2023	441228	15000	438	219	197	120	57
2024	446664	15000	444	222	202	123	59
2025	452095	15000	451	225	207	126	60
2026	457520	15000	457	229	213	129	62
2027	462940	15000	464	232	218	132	63

2028	468354	15000	470	235	224	136	65
2029	473763	15000	477	238	229	139	67
2030	479166	15000	483	242	235	143	68
2031	484563	15000	490	245	241	146	70
2032	489956	15000	497	249	247	150	72
2033	495342	15000	504	252	254	154	74
2034	500723	15000	511	256	260	158	76
2035	506099	15000	519	259	266	162	77
2036	511468	15000	526	263	273	166	79
2037	516832	15000	533	267	280	170	81
2038	522192	15000	541	270	286	174	83
2039	527545	15000	548	274	293	178	85
2040	532892	15000	556	278	301	183	87
2041	538235	15000	564	282	308	187	90

6.5.10 Product utilisation

The plant is expected to produce compost and recyclables that can be sold in the market. Around 15% compost shall be produced and 80% of recyclables can be recovered.

6.5.11 Costing of processing facility

Cost estimate for main waste processing facility including biomethanation plant has been provided in Annexure

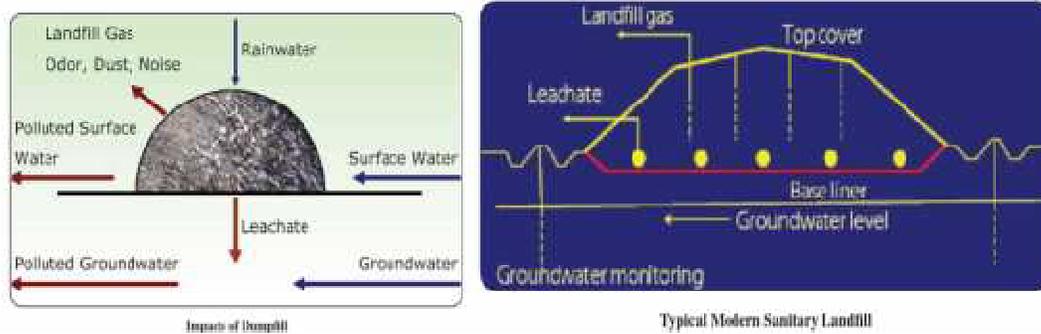
In the first year the capital investment for the waste processing facility is detailed out in the table below:

6.6 Municipal Sanitary landfill

Landfills are a vital component of any well-designed MSWM system. They are the ultimate repositories of MSW after all other MSWM options have been exercised. The landfill site is designed for the year 2041 for the ULB (land is available).

The overall approach to the development of the sanitary landfill for the ULB is formulated to satisfy the regulatory requirements of MSWM rules, CPHEEO guidelines and with the objectives of environmental protection and cost effectiveness. Considering the above, protection of the quality of the groundwater in the site and adjoining locations is of paramount importance in the formulation of the design approach for the landfill facility.

Picture 6-1: Typical Modern Sanitary Landfill



The finalized approach hence considers the environmental features of the proposed site and is designed to develop the landfill facility on the principles of containment engineering aimed at minimizing the following:

- The generation of Leachate, its subsequent outflow and uncontrolled dispersions into the surrounding aquatic environment; and
- The accumulation, migration and uncontrolled release of landfill gas into the host strata and atmosphere.

Since the waste to be landfilled is mostly inert, the generation of leachate and Gas will be within the permissible limits.

However adequate care has been given in designing the landfill to accommodate any future migration of toxic components to the environment.

6.6.1 Conceptual Design of Landfill

The landfill design comprises of an active period and a closure and post closure period. Landfill design in view of the 25 years operation period for the Dhule city. The closure and post-closure period for which the landfill will be monitored and maintained is 25 years after the active period is completed.

Phasing: The landfilling activity will be under taken in a phased manner for 25 years. Each phase comprises 5 years from the base year 2017 until the year 2042 (i.e.) for 2017-2022, 2023-2027, 2028-2032, 2033-2037, 2038-2042.

Inert Waste Volume and Land fill capacity

The quantum of inert collected which is 25% of the incoming waste at site will be filled in the proposed landfill. CPHEEO guidelines and MSW Rule 2016 norms have been adopted for assessing the waste volume. The detailed calculations for Inert Waste volume and the estimated Landfill capacity have been given below.

Table 6-14: Estimation of Landfill Quantity Year wise

Sr. No.	Year	MSW in TPD	Permissible Quantity of MSW per day for Landfill in Tonnes	Volume inerts/ non- bio degradable rejects per year from processing Plant (assuming 25% max.of feed) for disposal to Landfill per year, assuming density as 0.850 KG /cum
1	2017	167.65	41.91	17997
2	2018	172.24	43.06	18491
3	2019	176.94	44.23	18995
4	2020	181.73	45.43	19509
5	2021	186.61	46.65	20033
6	2022	191.60	47.90	20569
7	2023	196.69	49.17	21115
8	2024	201.88	50.47	21672
9	2025	207.17	51.79	22240
10	2026	212.57	53.14	22820
11	2027	218.08	54.52	23412
12	2028	223.70	55.93	24015
13	2029	229.43	57.36	24630
14	2030	235.28	58.82	25258
15	2031	241.24	60.31	25898
16	2032	247.33	61.83	26551
17	2033	253.53	63.38	27217
18	2034	259.86	64.96	27896
19	2035	266.31	66.58	28589
20	2036	272.89	68.22	29295
21	2037	279.59	69.90	30015
22	2038	286.43	71.61	30750
23	2039	293.41	73.35	31498
24	2040	300.52	75.13	32262
25	2041	307.77	76.94	33040
Total Waste in Cum for total concession period of 25 Y				623767

The depth of landfill has been considered keeping the ground water table at the site in to consideration. The height of the landfill is fixed at 18 m above Ground Level (GL) and 12 m below ground level considering the volume of waste to be dumped over a period of 25 years.

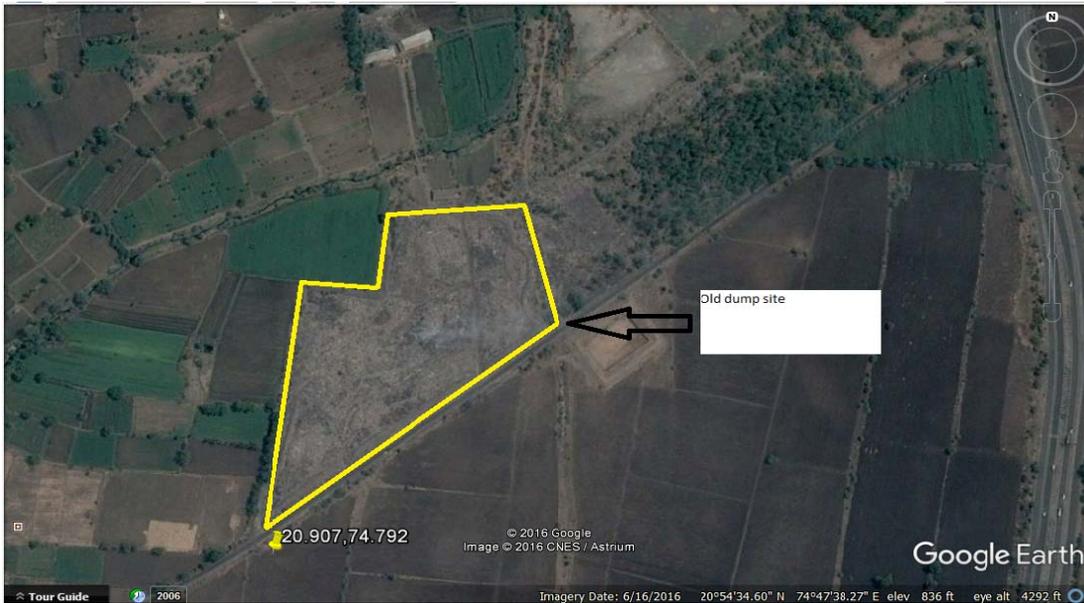
Table 6-15: New Landfill Design Specifications

DESIGN FOR NEW LANDFILL					
Waste Volume required for landfill	Cum			=	623767
Volume of Soil cover, Linear and Bund	Cum	30%		=	187130.21 Cum
Total Landfill Volume					810897.60 Cum
Depth landfill(Incl. Base Liner of 1.3 m thick)				=	12 m below ground level
Bund height				=	2 m
Bund width				=	3 m
Bund inner slope	1 in	2	Slope		
Above bund level landfill height with	1 in	3.5	Slope	=	18 m
Drain dimensions					1 m top width
				=	0.5 m bottom width
				=	0.5 m height
Bund outer slope	1 in				2
Bund inner slope (bottom)	1 in				2
Bund top slope	1 in				3.5
Bund top final height slope	1 in				20
Green belt required for entire landfill from fencing to landfill				=	10 m wide
Area required for total landfill including bund width, bund outer slope, drains etc.,				=	185.9 m X 185.9 m
Total area of the land in sqm				=	34573.17 sqm
Add. Land required for associated infrastructure				=	1728.65 sqm
1 acre				=	4047 sqm
Total area of the land in acres				=	9 Acres
				=	3.6 Ha

6.6.2 Availability of land

The proposed site is located on Varkhedi road. The site is around 4.67 Hectare land and approximately 5 km away from the Dhule city. In line with the regulatory guidelines, we require 0.5 Hectare land to cap the existing waste. Therefore, the balance available land is 3.67 Hectare where the landfill will be designed. Thus, the present site would be able to accommodate the next 25 year of waste considering the 25% of landfill waste from the incoming waste. However, we suggest to DMC that they will acquire another land for the city waste from 2041 onwards. The site is observed to be an open area, adjacent to a vegetation land and agricultural activities that are predominant in and around the site.

Map 6-4: Existing Dumpsite and Proposed Landfill Facility Site



Site Adequacy for Landfill Site – Dhule

Currently, around 1,00,000 tonnes of waste lying on the site and it is estimated that around 5,30,202 tons of rejects shall be generated during next 25 years from the Dhule city (25% rejects). The total area requirement for a scientific landfill would be around 3.6 Hectare and adequate for the next 25 years. The adequacy of the site is detailed in chapter 3.

6.6.3 Technical Specification and Leachate Management

The proposed landfill facility has to be constructed and operated in various phases as it allows sequential use of the landfill area. This facilitates the following activities for smooth functioning of the facility. At any given point of time the following four operations could be envisaged:

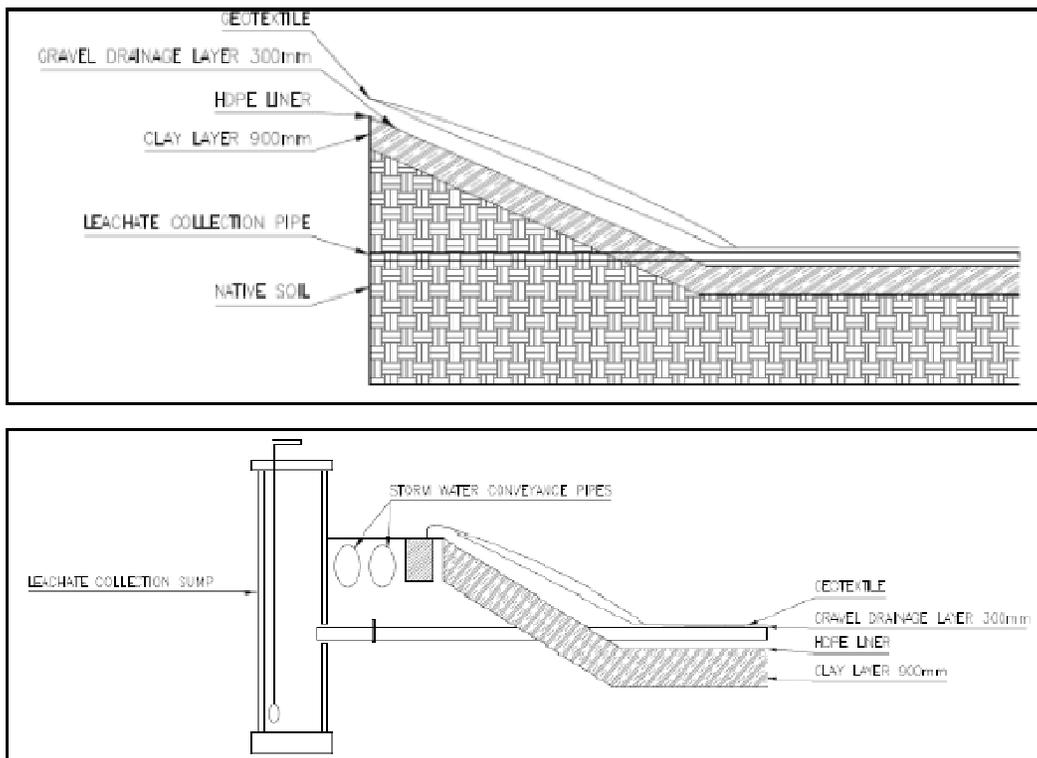
- Ø Part of the facility is having final Cover
- Ø Part of the facility is being actively filled.

- Ø Part of the facility is being prepared to receive the waste.
- Ø Part of the facility is undisturbed.

6.6.3.1 Liner System

The liner system would essentially comprise of HDPE geo-membrane and geo textile layers to be laid over compacted clay layer of 900 mm thickness. The clay layer would be of bentonite clay to be laid over native compacted soil to 95% procter density. The base area would have sufficient slope to guarantee draining of leachate and storm water. The composition of the base sealing system has to be in compliance with the SW Rules 2016. The permeability of the base layer would be less than 1×10^{-7} cm/s. In case adequate bentonite clay is not found in the nearby areas, then geo-synthetic clay liner (GCL), which is bentonite sandwiched between two layers of geo-textiles would be used as a base layer. The GCL may be further reinforced with an additional layer of HDPE liner. Above the clay liner or GCL liner a HDPE geo-membrane liner with standardized thickness of 2 mm and conforming to ASTM standards would be laid. Above this a protection layer of geo-textile liner with 2000 gm/m² weight would be laid. Above these layers a drainage layer of 300 mm thick with filter gravel and ensuring a permeability of greater than 10⁻² cm/sec would be laid. The drainage layer would comprise of 25-50 mm round shaped gravel and pipes of 200-250 mm diameter with sloping towards the leachate collection sump. A non-woven geo-textile layer would be laid above the drainage layer as a protection to the drainage layer and this also helps in maintaining high filtering capacity of the underlying drainage layer.

Picture 6-2: Typical Sectional Profile of Liner Systems & Leachate Collection of Sanitary Landfill



Geo-synthetic liner

The lining system is additional to the separation or unsaturated zone comprising soil or rock between the ground water and the landfill. The Geosynthetic Clay Liner is proposed considering that it is easier to lay and is cost effective as saving on clay and labour.

Geo-membranes

These are flexible sheets made from various plastic materials. The recommended liner along the side as well as the bottom of the facility is HDPE. HDPE lining is effected by overlapping the strips and joining them with a special welding technique. The thickness of the liner should be minimum 1.5 mm (Flat Cast Extruded). It will be used and placed above clay liner as per the requirement of SW Rules 2006.

Top Liner System

After the completion of each phase of the operation, the landfill has to be closed/ insulated by providing the final cover. The final cover has the following advantages:

- Enhances surface drainage
- Minimizes infiltration
- Vegetation grows on it
- Controlled release of the landfill gas

The final cover will have a barrier soil layer comprising of 60cm clay or amended soil with permeability coefficient less than 1×10^{-7} cm/sec. On the top of barrier soil layer, there shall be a drainage layer of 15cm on top of the drainage layer, there shall be a vegetative layer of 45cm to support natural plant growth and to minimize erosion.

Side Soil Bund and Anchor Trench

Side soil bund his proposed surrounding the landfill area for resisting the sliding of the waste along the slopes. The height of the soil bund has been restricted to 2m. The bund will be constructed from excavated earth. Anchor trench is provided for anchoring of liner in Bund.

Garland Drain

Storm water drain is very essential component of landfill facility. The first and important factor for a landfill is to prevent the entry of water streams in the landfill facilities, thus reducing the generation of leachate from the waste body, which ultimately reduce the migration of pollutants from landfill facility. Along the sides of the active filling area is intercepted and channeled to water courses without entering the operational area. For this purpose, garland drain of size 500mmx500m is provided along the sides of landfill facility. It is ultimately connected to leachate collection sump. After the final cover is laid on the landfill facility, it has to be ensured that the topography allows the smooth drainage of the precipitation rainfall and no ponding take place thereby enhancing the leachate problem.

Storm Water Drain

The storm water drain is also provided along the each side road to collect the rain water (surface runoff) from landfill site area. The L-shaped drain is proposed (sizewidth 500mm x 500mm depth).

6.6.3.2 Leachate Collection

The landfill facility essentially generates significant quantity of leachate due to biodegradation of the organic matter present in the waste body. The leachate is impregnated with harmful chemicals and

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pollutants. It is to be collected, removed from the landfill facility and treated before final disposal. In order to collect the leachate from the waste body a drainage layer of 30 cm granular material of permeability $> 1 \times 10^{-2}$ cm/sec is provided over the HDPE liner.

In order to collect and convey the leachate generated to the collection sump, a leachate collection system has been designed. It comprises of the following:

- Drainage layer
- A perforated pipe collection system
- Sump collection Area
- Treatment and disposal of the leachate

The generated leachate will be collected through perforated pipes (HDPE) by giving transverse slope for leachate collection via the terrace (2%) and the longitudinal slope (1%) for gravity flow to leachate collection sump.

Leachate Pipe

- The diameter of the leachate pipe : 200 mm (header)
- The diameter of the leachate pipe : 160 mm (lateral)
- Material of construction : HDPE

Leachate Collection Sump

A leachate collection sump is designed to collect the leachate from the landfill facility (all phases) and suitable treatment can be given at site. The leachate collection sump is located near landfill first phase as per topography for collection of leachate by gravity. It will be circular in shape (2m dia) and constructed in RCC.

Treatment of Leachate

The type of treatment facilities to be used depends upon the leachate characteristics. Typically, treatment may be required to reduce the concentration of following prior to discharge

- Degradable and non-degradable organic matter
- Specific Hazardous constituents
- Ammonia and nitrate ions
- Sulphides
- Odorous compounds and
- Suspended solids

Treatment process may be biological process (such as activated sludge, aeration, nitrification, denitrification), chemical process (such as oxidation, neutralization) and physical process (such as air stripping, activated adsorption, ultra filtration etc.). The type of treatment for leachate will be decided as per the characteristics of leachate. Treatment facilities for leachate can be provided after the development of sanitary landfill site.

Leachate Quantity estimate

SLF area (1st cell-5 years+ Capping of old waste)	=	10728.520
Waste receiving and windrow Pad Area	=	1200
Windrow Area (70% uncovered, hence consider only 70%)	=	<u>5712</u>

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Average rainfall intensity / day	=	15.00 MM
Runoff coefficient for windrow pad	=	0.85
Runoff coefficient for SLF	=	0.40
Leachate qty.from SLF = $(10728.52 \times 15 \times 0.40)/1000$	=	64.37 cum/day
Leachate qty from windrow = $(6912 \times 15 \times 0.15)/ 1000$	=	<u>15.55 cum/day</u>
Total qty.	=	80 cu. m/day

Leachate Holding Tank

The leachate overflow is collected in setting tank.

$$\text{Providing 4 hours capacity } V = 80 \times 4 / 24 = 13.33 \text{ cum}$$

$$\text{Providing Leachate Depth} = 1 \text{ M}$$

Clear board: 0.25m

$$\text{Plan Area Reqd. (A)} = V/\text{total depth} = 13.33\text{sqm.}$$

$$\text{Proposed} = 5\text{m} \times 3\text{m} \times 1.25\text{m depth}$$

Leachate Evaporation Tank

$$\text{Quantity of Leachate} = 80 \text{ cum / day}$$

$$\text{Providing depth of Leachate} = 1.25 \text{ M}$$

For 4 day capacity:

$$\text{Area} = 256 \text{ sq. m.}$$

Provide a tank of Size 18 m x 15 m Size

It may also be noted that excess leachate shall be re-circulated on the windrows to accelerate the composting process and to address the odour issue.

6.6.4 Environment monitoring and control

The objective of an environmental monitoring system is

- To find out whether a landfill is performing as designed
- To ensure that the landfill is conforming to the regulatory standards

Monitoring at a landfill site is carried out in four zones.

- On and within the landfill.
- In the unsaturated subsurface zone (vadose zone) beneath and around the landfill.
- In the ground water (saturated) zone beneath and around the landfill and
- In the atmosphere / local air above and around the landfill.

The parameters to be regularly monitored are:

- Leachate head within the landfill

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- Leachate and gas quantity within the landfill
- Long – term movements of the landfill cover
- Quality of pore fluid and pore gas in the vadose zone
- Quality of ground water in the saturated zone
- Air quality above the landfill, at the gas control facilities, at building on or near the landfill and along any preferential migration paths.

The indicators of leachate quality and landfill gas quantity shall be decided after conducting a study relating to the type of the waste, the age of the waste, the waste composition of leachate and gas likely to be generated and the geotechnical as well as hydrological features of the area. All the monitoring programmes must first establish the baseline/ background conditions prior to landfill monitoring.

The frequency of monitoring shall be capable of detecting unusual event and risk in the initial phases. This will give time to identify, diagnose the cause and enable early steps to be taken for containment or remediation. Usually a monthly/ bimonthly monitoring frequency is considered suitable during the operational phase as well as for 3 to 4 years after closure. The frequency can be decreased to 2 to 3 times a year in later years, if all system performance satisfactorily. Monitoring frequency may have to be increased if concentrations of gases/leachate are higher (Usually during monsoon period) than expected are detected, if control systems are changed or if drainage system gets clogged/non- functional.

A monitoring programme must specify:

- A properly selected offsite testing laboratory capable of measuring the constituents at correct detection levels.
- A methodology for acquiring and storing data.
- A statistical procedure for analysis of the data.

The following instruments equipment shall be used for monitoring

- Ground water samplers for monitoring water in wells
- Leachate samplers for leachate monitoring within the landfill and at the leachate tank.
- Vacuum lysimeters, filter tip samplers, free drainage samplers, for leakage detection beneath landfill liner.
- Surface water samplers for collection of sample sedimentation basin.
- Down hole water quality sensors for measuring conductivity, pH, DO, temperature in leachate wells, ground water wells and sedimentation basins.
- Portable gas monitors for onsite monitoring of gases.
- Active and passive air samplers for monitoring ambient air quantity.

It is recommended that location of each type of instrument/ equipment shall be finalized in consultation with an expert on the basis of topography of the area and layout of the landfill. A minimum of 4 sets of ground water monitoring wells (one up –gradient and three down gradient) for each aquifer are considered desirable.

Quantitative parameter to be monitored will be;

- Leachate quantity;
- Gas quantity;
- Surface water run –off quantity and
- Cover system settlement quantities.

Qualitative parameters to be monitored will be:

- Leachate quality within the landfill (at the base)
- Leachate quality after treatment
- Groundwater quality (up gradient and down gradient)
- Surface water quality at the exit of landfill
- Gas quality within the landfill
- Air quality above the landfill and at gas vents
- Air quality at gas control facilities.

The regulatory limits for various parameters of quality will be prescribed by the regulatory authorities.

6.6.5 Bio-mining and bio-remediation plan for existing dumpsite

It has been observed during the field visit that there has been general practice of waste burning in the city and hence, no significant amount of accumulated waste could be found in any part of the city. The waste analysis at the existing dump site (which is a new site -only 4 years old) has also indicated very high amount of inert content (>55%), with have scope of bio-mining / or scientific closure.

6.7 Costing of sanitary landfill

Total capital investment for 5 years for constructing sanitary is attached in annexure. The cost of sanitary land fill is Rs. 541.73 Lakh

6.8 Closure of Existing Dump-site and Land Reclamation

DMC is generating approximately 168 tons of municipal solid waste (MSW) per day, which is mainly disposed in the open dumpsite near Verkhedi road which spreads in an area of 4.67 hectare. Currently, DMC disposes the entire waste generated at disposal site. This site is operating for the last 4 years. This site is still operating and receiving waste from all over DMC area.

It has been observed during the field visit and the contour level measurements done at site that there is huge quantity of waste accumulated at the waste disposal site where landfill is proposed. As per the Survey approximately 110000 cum waste is accumulated on the site upto general ground level. To construct the landfill site for the project it is necessary to start the bio mining process. The earth/soil recovered can be used for filling on the same land and for construction of bund for the landfill. The rejects shall be stored after bundling on the same site and shall be land filled in the same landfill. The recyclables recovered in the process of bio mining shall be sold.

The present dump site falls under the category of uncontrolled solid waste disposal facility. Due to this scenario, anaerobic decomposition of organic content of the waste is leading to landfill gas generation, comprising mainly of methane. As, this site is not scientifically managed, there is no control over the escape of the landfill gas into the atmosphere. Only 70% of material is recoverable as by product like material for earth filling, recyclables etc. Therefore, we are proposing to Bio-mining & landfilling of the waste of bio-mining.

Out of total area of 4.67 hectare, about 80% of the land is filled with waste. As per our proposal we shall close the existing waste after bio-mining for land reclamation to create space for construction of Landfill Facility.

6.8.1 Planning of Closure of Existing Dumpsite for Land Reclamation

Concept planning and re-contour and stabilize slopes so that a final cover can be installed. Reclamation of land is a relatively new approach used to expand municipal solid waste (MSW) capacity and avoid the high cost of acquiring additional land. Once it gets filled, the landfill must be closed and no solid waste should be received at the site.

To utilize the available space optimally after a detailed survey is proposing the reclamation at survey number 61 and 62 site near Verkhedi road in a scientific manner at disposal yard.

6.8.2 Quantity Assessment & Design Parameters

The existing dump site is located at 5 km from the city and is in operation since 2014. The quantity of existing waste in this dumpsite has been calculated by means of two methods.

By daily incoming waste data and by existing physical nature of the dump site, i.e. height, area and waste quality

Sr. No.	Description	Details
Method I for Estimation of Existing Quantity of the Waste		
1	Average quantity of waste disposed (MTD)	120
2	Period of disposal (Years)	4
3	Quantity of Waste accumulated (MT)	175200
4	Quantity of waste accumulated after degradation (moisture and volatile loss - 50%)	87600
Method II for Estimation of Existing Quantity of the Waste		
1	Area of waste dumped (Acres)	11.5
2	Average Height of the waste (m)	2.25
3	Volume of the waste (m ³)	104710
4	Density (MT/m ³)	0.85
5	Quantity of waste (MT)	89000
	Adopted Quantity of Waste (MT)	89000

As per our physical observation, we have adopted method II for scientific bio-mining and landfilling of the waste of bio-mining. Large quantity of waste is degraded and most of recyclable from the dump has been removed by rag pickers at site from many years.

Total area en marked for closure of existing waste is 1.0 Acres.

6.8.3 Environmental Conditions of Dump site

Presently the waste received, gets dumped without any treatment, which has resulted into huge accumulation of waste as mentioned above. The main issues pertaining to the environmental and aesthetic condition are as below:

- Ø Leachate Pollution
- Ø Air- Pollution- smoke, odour and others
- Ø Flying of waste such as plastic
- Ø Health hazards, breeding of flies and rodents

6.8.4 Reclamation and Reuse Plan

Presently the dump is spread over the site of 11.5 Acres and part of this dump has to be relocated for creating vacant land for establishing of new landfill facilities. Area requirement for establishing landfill facilities is estimated to be around 9.0 Acres. It is therefore, necessary to relocate existing waste over this area. The proposed procedure to relocate this spread of MSW is as follows.

Identify and earmark the area required for establishing the new facilities on the 11.5 acres layout.

Processing treatment of accumulated waste shall be done in following way. This flow is only for guidance, the process may change according to the site requirement and composition of the waste when actually work at site starts:

- Bioremediation treatment should done by dividing the site into suitable blocks of 100 sqm to 200 sqm.
- Volume of waste to be determined through contour survey and site measurements. Weighment of heaps is difficult and problematic as gaseous emissions could endanger operators especially when no treatment is done.
- Hence initial Contour level survey of the site has been done Final Contour level survey shall be done before final completion of the work.
- With the help of Back Hoe loader the waste in the demarcated area will be loosened up.
- Usually the top layer has several materials in the active biological state. This layer is to be stabilised through herbal/biological sanitizers and water.
- Raking of garbage layer through long spike harrow operating in cross directions is to be done regularly to pull out rags, plastic, rubber, textiles etc. big size of rags, plastic, rubber, textiles etc will be taken out with help of labours by manual means.
- This waste shall be accumulated by the labours at a designated place on the site. Initial cleaning of recyclable waste may be required before it is bundled for transportation for sale or disposal.
- The left over waste shall be formed into open windrows of suitable height and length with help of back hoe loader.
- Additives like bio culture, raw compost or cattle dung to be added as desirable microbial substrates for speedy fermentation of waste and achieving of thermophilic temperature range of 55 to 65 degree C.
- Since the waste is old garbage most of the organic matter has already been decomposed. After 7-10 days of stabilization the waste shall be taken up for screening.
- Coarsely material and garbage shall be screened through rotary/horizontal screens
- The recovered earth can be used for ground levelling, bund making of the new landfill to be constructed, base filling of the road, landscaping, gardening. Authority in consultation with other concerned departments should also find out a green area where this "soil enrichner" can be spread. This soil enrichner shall be tested intermittently about the ingredients before use.

- The stone, bricks, ceramics which are removed while screening and raking should be used as landfilling cover material and base preparation.
- The recyclables like plastic glass metal rags cloth recovered from the waste during screening shall be sort out manually. The waste thus collected shall be bundled. This waste may be used in cement plant refractory or for making fuel or can be directly sold.
- A part of site shall be clearly ear marked space for storage of recyclable and reusable materials which will be recovered from bioremediation process of accumulated waste.
- There will be left over waste including lump of heterogeneous nature. The waste may be hard or soaked with leachate which will be difficult to disintegrate, unusable plastics and rags. This waste shall be in tune of 30 % of the total waste. This waste should be stored until the landfill is ready and shall be landfilled in the same landfill. The recovered earth can be used for cover material.
- Any hazardous waste or e-waste or battery or any waste other than municipal waste should be sent to proper disposal facility for such type of waste. Like Hazardous waste should go to a Hazardous waste treatment and Disposal facility or E waste should go to a e waste recycling facility.

Requisite soil layer and vegetative solid layer will be laid over the final profile. Gas venting system will also be provided

The methodology for partial closure encompasses the following sub tasks /activities.

Sub Task –1: Estimation of Waste Quantity

Sub Task –2: Bio-mining and Relocation of waste

Sub Task –3: Provision of final cover system

Sub Task –4: Leachate extraction and collection net work

Landfilling of the waste of bio-mining at the site covered with a varied height shall be done by relocating and consolidating the waste on a footprint of proposed landfill area for bio-mined waste.

The depth of landfill has been considered keeping the ground water table at the site in to consideration. The height of the landfill is fixed at 10 m above Ground Level (GL) and 12 m below ground level considering the volume of waste to be dumped over a period of 25 years.

6.8.5 Costing of Bio-mining of existing waste

Table 6-16: Costing of Bio-mining of existing waste

Estimate for Biomining of old dumped 18 waste

S. No.		Particular	Unit	Rate in Rs.
1	MJP DSR SWM section processing and disposal B1	Cutting, Dozing and spreading of Municipal Solid waste as well as natural ground with the help of Dozer or any other suitable machinery/equipment and compacting the M.S.W/soil with the help of Dozer it self up to required line & level. Excess of waste cut will be shifted with in the plot as per instruction given by Engineer-In-Charge. The newly filled area must also be compacted with the dozer up to required compaction etc. complete as directed by Engineer- in-Charge .	cum	250.00
2	CPWD DSR horticulture and landscaping 2016	Screening of old garbage through rotary/ vibratory seive through sieve of minimum 20 mm.		170.70
3	MJP DSR SWM section processing and disposal B1	Supply and Spray of innoculant and biosanitiser in required quantity		44.00
4	DSR page no 486	TRANSPORTATION AND CARRIAGE OF MATERIALS By mechanical transport including loading , unloading and stacking approximately 1 km		111.33
			Total	576.03

Quantityof waste 89000 cum

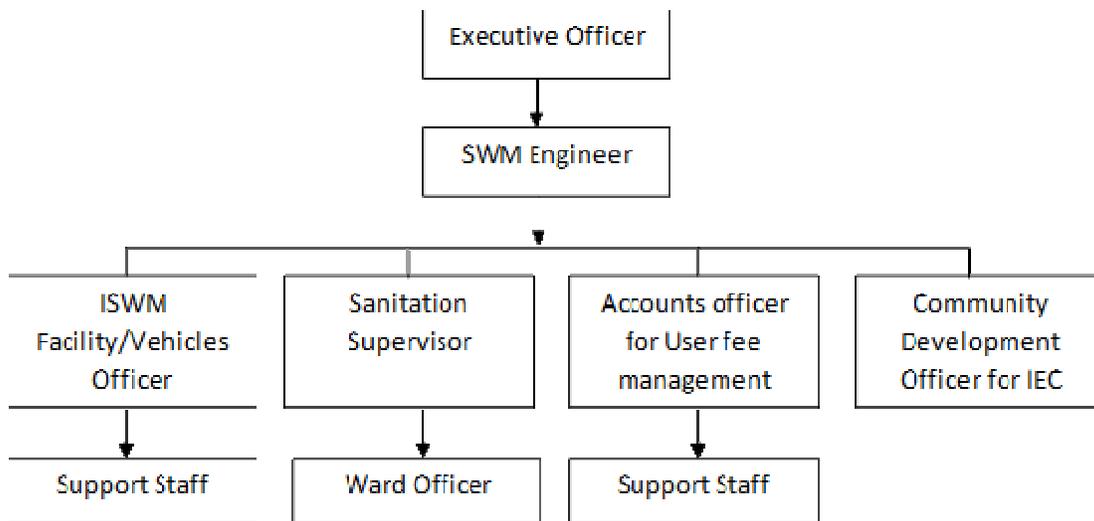
Amount 89000 x 576.03 = Rs. 51266670

Chapter 7. Institutional Aspects and Capacity Building

7.1 Introduction

The subject of solid waste management has remained neglected for the past several decades with the result that the level of service is highly inadequate and inefficient. For improving the solid waste management services it is essential to adopt modern methods of waste management, having a proper choice of technology, which can work in the given area successfully. Simultaneously, measures must be taken for institutional strengthening and internal capacity building so that the efforts made can be sustained over a period of time and the proposed system can be well managed. Institutional strengthening can be done by adequately decentralizing the administration, delegating adequate powers at the decentralized level, by including professionals into the administration and providing adequate training to the existing staff. NGO/private sector participation also needs to be encouraged to make the SWM services competitive and efficient.

7.2 Proposed Organizational Set-up



7.3 Decentralization of Administration

In the ULB, the SWM services can be performed effectively only if its administration is adequately decentralized at the ward level and prabhag level.

The SWM functions are proposed to be decentralized as under:

7.3.1 Ward Level & Prabhag Level Administration

The ward level administration should be fully responsible for ensuring storage of segregated waste at source, primary collection of waste, street sweeping and taking the waste to bulk community waste storage sites clearing debris and cleaning surface drains and public spaces. The cleaning of each street, lane by lane, markets and public space should be regularly supervised by the ward level supervisors. The presence of all SWM officers of the ward in the field during and morning hours is

most essential. A grievance redressal system should be put in place in each ward. Ward level efforts could be made in the following:

- Creating public awareness at the ward level
- Formation of Residents Association/ Neighbourhood Committees to ensure public participation in source segregation of recyclable waste and deposition of domestic waste in the handcarts on time during primary collection
- Involving school children to be watchdogs in preventing littering of streets by the people
- Interfacing with the people and officials and help in redressal of public grievances on SWM at the ward level
- Supporting the effort of cost recovery for the services rendered
- Encouraging NGO participation

7.3.2 City Level Administration

The city level administration should supervise and support the ward level administration. The SWM Department should be responsible for upkeep of vehicles, setting up and maintenance of processing plants as well as for managing the disposal sites in an environmentally acceptable manner.

The SWM department should also be responsible for the procurement of vehicles, equipment, and land for processing and disposal of waste. As a Head office it should take policy decisions and co-ordinate the activities of all the wards and be answerable to the chief executive officer and elected body for the efficient functioning of the department. It should look after the recruitment of manpower, human resources development and training, etc.

7.4 Training & Capacity Building

Human resources development is very essential for internal capacity building for any organization. Training, motivation, incentives for outstanding service and disincentives for those who fail to perform are essential for human resources development.

Concerted efforts should be made by the Municipal Council to inculcate among its officers and staff a sense of pride in the work they do and to motivate them to perform and give their optimum output to improve the level of services of the city and the image of the Municipal Council.

7.4.1 Special Training to Unqualified Staff

Unqualified supervisory staff should be given service training to qualify for supervising sanitation works.

7.4.2 Refresher Courses for Supervisory Staff

Refresher courses should be conducted for the supervisory staff at least every 5 years or they should be sent for training to get an exposure to advance in this field.

7.4.3 Work Norms

The sweepers may be assigned "Pin point" individual work assignments to the density of the area to be swept.

Similarly work norms may be prescribed for variety of vehicles used depending upon the distance to be travelled and the places to be covered. These norms may be prescribed after conducting time and motion study.

The norms of work for the supervisor may also be prescribed and monitored by the Municipal Council, for the extent of sweeping areas and the number of garbage collection points to be inspected watch day by the various levels of supervisors and inspection of processing and disposal sites etc. to ensure adequate output of the supervisory staff.

For capacity building of the department, senior officials should be frequently exposed to developments taking place in various parts of the State and Country by sending them out on city visits and to attend seminars, workshops and training courses. They should also be involved in all decision-making processes

7.5 Course Content for Training to Staff/Officers

A. Training to sanitation workers

- 1 Importance of sanitation in urban areas.
- 2 Present scenario of solid waste management system in the urban areas, deficiency in the system etc.
- 3 Impact of inefficient SWM services on health and environment
- 4 Impact of inefficient SWM services on the health of sanitation workers.
- 5 Inefficiency of tools and equipments used and loss of manpower productivity.
- 6 Need for modernization of solid waste management practices.
- 7 Options available for improving the services.
- 8 Advantages of using improved tools and equipments for primary collection of waste and street sweeping.
- 9 Need for synchronization of storage of waste of source, primary collection of waste and waste storage depots.
- 10 Proper upkeep of tools and equipments and waste storage depots.

B. Training to Sanitation Supervisors of Various levels

- 1 to 10 as per A above
- 11 Need for synchronization of transportation of waste with waste storage depot.
 - 12 Transportation of waste on day to day basis
 - 13 Waste processing and disposal options, advantages and disadvantages of various technologies.
 - 14 Sanitary land filling.
 - 15 Public and NGO participation in waste management.
 - 16 Building public awareness.
 - 17 Enforcement

C. Training for the officers looking after SWM Department

- 1 to 17 as per A & B above
- 18 SWM practices prevalent in other parts of the country and in the developed countries
 - 19 Institutional strengthening, internal capacity building and human resources development.
 - 20 Private sector participation in SWM
 - 21 Management information system
 - 22 Financial aspects
 - 23 Health aspects
 - 24 Legal aspects

D. Training modules of SBM

As a part of Swachh Bharat Mission (SBM) of GoI, an online e-portal has been created for training of municipal bodies. (<https://swachhbharat.cloudapp.net>). The portal draws from the

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leading practices in sanitation sector and introduces these to municipal functionaries who are at the forefront of delivering objectives of the Swachh Bharat Mission (SBM).

The various modules dwell into depth of each of the components of SBM and will be useful for officials of the state sanitation missions, city managers-engineers, administrators, field supervisors and sanitation workers in-charge of implementing SBM.

Successful completion will entitle the participant with a certificate from the Ministry of Urban Development, Govt. The ULB officials should be encouraged to complete the training modules of this portal.

The e-learning courses offered under this portal are as follows:

- i Municipal Solid Waste Management
- ii Individual Household Toilets
- iii Community and Public Toilets
- iv IEC and Public Awareness Program
- v PPP and Financing Sanitation
- vi Validated Sanitation Technologies

A certificate of completion is issued by the Ministry of Urban Development to the professional working in the government body, once the course is successfully completed.

Chapter 8. Community Awareness and Public Participation

8.1 Introduction

The success of any solid waste management scheme can be measured through the extent of co-operation of people, effectiveness of the proposed system and operational efficiency. While the effectiveness of the system and operational efficiency can be improved through HRD and capacity building, the co-operation of people can be achieved through Information, Education and Communication (IEC) techniques. During such campaigns, strategies for waste reduction, Reuse and Recycling (R – & – R) may also be propagated for deriving long-term benefits.

8.2 Status of Public Participation in SWM

Solid waste management is not on the priority list for general public. The general approach to SWM has been 'Out of Sight, Out of Mind' and 'Not in my backyard' attitude. Community participation is not very active. Segregation of waste at source is not practiced religiously by all public. Waste is burnt in the open to get rid of the smell and junk. Public participation can be considered negligible when it comes to Solid Waste Management.

Waste is disposed off carelessly into the environment. The afterthought of waste processing is not considered. Thus, waste often ends up on fertile soil and water bodies contaminating our environment. There are cases where waste ends up in our drains and clogs the drain resulting in an ample amount of wastage of resources and energy.

Also, waste management is not considered as a dignified job and there is lack of leadership in taking the system of waste management to a higher level. Thus, there are many loopholes in the system that needs to be corrected and catered to.

8.3 Essential Steps of Public Participation

The success of SWM depends on building meaningful partnership with the stakeholders. Active involvement of the following community groups is essential especially in primary collection:

- ❖ Resident Welfare Associations
- ❖ Hotel owners Association
- ❖ Hospital owners association
- ❖ Merchants union
- ❖ Diary owners association
- ❖ Builders (Building Contractors) Association

The ULB may organize the above groups through a series of interactive meetings with the office bearers before a phased programme for community awareness is launched.

NGOs can provide support in:

- ❖ Awareness creation programmes
- ❖ In developing pilot programmes
- ❖ In organizing door – to – door collection systems
- ❖ In setting up local processing units

Community awareness programme have to focus on:

- ❖ Awareness of the perils of the present practice, their role in keeping the surroundings clean.
- ❖ Not to litter on streets
- ❖ Storage of waste at source in two bins in a segregated manner
- ❖ Primary collection from doorstep
- ❖ Popularizing 4R strategy – Reduce, Reuse, Recycle, Recovery
- ❖ Discourage use of plastics
- ❖ Developing methodology for reaching schools to create awareness among children

8.4 Public Information, Education, Communication Programs (IEC)

For the successful implementation of any program involving public at large in SWM system, it is essential to spell out clearly and make them known the manner in which local body proposes to tackle the problem of waste management and extent to which public participation in Solid Waste Management is expected to keep the city clean and improve the quality of life in the city.

Based on the recommendations by the various government agencies, and the SWM Rule, 2016, the approach to an IEC plan could be:

- Organize the safaimitra, train them for providing professional services in field of Solid Waste Management.
- Provide safaimitra training and other capacity development to guarantee efficient, quality and timely waste management services including door to door collection of waste.
- Mobilize resident communities and bring awareness to segregate the waste and not to throw or dump waste in back-lanes and open plots
- Execute Awareness and information campaigns, organize SBM thematic drives, meetings etc. as instructed by officials and Consultant
- Training of field staff of ULB in solid waste management and door to door collection, route rationalizing of vehicles and it's planning and get it approved from officials and consultant.
- Awareness and training for segregation of waste at source to the citizens and staff of the ULB, organise meeting in consultation with Ward Corporator and RWA on weekly basis
- Promote primary collection, secondary collection of waste and cleaning of entire ward area i.e. door to door collection in assign wards, collection and removal of road side waste dumps, collection and cleaning of waste bins, cleaning of drains and nallahs and cleaning of entire ward area and back-lanes.
- Identification of open defecation points in the wards, creating awareness involving RWA, local residents, female groups, children and helping ULB to make the wards ODF, identification of locations for constructing new community /public toilets, suggest up gradation if required in existing community /public toilets. Filling up of application forms for constructing house hold toilets in the wards.
- Report weekly to the ULB officials and Consultant

The activity schedule is given below:

S.no	Activity	Sub Activity
1	Preparation and Designing promotional	Designing of SWM Flex and hoardings
		Designing of SWM Pamphlets

	materials	SWM Voice Recording Based on local theme
		Designing of SWM Uniform
		Designing of SWM Small Hording and promotional material
		Perform SWM Street Play
		Vehicle Route Planning as per MSW rules
		Logo Designing
		Share with the ULB Team and get approval for the same
2	Meeting with all stakeholder of Solid Waste Management activities	Meeting with Local Corporator and citizens to organize SWM campaign
		Meeting with Social and Youth Groups and organize SWM campaign
		Meeting with School and colleges and organize SWM campaign
		Meeting with Market Associations and organize SWM campaign
		Meeting with Municipal staff and organize SWM campaign
		Share and promote waste management video/best practices
		Organize rally with RWA for SWM weekly
		Meeting with women's group and self-help groups
		Pamphlet distribution at HH level and performing street play
3	Door to Door Waste Collection	HH/Shops and Public awareness for Uses of two/three dustbin for segregation of MSW
		HH /shops and other common places information Collection
		HH Awareness for Waste Segregation
		Promote D to D Waste Collection with segregation
		Training of Safaimitra for Door to Door waste collection
		Feedback and Suggestion from Stakeholder
		Report Preparation and sharing with the ULB weekly
4	Street Cleaning	Information collection of all Roads/Markets areas
		Study of Present system
		Design route map for proper cleaning in consultation with the ULB
		Training of Safaimitra for street cleaning. Help in Assigning

		responsibility to SafaiMitra with time scheduling
		Promote safaimitr for street cleaning on daily basis
6	Drain Nali Cleaning	Information collection of all Nalis and Drain
		Study of Present system
		Design route map for proper cleaning of drains
		Training of Safaimitra for Nallah and Drain cleaning
		Assign responsibility to SafaiMitra
		Strat Drain Cleaning on daily basis
		Proper collection of nali and drain waste. Assign responsibility to SafaiMitra
		Take 2 person sign daily from HH in each row / lane of every ward
7	Preparation of Progress report and submission to Nagar Nigam	Preparation of Qualitative report for each ward on monthly basis and its submission to the ULB
		Preparation of Quantitative report for each ward on monthly basis and its submission to the ULB
		Preparation of Budget Utilization report for each ward on monthly basis and its submission to the ULB
8	Making Wards Open Defecation Free	Identification of open defecation points in the wards
		Creating awareness involving RWA, local residents, female groups, children and helping the ULB to make the wards ODF
		Identification of locations for constructing new community /public toilets, suggest up gradation if required in existing community /public toilets
		Filling up of application forms for constructing house hold toilets in the wards.

Stop land filling or dumping of mixed waste soon after the timeline as specified in Rule for setting up and Citizens co-operation is vital to reduce, reuse and recycling of waste and in keeping garbage off the streets, by keeping biodegradable “wet” kitchen and food wastes unmixed and separate from recyclable “dry” wastes and other hazardous wastes. Their participation in primary collection of waste, using community bins for storage of waste generated in multistoried buildings, societies, commercial complexes and slums is also essential. If the reasons for doing so are explained, public participation is bound to improve.

8.5 Capacity Building in MSW Management

The communication material developed should be utilized in public awareness programmes through variety of approaches as under:

Group Education:

This may be done through:

- i) Group meetings in the community
- ii) Workshops
- iii) Exhibitions
- iv) Lecture series
- v) Panel Discussions, etc.

Mass Education:

This is very essential to cover the entire population as it is not possible to reach all the people through group education programs.

Mass Education programs can be planned using following methods of communication.

- i) Use of Print Media
- ii) Use of TV / Cable TV / Radio/Web Site
- iii) Use of Cinema Halls
- iv) Street Plays, Puppet Shows, etc.
- v) Posters
- vi) Pamphlets
- vii) Use of Hoardings
- viii) Use of Public Transport System
- ix) Use of School Children
- x) Primary School Curriculum to cover the subject
- xi) Involvement of National Cadet Corps (NCC), National Social Service (NSS) and Scouts
- xii) Involvement of Religious Leaders
- xiii) Involvement of Medical Practitioners
- xiv) Involvement of Mahila Mandals/Women Associations
- xv) Resident Associations
- xvi) Voluntary Organizations/NGO involvement

According to SWM Rules, 2016, all manufacturers of disposable products such as tin, glass, plastics packaging, etc., brand owners or marketing companies shall educate the masses for wrapping and disposal of their products.

8.6 Stakeholder Consultation

S. No.	Target Group	Action Plan
1.	Local influential/community leaders	Holding of locality wise meetings and group discussion with local influential, whereby the extent of societal problems of solid waste, related physical and humane factors, the consequent health hazards and the possible remedial measure are highlighted through the talks and technical presentation by the experts and social workers.

S. No.	Target Group	Action Plan
2.	Local NGOs	Motivating and advising local NGOs to participate in planning execution and follow up efforts of community action plans for ensuring a clean and healthy community life through litter free town.
3.	School teachers and students	Promoting schools as models of clean living and healthy environments and training school teachers and students as motivators and informal change agents for involving families and communities in segregation of waste at source and strategies for waste reduction. Reuse and recycling (R-&-R).
4.	Elite Group and Organizations like Rotary Clubs, Lions Club, Association and forums of writers and artists etc.	Motivate local influential people like leading businessmen, industrialists, office bearers of the elite clubs like Rotary, Lions, Junior Chamber of Commerce, local chapters of FICCI to undertake or sponsor such activities as solid waste management services through an effective strategy of public private partnership for improving sanitation conditions.
5.	Political / Religious Leaders	Motivate local MLAs and MPs and leaders or political parties to participate actively in the promotional efforts of community involvement for solid waste management scheme against the hazards of pollution, an effort which shall pay them abundantly through the building of possible public opinions.
6.	Representatives of media viz, Editors/Correspondents of local press any key functionaries of local radio and TV stations	Launching of mass campaign for educating and motivating local community and families about the need to have on site sanitation facility like community toilet complexes at the public places and household toilets at the family level.

8.7 CSR Initiatives

Corporate Social Responsibility is a management concept whereby private and community organizations integrate social and environmental concerns in their business operations and interactions with their stakeholders. CSR is generally understood as being the way through which a company achieves a balance of economic, environmental and social imperatives ("Triple-Bottom-Line- Approach"), while at the same time addressing the expectations of shareholders and stakeholders. – UNIDO Definition

CSR Initiatives are being proactively considered by Indian as well as multinational organizations. However, in a place like Dhule where there are pre-dominantly small and medium sized industries, their participation may be a little difficult. However, initiatives by them can be explored by mediation

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by local NGOs. They could facilitate some initiatives in terms of creating awareness amongst the public, supporting training programs for welfare associations and distribution of bins to the slums and weaker sections of the society.

The CSR opportunities can be explored on state-level industries and approached for SWM Systems.

Chapter 9. Other O & M Aspects

9.1 Management Information System

Collection and analysis of data related to MSWM is required to assess the existing situation and propose adequate measures for improving service delivery. Management information system (MIS) is a computerised system which can help capture, store, and retrieve data or information for decision makers. MIS can manage large amounts of data such as waste collection points, location of bins, designated secondary storage points, ward level vehicle movement, information on transportation of waste and its weightment. MIS helps in establishing a strong and reliable information database necessary to facilitate planning, midcourse corrections, and decision making. It enhances transparency and accountability of officials in the MSWM system. Information is the foundation of an MIS system. Therefore, for any ULB to have a sound MIS on solid waste management, it should have a good compilation of basic information ranging from a ward to a city level. Details on the minimum data requirement to establish a MIS is elaborated in Figure 9.1. Essentially all the information that was earlier kept and updated manually in the ULB has to be now available electronically. Creation and maintenance of such information and database is not very resource intensive and requires basic technical expertise at the ULB level.

ULB need to maintain a basic MIS system either through manual records or electronically. Once this system has been established, level two is to connect this basic database on solid waste to be analysed through map based tools and applications. The use of integrated technologies over the basic MIS system such as geographic information systems (GIS), global positioning system (GPS), radio frequency identification (RFID), and general packet radio services (GPRS) have resulted in the development of integrated and comprehensive solutions for MSWM. GIS and remote sensing imageries (visual capture of information using cameras) are now being integrated with MIS to provide spatial and visual validation for provision of services. A GIS system is actually a visual representation of information (attributes) on maps which are geo-referenced (show location coordinates). Data collected for monitoring and evaluation (M&E) of MSWM systems can thus be linked to the geographical locations on a map created in the GIS system. Data on maps can be used to analyse the spatial information and identify patterns, trends, and relationships in the existing information. GIS systems are useful in planning for door-to-door collection, waste transportation routes, location for waste collection bins, etc.

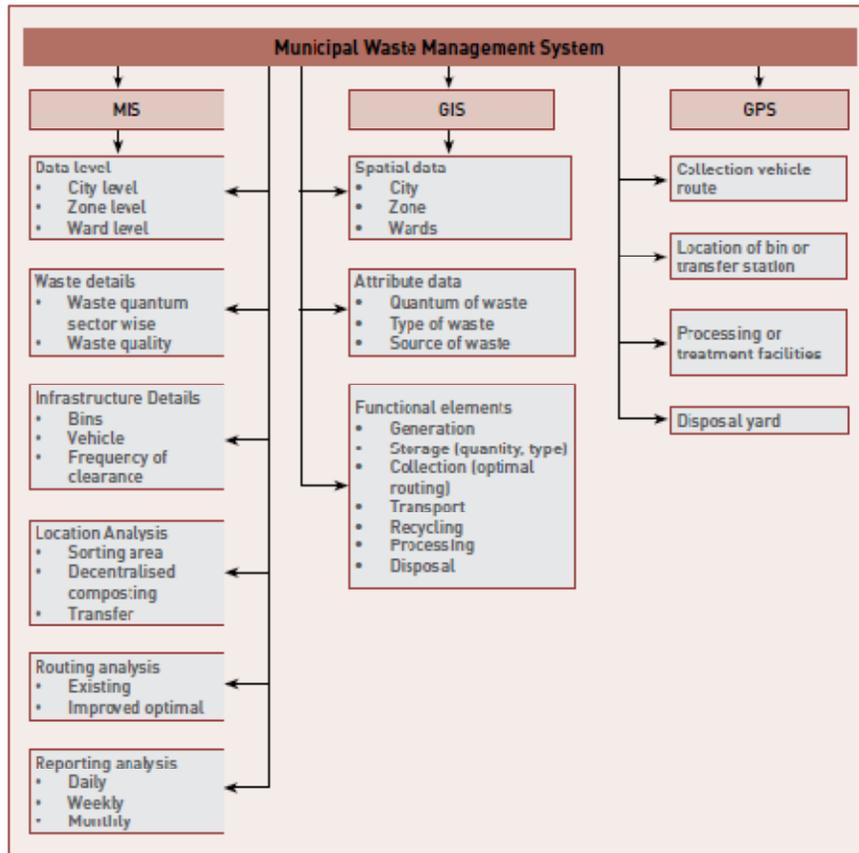
Once the GIS has been linked to the MIS, the system can be further advanced to show real-time spatial information captured through a global positioning system (GPS), e.g., real-time data regarding vehicle movement, secondary collection bin pickup, and transportation to processing and disposal sites can also be linked to the GIS system. Waste transport vehicles may be fitted with a GPS linked to the GIS system to enable real-time monitoring of vehicle movement.

In several advanced MIS systems, radio frequency identification (RFID) tags are used to identify equipment. These are electronic tags which can carry preloaded information specific to the equipment they are tagged to, e.g., secondary collection bins. Electronic scanners equipped with the general packet radio services (GPRS) technology can scan these tags and relay information to the GIS system, whereby all necessary information fed into the GPRS unit with regard to the equipment is updated automatically. GIS is then used to check the location.

Thus linked with GPRS or RFID systems, GIS provides real-time data on vehicles, collection of waste, bin pickup, and transportation of waste to treatment or disposal facilities.

These systems are now being suitably adopted by cities to improve service efficiency of MSWM. Minimum data requirements for an effective MIS–GIS–GPS system are shown in Figure 9.1.

Figure 9-1: Minimum Data Requirement for MIS, GIS and GPS Systems



9.1.1 Benefits of These Systems Include the Following:

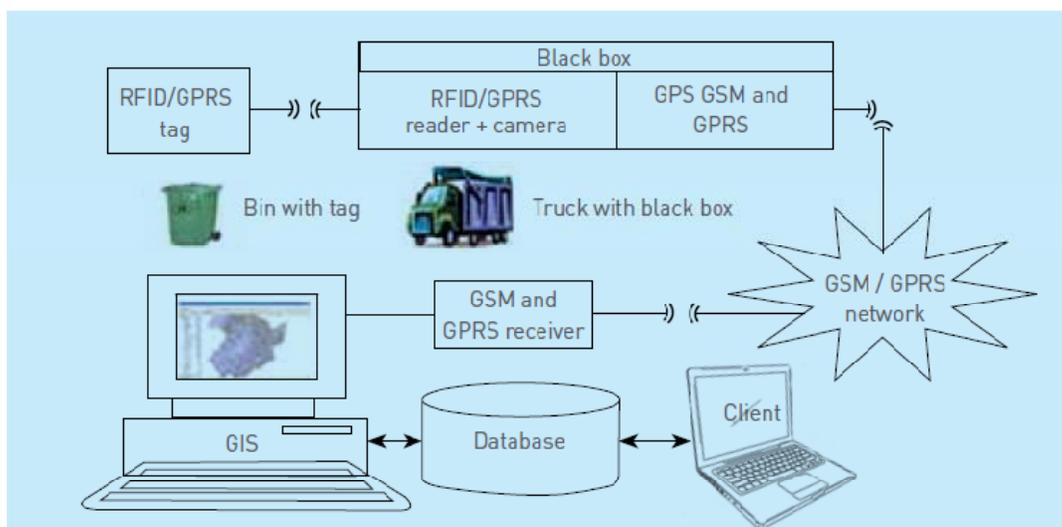
Data aggregation and process monitoring are managed electronically, avoiding daily human intervention, thereby increasing reliability and transparency of information and helping in resolution of disputes among citizens, contractors, and officials.

Effective and timely complaint redressal of grievances is generated through online monitoring system.

Movement of vehicles and tracking of average stoppage time may be monitored in real time by using a surveillance system based on GIS and or GPS technologies, thereby reducing noncompliance and enhancing efficiency.

Status of evacuation of bins on a daily basis can be monitored through RFID and or GPRS, facilitating increase in service efficiency and decrease in customer complaints.

Figure 9-2: Municipal Solid Waste Monitoring and Management System



9.2 Complaint Handling System

A complaint redressal system creates a platform for citizens to voice their complaints and grievances regarding provision of MSWM services and also helps in promoting efficiency and transparency at the ULB level. The ULB, through an analysis of the complaints or grievances it receives, is able to identify lacunae and bridge gaps in service delivery. The time taken for resolution of grievances and the action taken are also monitored and recorded through this system. Typically, ULBs have a common complaint redressal system for all municipal services.

A complaint redressal system is effectively supported through the introduction of a citizen charter. The citizen's charter is a written voluntary declaration by a ULB with the basic objective to empower the citizens to get public service in a given time frame.

The Citizen's Charter includes:

- information on municipal services and expected outcomes,
- municipal service delivery standards,
- response time for rendering services or redressing grievances,
- information dissemination process on the complaint redressal process, and
- Contact details of officers responsible for provision of the various municipal services.

The citizen's charter should be prepared by the ULB and officially adopted by the municipal council and widely publicised. Urban development or local government departments may prepare a model citizen's charter to be adopted by all ULBs in the state after preparing city-specific citizen's charters for their own city.

9.2.1 Elements of a Complaint Redressal System

Typical elements of a complaint redressal system include the following:

1. Complaint management system: A computerised central complaint management system should be networked and the complaints could be recorded through a register. A grievance redressal officer from the MSWM department or cell at senior level should be responsible for recording and monitoring the complaints and also for taking necessary actions for redressal.

2. Medium of complaint registration: Multiple channels or a combination of different channels may be adopted for receiving complaints, e.g., phone calls to a centralised customer service or complaint number, SMS messages to notified mobile numbers, automated generated complaints sent to commissioners for their records, walk-in complaint registration, and online complaint registration.

3. Complaint registration and recording system: This system should

- assign a unique ID to each complaint generated;
- record contact details of the complainant;
- record details of the physical location (zone, ward, area) relevant to the complaint;
- assign the complaint to the concerned official in the MSWM department or cell;
- record the stipulated time within which the complaint shall be redressed;
- provide an acknowledgement receipt to the complainant with all the above details, in case the complaint is registered manually or online; and
- Provide a complaint reference number with an SMS of registration to telephone-based complainants.

4. Resolution certificate: Field officers, after resolving the complaint, should take resolution certificate from the complainant and subsequently inform the complaint cell. The complaint shall thereafter be treated as resolved.

5. Complaint resolution and feedback: The designated official for complaint resolution in the MSWM department or cell shall be made aware of received complaints on a daily basis. Feedback could be taken through telephone, internet, SMS.

6. Pending complaints: Complaints which are not resolved in stipulated time shall be deemed pending. The reason for the pending complaint should be recorded and the designated officer and the complainant should be duly informed. Such pending complaints should automatically be escalated to higher officials for monitoring and directions.

7. Reporting and complaint analysis: A daily status report of complaint redressal should be prepared by an officer and submitted to the higher officer-in-charge for further directions. The complaint management system should generate periodic, area-wise reports on number of complaints received, nature of complaints, time taken for resolution, etc. The report should highlight the critical issues such as most frequently received complaints, frequently delayed responses, repetition of complaints (if any), time for resolution of complaints, etc. The weekly analysis of all complaints received should be reported to the Head of Municipal Council. Status of the complaints should be put in public domain and updated on a daily basis for ensuring transparency of the system.

9.3 Environmental Health and Safety Aspects

Apart from providing a sustainable solution to waste management, this system has many direct as well as indirect social, health and environmental benefits

Aspects	Description
Environmental Health	
Environmental Improvement	<ul style="list-style-type: none">• No dumping of waste on ground and open areas• Covered waste handling, to prevent spreading of foul odour at collection points• No open burning of MSW• Recycling of MSW

	<ul style="list-style-type: none"> • Composting of biodegradable waste • Development of sanitary landfill • In the long run, lower pollution levels would ensure cleaner environment and improve the ambiance of the cluster
Improvement in soil fertility	<ul style="list-style-type: none"> • Composting provides the dual benefits of generation of revenue for the system and restoring fertility to the soil • Does not carry harmful chemicals
Pollution Reduction	<ul style="list-style-type: none"> • Based on 4R principle (Reduce, Reuse, Recycle and Recover)
Health and Safety Aspects	
Improved Health	<ul style="list-style-type: none"> • Workers are trained in the appropriate techniques of waste handling • Reduction in spread of diseases, lower emissions, improved ground water quality and soil fertility • Reduced exposure to waste • Segregation of wastes and inspection prior to land filling will ensure that hazardous waste are not mixed with the MSW • Elimination of road side disposal would reduce the health hazards caused due to open decomposition
Safety Measures	<ul style="list-style-type: none"> • Implementation of the proposed strategy would result in safe disposal of MSW. Safety standards implemented at multiple levels, would result in safer working conditions for the waste collectors • Providing protective gear to waste collectors would prevent injuries when in contact with unsafe waste disposed

9.4 Post Closure Stabilization, Operation and Care

9.4.1 Long –Term Vegetative Stabilization

If a landfill cover is intended to be used for a specific purpose e.g. park or golf course or vehicle parking area, then the cover shall be stabilized in such a manner that the end –use is achieved. However, if no specific end –use is envisaged, then long – term vegetative stabilization will be undertaken to return the land to its original and natural vegetative landform.

Vegetation is by far the most common and usually the preferred stabilization option after closure of landfills. A self –perpetuating vegetative cover when established, not only minimizes wind and water erosion, but also provides the landfill some semblance of its original appearance and Land use by natural process within a reasonably short period.

Typically, vegetation efforts follow a series of steps. While the specific procedures are unique to each landfill and climatic regime, the following are usually representative element of the process:

Seedbed Preparation: Seedbed Preparation is necessary to set the stage for establishment of the short-term community. Initial operations may include grading, furrowing, or grouping to enhance microclimate and addition of nutrients and soil amendment, if required.

Short Term Vegetation: It is common practice, in both humid and dry environments, to rely largely on grasses for the primary source of short- term land cover. Usually several species are included in the initial seeding mixture to increase diversity and reduce the chance of total community failure. Short-term vegetation is usually by irrigation.

Long Term Vegetation: To achieve the ultimate goal of attaining a self-sustaining and stable community, a transition between short – term and long term vegetation must occur. In some cases, this may be left to invasion by native species after short– term vegetation is assured and soil development is well under way. In other cases –example, when irrigation has been used temporarily to establish the short –term community- it may be necessary or desirable to enhance the natural succession process by replanting with a more diverse mix of species suited to the next stage of community succession, such as shrubs.

Several factors limit the growth of plants on landfills. These include toxicity of landfill generated gases (methane and carbon dioxide) to root systems, low soil oxygen due to heavy compaction, thin cover layer inhibiting root penetration, low nutrient status of cover soil, high soil temperatures and poor soil structure. Some of these factors can be eliminated or their effect on plant growth reduced.

9.4.2 Closure and Post Closure Maintenance Plan

Determination of the end-use of landfill site is essential to decide the measures of closure and post – closure maintenance. Some of the uses of closed landfill sites near urban centers include park, recreational area, golf courses, vehicle parking area and sometimes even commercial development.

A closure and post closure plan for landfill involves following components.

- Plan for vegetative stabilization of the final cover
- Plan for management of surface water runoff with an effective drainage system.
- Plan for periodical inspection and maintenance of landfill cover and facilities.

9.4.3 Operation after closure

The following facilities will be operated routinely after closure:

- Leachate management system
- Surface water management system
- Environmental monitoring system;
- Cover rehabilitation and repair system;

The operating methodology will depend on the type of system adopted at the landfill.

9.4.4 Landfill Monitoring

The objective of an environmental monitoring system is

- To find out whether a landfill is performing as designed
- To ensure that the landfill is conforming to the regulatory standards

Monitoring at a landfill site is carried out in four zones.

- On and within the landfill.

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- In the unsaturated subsurface zone (vadose zone) beneath and around the landfill.
- In the ground water (saturated) zone beneath and around the landfill and
- In the atmosphere / local air above and around the landfill.

The parameters to be regularly monitored are:

- Leachate head within the landfill
- Leachate and gas quantity within the landfill
- Long – term movements of the landfill cover
- Quality of ground water in the saturated zone
- Air quality above the landfill, at the gas control facilities, at building on or near the landfill and along any preferential migration paths.

The indicators of leachate quality and landfill gas quantity shall be decided after conducting a study relating to the type of the waste, the age of the waste, the waste composition of leachate and gas likely to be generated and the geotechnical as well as hydrological features of the area. All the monitoring programmes must first establish the baseline/ background conditions prior to landfill monitoring.

The frequency of monitoring shall be capable of detecting unusual event and risk in the initial phases. This will give time to identify, diagnose the cause and enable early steps to be taken for containment or remediation. Usually a monthly/ bimonthly monitoring frequency is considered suitable during the operational phase as well as for 3 to 4 years after closure. The frequency can be decreased to 2 to 3 times a year in later years, if all system performance satisfactorily. Monitoring frequency may have to be increased if concentrations of gases/leachate are higher (Usually during monsoon period) than expected are detected, if control systems are changed or if drainage system gets clogged/non- functional.

A monitoring programme must specify:

- A properly selected offsite testing laboratory capable of measuring the constituents at correct detection levels.
- A methodology for acquiring and storing data.
- A statistical procedure for analysis of the data.

The following instruments equipment shall be used for monitoring

- Ground water samplers for monitoring water in wells
- Leachate samplers for leachate monitoring within the landfill and at the leachate tank.
- Vacuum lysimeters, filter tip samplers, free drainage samplers, for leakage detection beneath landfill liner.
- Surface water samplers for collection of sample sedimentation basin.
- Down hole water quality sensors for measuring conductivity, pH, DO, temperature in leachate wells, ground water wells and sedimentation basins.
- Portable gas monitors for onsite monitoring of gases.
- Active and passive air samplers for monitoring ambient air quantity.

It is recommended that location of each type of instrument/ equipment shall be finalized in consultation with an expert on the basis of topography of the area and layout of the landfill. A minimum of 4 sets of ground water monitoring wells (one up –gradient and three down gradient) for each aquifer are considered desirable.

Quantitative parameter to be monitored will be;

- Leachate quantity;
- Gas quantity;
- Surface water run –off quantity and
- Cover system settlement quantities.

Qualitative parameters to be monitored will be:

- Leachate quality within the landfill (at the base)
- Leachate quality after treatment
- Groundwater quality (up gradient and down gradient)
- Surface water quality at the exit of landfill
- Gas quality within the landfill
- Air quality above the landfill and at gas vents
- Air quality at gas control facilities.

The regulatory limits for various parameters of quality will be prescribed by the regulatory authorities.

9.4.5 Periodic Inspection and Maintenance

Periodic inspection and routine maintenance at a closed landfill site shall be carried out for a period of 15 year after closure. The following components of a closed landfill are inspected visually after landfill closure to confirm that all functional elements are working satisfactorily. A maintenance schedule with specified reporting formats is drawn up after each inspection.

9.4.6 Cover System

The final cover is inspected 2 to 4 time a year

- To check that vegetation growth is occurring satisfactorily and that plants are not showing stunted growth,
- To detect if any erosion gullies have been formed thereby exposing the barrier layers,
- To earmark depressions that may have developed with time and
- To identify ponding of water on the landfill cover. At least one inspection shall be carried out during or immediately after peak of the monsoon season.

Closed landfills show significant settlement. Rectification measures must not only re-establish the initial slope of the cover (for proper surface water runoff) but must also ensure that all the components of the landfill cover system continue to perform as originally envisaged. Adequate equipment and funds shall be allocated for post closure maintenance work in the form of soil filling re-grading the cover and re-vegetating the landfill cap.

In areas where extensive erosion gully formation is observed, filling of cover material, regarding of cover slopes and re-vegetation must be routinely undertaken.

9.4.7 Surface Water Drainage System

The surface water drainage system shall also be inspected 2 to 4 times a year.

- To identify cracks in drains due to settlements
- To delineate clogged drain requiring immediate clean up and
- To study the level of deposited soil in the storm water basin and initiate excavation measures.

9.4.8 Gas and Leachate Management System

Periodic inspection of the gas and leachate collection system shall be undertaken to identify broken pipes, leaking gas (if any) and damaged or clogged wells/ sumps. Repair work for gas and leachate management system requires skilled man power and shall be carried out by the agencies operating the gas treatment and leachate treatment facilities. One may often have to install new gas extraction and leachate collection wells if the damaged/ clogged facilities are inaccessible and irreparable.

9.4.9 Environmental Monitoring system

Ground water monitoring wells, air quality monitoring system and vadose zone monitoring instruments shall be periodically inspected to check satisfactory functioning of the systems and to ensure good health of all well caps and sampling ports.

Environmental monitoring system shall be maintained during the entire post – closure period as per the requirements of the local environments regulatory agencies. Wherever possible, monitoring instruments shall be periodically recalibrated. Sample devices shall be routinely detoxified and checked for proper functioning of the opening and closing of valves or springs loaded mechanisms.

9.5 Landfill Quality Assurance and Quality Control

Quality Assurance plan shall be prepared for each stage of the land filling process, accordingly the quality shall be controlled to ensure:

- The landfill design of a high standard.
- Effective mechanisms are in place to ensure construction and operation to design parameters.
- Documentation is carried out during design, construction, operation, closure, monitoring and post closures care for purposes of satisfying regulations and legal liability.
- Public has access to and is aware about the acceptability of land filling quality.

An independent engineer shall oversee the implementation of QC programme. Advice may be taken from a Quality Assurance Agency for incorporation of quality control conciliation in award of contracts relating to siting, planning, design, construction, operation, monitoring and maintenance

9.6 Environment Mitigation Measures

Environment mitigation measure addresses all the adverse environmental impacts of the proposed facility. This would also include the social and health and safety issues.

Service	Risk Involved	Mitigation Plan
Collection	Waste spillage by stray animals	Covered bins
	Removal of recyclables by rag pickers	Waste collected by primary collection vehicles directly transferred to refuse compactors, which transfer the waste to the landfill site, thus ensuring minimum ground touch during the collection and transportation.
	E-waste, hazardous waste getting mixed with household waste	Separate collection vehicles for e-waste and hazardous waste
	Huge emissions while operating the vehicles in highly dense areas	Rickshaws will operate in highly dense areas and hence contribute to emission reduction
	Spillage of waste around collection bins	Waste will be majorly collected from each household and the collection bins will only be used for waste collected from street sweeping as

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Service	Risk Involved	Mitigation Plan
		well as pedestrian waste
	No door-to-door collection of waste	Propose a plan for door-to-door collection of municipal solid waste by also charging user-fees and penalty for irresponsible disposal of waste
	Nuisance due to location of waste collection bins. During the monsoon the waste may mix with the runoff and may potentially create unhygienic conditions around the site	Covered collection bins are proposed and are placed on a slightly elevated impervious areas
Storage at Satellite Stations	Spillage of waste during unloading and loading	Solid and covered platform must be made and proper equipments should be provided to handle the waste
	Delay in tertiary transportation due to some unavoidable issues	Provisions must be made at the satellite station to store the waste for a few more days in any emergency, especially for wet waste
Transportation	Waste Spillage while transportation	Transportation in covered vehicles
	Non-collection of waste in a particular region due to non-functioning of any vehicle	Centralized GPS monitoring as well as stand-by vehicles will ensure that the waste is collected as schedules
	Spillage of waste while transferring waste to refuse compactors manually	Auto-tippers will transfer the waste to the refuse compactors
Segregation	Poor segregation resulting in poor collection of recyclables	Automatic segregator will ensure efficient segregation
	Theft of recyclables from segregation unit	Segregation unit has been planned in the centralized landfill site with proper boundary walls
	Odour nuisance	De-odorizers in place to maintain
Disposal & Landfilling	Landfill site being accessed by stray animals	Landfill site provided by boundaries to prevent this
	Leachate contaminating the ground water as well as downstream water courses	Proper leachate collection system is planned; further landfill site not close to any water body
	Landfill site prone to frequent fires	Gas collection system provided to reduce the leakage of methane and hence prevent fires; further fire hydrants provided at the landfill site
	Contaminated air at the landfill site	Ambient air quality in and around the landfill site to be maintained
	Loss of amenity, aesthetics, property values to neighbours	Landfill site lies at more than 250 metres from any residential establishments
	Odour Nuisance	Adequate buffer in the form of green belt to be provided
Safety of manpower involved in operations	Health and safety hazards to workers during waste collection, transportation and at compost and disposal site	Occupational Safety Plan shall be prepared. This shall include: (i) provision of personal protection equipment such as gloves, boots, (ii) Eliminating manual handling of waste; and (iii) Training of workers on safe handling of waste

Chapter 10. Cost Estimates Summary

10.1 Introduction

In this chapter, the project cost details for Dhule Municipal Council is provided including the details of capital investment and annual O&M cost. The cost details are provided as per the current value of rupee without any inflation. The costing of the project has been done for the next 25 years.

10.2 Cost Estimates for Collection and Transportation

For waste collection & transportation system in the ULB, an estimate of **Rs. 951.48 lakh** has been made during first year of the project, with the details of unit rate, number of equipment needed every 5 year, as provided below:

Table 10-1: Cost Estimates of C&T system

Year	2017	2022	2027	2032	2037	2042
Total Auto Tippers required by ULB	79	84	89	95	100	103
cost of four wheel auto tippers @ Rs 625000 per unit, Rs lakh	493.75	525	556.25	593.75	625	643.75
Hand carts requirement	166	183	201	221	243	267
Cost of containerized Hand Cart for garbage Collection @ Rs 9600/ per unit, Rs lakh	15.9	17.5	19.3	21.2	23.3	25.7
Road side litter bins	400	440	484	532	586	644
Total Road Side Twin litter bins required for commercial area @Rs.6332 per unit, Rs.Lakh	25.33	27.86	30.65	33.71	37.08	40.79
TOTAL (Rs, lakh)	535.01	570.39	606.18	648.67	685.41	710.21

10.2.1 O&M Expenditure

The O&M cost for the proposed project is evaluated in terms of manpower requirement for providing the SWM services, maintenance expenses of the equipment and operations cost as fuel cost, etc.

Table 10-2: O & M Expenditure for C & T

YEAR	Annual O& M Cost for C&T (Rs)					2041
	2017	2022	2027	2032	2037	
Vehicles required	79	84	89	95	100	103
Cost of vehicle in lakh	573.54	602.21	632.32	663.94	697.14	731.99
manpower required	280	262	277	295	310	319
Manpower salary	40320000	37728000	39888000	42480000	44640000	45936000
Fuel	8650500	9198000	9745500	10402500	10950000	11278500
Maintenance of vehicles	6882480	7226604	7587934	7967331	8365697	8783982
Uniform and PPE for staff	280000	262000	277000	295000	310000	319000
TOTAL O&M COST	56132980	54414604	57498434	61144831	64265697	66317482

Manpower costs: The manpower has been considered to carry out various intended services. Around 280 people would be needed to carry out the C&T activity in the first year of the project. **In the year 2017 the O & M cost for C& T works out to be Rs. 56132980 which is Rs. 935 per ton of waste.**

Table 10-3: Manpower Requirement

No. of Persons needed for SWM Project				
2017	2022	2027	2032	2037
280	262	277	295	310

Table 10-4: Operation and maintenance cost

No. of Persons needed for SWM Project			
	Vehicles are purchased by ULB and O&M is done by ULB in Rs	Vehicles are purchased by ULB and O&M is given on contract in Rs	Vehicles are purchased by Contractor and O&M is done by Contractor in Rs
Calculated O&M cost per ton	935	1102	1547
Total yearly cost to ULB	56310375	66367950	93168075

It has been recommended that ULB shall purchase the vehicles and contract it to private contractor for Operation and Maintenance. It has also been recommended that ULB shall contract the C&T dividing the city in four or five parts. This will give competitive price to the ULB and in case of non performance of any contractor the contract can be transferred to best performing contractor.

10.3 Cost Estimates for Processing and Disposal

Average 10 year waste for the ULB is estimated to be around 200 TPD (Phase I) in which around 58% of the waste is wet waste, hence, a compost plant for the same has been proposed. The processing facility is proposed with the infrastructure to also recover recyclables of around 27%. The plant shall be developed in the area of existing vermin compost facility which needs to be completely revamped. The processing facility is proposed to be upgraded to the capacity of around 60 TPD to take care of additional waste in the second phase. Cost estimate for the same is provided below.

10.3.1 Capital Expenditure

Table 10-4: Capital Expenditure

S.No.	Particular	Amount in Rs.
1	Four wheel auto tippers 79 nos.	49375000.00
2	Handcarts 166 nos	1593600.00
3	Road Side Twin litter bins 100 liter twin bin with stand 400 nos	2532800.00
4	Waste Receiving, Pre-Sorting Area & Windrow Pad	11938883.94
5	Leachate Holding tank	257142.69
6	Sheds for Compost Plant and Material recovery facility	16826080.00
7	Processing plant and machinery	47850000.00
8	Drainage Works	3512051.00
9	Office	744642.00
10	Toilets	222000.00
11	Fire extinguisher	193060.00
12	Weigh bridge	571825.00
13	Rest room	744642.00
14	Back hoe loader for processing plant	2450000.00
15	water tanker for windrows	1163000.00
16	Tipper (2 nos)	3100000.00
17	Development of Landfill	54173841.00
18	Bioming of old dumped waste	51266670.00
19	Public awareness programmes	10000000.00
	Base cost of the project	258515237.63

Additional cost of around 30% of the equipment cost (2017) has been considered in the 10th year for major overhauling of the plant's machinery. Total capital investment needed for the SLF with ancillary infrastructure and SLF management equipment, over the span of 25 years is provided below, including the cost for replacement of SLF vehicles in the 10th year. It may be noted that the SLF be developed in five cells, with each cell lasting for 5 years.

Table 10-5: O&M for SLF and Processing Facility

II	O&M for SLF and Processing facility			
	Manpower	Nos	Per Month	Amount Per Month
1	Supervisor	4	15000	60000
	Drivers	8	11000	88000
	Mechanic	1	14000	14000

	Electrician	1	12000	12000
	Workmen	25	9000	225000
	Security guard	6	8000	48000
2	Diesel consumption At SLF & processing plant	Litre per month	3000	195000
3	Power (processing plant)			350000
3	Repair and Maintenance @ LS of Machinery cost,	LS	Per Month	180000
4	Civil works maintenance @ 2% per annum	LS	per month	218000
	Consumables	LS		135000
	Total Per Month (Rs)			1525000
	Annual O&M cost (In Rs lakh)			183.00

The operation and maintenance cost of processing and landfill works out to be Rs303.86 per ton. It has been recommended to contract the Processing plant on PPP basis. The investment done by PPP partner shall be treated as the share of ULB. The grant available from center and state shall be transferred to PPP partner as per the progress of the work. Providing the contract to a PPP partner the operation and maintenance cost to the ULB shall be zero if the revenue of recoverable such as compost and plastic etc is given to the PPP partner.

Possibility shall be explored to contract the operation and maintenance of the landfill on tipping fees basis. the tipping fees for maintaining the landfill work out to be 303.86 per ton of waste. Possibility shall be explored to contract the construction, operation and maintenance of the processing plant and landfill on PPP basis. The tipping fees for maintaining the processing plant and landfill work out to be Rs.110 per ton of waste if the revenue of recoverable such as compost and plastic etc is given to the PPP partner.

10.4 Total Revenues Generated

10.4.1 Proposed Tariff Charges

Currently, there is no user fee in the city for providing solid waste management services. In order to mobilise financial resources for SWM project especially for waste treatment & disposal, it is important to levy some kind of user fee on the public to recover the ULB expenses against SWM related works.

Table 10-6: Proposed Tariff Charges

Category	User Charges (Rs./Month)
Domestic – Non Slum	30-40
Domestic – Slum/weekender section	15-20
Commercial – Small	50-100
Commercial – Large	200 - 500
Big Hotels /mall	1000-2000

However in initial years, the ULB may not be able to recover 100% user fee from households. Therefore, state Govt / ULB may make up the deficit from other sources in initial years.

10.4.2 Revenue from Sale of Products

Various revenue streams for the proposed MSW project are expected to be as follows:

- Sale of compost: On an average around 15% of compost is expected to be produced in the composting facility on daily basis which could be sold at the price of Rs 1500 per ton
- The city's waste has 25% recyclables therefore at least 15% of the waste is expected to be recovered as recyclables on daily basis . Plastics and paper can be sold in the market at the selling price of Rs. 2000/- per ton whereas other waste can be sold at the rate of Rs. 1000 per ton.

Table below provides year wise production of compost, recyclables from the processing facility for the ULB

Table 10-7: Production of Useful Products from Waste Processing Facility

Year	MSW (TPD)	Quantity of Useful product			Revenue (Rs lakh per annum)			
		Compost 10% of total waste	Recyclable (paper & plastic)	Others sellable	Compost Rs. 1500/ ton	Paper & plastic Rs. 2000/ ton	Cloth & others Rs. 1000/ton	TOTAL
		10%	6%	5%	in Lakh/year	in Lakh/year	in Lakh/year	in Lakh/year
2017	167.6	16.76	10.056	8.38	91.76	73.41	30.59	195.76
2018	172.2	17.22	10.332	8.61	94.28	75.42	31.43	201.13
2019	176.9	17.69	10.614	8.845	96.85	77.48	32.28	206.62
2020	181.7	18.17	10.902	9.085	99.48	79.58	33.16	212.23
2021	186.6	18.66	11.196	9.33	102.16	81.73	34.05	217.95
2022	191.6	19.16	11.496	9.58	104.90	83.92	34.97	223.79
2023	196.7	19.67	11.802	9.835	107.69	86.15	35.90	229.75
2024	201.9	20.19	12.114	10.095	110.54	88.43	36.85	235.82
2025	207.2	20.72	12.432	10.36	113.44	90.75	37.81	242.01
2026	212.6	21.26	12.756	10.63	116.40	93.12	38.80	248.32
2027	218.1	21.81	13.086	10.905	119.41	95.53	39.80	254.74

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2028	223.7	22.37	13.422	11.185	122.48	97.98	40.83	261.28
2029	229.4	22.94	13.764	11.47	125.60	100.48	41.87	267.94
2030	235.3	23.53	14.118	11.765	128.83	103.06	42.94	274.83
2031	241.2	24.12	14.472	12.06	132.06	105.65	44.02	281.72
2032	247.3	24.73	14.838	12.365	135.40	108.32	45.13	288.85
2033	253.5	25.35	15.21	12.675	138.79	111.03	46.26	296.09
2034	259.9	25.99	15.594	12.995	142.30	113.84	47.43	303.56
2035	266.3	26.63	15.978	13.315	145.80	116.64	48.60	311.04
2036	272.9	27.29	16.374	13.645	149.41	119.53	49.80	318.75
2037	279.6	27.96	16.776	13.98	153.08	122.46	51.03	326.57
2038	286.4	28.64	17.184	14.32	156.80	125.44	52.27	334.52
2039	293.4	29.34	17.604	14.67	160.64	128.51	53.55	342.69
2040	300.5	30.05	18.03	15.025	164.52	131.62	54.84	350.98
2041	307.8	30.78	18.468	15.39	168.52	134.82	56.17	359.51

10.4.3 Revenue from User Charges

Following table shows how collection from user fee and revenue from sale of product shall take care of annual O&M expenses. It is to be noted that around 50% of the O&M expenses are towards salary of sanitation staff for C&T of waste. This money is already being spent by ULB, hence it is assumed that ULB already has budget provision for this amount.

Table 10-8: User Fee Collection

Year	No. of HHs	Non-slum H/H	Slum H/H	Comm. Unit	User fee collection (Rs, lakh)			
					30 Rs/month	20 Rs/month	75 Rs/month	TOTAL
					Non-slum, 60%	Slum, 60%	Comm., 60%	
2017	78556	60794	17762	6504	131	26	35	192
2018	79608	61136	18472	6591	132	27	36	194
2019	80659	61943	18716	6678	134	27	36	197
2020	81709	62750	18959	6765	136	27	37	199
2021	82757	63555	19202	6852	137	28	37	202
2022	83805	64359	19446	6939	139	28	37	204
2023	84851	65163	19688	7025	141	28	38	207
2024	85897	65966	19931	7112	142	29	38	210
2025	86941	66768	20173	7198	144	29	39	212
2026	87985	67569	20415	7285	146	29	39	215
2027	89027	68370	20657	7371	148	30	40	217
2028	90068	69169	20899	7457	149	30	40	220
2029	91108	69968	21140	7543	151	30	41	222

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2030	92147	70766	21381	7629	153	31	41	225
2031	93185	71563	21622	7715	155	31	42	227
2032	94222	72360	21863	7801	156	31	42	230
2033	95258	73155	22103	7715	158	32	42	232
2034	96293	73950	22343	7801	160	32	42	234
2035	97327	74744	22583	7801	161	33	42	236
2036	98359	75537	22823	8058	163	33	44	240
2037	99391	76329	23062	8144	165	33	44	242
2038	100421	77120	23301	8229	167	34	44	245
2039	101451	77911	23540	8314	168	34	45	247
2040	102479	78701	23779	8400	170	34	45	250
2041	103507	79490	24017	8485	172	35	46	252

Chapter 11. Financial Model

11.1 Project financial structuring

Any proposed solid waste management system will require provision of financial resources for its smooth running. Various elements involved in the financial planning are described below.

It is recommended that SWM be treated as a specific exclusive development project, which requires a large dose of capital investment and continuously increasing operation and maintenance costs over the next few years. The inadequate provision of funds over a very long period has led to inadequate and improper solid waste management system. It is necessary that solid waste management is treated as a specific and exclusive project, which requires a large capital investment as well as large operation maintenance cost. As the equipment in use in solid waste management has a shorter life as compared to in the other municipal services such as water supply and sewerage, a large capital investment is continuously required. Hence there has to be a specific plan for raising the necessary funds for this purpose. It is therefore, necessary to appreciate that a well-developed financial plan which anticipates a predetermined stream of fixed and variable expenditure be prepared, so that it is possible to make a concomitant plan for raising the necessary stream of revenues/funds for this purpose. In other words, one has to find out ways and means by which the required finances are raised to operationalize the SWM project over the design period. This becomes necessary because the present structure of revenue does not contain any instrument specifically dedicated to the needs of SWM. It is also obvious that in future the municipal agency will find it increasingly difficult to draw the required amounts from the existing revenue resource.

The rate of tax would also have to be periodically adjusted to the rate of inflation so as to accommodate the changing financial requirements. Experience in other areas of Public Revenue & Expenditure suggests that the gap between Revenue and Expenditure increases over time if tax rates are not revised, and this automatically results into less and less efficient discharge of services. The revision of the tax rate every 3 to 5 years is important because in its absence matching revenue and expenditure becomes impossible.

Action Plan

First year capital investment for the project is estimated as Rs 2585.15 lakh, presented as below:

Table 11-1: Capital Investment for Project

S.No.	Particular	Amount in Rs.
1	Four wheel auto tippers 79 nos.	49375000.00
2	Handcarts 166 nos	1593600.00
3	Road Side Twin litter bins 100 liter twin bin with stand 400 nos	2532800.00
4	Waste Receiving, Pre-Sorting Area & Windrow Pad	11938883.94
5	Leachate Holding tank	257142.69
6	Sheds for Compost Plant and Material recovery facility	16826080.00
7	Processing plant and machinery	47850000.00
8	Drainage Works	3512051.00
9	Office	744642.00
10	Toilets	222000.00
11	Fire extinguisher	193060.00
12	Weigh bridge	571825.00

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13	Rest room	744642.00
14	Back hoe loader for processing plant	2450000.00
15	water tanker for windrows	1163000.00
16	Tipper (2 nos)	3100000.00
17	Development of Landfill	54173841.00
18	Biomining of old dumped waste	51266670.00
19	Public awareness programmes	10000000.00
	Base cost of the project	258515237.63

The Project cost Rs. 2585.15 Lakh works out to be Rs.670.49 per capita as per 2011 census population of 385559.

Various measures should be taken to make the system self-supporting. These involve both short term as well as medium term action outlined below:-

- For mobilizing financial resources for SWM, the percentage allotment for SWM from the total annual budget of municipal agency may be immediately increased by necessary budgetary reallocation.
- For increasing budgetary allocation, the top priority should be given to SWM among the essential services.
- Different commercial establishments like hotels including kiosks, eating houses, restaurants, star hotels and retail markets shall be charged with user fee for waste management. The charge should be based on weight basis and the rates should vary depending on the size of establishment and its grade.
- Solid waste management is a public utility service and should preferably be managed on a "no profit no loss" basis.
- Industries which are within the municipal limits should be permitted to dispose of their non – hazardous waste on municipal sites on cost recovery basis.
- To reduce the financial burden on the municipal agency, the feasibility of involving the private sector should be explored. However, the ultimate responsibility should lie with the municipal agency.
- For an efficient recovery of solid waste user charge, combined bills along with the other municipal services like, electricity/ water supply should be raised as is practiced in other countries.
- Municipal bodies should raise the financial resources through all available means to meet both direct and indirect costs of solid waste management.
- Wherever specialized services (hospitals, commercial areas etc.) or house-to-house collection are provided, the element of full cost recovery be introduced.
- Central/ State Government may consider exemption of machineries, plants, and vehicles for Solid Waste Management from customs, excise and local taxes.
- Long-term plans should provide for rising of resources for capital expenditure during various years through adoption of a rational mechanism such as sinking fund.
- Approximate estimate of Operation & Maintenance has been prepared in following pages, which is only tentative; Tariff may be revised on the basis of actual operation & maintenance expenditure incurred during implementation.

11.2 Funds for Capital Expenditure

Solid Waste Management (SWM) is one of the obligatory functions of the urban local bodies in the country. The local urban bodies are, therefore, required to provide adequate services for the collection, transportation and disposal of waste.

SWM services are highly labour intensive and on account of increased wage structure of the Government and municipal employees, this service is becoming more and more expensive. Besides, the efficiency of the labour force employed in the urban local bodies is far from satisfactory. High wage structure and inefficiency of the work force result in steep rise in the cost of service. It is therefore, necessary that the local bodies may seriously consider private sector participation in solid waste management.

11.2.1 Area where Privatization can be attempted

Private sector participation may be considered in areas where local bodies have not been providing services through their own labour force. This will check the growth in the establishment cost, bring economy in expenditure and introduce the element of healthy competition between private sector and public sector in SWM services. There should be right mix of private sector and public sector to ensure that there is no exploitation of labour as well as management. Some of the examples of the areas where private sector participation can be considered are as under:

Door to door collection of domestic waste, door to door collection of commercial waste, door to door collection of hospital waste, construction waste, market waste, setting up, operation and maintenance of waste disposal facility, setting up, operation and maintenance of waste treatment plants, supplying of vehicles on rent, supplying of vehicles on lease, repairs and maintenance of vehicles, transportation of waste on contractual basis, etc.

The contract should carry a provision of penalty for failure to perform the contractual obligation.

The local body while giving a contract to a private sector and voluntary organization/Non-Government Organization (NGO) should make an enabling provision in the contract to inspect the work and measure the performance measurement and the report should be submitted to the higher authorities.

11.2.2 Option for VGF under SBM

Under the Swachh Bharat Mission (SBM) of the Central Government, ULBs can avail funding for project development and implementation of SWM projects. The Grant from Central and State Government option of obtaining viability gap funding (VGF) from central government and state government under SBM shall be used to offset the capital cost burden on the ULB. SWM rules, advisories, CPHEEO manuals (including cost-recovery mechanisms), O&M practices and Service-level Benchmark advisories released by MoUD from time to time.

Central government incentive for the SWM projects will be in the form of a maximum of 34% Grant / VGF for each project. Matching grant from the Government of Maharashtra shall be 14% of the total project cost. The remaining funds amounting to 49% of the total Project cost have to be generated by ULB through –

- Private Sector Participation
- Additional Resources from State Government/ULB
- Beneficiary Share
- User Charges
- Innovative revenue streams

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- Corporate Social Responsibility
- External Assistance

While considering projects under MSWM it is ensured that there is no duplication in terms of funding under any other scheme or programme.

Salient features regarding the financial assistance for SWM projects in Swachh Bharat mission are:

- The maximum support from Government (Center and State) is 49% of the project cost
- The ULB shall utilize its own resources to contribute 51% share.
- The project can be implemented on PPP mode. Government share can be can be utilised as viability gap fund for the project
- The partial operation and maintenance cost shall be recovered from the sale of compost and recyclables as well as user charges.

As per the Budget copies made available from the Dhule Municipal Corporation following provisions have been made by the corporation:

Provision of Fund 16-17 from 14th Finance commission - Rs. 13 Crore

Population of ULB in 2011	-	375559	
Project cost as per DPR	-	Rs. 2585.15 lakh	
35% grant available from Center	-	Rs. 2585.15 x 35%	= Rs. 904.80 Lakh
40% grant of center by state govt.	-	Rs. 904.80 x 40%	= Rs. 361.92 Lakh
Fund requirement by ULB	-	Rs. 2585.15 – 904.80 – 361.92	= Rs. 1318.42 Lakh

PPP is proposed for Processing and Disposal. The PPP contribution of 5.00 crore is proposed for processing plant. The fund available from various sources of grants (excluding Swachh Maharashtra Mission) as mentioned above amounting to total 818.42 Lakh can be utilized as ULB share of 14 th finance commission for SWM project.

11.3 Finance for Operation & Management

The O&M cost for the proposed project is evaluated in terms of manpower requirement for providing the SWM services, maintenance expenses of the equipment and operations cost as fuel cost, etc. The table below shows the annual maintenance cost of all the equipment and plant & machinery for collection & transportation, treatment & disposal facility with the current market rate.

Following table shows how collection from user fee and revenue from sale of product shall take care of annual O&M expenses. It is to be noted that around 50% of the O&M expenses are towards salary of sanitation staff for C&T of waste. This money is already being spent by ULB, hence it is assumed that ULB already has budget provision for this amount.

Table 11-2: Finance for O & M

Year	Collection@60%, Rs lakh per annum	Revenue from sale of end product	Annual Revenue (TOTAL)	Annual O&M Cost	Surplus/Deficit
		Rs, lakh			
2017	192	195.76	387.76	745.69	-357.93
2018	194	201.13	395.13	760.60	-365.47
2019	197	206.62	403.62	775.82	-372.20
2020	199	212.23	411.23	791.33	-380.10
2021	202	217.95	419.95	807.16	-387.21
2022	204	223.79	427.79	823.30	-395.51
2023	207	229.75	436.75	839.77	-403.02
2024	210	235.82	445.82	856.56	-410.74
2025	212	242.01	454.01	873.69	-419.68
2026	215	248.32	463.32	891.17	-427.85
2027	217	254.74	471.74	908.99	-437.25
2028	220	261.28	481.28	927.17	-445.89
2029	222	267.94	489.94	945.72	-455.78
2030	225	274.83	499.83	964.63	-464.80
2031	227	281.72	508.72	983.92	-475.20
2032	230	288.85	518.85	1003.60	-484.75
2033	232	296.09	528.09	1023.67	-495.58
2034	234	303.56	537.56	1044.15	-506.59
2035	236	311.04	547.04	1065.03	-517.99
2036	240	318.75	558.75	1086.33	-527.58
2037	242	326.57	568.57	1108.06	-539.49
2038	245	334.52	579.52	1130.22	-550.70
2039	247	342.69	589.69	1152.82	-563.13
2040	250	350.98	600.98	1175.88	-574.90
2041	252	359.51	611.51	1199.40	-587.89

*Around 50% of the O&M expenses are towards salary of sanitation staff for C&T of waste. This money is already being spent by ULB, hence it is assumed that ULB already has budget provision for this amount.

ANNEXURE

COST ESTIMATES

S.No.	Particular	Amount in Rs.
1	Four wheel auto tippers 79 nos.	49375000
2	Handcarts 166 nos	1593600
3	Road Side Twin litter bins 100 liter twin bin with stand 400 nos	2532800
4	Waste Receiving, Pre-Sorting Area & Windrow Pad	11938883.94
5	Leachate Holding tank	257142.69
6	Sheds for Compost Plant and Material recovery facility	16826080
7	Processing plant and machinery	47850000
8	Drainage Works	3512051
9	Office	744642
10	Toilets	222000
11	Fire extinguisher	193060
12	Weigh bridge	571825
13	Rest room	744642
14	Back hoe loader for processing plant	2450000
15	water tanker for windrows	1163000
16	Tipper (2 nos)	3100000
17	Development of Landfill	54173841
18	Bioming of old dumped waste	51266670
19	Public awareness programmes	10000000
	Base cost of the project	258515237.6

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1. Four wheel auto tippers

S.No	Four wheel auto tippers	Reference	No.	Rate in Rs.	Amount in Rs.
	<p>GARBAGE TIPPER MOUNTED ON FOUR WHEELER : Providing erecting garbage tipper mounted on four wheeler i.e TATA , Ashoka Leyland or any other equivalent for having capacity of Garbage up to 2 ton with carrying Dry and wet garbage in separate compartment. It should be operated through 12 V Battery operated power pack hydraulic system . It should be convenient for door to door collection of garbage. Capacity of container 1.1 cum to 4.5 cum.Rates are inclusive of all taxes and one year guarantee with third party coverage etc, completeas directed by Engineer- in-Charge .</p>	<p>MJP SWM DSR Item no. 7</p>	79	625000	49375000.00

2. Hand Carts

S.No	Particular	Reference	No.	Rate in Rs.	Amount in Rs.
	Segregation hand cart	MJP SWM DSR Item no. 7	166	9600.00	1593600.00
	<p>SEGREGATION HANDCART (Cap 360 liter) : Providing & supplying at site segregation handcart of following capacity including all taxes and one year insurance with third party coverage etc, complete. Segregation handcart having capacity 360 Liter. Made from Angle 25mmx03mm & orca sheet of 16 Guage , two nos iron wheel of 500mm dia made from 32mm flat with double ball bearings of 6205 and one removable segregation partition with 3 equal provision for segregation & rear side door to unload waste with handle and lock provision, one front wheel of HDPE 200 mm complete with two shade color and ready for use as per requirement as directed by engineer in charge ..</p>				

3. Road Side Twin litter bins 100 liter twin bin with stand

S.No	Particular	Reference	No.	Rate in Rs.	Amount in Rs.
	Total Road Side Twin litter bins required for commercial area 100 liter twin bin with stand	MJP SWM DSR Item no. 5	400	6332	2532800.00
	<p>FLOOR MOUNTED GARBAGE BIN : Providing and supplying floor mounted Garbage Bin Body Rectangular Shape following capacity single bin with stand, U-shaped Collar with lid opening in front side for pulling the garbage, steel cage. Garbage bin container shall be made from Linear Low Density Polythene Plastic (LLDPE) material made by rotational molding process covered eighth suitable lid or same material duty higher with the container. All the steel components i.e. stand posts, cage and other fixtures shall be powder coated with green/blue colour as per requirement of the indenter with following requirement and specification including transportation, loading, unloading, stacking at site , all taxes and one year guarantee with third party converge etc. complete as directed by engineer in charge .</p>				

4. Abstract Tipping Area & Windrow Platform						
Sl. No.	Reference	Description of work	QTY.	UNIT	RATE IN Rs.	AMOUNT IN Rs.
1	2	3	4	5	6	7
1	Page 9 Item no.1	Excavation for foundation in earth, soil of all types, sand, gravel and soft murum, including removing the excavated material up to a distance of 50 m. beyond the building area & stacking and spreading as directed, dewatering, preparing the bed for the foundation and necessary back filling, ramming, watering including shoring and strutting etc. complete. (Lift upto 1.5 m.) Spec. No.: Bd.A.1 Page No. 259	2503.68	Cum	115	287923.2
2	Page 274 item no.758	Compacting sub grade / gravel / oversize metal (200mm loose) layer upto 2 m width with By Vibratory Roller. including necessary, labour, materials and artificial watering etc. complete. Spec. No.: Rd. 32 Page No. 206	9600	Sqm	14	134400
3	Page No. 23 I no 36	Providing and casting in situ cement concrete M-15 of trap / granite / quartzite / gneiss metal for Foundation including centering, formwork, compacting, roughening them if special finish is to be provided and curing and finishing if required complete,with Concrete mixer. . Spec. No.: Bd.E.2 Page No. 288 and B.7 Page No 38 A) With natural sand.	1452.96	Cum	4270	6204139.2
4	page no 33 l. no. 44	Providing and laying in situ cement concrete M ---- of trap / granite /quartzite/ gneiss metal for R.C.C. work in foundations like raft, strip foundations, grillage and footings of R.C.C. columns and steel stanchions etc. including bailing out water, formwork, cover blocks compaction and curing roughening the surface if special finish is to be provided (Excluding reinforcement and structural steel) complete, with Concrete concrete mixer. With natural sand. Spec. No.: Bd.F.3 Page No. 298 and B.7, Page No.38 B) M-25				
	page no 33 l. no. 44 (B)	In Column Footings	17.28	Cum	5032	86952.96

5	page 42 Item no.66	Providing and fixing in position TMT FE-500 bar reinforcement of various diaMetres for R.C.C. pile caps, footings, foundations, slabs, beams, columns, canopies, staircases, newels, chajjas, lintels, pardies, coping, fins, arches, etc. as per detailed designs, drawings and schedules, including cutting, bending, hooking the bars, binding with wires or tack welding and supporting as required etc. complete. Spec. No.: BdF-17 Page No. 306 circular page 279	98903.52	Kg.	52.83 4	5225468.576
					Total	11938883.94

4. BOQ Tipping Area & Windrow Platform								
Sl. No		Description Of Work	No	L	B	H	Quantity	Unit
1		3	4	5	6	7	8	9
1	B&C DSR 16 17 Dhule page 9 Item no.1 (A)	Excavation for foundation in earth, soil of all types, sand, gravel and soft murum, including removing the excavated material up to a distance of 50 m. beyond the building area & stacking and spreading as directed, dewatering, preparing the bed for the foundation and necessary back filling, ramming, watering including shoring and strutting etc. complete. (Lift upto 1.5 m.) Spec. No.: Bd.A.1 Page No. 259						
		Waste Receiving cum presorting area	1	30	40	0.25	300	
		Windrow Pad	1	140	60	0.25	2100	
		Column bases						
		Waste Receiving Area	28	0.8	1	1.2	26.88	
		Windrow Pad	80	0.8	1	1.2	76.8	
							2503.7	Cu m
2	Page 274 item no.758	Compacting sub grade / gravel / oversize metal (200mm loose) layer upto 2 m width with By Vibratory Roller.including necessary, labour, materials and artificial watering etc. complete. Spec. No.: Rd. 32 Page No. 206						
		Waste Receiving Area	1	30	40		1200	

		Windrow Pad	1	140	60		8400	
							9600	Sq m
3	Page No. 23 I no 36	Providing and casting in situ cement concrete M-15 of trap / granite / quartzite / gneiss metal for Foundation including centering, formwork, compacting, roughening them if special finish is to be provided and curing and finishing if required complete,with Concrete mixer. . Spec. No.: Bd.E.2 Page No. 288 and B.7 Page No 38 A) With natural sand.						
		Waste Receiving Area	1	30	40	0.15	180	
		Windrow Pad	1	140	60	0.15	1260	
		Column bases						
		Waste Receiving Area	28	0.8	1	0.15	3.36	
		Windrow Pad	80	0.8	1	0.15	9.6	
							1453	Cu m
4	page no 33 I. no. 44	Providing and laying in situ cement concrete M ---- of trap / granite /quartzite/ gneiss metal for R.C.C. work in foundations like raft, strip foundations, grillage and footings of R.C.C. columns and steel stanchions etc. including bailing out water, formwork, cover blocks compaction and curing roughening the surface if special finish is to be provided (Excluding reinforcement and structural steel) complete, with Concrete concrete mixer. With natural sand. Spec. No.: Bd.F.3 Page No. 298 and B.7, Page No.38 B) M-25						
	page no 33 I. no. 44 (B)	In Column Footings	28	0.8	1	0.2	4.48	
			80	0.8	1	0.2	12.8	
							17.28	Cu m

5	B&C DSR 16 17 Dhule page 42 Item no.66	Providing and fixing in position TMT FE-500 bar reinforcement of various diaMetres for R.C.C. pile caps, footings, foundations, slabs, beams, columns, canopies, staircases, newels, chajjas, lintels, pardies, coping, fins, arches, etc. as per detailed designs, drawings and schedules, including cutting, bending, hooking the bars, binding with wires or tack welding and supporting as required etc. complete. Spec. No.: BdF-17 Page No. 306 circular page 279						
		for footing @ 90 kg/ cum	17.28	90			1555.2	Kg
		for Slabs @ 67 kg/ cum	1453	67			97348	Kg
						Total	98904	Kg

5. Detailed abstract and Measurement of Leachate Tank									
Sl. No	Description	No.	L	B	H	Total	unit	Rate	Amount
1	Excavation for foundation in earth, soil of all types, sand, gravel and soft murum, including removing the excavated material up to a distance of 50 m. beyond the building area & stacking and spreading as directed, dewatering, preparing the bed for the foundation and necessary back filling, ramming, watering including shoring and strutting etc. complete. (Lift upto 1.5 m.) By Mechanical Means		5	4	3.5	70	m ³	115	8050
	B&C DSR 16 17 Dhule page 9 Item no.1								
2	Providing and casting in situ cement concrete M-15 of trap / granite / quartzite / gneiss metal for Foundation including centering, formwork, compacting, roughening them if special finish is to be provided and curing and finishing if required complete,with Concrete mixer. . Spec. No.: Bd.E.2 Page No. 288 and B.7 Page No 38 A) With natural sand.		5	5	0.15	3.75	m ³	4270	16012.5
	PCC for floor (footing)								
	DSR 16 17 Dhule page 23 I no. 36								
3	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:6 in ----- - of inner walls/ in plinth external walls including bailing out water, striking joints on unexposed faces, raking out joints on exposed faces and watering Complete. Spec. No.: Bd.G. 1 Page No. 313								
	DSR 16 17 Dhule Page no 67 item no. 67 ©								
	Longer Walls	2	4.4	3	0.2	5.28			
	Shorter Walls	2	3.4	3	0.2	4.08			
	Total					9.36	m ³	6090	57002.4

5	Providing and installing Submersible 5HP Leachate pump of ISI mark dry type squirrel cage induction type, IP 68 the class of insulation is F-class having SD 50m, 2880 RPM, 3Phase, DOL, using copper cable of approx 15m in length of size 1x4x2.5mm ² , discharge size 80mm, capacity 16 to 20cum per hr with head of 16 to 20m including all electrical connections, starter making connection to the motor and other safety devices to electrical panel board as per manufacturer's specification. M JP SOR SWM								
	M JP SOR SWM 16 17								
	Total	1					Nos	75000	75000
	Providing & laying HDPE Geomembrane Sheet of following thickness 100% acid, alkali proof, 100% reinforced ceiling quality, every joint electronically welded, as per relevant IS Specification & placing in proper position on prepared bed on foundation/embankment with welding the joints of sheet using hot sedge and extrusion welding techniques according to the liner manufacturer specifications at ambient temperatures of 5 degree Celsius to 45 degree Celsius including all taxes labour for jointing & placing etc complete.								
	M JP SOR SWM 16 17 Page no 233 Item No.1(I)								
	Longer Walls	2	4	3		24	Sqm		
	Shorter Walls	2	3	3		18	Sqm		
	Total					42	Sqm	235	9870
	Providing & Fixing in Position steel fiber reinforced concrete (SFRC) frame & covers of approved make including loading, unloading, transportation, all taxes etc. all complete as directed by engineer in charge (20 Ton capacity)								
	M JP SOR SWM 16 17 Page no 221 Item No.17 E								
		1					Nos	2606	2606
								Total	257142.69

6. Abstract of Cost of Shed (8.0m Ht.)						
Sl. No.	Ref No	Description	Qty	Unit	Rate in Rs.	Amount in Rs.
1	2	3	4	5	6	7
1	page 9 Item no.1 (A)	Excavation for foundation in earth, soil of all types, sand, gravel and soft murum, including removing the excavated material up to a distance of 50 m. beyond the building area & stacking and spreading as directed, dewatering, preparing the bed for the foundation and necessary back filling, ramming, watering including shoring and strutting etc. complete. (Lift upto 1.5 m.) Spec. No.: Bd.A.1 Page No. 259	37.50	m ²	115.00	4312.50
2	page no 278 l. no.782	Providing, laying and spreading soil on a prepared sub grade, pulverizing, mixing the spread soil in place with rotavator with 3 % per cent %slaked lime with minimum content of 70 per cent %of CaO, grading with motor grader and compacting with the road roller at OMC to achieve at least 98 per cent of the max dry density to form a layer of sub base.	63.00	cum	520.00	32760.00
3	Page No. 23 Item no 36	Providing and casting in situ cement concrete M-15 of trap / granite / quartzite / gneiss metal for Foundation including centering, formwork, compacting, roughening them if special finish is to be provided and curing and finishing if required complete,with Concrete mixer. . Spec. No.: Bd.E.2 Page No. 288 and B.7 Page No 38 A) With natural sand.				
	Page No. 23 Item no 36 (A)	PCC for floor (footing)	63.00	cum	4270.00	269010.00
	Page No. 23 Item no 36 (B)	In Column bases.	6.88	cum	4170.00	28668.75

4	Page no. 99 I no. 143	Providing and laying Polished Shahabad Stone flooring 25mm to 30mm thick and required width wide in plain/diamond pattern on a bed of 1:6 C.M. including cement float, filling joints, with neat cement slurry, curing, polishing and cleaning complete. Spec. No.: Bd.M.3 Page No. 380	420.00	sqm	555.00	233100.00
5	page no 34 I no. 46	Providing and casting in situ cement concrete M---- of trap / granite /quartzite/ gneiss metal for R.C.C. columns as per detailed designs and drawing or as directed including centering, formwork, cover blocks compacting and roughening the surface if special finish is to be provided and curing complete. (Excluding reinforcement).with Concrete concrete mixer. With natural sand. Spec. No.: Bd.F.5 Page No. 300 and B.7, Page.No. 38				
	page no 34 I no. 46 (B)	In column	24.79	m ³	6940.00	172042.60
6	page no 35 I no. 48	Providing & casting in situ cement concrete M----- of trap / granite /quartzite/ gneiss metal for R.C.C. beams and lintels as per detailed designs & drawings or as directed including centering, formwork, cover blocks compaction & roughening the surface if special finish is to be provided & curing complete. (Excluding reinforcement). with Concrete concrete mixer With natural sand. Spec. No.: Bd.F.6 Page No. 300 and B.7, Page No.38				
	page no 35 I no. 48 (B)	Beam	31.00	m ³	7190.00	222890.00

7	page 19 Item no.27	Providing and fabricating structural steel work in rolled sections like joists, channels, angles, tees etc. as per detailed designs and drawing including fixing in position without connecting plates, braces etc. and one coat of anticorrosive paint and over it two coat of oil paintings of approved quality and shade complete. Spec. No.: Bd.C.2 Page No. 275				
			11.76	MT	56448.00	663900.73
8		Providing and fixing valley gutter of 24 B.W.G. (0.8mm) plain galvanised iron sheets 120 cm wide with teak wood planking 20 mm thick including two coats of coal-tarring the upper surface of plank (excluding painting to underside of plank) Spec. No.: Bd. R. 10, Page No. 455				
	page 125 Item no.267	Ridges plain	42.00	M	277.00	11634.00
	page 126 Item no.269	Gutter (600mm overall girth.)	84.00	M	2080.00	174720.00
9	page 175 Item no.404(C)	Providing and fixing on walls/ ceiling/ floor ----- mm dia. CPVC pipe with necessary fittings, remaking good the demolished portion etc. complete. Spec. No.: BD.V 5 page 551 and as directed by Engineer in charge C) 25mm	176.00	M	228.00	40128.00
10	page 245 Item no.579	Providing and fixing in position TMT FE-500 bar reinforcement of various diaMetres for R.C.C. pile caps, footings, foundations, slabs, beams, columns, canopies, staircases, newels, chajjas, lintels, pardies, coping, fins, arches, etc. as per detailed designs, drawings and schedules, including cutting, bending, hooking the bars, binding with wires or tack welding and supporting as required etc. complete. Spec. No.: BdF-17 Page No. 306	15.72	MT	52834.00	830391.98

11	page 67 Item no.67 (C)	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:6 in ----- of inner walls/ in plinth external walls including bailing out water, striking joints on unexposed faces, raking out joints on exposed faces and watering Complete. Spec.No.: Bd.G. 1 Page No. 313 C) superstructure	23.92	cum	6090.00	145672.80
12	page 94 Item no.122	Providing rough cast cement plaster externally in two coats with coloured cement finish to concrete/ brick/stone masonry surfaces in all positions with base coat 12 to 15 mm. thick in C.M. 1:4 using gray cement and roughcast treatment 12 mm thick in proportion of 1:1 1/2:3 using colour pigment including scaffolding and fourteen dayscuring etc. completed Spec. No.: Bd.L.9, Page No.370	208.00	sqm	345.00	71760.00
13	page 125 Item no.265	Providing and fixing corrugated galvanised iron sheets of 0.63mm thick (24 B.W.G.) for roofing without wind tilesincluding fastening with galvanised / iron screw / bolt and lead / bitumen washers as per drawing complete.(Weight of 5.5 kg/sq.m.) Spec. No.: Bd.R.5, Page No. 453	691.84	Sqm	671.00	464224.64
					Total	3365216.00
		Curing Shed	1.00	3365216.00	3365216	
		Compost Processing Shed (2 Nos)	2.00	3365216.00	6730432	
		Dry Waste Processing	1	3365216.00	3365216	
		Refinement & Store	1	3365216.00	3365216	
		Grand Total Amount			16826080	

7. Processing plant and machinery



ATL/MSW/2017/2262

Date: 28th March, 2017

**COMMISSIONER
DHULE MUNICIPAL CORPORATION
REF -
ECOPRO ENVIRONMENTAL SERVICES**

KIND ATTN: MR.AJAY JAIN

**SUB: OFFER FOR 150 to 200 TPD CAPACITY MSW COMPOST
PLANT WITH MATERIAL RECOVERY
FOR DHULE**

Dear Sir,

This has reference to the discussion we had with our technical team, please find enclosed herewith attached our offer for 150 - 200 TPD Municipal Solid Waste Compost Plant and Plastic bailing and Material Recovery Facility
Alfa Therm Limited (ATL), an ISO 9001:2008 and OHSAS 18001:2007 certified engineering company that provides technological solutions and equipment for municipal solid waste compost plants, waste incineration, High technology Shredders for volume reduction of waste and process heating besides catering to other needs of various streams of Waste Management since 1989.

Our Environment Division manufactures complete MSW Processing Plants, Waste Incinerators, Rotary Kilns, Gravity Separators, Shredders, Balers, Waste Compactors, Magnetic Separators, Dryers etc. and also supplies individual equipment like Trommels, material handling systems, vibrating screens or any other machinery related to waste processing.

Our customers include BBMP, Ramky Enviro Engineers Ltd, ILFS Environmental & Infrastructural Services Limited, UPL Ltd, A2Z Infrastructure Ltd, SPML Infra Ltd, Allahabad Waste Processing Ltd, ILFS, Madurai Waste Management, KCDC, Reliance Industries Ltd, Larsen & Toubro Ltd, ABB Ltd, Alstom Ltd, NALCO, NTPC, Avon Cycles Ltd, Perfetti India Ltd, Rico Auto Industries Ltd, Hero Cycles Ltd, International Tractors Ltd, Punjab Tractors Ltd, Swaraj Mazda Ltd, Nirma Ltd, Bhushan Steel Ltd, Jaypee Karcham Hydro Corporation, Surya Pharmaceuticals Ltd, Heinz India Ltd, Cadbury India Ltd, Vedanta Aluminium Ltd, Hutti Gold Mines Company, NMDC etc.

Alfa Therm plant and equipment have been exported to Syria, Kingdom of Saudi Arabia, Azerbaijan, Hungary, New Zealand, Germany, Fiji, Iraq, Congo, Kenya, Nigeria, Namibia, Angola, Vietnam, Maldives, British Virgin Island, Nepal, Sudan, Lebanon, Brunei, Afghanistan, Bhutan, Bangladesh, Seychelles, Liberia, Sierra Leone, Guinea, Mauritania, Sri Lanka and Libya.

The Municipal Solid waste processing plant will give you Compost as output and optional RDF line can also be supplied at an extra cost.

While compost is used in agriculture and gardening, the RDF is used as fuel in cement and similar industries.



ALFA-THERM LIMITED

Head Office: 6, Community Centre, Mayapuri, Phase-1, New Delhi-110064 (INDIA).

Ph : 91-11-2811-5222 / 6222, 2811-7391, 2811-4748 Fax : 91-11-2811-5396

E-mail : asmaw@alfathermtd.com Web : www.alfathermtd.com

SOLID WASTE MANAGEMENT DIVISION



The MSW processing plant of 150 - 200 TPD
consists of: (8 hours operation)

1. Pre-sorting Section of 20 TPH capacity suitable for 150 TPD compost plant
2. Preparatory Section of 10 TPH capacity suitable for 150 TPD compost plant
3. Finishing Section of 6 TPH capacity suitable for 150 TPD compost plant

We hope that you will find our offer in line with your requirement and look forward to receive your valued order at the earliest.

In case you need any further information; please do not hesitate to contact us or

Thanking you and best regards,

For Alfa Therm Limited

Vandana Malik Chawla
(Marketing Division)



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**PROPOSAL
FOR
MSW PROCESSING PLANT
OF
CAPACITY 150-200 TPD
WITH
MATERIAL RECOVERY**



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SOLID WASTE MANAGEMENT DIVISION



PROCESS DESCRIPTION OF A MSW PROCESSING PLANT

- a) Reception of MSW (segregated at source or mixed)
- b) Weighing of incoming vehicle to determine the quantity of waste
- c) Unloading the waste on the Tipping Floor
- d) Visual inspection of waste
- e) Manual Sorting of large sized inert material and removal of rejected to landfill site
- f) Pre-Processing activities - <100 mm to compost line while >100 mm to RDF/Landfill
- g) Transferring screened material to Windrow Pads
- h) Windrow management activities comprising of periodic turning – Retention time 21 days
- i) Shifting of material to Monsoon Shed – Residence time 14 days
- j) Feeding of fermented material to Processing Section – on line Rotary Sieves of 35 and 16 mm respectively. Rejects of Tromell 35 (+35 mm) to RDF/landfill. Screened material passed on to 16mm Tromell
- k) Oversized (+16mm) rejects to landfill.
- l) Stacking of under sized (-16mm) in Curing Section – residence time 14 days
- m) Semi-finished under sized (-16 mm) material feeding to Finishing Section – Tromell 4 mm
- n) Enriching the end product (compost) with useful organisms, if required.
- o) Bagging & Storage of compost



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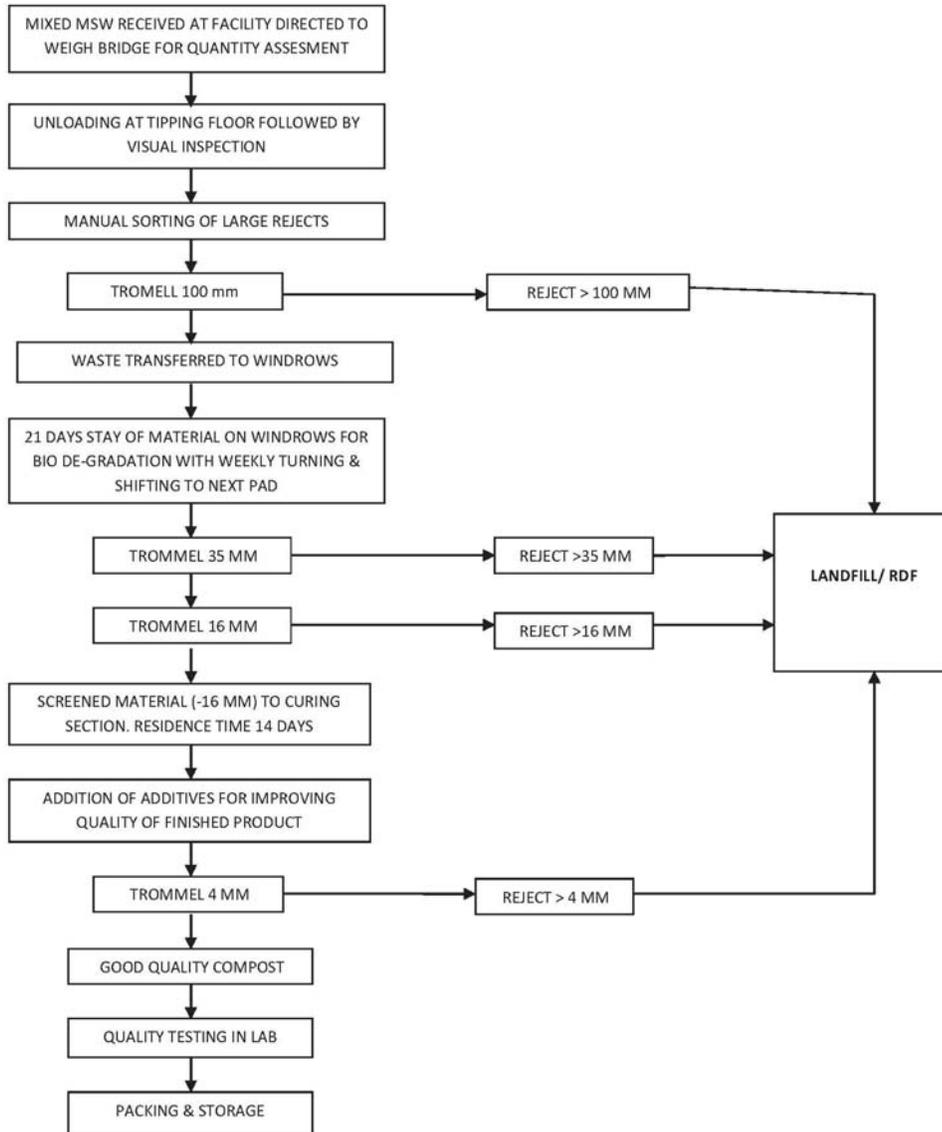
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SOLID WASTE MANAGEMENT DIVISION



MATERIAL FLOW CHART IN A 150 TPD MSW PROCESSING PLANT





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SOLID WASTE MANAGEMENT DIVISION



ISO 9001:2008

**TECHNICAL SPECIFICATIONS
OF
PRE-SORTING SECTION,
PREPARATORY SECTION
AND
FINISHING SECTION
OF
150-200 TPD COMPOST PLANT**



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SOLID WASTE MANAGEMENT DIVISION



PRE-SORTING SECTION

(20 TPH CAPACITY SUITABLE FOR 150-200 TPD PROCESSING PLANT)

S.No.	EQUIPMENT DESCRIPTION	SIZES (LENGTH X WIDTH)	QTY.
1	Apron feed Conveyor with Hopper	5 mtr x 1.5 mtr	01 No.
2	Feeding Conveyor	15 mtr x 1.2 mtr	01 No.
3	Tromell 100 mm	7 mtr x Dia 2.5 mtr	01 No.
4	Reject Conveyor to carry > 100mm	8 mtr x 0.8 mtr	01 No.
5	Accept Conveyor to carry < 100mm	20 mtr x 0.8 mtr	01 No.
6	Magnetic Separator	-	01 No.
7	Reversible Transfer Conveyor	6 mtr x 0.8 mtr	01 No.
8	Electrical Control Panel with cabling	Provided separately for this section	01 No.



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SOLID WASTE MANAGEMENT DIVISION



PREPARATORY SECTION

(10 TPH CAPACITY SUITABLE FOR 150-200 TPD PROCESSING

S.No.	EQUIPMENT DESCRIPTION	SIZES (LENGTH X WIDTH)	QTY.
1	Hopper Suitable Size	-	
2	Feeding Conveyor	14 mtr x 0.8 mtr	01 No.
3	Tromell 35 mm	6 mtr x Dia 2 mtr	01 No.
4	Reject Conveyor >35 mm	7 mtr x 0.6 mtr	01 No.
5	Process Conveyor < 35mm	14 mtrs x 0.6 mtr	01 No.
6	Tromell 16 mm	6 mtrs x Dia 2 mtr	01 No.
7	Reject Conveyor >16 mm mass	7 mtr x 0.6 mtr	01 No.
8	Process Conveyor to carry < 16mm mass	16 mtrs x 0.6 mtr	01 No.
9	Reversible conveyor	8 mtrs x 0.6 mtr	01 No.
10	Magnetic Separator	-	01 No.
11	Electrical Control Panel with cabling	Provided separately for this section	01 No.



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SOLID WASTE MANAGEMENT DIVISION



FINISHING SECTION

(6 TPH CAPACITY SUITABLE FOR 150-200 TPD PROCESSING PLANT)

S.No.	EQUIPMENT DESCRIPTION	SIZES (LENGTH X WIDTH)	QTY.
1	Hopper suitable size	-	01 No.
2	Feeding Conveyor	11 mtr x 0.6 mtr	01 No.
3	Tromell 4 mm	5.5 mtrs x Dia 1.6 mtrs	01 No.
4	Reject Conveyor to carry > 4 mm	6 mtr x 0.6 mtr	01 No.
5	Process Conveyor < 4 mm	17 mtrs x 0.6 mtr	01 No.
6	De-stoner with dust collection system	-	01 No.
7	Magnetic separator	-	01 No.
8	De-stoner with air classifier for dust suppression	-	01 No.
9	Compost Conveyor	7 mtr x 0.6 mtr	01 No.
10	De-stoner rejects conveyor	7 mtr x 0.4 mtr	01 No.
11	Electrical Control Panel with cabling	Provided separately for this section	01 No.



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SOLID WASTE MANAGEMENT DIVISION



TECHNICAL SPECIFICATION

BELT CONVEYOR

Width	1000 mm	800 mm	600 mm
MOC of Belt	Nylon	Nylon	Nylon
Cover/Construction Grade	M-24- 400 / 4	M-24 – 315 / 3	M-24 – 315 / 3
Thickness – top / bottom	5 / 2	3 / 1.5	3 / 1.5
Bearing	NTN/SKF or equivalent	NTN/SKF or equivalent	NTN/SKF or equivalent
Impact Idler spacing	500 mm	500 mm	500 mm
Return Idler spacing	2000 mm	2000 mm	2000 mm
Motor	Electrical	Electrical	Electrical
Finishing	1 coat of epoxy primer and 2 coats of epoxy paint	1 coat of epoxy primer and 2 coats of epoxy paint	1 coat of epoxy primer and 2 coats of epoxy paint

TROMMELS

DESCRIPTION	TROMMEL 100 mm	TROMMEL 35	TROMMEL 16	TROMMEL 4
Location	Pre-Sorting	Preparatory	Preparatory	Refinement
Size (in m)	7 x 2.25	6 x 2	6 x 2	5.5 x 1.6
Mounting	Inclined – 5°	Inclined – 5°	Inclined – 5°	Inclined – 5°
Bag Opening Knife	Provided	Provided	Not required	Not required
MOC of Screen	6 mm thick M.S. conforming to IS: 2062 and spring steel mesh for finishing Tromell 4			
MOC of shell	10 mm thick Mild Steel conforming to IS: 2062 and 8 mm for Tromell 4 mm			
Motor	Electrical			
Maintenance	Can be opened from top & sides for easy inspection & maintenance. Platform Provided			
Finishing	One coat of Primer with double coat of epoxy paint			



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SOLID WASTE MANAGEMENT DIVISION



CONTROL PANEL

Material of Construction	CRC sheet of suitable thickness
Power Indications	3 phase RYB indicators
Isolation of panel	MCB provided
Status indicators	Provided
Operating push buttons	Provided separately for each equipment
Emergency Stop	Provided
Finishing	Powder coated

DE-STONER

Material to be handled	Finished MSW compost
Material to be separated	Stones/Glass/Sand/Pebbles
Bulk Density	0.8-0.9 t/m ³
Particle size	Upto 4 mm
Base structure	Heavy duty structural steel
Material of Construction	Mild Steel
Blower	Centrifugal type
Dust Collection system	Provided



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SOLID WASTE MANAGEMENT DIVISION



TOTAL ALL INCLUSIVE PRICE

FOR 150 - 200 TPD MSW PROCESSING PLANT FOR DHULE

S.NO	DESCRIPTION	AMOUNT
1	Total price for supply, installation and commissioning of Processing plant with material recovery facility of 150-200 TPD capacity as per details mentioned above	Rs.4,09,50,000/- (Rupees: Four Crores Nine Lakh Fifty Thousand Only)
The above mentioned prices are total all inclusive prices including all Taxes, Freight charges ,packing & Forwarding charges and Erection and commissioning charges		

Exclusions: All civil works wherever required. You will provide electrical supply at the input of our control panel.

DELIVERY PERIOD

We shall deliver the equipment within 10-12 weeks from the date of receipt of your order along with advance payment.

VALIDITY

Our offer is valid for 180 days from the date of this offer.

WARRANTY

The equipment shall be warranted for a period of 1 year from the date of dispatch against any manufacturing defects.

Thanking you

For Alfa Therm Limited

3	Providing and laying in situ cement concrete M 20 ---- of trap / granite /quartzite/ gneiss metal for R.C.C. work in beam and lintels as per detailed drawing and design or as directed including centring frame work cover blocks compaction and roughening the surface if special finish is to be provided (Excluding reinforcement and structural steel) complete, with Concrete concrete mixer. With crushed sand. Spec. No.: Bd.F.6 Page No. 300 and B.7, Page No.38)	2	900	0.15	0.5				
	for walls	1	900	0.15	0.8	135 108	m ³		
	For base				Total	243		6670	1620810
	B&C DSR 16 17 Dhulepage no 35 I no. 49 C								
4	Providing and fixing in position TMT FE-500 bar reinforcement of various diaMetres for R.C.C. pile caps, footings, foundations, slabs, beams, columns, canopies, staircases, newels, chajjas, lintels, pardies, coping, fins, arches, etc. as per detailed designs, drawings and schedules, including cutting, bending, hooking the bars, binding with wires or tack welding and supporting as required etc. complete. Spec. No.: BdF-17 Page No. 306								
	B&C DSR 16 17 Dhule page 245 Item no.579	67	243			16.281	Ton	5283 4	860190.354
	Page no. 279 - I no 7 circular								
5	Providing internal cement plaster 6 mm thick in C.M. 1:4 without neeru finish to concrete surface in all positions including scaffolding and curing complete Spec. No.: Bd.L.1, Page No.367	2	900	0.65		1170			
		1	900	0.5		450			
	B&C DSR 16 17 Dhule page 93 Item no.111					1620	m ²	93	150660
								Total	3512051.60

9. Office (Abstract of cost)						
Sr. No.	Item No.	Description	Unit	Quantity	Rate	Amount
1	page 9 Item no.1	Excavation for foundation in earth, soil of all types, sand, gravel and soft murum, including removing the excavated material up to a distance of 50 m. beyond the building area & stacking and spreading as directed, dewatering, preparing the bed for the foundation and necessary back filling, ramming, watering including shoring and strutting etc. complete. (Lift upto 1.5 m.) Spec. No.: Bd.A.1 Page No. 259	Cu m			
		TOTAL	Cu m	64.0	115	7360
2	Page No 23 Item 36	Providing and casting in situ cement concrete M-15 of trap / granite / quartzite / gneiss metal for Foundation including centering, formwork, compacting, roughening them if special finish is to be provided and curing and finishing if required complete,with Concrete mixer. . Spec. No.: Bd.E.2 Page No. 288 and B.7 Page No 38 A) With natural sand.	Cu m			
		TOTAL	Cu m	7.2	4270	30612.3

3	page no 39 l. no. 60	Providing & casting in situ cement concrete M---- of trap / granite /quartzite/ gneiss metal for R.C.C. beams and lintels as per detailed designs & drawings or as directed including centering, formwork, cover blocks compaction & roughening the surface if special finish is to be provided & curing complete. (Excluding reinforcement). with Concrete concrete mixer With natural sand. Spec. No.: Bd.F.6 Page No. 300 and B.7, Page No.38 for M25	Cu m			
	page no 39 l. no. 60 (A)	Footing total		9.24	5560	51374.4
	page no 34 l. no. 47 (B)	Column		2.95	6815	20104.3
	page no 35 l. no. 49 (B).	Beams		4.42	7090	31337.8
	page no 36 l. no. 50 (B)	Slab		7.7	7375	56787.5
4	page no 42 l. no. 66 (A)	Providing and fixing in position TMT FE-500 bar reinforcement of various diaMetres for R.C.C. pile caps, footings, foundations, slabs, beams, columns, canopies, staircases, newels, chajjas, lintels, pardies, coping, fins, arches, etc. as per detailed designs, drawings and schedules, including cutting, bending, hooking the bars, binding with wires or tack welding and supporting	KG			

		as required etc. complete. Spec. No.: BdF-17 Page No. 306				
		TOTAL	KG	3296.60	52.83	174172.6
5	Page no 12 item no. 13	Filling in plinth and floors with contractors soil sand or murum in 15 cm to 20cm, layers including watering and compaction complete. Spec. No.: Bd.A.11 Page No. 263	Cu m			
		TOTAL	Cu m	3.4	320	1073.3
6	Page no 67 item no. 67 ©	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:6 in ----- - of inner walls/ in plinth external walls including bailing out water, striking joints on unexposed faces, raking out joints on exposed faces and watering Complete. Spec. No.: Bd.G. 1 Page No. 313	Cu m			
		TOTAL	Cu m	13.0	6090	78919.9
7	Page no 67 item no. 68	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:4 in half brick thick wall including mild steel longitudinal reinforcement of 2 bars of 6 mm diaMetre / 2 hoop iron strips 25 mm X 1.6 mm at every third course, properly bent and bonded at ends	Sq m			

		scaffolding, racking out joints and watering Complete. Spec. No.: Bd.G.7 Page No. 316				
		TOTAL	Sq m	1.5	885	1327.5
8	Page no 94 item no. 120	Providing sand faced plaster externally in cement mortar using approved screened sand, in all positions including base coat of 15 mm thick in cement mortar 1:4 using waterproofing compound at 1 kg per cement bag curing the same for not less than 2 days and keeping the surface of the base coat rough to receive the sand faced treatment 6 to 8 mm thick in cement mortar 1:4 finishing the surface by taking out grains and curing for fourteen days scaffolding	Sq m			
		TOTAL	Sq m	154.8	295	45658.6
9	Page no 93 item no. 111	Providing internal cement plaster 6 mm thick in a single coat in cement mortar 1:4 without neeru finish to concrete surface in all positions including scaffolding and curing complete. Spec. No.: Bd.L.1 Page No. 367	Sq m			
		Total	Sq m	154.78	92	14239.3

10	Page no 113 item no. 207	Providing and applying two coats of water proof cement paint of approved manufacture and of approved colour to the plastered surfaces including scaffolding if necessary, cleaning and preparing the surface, watering for two days complete. complete. Spec. No.: Bd.0.8 Page No. 406	Sq m			
		Total	Sq m	309.6	50	15480.0
11	Page no 99 item no. 143	Providing and laying Polished Shahabad Stone flooring 25mm to 30mm thick and required width wide in plain/diamond pattern on a bed of 1:6 C.M. including cement float, filling joints, with neat cement slurry, curing, polishing and cleaning complete. Spec. No.: Bd.M.3 Page No. 380	Sq m			
		TOTAL	Sq m	27	555	14985.0
12	Page no 184 item no. 434	Providing and fixing European type white glazed earthenware coupled closet syphonic trap with symphonic low level white glazed 10 litres cistern with black backlite seat with all necessary pipe connection etc. complete. Spec. No.: As directed by Engineer in charge.				
		TOTAL	Ea ch	2	4448	8896

13	Page no 183 item no. 430	Providing and fixing white glazed earthenware lipped flat back/corner type Urinal with PVC 5 liters flushing cistern of 5 liters with fittings, inlet pipe with stop tap, brackets for fixing the cistern, 32 mm diaMetre P.V.C. flush pipe with fitting including lead soil pipe, lead trap & soil pipe connection up to the outside face of wall. Spec. No.: Bd.V.26 Page No. 564	Each			
		TOTAL	Each	4	1135	4540
14	Page no 194 item no. 484	Providing soak pit of size 120cm x 120cm x 120cm including excavating and filling with brick-bats. Spec. No.: Bd.V.46, Page No. 576	no	1	685	685
15	Page no 194 item no. 485	Providing and fixing H.D.P container Sintex or alike one piece moulded water tank made out of low density polythylar and built corrugation including of delivery up to destination hoisting and fixing of accessories such as inlet, outlet overflow of all tanks capacity above 1000 to 20,000 litres Spec. No.: As directed by engineer-in-charge.	lit	1000	8	8000

16	Page no 150 item no. 350	<p>Providing and fixing in position, Single shuttered aluminium extruded powder coated openable door of overall size 0.90 m x 2.40 m with aluminium door frame of powder coated section 101.60 x 44.75mm , 3.18 mm thick and shutter comprising of powder coated section having bottom and lock rail of size 150 mm x 44.5 mm , 2.90 mm thick top rails 47.62 x 44.45 mm , 3.18 mm thick , vertical style 47.62 x 44.45 mm, 3.00 mm thick and for shutter plain glass panes 5 mm thick for top panels and 12mm thick both side laminated phenol bonded particle board panels for bottom panels etc. , I.S.I. mark , heavy duty, Hydraulic floor spring of 150 kg capacity , having heavy duty concealed lock, necessary beading, glazing clips, PVC gaskets, 250mm length tower bolts, 150mm diam. pad handle, etc. as per detailed design and drawing or as directed by engineer in charge including all materials , labours, and equipment etc Spec. No.: As directed by Engineer in charge.</p>	Sq m	15.45	7210	111394.5
		TOTAL				676947.8 9
		Add 5% for sanitary fittings				33847.39
		Add 5% for electrical				33847.39
				Grand Total		744642.6 7

9. Office Building - BOQ

Sr. No.	Item No.	Description	Unit	No	Length	Width	Depth	Quantity
1	page 9 Item no.1	Excavation for foundation in earth, soil of all types, sand, gravel and soft murum, including removing the excavated material up to a distance of 50 m. beyond the building area & stacking and spreading as directed, dewatering, preparing the bed for the foundation and necessary back filling, ramming, watering including shoring and strutting etc. complete. (Lift upto 1.5 m.) Spec. No.: Bd.A.1 Page No. 259	Cum					
		Excavation for Footing of office Building	Cum	8	2.00	2.00	2.00	64.00
		TOTAL	Cum					64.0
2	Page No 23 Item 36	Providing and casting in situ cement concrete M-15 of trap / granite / quartzite / gneiss metal for Foundation including centering, formwork, compacting, roughening them if special finish is to be provided and curing and finishing if required complete,with Concrete mixer. . Spec. No.: Bd.E.2 Page No. 288 and B.7 Page No 38 A) With natural sand.	Cum					
		PCC Below Footing of office Building	Cum	8	2.00	2.00	0.10	3.20
		PCC Below Ground Slab of office Building	Cum	1	8.54	2.54	0.10	2.17
		PCC Below Ramp of office Building	Cum	1	6.00	2.00	0.15	1.80
		TOTAL	Cum					7.2

3	page no 39 l. no. 60	Providing & casting in situ cement concrete M----- of trap / granite /quartzite/ gneiss metal for R.C.C. beams and lintels as per detailed designs & drawings or as directed including centering, formwork, cover blocks compaction & roughening the surface if special finish is to be provided & curing complete. (Excluding reinforcement). with Concrete concrete mixer With natural sand. Spec. No.: Bd.F.6 Page No. 300 and B.7, Page No.38 for M25	Cum					
		M-15 Grade Concrete (1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) -As per design mix)	Cum					
		For Office building Construction	Cum					
	page no 39 l. no. 60 (A)	Footing Bottom	Cum	8	1.90	1.90	0.25	7.22
		Footing Trapazium [H/3{(A1+A2)+(SQRT of A1 X A2)}]	Cum	8	0.25			2.02
							Footing total	9.24
		Column	Cum	8	0.23	0.30	5.35	2.95
	page no 34 l. no. 47 (B)	Longer Plinth Beam	Cum	2	9.00	0.23	0.30	1.24
		Shorter Plinth Beam	Cum	4	3.00	0.23	0.30	0.83
		Longer Roof Beam	Cum	2	9.00	0.23	0.30	1.24
		Shorter Roof Beam	Cum	4	4.00	0.23	0.30	1.10
							Beam total	4.42
	page no 36 l. no. 50 (B)	Ground Slab	Cum	1	9	3	0.10	2.24
		Roof Slab	Cum	1	9	4	0.10	3.60
		Longer Lintels	Cum	2	9.00	0.23	0.10	0.41
		Shorter Lintels	Cum	2	3.00	0.23	0.10	0.14
		Lintels on Main Door	Cum	1	1.45	0.23	0.10	0.03
		Lintels on Side / Bath Room Door	Cum	2	1.20	0.23	0.10	0.06
		Lintels on Window Big	Cum	2	2.20	0.23	0.10	0.10
		Lintels on Window Small	Cum	2	1.20	0.23	0.20	0.11

		Lintels on Ventilator Big	Cum	2	1.20	0.23	0.20	0.11
		Lintels on Ventilator Small	Cum	2	0.70	0.23	0.10	0.03
		Sun Shades on Main Door	Cum	1	1.45	0.75	0.10	0.11
		Sun Shades on Side / Bath Room Door	Cum	2	1.20	0.50	0.10	0.12
		Sun Shades on Window Big	Cum	2	2.20	0.75	0.10	0.33
		Sun Shades on Window Small	Cum	2	1.20	0.50	0.10	0.12
		Sun Shades on Ventilator Big	Cum	2	1.20	0.50	0.10	0.12
		Sun Shades on Ventilator Small	Cum	2	0.70	0.30	0.10	0.04
			Cum				TOTAL	7.7
4	page no 42 l. no. 66 (A)	Providing and fixing in position TMT FE-500 bar reinforcement of various diaMetres for R.C.C. pile caps, footings, foundations, slabs, beams, columns, canopies, staircases, newels, chajjas, lintels, pardies, coping, fins, arches, etc. as per detailed designs, drawings and schedules, including cutting, bending, hooking the bars, binding with wires or tack welding and supporting as required etc. complete. Spec. No.: BdF-17 Page No. 306	KG					
		circular page 279	KG					
		Footing @ 90kg/cum		9.24	90			831.60
		column @ 200 kg/cum		2.95	200			590.00
		beam @ 250 kg/cum		4.42	250			1105.00
		Slab @ 100 kg /cum		7.7	100			770.00
		TOTAL	KG					3296.6
5	Page no 12 item no. 13	Filling in plinth and floors with contractors soil sand or murum in 15 cm to 20cm, layers including watering and compaction complete. Spec. No.: Bd.A.11 Page No. 263	Cum					
			Cum	1	8.60	2.60	0.15	3.35
		TOTAL	Cum					3.4

6	Page no 67 item no. 67 ©	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:6 in ----- of inner walls/ in plinth external walls including bailing out water, striking joints on unexposed faces, raking out joints on exposed faces and watering Complete. Spec. No.: Bd.G. 1 Page No. 313	Cum					
		For Office Building						
		Longer Walls	Cum	2	9	0.23	3.50	14.49
		Shorter walls	Cum	2	3	0.23	3.50	4.83
		Deduction for Columns on the peripheral Wall	Cum	-8	0.23	0.23	3.50	-1.48
		Deduction for Main Door	Cum	-1	1.25	0.23	2.25	-0.65
		Deduction for Side / Bath Room Door	Cum	-2	1.00	0.23	2.00	-0.92
		Deduction for Window Big	Cum	-2	2.00	0.23	3.00	-2.76
		Deduction for Window Small	Cum	-2	1.00	0.23	2.00	-0.92
		Deduction for Ventilator Big	Cum	-2	1.00	0.23	0.50	-0.23
		Deduction for Ventilator Small	Cum	-2	0.50	0.23	0.30	-0.07
		Steps Infront of Main Doors (1st Step)	Cum	1	0.90	1.85	0.20	0.33
		Steps Infront of Main Doors (2nd Step)	Cum	1	0.60	1.85	0.20	0.22
		Steps Infront of Main Doors (3rd Step)	Cum	1	0.30	1.85	0.20	0.11
		TOTAL	Cum					13.0
7	Page no 67 item no. 68	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:4 in half brick thick wall including mild steel longitudinal reinforcement of 2 bars of 6 mm diaMetre / 2 hoop iron strips 25 mm X 1.6 mm at every third course, properly bent and bonded at ends scaffolding, racking out joints and watering Complete. Spec. No.: Bd.G.7 Page No. 316	Sqm					
		112 MM Wall (Bathroom Partition Wall)	Sqm					
		Longer Walls	Sqm	1	3		3.50	10.50
		Shorter walls	Sqm	1	2		3.50	7.00
		Deduction for Ventilator Small	Sqm	-2	1.00		2.00	-4.00
		Deduction for Urinary Door	Sqm	-2	3.00		2.00	-12.00
		TOTAL	Sqm					1.5

8	Page no 94 item no. 120	Providing sand faced plaster externally in cement mortar using approved screened sand, in all positions including base coat of 15 mm thick in cement mortar 1:4 using waterproofing compound at 1 kg per cement bag curing the same for not less than 2 days and keeping the surface of the base coat rough to receive the sand faced treatment 6 to 8 mm thick in cement mortar 1:4 finishing the surface by taking out grains and curing for fourteen days scaffolding	Sqm					
			Sqm					
			Sqm	4	9		3.50	126.00
			Sqm	4	3		3.50	42.00
			Sqm	2	3		3.5	21.00
			Sqm	2	2		3.5	14.00
		Deduction door	Sqm	-2	1.25		2.25	-5.63
		Deduction window	Sqm	-4	1.00		2.00	-8.00
		Deduction	Sqm	-4	2.00		3.00	-24.00
		Deduction for Window Small	Sqm	-4	1.00		2.00	-8.00
		Deduction for Ventilator Big	Sqm	-4	1.00		0.50	-2.00
		Deduction for Ventilator Small	Sqm	-4	0.50		0.30	-0.60
		TOTAL	Sqm					154.8
9	Page no 53 item no. 1	Providing internal cement plaster 6 mm thick in a single coat in cement mortar 1:4 without neeru finish to concrete surface in all positions including scaffolding and curing complete. Spec. No.: Bd.L.1 Page No. 367	Sqm					
		Same As outer Plaster	Sqm					154.78
		Total	Sqm					154.78
10	Page no 74 item no. 12	Providing and applying two coats of water proof cement paint of approved manufacture and of approved colour to the plastered surfaces including scaffolding if necessary, cleaning and preparing the surface, watering for two days complete. complete. Spec. No.: Bd.0.8 Page No. 406	Sqm					
		Same As 15 mm Plaster	Sqm	2	154.78			309.56
		Total	Sqm					309.6

11	B&C DSR 16 17 nagar Page no. 59 I no. 1	Providing and laying Polished Shahabad Stone flooring 25mm to 30mm thick and required width wide in plain/diamond pattern on a bed of 1:6 C.M. including cement float, filling joints, with neat cement slurry, curing, polishing and cleaning complete. Spec. No.: Bd.M.3 Page No. 380	Sqm					
		Office Area	Sqm	1	7	3		21
		Toilet Area	Sqm	1	2	3		6
		TOTAL	Sqm					27
12	B&C DSR 16 17 nagar Page no. 128 I no. 51	Providing and fixing European type white glazed earthenware coupled closet syphonic trap with symphonic low level white glazed 10 litres cistern with black backlite seat with all necessary pipe connection etc. complete. Spec. No.: As directed by Engineer in charge.	Each	2				2
		TOTAL	Each					2
13	Page no 183 item no. 430	Providing and fixing white glazed earthenware lipped flat back/corner type Urinal with PVC 5 liters flushing cistern of 5 liters with fittings, inlet pipe with stop tap, brackets for fixing the cistern, 32 mm diaMetre P.V.C. flush pipe with fitting including lead soil pipe, lead trap & soil pipe connection up to the outside face of wall. Spec. No.: Bd.V.26 Page No. 564	Each	4				4
14	Page no 194 item no. 484	Providing soak pit of size 120cm x 120cm x 120cm including excavating and filling with brick-bats. Spec. No.: Bd.V.46, Page No. 576	no	1				1
15	Page no 194 item no. 485	Providing and fixing H.D.P container Sintex or alike one piece moulded water tank made out of low density polythyler and built corrugation including of delivery up to destination hoisting and fixing of accessories such as inlet, outlet overflow of all tanks capacity above 1000 to 20,000						

		litres Spec. No.: As directed by engineer-in-charge.					
		TOTAL	per litre	1	1000		1000
16	Page no 150 item no. 350	Providing and fixing in position, Single shuttered aluminium extruded powder coated openable door of overall size 0.90 m x 2.40 m with aluminium door frame of powder coated section 101.60 x 44.75mm , 3.18 mm thick and shutter comprising of powder coated section having bottom and lock rail of size 150 mm x 44.5 mm , 2.90 mm thick top rails 47.62 x 44.45 mm , 3.18 mm thick , vertical style 47.62 x 44.45 mm, 3.00 mm thick and for shutter plain glass panes 5 mm thick for top panels and 12mm thick both side laminated phenol bonded particle board panels for bottom panels etc. , I.S.I. mark , heavy duty, Hydraulic floor spring of 150 kg capacity , having heavy duty concealed lock, necessary beading, glazing clips, PVC gaskets, 250mm length tower bolts, 150mm diam. pad handle, etc. as per detailed design and drawing or as directed by engineer in charge including all materials , labours, and equipment etc Spec. No.: As directed by Engineer in charge.	Sqm				
		Main Door	Sqm	1	2	2.25	4.5
		Front Window	Sqm	1	2	1.5	3
		Side Door	Sqm	2	1.1	2.25	4.95
		Side Window	Sqm	2	1	1.5	3
		TOTAL	per litre	1	1000		15.45

10. TOILET BLOCK

B&C Letter no. 742	-	Dated . 28.01.2014
Proposed	-	10 sq m
Rate	-	Rs. 22200 per sq m
Total Amount	-	Rs. 2,22,000/-

11. Fire extinguisher

Proposed	-	20 nos
Rate	-	Rs. 4344 per no. (page no. 411 Item no.1091)
Total Amount	-	Rs. 86880/-

12 Weigh Bridge MJP DSR SWM Garbage weighing machine

ItemNo.	Description	Unit	Labour Rate	Rate for DSR 2016-2017
1	Providing & Supplying, Fixing, weigh bridge of 20 to 50 MT load with micro controller based fully electronic weighbridges are equipped with high precision hi-tech sensortronics make double ended shear beam Type load cells (Model : 65058) enriched by sophisticated undicator and strong rugged platform thus assuring the accuracy and reliabilty of the product, Capacity : 25 T / 50 Tonnes with Four sensortronics Loadcells, Only Accuracy : 5 Kgs. Loadcells which are Repairable and accurate at all corners. Platform size : 7 meter x 3 meter. Mounting it over the civil column. The rates of weighbridge are including all material cost & Labour cost loading, unloading transportation, all taxes etc. complete as directed by Engineer- in-Charge .	No.		571825.00

13. Construction of Rest Room

Abstract

Sr. No.	Item No.	Description	Unit	Quantity	Rate	Amount
1	page 9 Item no.1	Excavation for foundation in earth, soil of all types, sand, gravel and soft murum, including removing the excavated material up to a distance of 50 m. beyond the building area & stacking and spreading as directed, dewatering, preparing the bed for the foundation and necessary back filling, ramming, watering including shoring and strutting etc. complete. (Lift upto 1.5 m.) Spec. No.: Bd.A.1 Page No. 259	Cum			
		TOTAL	Cum	64.0	115	7360
2	Page No 23 Item 36	Providing and casting in situ cement concrete M-15 of trap / granite / quartzite / gneiss metal for Foundation including centering, formwork, compacting, roughening them if special finish is to be provided and curing and finishing if required complete,with Concrete mixer. . Spec. No.: Bd.E.2 Page No. 288 and B.7 Page No 38 A) With natural sand.	Cum			
		TOTAL	Cum	7.2	4270	30612.3
3	page no 39 I. no. 60	Providing & casting in situ cement concrete M----- of trap / granite /quartzite/ gneiss metal for R.C.C. beams and lintels as per detailed designs & drawings or as directed including centering, formwork, cover blocks compaction & roughening the surface if special finish is to be provided & curing complete. (Excluding reinforcement). with Concrete concrete mixer With natural sand. Spec. No.: Bd.F.6 Page No. 300 and B.7, Page No.38 for M25	Cum			
	page no 39 I. no. 60 (A)	Footing total		9.24	5560	51374.4

	page no 34 l. no. 47 (B)	Column		2.95	6815	20104.3
	page no 35 l. no. 49 (B).	Beams		4.42	7090	31337.8
	page no 36 l. no. 50 (B)	Slab		7.7	7375	56787.5
4	page no 42 l. no. 66 (A)	Providing and fixing in position TMT FE-500 bar reinforcement of various diaMetres for R.C.C. pile caps, footings, foundations, slabs, beams, columns, canopies, staircases, newels, chajjas, lintels, pardies, coping, fins, arches, etc. as per detailed designs, drawings and schedules, including cutting, bending, hooking the bars, binding with wires or tack welding and supporting as required etc. complete. Spec. No.: BdF-17 Page No. 306	KG			
		TOTAL	KG	3296.60	52.83	174172.6
5	Page no 12 item no. 13	Filling in plinth and floors with contractors soil sand or murum in 15 cm to 20cm, layers including watering and compaction complete. Spec. No.: Bd.A.11 Page No. 263	Cum			
		TOTAL	Cum	3.4	320	1073.3
6	Page no 67 item no. 67 ©	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:6 in ----- of inner walls/ in plinth external walls including bailing out water, striking joints on unexposed faces, raking out joints on exposed faces and watering Complete. Spec. No.: Bd.G. 1 Page No. 313	Cum			
		TOTAL	Cum	13.0	6090	78919.9
7	Page no 67 item no. 68	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:4 in half brick thick wall including mild steel longitudinal reinforcement of 2 bars of 6 mm diaMetre / 2 hoop iron strips 25 mm X 1.6 mm at every third course, properly bent and bonded at ends scaffolding, racking out joints and watering Complete. Spec. No.: Bd.G.7	Sqm			

		Page No. 316				
		TOTAL	Sqm	1.5	885	1327.5
8	Page no 94 item no. 120	Providing sand faced plaster externally in cement mortar using approved screened sand, in all positions including base coat of 15 mm thick in cement mortar 1:4 using waterproofing compound at 1 kg per cement bag curing the same for not less than 2 days and keeping the surface of the base coat rough to receive the sand faced treatment 6 to 8 mm thick in cement mortar 1:4 finishing the surface by taking out grains and curing for fourteen days scaffolding	Sqm			
		TOTAL	Sqm	154.8	295	45658.6
9	Page no 93 item no. 111	Providing internal cement plaster 6 mm thick in a single coat in cement mortar 1:4 without neeru finish to concrete surface in all positions including scaffolding and curing complete. Spec. No.: Bd.L.1 Page No. 367	Sqm			
		Total	Sqm	154.78	92	14239.3
10	Page no 113 item no. 207	Providing and applying two coats of water proof cement paint of approved manufacture and of approved colour to the plastered surfaces including scaffolding if necessary, cleaning and preparing the surface, watering for two days complete. complete. Spec. No.: Bd.0.8 Page No. 406	Sqm			
		Total	Sqm	309.6	50	15480.0
11	Page no 99 item no. 143	Providing and laying Polished Shahabad Stone flooring 25mm to 30mm thick and required width wide in plain/diamond pattern on a bed of 1:6 C.M. including cement float, filling joints, with neat cement slurry, curing, polishing and cleaning complete. Spec. No.: Bd.M.3 Page No. 380	Sqm			

		TOTAL	Sqm	27	555	14985.0
12	Page no 184 item no. 434	Providing and fixing European type white glazed earthenware coupled closet syphonic trap with symphonic low level white glazed 10 litres cistern with black backlite seat with all necessary pipe connection etc. complete. Spec. No.: As directed by Engineer in charge.				
		TOTAL	Each	2	4448	8896
13	Page no 183 item no. 430	Providing and fixing white glazed earthenware lipped flat back/corner type Urinal with PVC 5 liters flushing cistern of 5 liters with fittings, inlet pipe with stop tap, brackets for fixing the cistern, 32 mm diaMetre P.V.C. flush pipe with fitting including lead soil pipe, lead trap & soil pipe connection up to the outside face of wall. Spec. No.: Bd.V.26 Page No. 564	Each			
		TOTAL	Each	4	1135	4540
14	Page no 194 item no. 484	Providing soak pit of size 120cm x 120cm x 120cm including excavating and filling with brick-bats. Spec. No.: Bd.V.46, Page No. 576	no	1	685	685
15	Page no 194 item no. 485	Providing and fixing H.D.P container Sintex or alike one piece moulded water tank made out of low density polythyler and built corrugation including of delivery up to destination hoisting and fixing of accessories such as inlet, outlet overflow of all tanks capacity above 1000 to 20,000 litres Spec. No.: As directed by engineer-in-charge.	lit	1000	8	8000

16	Page no 150 item no. 350	Providing and fixing in position, Single shuttered aluminium extruded powder coated openable door of overall size 0.90 m x 2.40 m with aluminium door frame of powder coated section 101.60 x 44.75mm , 3.18 mm thick and shutter comprising of powder coated section having bottom and lock rail of size 150 mm x 44.5 mm , 2.90 mm thick top rails 47.62 x 44.45 mm , 3.18 mm thick , vertical style 47.62 x 44.45 mm, 3.00 mm thick and for shutter plain glass panes 5 mm thick for top panels and 12mm thick both side laminated phenol bonded particle board panels for bottom panels etc. , I.S.I. mark , heavy duty, Hydraulic floor spring of 150 kg capacity , having heavy duty concealed lock, necessary beading, glazing clips, PVC gaskets, 250mm length tower bolts, 150mm diam. pad handle, etc. as per detailed design and drawing or as directed by engineer in charge including all materials , labours, and equipment etc Spec. No.: As directed by Engineer in charge.	Sqm	15.45	7210	111394.5
		TOTAL				676947.89
		Add 5% for sanitary fittings				33847.39
		Add 5% for electrical				33847.39
				Grand Total		744642.67

13. Construction of Rest Room

BOQ - Civil Work

Sr. No.	Item No.	Description	Unit	No	Length	Width	Depth	Quantity
1	page 9 Item no.1	Excavation for foundation in earth, soil of all types, sand, gravel and soft murum, including removing the excavated material up to a distance of 50 m. beyond the building area & stacking and spreading as directed, dewatering, preparing the bed for the foundation and necessary back filling, ramming, watering including shoring and strutting etc. complete. (Lift upto 1.5 m.) Spec. No.: Bd.A.1 Page No. 259	Cum					
		Excavation for Footing of office Building	Cum	8	2.00	2.00	2.00	64.00
		TOTAL	Cum					64.0
2	Page No 23 Item 36	Providing and casting in situ cement concrete M-15 of trap / granite / quartzite / gneiss metal for Foundation including centering, formwork, compacting, roughening them if special finish is to be provided and curing and finishing if required complete, with Concrete mixer. . Spec. No.: Bd.E.2 Page No. 288 and B.7 Page No 38 A) With natural sand.	Cum					
		PCC Below Footing of office Building	Cum	8	2.00	2.00	0.10	3.20
		PCC Below Ground Slab of office Building	Cum	1	8.54	2.54	0.10	2.17
		PCC Below Ramp of office Building	Cum	1	6.00	2.00	0.15	1.80
		TOTAL	Cum					7.2
3	page no 39 l. no. 60	Providing & casting in situ cement concrete M----- of trap / granite / quartzite / gneiss metal for R.C.C. beams and lintels as per detailed designs & drawings or as directed including centering, formwork, cover blocks compaction & roughening the surface if special finish is to be provided & curing complete. (Excluding reinforcement). with Concrete concrete mixer With natural sand.	Cum					

		Spec. No.: Bd.F.6 Page No. 300 and B.7, Page No.38 for M25						
		M-15 Grade Concrete (1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) -As per design mix)	Cum					
		For Office building Construction	Cum					
	page no 39 l. no. 60 (A)	Footing Bottom	Cum	8	1.90	1.90	0.25	7.22
		Footing Trapazium [$H/3\{(A1+A2)+(SQRT\ of\ A1\ X\ A2)\}$]	Cum	8	0.25			2.02
		Column	Cum	8	0.23	0.30	5.35	9.24
	page no 34 l. no. 47 (B)	Longer Plinth Beam	Cum	2	9.00	0.23	0.30	1.24
		Shorter Plinth Beam	Cum	4	3.00	0.23	0.30	0.83
		Longer Roof Beam	Cum	2	9.00	0.23	0.30	1.24
		Shorter Roof Beam	Cum	4	4.00	0.23	0.30	1.10
							Beam total	4.42
	page no 36 l. no. 50 (B)	Ground Slab	Cum	1	9	3	0.10	2.24
		Roof Slab	Cum	1	9	4	0.10	3.60
		Longer Lintels	Cum	2	9.00	0.23	0.10	0.41
		Shorter Lintels	Cum	2	3.00	0.23	0.10	0.14
		Lintels on Main Door	Cum	1	1.45	0.23	0.10	0.03
		Lintels on Side / Bath Room Door	Cum	2	1.20	0.23	0.10	0.06
		Lintels on Window Big	Cum	2	2.20	0.23	0.10	0.10
		Lintels on Window Small	Cum	2	1.20	0.23	0.20	0.11
		Lintels on Ventilator Big	Cum	2	1.20	0.23	0.20	0.11
		Lintels on Ventilator Small	Cum	2	0.70	0.23	0.10	0.03
		Sun Shades on Main Door	Cum	1	1.45	0.75	0.10	0.11
		Sun Shades on Side / Bath Room Door	Cum	2	1.20	0.50	0.10	0.12
		Sun Shades on Window Big	Cum	2	2.20	0.75	0.10	0.33
		Sun Shades on Window Small	Cum	2	1.20	0.50	0.10	0.12
		Sun Shades on Ventilator Big	Cum	2	1.20	0.50	0.10	0.12

		Sun Shades on Ventilator Small	Cum	2	0.70	0.30	0.10	0.04
			Cum				TOTAL	7.7
4	page no 42 I. no. 66 (A)	Providing and fixing in position TMT FE-500 bar reinforcement of various diaMetres for R.C.C. pile caps, footings, foundations, slabs, beams, columns, canopies, staircases, newels, chajjas, lintels, pardies, coping, fins, arches, etc. as per detailed designs, drawings and schedules, including cutting, bending, hooking the bars, binding with wires or tack welding and supporting as required etc. complete. Spec. No.: BdF-17 Page No. 306	KG					
		circular page 279	KG					
		Footing @ 90kg/cum	9.24	90				831.60
		column @ 200 kg/cum	2.95	200				590.00
		beam @ 250 kg/cum	4.42	250				1105.00
		Slab @ 100 kg /cum	7.7	100				770.00
		TOTAL	KG					3296.6
5	Page no 12 item no. 13	Filling in plinth and floors with contractors soil sand or murum in 15 cm to 20cm, layers including watering and compaction complete. Spec. No.: Bd.A.11 Page No. 263	Cum					
			Cum	1	8.60	2.60	0.15	3.35
		TOTAL	Cum					3.4
6	Page no 67 item no. 67 ©	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:6 in ----- - of inner walls/ in plinth external walls including bailing out water, striking joints on unexposed faces, raking out joints on exposed faces and watering Complete. Spec. No.: Bd.G. 1 Page No. 313	Cum					
		For Office Building						
		Longer Walls	Cum	2	9	0.23	3.50	14.49
		Shorter walls	Cum	2	3	0.23	3.50	4.83
		Deduction for Columns on the peripheral Wall	Cum	-8	0.23	0.23	3.50	-1.48
		Deduction for Main Door	Cum	-1	1.25	0.23	2.25	-0.65
		Deduction for Side / Bath Room Door	Cum	-2	1.00	0.23	2.00	-0.92
		Deduction for Window Big	Cum	-2	2.00	0.23	3.00	-2.76
		Deduction for Window Small	Cum	-2	1.00	0.23	2.00	-0.92

		Deduction for Ventilator Big	Cum	-2	1.00	0.23	0.50	-0.23
		Deduction for Ventilator Small	Cum	-2	0.50	0.23	0.30	-0.07
		Steps Infront of Main Doors (1st Step)	Cum	1	0.90	1.85	0.20	0.33
		Steps Infront of Main Doors (2nd Step)	Cum	1	0.60	1.85	0.20	0.22
		Steps Infront of Main Doors (3rd Step)	Cum	1	0.30	1.85	0.20	0.11
		TOTAL	Cum					13.0
7	Page no 67 item no. 68	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:4 in half brick thick wall including mild steel longitudinal reinforcement of 2 bars of 6 mm diaMetre / 2 hoop iron strips 25 mm X 1.6 mm at every third course, properly bent and bonded at ends scaffolding, racking out joints and watering Complete. Spec. No.: Bd.G.7 Page No. 316	Sqm					
		112 MM Wall (Bathroom Partition Wall)	Sqm					
		Longer Walls	Sqm	1	3		3.50	10.50
		Shorter walls	Sqm	1	2		3.50	7.00
		Deduction for Ventilator Small	Sqm	-2	1.00		2.00	-4.00
		Deduction for Urinary Door	Sqm	-2	3.00		2.00	-12.00
		TOTAL	Sqm					1.5
8	Page no 94 item no. 120	Providing sand faced plaster externally in cement mortar using approved screened sand, in all positions including base coat of 15 mm thick in cement mortar 1:4 using waterproofing compound at 1 kg per cement bag curing the same for not less than 2 days and keeping the surface of the base coat rough to receive the sand faced treatment 6 to 8 mm thick in cement mortar 1:4 finishing the surface by taking out grains and curing for fourteen days scaffolding	Sqm					
			Sqm					
			Sqm	4	9		3.50	126.00
			Sqm	4	3		3.50	42.00
			Sqm	2	3		3.5	21.00
			Sqm	2	2		3.5	14.00
		Deduction door	Sqm	-2	1.25		2.25	-5.63
		Deduction window	Sqm	-4	1.00		2.00	-8.00
		Deduction	Sqm	-4	2.00		3.00	-24.00
		Deduction for Window Small	Sqm	-4	1.00		2.00	-8.00

		Deduction for Ventilator Big	Sqm	-4	1.00		0.50	-2.00
		Deduction for Ventilator Small	Sqm	-4	0.50		0.30	-0.60
		TOTAL	Sqm					154.8
9	Page no 53 item no. 1	Providing internal cement plaster 6 mm thick in a single coat in cement mortar 1:4 without neeru finish to concrete surface in all positions including scaffolding and curing complete. Spec. No.: Bd.L.1 Page No. 367	Sqm					
		Same As outer Plaster	Sqm					154.78
		Total	Sqm					154.78
10	Page no 74 item no. 12	Providing and applying two coats of water proof cement paint of approved manufacture and of approved colour to the plastered surfaces including scaffolding if necessary, cleaning and preparing the surface, watering for two days complete. complete. Spec. No.: Bd.0.8 Page No. 406	Sqm					
		Same As 15 mm Plaster	Sqm	2	154.78			309.56
		Total	Sqm					309.6
11	B&C DSR 16 17 naga r Page no. 59 I no. 1	Providing and laying Polished Shahabad Stone flooring 25mm to 30mm thick and required width wide in plain/diamond pattern on a bed of 1:6 C.M. including cement float, filling joints, with neat cement slurry, curing, polishing and cleaning complete. Spec. No.: Bd.M.3 Page No. 380	Sqm					
		Office Area	Sqm	1	7	3		21
		Toilet Area	Sqm	1	2	3		6
		TOTAL	Sqm					27
12	B&C DSR 16 17 naga r Page no. 128 I no. 51	Providing and fixing European type white glazed earthenware coupled closet syphonic trap with symphonic low level white glazed 10 litres cistern with black backlite seat with all necessary pipe connection etc. complete. Spec. No.: As directed by Engineer in charge.	Each	2				2
		TOTAL	Each					2

13	Page no 183 item no. 430	Providing and fixing white glazed earthenware lipped flat back/corner type Urinal with PVC 5 liters flushing cistern of 5 liters with fittings, inlet pipe with stop tap, brackets for fixing the cistern, 32 mm diaMetre P.V.C. flush pipe with fitting including lead soil pipe, lead trap & soil pipe connection up to the outside face of wall. Spec. No.: Bd.V.26 Page No. 564	Each	4				4
14	Page no 194 item no. 484	Providing soak pit of size 120cm x 120cm x 120cm including excavating and filling with brick-bats. Spec. No.: Bd.V.46, Page No. 576	no	1				1
15	Page no 194 item no. 485	Providing and fixing H.D.P container Sintex or alike one piece moulded water tank made out of low density polythylar and built corrugation including of delivery up to destination hoisting and fixing of accessories such as inlet, outlet overflow of all tanks capacity above 1000 to 20,000 litres Spec. No.: As directed by engineer-in-charge.						
		TOTAL	per litre	1	1000			1000
16	Page no 150 item no. 350	Providing and fixing in position, Single shuttered aluminium extruded powder coated openable door of overall size 0.90 m x 2.40 m with aluminium door frame of powder coated section 101.60 x 44.75mm , 3.18 mm thick and shutter comprising of powder coated section having bottom and lock rail of size 150 mm x 44.5 mm , 2.90 mm thick top rails 47.62 x 44.45 mm , 3.18 mm thick , vertical style 47.62 x 44.45 mm, 3.00 mm thick and for shutter plain glass panes 5 mm thick for top panels and 12mm thick both side laminated phenol bonded particle board panels for bottom panels etc. , I.S.I. mark , heavy duty, Hydraulic floor spring of 150 kg capacity , having heavy duty concealed lock, necessary beading, glazing clips, PVC gaskets, 250mm length tower bolts, 150mm diam. pad handle, etc. as per detailed design and drawing or as	Sqm					

		directed by engineer in charge including all materials , labours, and equipment etc Spec. No.: As directed by Engineer in charge.						
		Main Door	Sqm	1	2	2.25		4.5
		Front Window	Sqm	1	2	1.5		3
		Side Door	Sqm	2	1.1	2.25		4.95
		Side Window	Sqm	2	1	1.5		3
		TOTAL	per litre	1	1000			15.45

14. Back hoe loader:

Govt. of India
Ministry of Commerce & Industry
Department of Commerce
Director General of Supplies & Disposals
Jeevan Tara Building
5, Sansad Marg New Delhi-110001

Digitally signed By:
SARVESH TRIVEDI
Email id:
sarveshtrivedi.dgsnd@nic.in

Amendment No. BACHOELoad/AM-4/RC-210A0000/1016/74/05278/1108/1

Dated: 18-NOV-16

Effective Date: 18-NOV-16

To
M/S ACTION CONSTRUCTION EQUIPMENT LTD.
DHUDHOLA LINK ROAD DHUDHOLA VILLAGE
PALWAL
121102-HARYANA

Sub: Rate Contract for supply of Backhoe Loader valid for the period
from 14-MAR-16 To 31-MAR-17 .

Dear sir,

The following amendment to the schedule of subject rate contract are hereby authorized:-

Ref: (1) This Office RC No. BACHOELoad/AM-4/RC-210A0000/1016/74/05278/1108
(2) Your Letter No. ACE/DGSND/BACKHOE/1117.
Letter Date. 17-NOV-16.

<u>ITEM DESCRIPTION:</u>	Amendment In Rate
Schedule: Backhoe Loader..	
Model: ACE AX130, 4WD, 96 HP Engine, Heavy Duty Tyre, Excav Bucket : 0.24 Cu.m, Loader Bucket : 1.00 Cu.m	
NDP Rate : 2550000	Final Price (Excl. of markup and freight) 2450000.00
Model: ACE AX130, 4WD, 96 HP Engine, Standard Tyre, Excav Bucket : 0.24 Cu.m, Loader Bucket : 1.00 Cu.m	
NDP Rate : 2600000	Final Price (Excl. of markup and freight) 2523540.31

[Calculation Sheet \(Please click to view\)](#)

All the other terms and condition of Subject Rate Contract will remain unaltered.
[Click Here to View Documents](#)

Yours Faithfully,

FOR AND ON BEHALF OF THE PURCHASERS
NAMED IN THE FORM DGS&D 1001.

15. Water tanker

Description & Price of Items																											
Sr. No	Model Name	IDP Rate	Discount % & Fixed	Govt. NDP	Markup	Total ED on Markup	Ed. Cess on Markup	Val on Markup	Total Markup	Basic Ed%	NCCD% Ed%	Cess %	Ed. Cess %	Final Price (Exclusive of Markup and freight charges)	Average Freight Zone Wise												
															Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9				
1	3 KL WT TATA LPT 706 EV08 Cab Chassis BS III	72398	2	0	70925.04	4400	357.5	10.56	771.129	5485.188	8	0	.125	2	15.25	886632.21	19460	19460	19460	19460	19460	19460	19460	19460	19460		
2	6 KL WT TATA SA 1212TC 42 CAB CHASSIS 4x4 BS III	1304652	2	0	1276553.96	6960	491.553	14.52	999.303	7555.895	8	0	.125	2	15.25	1586900.79	22511	22511	22745	22745	22745	22745	22745	22745	22745	30000	
3	6 KL WT TATA LPT 1106EJ38 CAB CHASSIS BS III	903104	2	0	885041.92	6960	491.553	14.52	999.303	7555.895	8	0	.125	2	15.25	1105334.72	22511	22511	22745	22745	22745	22745	22745	22745	22745	24287	
4	9 KL WT TATA SE 1613 TC 42 CAB CHASSIS BS III	1238884	2	0	1205286.32	6960	491.553	14.52	999.303	7555.895	8	0	.125	2	15.25	1505390.07	22511	22511	22745	22745	22745	22745	22745	22745	22745	22745	30000
5	9 KL WT TATA SE 1613 42 CAB CHASSIS BS III	1163128	2	0	1136865.44	6960	491.553	14.52	999.303	7555.895	8	0	.125	2	15.25	1423386.5	22511	22511	22745	22745	22745	22745	22745	22745	22745	22745	30000
6	3 KL WT TATA SA 121232 CHASSIS 4X4 BS III	1333176	2	0	1295172.48	6960	491.553	14.52	999.303	7555.895	8	0	.125	2	15.25	1509319.24	22511	22511	22745	22745	22745	22745	22745	22745	22745	22745	30000
9	Optional item portable water pump with captive engine	30900	0	0	30900	0	0	0	0	0	8	0	.125	2	15.25	38591.21	0	0	0	0	0	0	0	0	0	0	0

Note :- The following 5 Zones for inviting average freight charges is finalized :
 Zone : 1) Andhra Pradesh,Karnataka,Kerala,Tamil Nadu,Pondicherry.
 Zone : 2) Maharashtra,Gujarat,Goa,Kerala & Nagar Haveli, Jammu & Din.
 Zone : 3) M.P., Rajasthan.
 Zone : 4) Delhi, Haryana, Punjab, Chandigarh.
 Zone : 5) J&K, Himachal Pradesh.
 Zone : 6) Orissa, Chhattisgarh, Jharkhand, West Bengal.
 Zone : 7) Uttar Pradesh, Bihar, Uttaranchal.
 Zone : 8) North Eastern States: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura.
 Zone : 9) Andaman & Nicobar Island, Lakshadweep.

16. Tipper - 2 nos.

Description & Price of Items														
Sr. No	Model Name	NIP Rate	Discount % & Fixed	Govt. NCP	Markup	Total ED on Markup	Est. on Markup	Net on Markup	Total Markup	Basic Ed% of Markup	MCCD%	Cess %	Est. Cess %	Final Price (Exclusive of Markup and Freight Charges) PER KM Charges
1	Half Dropside Load Body on SE16342 TC engine BSII	1061917	2 0	1040578.86	5500	684375	0	867213	7061588	12.5	0	.125	0	1438153.35
2	6.5Cum Box Tipper on SK161336 681 engine BSII	1192339	2 0	1168862.22	5500	684375	0	867213	7061588	12.5	0	.125	0	1500885.5
3	6.5Cum Box Tipper on SK161336 681 engine BSII	1124406	2 0	1101917.86	5500	684375	0	867213	7061588	12.5	0	.125	0	1414778.91
4	8Cum Box Tipper on SK161336 681 engine BSII	1147801.2	2 0	1124649.18	5500	684375	0	867213	7061588	12.5	0	.125	0	1446985.19
10	SA 1212 TC-42, 4x4 four wheel drive Cab Load Body BS II	1461917	2 0	1422578.86	5500	684375	0	867213	7061588	12.5	0	.125	0	1838461.95
11	LPK 251833 6x4 Dumper with 11 Cubic metre TC engine BS II	1626967	2 0	1603247.86	5500	684375	0	867213	7061588	12.5	0	.125	0	2058445.75
16	LPT 909 EX-38 BS II Truck High Deck Loadbody with 497 BS II with 687 TC/C Engine	647037	2 0	634096.25	4000	505	0	568425	5083125	12.5	0	.125	0	800419.78
21	LPT 161342 Truck C.L.B BS II with 687 TC/C Engine	1026074	2 0	1005582.52	5500	684375	0	867213	7061588	12.5	0	.125	0	1291054.02
24	LPTA 713 TC-42 BSII 4x4 Goods Truck CLB	1560965	2 0	1536175.1	5500	684375	0	867213	7061588	12.5	0	.125	0	2001883.89
25	LPA 716-32 BSII 4x4 Multiutility Truck BSII	1790965	2 0	1756135.9	5500	684375	0	867213	7061588	12.5	0	.125	0	2253462.68
26	LPK 1613 Tipper BS IV, 8.5Cum	1560000	2 0	1519000	5500	684375	0	867213	7061588	12.5	0	.125	0	196292.08

	Laying 15cm. to 23 cm. trap/ granite/ quartzite/ gneiss rubble soling including hand packing with rubble chips complete excluding cost of material Spec. No.: MORTH 313	1	165	165	0.2	5445	Cum		
	PWD DSR 2016-17 Page 273 item no.747								
	Total					5445	Sqm	39	212355
5	Sand or Soil filling in embankment								
	Providing earth work in embankment with approved materials obtained from departmental land or other sources upto lead of 50m. including all lifts, laying in layers of 20cm. to 30cm. thickness breaking clods, dressing to the required lines, curves, grade & section, watering and compaction with vibratory roller with V-net attachment to achieve 95 % of standard proctor density complete Spec. No.: MORTH 305								
	PWD DSR 2016-17 Page 270 item no.724								
5-A	Longer Side (Breadth= 2Mtr at Bottom & 1 Mtr at Top)	2	185	2	1	740	Cum		
5-B	Shorter Side (Breadth= 2Mtr at Bottom & 1 Mtr at Top)	2	185	2	1	740	Cum		
	Total					1480	Cum	110	162800
6	Construction of Sub base / Sub Grade on embankment								
	Watering and compacting of embankment formed of materials obtained from the road cutting, within a lead of 50m, to 95% of standard proctor density after laying them in layers of 20 cm to 30 cm with power roller. Spec. No.: MORTH 305								
	PWD DSR 2016-17 Page 269 item no.718								
6-A	Longer Side (Breadth= 2Mtr at Bottom & 1 Mtr at Top)	2	190	1	0.2	76	Cum		
6-B	Shorter Side (Breadth= 2Mtr at Bottom & 1 Mtr at Top)	2	190	1	0.2	76	Cum		
	Total					152	Cum	48	7296

7	Geosynthetic clay on embankment								
	Geotextile Filter (Laying of a geotextile filter between pitching and embankment slopes on with pitching is laid to prevent escape of the embankment material through the voids of the stone pitching / cement concrete blocks as well as to allow free movement of water without creating any uplift head on the pitching.) Spec. No.: MORT & H – 700								
	PWD DSR 2016-17 Page 259 item no.661								
7-A	Longer Side (Consider Embankment Ht=6 Mtr, Horizontal Length= 4Mtr, 1/2(6X4) for Breadth of Geosynthetic clay)	2	170	8		2720	Sqm		
7-B	Shorter Side (Consider Embankment Ht=6 Mtr, Horizontal Length= 4Mtr, 1/2(6X4) for Breadth of Geosynthetic clay)	2	170	8		2720	Sqm		
7-C	Bottom	1	165	165		27225	Sqm		
						32665	Sqm	856	27961240
8	Providing & Fixing in Position steel fiber reinforced concrete(SFRC) frame & covers of approved make including loading, unloading , transportation , all taxec etc. all complete as directed by engineer incharge (20 Ton capacity)								
	M JP SOR SWM 16 17 Page no 221 Item No.17 E								
8-A	Longer Side (Consider Embankment Ht=6 Mtr, Horizontal Length= 4Mtr, 1/2(6X4) for Breadth of Geosynthetic clay)	2	170	8		2720	Sqm		
8-B	Shorter Side (Consider Embankment Ht=6 Mtr, Horizontal Length= 4Mtr, 1/2(6X4) for Breadth of Geosynthetic clay)	2	170	8		2720	Sqm		
8-C	Bottom	1	165	165		27225	Sqm		
						32665	Sqm	235	7676275
							Total		54173841

18 Estimate for Biomining of old dumped waste

S. No.		Particular	Unit	Rate in Rs.
1	MJP DSR SWM section processing and disposal B1	Cutting, Dozing and spreading of Municipal Solid waste as well as natural ground with the help of Dozer or any other suitable machinery/equipment and compacting the M.S.W/soil with the help of Dozer it self up to required line & level. Excess of waste cut will be shifted with in the plot as per instruction given by Engineer-In-Charge. The newly filled area must also be compacted with the dozer up to required compaction etc. complete as directed by Engineer- in-Charge .	cum	250.00
2	CPWD DSR horticulture and landscaping 2016	Screening of old garbage through rotary/ vibratory seive through sieve of minimum 20 mm.		170.70
3	MJP DSR SWM section processing and disposal B1	Supply and Spray of innoculant and biosanitiser in required quantity		44.00
4	DSR page no 486	TRANSPORTATION AND CARRIAGE OF MATERIALS By mechanical transport including loading , unloading and stacking approximately 1 km		111.33
			Total	576.03

Quantity of waste 89000 cum

Amount 89000 x 576.03 = Rs. 51266670/-

19. Awareness Program and Capacity Building

Lump Sum

Rs. 100,00,000/-