

DRAFT DETAILED PROJECT REPORT

MUNICIPAL SOLID WASTE MANAGEMENT SCHEME FOR JAMMU MUNICIPAL CORPORATION



YEAR : 2015 - 16

ESTIMATED COST: Rs.14903.33 Lacs

CHAPTER – 1

SUBJECT INTRODUCTION

1. Introduction

1.1 What is Municipal Solid Waste?

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 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. When farmers buy the compost it will indirectly affect the food chain.) while treating such wastes.

According to the Hazardous Waste Management Rules 2010, the onus of managing and treating hazardous waste 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 What is Municipal Solid Waste Management

Municipal Solid Waste Management (MSWM) refers to a systematic process that comprises of waste segregation and storage at source, primary collection, secondary storage, transportation, secondary segregation, resource recovery, processing, treatment, and final disposal of solid waste.

1.3 Significance of MSW Management

Though Solid Waste Management (SWM) is an age old service provided by the urban local bodies (ULBs), efficient municipal solid waste management benefits in maintaining hygienic conditions leading to lesser health issues, better living environment, improved economic prosperity in the area, aesthetically cleaner surroundings with cleaner drains for storm water flow, cleaner water sources and safer neighbourhoods. Some of the key benefits of solid waste management have been discussed in the following sections.

1.3.1 Environment, Health and Safety Benefits

Effective solid waste management helps preserve environment in the project area;

- As it ***prevents waste*** to contamination of water (in drains) and soil in particular;
- ***Reduces waste*** sent to the landfill, which may have negative impacts on groundwater and air quality;
- ***Reduce emissions*** from energy consumption- as waste when recycled requires less energy than making goods from virgin materials thereby reducing the energy demand and pressure on non renewable sources (oil, fossil fuels);

- ***Contributes to Climate Change*** by reducing methane emissions from landfills. Waste prevention and recycling (including composting) divert organic wastes from landfills, reducing the methane released when these materials decompose. Thereby reducing the emission of greenhouse gases and climate change;
- Improved waste management services reduce chances of spread of diseases; and
- Efficiently designed waste management reduces multiple handling of waste avoiding potentially injurious or dangerous practices.

1.3.2 Economic Benefits

- Reduction in quantum of waste by diverting it to recycling and other processing unit reduces the landfill costs;
- Better managed waste management services indicate better value at same cost;
- An effective waste management implies reduce, reuse and recycle waste matter leading to introduction of more and more of waste matter into the value chain leading to economic benefits; and
- Waste management being a labour intensive activity, it helps in employment generation. Introduction of rag pickers into formalized waste collection and segregation process is a win scenario for implementers

1.4 Salient Features of MSW Rules, 2000

Responsibility of the Urban Local Body

- The Rule designates the Urban Local Bodies as sole responsible to manage solid waste in their area and dictates that “*within the territorial area of the municipality, be responsible for the implementation of the provisions of these rules, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes*”
- Prohibits waste to be exposed to open atmosphere;
- Prohibits waste disposal by burning (garbage, dry leaves) in open;

Collection of MSW

- Mandates collection of waste from slums and open squatter areas, hotels/restaurants/office complexes and commercial areas;
- Avoid Manual handling of waste, and ensure that the waste is collected and removed from the municipal area daily;
- Vehicles used for transportation of wastes to be covered;
- Bio degradable waste and non bio-degradable waste must be collected in separate bins from

source. Waste bins for biodegradable waste 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':

- Construction/demolition wastes/debris to be separately collected and disposed off following proper norms;
- Stray animals are to be kept out from the waste storage facilities

Processing of MSW

- Recover recyclables from mass before treating for biodegradable portion of the waste; Treatment of biodegradation composting, by windrow method or any other suitable methods such as anaerobic digestion etc as approved by Central Pollution Control Board (CPCB) may be adopted;
- In case the municipal body is engaged in any other treatment technology, such as incineration, energy recovery from waste etc. it must be duly approved by CPCB;

Disposal of MSW

- Municipal body to develop scientifically designed landfill as disposal facility out of waste processing facilities, as well as pre-processing rejects or unprocessed mixed waste (applicable if the waste is not fit for any treatment) in a scientifically designed sanitary landfill for a long term of 20 –25 years
- Site suitability criteria to be ensured for selection of landfill sites
- Land filling of mixed waste must be avoided, unless the waste is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land-filling shall be done following proper norms.

Monitoring of Pollution

- Municipality to take adequate pollution prevention steps for all its waste management and handling units
- Measures to reduce air pollution typically in case the unit has a waste to energy units.
- Environment Monitoring (ground and surface water, air quality) for waste handling site

Awareness Programs

- The municipality to be engaged in encouraging citizens, by organizing awareness programmes for segregation of waste at source and promote recycling or reuse of segregated materials through community participation programs involving representatives of local resident welfare associations, community based organizations (CBOs) and nongovernmental organizations.

1.5 Waste Quantification and Characterization

1.5.1 Waste Quantification

As waste generation is a factor of population, lifestyles and level of urbanization, the quantification process has been linked with population multiplied by the waste generation factor of the urban area. The factor of waste generation in turn has been calculated by monitoring 'total waste generation' to the population of the city at a given time (total waste generation/ population). Accordingly waste generation factor between 0.2-0.6 kg/capita/day has been recommended for Indian cities. A city wise bifurcation has been provided in table below.

Table: Quantity of Municipal Solid Waste in Indian Urban Centers

Population Range (in Millions)	Number of Urban Centres (sampled)	Total population (in Million)	Average per Capita value (kg/capita/day)	quantity (tones/day)
< 0.1	328	68.3	0.21	14343.00
0.1 - 0.5	255	56.914	0.21	11952.00
0.5 - 2.0	31	21.729	0.25	5432.00
1.0 - 2.0	14	17.184	0.27	4640.00
2.0 - 5.0	6	20.597	0.35	7209.00
> 5.0	3	26.306	0.50*	13153.00

* 0.6 kg/capita/day generation of MSW has been observed in metro cities

Source: Manual on MSW Management 2000

1.6 Waste Characteristics and Importance of Its Measurement

MSW characteristics depend on the type of activity from which it is produced; such as households, commercial shops, hotels & restaurants, markets and mass storage units, institutions and offices etc. Waste composition basically indicates the

Physical Characteristics and Chemical Characteristics of waste.

Typical physical and chemical characterization waste for Indian Cities has been found as follows;

Table 3.2: Physical and Chemical Characteristics of MSW in Indian Cities

Population Range (in millions)	0.1 to 0.5	0.5 to 1.0	1.0 to 2.0	2.0 to 5.0	> 5
Physical Characteristics					
Paper (as %)	2.91	2.95	4.71	3.18	6.43
Rubber Leather And Synthetics (as %)	0.78	0.73	0.71	0.48	0.28
Glass (as %)	0.56	0.35	0.46	0.48	0.94
Metals (as %)	0.33	0.32	0.49	0.59	0.8
Total compostable matter (as %)	44.57	40.04	38.95	56.67	30.84
Inert (as %)	43.59	48.38	44.73	49.07	53.9
Chemical Characteristics					
Moisture (as %)	25.81	19.52	26.98	21.03	38.72
Organic matter (as %)	37.09	25.14	26.89	25.6	39.07
Nitrogen as Total Nitrogen (as %)	0.71	0.66	0.64	0.56	0.56
Phosphorous as P₂O₅(as %)	0.63	0.56	0.82	0.69	0.52
Potassium as K₂O(as %)	0.83	0.69	0.72	0.78	0.52
C/N Ration	30.94	21.13	23.68	22.45	30.11
Calorific value* in Kcal/kg	1009.89	900.61	980.05	907.18	800.7

Source: Manual on Municipal Solid Waste Management 2000- CPHEEO

*Calorific Value on dry weight basis

1.7 Issue of Municipal Solid Waste

Wherever people live and work they will generate waste and that too in increasing quantities with the progress of economy and change in life style. Currently Nation-wide every urban citizen is generating 400 to 500 gm solid waste per day which is still 1/3 to 1/4th as compared to developed countries.

Arbitrary disposal of solid waste as open dumping has been the most wide spread form of waste management in every city of India. This practice has thrived because of the mistaken belief that it is the easiest and cheapest method of waste disposal.

During the last few decades, deposition of waste along road side, on river banks, in marsh lands has proved highly detrimental to the ground water and living environment. The physical, chemical and biological contaminants in solid waste have been choking drainage and water flows in several part of city, building up of toxic heavy metals and poisonous substances in the surrounding lands. This is also assuring ideal breeding ground for pathogens, flies, mosquitoes, rodents, vulture thereby, causing new disease epidemics.

1.7.1 Background and legal aspects

In the last decade of the 20th century municipal solid waste drew country wide attention of Citizen Forums, Judiciary, some of the Beurocrats and Democrats of Urban Local Bodies, Planning Commission and Officials of Central Government.

The subject got real high level of attention from the incidence of heavy rains-in Sept 1994 in the city of Surat. Where Solid waste and rain water created so-called plague situation. (Unfortunately similar incidences again happened in several cities during July 05 and Aug 2006).

Combined action from the multiple agencies cited above resulted in framing and enactment of: Specific rules and regulations on this subject: These are:

Municipal Solid Waste [Management and Handling] Rules 2000 from the Ministry of Environment and Forest (MOEF) Govt. of India Final notification of these rules was done under the Gazette of India No. 648 Extra Ordinary Part II-Section3-Subsection (ii) of 3rd October 2000.

Compliance of these rules (briefly called MSW Rules 2000) has become mandatory for every Urban Local Body that includes Municipal Corporation, Municipality, Nagar Palika, Nagar Nigam, Nagar Panchayat, Municipal Corporation and Notified Area Committee.

Under these MSW rules all Municipal Authorities have to follow prescribed norms for collection, segregation, storage, transportation, processing and disposal of Municipal solid waste generated in their respective jurisdiction.

1.7.2 Compliance Schedules

The entire aspects of Municipal Solid Waste Management have been stipulated in 4 schedules.

The schedule I stipulates deadlines for implementation of major action plan as following:

Implementation Schedule

Sr. No.	Compliance Criteria	Schedule
1.	Setting up of waste processing and disposal facilities	By 31.03.2013 or earlier
2.	Monitoring the performance of waste processing and disposal facilities	Once in six months
3.	Improvement of existing landfill sites as per provisions of these rules	By 31.03.2013 or earlier
4.	Identification of landfill sites for future use and making site (s) ready for operation.	By 31.03.2013 or earlier

Schedule II stipulates specific action plan for MSW collection, segregation, storage, transportation, processing and disposal.

Schedule III stipulates specification for landfill sites and

Schedule IV stipulates standards for compost, leachates and incineration.

1.7.3 Stipulations under schedule II covers major tasks: from collection up to final disposal of MSW. This has major bearing on augmentation of financial resources, materialistic requirements and need for land area as well as governs the applicability of processing technologies. Some of the major aspects as per this schedule are described here.

Management of Municipal Solid Wastes

S. No.	Parameters	Compliance criteria
1.	Collection of municipal solid wastes	<p>Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments. To prohibit littering and facilitate compliance, the following steps shall be taken by the municipal authority, namely :-</p> <ol style="list-style-type: none"> <li data-bbox="555 499 1503 752">i. Organising house-to-house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using bell ringing of musical vehicle (without exceeding permissible noise levels); <li data-bbox="555 775 1503 913">ii. Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas; <li data-bbox="555 936 1503 1075">iii. Wastes from slaughter houses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature, shall be managed to make use of such wastes; <li data-bbox="555 1097 1503 1236">iv. Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose; <li data-bbox="555 1258 1503 1397">v. Collected waste from residential and other areas shall be transferred to community bin by hand-driven containerised carts or other small vehicles; <li data-bbox="555 1420 1503 1626">vi. Horticultural and construction or demolition wastes or debris shall be separately collected and disposed off following proper norms. Similarly, wastes generated at dairies shall be regulated in accordance with the State laws; <li data-bbox="555 1648 1225 1684">vii. Waste (garbage, dry leaves) shall not be burnt; <li data-bbox="555 1706 1503 1845">viii. Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws. <li data-bbox="555 1868 1503 1957">ix. The municipal authority shall notify waste collection schedule and the likely method to be adopted for public benefit in a city or town.

S. No.	Parameters	Compliance criteria
		<p>It shall be the responsibility of generator of wastes to avoid littering and ensure delivery of wastes in accordance with the collection and segregation system to be notified by the municipal authority as per para 1(2) of this Schedule.</p>
2.	Segregation of municipal solid wastes	<p>In order to encourage the citizens, municipal authority shall organise awareness programmes for segregation of wastes and shall promote recycling or reuse of segregated materials.</p> <p>The municipal authority shall undertake phased programme to ensure community participation in waste segregation. For this purpose, regular meetings at quarterly intervals shall be arranged by the municipal authorities with representatives of local resident welfare associations and non-governmental organizations.</p>
3.	Storage of municipal solid wastes	<p>Municipal authorities shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely :-</p> <ul style="list-style-type: none"> <li data-bbox="587 1137 1503 1335">i. Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users; <li data-bbox="587 1357 1503 1554">ii. Storage facilities to be set up by municipal authorities or any other agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly; <li data-bbox="587 1576 1503 1832">iii. Storage facilities or 'bins' shall have 'easy to operate' design for handling, transfer and transportation of waste. 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; <li data-bbox="587 1854 1503 1995">iv. Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.

S. No.	Parameters	Compliance criteria
4.	Transportation of municipal solid wastes	<p>Vehicles used for transportation of wastes shall be covered. Waste should not be visible to public, nor exposed to open environment preventing their scattering. The following criteria shall be met, namely:-</p> <ol style="list-style-type: none"> <li data-bbox="544 367 1503 517">i. The storage facilities set up by municipal authorities shall be daily attended for clearing of wastes. The bins or containers wherever placed shall be cleaned before they start overflowing; <li data-bbox="544 533 1503 622">ii. Transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is avoided.
5.	Processing of municipal solid wastes	<p>Municipal authorities shall adopt suitable technology or combination of such technologies to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted, namely:-</p> <ol style="list-style-type: none"> <li data-bbox="544 810 1503 1066">i. The biodegradable wastes shall be processed by composting, vermin composting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes. It shall be ensured that compost or any other end product shall comply with standards as specified in Schedule-IV; <li data-bbox="544 1081 1503 1447">ii. Mixed waste containing recoverable resources shall follow the route of recycling. Incineration with or without energy recovery including pelletisation can also be used for processing wastes in specific cases. Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down before applying for grant of authorisation.
6.	Disposal of municipal solid wastes	<p>Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Land filling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land-filling shall be done following proper norms. Landfill sites shall meet the specifications as given in Schedule –III.</p>

1.7.4 Specifications for Sanitary Land Fill

Site Selection:

1. In areas falling under the jurisdiction of 'Development Authorities' it shall be the responsibility of such Development Authorities to identify the landfill sites and hand over the sites to the concerned municipal authority for development, operation and maintenance. Elsewhere, this responsibility shall lie with the concerned municipal authority.
2. Selection of landfill sites shall be based on examination of environmental issues. The Department of Urban Development of the State or the Union territory shall co-ordinate with the concerned organisations for obtaining the necessary approvals and clearances.
3. The landfill site shall be planned and designed with proper documentation of a phased construction plan as well as a closure plan.
4. The landfill sites shall be selected to make use of nearby wastes processing facility. Otherwise, wastes processing facility shall be planned as an integral part of the landfill site.
5. The existing landfill sites which continue to be used for more than five years shall be improved in accordance of the specifications given in this Schedule.
6. Biomedical wastes shall be disposed off in accordance with the Bio-medical Wastes (Management and Handling) Rules, 1998 and hazardous wastes shall be managed in accordance with the Hazardous Wastes (Management and Handling) Rules, 1989, as amended from time to time.
7. The landfill site shall be large enough to last for 20-25 years.
8. The landfill site shall be away from habitation clusters, forest areas, water bodies monuments, National Parks, Wetlands and places of important cultural, historical or religious interest.
9. A buffer zone of no-development shall be maintained around landfill site and shall be incorporated in the Town Planning Department's land-use plans.
10. Landfill site shall be away from airport including airbase. Necessary approval of airport or airbase authorities prior to the setting up of the landfill site shall be obtained in cases where the site is to be located within 20 km of an airport or airbase.

Facilities at the Site:

1. Landfill site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation.
2. The landfill site shall be well protected to prevent entry of unauthorized persons and stray animals.
3. Approach and other internal roads for free movement of vehicles and other machinery shall exist at the landfill site.
4. The landfill site shall have wastes inspection facility to monitor wastes brought in for landfill, office facility for record keeping and shelter for keeping equipment and machinery including pollution monitoring equipments.
5. Provisions like weigh bridge to measure quantity of waste brought at landfill site, fire protection equipments and other facilities as may be required shall be provided.
6. Utilities such as drinking water (preferably bathing facilities for workers) and lighting arrangements for easy landfill operations when carried out in night hours shall be provided.
7. Safety provisions including health inspections of workers at landfill site shall be periodically made.

Specifications for land filling:

1. Wastes subjected to land filling shall be compacted in thin layers using landfill compactors to achieve high density of the wastes. In high rainfall areas where heavy compactors cannot be used alternative measures shall be adopted.
2. Wastes shall be covered immediately or at the end of each working day with minimum 10 cm of soil, inert debris or construction material till such time waste processing facilities for composting or recycling or energy recovery are set up as per Schedule I.
3. Prior to the commencement of monsoon season, an intermediate cover of 40-65 cm thickness of soil shall be placed on the landfill with proper compaction and grading to prevent infiltration during monsoon. Proper drainage berms shall be constructed to divert run-off away from the active cell of the landfill.
4. After completion of landfill, a final cover shall be designed to minimize infiltration and erosion. The final cover shall meet the following specifications, **namely :--**

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

Pollution prevention:

1. In order to prevent pollution problems from landfill operations, the following provisions shall be made, namely :-
 - a) Diversion of storm water drains to minimize leachate generation and prevent pollution of surface water and also for avoiding flooding and creation of marshy conditions;
 - b) Construction of a non-permeable lining system at the base and walls of waste disposal area. For landfill receiving residues of waste processing facilities or mixed waste or waste having contamination of hazardous materials (such as aerosols, bleaches, polishes, batteries, waste oils, paint products and pesticides) minimum liner specifications shall be a composite barrier having 1.5 mm high density polyethylene (HDPE) geomembrane, or equivalent, overlying 90 cm of soil (clay or amended soil) having permeability coefficient not greater than 1×10^{-7} cm/sec. The highest level of water table shall be at least two meter below the base of clay or amended soil barrier layer;
 - c) Provisions for management of leachates collection and treatment shall be made. The treated leachates shall meet the standards specified in Schedule- IV;
 - d) Prevention of run-off from landfill area entering any stream, river, lake or pond.

1.7.5 Standards for Compost

1. The waste processing or disposal facilities shall include composting, incineration, pelletisation, energy recovery or any other facility based on state-of-the-art technology duly approved by the Central Pollution Control Board.
2. In case of engagement of private agency by the municipal authority, a specific agreement between the municipal authority and the private agency shall be made particularly, for supply of solid waste and other relevant terms and conditions.
3. In order to prevent pollution problems from compost plant and other processing facilities, the following shall be complied with, **namely :-**

- i. The incoming wastes at site shall be maintained prior to further processing. 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 a leachate treatment and disposal facility;
- ii. Necessary precautions shall be taken to minimize nuisance of odour, flies, rodents, bird menace and fire hazard;
- iii. In case of breakdown or maintenance of plant, waste intake shall be stopped and arrangements be worked out for diversion of wastes to the landfill site;
- iv. Pre-process and post-process rejects shall be removed from the processing facility on regular basis and shall not be allowed to pile at the site. Recyclables shall be routed through appropriate vendors. The non-recyclables shall be sent for well designed landfill site(s).
- v. In case of compost plant, the windrow area shall be provided with impermeable base. Such a base shall be made of concrete or compacted clay, 50 cm thick, having permeability coefficient less than 10⁻⁷ cm/sec. The base shall be provided with 1 to 2 per cent slope and circled by lined drains for collection of Leachate or surface run-off;
- vi. Ambient air quality monitoring shall be regularly carried out particularly for checking odour nuisance at down-wind direction on the boundary of processing plant.
- vii. In order to ensure safe application of compost, the following specifications for compost quality shall be met, **namely:-**

Parameters	Concentration not to exceed * (mg/kg dry basis , except pH value & C/N ratio)
Arsenic	10.00
Cadmium	5.00
Chromium	50.00
Copper	300.00
Lead	100.00
Mercury	0.15
Nickel	50.00
Zinc	1000.00
C/N ratio	20-40
PH	5.5 – 8.5

- * Compost (final product) exceeding the above stated concentration limits shall not be used for food crops. However, it may be utilized for purposes other than growing food crops.

1.7.6 Standards for compost under Fertilizer Control Order of March 2006 from Ministry of Agriculture

Under the MSW Rules 2000 from MOEF only the tolerance limits of heavy metal content in the Compost along with few chemical parameters were prescribed. Subsequently Ministry of Agriculture, Govt. of India have notified positive contents that the compost from city waste should have along with label directions etc. These specifications have been prescribed under the “Fertilizer Control Order” published in the Gazette of India Extra Ordinary Part II – Section 3 – Subsection (ii) of 24th March 2006. This is referred as “Fertilizer (control) Amendment Order, 2006.

Various requirements specified under this order are given in the relevant chapter on recovered products.

1.8 NEED OF THE PROJECT

Preparation of the Manual on Municipal Solid Waste Management is mainly to assist the personnel involved in managing the solid waste generated in the cities/ towns of the country. Govt. of India has launched a development programme to improve the environment, economical condition, and basic services etc. for such cities. Municipal solid waste management is the need of the day to keep the city clean and improve the hygienic condition and environment of the town.

1.9 PROPOSAL UNDER THIS DPR:

1. Primary collection, storage & transportation
2. Windrow platforms for partial aerobic decomposition and primary segregation.
3. Compost plant, segregation, screening and conveyor belts etc.
4. Power Plant.
5. 2 Nos. Transfer Station
6. Sanitary landfill for 5 years.
7. Vehicle and Equipment at MSWD site.
8. Vehicle Parking, Washing and Workshop Shed.
9. Internal roads.
10. Water supply, Electrification of MSWD Campus.
11. Boundary wall, Office & labs, Canteen, Workers crèche, generator room, HT-LT/ MEP room and Development of green belt etc.
12. Public awareness and Training program etc.

1.10 SERVICE LEVEL BENCH MARK

It will help effect performance improvements in the identified service sectors by (i) helping local decision makers identify gaps, plan and prioritize improvement measures, (ii) enabling identification and transfer of best practice (iii) enhancing accountability to customers for service delivery levels, (iv) providing a framework that can underline contracts / agreements with service providers, and (v) making it possible to link decision making on financial allocations to service outcomes.

Service level parameters can be measured either from a utility manager's / planner's perspective or from a citizen's or consumer's perspective, Further, to facilitate comparison between cities / service delivery jurisdictions, and changes in performance over time, it is important that the performance levels are benchmarked, and monitored against those benchmarks.

S. No.	Proposed Indicator	Benchmark	
		Existing	Proposed
1	Household level coverage of Solid Waste Management Services	40%	100%
2	Efficiency of collection of municipal solid waste	30%	100%
3	Extent of segregation of municipal solid waste	0%	100%
4	Extent of municipal solid waste RECOVERED/RECYCLED	0% by JMC but rag pickers is doing it by themselves (5 to 7 %)	80%
5	Extent of scientific disposal of municipal solid waste	0%	100%
6	Extent of cost recovery in Solid Waste Management Services	0%	100%
7	Efficiency in redressal of customer complaints	10%	80%
8	Efficiency in collection of user charges	0%	90%
9	Extent of processing and treatment of MSW	0%	100%

1.11 INSTITUTIONAL RESPONSIBILITIES:

JK UEED will be whole-sole responsible for execution, implementation and operation & maintenance of the scheme.

1.12 PROPOSED MSWD SITE

Jammu Municipal Corporation acquired approximately 25 acre of land at Jammu-Srinagar bypass road.

1.13 SCHEDULE OF RATE:

For Jammu town in general JKSOR 2012 with 35% cost index for scheduled item has been taken for estimation purpose. Wherever items in SSR schedule are not available but are necessary to be executed, prevailing market rates have been followed. The rates for Non- schedule items are based on market enquiry.

1.15 CONCLUSION:

DPR of Municipal Solid Waste Management for Jammu Municipal Corporation area amounting to **Rs. 14934.37 Lacs** has been prepared and is being submitted for approval.

CHAPTER – 2

JAMMU– TOWN PROFILE

2.1 Introduction

Jammu is the largest city in the Jammu region and the winter capital of Indian administered state of Jammu and Kashmir and situated on the banks of Tawi river. It is a municipal corporation. Jammu is also known as the City of Temples owing to the number of historical temples and domes of old mosques located within the city. With its fastest growing urban agglomerations and booming infrastructure the winter capital of state is the second largest city in the state.



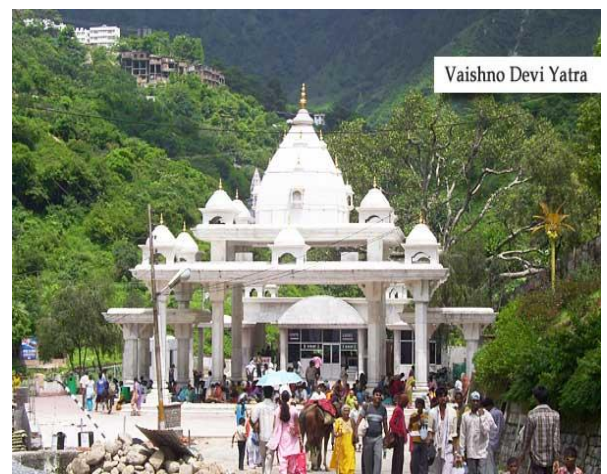
2.2 History

Jammu has historically been the capital of Jammu Province and the winter capital of the erstwhile Jammu and Kashmir princely state (1846–1952). Jambu Lochan was the brother of Raja Bahu Lochan who constructed a fort, Bahu Fort, on the bank of river Tawi. The city name figures in the ancient book Mahabharata. Excavation near Akhnoor, 32 kilometres (20 mi) from Jammu city, provides evidence that Jammu was once part of the Harappan civilization. Remains from the Maurya, Kushan, Kushanshahs and Gupta periods have also been found in Jammu. After 480 CE, the area was dominated by the Hephthalites and ruled from Kapisa and Kabul. They were succeeded by the Kushano-Hephthalite dynasty from 565 to 670 CE, then by the Shahi from 670 CE to the early 11th century, when the Shahi were destroyed by the Ghaznavids. Jammu is also mentioned in accounts of the campaigns of Timur. The area witnessed changes of control following invasions by Mughals and Sikhs, before finally falling under the control of the British. The Dev Dynasty ruled it for about 984 years from 840 CE to 1816 CE. The city

remained in scientific isolation and lagged behind other Indian cities. Then came the Dogra Rule that revived its ancient glory by building great temples, renovated old shrines, built educational institutes and many more. A 43 km long railway line connecting Jammu with Sialkot was laid in 1897 but it was abandoned after the Partition of India as the railway link to Sialkot was broken. Jammu had no rail services until 1971, when the Indian Railways laid the Pathankot - Jammu Tawi Broad Gauge line. The new Jammu Tawi station was opened in 1975. In 2000, much of the old railway station was demolished to make way for an art centre. After partition of India, Jammu continued to be the winter capital of state.



Bahu Fort, Jammu



Mata Vaisho Devi Temple

2.3 Geography

Jammu is located at 32.73°N 74.87°E. It has an average elevation of 327 m (1,073 ft). Jammu city lies at uneven ridges of low heights at the Shivalik hills. It is surrounded by Shivalik range to the north, east and southeast while the Trikuta Range surrounds it in the north-west. It is approximately 600 kilometres (370 mi) from the national capital, New Delhi.

The city spreads around the Tawi river with the old city overlooking it from the north (right bank) while the new neighbourhoods spread around the southern side (left bank) of river. There are four bridges on the river. The fifth bridge on the Tawi river is under construction and would be ready soon. The city is not flat. One part is high and other is low and the city spreads on these uneven ridges of very low heights. The Bahu hill and the old city spread on each bank of Tawi are the highest points with the royal Dogra Palace at another height overlooking it. The airport is situated at Satwari.

2.4 Climate

Jammu, like the rest of north-western India, features a humid subtropical climate with extreme summer highs reaching 46 °C (115 °F), and temperatures in the winter months occasionally falling below freezing. June is the hottest month with average highs of 40.6 °C (105.1 °F), while January is the coldest month with average lows reaching 7 °C (45 °F). Average yearly precipitation is about 42 inches (1,100 mm) with the bulk of the rainfall in the months from June to September, although the winters can also be rather wet. In winter dense smog causes much inconvenience and temperature even drops to 2 °C (36 °F). In summer, particularly in May and June, extremely intense sunlight or hot winds can raise the mercury to 46 °C (115 °F). Following the hot season, the monsoon lashes the city with heavy downpours along with thunderstorms: rainfall may total up to 669 mm (26.3 in) in the wettest months.

2.5 Administration

Jammu city serves as the winter capital of Jammu & Kashmir state from November to April when all the offices move from Srinagar to Jammu. Srinagar serves as the summer capital from May to October. Jammu was a municipal committee during 2001 census of India. With effect from 5 September 2003, it has upgraded status of a municipal corporation.

2.6 Economy

Jammu city is the main cultural and economic centre of the administrative division of Jammu. The city has a number of small industries. The industrial estates of Gangayal and Bari-Brahmana are the largest in the entire state. Jammu has a number of food grain mills. Jammu also has largest number of shopping complexes, cinemas, recreation centres in the state. At present the real-estate business is flourishing but some anomalies in the constitution of the state have made it to lag behind other cities.

2.7 Demographics

As of 2011 India census, the population of Jammu city within jurisdiction of Jammu Municipal Corporation was 503,690 and the population of Jammu urban agglomeration (including adjacent urban areas) was 651,826. Males constituted 52.7% of the population; females numbered constituted 47.3% of the population. The sex ratio was 898 females per 1,000 males against national average of 940. Jammu had an average literacy rate of

89.66%, much higher than the national average of 74.4%: male literacy was 93.13% and female literacy was 85.82%. In Jammu, (8.47% of the population) persons were under 6 years of age. The principal languages spoken are Dogri, Hindi, Kashmiri, Urdu and English.

CHAPTER – 3

EXISTING STATUS

3.1 Introduction

Solid waste management is poorly performed resulting in problems of health, sanitation and environmental degradation in most of the towns. Unless concerted efforts are made to improve the flow of resources to solid waste management and build up systems that incorporate the basic requirements of a proper waste management practice.

3.2 Existing Status

3.2.1 Sources & Quantity

The Municipal Corporation of Jammu town generates around 251 MT of solid waste every day. The per capita generation rate of Jammu town is 450 gms/cap./day. The Corporation shows a collection efficiency of over 50%. The major sources of solid waste generation in town are household domestic waste, commercial establishments, markets, hotels and restaurants, etc.

The major sources of generation of waste:

- Local Residents
- Anaz Mandi and Vegetable Market
- Sweet Shops and restaurants
- Hospital and Dispensaries
- Domestic and Stray animals
- Shops and commercial establishments
- Others

3.2.2 Present Practices of Solid Waste Management

The Corporation is responsible for collection, transportation and disposal of Solid Waste. Storage and segregation of waste at source is not very prominent in Jammu. In the absence of practice of segregation of waste at source, rag pickers pick up part of this waste in solid condition and spread the contents around for sorting and collection. Currently there is no arrangement for doorstep collection of waste. Local inhabitants throw wastes in the near-by vacant plots or on the streets.

3.2.3 Storage of Solid Waste at Generation Point

The scientific and systematic storage of waste at source is not in practice and in the absence of the desirable system of storage of waste at source; the waste is thrown on the streets, treating streets as receptacle of waste. No segregation of non-biodegradable/ recyclable waste is done either at the source or at the streets/ roads. This hampers the composting process, when dumped along with biodegradable waste, besides causing loss of revenue due to the deprivation of salvage value of the recyclable wastes.

3.2.4 Existing condition and practices

The municipal Corporation is responsible for collection, transportation and disposal of Solid Waste. In the town there is no scientific and systematic storage of waste at the source. Jammu Municipal Corporation had adopted only dumping as method of disposal of the waste material. Currently the wastes are not treated in a systematic and scientific manner while disposing. The wastes are just dumped without segregation of biodegradable and non-biodegradable wastes. As a result whole area in and around the disposal site is unhygienic with bad odor and posing serious threat to environment and to the public health.

3.3 Future Generation Trends

There is no precedence of studies on per capita waste generation trends of the Jammu. The projected generation of waste has been calculated according to the norms/standards prescribed in the manual on municipal solid waste management of Ministry of Urban Development and Poverty Alleviation.

It is estimated that the municipal area with projected population of 7.45 lakhs will generate around 335 MTPD of solid waste per day at 450 gm / cap / day, by the year 2025. Such a high volume of waste generation warrants a strategic approach for disposal in addition of the need for initiating steps for reduce, recover, reuse and recycling strategies in Jammu.

3.4 Issues and Concerns

The wastes are not treated in a systematic and scientific manner while disposing. The waste collection efficiency is still 50% percent. There is also tradition of dumping of waste in streets and on open, vacant plots. Existing open dumping system may cause not

only health hazard and fire but also a potential breeding ground for vectors and diseases. It may also contaminate ground water.

3.5 Problem being faced by Jammu Municipal Corporations

Except for a few progressive municipal Corporations in the country, all other local bodies suffer due to non-availability of adequate expertise and experience. Hence solid waste is not properly handled resulting in creation of environmental pollution and health hazards. These local bodies lack in technical, managerial, administrative, financial resources, adequate institutional arrangement and the technical know how of managing urban solid waste. It is therefore, very essential to provide proper guidance and training to the personnel to make them efficient in managing the solid waste generated in their areas.

3.6 Solid Waste Management:

As per study conducted, the town generates approximately 251 metric tons Municipal Solid Waste per day as in Year 2014. But the Municipal Authority is capable to lift around 134 metric tons waste by using the available vehicle & equipments. The waste is being dumped in low-lying areas without any treatment.

There is no door – door collection system. The residents throw their waste on roadsides, on low-lying areas etc. The waste thrown on road side is lifted by hand carts and transported to nearest temporary centre. In Jammu there are 81 temporary collection centres as listed annexed in the DPR.

The present system is absolutely against the norms of proper Solid Waste Management system as per MSW rule 2000.

The Nagar Nigam Jammu does not have sufficient staff and proper infrastructure for solid waste management.

The list of existing vehicle and equipments with the Nagar Nigam Jammu is as under:

Sl. No.	Description	Numbers available
1.	Refuse Collector 6.5 cum capacity	2
2.	Dumper Placer	7
3.	Refuse Collector 10 cum capacity	4
4.	Loader / front end loader	2
6.	Metallic Bins 4.5 cum capacity	200

Sl. No.	Description	Numbers available
7	JCB	3
8	Road Cleaning Machine	2

These equipments are not capable to clear the daily waste generation by the entire population covered by Nagar Nigam Jammu.

Man Power Available:

Nagar Nigam has informed of having following staff engaged on solid waste management works.

1. Sanitary Inspector - 57 No.
2. Sweepers - 2000Nos.

3.7 Existing Situation of Market Waste:

At present there are 10 Vegetable, Fruits, & Grain Market in Jammu city.

The waste from market is being lifted on daily basis through Tata ace & Auto Three Wheeler tipper disposed of by dumping in low laying area.

3.8 Slaughter House:

There are 2 Nos. slaughterhouses in Dogra Hall & Guggar Naggar & 200 Meet Shops in Jammu city. Slaughtering is being done in open places also and the waste is being consumed by dogs & the rest is disposed off along with Municipal Solid Waste.

3.9 NEED OF THE PROJECT:

Solid Waste Management is a part of public health and sanitation, and according to the Indian Constitution, falls within the purview of the State list. Since this activity is non-exclusive, non-rivalled and essential, the responsibility for providing the service lies within the public domain. The activity being of a local nature is entrusted to the Urban Local Bodies. The Urban Local Body undertakes the task of solid waste service delivery, with its own staff, equipment and funds. In a few cases, part of the said work is contracted out to private enterprises.

Solid Waste Management System is needed to ensure better human health and safety. In the town there is no proper and systematic collection, storage and transportation of waste due to lack of equipments, skilled manpower and knowledge.

Therefore there is urgent need to implement solid waste management scheme in the town for proper collection, transportation, treatment and disposal.

3.10 INVESTIGATION AND STUDY:

3.10.1 Domestic Waste Generation:

Samples from houses covering all income groups were collected continuously for seven days subjected to weight and volumetric measurements.

Each sample collected from 100 places were weighed by a 50Kg capacity spring balance and recorded. It is found that in Jammu average domestic solid waste generation works out to 0.30 kg/capita/day, which is approximately 66.66% of the total waste.

3.10.2 Road Sweeping:

Sanitary Inspector Municipal Corporation has informed that approximately 14314kg (14.31 M. Tons) waste from road sweepings is collected on daily basis. Out of which quantity of dust is 14.31 MT (14314 Kg)

Average per capita works out to $14314 / 715714 = 0.02$ kg/capita/day

3.10.3. Commercial Waste Generation:

Sanitary Inspector Municipal Corporation has informed that approximately 715714kg (71.57 M. Tons) waste from vegetable market, shops, fruit market etc. is being collected daily.

Average per capita works out to $71571 / 715714 = 0.10$ kg/capita/day

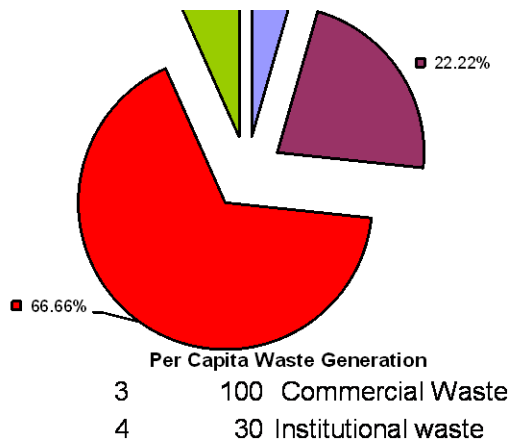
3.10.4. Institutional Waste Generation:

Sanitary Inspector Municipal Corporation has informed that approximately 21471kg (21.47 M. Tons) waste from institutions is collected on daily basis.

Average per capita works out to $21471 / 715714 = 0.03$ kg/capita/day.

3.10.5. Per Capita Waste Generation in Year 2014

Domestic waste	= 0.30 kg
Road sweeping (dust)	= 0.02 kg
Commercial waste	= 0.10 kg
Institutional waste	= 0.03 kg
Total waste generation	$\overline{0.45}$ kg / capita / day



	Kg/Capita/day	Percentage
Road Sweeping	0.02	4.44%
Commercial Waste	0.10	22.22%
Domestic Waste	0.30	66.66%
Institutional waste	0.03	6.66%
Total	0.45	Kg/Capita/day

3.11. DENSITY OF SOLID WASTE

A plastic bucket of 13 liters or 0.013 cum was used for working out Density of Municipal Solid Waste, samples from the heap of waste at different collecting centers and existing dumping sites were taken. In plastic bucket without any compaction and weighed with the help of 50 Kg spring balance. Recorded data are furnished in table:

Sl. No.	Particulars	Wt. in Kg	Vol. Cum	Density Kg/ Cum
1	Sample No. – 1	7.80	0.013	600
2	Sample No. – 2	6.89	0.013	530
3	Sample No. – 3	5.20	0.013	400
4	Sample No. – 4	6.11	0.013	470
Total		26.00	0.052	2000
Average bulk Density				500

CHAPTER -4**POPULATION PROJECTION AND WASTE GENERATION****4.1 PROJECTED POPULATION**

Census Population of Jammu Town⁷ of various decades is given below:

Year	Population	Increase (x)	Incremental increase (y)	%age of decadal Increase
1	2	3	4	5
1961	102738			
1971	157708	54970		53.505
1981	214737	57029	2059	36.161
1991	369960	155223	98194	72.285
2001	549791	179831	24608	48.608
2011	576195	26404	-153427	4.803
Total	3	1971129	473457	-28566.00
Average		94691.40	-5713.20	43.072
Say		94692.00	-5713.00	43.07

i) Arithmetical Progression Method –

			$P_n = P_e + 0.1 \times (X)$
Increase in population per decade	(i)	=	94692
Projected population in	2016 =	$576195 + 0.5 \times 94692$	= 623541
Projected population in	2017 =	$576195 + 0.6 \times 94692$	= 633010
Projected population in	2032 =	$576195 + 2.1 \times 94692$	= 775048
Projected population in	2047 =	$491555 + 3.6 \times 95140$	= 917086

ii) Geometrical Progression Method –

			$P_n = P_1 \times (1+r_g)^m$
Rg=		$(0.535 \times 0.362 \times 0.723 \times 0.486 \times 0.048)^{1/5}$	= 0.31828
Geometrical Mean		Rg	= 0.31828
Projected population in	2016	$= 576195 \times (1+Rg)^{0.5}$	= 661567
Projected population in	2017	$= 576195 \times (1+Rg)^{0.6}$	= 680103
Projected population in	2032	$= 576195 \times (1+Rg)^{2.1}$	= 1029411
Projected population in	2047	$= 576195 \times (1+Rg)^{3.6}$	= 1558126

iii) **Incremental Increase Method –**

$$P_n = P_e + n(x) + \{n(n+1)(y)\} / 2$$

Projected population in	2016=	$576195 + 0.5 \times 94692 + \{0.5(0.5+1)(-5713)\} / 2$	=	621399
Projected population in	2017=	$576195 + 0.6 \times 94692 + \{0.6(0.6+1)(-5713)\} / 2$	=	630268
Projected population in	2032=	$576195 + 2.1 \times 94692 + \{2.1(2.1+1)(-5713)\} / 2$	=	756452
Projected population in	2047=	$576195 + 3.6 \times 94692 + \{3.6(3.6+1)(-5713)\} / 2$	=	1971129

iv) **Decadal Increase Method–**

$$P_n = P_e + 0.1 \times \{(x) + (y)\}$$

Projected population in	2016=	$576195 + 0.5 (94692 \times 43.07\%)$	=	700284
Projected population in	2017=	$576195 + 0.6 (94692 \times 43.07\%)$	=	725102
Projected population in	2032=	$576195 + 2.1 (94692 \times 43.07\%)$	=	1097370
Projected population in	2047=	$576195 + 3.6 (94692 \times 43.07\%)$	=	1469638

The population derived by various methods is summarized as below:-

Sl. No.	Method	POPULATION			
		2016	2017	2032	2047
1	Arithmetical Progression Method	623541	633010	775048	917086
2	Geometrical Progression Method	661567	680103	1029411	1558126
3	Incremental Increase Method	621399	630268	756452	1971129
4	Decadal Increase Method	700284	725102	1097370	1469638

v) **Conclusion:**

Population projected by decadal increase method has been adopted, which seems quite realistic.

Year	2016	2017	2032	2047
Population	700284	725102	1097370	1469638
Floating Population @ 10%	70028	72510	109737	146964
Total Population	770312	797612	1207107	1616602

4.3 Ward Wise Population:

There are 71 wards in Jammu Municipal Corporation Area, which are tabulate below.

Sl. No.	Name of Wards	Population Year					
		2011	2016	2017	2022	2032	2047
1	Panjtirthi	7177	8723	9032	10577	13669	18306
2	Jullakha Mohalla	6848	8323	8618	10093	13042	17466
3	Mast Garh	8699	10572	10947	12821	16567	22188
4	Bhabrian	4246	5160	5343	6258	8087	10830
5	Talab Khatika	5274	6410	6637	7773	10044	13452
6	Gujjar Nagar	5040	6125	6342	7428	9599	12855
7	Kanji House	6415	7797	8073	9454	12217	16362
8	Dogra Hall	11026	13401	13875	16250	20999	28123
9	Mohalla Ustad	8393	10201	10562	12370	15985	21407
10	Pacca Danga	7747	9415	9749	11417	14754	19759
11	Mohalla Molhotra	2429	2952	3057	3580	4626	6195
12	Krishna Nagar	7031	8545	8848	10362	13391	17933
13	Resham Ghar	7998	9720	10065	11787	15232	20400
14	Bhagwati Nagar	6033	7332	7592	8891	11490	15388
15	Pratap Garh	5223	6348	6573	7698	9947	13322
16	New Plot	11676	14191	14693	17208	22237	29781
17	Ambphalla	4974	6045	6259	7331	9473	12687
18	Sarwal	9510	11558	11968	14016	18112	24256
19	Chand Nagar	8936	10860	11245	13170	17019	22792
20	Gandhi Nagar (N)	9952	12095	12524	14667	18954	25383
21	Gandhi Nagar	8272	10053	10410	12191	15754	21098
22	Shastri Nagar	5752	6991	7238	8477	10955	14671
23	Nai Basti	12110	14718	15240	17848	23064	30888
24	Rehari Colony (N)	7264	8828	9141	10706	13834	18527
25	Rehari Colony (S)	5332	6480	6710	7858	10155	13600
26	Subhas Nagar	11069	13453	13930	16313	21081	28232
27	Bakshi Nagar	6540	7948	8230	9639	12456	16681
28	Gurah Bakshi Nagar	8512	10345	10712	12545	16211	21711

Sl. No.	Name of Wards	Population Year					
		2011	2016	2017	2022	2032	2047
29	Raipur Mangolia	10197	12393	12832	15028	19420	26008
30	Talab Tillo (N)	7604	9242	9569	11207	14482	19395
31	Talab Tillo (S)	9014	10955	11344	13285	17167	22991
32	Gole	12778	15530	16080	18832	24336	32591
33	Shiv Nagar	11238	13658	14142	16562	21403	28664
34	Janipur (N)	3240	3938	4077	4775	6171	8264
35	Janipur (S)	4663	5667	5868	6872	8881	11893
36	Janipur Central	7919	9624	9966	11671	15082	20198
37	Janipur (W)	15830	19239	19921	23330	30148	40376
38	Paloura	7794	9473	9808	11487	14844	19879
39	Top Sherkhania	10320	12543	12987	15210	19655	26322
40	Poonch House	13001	15801	16361	19161	24761	33160
41	Bohri	9710	11801	12219	14311	18493	24766
42	Nanak Nagar (W)	7584	9217	9544	11177	14444	19344
43	Nanak Nagar (E)	8855	10762	11143	13050	16864	22585
44	Nanak Nagar (N)	11237	13657	14141	16561	21401	28661
45	Digiana	13871	16858	17456	20443	26417	35379
46	Saniav Nagar	8657	10521	10894	12759	16487	22080
47	Bahu (E)	12888	15664	16219	18994	24545	32872
48	Bahu (W)	5249	6379	6606	7736	9997	13388
49	Narwal Bala	3956	4808	4978	5830	7534	10090
50	Channi Himmat	9457	11494	11901	13938	18011	24121
51	Channi Himmat Thanjar	3793	4610	4773	5590	7224	9674
52	Channi Himmat Biza	9757	11858	12279	14380	18582	24886
53	Channi Biza Sec (1-4)	8119	9868	10217	11966	15463	20708
54	Channi Rama	4315	5244	5430	6359	8218	11006
55	Deeli	8146	9900	10251	12006	15514	20777
56	Gangyal -1	8497	10327	10693	12523	16183	21672
57	Gangyal -2	7714	9375	9708	11369	14691	19675
58	Digiana	8940	10865	11250	13176	17026	22802
59	Paloura Top	9115	11078	11471	13434	17360	23249

Sl. No.	Name of Wards	Population Year					
		2011	2016	2017	2022	2032	2047
60	Paloura Centre	6381	7755	8030	9404	12153	16275
61	Patta Paloura	12403	15074	15608	18279	23622	31635
62	Chinor Keran -1	8018	9745	10090	11817	15270	20451
63	Chinor Keran-2	6211	7549	7816	9154	11829	15842
64	Chak Chadwad	12731	15473	16021	18763	24246	32472
65	Barnai Upper Darmal	4520	5493	5688	6662	8608	11529
66	Upper Muthi	13854	16838	17434	20418	26385	35336
67	Lower Muthi	9299	11302	11702	13705	17710	23718
68	Greater Kailash	4621	5616	5815	6810	8801	11786
69	Sainik Colony	2832	3442	3564	4174	5394	7223
70	Chinik Colony -2	8715	10592	10967	12844	16598	22228
71	Tawi Vihar	3674	4467	4626	5412	6996	9374
Total		576195	700284	725102	849192	1097370	1469638

4.4 PROJECTION OF WASTE GENERATION

Waste generation @0.45Kg/capita/day (including waste generation from floating population) in base & design year is given below:

Year	Projected Population	Floating Population @10%	Total Population	Waste Generation in MT/day	Volume of Waste @ 500Kg/cum
2016	700284	70028	770312	346.64	693.28
2017	725102	72510	797612	358.93	717.85
2018	749920	74992	824912	371.21	742.42
2019	774738	77474	852212	383.50	766.99
2020	799556	79956	879512	395.78	791.56
2021	824374	82437	906811	408.06	816.13
2022	849192	84919	934111	420.35	840.70
2023	874009	87401	961410	432.63	865.27
2024	898827	89883	988710	444.92	889.84
2025	923645	92365	1016010	457.20	914.41
2026	948463	94846	1043309	469.49	938.98
2027	973281	97328	1070609	481.77	963.55

Year	Projected Population	Floating Population @10%	Total Population	Waste Generation in MT/day	Volume of Waste @ 500Kg/cum
2028	998099	99810	1097909	494.06	988.12
2029	1022917	102292	1125209	506.34	1012.69
2030	1047735	104773	1152508	518.63	1037.26
2031	1072552	107255	1179807	530.91	1061.83
2032	1097370	109737	1207107	543.20	1086.40
2047	1469638	146964	1616602	727.47	1454.94

4.5 Zone Wise Population & Waste Generation:

In Jammu Municipal Corporation Area divided in 2 zones for the purpose of solid waste management system.

Zone-I

Sl. No.	Name of Wards	Population Year					
		2011	2016	2017	2022	2032	2047
1	Panjtirthi	7177	8723	9032	10577	13669	18306
2	Jullakha Mohalla	6848	8323	8618	10093	13042	17466
3	Mast Garh	8699	10572	10947	12821	16567	22188
4	Bhabrian	4246	5160	5343	6258	8087	10830
5	Talab Khatika	5274	6410	6637	7773	10044	13452
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7	Kanji House	6415	7797	8073	9454	12217	16362
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11	Mohalla Molhotra	2429	2952	3057	3580	4626	6195
12	Krishna Nagar	7031	8545	8848	10362	13391	17933
13	Resham Ghar	7998	9720	10065	11787	15232	20400
14	Bhagwati Nagar	6033	7332	7592	8891	11490	15388
15	Pratap Garh	5223	6348	6573	7698	9947	13322
16	New Plot	11676	14191	14693	17208	22237	29781
17	Ambphalla	4974	6045	6259	7331	9473	12687
18	Sarwal	9510	11558	11968	14016	18112	24256

Sl. No.	Name of Wards	Population Year					
		2011	2016	2017	2022	2032	2047
24	Rehari Colony (N)	7264	8828	9141	10706	13834	18527
25	Rehari Colony (S)	5332	6480	6710	7858	10155	13600
26	Subhas Nagar	11069	13453	13930	16313	21081	28232
27	Bakshi Nagar	6540	7948	8230	9639	12456	16681
28	Gurah Bakshi Nagar	8512	10345	10712	12545	16211	21711
29	Raipur Mangolia	10197	12393	12832	15028	19420	26008
30	Talab Tillo (N)	7604	9242	9569	11207	14482	19395
31	Talab Tillo (S)	9014	10955	11344	13285	17167	22991
32	Gole	12778	15530	16080	18832	24336	32591
33	Shiv Nagar	11238	13658	14142	16562	21403	28664
34	Janipur (N)	3240	3938	4077	4775	6171	8264
35	Janipur (S)	4663	5667	5868	6872	8881	11893
36	Janipur Central	7919	9624	9966	11671	15082	20198
37	Janipur (W)	15830	19239	19921	23330	30148	40376
38	Paloura	7794	9473	9808	11487	14844	19879
39	Top Sherkhania	10320	12543	12987	15210	19655	26322
40	Poonch House	13001	15801	16361	19161	24761	33160
41	Bohri	9710	11801	12219	14311	18493	24766
59	Paloura Top	9115	11078	11471	13434	17360	23249
60	Paloura Centre	6381	7755	8030	9404	12153	16275
61	Patta Paloura	12403	15074	15608	18279	23622	31635
62	Chinor Keran -1	8018	9745	10090	11817	15270	20451
63	Chinor Keran-2	6211	7549	7816	9154	11829	15842
64	Chak Chadwad	12731	15473	16021	18763	24246	32472
65	Barnai Upper Darmal	4520	5493	5688	6662	8608	11529
66	Upper Muthi	13854	16838	17434	20418	26385	35336
67	Lower Muthi	9299	11302	11702	13705	17710	23718
Sub Total		370296	450043	465990	545742	705234	944475
Floating Pop.@10%		37030	45004	46599	54574	70523	94448
Total Population		407326	495047	512589	600316	775757	1038923
Waste Generation (MT/day)		183.30	222.77	230.67	270.14	349.09	467.52

Zone-II

Sl. No.	Name of Wards	Population Year					
		2011	2016	2017	2022	2032	2047
19	Chand Nagar	8936	10860	11245	13170	17019	22792
20	Gandhi Nagar (N)	9952	12095	12524	14667	18954	25383
21	Gandhi Nagar	8272	10053	10410	12191	15754	21098
22	Shastri Nagar	5752	6991	7238	8477	10955	14671
23	Nai Basti	12110	14718	15240	17848	23064	30888
42	Nanak Nagar (W)	7584	9217	9544	11177	14444	19344
43	Nanak Nagar (E)	8855	10762	11143	13050	16864	22585
44	Nanak Nagar (N)	11237	13657	14141	16561	21401	28661
45	Digiana	13871	16858	17456	20443	26417	35379
46	Saniav Nagar	8657	10521	10894	12759	16487	22080
47	Bahu (E)	12888	15664	16219	18994	24545	32872
48	Bahu (W)	5249	6379	6606	7736	9997	13388
49	Narwal Bala	3956	4808	4978	5830	7534	10090
50	Channi Himmat	9457	11494	11901	13938	18011	24121
51	Channi Himmat Thanjar	3793	4610	4773	5590	7224	9674
52	Channi Himmat Biza	9757	11858	12279	14380	18582	24886
53	Channi Biza Sec (1-4)	8119	9868	10217	11966	15463	20708
54	Channi Rama	4315	5244	5430	6359	8218	11006
55	Deeli	8146	9900	10251	12006	15514	20777
56	Gangyal -1	8497	10327	10693	12523	16183	21672
57	Gangyal -2	7714	9375	9708	11369	14691	19675
58	Digiana	8940	10865	11250	13176	17026	22802
68	Greater Kailash	4621	5616	5815	6810	8801	11786
69	Sainik Colony	2832	3442	3564	4174	5394	7223
70	Chinik Colony -2	8715	10592	10967	12844	16598	22228
71	Tawi Vihar	3674	4467	4626	5412	6996	9374
Sub Total		205899	250241	259112	303450	392136	525163
Floating Pop. @ 10%		20590	25024	25911	30345	39214	52516
Total Population		226489	275265	285023	333795	431350	577679
Waste Generation (MT/day)		92.65	112.61	116.60	136.55	176.46	236.32

CHAPTER – 5

REQUIREMENT OF VEHICLE AND EQUIPMENT

5.0 INTRODUCTION

5.1 For Storing Household Waste

- They shall not throw any solid waste in their neighbourhood, on the street, open spaces, and vacant plots or into drains.
- They shall (a) keep the food waste/ Bio-degradable as and when generated, in any type of domestic waste container, preferably with a cover, and (b) keep dry/ recyclables wastes preferably in bags or sacks.
- Use of a non-corrosive container with lid is advised for the storage of food/biodegradable/wet waste. A container of 15 litre (0.015 cu.mtr) capacity for a family of 5 members would ordinarily be adequate. However, a household may keep large containers or more than one container to store the waste produced in 24 hours having a spare capacity of 100% to meet unforeseen delay in clearance or unforeseen extra loads. Wet wastes should preferably not be disposed of in plastic carry bags.
- Keep domestic hazardous waste listed under para 9.3 separately, for disposal at the place may be as arranged for by the ULB.
- In slums, where because of lack of access or due to narrow lanes, it is not found convenient to introduce house-to-house collection system, community bins of suitable sizes ranging from 40 to 100 litre (0.04 to 0.1 cu. Mtr.) capacity may be placed at suitable locations by the local body to facilitate the storage of waste generated by them. They may be directed to put their waste into community bins before the hour of clearance each day.

5.2 For Storing Waste from Shops/ Offices/ Institutions/ Workshop etc.

- The size of the container should be adequate to hold the waste, they normally generate in 24 hours with 100% spare capacity to meet unforeseen delay in clearance or unanticipated extra loads.

A statement showing the action to be taken by various categories of waste generators is as under:-

STORAGE OF WASTE AT SOURCE IN A NUT SHELL.

Sl. No.	Source of Waste Generation	Action to be taken
1.	Households	1. Not to throw any solid waste in the neighborhood, on the streets, open spaces, and vacant lands, into the drains or water bodies. 2. Keep food waste/biodegradable waste in a non-corrosive container with a cover (lid). 3. Keep, dry/recyclable waste in a bin/bag or a sack. 4. Keep domestic hazardous waste if and when generated separately for disposal at specially notified locations.
2.	Multistoried buildings, commercial complexes, private societies, etc.	1 to 4 as above 5. Provide separate community bin/bins large enough to hold food/biodegradable waste and recyclable waste generated in the building/society. 6. Direct the members of the association/ society to deposit their waste in community bin on day to day basis before the hour of clearance.
3.	Slums	1 to 4 as above. 5. Use community bins provided by local body for deposition of food and biodegradable waste.
4.	Shops, offices, institutions, etc.	1 to 4 as above. 5. If situated in a commercial complex, deposit the waste so stored as per 2 and 3 above in community bins provided by the association.
5.	Hotels & Restaurants	1 to 4 as above 5. However, the container used should be strong, not more than 100 litre in size, should have a handle on the top or handles on the sides and a rim at the bottom for easy handling.

Sl. No.	Source of Waste Generation	Action to be taken
6.	Vegetable & Fruit Markets	<ol style="list-style-type: none"> 1. Provide large containers, which match with transportation system of the local body. 2. Shop keepers not to dispose of the waste in front of their shops or open spaces. 3. Deposit the waste as and when generated into the large container placed in the market.
7.	Meat & Fish Markets	<ol style="list-style-type: none"> 1. Not to throw any waste in front of their shops or open spaces around. 2. Keep a non-corrosive container/ containers not exceeding 100 litre capacity with lid handle and the rim at the bottom and deposit the waste in the said containers as and when generated. 3. Transfer the contents of this container in to a large container provided by the association of the market or local body on day to day basis before the hour of clearance.
8.	Street Food Vendors	<ol style="list-style-type: none"> 1. Not to throw any waste on the street, pavement or open spaces. 2. Keep bin or bag for the storage of waste that generates during street vending activity. 3. Preferably have an arrangement to affix the bin or bag with the hand-cart used for vending.
9.	Marriage Halls, Community Halls, Kalyan Mandaps, etc.	<ol style="list-style-type: none"> 1. Not to throw any solid waste in their neighbourhood, on the streets, pen spaces and vacant lands, into the drains or water bodies. 2. Provide a large container with lid which may match with the transportation system of the local body and deposit all the waste generated in the premises in such containers.
10.	Hospitals, Nursing Homes etc.	<ol style="list-style-type: none"> 1. Not to throw any solid waste in their neighbourhood, on the streets, open spaces, and vacant lands, into the drains or water bodies. 2. Not to dispose off the biomedical waste in the municipal dust bins or other waste collection or storage site meant for

Sl. No.	Source of Waste Generation	Action to be taken
		<p>municipal solid waste.</p> <p>3. Store the waste as per the directions contained in the Government of India, Ministry of Environment Biomedical Waste (Management & Handling) Rules 1998.</p>
11.	Construction & Demolition Waste	<p>1. Not to deposit construction waste or debris on the streets, foot paths, pavements, open spaces, water bodies etc.</p> <p>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.</p>
12.	Garden Waste	<p>1. Compost the waste within the garden, if possible.</p> <p>2. Trim the garden waste once in a week on the day notified by the local body.</p> <p>3. Store the waste into large bags or bins for handling over to the municipal authorities or contractors appointed for the purpose on the day of collection notified.</p>

REQUIREMENT OF VEHICLE AND EQUIPMENTS FOR DOOR TO DOOR COLLECTION AND TRANSPORTATION

It is proposed that domestic waste and road sweeping will be brought to road side dust bin by Battery Operated Tricycle Rickshaw & Wheel Barrow. Waste from dust bin will be transported to SWM Site by Dumper Placer.

Domestic waste collected by TATA Ace will be transported upto a Transfer Station. From this point it will be carried by Refuse Collector (tippers) upto SWM Site.

5.3. PRIMARY STORAGE AND TRANSPORTATION FOR ZONE-I:-

5.3.1 Door To Door Collection:-

Considering the topography of the town, it is proposed that Domestic Waste in Jammu City will be collected by different type of vehicle as under:

Tata Ace 1.5 cum capacity	30%
Battery Operated Motorized Tricycle Heavy Duty Rickshaw	60%
Hand Cart	10%

i) Requirement of Tata Ace with Tipper:-

$$\begin{aligned} \text{Total Domestic waste generation in year 2022} &= (600316 \times 0.30) / 1000 \\ &= 180.09 \text{ MT} = 360.19 \text{ cum} \end{aligned}$$

$$\text{Waste to be collected by Tata Ace 30\%} = 108.06 \text{ cum}$$

Each vehicle will cover 450 house in one trip, waste collected from 450 household

$$= 450 \times 5 \times 0.30 / 500 = 1.35 \text{ cum,}$$

$$\text{Assuming 5 trips, waste lifted} = 1.35 \times 5 = 6.75 \text{ cum/ vehicle}$$

$$\text{Nos. of Tata Ace with Tipper required} = 108.06 / 6.75 = 16.01 \text{ Say } 16 \text{ Nos.}$$

ii) Requirement of Battery Operated Tricycle Rickshaw for year 2022 with 6 Bins each of 50 LTS. Capacity:-

$$\text{Population in year 2022} = 600316$$

$$\begin{aligned} \text{Total Domestic waste generation in year 2022} &= (600316 \times 0.30) / 1000 \\ &= 180.09 \text{ MT} = 360.19 \text{ cum} \end{aligned}$$

$$\text{Waste to be collected by Battery Operated Tricycle Rickshaw 60\%} = 216.11 \text{ cum}$$

$$\text{Capacity of each rickshaw} = 6 \times 50 = 300 \text{ Lts.}$$

Assuming 5 trips per day by each Battery Operated Tricycle Rickshaw

$$\text{Hence Nos. required} = 216.11 \times 1000 / 300 \times 5 = 144.07 \text{ Say } = 144 \text{ Nos.}$$

iii) Requirement of Hand Cart for year 2022 with 4 Bins each of 30 LTS. Capacity:-

Population in year 2022 = 600316

$$\begin{aligned} \text{Total Domestic waste generation in year 2022} &= (600316 \times 0.30) / 1000 \\ &= 180.09 \text{ MT} = 360.19 \text{ cum} \end{aligned}$$

$$\text{Waste to be collected by Hand Cart 10\%} = 36.02 \text{ cum}$$

$$\text{Capacity of each hand cart} = 4 \times 30 = 120 \text{ Lts.}$$

Assuming 5 trips per day by each hand cart

$$\text{Hence Nos. required} = 36.02 \times 1000 / 120 \times 5 = 60.03 \text{ Say} = 60 \text{ Nos.}$$

5.3.1.1 Institutional & Commercial Waste Shall be collected as under:

$$\text{Auto Three Wheeler} = 40\%$$

$$\text{TATA Ace with tipper} = 40\%$$

$$\text{Refuse Collector} = 20\%$$

Waste so collected will be transported upto a Transfer Station-1 from where it will be lifted by Refuse Collector/ Tippers for transporting up to MSWD Site.

$$\text{Commercial Waste} = 600316 \times 0.10 / 1000 = 60.03 \text{ MT}$$

$$\text{Institutional Waste} = 600316 \times 0.03 / 1000 = 18.01 \text{ MT}$$

$$\text{Total Waste} = 78.04 \text{ MT} = 156.08 \text{ cum}$$

i) Requirement of 1.0 cum Capacity Auto Three Wheeler:

$$\text{Total Trips by Auto Three Wheeler} = 156.08 \times 0.4 / 1.0 = 62.43$$

Considering 6 trip per day

$$\text{Nos of Auto Three Wheeler required} = 62.43 / 6 = 10.41, \text{ Say} = 11 \text{ Nos.}$$

ii) Requirement of TATA Ace:

$$\text{Effective Capacity of TATA Ace} = 1.50 \text{ cum}$$

$$\text{Total Trips by TATA Ace} = 156.08 \times 0.4 / 1.5 = 41.62$$

Considering 6 trip per day

$$\text{Nos of TATA Ace Required} = 41.62 / 6 = 6.94, \text{ Say} = 7 \text{ Nos.}$$

iii) Requirement of 6.5 cum Capacity Refuse Collector:

$$\text{Effective Capacity of Refuse Collector} = 6.5 \text{ cum}$$

$$\text{Total Trips by Refuse Collector} = 156.08 \times 0.2 / 6.5 = 4.80$$

Considering 4 trip per day

$$\text{Nos of Refuse Collector required} = 4.80 / 4 = 1.20 \text{ Say} = 1 \text{ No.}$$

5.3.1.2 MS Container 4.5 cum Capacity:-

Waste to be collected by Tricycle Rickshaw 60% = 216.11 cum (ref. page 40)

Waste to be collected by Hand Cart 10% = 36.02 cum

Total Waste = 252.13 cum

Effective Capacity of 4.5cum bins considering 80% = 4.5 cum

Nos of 4.5 cum bins required = $252.13/4.5 = 56.03$, Say = 56 Nos.

As per recommendation given in CPHEEO Manual para 12.6, page – 227 provision for 100% spare capacity has been proposed to avoid the over flow and enable the local body to transport the containers in any shift or on the alternate day or even twice a week depending on when the container gets full. For this purpose 4.5cum capacity metallic container bins have been provided, qty. is worked out as under:

Requirement of 4.5cum container for year 2022 for 100% spare capacity

Total No. of 4.5 cum MS container required = $56+56= 112$ Nos.

5.3.1.3 One time supply of twin bins 15 ltrs capacity for each house:-

Population in year 2017 = 512589

No of houses, assuming 5 persons per house = $512589/ 5 = 102518$

No. of bins required @ 2 bins per house = $102518 \times 2 = 205036$ Nos.

5.3.1.4 Requirement of Dumper Placer:-

Nos of 4.5 cum dust bins to be lifted = 56 Nos.

Nos of trips 6 per day

Nos of required dumper placer = $56/ 6 = 9.33$, Say=10 Nos.

5.3.2 Vehicle required for transportation of waste from transfer station -1 to MSWD Site.**5.3.2.1 Hopper:-**

Hopper with Hook- loading System, 2 Nos (1W +1 Stand by) Container (10 cum Capacity) for each hopper:-

Total Waste at TS-1 in year 2022= 270.14 MT = $270.14 / 0.5 = 540.28$ Cum

Providing 10cum capacity hopper and considering 6 trip/day by each hopper.

Nos. of hopper required = $540.28 / 10 \times 6 = 9$ Nos.

5.4 PRIMARY STORAGE AND TRANSPORTATION ZONE-II:-

5.4.1 Door To Door Collection:-

Considering the topography of the town, it is proposed that Domestic Waste in Jammu City will be collected by different type of vehicle as under:

Tata Ace with tipper 1.5 cum capacity	30%
Battery Operated Motorized Tricycle Heavy Duty Rickshaw	30%
Auto Three Wheeler 1.0 cum capacity	30%
Hand Cart	10%

i) Requirement of 1.5 cum capacity Tata Ace with Tipper:-

$$\begin{aligned} \text{Total Domestic waste generation in year 2022} &= (333795 \times 0.30) / 1000 \\ &= 100.14 \text{ MT} = 200.28 \text{ cum} \end{aligned}$$

$$\text{Waste to be collected by Tata Ace 30\%} = 60.08 \text{ cum}$$

$$\begin{aligned} \text{Each vehicle will cover 450 house in one trip, waste collected from 450 household} \\ = 450 \times 5 \times 0.30 / 500 &= 1.35 \text{ cum,} \end{aligned}$$

$$\text{Assuming 5 trips, waste lifted} = 1.35 \times 5 = 6.75 \text{ cum/ vehicle}$$

$$\text{Nos. of Tata Ace with Tipper required} = 60.08 / 6.75 = 8.90 \text{ Say } 9 \text{ Nos.}$$

ii) Requirement of Battery Operated Tricycle Rickshaw for year 2022 with 6 Bins each of 50 LTS. Capacity:-

$$\text{Population in year 2022} = 333795$$

$$\begin{aligned} \text{Total Domestic waste generation in year 2022} &= (333795 \times 0.30) / 1000 \\ &= 100.14 \text{ MT} = 200.28 \text{ cum} \end{aligned}$$

$$\text{Waste to be collected by Battery Operated Tricycle Rickshaw 30\%} = 60.08 \text{ cum}$$

$$\text{Capacity of each rickshaw} = 6 \times 50 = 300 \text{ Lts.}$$

Assuming 5 trips per day by each Battery Operated Tricycle Rickshaw

$$\text{Hence Nos. required} = 60.08 \times 1000 / 300 \times 5 = 40.05 \text{ Say } = 40 \text{ Nos.}$$

iii) Requirement of 1.0 cum Capacity Auto Three Wheeler:

$$\begin{aligned} \text{Total Domestic waste generation in year 2022} &= (333795 \times 0.30) / 1000 \\ &= 100.14 \text{ MT} = 200.28 \text{ cum} \end{aligned}$$

$$\text{Waste to be collected by Auto Three Wheeler 30\%} = 60.08 \text{ cum}$$

$$\text{Capacity of each Auto Three Wheeler} = 1.0 \text{ Cum}$$

Assuming 5 trips, waste lifted = $1.0 \times 5 = 5.0$ cum/ vehicle
Nos. of Auto Three Wheeler required = $60.08/5.0 = 12.02$ Nos. Say **12 nos.**

iv) Requirement of Hand Cart for year 2022 with 4 Bins each of 30 LTS. Capacity:-

Total Domestic waste generation in year 2022 = $(333795 \times 0.30) / 1000$
= 100.14 MT = 200.28 cum
Waste to be collected by Hand Cart 10% = 20.03 cum
Capacity of each hand cart = $4 \times 30 = 120$ Lts.
Assuming 5 trips per day by each hand cart
Nos. of Hand Cart required = $20.03 \times 1000 / 120 \times 5 = 33.38$ Say = **34 Nos.**

5.4.2.1 Institutional & Commercial Waste will be collected as under:

Auto Three Wheeler = 40%
TATA Ace with tipper = 40%
Refuse Collector = 20%

Waste so collected will be transported upto a Transfer Station-2 from where it will be lifted by Refuse Collector/ Tippers for transporting up to MSWD Site.

Commercial Waste = $333795 \times 0.10/1000 = 33.38$ MT
Institutional Waste = $333795 \times 0.03/1000 = 10.01$ MT
Total Waste = 43.39 MT = $43.39/0.5 = 86.79$ cum

i) Requirement of Three Wheeler:

Effective Capacity of Auto Three Wheeler = 1.0 cum
Total Trips by Auto Three Wheeler = $86.79 \times 0.4 / 1.0 = 34.72$
Considering 6 trip per day
Nos of Auto Three Wheeler required = $34.72/6 = 5.79$, Say = **6 Nos.**

ii) Requirement of TATA Ace:

Effective Capacity of TATA Ace = 1.50 cum
Total Trips by TATA Ace = $86.79 \times 0.4 / 1.5 = 23.14$
Considering 6 trip per day
Nos of TATA Ace Required = $23.14 / 6 = 3.86$, Say = **4 Nos.**

iii) Requirement of 6.5 cum Capacity Refuse Collector:

Effective Capacity of Refuse Collector= 6.50cum

Total Trips by Refuse Collector = $86.79 \times 0.2 / 6.50 = 2.67$

Considering 3 trip per day

Nos of Refuse Collector required = $2.67 / 3 = 0.89$ Say = 1 No.

5.4.1.2 MS Container 4.5 cum Capacity:-

Waste to be collected by Tricycle Rickshaw 30% = 60.08 cum, (Ref. page-43(iii))

Waste to be collected by Hand Cart 10% = 20.03 cum

Total Waste = 80.11 cum

Effective Capacity of 4.5cum bins considering 100% = 4.50 cum

Nos of 4.5 cum bins required = $80.11/4.50 = 17.80$, Say = 18 Nos.

As per recommendation given in CPHEEO Manual para 12.6, page – 227 provision for 100% spare capacity has been proposed to avoid the over flow and enable the local body to transport the containers in any shift or on the alternate day or even twice a week depending on when the container gets full. For this purpose 4.5cum capacity metallic containers bins have been provided, qty. is worked out as under:

Requirement of 4.5cum container for year 2022 for 100% spare capacity

Total No. of 4.5 cum MS container required = 18+18= 36 Nos.

5.4.1.3 One time supply of twin bins 15 ltrs capacity for each house:-

Population in year 2017 = 285023

No of houses, assuming 5 persons per house = $285023 / 5 = 57005$

No. of bins required @ 2 bins per house = $57005 \times 2 = 114010$ Nos.

5.4.1.4 Requirement of Dumper Placer:-

Nos of 4.5 cum dust bins to be lifted = 18 Nos.

Nos of trips 6 per day

Nos of required dumper placer = $18 / 6 = 3$ Nos.

5.4.2 Vehicle required for transportation of waste from transfer station -2 to MSWD Site.

5.4.2.1 Hopper:-

Hopper with Hook- loading System and 2 Nos (1W +1 Stand by) Container 10 cum Capacity for each hopper:-

Total Waste at TS-2 in year 2022= 136.55 MT = $136.55 / 0.5 = 273.10$, say = 274 cum

Providing 10cum capacity hopper and considering 6 trip/day by each hopper.

Nos of tipper required = $274 / 10 \times 6 = 4.57$, Say = 5 Nos.

5.5 Requirement of Vehicle & Equipment in tabulated below:

As per page-241 para 13.8 (Vii), of CPHEEO Manual on Solid Waste it is recommended that 30% stand by vehicle of the total vehicle requirement may be considered. However 20% standby vehicle taken in the DPR.

Sl. No.	Description	Requirement duration Upto Year 2020						
		For Zone - I	For Zone - II	Total	Standby Qty. @ 20%	Total Req.	Available	Net Requirement
1	4.5 cum capacity metallic bins	112	36	148	30	178	200	Surplus
2	One time supply of twin plastic covered bucket 15 ltrs capacity for each house	205036	114010	319046	63809	382855	0	382855
3	Battery Operated Heavy Duty Tricycles Rickshaw	144	40	184	37	221	0	221
4	Tata Ace 1.5 cum capacity tipper	23	13	36	7	43	0	43
5	Auto Three wheeler 1.0cum capacity tipper	11	18	29	6	35	17	18
6	Hand cart	60	34	94	19	113	0	113
7	Refuse Collector 6.5 cum capacity	1	1	2	1	3	2	1
8	Hopper with hook-loading system and 10 cum capacity container.	9	5	14	3	17	0	17
10	Dumper Placer	10	3	13	3	16	7	9
11	Front end loader	4	2	6	1	7	2	5
12	JCB Machine	4	2	6	1	7	3	4
13	Road Sweeping Machine	1	1	2	0	2	2	Nil

5.6 System Proposed for Primary Collection, Storage and Transportation

- ❖ Households in residential colonies should store their segregated waste in 2 nos. 15 ltrs capacity plastic covered bins which shall be provided to each household.
- ❖ In narrow lanes where refuse collectors are unable to ply, TATA Ace tipper and auto three wheeler tippers & hand cart will collect the waste directly from door to door.

- ❖ Battery Operated Tricycle Trolley each with bins to be used for door-to-door collection in Jammu residential colonies, and carry up to dustbin containers.
- ❖ 4.5 cum capacity – covered dustbins has been provided all over the city. The waste is to be brought directly to these containers kept at suitable places.
- ❖ 4.5 cum capacity metallic bins are also proposed enabling to make up 100% spare storage capacity.
- ❖ Refuse collectors will be deployed to take the waste from 4.5 cum bins placed at different location and transport it upto transfer station.

5.7 Transfer Station

Two number transfer station have been proposed in zone-I & zone-II, transfer station has been planned in 1 acre land, which is available with municipal Corporation Jammu.

10 cum capacity closed tipper (Refuse Collector) will transport the waste from here to SLF site for treatment and disposal.