Feasibility Report

Implementation of Integrated Municipal Solid Waste Management System in Tumkur, Karnataka

Submitted to

Infrastructure Development Department
(IDD), Government of Karnataka

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Submitted By

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1. Executive Summary

1. Tumkur, an administrative district in Karnataka, occupies an area of approximately 10,600 square kilometers. It is situated on the National Highway No. 4 and is located to the North West of Bangalore at a distance of 70 kilometers. As per 1991 census the population of Tumkur was 1, 39,000 and increased to 2, 48,592 as per 2001 census i.e. a decadal growth rate of above 78%.

   The estimated quantum of MSW generated in the city is approximately 114 tonnes per day (TPD), of which residential waste amounts to approximately 52% of the generation. Street sweeping activity in the city is carried out by the pourakarmikas (PKs). A total of 5 Self Help Groups are involved in primary collection by way of tractors (for commercial establishments and bulk generators) and 31 pushcarts (for households).

2. Tumkur City Municipal Council (TCMC) has outsourced the MSW management activities in all the 35 wards of the city. The activities outsourced are street sweeping, debris collection, primary transportation, bulk waste collection and secondary transportation. SHGs carry out the primary collection of MSW. The common practice followed in Tumkur is dumping of MSW into RCC bins / masonry bins and on the road sides (open collection points). For the disposal of MSW, open dumping is followed by TCMC.

3. The MSW, management experiences several issues and constraints in Tumkur city which can be summarized as follows:
   a. Low quality of service being provided despite high costs.
   b. Segregation, treatment and disposal of different streams of MSW are not practiced.
   c. Collection practices adopted involve multiple handling and hence result in some littering.
   d. Lack of periodic medical checkups and absence of standard accessories/equipment for street sweeping results in sanitary workers being exposed to health hazards.
   e. Environmental issues of dust pollution and high levels of noise.
   f. TCMC have been dumping the MSW collected in the outskirts of the city polluting the surrounding air and ground/surface water.

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4. It is proposed to introduce a 2-bin collection system. The primary collection would be carried out by deploying a combination of auto tippers and pushcarts. The MSW collected directly from large generators such as hotels, restaurants, marriage and function halls would be transported to the compost facility/ scientific landfill facility by dumper placers. Dumper bins would be located at identified locations for secondary storage of segregated MSW collected from various sources. The transportation of dumper bins to the compost facility would be through dumper placers and the street sweepings would be transported by deployment of tractors. The MSW collected from various generators would need to be treated before disposal. A compost facility would need to be set up at Ajjagonadanahalli. It is proposed to develop a sanitary landfill facility of 68 MT capacity, on an area of approximately 40 acres.

5. The summary of estimated hard cost of the Project is presented as below:

Sl No.	Description	Amount (Rs. Lakhs)
1	Physical Infrastructure Components	
a	Collection and Transportation	182.0
b	Compost Facility	250.0
c	Landfill Facility	358.3
2	Contingency (8%)	63.2
3	Interest during construction	134.0
	Total	**987.5**

6. The quantum of MSW generated in Tumkur city is around 100 TPD. For such a small quantum of MSW the scale of operations needed for the C&T and the T&D activities would be limited. Thus the Project could be implemented by a single private operator under a BOT concession framework. The average useful working life of an integrated T&D facility is around 20-25 years and the tenure for the BOT concession could be co-terminus with the same.

7. The estimated financial assistance required for the Project to be viable is presented below:

Sl. No.	Activity	Monthly Annuity (Rs. Lakhs)	Tipping Fee (Rs. per TPD)
1	Collection and Transportation	23.4	592.0
2	Treatment and Disposal	-	449.0
3	Entire chain of MSW	-	1032.0

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	management activities		

2. Introduction

2.1. Project Background

a. Tumkur, an administrative district in Karnataka, occupies an area of approximately 10,600 square kilometers. It is situated on the National Highway 4 and is located to the North West of Bangalore at a distance of approximately 70 kilometers. It consists primarily of elevated land intersected by river valleys. A range of hills rising to nearly 4,000 feet (1,200 meters) crosses it from north to south, forming the watershed between the systems of the Krishna and the Kaveri.

b. As per 1991 census the population of Tumkur was 1,39,000 and increased to 2,48,592 as per 2001 census i.e. a decadal growth rate of above 78%. This increased population is creating a strain on all civic infrastructure services, with MSW management being no exception.

c. MSW management is an obligatory function of the Town Municipal Councils under the Karnataka Municipalities Act, 1964. Also, the MSW Rules make it mandatory for an urban local body to practice scientific treatment and disposal of the MSW generated.

d. As a part of various studies undertaken, strategy and plans for integrated MSW management have been developed for Tumkur. The studies undertaken by Tumkur City Municipal Council (TCMC) include preparation of an action plan for collection and transportation of MSW and preparation of a Detailed Project Report (DPR) for development of integrated treatment and disposal facility.

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2.2. Project Idea

TCMC intends to undertake MSW management activities comprising collection and transportation (C&T) and treatment and disposal (T&D) under PPP framework. For the purpose of implementation of an integrated MSW management system a pre-feasibility analysis is being carried out for developing an appropriate structure for project implementation and for assessment of any funding/financial assistance, if required ("the Project").

2.3. Need for integrated approach

a. MSW management, to reduce the impact on the environment, requires an integrated approach involving components such as collection from various generators, segregation at source, recycling of the MSW, reuse and disposal, etc. Healthy environment demands an integrated approach that involves complementary use of a variety of practices to handle the MSW, stream safely and effectively with the least adverse impact on human health and the environment. Integrated approach would be adopted to dispose the MSW generated in the city as the approach amalgamates three stages of MSW management. The adoption of this approach would stream line the collection of MSW from diverse generating points in the city and transporting them to the treatment facilities. The rejects obtained from composting, would then be disposed in a scientific landfill.

b. The integrated approach is critically important for the MSW management to work efficiently. A well integrated approach captures the primary collection, secondary collection and treatment and disposal; add value by vertically integrating the MSW process.

c. In addition, an integrated approach would reduce the littering on the streets, enhance the cleanliness of the city, and increase the viability, profitability and sustainability of MSW systems through their impact on increasing incomes, employment while reducing pollution levels.

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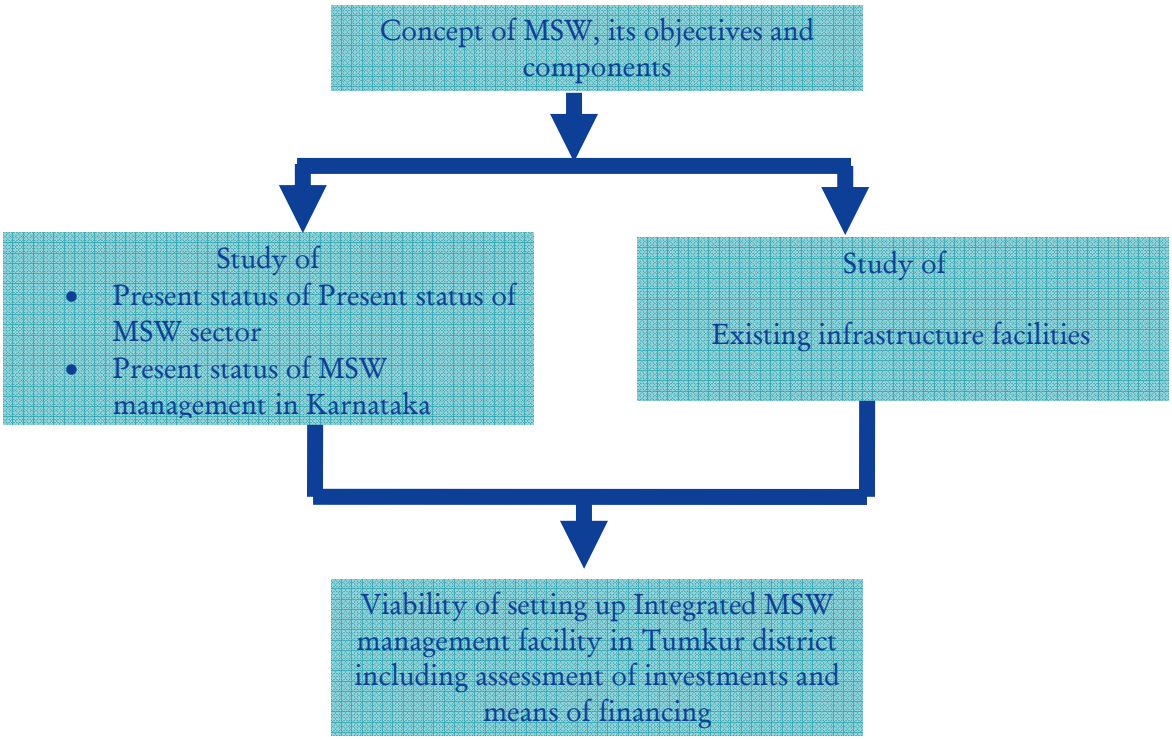
2.4. Scope of work

The activities being undertaken for the Project include:



a. The interpretation of MSW sector as presented in this report is based on interactions with limited key players namely government stakeholders, sectoral companies involved in the business of MSW management. Hence, they are indicative of the situations prevalent at the time of conducting the study.

b. The study is based on the studies carried out by TCMC, market information, whether from public and private sources, and it has been ensured to the best of its ability, the correctness and the validity of the same, by cross checking from various sources.

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2.5. Approach and Methodology

The approach and methodology adopted in assessing the feasibility of the integrated MSW management facility in Tumkur is given below:

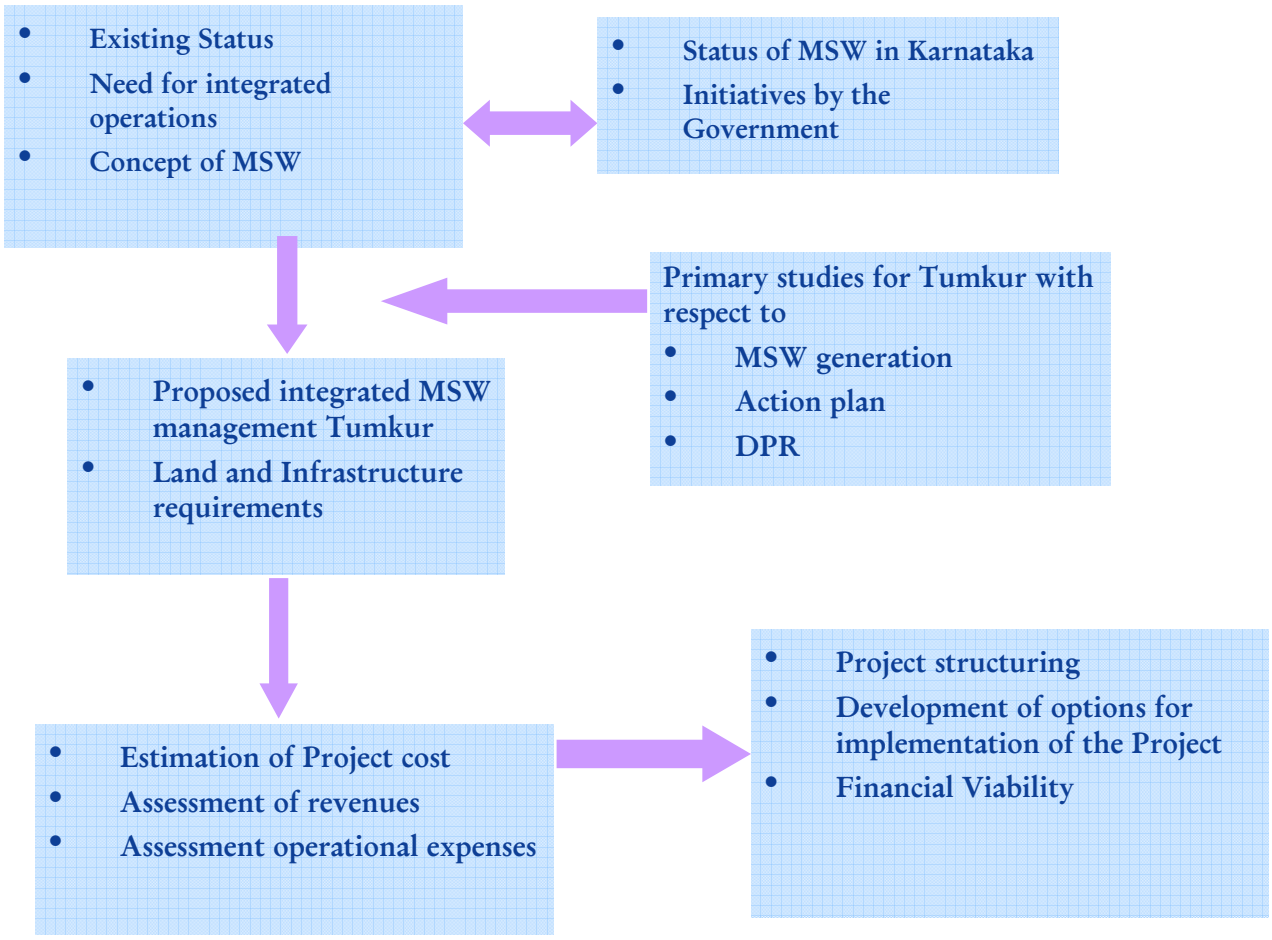

Figure: Methodology adopted for assessing the feasibility

3. Sector Profile

This section sets out the present scenario of MSW management sector in the country.

3.1. Industry Overview

a. MSW management is a key component of municipal services with extensive impact on the city's appearance and health of the citizens. MSW management is the collection, transportation, processing, recycling or disposal of waste materials. The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics. MSW management is also carried out to recover resources from it. Waste management and treatment can involve solid, liquid, gaseous or radioactive substances, with different methods and fields of expertise for each.

Figure: Components of Integrated solid waste management

b. The collection, transportation, treatment and disposal of MSW is one of the most pressing problems of the cities today. With rapid urbanisation as a result of planned and unplanned growth and industrialisation, the problem of handling MSW has increased in alarming proportions over the past few years.

c. Climate change is now recognized as a core development issue. The clean development mechanism (CDM) created under the Kyoto Protocol is a market-based mechanism that can reward project developers undertaking energy efficiency, renewable energy, and other low-carbon projects by bringing in additional revenue to projects by rewarding them with "carbon credits" equal to the amount of greenhouse gas (GHG) emissions reductions achieved. The sector has great potential for GHG emission reduction, while various opportunities exist in "waste to energy" and CDM could provide an additional source of finance to project developers.

d. Various estimates exist for waste generation in Indian urban areas, which range between 294 grams per capita per day to 484 grams per capita per day. In most cases, the collection efficiency is reportedly low and is estimated to be between 40 – 60 % of MSW generation.

e. Urban Local Bodies (ULBs), responsible for the MSW management, spend 60 to 70% of the total budgetary allocation on collection of the MSW and another 20 to 30% on transportation thus leaving less than 5% for the final disposal of the MSW. So far, disposal of wastes is being done in an unscientific manner. Crude open dumping of wastes is done in low-lying areas. Waste is also commonly deposited at dump yards without ascertaining the suitability of the land for waste disposal. Such sites emanate foul smell; become breeding grounds for flies, pests etc. and pose serious threat to underground water reserves. High organic content Indian MSW and the tropical climate mean that uncollected waste would decompose rapidly and pose a potential health hazard. In addition GHG emission in this sector has been contributing to global warming in greater degree in recent years. The sector is also characterised by low service delivery levels, sub-optimal productivity of manpower and resources deployed and inequitable cost recovery.

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f. The 74th Amendment Act of the Constitution of India has made some fundamental changes in the system of local governance in the country. The provision of urban municipal services is covered under the Twelfth Schedule of the 74th Amendment to the Constitution of India. The Twelfth Schedule suggests specific functions and responsibilities to local bodies including Public health, sanitation, conservancy, and MSW management. The Constitution 74th Amendment Act, 1992 is an initiative to decentralize power and strengthen democracy at the local level. The concept of local-self government provides a framework for effective functioning of the ULBs to ensure provision of urban services and infrastructure. Besides the traditional core functions of municipalities, it also includes development functions like planning for economic development and social justice, urban poverty alleviation programmes and promotion of cultural, educational and aesthetic aspects. The municipalities are now involved in the preparation and implementation of local development plans and social justice programmes. To improve the financial health of the municipalities, the State Finance Commission has been set up and transfers are effected on an annual basis to the municipalities.

g. Studies conducted by various agencies (Planning Commission, National Institute of Urban Affairs (NIUA), National Institute of Public Finance and Policy (NIPFP), etc have indicated that finances of ULBs in the country are under stress which has significantly hampered their ability to provide and maintain infrastructure services. With little or no increase in their revenue bases, compounded by inadequate user chargers, ULBs are dependent on higher levels of governance for their sustainability. ULBs also are accumulating huge liabilities (debt services, pensions, contractor payments etc,) and are facing problems in servicing them. With the responsibilities being mandated pursuant to the 74th Amendment and the state of municipal finances, ULBs are increasingly looking at private sector as one of the means of providing finances for the delivery of civic services, including MSW management.

h. Pursuant to the Supreme Court initiatives, Ministry of Environment and Forests (MoEF), Government of India (GoI), has formulated MSW Rules, which makes it mandatory for every municipal authority to implement a scientific MSW management system.

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i. To address the increasingly critical issues in MSW management, the MSW Rules also lay down a time schedule and the local authorities are responsible for implementing the recommended waste management practices within the said time frame. The Act lays down compliance criteria for collection of the waste, segregation at the source, transportation, processing and final disposal which are listed below:

   i. The MSW disposal options such as dumping of the wastes in oceans, rivers, open areas, compaction and bailing are no more acceptable.
   ii. The biodegradable wastes shall be processed by composting, vermin-composting, anaerobic digestion or any other appropriate biological processing for stabilisation of wastes.
   iii. Mixed waste containing recoverable resources should be recycled.
   iv. Landfilling would be the waste disposal method for non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing.

j. As per the MSW Rules, the Secretary-in-charge of the Department of Urban Development would be responsible for enforcement of the said rules across the state whereas, the District Magistrate/Deputy Commissioner would be responsible for enforcement of the same within their jurisdiction.

k. While the time schedules set out by the MSW Rules have expired, few ULBs have been able to adhere to the same. There are, however, initiatives undertaken to improve activities in the MSW chain by most ULBs.

l. Though MSW is one of the key components of urban civic services, it is among the neglected services in urban centres. The importance of providing effective MSW management services stems from its direct impact on the health and lives of citizens. Since MSW is perceived as a public good, it is the onus of the ULBs to serve all citizens of a city with efficient MSW services and, therefore, is ineffective without universal coverage.

m. Though C&T of MSW is being undertaken with private participation (predominantly through service contracts) since long, very few ULBs in the country have fully functional treatment facilities and scientific landfill meeting their needs. Even though treatment plants of varying capacities with varying

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technologies exist in the country, implemented either by government or by the private sector, few offer learnings which can be replicated in other regions. On the contrary, majority of treatment plants are non - operational / underutilised / under litigation due to various reasons including non - adherence to contractual obligations, operational inefficiencies and lack of finances.

n. Most ULBs in the country have initiated development activities for setting up of landfills – often with minimal interaction with nearby urban agglomerations. As land is a scarce resource (especially for an activity such as MSW management), coupled with the fact that many ULBs do not have adequate skills in this new activity, few landfills have been operationalised. The concept of regional landfills could mitigate some of these deficiencies, and could possibly be made functional in a shorter time frame, meeting the needs of wider population.

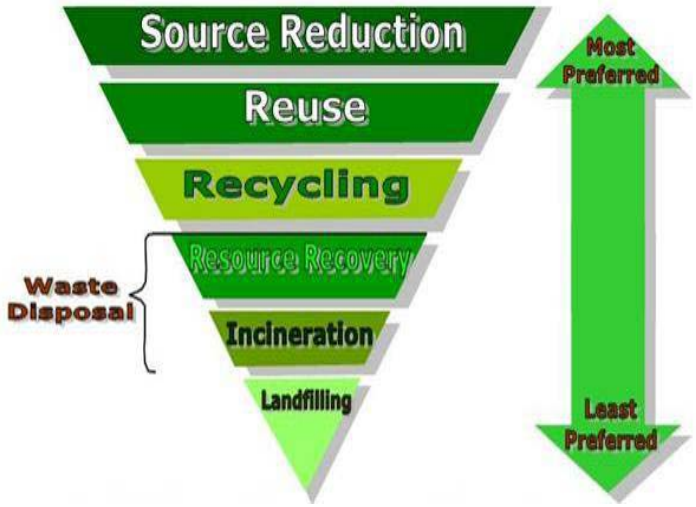

Figure: Hierarchy in solid waste management

o. The above figure captures the generally recognized hierarchy of the MSW management practice encapsulating the key components of the integrated solid waste management i.e. recycling, recovery (treatment options such as composting, waste to energy, incineration), transfer and disposal (landfilling). The premise is to minimize generation and reuse as much waste as practically feasible in order to reduce the resource consuming activities such as transfer, treatment and disposal.

3.2. Current status and practices of MSW management

a. Waste Generation:

The various sources of MSW generation include domestic households, commercial establishments, hotels, markets, marriage halls and nursing homes.

i. Domestic Households: The waste generated in domestic households forms the major component of the total MSW generated in ULBs. The households in the city, based on income groups can be categorised as high income group, middle income group and low income group (including economically weaker section dwellings). A lower per capita waste generation for higher income group (HIG) or medium income group (MIG) compared to lower income group (LIG) can be attributed the large quantum of recyclables (newspapers, bottles, cans, milk covers etc.) not forming part of the municipal stream.

ii. Commercial Establishments: The commercial establishments in the cities range from general shops, petty shops, bakeries and juice shops, electrical and electronics and wholesale and retail stores.

iii. Institutions: This category consists of offices and schools (residential & non-residential).

iv. Hotels, Restaurants and Lodgings: Hotels, restaurants and lodgings mainly generate biodegradable waste.

b. Collection and Transportation Practices:

The features of C&T practices in most ULBs are set out below:

i. There are no organized efforts to segregate the waste at source. Drain silt and street sweepings get mixed with the household waste.

ii. There is usually a pile up on Mondays as there are no primary collection and street sweeping activities on Sundays.

iii. Logistics management, including beat allocation, is not based on a scientific analysis of the requirements resulting in non-optimal street sweeping practices.

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iv. The sufficiency of the existing infrastructure to handle the current waste generation is less and would need to be suitably designed and procured to ensure optimal utilization of the same.

Residential Welfare Associations (RWAs) and Non Government Organisations (NGOs) would need to be actively involved in improving C&T practices. This would include designing and monitoring of information, education and communication (IEC) campaigns, appointment and supervision of operators for collection in consultation with ULBs concerned, part funding of collection of MSW, recovering the same through user fees, etc.

3.3. Characteristics of MSW Sector

As there is a need to provide sustainable hygienic civic facilities to municipal authority's stakeholders and citizens, and MSW management is a key component, effective provision of this service is imperative for ULBs. Adoption of integrated and scientific practices would imply that all decisions on waste handling should take into account economic, environmental, social and institutional dimensions in a holistic manner. The activities involved in integrated solid waste management include the following:

a. Generation
b. Collection
c. Transportation
d. Treatment, and
e. Disposal

a. Generation

It is necessary to have accurate data on the MSW generation and characteristics for setting out the roadmap for waste management and designing strategies and activities for implementation. Most municipalities do not have an accurate estimate for the generation of MSW. While empirical studies have been conducted at a few places, the results of extrapolation of the same to all the other ULBs seem to be erroneous. Commitment of assured waste is crucial in all "tipping" based procurement services, wherein payment is based on quantum of MSW handled.

Very few primary waste quantification and characterization studies have been carried out prior to designing the Solid waste management (SWM) systems. The data is also prone to wide fluctuations; the sampling method would need to account for the fluctuations in generation by day, season etc. The characterization studies need to factor in the moisture content (assessment in wet and dry condition, and the meteorological conditions of the ULB concerned); there is a need for a scientific and statistical representation of samples prior to arriving at any conclusions.

b. Collection and transportation

There exists a choice between the modes of primary collection – dumper bin based approach and compactor based approach. The choice of the alternative is being decided on economic considerations. Metros seem to prefer usage of compactors. Two bin systems is being propagated to handle organic and inorganic matter separately in most places; while in Karnataka, single bin with collection of organic and inorganic matter at separate time is being proposed.

Since construction waste has sale value, it is normally sold off directly by construction firms / house owners. Alternatively, in some ULBs, the municipal authorities, upon being informed by the generators, pick up the waste and dispose them in low lying areas.

Figure: Waste segregation

Segregation of waste and subsequent individual handling systems for different types of waste would result in better economic, social and environmental benefits.

There are no reported standards to measure effectiveness of C&T activities. Payment is based on number of vehicle trips and least cost transportation programs are reportedly not being used.

Issues regarding to environmental and social risks have not been addressed and contractors reportedly do not adhering to regulations on contract labour and minimum wages.

c. Treatment and Disposal

i. There is a lack of awareness in the country for scientific disposal.
ii. Development of treatment and disposal facilities is viewed as an increased financial obligation for compliance to MSW Rules.
iii. Various technologies (composting and vermi-composting, incineration, power generation, fuel pelletisation, bio-methanation) are available for MSW treatment and ULBs would need to carry out suitable analysis prior to selecting the same, It would also be appropriate to assess the additionality potential under the CDM mechanisms prior to the choice of the technology option. The data for estimating the CDM potential would need to be obtained during the design stage itself.
iv. Traditional development models include high revenue risks to the developer high due to unviable model of royalty payments by the private investor.
v. There is no clear monitoring mechanism and project payments not linked to performance of service;
vi. Landfill facilities are cost centres with no saleable outputs, capital intensive with significant back-ended costs.
vii. There are not many private developers in the sector as is evident from the limited players participating in all bid processes.
viii. "Waste to Energy" and GHG emission reduction has not been fully mainstreamed in the sector.

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ix. These projects have long gestation period (1 – 2 years for project development, e.g. Bangalore, Delhi) with time consuming issues including land acquisition, clearances.

d. There is an urgent need to manage MSW from the time it is created to its safe disposal. Improper disposal of MSW has serious results for the environment and human health. The most serious problems are ground water pollution and air pollution. Given the potential harmful effects to the environment and to the overall appearance of the city, SWM plays an important role in the citizens' lives and city's development.

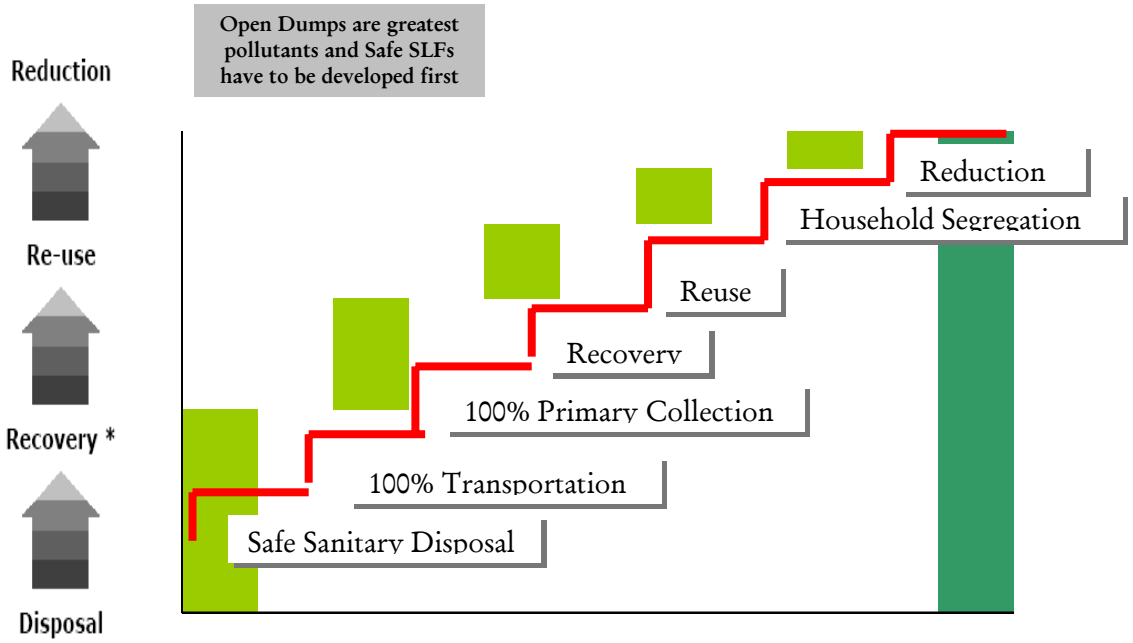

Figure: Value addition chain of MSW management

e. The risk of pollution and contamination caused by open dump yards (which are known to cause most damage to the environment) is mitigated by the development of treatment facilities and engineered sanitary landfills. By designing them in accordance with MSW Rules, statutory compliance is also achieved.

f. ULBs were focusing their SWM primarily towards C&T, with little effort towards treatment and disposal. However, it is evident from the above graph that open dumps rank highest in polluting the environment.

g. Given that the MSW Rules mandate landfilling as the only mode of disposal and landfilling of only inertised waste, it has become imperative for all ULBs to develop waste processing and engineered sanitary landfills for safe disposal. Safe disposal, therefore, plays an important role in the overall SWM chain.

h. However, the prevailing practice in urban India is open dumping of raw waste and rejects from the operational treatment plants. There is no operational engineered scientific landfill in India, barring development efforts by few ULBs as explained below.

i. Landfills are currently the preferred option of final disposal of waste, as per MSW Rules. Waste disposal by way of scientific landfills is a complex process with multiple issues that need to be addressed during its construction and operations. While most municipalities have commenced activities for developing a landfill (Delhi, Bangalore), no city has an engineered sanitary landfill in operation.

j. In the area of setting up of scientific engineered landfill facilities, there are not many private developers, which may be due to the fact that the awareness in the country for the need to dispose MSW in a scientific way is only recent. Therefore, only a few operators such as Ramky Infrastructure Limited, Gujarat Enviro, who have been involved in the operations of hazardous waste landfills are active in the country presently and are submitting proposals for several projects. Experience shows that due to the fact that landfills, except at few large cities in the country, other places require the smaller capital investment and the project requires long time in recovering the investments, many private developers are not to keen to participate in the tender process. There is a clear need to build up awareness amongst private investors to increasingly take interest in such projects in the future.

k. Management of MSW presents many opportunities for greenhouse gas emission reductions (including the waste to energy/ methane utilization options). Source reduction and recycling can reduce emissions at the manufacturing stage, increase forest carbon storage, and avoid landfill methane emissions. Combustion of waste allows energy recovery to displace fossil fuel-generated electricity from utilities, thus reducing greenhouse gas emissions from the

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utility sector and landfill methane emissions. Diverting organic materials from landfills also reduces methane emissions.

3.4. MSW management system in Karnataka

Government of Karnataka (GoK) has undertaken several initiatives to ensure timely and effective implementation of the provision/requirement MSW Rules across all ULBs in the state. As a first step a state policy on integrated MSW management ("State Policy") has been prepared by the Directorate of Municipal Administration (DMA) and Karnataka Urban Infrastructure Development & Finance Corporation (KUIDFC) under the Nirmala Nagara program of GoK to provide directions for carrying out MSW management activities. A total fund of approximately Rs. 130 Crores has been released to the ULBs under Eleventh and Twelfth Finance Commission grant.

With an objective of making the MSW management activities self sustainable and to enable recovery of costs to the extent possible, GoK has issued a Government Order No.186:2006-07 dated 8-12-2006.

a. State Policy on MSW Management

Under the State Policy, guidelines have been set out for the service provider for collection, transportation, treatment and disposal of MSW and the ULBs in the state are required to adopt these guidelines for MSW management. The touchstone principles of the State Policy are set out below:

i. Promoting awareness of MSW management principles among citizens and other stakeholders.
ii. Minimizing multiple and manual handling of MSW, and designing a system to ensure that MSW does not touch the ground till treatment and final disposal.
iii. Defining the roles and responsibilities of various stakeholders and putting in place an operating framework, which would include appropriate contractual structures.
iv. Developing systems for effective resources utilization and deployment.

v. Promoting recovery of value from MSW; developing treatment and final disposal facilities, which, while adhering to the statutory requirements, are sustainable, environmentally friendly and economical.

The objectives of the State Policy on MSW management are as follows:

i. Providing directions for carrying out the MSW management activities viz. collection, transportation, treatment and disposal in a manner, which is not just environmentally, socially and financially sustainable but is also economically viable.

ii. Establishing an integrated and self-contained operating framework for MSW management, this would include the development of appropriate means and technologies to handle various MSW management activities.

iii. Enhancing the ability of the ULBs to provide effective MSW management services to their citizens.

b. Creation of SWM Cell

Recognising the need for scientific management of MSW and the lack of skills at ULBs to effectively handle the same, SWM cell has been created in KUIDFC. The SWM cell has commissioned studies in 17 ULBs as a first step to assess the current practices. The cell also provides technical assistance to all ULBs in the state.

c. Other initiatives

i. Workshops have been carried out at the Divisional and District levels for ULBs.

ii. Technical committees have been constituted for a) finalizing design and specification of tools and equipments b) design and specification of the infrastructure, tools and equipments required for disposal of MSW through composting and landfill.

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iii. A manual on technical specification for tools, equipments and vehicles required for management of SWM has been brought out by KUIDFC. A technical manual has also been prepared for treatment and landfill operations.

iv. A tool kit for municipalities on contract documents of various activities of SWM has been prepared (total 18 nos.).

v. For effective implementation of integrated solid waste management (ISWM) in the state, DMA has recruited about 123 Environmental Engineers in the ULBs.

vi. GoK has issued a Government order dated 6-01-2006, for collection of user charges for SWM activities.

vii. A standard template for preparing action plan has been devised by KUIDFC and all the ULBs are required to prepare the action plans for their city/town.

viii. So far an amount of approximately Rs. 40 crores has been released by DMA to these ULBs for procurement of tools, equipment, vehicles etc.

ix. KUIDFC has taken up project financing and implementation of SWM activities in the 10 coastal towns under ADB.

d. IEC Material & Activities

IEC is the key to the success of the modernization. Involvement of the community is going to be the main thrust of the program. Lead NGOs were appointed for IEC activities and in the first phase about 33 ULBs under Nirmala Nagara Project were selected for awareness programme in SWM. In the second phase, IEC activities have been extended to 23 CMCs and 66 TMCs of the state.

Six booklets on IEC for various target groups including, children, general public, NGOs, ULBs, elected representatives and Pourakarmikas (PKs) have been prepared. A documentary film on SWM for general awareness and another documentary film exclusively on Municipal Landfill have also been produced by KUIDFC for creating awareness and educating the ULBs.

e. Implementation of ISWM

Implementation of ISWM as per MSW Rules has been undertaken in the state in a phased manner. The progress is set out in the table below:

Phase	Year of Implementation	Coverage
Phase 1	2004	57 ULBs under Nirmala Nagara Programme (mostly City Corporations and City Municipal Councils)
Phase 2	2006	73 ULBs (mostly Town Municipal Councils)
Phase 3	2007	Remaining 91 ULBs (mostly Town Panchayats)

Source: SOUI Karnataka, 2007

f. Waste Generation

The total amount of MSW generated in the ULBs is about 10,228 TPD and the average collection efficiency is about 93 per cent.

Sl.No.	ULB Category	Total tonnes of (MSW) generated per day	Total tonnes of MSW collected per day	Collection Efficiency
1.	MC	1110.0	986.0	88.8
2.	CMC	1465.0	1136.0	77.5
3.	TMC	6954.0	6845.0	98.4
4.	TP	698.0	622.0	89.1
Total		**10228.0**	**9590.0**	**93.7**

Source: SOUI Karnataka, 2007

MC- Municipal Corporation, CMC- City Municipal Corporation, TMC Town Municipal Corporation,TP-Town Panchayat

g. Primary Collection

Primary collection of MSW through door-to-door collection of waste has been commenced in about 59 ULBs in the state involving more than 400 self help groups (SHGs) for the activity. Primary collection is carried out using auto tippers and pushcarts. Residents are encouraged to segregate, store and deliver MSW to primary collection staff as per procedures set out by ULBs.

h. Secondary Storage & Transportation

Usage of metal containers of specified dimensions and capacity is proposed for secondary storage. The usage of concrete bins is being discontinued as per the mandatory recommendation of the Committee constituted by the Hon'ble Supreme Court of India. In accordance with the provisions of ISWM Policy, the recommended mechanism involves MSW to be placed hydraulically into the secondary containers by auto tippers, metal containers to be handled mechanically through dumper placers, or tractors with tipping trailer mechanism. Use of secondary containers and dumper placers/tractor placers

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would be decided based on the type of the town, population, quantum of MSW generated etc.

The number of public dustbins (PDBs) and the average spacing between PDBs is set out in the table below.

Sl.No.	ULB Category	Number of PDBs	Average spacing between PDBs (meters)
1.	MC	5043	325.0
2.	CMC	13375	262.0
3.	TMC	7731	263.0
4.	TP	4114	158.0
Total		**30263**	**252.0**

Source: SOUI Karnataka 2007- Excluding Bangalore

From the PDBs and open collection points, MSW is transported to disposal sites by means of trucks or tractor-trailers. Bangalore, Mysore and Hubli – Dharwad have privatised the C&T activities for some parts of the city. Transfer of MSW into transport vehicles is done manually. The total number of vehicles in the ULBs and their capacities are presented below.

Sl.No.	ULB Category	Lorries		Mini - lorries		Tractors		Others	
		number	tonnes	number	tonnes	number	tonnes	Number	tonnes
1.	MC	38	115.0	1	4.0	73	4.0	55	133.0
2.	CMC	32	150.0	21	63.0	172	654.0	38	159.0
3.	TMC	3	11.0	21	61.0	136	333.0	22	35.0
4.	TP	170	354.0	13	21.0	80	668.0	28	324.0
Total		**243**	**629.0**	**56**	**149.0**	**461**	**1659.0**	**143**	**651.0**

Source: SOUI Karnataka 2007- Excluding Bangalore

i. Treatment

As per Status of Urban Infrastructure (SOUI) Report Karnataka 2007, except in Bangalore and Mysore, there are no large treatment (composting) plants in operation in the State. Karnataka Compost Development Corporation (KCDC) is one of the largest compost manufacturers in the country, and is owned by

GoK. The compost plant at Mysore, owned by Mysore City Corporation, has been constructed with Asian Development Bank (ADB) assistance. Another compost plant at Mangalore under ADB assisted is in the verge of completion.

The solid waste management policy states that composting would be the treatment and processing option for MSW. At present there are concerns on sale of the compost. It has been proposed that the incoming MSW shall be composted using aerobic composting technique so that the MSW is inertised. If there is a market for the compost then the inertised MSW would be sieved and compost sold while the rejects are land filled. If there were no market for compost the inertised MSW would be landfilled.

j. Disposal

The rejects from the composting process have to be land filled. It is proposed that a sanitary landfill would be developed for Class I towns. The Sanitary landfill approach is based on the MSW Rules. For smaller ULBs with lower MSW generation, it is proposed that progressive development approach to MSW management shall be adopted. It is proposed that an engineered landfill development would take place for all the waste. Progressively the treatment and improved landfill practises shall be implemented.

KUIDFC was the first to set up and operationalize the first landfill site as per MSW Rules in India at Puttur. Another sanitary lanfill as per Rules is operational in Karwar. A sanitary landfill as per MSW Rules is in the verge of completion in Mangalore. Engineered landfill as per State policy on ISWM is operational in Ankola. Sanitary landfill in Udupi is under construction. (*Source SoUI Karnataka 2007)*

The status of landfills in the state are set out below.

i. Out of 225 ULBs in the state, 222 ULBs have identified the land required for establishing landfill sites. A total of 217 landfill sites have been identified and for 214 of these sites the authorizations have been issued by Karnataka State Pollution Control Board (KSPCB).
ii. Rs.16.53crores has been released for procurement of private lands identified for landfill sites.

iii. Development of landfill sites has been taken up utilizing the Eleventh & Twelfth Finance Commission Grants. So far, approximately Rs. 31 crores has been released to 216 ULBs for this activity.

k. Nirmala Nagara Programme

The Nirmala Nagara Programme is under implementation in 57 ULBs of the state since August 2003. MSW management is one of the components under the programme. The strategy for implementation has been designed in two phases – preparatory phase and implementation phase. The preparatory phase consists of enhancing effectiveness of the existing system and undertaking IEC campaigns for promoting awareness and willingness among stakeholders. The implementation phase would consist of the various components in the SWM chain, such as, door to door collection, secondary storage of MSW, transportation, treatment and disposal.

l. MIS System

To monitor the SWM activities in the state, an MIS system has been introduced. The Project Directors of the District Urban Development Cells (DUDC) responsible for collating the information of the ULBs in their jurisdiction. The consolidated statement is then uploaded to the system.

3.5. Key Issues & Constraints

Important fallout of rapid urbanization is the corresponding increase in waste generation. ULBs have the mandate to provide efficient, scientific MSW management services in terms of statutory guidelines. The sector, however, is constrained by the following:

a. MSW services being perceived as a public good, ineffective without universal implementation.
b. Low quality of service being provided despite high costs.
c. Engagement of vast labour resources; however, the productivity of manpower is reportedly sub-optimal.
d. Due to perception of management of MSW as a free good, cost recovery is low and dependent on general revenues and transfers.

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e. The workforce comprises a significant proportion of women and economically weaker sections of society. Any restructuring of the existing activities would have a direct impact on their livelihood.

f. The MSW management function in most ULBs is overseen by members of the medical fraternity (health officers). However, C&T activities are logistics oriented while treatment and disposal activities need an engineering focus.

g. Most ULBs do not have the required treatment and disposal facilities for MSW and the skills for managing such tasks are not adequate.

h. No accurate estimates of MSW quantities are prepared. Waste quantification and waste characterization studies are also not carried out prior to design of MSW systems.

i. Due to the different development stage of various cities, different ways of management and treatment may require different value chains and "business models".

The issues could further be categorized into techno-commercial and governmental issues, institutional and social issues etc. and the details are set out below:

a. Techno-commercial and Governance issues

Several constraints are experienced in managing MSW, starting right at the waste generation stage to the collection & transportation of the generated waste and the final treatment and disposal of this waste. Some of the techno-commercial and governance issues are summarized below.

Techno-commercial Issues	Governance Issues
• Municipalities have no accurate estimation on MSW generation, making it difficult to plan effectively. • Very few primary waste quantification and characterization studies are being carried out prior to designing SWM systems. • Segregation of MSW and subsequent individual handling systems for different types of waste not being done. • Absence of any reported standards to measure effectiveness of C&T activities. Payment is usually based on number of vehicle trips and least cost transportation programs are reportedly not being used. • Lack of a clear monitoring mechanism, resulting in disparity between contract payments and actual performance of the Parties. • Environmental and social risks not addressed adequately. • Contractors often do not adhere to regulations on contract labour and minimum wages. • Lack of awareness for scientific disposal.	• In most ULBs, MSW management activities are handled by the Health Department. It may also be essential to involve the engineering department as well as the MSW treatment process requires expertise in construction activities. • ULB staff is not often trained on the aspects of treatment and disposal. • In many ULBs there is no specific SWM charter or a separate cell established to cater to MSW activities. • MSW management is a labour intensive activity. Since several governments have halted fresh recruitments, there has been an increasing reliance on contract labour, who more often than not do not adhere to rules and regulations. • Sanitary workers are not provided with safe equipment for handling MSW. Safety of workers not seen as a priority. • Timing for street sweeping activity are usually set and sometimes coincide with peak traffic movement. • Repetitive nature of work coupled with lower motivation results in sub optimal

Techno-commercial Issues	Governance Issues
• Development of treatment & disposal facilities is often viewed as an increased financial obligation for compliance to MSW Rules. • Traditional development models include high revenue risks to the developer due to unviable model of royalty payments by the private investor. • Landfill facilities are cost centres with no saleable outputs, capital intensive with significant back-ended costs. • Not many private developers in the sector. • Long gestation project period coupled with time consuming issues such as land acquisition, obtaining clearances, etc.	productivity levels. • While efforts are being made by ULBs in designing "output" oriented indicators, the desired objective of "clean/ healthy/ environment friendly" has a subjective connotation and has not been translated to objectively measurable indicators. • MSW transporting vehicle are very often not fully covered, spilling garbage/ leachate along the way. • Siting of MSW facilities are prone to NIMBY (Not in My Backyard) syndrome and needs to be appropriately addressed.

The MSW sector also experiences several other constraints pertaining to institutional mechanisms, human resources, contracts management and other social & environment issues. Some of these governance issues are set out below:

b. Institutional set up

In most ULBs, (Bangalore, Mysore, Trivandrum, Vishakhapatnam), MSW management activities is handled by the Health Department which is staffed with medical officers, health inspectors etc. As the MSW management activities entail logistics / fleet management of vehicles, repair and maintenance of equipment and civil engineering oriented activities such as MSW treatment which involves mechanization and landfill management that requires expertise in construction activities, it may be essential to have involvement of engineering department as well. SWM also attracts a significant portion of ULB budgets, however, the emphasis is mostly knee-jerk- top officials react usually for emergencies; there are very few ULBs with stated charter for MSW management.

Since these activities requiring compliance with MSW Rules are new, ULB staff is not trained on the aspects of treatment and disposal. Requirement of skill sets, including those for assessing and monitoring of CDM benefits in these areas need to be inculcated in the ULB staff.

Initiatives that could strengthen the institutional governance aspects could include framing of an SWM charter, setting up of a separate cell for SWM (with inputs from heath, engineering departments), capacity building for staff and development of scientific guidelines for designing and implementing projects.

c. Human Resources

MSW management is a labour intensive activity; normally solid waste department has the maximum number of employees in an ULB. This is especially seen in the area of collection, transportation and street sweeping activities. The ratio of women employee is also significantly higher. Since several governments have put a freeze on fresh recruitment, there has been an increasing reliance to contract labour. However, the contractors providing such labour are reportedly not adhering to the regulations on contract labour and minimum wages. In addition, sanitary workers are not provided with safe equipment for handling MSW. Manual handling results in health hazards to workers due to presence of broken glass, needles and exposure to germs. With such a large labour force, the health and safety issues need to be high on the priority of the ULBs.

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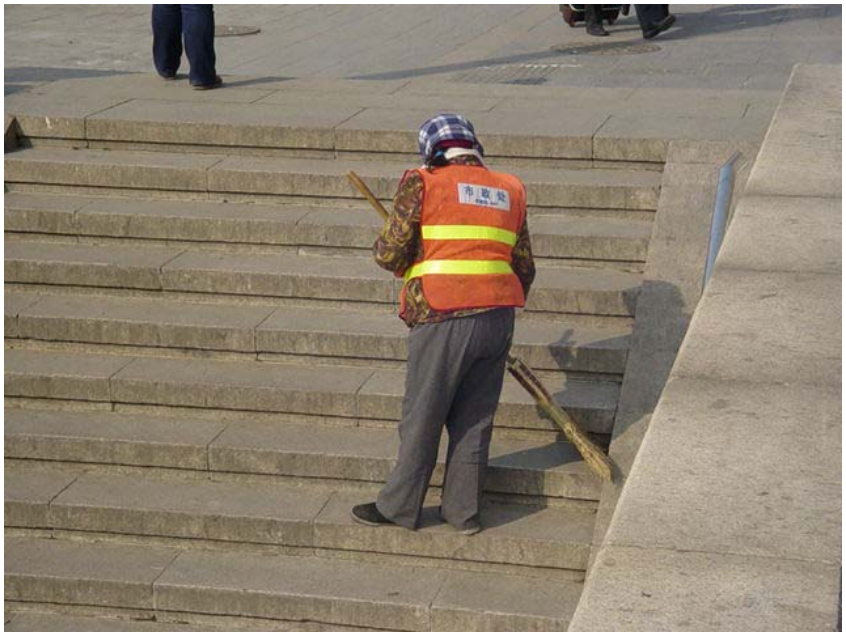

Figure: Street sweeping

The timings for street sweeping activity are usually set and sometimes coincide with peak traffic movement. Usage of protective gear and ergonomic equipment is not common; repetitive nature of work coupled with lower motivation results in sub optimal productivity levels.

d. Contract Monitoring

Conventional contracting relied on prescription of input oriented controls such as the number of employees, vehicles and other tools and equipment. Construction activities were typically conducted with preparation of bill of quantities; design risk entirely borne by the contracting agency. This has not necessarily led to the desired outcomes. The emphasis of all the infrastructure sectors is shifting towards outcomes and "output" oriented indicators. While efforts are being made by ULBs in designing such standards, the desired objective "clean/ healthy/ environment friendly" has a subjective connotation and has not been translated to objectively measurable indicators.

The monitoring activity by the ULB staff hence is, at times, adhoc leading to disputes with the contractors. MSW management is still being "provided" by ULB rather than being outsourced. With the advent of private sector participation (PSP), the roles would need to change from provider of service to contract managers. There is a need to build capacity in the ULBs for the same.

e. Social and Environment

Scientific MSW management practices aim to control ground water and air pollution. It is essential that transporting vehicles are fully covered and do not spill garbage/ leachate on the way; treatment and disposal facilities are appropriately designed.

A host of informal workers are present in the system, whose health and safety would need to be taken into consideration while designing any system.

Siting of MSW facilities are prone to NIMBY syndrome, and would need to be addressed appropriately, through a consultative process. Resettlement & rehabilitation, if any, would need to be adequately addressed.

A host of informal workers are present in the system, whose health and safety would need to be taken into consideration while designing any system.

4. Project Concept

This section sets out the status of MSW management in Tumkur city and the Project concept.

4.1. Details of Tumkur City

a. Profile of the City

The salient features of the city are set out in the table below:

Description	Value
Population (2007)	3.28 Lakhs
Number of Households	65400
Commercial Establishments	8055
Area	51.9 square kilometers
Number of wards	35
Connectivity	By Road: 70 kilometers from Bangalore
	Nearest Airport 70 kilometers in Bangalore
	By Rail: At Junction

The population of the city and the pattern of its increase over the years are set out in the table below. It can be observed that while the population increase was approximately 27% during the decade of 1981-91, the next decade (1991-2001) witnessed a huge decadal growth rate from 27% to approximately 78%. However, during the last five years, as a result of the influx of several service industries in the city and neighboring areas, the population has increased by approximately 22%.

Census Year	Population ('000)	Decadal growth (%)
1951	36	
1961	47	30.0

Census Year	Population ('000)	Decadal growth (%)
1971	70	49.0
1981	109	56.0
1991	139	27.0
2001	248	78.0
2004	288	54.0
2007	328	46.0
2009	354	54.0

The city has been divided into 35 municipal wards and the approximate number of households and population in each ward are set out as Annexure 1. The details of other MSW generators such as commercial establishments, hotels and restaurants in each ward are also set out as Annexure 1.

While there are 19 declared slums in the city, 18 more slums have been identified. The details of the slums and approximate number of households in each of these slums are set out as Annexure 2.

b. Waste Generation

The estimated quantum of MSW generated in the city is approximately 114 tonnes per day (TPD), of which residential waste amounts to approximately 52% of the generation. The total quantum of MSW generated is presented in the table below: The detail of quantum of MSW generation for each of the generators is set out as Annexure 3.

Sl. No.	Type of Waste Generator	Total Waste Generated (TPD)
1	Non-Slum Households	41.0
2	Slum (BPL) Households	18.3
3	Commercial shops	8.1
4	Major hotels and resorts	1.8
5	Small Hotels	0.9
6	Markets	0.3
7	Choultries	4.5
8	Hostels	3.7
9	Institutions	0.4
10	Boarding and lodging centers	4.8
11	Vegetable shops	0.9
12	Meat shops/ slaughter houses	2.6

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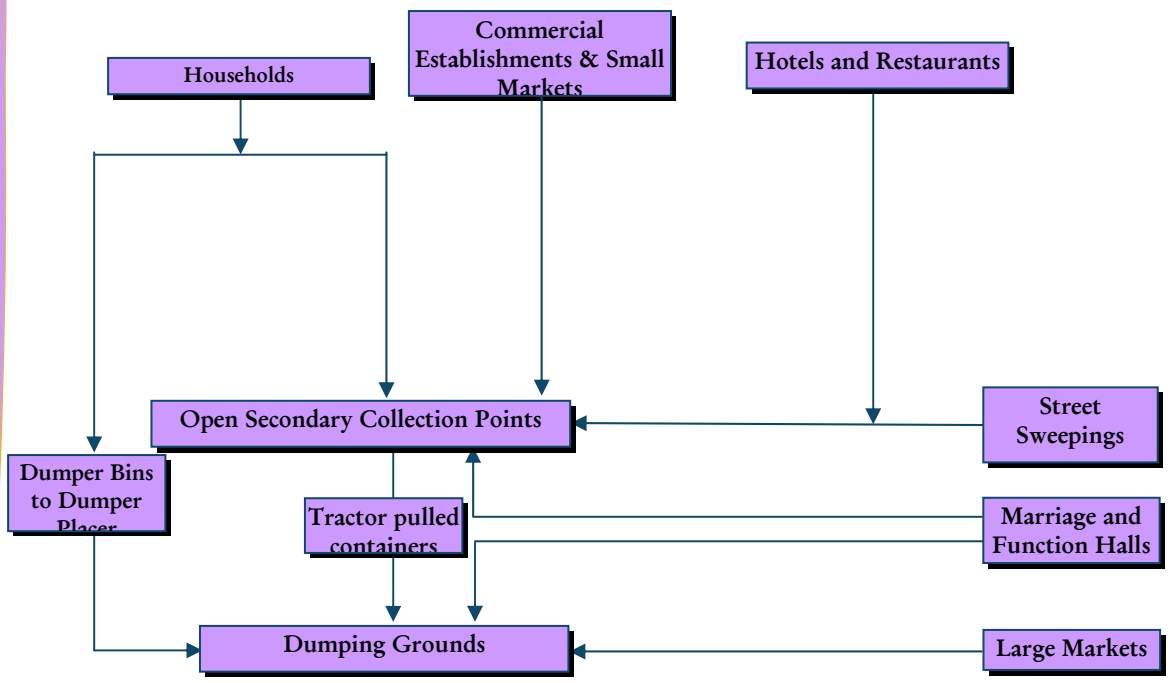
13	Wet waste from medical centers	0.4
Total		**87.7**
Construction waste		11.4
Waste from floating population		2.0
Street sweeping waste		13.0
Grand Total		**114.1**

c. Current Practice

The MSW management activities are being supervised by the Health Department of TCMC. The city is divided into 3 health zones and each zone is divided between health inspectors. The current practice for MSW management in Tumkur is depicted below:



i. Collection and Transportation of MSW

The current practices of collection and transportation of MSW from various generators as set out below.

TCMC has introduced door-to-door

collection of MSW from domestic households by deploying pushcarts in some of the wards. However, the common practice is dumping of MSW into RCC bins / masonry bins and on the road sides (open collection points). SHGs carry out the primary collection of MSW. A total of 5 SHGs are involved in primary collection by way of tractors (for commercial establishments and bulk generators) and 31 pushcarts (for households).

The list of SHGs presently involved in door to door collection of MSW in the city is set out below:

Sl.No.	Name of SHG
1	Saraswati Nagara Stree Shakti Group
2	Evergreen Nagara Stree Shakti Group
3	Nisarga Nirantara Ulitaya Stree Shakti Group
4	Vandana Nirantara Ulitaya Stree Shakti Group
5	Prakruti Nagara Stree Shakti Group

Source: MSW Action Plan

ii. Street Sweeping

The street sweeping activity in the city is carried out by the PKs. The street sweeping activities are classified into three categories depending upon the frequency of collection namely; A type roads (daily collection), B type roads (collection twice a week) and C type roads (once a week). The detail of the bins in each of the wards is set out in Annexure 4.

The street sweepings and the silt collected from the road side drains are temporarily stored is small heaps on the road sides or are collected in the bins. The estimated road length in Tumkur is 666 kilometers, which has been classified into three categories depending upon the frequency of sweeping, namely, A type (133.23 km cleaned on a daily basis), B type (233.1 km cleaned twice a week) and C type (299.74 km cleaned once a week).

Sl No	Classification of Roads	Road length (Km)
1	Type A (sweeping on a daily basis)	133.2
2	Type B (sweeping twice a week)	233.1
3	Type C (sweeping once a week)	299.7
Total Road length		**666.0**

Source: MSW Action Plan

In order to facilitate collection of MSW from the bulk generators, secondary storage bins (dumper bins) have been placed at commercial areas and bulk waste generation points. The MSW stored in the dumper bins is transferred to the compost facility using dumper placers. The details of the transportation vehicles owned by TCMC and the condition of the vehicles are set out in Annexure 5.

iii. Treatment and Disposal of MSW

At present, there is no sanitary landfill facility for disposal of the MSW generated in the city. The MSW collected is being dumped in the open areas at Ajjagondanahalli.

iv. Staffing Details

The MSW management activities are being supervised by the Health Department of TCMC. The city is divided into 3 health zones and each zone is divided between health inspectors. The details of the officials and other conservancy staff including PKs is set out as Annexure 6.

v. Current cost of service delivery

The expenditure incurred in the last three years by TCMC on MSW management activities is set out in the table below:

Particulars	Expenditure on SWM head (in lakhs)		
	2004 -2005	2005-2006	2006-2007

Salaries for SWM staff	79.0	85.1	88.0
Contracts	72.7	57.9	58.7
Purchase of tools and equipments	7.7	4.3	50.2
O&M of the existing vehicles	30.8	30.4	28.7
Miscellaneous	0.8	0.3	1.0
Total	**191.0**	**177.0**	**226.6**

Source: MSW Action Plan

d. Key Issues affecting service delivery

The major issues affecting the service delivery in Tumkur city are as follows:

i. Low quality of service being provided despite high costs.
ii. Due to perception of management of MSW as a free good, cost recovery is low and dependent on general revenues and transfers.
iii. Multiple handling of MSW.
iv. There is no land available/identified for the development of treatment and disposal facilities.
v. Segregation of MSW is not happening at the source due to lack of awareness.
vi. Standard equipments and vehicles are not available with the ULB.
vii. Lack of manpower.

4.2. Project Description

The proposed Project would include collection and transportation of MSW followed by its treatment and disposal.

a. Collection and Transportation of MSW

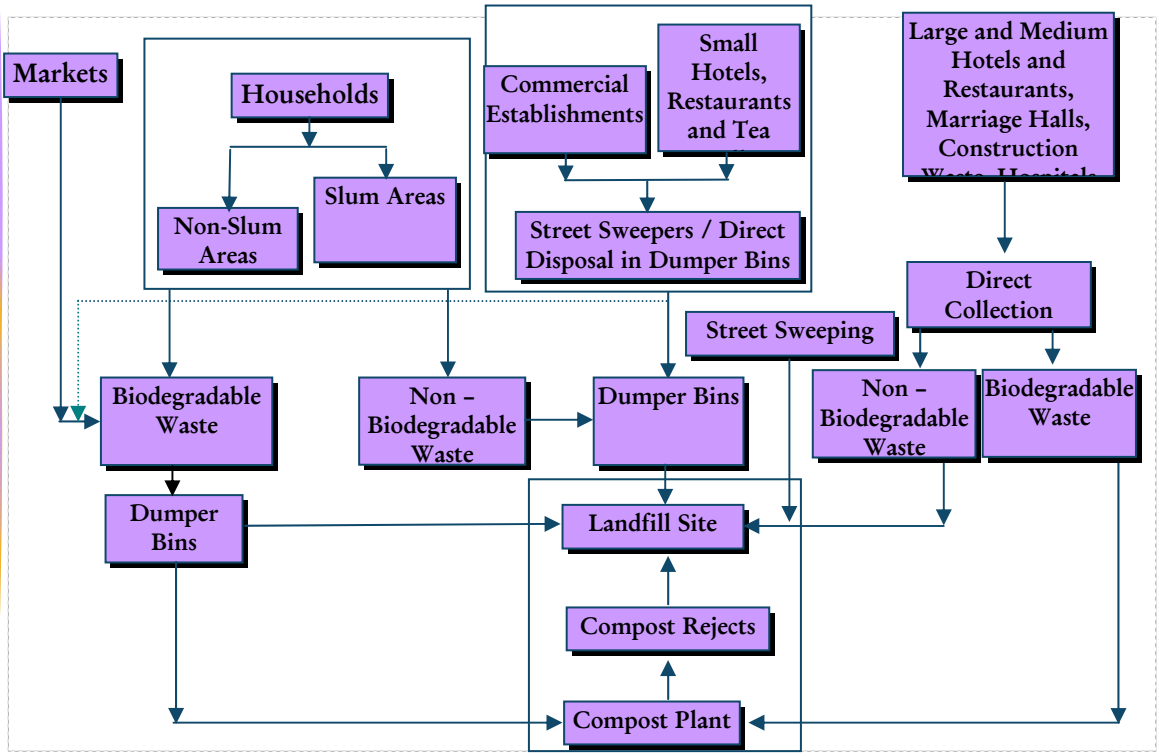
The activities would include collection of MSW from the different waste generators such as domestic households, commercial establishments, hotels, institutions etc., sweeping of streets and subsequent transportation of the waste collected, to the processing facility or the final disposal site. The activities envisaged would be undertaken with the assistance of self help groups and with participation of local populace.

b. Treatment and Disposal of MSW

The treatment facility would be a compost facility wherein the MSW would be processed. The bio-degradable components of the MSW would be processed and converted to compost and non-biodegradable component of MSW and the rejects from compost facility would be sent to the sanitary landfill facility.

4.3. Project Components

The strategy for collection, transportation, treatment and disposal of MSW, requirement of physical infrastructure components and the basis for the estimation of the same are discussed in this section. The proposed MSW management strategy for Tumkur is depicted below:



a. Collection and Transportation

The process of collection and transportation of MSW is one of the significant activities that have concurrent implication of the treatment and disposal of MSW.

i. Introduction of 2-bin system (biodegradable and non-biodegradable) of MSW to enable segregation and storage at source is proposed.

ii. The system of waste collection would be primarily door-to-door based, and would be managed under service contracts with private operators and active involvement of SHGs, wherever possible.

iii. As per the State Policy, the primary collection would be carried out by deploying a combination of auto tippers and pushcarts.

iv. The MSW collected directly from large generators such as hotels, restaurants, marriage and function halls would be transported to the compost facility/ scientific landfill facility by dumper placers.

v. Dumper bins would be located at identified locations for secondary storage of segregated MSW collected from various sources.

vi. The transportation of dumper bins to the compost facility would be through dumper placers and the street sweepings would be transported by deployment of tractors.

The activities carried out for collection and transportation of the MSW is as set out below:

i. Domestic households

The collection of MSW from the households would require collection from the general parts of the city i.e. non-slum areas and the slum areas. In line with the State Policy, individual strategies have been developed for collection of MSW from these 2 sources and the details of the same are set out below.

Primary collection of MSW from non-slum areas

- Door-to-door collection would be the primary mode of collection from domestic households. Auto tippers and pushcarts are proposed to be deployed for primary collection of MSW.
- The MSW collected in auto tippers and pushcarts would be transported to dumper bins.
- The dumper bins containing the biodegradable waste would be transported to the compost facility and those containing non biodegradable waste would be transported to the landfill facility.

Primary collection of MSW from slum areas

- Considering the practical difficulty in door-to-door collection of MSW from slum areas, it is proposed to place HDPE bins, with the residents being required to dispose the MSW in these bins.
- Only tricycles are proposed to be deployed for collection of MSW from these areas, as accessibility of such areas by auto tippers would be a constraint.

ii. Bulk Generators comprising markets, hotels, commercial establishments, restaurants, choultris etc.

Markets

- In large markets, it is proposed to place dumper bins at strategic locations and the MSW collected would be directly transported to the compost facility.

- PKs would sweep and collect the waste in smaller markets and store it in dumper bins. Containerized push carts are proposed to be used by the PKs in small markets.

Hotels, restaurants, choultris etc,

- Bulk generators would need to maintain dumper bins and dispose the MSW only in the dumper bins, which would later be colleted by the dumper placers.

- The waste collected would be transported to compost / sanitary landfill facility through dumper placers.

iii. Street sweepings

- The roads in the city have been categorized into three types, as set out below, based on the street sweeping requirements.

Type	Classification	Length (km)
A	Sweeping on a daily basis	133.2
B	Sweeping twice a week	233.1

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Type	Classification	Length (km)
C	Sweeping once a week	299.7

Source: MSW Action Plan

- Zone Wise Street sweeping and roadside drain cleaning frequency as per the State Policy.

Type	Road length (km)	Frequency	Days						
			Sun	Mon	Tue	Wed	Thu	Fri	Sat
A	133.2	Swept daily	133.2	133.2	133.2	133.2	133.2	133.2	133.2
B	233.1	Swept twice a week	AC	77.7	77.7	77.7	77.7	77.7	77.7
C	299.7	Swept once a week	AC	42.8	42.8	42.8	42.8	42.8	42.8
Total	**666.0**								

Source: MSW Action Pan; AC – Area cleaning as a task work

The total number of vehicles and equipments required for collection and transportation, street sweeping and secondary storages is listed below.

a. Primary collection from non- slum areas

- Auto tippers and pushcarts are proposed to be deployed for collection of MSW from households.
- In areas with narrow lanes, pushcarts would be deployed for primary collection.
- The coverage of auto tippers and pushcarts is 1000 and 250 households respectively.
- The requirements of auto tipper and pushcarts in each of the wards have been estimated assuming these coverages.

Sl. No.	Description	Numbers
1	Total number of households in non-slum areas	49023
2	Percentage coverage of households	
a	Auto tippers (70%)	34316
b	Pushcarts/tricycles (30%)	14707
3	Coverage of the primary collection vehicle	
a	Auto tippers	1000
b	Pushcarts/tricycles	250
4	Estimated requirements	
a	Auto tippers	6
b	Pushcarts	173

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Sl. No.	Description	Numbers
4	Number of SHGs identified for managing and monitoring door to door collection	40

b. Primary collection from slum areas

- For purposes of estimation, the current slum households have been considered.
- One 40 liter high-density polyethylene (HDPE) litter bin would be placed for collection of MSW at a strategic location for every 20 dwelling units in the slum areas.

S. No.	Description	Numbers
1	Total number of households in slum areas	24432
2	Mode of collection of waste from households	
a	Pushcarts	51
b	HDPE bins	1222

c. Street sweeping

- The PKs would carry out the street sweeping activity and would be responsible for sweeping of the roads, cleaning of the adjoining drains.
- The street sweeping activity would be carried out on a daily basis in the roads categorized as 'A' type, twice a week for roads categorized as 'B' type and once a week for 'C' type roads.
- The requirement of PKs for street sweeping has been estimated based on the road classification. The estimated manpower requirement for the same is 243.
- Street sweeping waste silt from drains would be transported to the low lying areas.

Sl.No.	Road type	Road Length (km)	Number of PKs to be deployed
1	Type A	133.2	133
2	Type B	233.1	67
3	Type C	299.7	43
	Total	**666.0**	**243**

d. Secondary collection

- The MSW collected from all the sources would be stored in dumper bins The number of dumper bins have been estimated based on the total quantum of MSW generated.

- In line with the state policy, it has been proposed to use dumper bins of volumetric capacity 3.0 cubic meter and 4.5 cubic meter. The estimated capacity of dumper bins in terms of quantum of MSW (Metric Tons) would be of 1.2 metric tons and 1.8 metric tons respectively.

- The total estimated number of the dumper bins each of the wards are set out in the table below:

Sl. No.	Description	Numbers
1	Total quantum of MSW generated (TPD)	125
2	Density of MSW	0.4
3	Volumetric Capacity of dumper bin (cubic meters)	3.0
4	Capacity of dumper bins for Waste (tonnes)	1.2
5	Number of 3 cubic meters dumper bins required	33
6	Volumetric Capacity of Dumper Bin (cubic meters)	4.5
7	Capacity of dumper bins for Waste (tonnes)	1.8
8	Number of 4.5 cubic meters dumper bins required	70

e. Transportation of MSW

- The dumper bins would be transported to the compost facility / scientific landfill facility in dumper placers.
- The biodegradable waste collected would be transported to the treatment facility and the waste from the treatment facility would be disposed into the landfill.

b. Treatment of MSW

Treatment of MSW is beneficial in many ways and some of the immediate benefits that could be envisaged are extraction of useable products such as compost, reduction in quantity of waste for disposal at scientific landfill facility

and elimination of decomposition of MSW due to open dumping. The MSW collected from various generators would need to be treated before disposal. Presently the MSW is dumped openly at Ajjagonadanahalli. A compost facility would need to be set up at Ajjagonadanahalli.

c. Disposal Facility

Disposal of MSW is an essential requirement for Tumkur. It is estimated that MSW generation would increase in future due to increase in population and expansion of geographical area of the city. It is proposed to develop a sanitary landfill facility of 68 MT capacity, on an area of approximately 40 acres.

A summary of the proposed sanitary landfill design is set out below.

i. Design Life

The phases of design life of a landfill comprises of an "active" period and a "closure and post-closure" period. As per MSW Rules the active period of a landfill site shall be large enough to last for 20-25 years. The "closure" and "post-closure" period for which a landfill is monitored and maintained will typically be 15 years after the "active" period is completed.

ii. Sanitary Landfill layout

The present Project is an integrated activity comprising of composting and engineered landfill. The landfill site will comprise of the area in which the waste will be filled as well as additional area for support facilities. Within the area to be filled, work may proceed in phases with only a part of the area under active operation. The following facilities will be required for efficient operation of landfill:

a. Road – access and internal
b. Equipment Maintenance shed
c. Weigh bridge
d. Office and amenities
e. Temporary waste storage
f. Areas for stockpiling cover material and liner material
g. Leachate Collection and Recovery System (LCRS)

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h. Landfill gas management facilities
i. Leachate monitoring wells

The facilities shall be developed as independent of each other as landfill facility may be developed as separate unit for ease of operation. However, the common facilities which are considered are:

a. Access road
b. Weigh bridge
c. Laboratory Building
d. Facilities like canteen, toilet, rest area, etc.
e. Water supply system
f. Transformer yard & control panel room

The layout of landfill will be governed by the shape of the available landfill area in Ajjagondanahalli site.

5. Market Assessment

This section sets out the market assessment for municipal waste compost (MWC).

5.1. Industry Outlook

a. Growth in compost volumes are generally driven by policy directives framed with the objective of reducing the level of organic material dumped in landfills. City managements also derive subsequent financial savings due to lower volumes being landfilled.

b. Green waste composting, accounts for more than 70% of global compost volumes. MSW composting has achieved significant volumes mainly in the European Union.The composting volumes in many Asian countries are small mainly due to the failure of centralised municipal waste composting facilities. Centralised composting facilities with high capital investments were set up in countries like Japan, Thailand, Vietnam and China. Most of these plants either operate with low capacity utilisation or are shut down on account one or more of the following reasons:

- High operating expenses leading to plant maintenance issues;
- Poor quality of compost;
- Poor market acceptance and hence a limited market;
- Financial non-viability due to the above mentioned factors.

c. The single biggest concern for compost producers is the limited market, given the lack of awareness among users who tend to compare MWC with chemical fertilizers. MWC, acknowledged to be a soil enricher, would not yield the immediate visible results that would accrue from using chemical fertilizers. Hence, purchase of compost is considered by many users to be an additional/unnecessary expenditure.

d. Further, users are also wary of using MWC because of quality variation across batches and the presence of trace metals, pathogens and foreign bodies like plastic, glass etc., in compost. To counter the same, quality specifications are being set up in various countries and it is felt that adherence to the same would provide greater acceptance for MWC.

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e. Compost revenues

A World Bank research paper[1] indicates that "Composting rarely generates profits on its own". Due to the uncertainties attached to the revenue streams as a result of limited market, no compost plant in the world has really been financially viable on a stand-alone basis. City managements usually support compost plants by payment of tipping fees. The following table indicates the revenue streams for compost plant in developed countries:

Description	Revenue
Sale of compost	$10 - $40/T
Tipping fee for input waste	$20 - $80/T

City managements, apart from providing financial benefits in the form of tipping fee, also provide/participate in:

- Capital/operating credits to the plant;
- Programs to popularize use of compost in order to increase the size of the market;
- Procurement support by using compost for all public works, gardens etc;

f. Other observations

i. Compost applications in most countries are mainly landscaping, gardening, turf and nurseries. Horticulture applications and usage in vineyards and for sugar beet cultivation are also popular. The usage of compost for other agriculture purposes is generally low.

[1] Urban Waste Management: Composting and its Applicability in Developing Countries, March 2000

ii. Quality standard and monitoring agencies are being set up to tackle the negative perceptions regarding MWC and this would also help in developing a market for compost.

5.2. MWC Trends in India

a. Structural Issues

A number of key structural drivers of growth of composting volumes (prevalent in developed countries) are absent in India. The impact of the same would constrain growth of compost for reasons mentioned below:

i. MSW composting requires higher investments and careful control of manufacturing to ensure consistent product quality and has the potential for buyer resistance in case of quality variation;
ii. Absence of standards and monitoring agencies for compost;
iii. User acceptance of self-certification of waste is still low.

b. Market Issues

The operational capacity as well as the estimated sales figures of composting units is presented in the following table:

S No.	Location	Capacity (Compost) TPA	Sales estimates[2](T)
1	KCDC	14000	8000
2	Chincholi	9000	< 1000
3	Bhopal	9000	750 combined
4	Gwalior	9000	
5	Vijayawada	11250	6000 or lower (approx.)
6	Kolkatta	63000	< 20000
7	Thane	27000	Low
8	Ahmedabad	45000	<18000
9	Puri	9000	< 2000
10	Delhi- Bhalswa	45000	< 18000
11	Calicut	27000	Low
12	Mysore	18000	Low
13	Nashik	27000	Low
	Total	**3,60,000[3]**	**< 100000**

[2] Figures pertain to FY01
[3] Includes other smaller places

5.3. Organic Manure Business Analysis

a. Organic Input Options:

The farming community has both in-house and bought out options for catering to the organic inputs required for crop production. The in-house products include:

- Farmyard manure;
- Generic products like neem cake, longee cake, non-edible oil meals, chicken manure, top soils etc; and
- Formulated organic manures.

Farmyard manure usage is significant in spite of uncertainties in quality and delivery due to the price at which it is available - Rs.400-600/T including transportation. The most commonly used generic products are neem cake (3000 to 6000 Rs/T) pressurized and spent mushroom compost (Rs.260/T + transportation costs).

Formulated organic manures comprise a range of low and high nutrient analysis products. Generic products along with other inputs are used to formulate the organic manures. The following table sets out the types and price range of formulated organic manure:

Formulated organic manure bases	Price range (Rs. / Tonne)
Municipal waste compost	800 – 3600
Press mud + distillery spent wash compost	1500 – 2500
Spent mushroom compost and other ingredients	2000 – 3500
Meals[4] - high analysis	6000 – 6500
Lower analysis	3000 – 6000
Vermicompost and other ingredients	2500 – 3200

[4] Organic products with high analysis (NPK content – 7:10:5)

The consumption of formulated organic manure in South India was estimated at about 75000 T to 80000T in FY01. The following table presents the breakup of sales of different types of formulated organic manure in South India:

Formulated organic manure	Consumption (Tons)
Municipal waste compost	14000 – 15000
Press mud compost	19000 – 20000
High analysis meals	24000 – 25000
Others	16000 – 17000
Total	75000 – 80000

Plantations, sugarcane, grapes and coconut farms together are estimated to account for over 80% of formulated organic manure consumption, as presented in the following table:

Consumption	Percentage (%)
Plantations[5]	40 % – 45 %
Sugarcane, Grapes, Arecanut	25 % - 30 %
Others[6]	15% - 20%

MWC is not recommended by any of the agricultural institutions. Institutional support for the product is thus lacking. The constraints limiting overall consumption of organic manure and MWC are:

a. The overall usage of organic inputs is significantly lower vis-à-vis recommendations of the agricultural universities.
b. There are no standards for the product.
c. Organic farming is yet to gain significant acreage in India. MWC is not yet a recommended input for certified organic farming.
d. Economics of organic manure not sustainable at the current practices in a number of field crops.
e. Product economics are yet to reach a critical mass of opinion for diffusion within / across crops geography.
f. Product considered optional: first to face the axe of current low commodity price scenario.
g. Product usage practices range from no usage to low proportional blends with other organic inputs.

[5] Plantations include rubber, cardamom, cloves, pepper, coffee, tea etc.
[6] Other crops include coconut, banana, citrus and vanilla

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h. Unsustainable manufacturer claims/practices.

While potential for compost is very high, because of lack of awareness among farmers, the actual use of MSW compost is quite limited. Thus, the market remains untapped.

5.4. Projections

The potential demand for compost has been estimated after discussions with various authorities.

a. The requirement of compost by GoK each year is around 8750 MT under its Coconut Development Scheme.

b. State-owned corporations like Kerala Agro Industries Corporation Ltd (KAIC) procure compost from around 50 producers and sell directly to farmers. The total amount sold in FY02 was 20,000 MT, which can be considered as an estimate of the demand in the state, apart from procurement made under specific schemes.

The following table represents the potential demand:

Organisation	Demand (MT)
Coconut Development Board	8750
KAIC & Other Corporations	20000
Total	**28750**

The market demand for MWC is likely to continue because of lack of awareness among farmers and the actual use of MSW compost is quite limited.

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6. Statutory and Legal Framework

This section sets out the review of the legal framework for the Project.

6.1. Applicable Laws

a. Given the serious condition of urban MSW management a Public Interest Litigation was filed in the Supreme Court in 1996. To review the SWM situation in the country and come up with recommendations, the Supreme Court constituted the Burman Committee in 1999. On the directive of the Supreme Court and based on the recommendations of the Burman Committee, the Ministry of Environment and Forests, Government of India, formulated the MSW Rules, under Environment Protection Act, 1986. According to these Rules, the ULBs are responsible for the waste segregation, collection, transportation, treatment process and disposal.

b. The responsibility for implementation of these Rules is entrusted to the Secretary, Urban Development Department (UDD) for Municipal Corporations & District collectors for the Municipal Councils, including infrastructure development for collection, storage, segregation, transportation, processing and disposal of MSW.

c. The MSW Rules requires that "biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for the stabilization of wastes." Composting of wastes is being preferred over other modes of treatment in most ULBs.

d. Acts and Notifications for Solid Waste Management

   i. According to the Constitution (74th Amendment) Act, 1992 of the Government of India (GoI), the ULBs are responsible for the provision of SWM services. ULBs are assisted by the respective state and central governments with policy, financial, technical and institutional support.

   ii. To effectively perform its functions as contemplated under Section 6, 8 and 25 of the Environment Protection Act, 1986, the Central Government has also made or issued other Rules, Notifications and

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Orders that impinge upon the environmentally safe handling of wastes. These include:

- The Bio-Medical Wastes (Management & Handling) Rules, 1998.
- The Recycled Plastics (Manufacture and Usage) rules, 1999.

e. Reform Principles governing MSW Management

The MSW disposal in most of the cities till recently was viewed as an administrative function or worst still, as an employment generation opportunity or confined to dumping the garbage away from the city areas. However, in the recent past there is a perceptible change in this behaviour and attitude, since the time reform based rules and principles have been introduced for management of MSW. Scientific MSW disposal is now being thought of and implemented by city managers. Given the huge capital costs incurred for managing each stage of SWM in a scientific manner, the State Government is subsidizing a part of the capital costs through some government incentive schemes and is also encouraging private sector participation. In order to render the MSW management system sustainable, the stress is laid on private participation & community involvement through sensitization, regulation and promotional activities.

f. The above-mentioned rules, acts, notifications and reform principles have been envisaged with a view to improving the efficiency and effectiveness of the MSW management system in the country. In addition to the regulatory and policy framework that has been put in place, the objective of achieving good standards in public health & hygiene can only be possible when the institutional structures are designed for delivering these desirable outcomes.

6.2. Rights and Obligations of Municipal Councils in Karnataka

a. Rights and privileges of individual councilors and president[7] that, any council may call the attention of the proper authority for any neglect in the execution of municipal work, to any waste of municipal property or the wants of any locality and may suggest improvements which he considers desirable.

[7] Section 45

b. Right of the municipal council[8] to lease, sale or enter into contract in respect of any of the immovable property belonging to them or acquired by them in order to implement the provisions of the Act. Management of the MSW is one of the obligations of municipal council under the Act, the municipal council by virtue of this Section, the municipal council may transfer the land belonging to them to the developer to be utilized for implementing the project relating to MSW management.

c. Obligatory functions of municipal council[9] to make adequate provisions to clean public streets, places, sewers and all spaces not being private property, which is open to the enjoyment of the public, whether such spaces are vested in the municipal council or not, removing noxious vegetation and abating all public nuisances.

d. Obligatory functions of municipal council[10] for, providing covered metallic receptacles and covered metallic receptacles mounted on wheels for use by servants employed by the Municipal Council for the removal and disposal of night-soil, rubbish. In this clause, 'rubbish' includes dust, ashes, broken bricks, mortar, sewage, dung, dirt, substances and refuse of any kind.

e. Municipal Property[11]- Every municipal council may for the purpose of this Act, acquire and hold property both movable and immovable, whether within or without the limits of the municipal area i.e., all public sewers and drains, water courses, in alongside or under any street and all works, materials and things appertaining thereto, etc.

f. Taxes which may be imposed[12]- Subject to the general or special orders of the Government, a municipal council, may levy tax on buildings or vacant lands or both situated within the municipal area (hereinafter referred to as property tax).

[8] Section 72
[9] Section 87(c) (f
[10] Section 87 (r)
[11] Section 81
[12] Section 94

g. Municipal council may charge fees for certain licences, etc[13]- When any licence or permit is granted by the municipal council under this Act, or when permission is given by it for making any temporary erection or for putting up any projection, or for the temporary occupation of any public street or other land vested in the municipal council, the municipal council may charge a fee for such licence or permission.

h. Power of municipal council to undertake works and incur expenditure for improvement, etc[14]- The municipal council may, subject to the control of the Government,- (a) draw up detailed schemes i.e, improvement scheme for the improvement or expansion or both of the areas within the municipal area. (b) undertake any works and incur any expenditure for the improvement or development of any such area and for the framing and execution of such improvement schemes as may be necessary from time to time.

i. Municipal council can acquire the land[15] for the public purpose under the Land Acquisition Act, 1894. Provided upon the payment of the costs which may be incurred on account of the acquisition, transfer the land to the municipal council.

j. Establishment of Improvement Board[16]- Government may after consulting the municipal council, for the purpose of undertaking and executing of improvement schemes in any municipal area, direct the establishment of an Improvement Board in accordance with the provisions of this section.

6.3. Surveys and Investigations

The surveys to be carried out for development of landfill facility include topographic survey and soil survey. The various surveys and investigations required to be carried out for the Project is set out below.

- Pollution due to compost facility and landfill facility
- Current land use pattern of the site and the vegetation

[13] Section 138
[14] Section 155
[15] Section 159
[16] Section 173

- Geophysical survey – a field study to be conducted at a minimum of one sounding per acre of land for the following parameters

  - Geology of the area
  - Depth and extent of Weathered zone
  - Direction of flows of underground water
  - Hydrological information about the area (surface and ground water)

- Geotechnical survey

  - Stratification of sub-soil-type of soil and depth
  - Strength / bearing capacity and compressibility of soil
  - Depth to ground water and bedrock (if located within the 10m of base of landfill)
  - Permeability of various strata beneath the landfill
  - Extent of availability and characteristics of different types of soil at the site which could be used as inner liner material, drainage material, top soil and protective soil from adjacent borrow area

- Ground Water

  - Water characteristics of surface water & sub-soil water both on up- stream & down stream side of the facility
  - Depth and extent of aquifer zone

- Rapid Environmental Impact Assessment Study

  REIA study comprises detailed environmental investigations, analysis of the available secondary information on the present condition of air, water, land, ecological and socio – economic environment of the Project site. The key components considered for the baseline study include.

  - Ambient air quality and meteorological data like wind speed, wind direction, temperature, relative humidity, cloud cover, rainfall etc

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- Water Quality for all physio-chemical, metals, bacteriological parameters etc
- Noise
- Meteorological Conditions
- Ground Water Hydrology
- Ecology
- Socio – Economic Conditions

6.4. Indicative List of clearances

For development of the Project, the indicative list of clearances from various agencies and the requirements is listed in the table below.

Statutory Body	Requirement
• TCMC	Concession Agreement, building plan approvals
• KSPCB	Under Air & Water Act
• Department of Environment, Karnataka	As the Project comes under Category B as per MoEF Act for EIA, Public consultation etc
• MoEF, GoI	Final approval for EIA
• Airports Authority of India	Approval for landfill & compost plant if the facility is within 20 kms of airport
• Forest Department – State	Forest area and its security
• Environmental Department	Air/Water pollution and general natural circumstance
• Police Department	Law & order, traffic arrangement
• Revenue Department	Govt. Land & other laws governed by the department
• Town Planning Department	Municipal Corporation / Council & other statutory rural development authorities
• Industries Department	Related rules governed for industrial development
• Fire Department	General approval for fire safety norms
• District Health Officer	Health & vector nuisance related laws
• Telecommunication	Telephone, telegraph communication

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Statutory Body	Requirement
Department	
• Electric Supply	Electric Supply transmission / generation
• Water supply and Sewerage Board	Water supply and Sewerage Projects, related, pipelines and other constructions

7. Environmental and Social Impacts

This section sets out the environment management plan for the Project.

7.1. Environmental Impact Assessment

a. With rapid urbanization and growth of industry & business has led to increased waste generation but the infrastructure development for MSW management has never kept pace. Paucity of urban land for waste disposal leads to waste disposed arbitrarily as open dump wherever any open space or land is found. Poor MSW management is associated with increased health problems in all sections of population. The recent floods in Mumbai, Bangalore, Chennai, Surat, and in other part of the country are live examples of waste related problems.

b. General environmental impacts like loss of vegetation due to site clearance, air pollution due to dust generated by construction activities, odour nuisance, stay animal and rodent problems, etc. will always be associated with any sanitary landfill site development project. Adopting proper mitigative measures during construction and operation of the landfill site could mitigate these impacts.

Table below presents the general impacts during construction and operation phases of sanitary landfill and suggested mitigation measures:

Activity	Possible Environmental Impact	Suggested Mitigative Measure
Pre construction stage		
Cutting of trees, clearing of shrubs	Loss of vegetation and trees	Minimization of tree cutting to the extent possible
Construction stage		
Construction activities for development of site for landfill	1. Deterioration of air quality due to earth work excavation 2. Disturbance to the natural drainage 3. Soil contamination	1. Frequent watering of construction sites to suppress dust emission and transport of earth in covered vehicles 2. Any construction activity should restore the natural course of the drainage 3. No spillage of oil/ diesel from the

Activity	Possible Environmental Impact	Suggested Mitigative Measure
		construction equipments
	4. Water contamination	4. Any construction activity should ensure that the water bodies are not contaminated
	5. Disposal of excess earth.	5. The excess earth should be transported to designated place and shall be used for filling and covers
	6. Disturbance to other services	6. Any shifting of cable / utility lines should be attended with minimum period of disturbance.
	7. Safety of residents and road users in the implementation area.	7. Provision of temporary crossings/bridges wherever necessary to facilitate normal movement.
	8. Noise pollution due to the use of machinery and movement of traffic in sensitive locations	8. Use of less noise generating equipment and avoiding activities during night.
Operation and Maintenance		
Open storage of MSW before landfilling	1. Flying of waste materials and emission of dust particles	1. Coverage of storage area with polythene sheets to prevent the spread of waste materials and generation of dust.
	2. Bad smell and odour and generation of methane gas	2. Spraying of storage areas with anti odour sprays and neat spread of stored material to create good aeration avoiding decay of waste materials.
	3. Menace of flying birds and breeding of houseflies and mobility of stray dogs in the area	3. Covering of the temporary dump areas with polythene sheets, use of repellents and close fencing of the area.

7.2. Environmental Management Plan

A number of environmental impacts are identified that may arise during construction, operation and maintenance of landfill site. These impacts were analyzed and mitigative measures for the same are proposed. These mitigative measures should be implemented during construction and operation of the landfill.

Potential Impact	Mitigative Measure
Impact due to emission of green house gases	• Provision of landfill gas management system
Dust generation due to vehicle movement and placement of waste and cover material	• Construction of pucca roads • Provision of green cover • Provision of protective gear to landfill employees
Impact due to vehicle exhaust emissions	• Construction of pucca roads • Provision of green cover
Odour impacts due to landfill activities	• Regularly covering daily cells • Provision of green cover
Impact on surface water	• Re – Engineering of already dumped waste • Provision of leachate collection and treatment system • Provision of bottom impervious liner • Construction of cut-off and peripheral drains
Impact on ground water quality	• Provision of bottom impervious liner • Provision of leachate collection and treatment system • Construction of cut-off and peripheral drains
Impact due to noise	• Provision of green cover • Provision of ear plugs to landfill employees
Impact on ecological environment	• Compensate the loss of trees if any due to site clearance by providing green cover around the landfill site
Risk of disease transmission	• Re – Engineering of already dumped waste • Proper and timely compaction of waste • Avoiding stagnation of water pools • Avoiding burning of waste • Provision of protective gear to landfill employees

7.3. Project specific impacts and mitigative measures

a. Impact due to Emission of Green House Gases such as Methane and Carbon Monoxide

Impact Statement: The anaerobic decomposition of organic part of MSW will result green house gases such as CH_4 and CO. Since MSW is composted and

inert material is landfilled, gas generation may not be very high. However there will be some quantity of gas generation, which should not be allowed into the atmosphere.

Mitigative Measures: A proper gas collection system with treatment or flaring facility should be provided with the final cover of the landfill. The final cover and gas management system should be in compliance to MoEF guidelines or CPHEEO recommendations.

b. Dust generation due to vehicle movement and placement of waste and cover Material

Impact Statement: Movement of vehicles, placement of waste, placement of covering material, bulldozing, compaction activities, etc. are the major dust generation activities at the disposal site. The impacts would be more significant in dry season and moderate in monsoon seasons.

Mitigative Measures: The impacts could be minimised by filling the landfill in small cells (segments), construction of pucca (meta / BT) roads, providing vegetative cover around the site, providing protective gear to the workers and ensuring that the site surroundings are isolated from any major developments.

c. Impact due to Vehicle Exhaust Emissions

Impact Statement: A number of vehicles would ply every day from TCMC limits carrying MSW to landfill facility. This would further increase as the input waste increases every year. However, except SPM levels, exhaust gases like NOx and SO_2 are well within the NAAQ Standards and do not indicate any significant air quality problems.

Mitigative Measures: Construction of pucca (meta / BT) roads, providing vegetative cover around the site, etc. will reduce the SPM levels and further helps in decrease of exhaust emissions.

d. Odour Impacts due to Landfill Activities

Impact Statement: Odour at landfill site facility is generated from movement, placement and decomposition of waste.

Mitigative Measures: To reduce the odour impact fill the landfill site in small well defined cells and use daily cover as and when necessary to prevent prolonged exposure of vulnerable waste to the atmosphere. It is recommended to have thick green cover along the boundary of the site to mitigate the odour problem. It is also recommended to maintain the site isolated from any development within 500m periphery of the site.

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e. Impact on Ground Water Quality

Impact Statement: Subsurface water quality is most vulnerable to any landfill development and it becomes more critical in places like Tumkur. Ground water can be contaminated due to percolation of leachate and runoff from the active landfill site.

Mitigative Measures: To protect the ground water from the contamination due to development of landfill site following containment measures should be taken;

- A composite liner system should be provided at the bottom as recommended by MoEF.
- HDPE liner should be designed for puncture protection.
- Clay/Amended soil liner should have permeability less than 1 X 10-7 cm/sec.
- A comprehensive Leachate collection and treatment should be provided
- Cut-off drains around active landfill site and peripheral drains around landfill site should be provided

f. Impact due to Noise

Impact Statement: The sources of noise impacts will be during construction phase and during operation phase. During construction phase due to operation of heavy equipment and machinery like trucks, JCB, bulldozers, trackeddozers, compactors, generators, etc. noise levels are expected to be high. During operation phase vehicle movement and other associated activities are the major sources of noise pollution.

Mitigative Measures: To mitigate the noise impacts on labour and employees working in site earplugs should be provided. Vegetative cover around landfill site will reduce the noise levels during operation phase.

g. Impact on Ecological Environment

Impact Statement: There are no endangered species present within proposed site. It is anticipated that there will not be any major impact on ecological

environment if proper containment measures are taken. However the impact on flora due to landfill development can be attributed as loss of trees within proposed site due to site clearance.

Mitigative Measures: Compensate the loss of trees due to site clearance activity by providing vegetative cover around the landfill site.

h. Avoidance of Risks of Disease Transmission

Impact Statement: With the current practice of open dumping of compost rejects, inerts and semi – product the risk of disease transmission at the site and to the near by community is very high. The proposed development of sanitary landfill facility adjacent to existing compost facility is expected to reduce this risk significantly. Diseases transmitted through landfill site generally are vector born, water born and air born.

Mitigative Measures: To mitigate the immediate risk of disease transmission already dumped waste should be re-engineered. During the operation of landfill, timely compaction of waste and application of daily cover should be strictly implemented to mitigate the vector born diseases. Stagnation of water pools should be avoided to mitigate the water born diseases and fly and mosquito breeding. No burning of waste should be allowed to avoid the air born diseases. All the landfill site personnel shall be provided with protective gear and regular health check ups.

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8. Project Financials

This section sets out the details of Project cost, revenue and financial viability.

8.1. Estimation of Project Cost

The cost for provision of MSW management services has been estimated for the collection, transportation, treatment and disposal of MSW.

a. Collection & Transportation

The cost for physical infrastructure components in the collection and transportation services includes procurement of following tools/equipments/vehicles:

i. Auto tippers and pushcarts for primary collection from non slum areas and bulk generators;

ii. Pushcarts and litter bins for primary collection from slum areas;

iii. Pushcarts and other street sweeping equipments like (long handle brooms, small brooms, gloves, boots, etc.) for street sweeping activities;

iv. Dumper placers for transportation of MSW from various wards.

The estimated cost for net requirements of vehicles and equipments required for collection & transportation services of MSW management are set out in the table below:

Sl. No.	Components	Estimated Requirement	Available	Net Requirement	Per Unit Cost (Rs Lakhs)	Total Cost (Rs Lakhs)
1	**Primary Collection**					**130.0**
a	Auto Tippers	39	0	39	3.0	117.0
b	Push Carts	117	0	117	0.083	10.0

Sl. No.	Components	Estimated Requirement	Available	Net Requirement	Per Unit Cost (Rs Lakhs)	Total Cost (Rs Lakhs)
c	HDPE Bins	1236	0	1236	0.003	4.0
2	**Street Sweeping**					**29.0**
a	Push Carts	232	0	232	0.083	19.0
b	Other street sweeping equipment	Lumpsum				9.0
3	**Secondary Storage of MSW**					**23**
a	3 cubic meter capacity DBs	30	30	0	0.45	0
b	4.5 cubic meter capacity DBs	70	30	40	0.58	23.2
4	**Transportation of MSW**					**0.0**
a	Twin Load dumper placers	4	5	0	11.2	0.0
b	Tractor Placers	2	5	0	5	0.0
	Grand Total					**182**

b. Processing Facility

The physical infrastructure components required for the development of a compost facility of the capacity of 125 TPD would be as follows:

Sl. No.	Description	Cost (Rs. Lakhs)
1	Civil works	150.0
2	Plant and machinery	100.0
	Total	**250.0**

c. Disposal Facility

The cost of physical infrastructure components for development of landfill facility of the capacity of 68 TPD would include the following:

Sl. No.	Description	Cost (Rs. Lakhs)
1	Land and site development	41.6
2	Buildings	73.5
3	Plant and machinery	131.6
4	Miscellaneous Fixed Assets	111.5
	Total	**358.3**

The detail of cost for development of treatment and disposal facility is set out as Annexure 7.

d. Summary of estimated Hard Cost of the Project

Sl No.	Description	Amount (Rs. Lakhs)
1	Physical Infrastructure Components	
a.	Collection and Transportation	182.0
b.	Compost Facility	250.0
c.	Landfill Facility	358.3
2	Contingency (8%)	63.2
3	Interest during construction	134.0
	Total	**987.5**

The other financial assumptions are set out as Annexure 8

8.2. Estimation of Revenue and Expenses

a. Operation and Maintenance cost

The operations and maintenance cost would depend on the facilities built, the required level of O&M activities. However, at the feasibility stage, based on the action plan prepared by TCMC, the O&M cost components are estimated as follows.

Sl. No.	Component	Total Cost (Rs. Lakhs)
1	**Collection and Transportation**	**244.0**

Sl. No.	Component	Total Cost (Rs. Lakhs)
a.	Salaries of SWM staff	147.0
b.	Maintenance cost of equipment and vehicles	46.0
c.	Fuel expenses	50.0
2	**Treatment and Disposal**	**91.0**
	Total	**335.0**

The details of the O&M cost has been set out as Annexure 9.

b. Revenue Streams

The revenue stream of the ISWM facility is from two sources:

- Revenue from the sale of compost produced at the processing facility.
- Revenue generated from the collection of user charges from the households in the non slum areas.

Description	Year 2	Year 3	Year 4
Sale of compost	9.1	9.6	10.0
User charges	9.3	9.8	10.3
Total	**18.4**	**19.4**	**20.3**

The implementation period of one year is envisaged for the Project. The assumptions made for the estimation of user charges is Rs 20 per household. The estimation excludes the households in the slum areas. The quantum of compost generated from the processing facility is assumed as 20% of the raw waste. The sale price of compost is assumed at Rs. 1000 per tonne of compost.

8.3. Assessment of Financial Viability

From the above it can be seen that with the annual operations and maintenance cost at around Rs. 335 lakhs is significantly higher than the annual revenue generated from the Project which is at around Rs 18 lakhs. Thus the Project is not viable on a standalone basis and a financial assistance would be required towards the Project by TCMC to the private operator. The financial assistance could in the form of fixed annuity payments or tipping fee payable by TCMC for the quantum of MSW handled by the private operator.

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8.4. Estimation of financial assistance

a. The financial assistance towards collection and transportation of MSW has been estimated for the quantum of MSW actually collected and transported by the private operator. For processing and landfilling of MSW the financial assistance has been estimated for the quantum of MSW supplied at the entry gate of the integrated treatment and disposal facility. The financial assistance for the entire chain of MSW management activities has also been estimated.

b. The financial assistance towards the Project has been estimated to make the Project viable by having an equity IRR assumed at 20%. Escalation in the Tipping Fee over the subsequent years includes a base escalation of 5%. The table below sets out the financial assistance towards the Project:

Sl. No.	Activity	Monthly Annuity (Rs. Lakhs)	Tipping Fee (Rs. per TPD)
1	Collection and Transportation	23.4	592.0
2	Treatment and Disposal	-	449.0
3	Entire chain of MSW management activities	-	1032.0

The assumptions for the parameters considered for the estimation of Tipping Fee are set out as Annexure 10.

8.5. Scenario analysis

The Tipping Fee payable by TCMC to the private operator has been estimated under different scenarios. The scenarios have been framed with respect to the variations in the quantum of MSW generated in the O&M costs for the Project.

The assumptions considered in the three scenarios are set out below:

Scenario	Description
Scenario 1	MSW generation increased by 5%
Scenario 2	MSW generation increased by 5%
Scenario 3	MSW generation increased by 5%
Scenario 4	MSW generation increased by 5%

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The estimated Tipping Fee payable by TCMC to the private operator under the scenarios is set in the table below.

Scenario		Tipping Fee (Rs. per MT of MSW)		
	Monthly Annuity Payment C&T	C&T	T&D	Entire chain of MSW management
Scenario 1	24.47	618.0	459.0	1068.0
Scenario 2	22.42	566.0	440.0	996.0
Scenario 3	-	564.0	428.0	983.0
Scenario 4	-	624.0	473.0	1086.0

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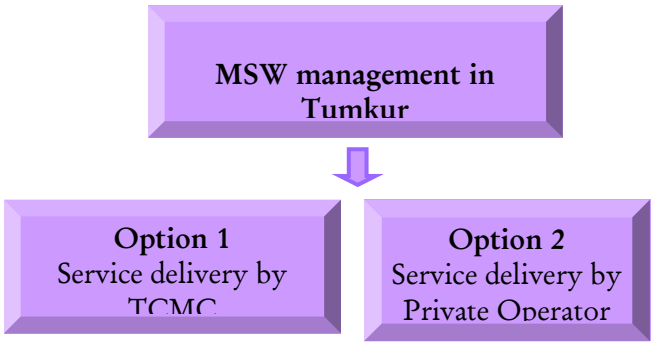
9. Operating Framework

This section sets out the implementation framework for the Project

9.1. Options for Project Implementation

The Project Facilities could be developed by TCMC either by deployment of its own resources or under an appropriate PPP framework. The two primary development options comprise:



a. Option 1: Service delivery by TCMC

Under this option, the two distinct activities, with respect to collection & transportation of MSW and treatment & disposal of MSW, would need to be undertaken by TCMC in the following manner.

i. Collection and transportation of MSW

- Procure tools / equipment and vehicles such as auto tippers, pushcarts, dumper bins, dumper placers and etc. for collection and transportation of MSW.
- Hire manpower for carrying out the activities envisaged.

ii. Treatment and disposal of MSW

- Select a contractor to undertake development of the compost facility and develop the landfill facility.

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- Hire skilled manpower for carrying out the operations and maintenance of the developed facilities.

b. Option 2: Service delivery through Private Operator(s) with TCMC playing the role of a facilitator

Increasingly, MSW management activities are being privatized in different cities, with the ULBs assuming the role of a facilitator. PSP is increasingly being viewed as a solution for providing efficient MSW management services, by many ULBs. There exist different options for implementation of the Project under PPP frameworks.

In this option, implementation of MSW management would be undertaken by a private operator(s). The private operator(s) would need to carry out their roles and responsibilities as per the contractual agreement signed with TCMC. The involvement of private operator(s) in various stages in the MSW management chain is detailed below.

i. Collection and Transportation

TCMC would identify private operator for carrying out this activity. Primary collection of MSW from the households would be carried out by the private operator. The private operator would be responsible for identification of collection crew, procurement of tools/ equipment/ vehicles and operation & maintenance of the same. The dumper bins, transportation vehicles and other equipment would be procured by the private operator who would also be responsible for O&M of the same. The private operator would be required to collect the user charges from the households for provision of door to door collection services.

ii. Treatment and landfill facility

The private operator would be responsible for development of an integrated treatment and disposal facility. The operator would be responsible for mobilization of finances for development of these facilities (capital expenditure) and also O&M of these facilities in accordance with design, construction and O&M specifications provided by TCMC.

A comparative analysis of the risks associated in an event of implementation of the two options discussed above is set out in the table below:

Options	Parameters	Impact
Service delivery by TCMC	Manpower	Recruitment & management of operational staff by TCMC
	Skill set	TCMC would need to appoint technical consultants for developing a strategy for integrated MSW management and for design and construction of MSW treatment & disposal facilities. TCMC would also be required to hire skilled manpower to operate and maintain the treatment and disposal facilities.
	Service Delivery	Since payments to operational staff are not performance based and often their motivation levels are low, this could affect the level of service delivery.
	Finances	TCMC would need to mobilize finances for procurement of tools / equipment and vehicles and for development of C&T and T&D facilities.
	Project Risks	The projects related risks such as design risk, cost over-run risk, time risks etc. and adherence to applicable laws would be retained by TCMC.
Service delivery under PPP frameworks	Manpower	TCMC would need only supervisory staff as the private operator would be responsible for deployment of staff for providing MSW management services.
	Skill set	The onus of providing skilled manpower would be with private operator.
	Service Delivery	As the payment to the operator would be made subsequent to demonstration by him of adherence to performance standards specified by TCMC, the service delivery levels would be high.
	Finances	The private operator would need to mobilize finances for procurement of tools / equipment and vehicles and for development of T&D facilities.
	Project Risks	The projects related risks such as design risk, cost over-run risk, time risks etc. and adherence to applicable laws would be retained by private operator.

Under Option 1, TCMC would not only retain all the Project related risks and be required to raise finances for undertaking the Project, but would also need to

monitor and manage the operational staff. In contrast, if TCMC implements the Project under Option 2, it would need to appoint private sector operator and recruit only sector specialists for overseeing their activities.

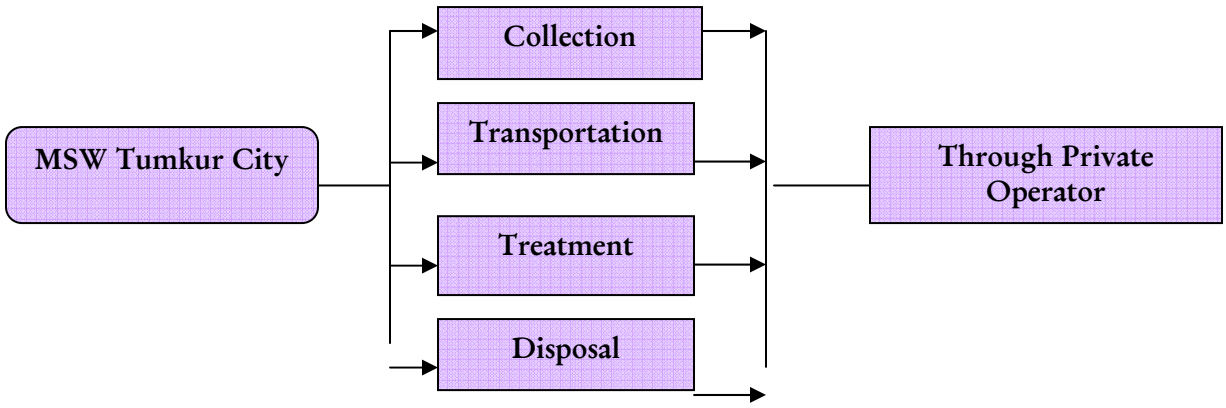
In view of the local situation, and from the point of view of effective implementation of MSW management in the city, Option 2 is more suitable for Tumkur.

9.2. Project Implementation under an appropriate PPP framework

The components of the Project could be implemented in the following ways.

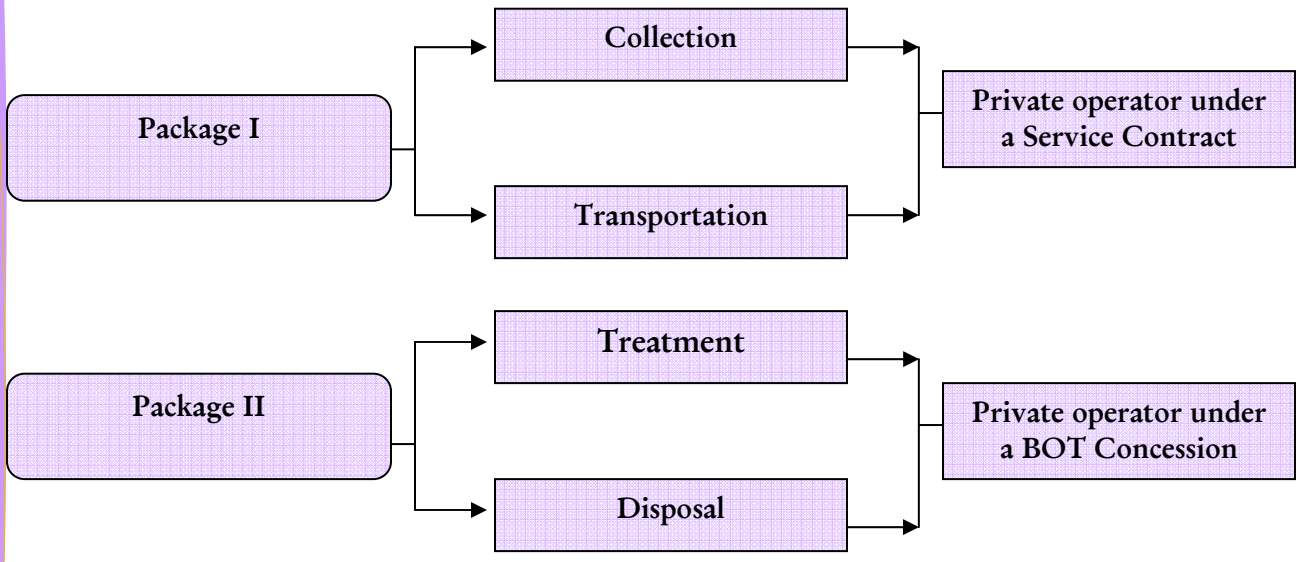
a. Option 1: Implementation by a single private operator

Under this option the entire chain of MSW management activities including collection and transportation of MSW and treatment and disposal of MSW facility would be undertaken through the private operator. The private operator under this option would be selected through a transparent competitive bidding process. TCMC in turn would need to pay a service fee for the services rendered. The advantage of having a single private operator would be that since the entire system is implemented by a single private operator, the operations would be easy to undertake and monitor but the disadvantage could be failure of the private operator in performing its obligations would lead to collapse of the entire SWM system in TCMC.



b. Option 2: Implementation by different operators

Under this option two packages could be formed; Package I - Collection and Transportation and Package II- Treatment and Disposal of MSW. Each of the two packages could be undertaken independently by different operators. The private operators could be selected through a transparent competitive bidding process. C&T of MSW could be implemented by private operator under a service contract. The integrated T&D facility could be developed under BOT concession framework.



The advantage of having two packages would be that, as the activities in the MSW chain is classified in two separately handled packages through different contracts it makes operations easy to undertake and monitor also specialized skills would be brought in as each private operator would perform only one activity in the SWM chain.

9.3. Project Implementation Option

The quantum of MSW generated in Tumkur city is around 100 TPD. For such a small quantum of MSW the scale of operations needed for the C&T and the T&D activities would be limited. Thus the Project could be implemented by a single private operator under a BOT concession framework. The average useful working life of an integrated T&D facility is around 20-25 years and the tenure for the BOT concession could be co terminus with the same.

9.4. Indicative Implementation Framework

The Project could be developed under a BOT Concession framework and the salient features of the same are set out below.

a. The mobilisation of finances would be the responsibility of the private operator. The entire finance required for the Project would have to be raised by the private operator within a pre-specified time frame. Therefore, TCMC would not be responsible for raising the funds for meeting the initial capital expenditure.

b. TCMC would lay down the performance standards for the C&T activities and the technical specifications for the construction of integrated T&D facility and subsequent O&M of the same, which would have to be adhered to by the private operator. In the event that the private operator fails to meet the performance standards and technical specifications laid down by TCMC, TCMC would have the option of substituting the private operator.

c. The risk of time-bound completion of the Project would be passed on to the private operator.

d. Since the revenue streams from the Project would commence only after completion of the Project, it would be in the interest of the private to complete the Project as early as possible. TCMC may also stipulate a penalty to be paid by the private operator in case of delay in implementation of the Project.

e. The risk of over-runs in construction cost and operational expenses would be passed on to the private operator. Since the private operator is responsible for the implementation of the Project, any increase in cost of the Project would also be borne by him.

9.5. Role of Stakeholders

The stakeholders in the Project include TCMC, the identified private operator and the generators of MSW. The roles and obligations of these stakeholders are set out in this section.

a. Role of TCMC

- Set out Management Plan.

- Monitor the works being performed by the private operator.
- Ensure compliance by RWAs and citizens.
- Make the payments to the private operator.

b. Role of Private Operator

- Collection of MSW from different categories of waste generators.
- Development, operation, maintenance, and management of integrated processing and disposal facility.
- Transportation of MSW to the integrated treatment and disposal facility.
- Processing of the MSW received at the integrated treatment and disposal facility.
- Landfilling of the rejects of the processing facility and other non-biodegeadable MSW.
- IEC campaigns with the public and all stakeholders in TCMC area to inculcate good MSW management practices, including recycling, and segregation.

c. Citizens

Participation of citizens in efficient disposal of MSW is vital as it would reduce the environmental impact and help in enhancement of serenity of the city. The functions that need to be carried out by the citizens from various sources are as set out below:

- Household

The citizens would need to carry out segregation of waste at the household level and the segregated waste should be handed over to the primary collection crew at the pre-notified time. For the services provided for collection of segregated waste from household by the PKs, the citizens shall pay a user fee on a monthly basis. Unhygienic disposal of waste on streets would need to be avoided by the citizens.

- Bulk generators

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Bulk generators like hotels, commercial establishments, function halls etc. should dispose the waste thorough primary collection crew at the pre-notified time. Other bulk generators like choultry halls should dispose the waste in the secondary containers that would be placed at strategic locations in each ward.

d. Resident Welfare Associations

RWAs would need to inform the residents about the proposed strategy for MSW management and Ensure that the residents co-operate and follow all the principles of disposal of waste generated. RWAs shall appoint primary collection crews to initiate door-to-door collection process and also ensure that residents. The residents would need to segregate the waste into biodegrable and non-biodegrable waste and handover the same to primary collection crew. RWAs shall also monitor the performance of the private operators, wherever required.

9.6. Bid Process Management for Identification of the Private Operator

A transparent competitive bid process could be carried out for the identification of the private operator. The process would involve preparation of tender documents and carrying out a bid process for identification of the private operator.

a. Tender Documents

Selection of the private Developer would be carried out in a transparent competitive bidding process. TCMC could adopt a single stage process for selection of the private operator.

The contractual documents that would need to be prepared for selection of the private operator would include:

i. Request for Proposal document (RFP)

The RFP document shall comprise the eligibility criteria, qualification criteria and evaluation methodology for selection of Successful Bidder for the development of the Project.

ii. Draft Concession Agreement (DCA)

The DCA would comprise roles and responsibilities of the stakeholder, payment terms, events of defaults, termination conditions, termination payments, design and construction requirements, O&M requirements etc.

iii. Project Information Memorandum (PIM)

The PIM would include extracts from the Detailed Project Report (DPR) prepared by TCMC.

b. Process for Selection

The evaluation of the Proposals could be carried out in four stages as detailed below.

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Stage 1: Scrutiny of "Key Submissions"
Stage 2: Evaluation of "Qualification Information"
Stage 3: Evaluation of "Technical Proposal" and
Stage 4: Evaluation of the "Financial Proposal".

Stage 1: Scrutiny of "Key Submissions"

The Bidders would be required to submit documents as listed in RFP document along with supporting documents validating their eligibility, technical experience and financial capability. The Proposals submitted by Bidders would be checked for key submissions and responsiveness to ascertain that the documents required as per the RFP have been submitted. The key submission would include the following.

- Covering Letter for submission of proposal
- Details of Bidder
- Power of Attorney
- Memorandum of Understanding in case of Consortium
- Anti-Collusion Certificate
- Bid Security

Stage 2: Evaluation of "Qualification Information"

The responsive Proposals would then be evaluated on the basis of the Qualification Information, Technical Proposal and Financial Proposal criteria.

i. Qualification Information

Only Business Entities shall be eligible for bidding for the Project and a Business Entity shall mean a company incorporated under the Companies Act, 1956 or under an equivalent law abroad.

Assessment of Technical Capability

The Bidder would need to satisfy the following criteria to qualify for the Project. The Bidder's technical capability could be proposed established

based on the following parameters and the Bidders would be required to meet at least one of the following three parameters mentioned below:

- Experience in development or operating and maintaining a compost plant handling at least 45000 tonnes per annum of raw waste for each of the last two completed financial years[17], or

- Experience in development or operating and maintaining a landfill facility handling at least 7500 tonnes per annum of input waste for each of the last two completed financial years, or

- Experience in collection and transportation of at least 35000 TPA of waste for each of the last two completed financial years.

Assessment of Financial Capability

Financial Capability of the Bidders could be evaluated based on net worth and net cash accruals and the Bidders shall be required to meet both parameters set out below:

- Networth of the applicant as at the end of the most recent financial year shall be at least equal to Rs. 6 Crores.

  and

- The aggregate net cash accruals of the applicant for the last two financial years shall be at least equal to Rs. 2.5 Crores.

Stage 3: Evaluation of "Technical Proposal"

The Technical Proposals of the Bidders, who pass Stage 2 evaluation, as described above, would be evaluated and the parameters that could be considered for the same are set out in table below.

[17] The financial year would be the same as the one normally followed by the Bidder for its annual financial statements

- Methodology Statement
- Project Construction Plan
- Resource Utilisation Statement
- Financial Plan
- Operations & Maintenance Scheme
- Project Schedule
- Environment, Health & Safety Policy and Practice

The Technical Proposals would be scored on the basis of the above parameters and the threshold score for evaluation of the Financial Proposals could be 70 marks.

Stage 4: Evaluation of "Financial Proposal"

The Financial Proposals of the Bidders would be

- Financial Support In terms of monthly annuity payment (in Rs. Lakhs) from TCMC in case of Payment Mechanism 1, or
- Tipping fee to be (in Rs.) to be charged per TPD of MSW received at the entry gate of the integrated treatment and disposal facility in case of Payment Mechanism 2.

Under the recommended option, Tipping fee to be charged per TPD of MSW received at the entry gate of the integrated treatment and disposal would be the bid parameter and the Bidder quoting the lowest Financial Proposal would be the Successful Bidder for development of the Project.

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10. Way Forward

a. TCMC would need to approve the proposed strategy for implementation of the MSW management activities in the city.

b. TCMC would need to identify land for development of the integrated treatment and disposal facility and acquire the same for the development of the Project.

c. TCMC would need to obtain necessary approval for the Project from its Council and other government agencies concerned.

d. Procurement documents and tender documents for identification of the private operator would need to be prepared.

e. TCMC would need to carry out a bid process management for identification of the private operator.

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ANNEXURES

Annexure 1

Ward-wise Details of Population and other Waste Generators

Ward Number	Population	Number of Households		Shops	Choultry	Hotels	Hostels and Institutions	Meat shops/ Slaughter house	Road Length (mt)
		Slum/BPL Households	Non-Slum Households						
1	10211	298	956	174	-	6	2	7	29413
2	7981	974	700	316	2	4	5	13	31540
3	7421	486	873	156	3	3	8	13	8839
4	7540	679	999	378	1	2	7	10	16402
5	7161	698	950	451	-	3	6	4	28871
6	12999	1978	1102	365	-	2	8	-	12387
7	7340	707	1002	356	4	1	12	12	6299
8	8225	166	987	154	-	6	4	13	8587
9	12456	452	1502	224	-	5	13	15	8028
10	13987	333	1242	324	3	2	2	5	15257
11	11452	680	1678	245	-	3	11	9	7605
12	11523	892	950	312	4	6	9	40	10491
13	9987	1172	1326	356	1	2	8	2	6389
14	8453	567	859	178	1	4	6	4	8580
15	7456	348	1178	258	-	3	7	4	17636
16	10289	1249	1287	385	1	5	4	6	7281
17	8792	738	1445	18	2	6	9	1	7923
18	6894	1002	1444	332	2	3	5	4	6468
19	7188	533	1321	256	1	2	10	8	12221
20	9956	711	897	256	3	1	11	14	6372
21	10358	745	2000	154	2	7	14	4	28204
22	11945	526	835	157	2	6	16	-	8241
23	7942	388	1000	245	-	2	18	12	18673
24	12346	1278	900	86	2	8	19	-	19421
25	7855	1212	866	62	2	3	11	3	8743
26	7999	1004	1108	82	2	5	9	10	37825
27	7845	456	878	73	1	8	12	6	11209
28	7030	991	1324	94	3	5	8	4	23876

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29	8265	455	997	64	2	4	9	7	47472
30	9745	256	2020	76	3	3	7	-	41213
31	8084	987	1223	521	2	3	6	5	54013
32	12005	298	888	251	1	2	1	8	28167
33	8492	469	1731	562	2	3	5	5	8345
34	11798	579	1600	134	2	4	7	3	36703
35	8831	125	900	141	1	3	3	9	37477
Total	**327851**	**24432**	**40968**	**8055**	**55**	**135**	**292**	**260**	**666171**

Annexure 2

Details of Slums and Approximate Number of Households

Ward No.	Name of the slum	Number of Households	Type (Declared / Identified)
1	Antharasanahally (A.K Colony)	110	Identified
1	Yellapura A.K. colony	228	Identified
1	Yellapura Karmikara colony	130	Identified
2	Sira gate A.K.Colony	347	Declared
5	Dibbur Janata Colony	330	Declared
5	Dibbur	192	Identified
7	G.C.R. Colony	117	Declared
7	Sante Maidana	221	Declared
8	Labour colony	450	Declared
8	Hegde Colony	189	Declared
10	Kuripalya	309	Declared
10	Ganga sandra (A.K. colony)	388	Identified
10	Unknown data	150	Identified
11	Sweeper Colony	284	Declared
11	Nazarabad	180	Declared
11	Tippu nagar	127	Identified
13	Idga Mohalla	402	Declared
14	All Setty Kere Palya	151	Declared
15	Railyway Goodshed colony	172	Declared
19	Bidurumale tota	567	Declared
19	Bhagya Mandira	100	Declared
20	N.R.Colony	264	Declared
20	Ambedkar nagar	165	Declared
23	Upparahalli	612	Declared
25	Pakeer gudisalu	248	Declared
28	Sathyamangala A.K. Colony	188	Identified
29	Maralur Janata Colony	122	Declared
30	Devenur Handijog colony	381	Identified

31	Shetti hally (A.K.Colony)	1355	Identified
31	Maruti nagar	455	Identified
31	Jayanagara	67	Identified
33	Ellara Bande	93	Identified
33	Kyathsandra Indira colony	152	Identified
33	Kyathasandra A.K. colony	295	Identified
35	Batawadi Harijana colony	175	Identified
35	Behind RMC yard	199	Identified
35	Rajeev Gandhi nagar	60	Identified
	Total	**9975**	

Annexure 3

Waste generation Tumkur City

Sl. No.	Type of Waste Generator	Total No.	Unit Qty. of Waste Generated (kg)	Total Waste Generated (TPD)
1	Non-Slum Households	40968	1	41.0
2	Slum (BPL) Households	24432	0.75	18.3
3	Commercial shops	8055	1	8.1
4	Major hotels and resorts	40	45	1.8
5	Small Hotels	95	10	0.9
6	Markets	2	130	0.3
7	Choultries	55	-	4.5
8	Hostels	92	40	3.7
9	Institutions	200	2	0.4
10	Boarding and lodging centers	95	50	4.8
11	Vegetable shops	90	10	0.9
12	Meat shops/ slaughter houses	260	10	2.6
13	Wet waste from medical centers	81	5	0.4
Total				**87.7**
Construction waste		120	-	11.4
Waste from floating population		5500	-	2.0

Street sweeping waste	130	100	13.0
Grand Total			**114.1**

Annexure 4

Ward-wise Details of Bins

Ward number	Dust Bins	Ward number	Dust Bins
1	11	19	22
2	53	20	19
3	20	21	23
4	26	22	47
5	30	23	34
6	15	24	36
7	12	25	33
8	16	26	32
9	33	27	35
10	21	28	22
11	7	29	8
12	35	30	30
13	45	31	38
14	28	32	24
15	25	33	36
16	19	34	20
17	34	35	21
18	19		

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Annexure 5

Details of Vehicular Fleet Available with ULB

Type of vehicle	Register No.	Condition of the vehicle
Tractor	KA-06-G-230 KA-06-G- 231	Good
Tractor	KA-06-G-228 KA-06-G-229	Good
Tractor	CNT-7625 CNT – 7626	Not satisfactory
Tractor	KA-06-A-1418 KA-06-A-1419	Good
Tractor	KA-06-G-85-86	Good
Tractor	CNT-7606 CNT-7607	Not satisfactory
Tractor	CNT-9533-9534	Not satisfactory
Tractor	KA-06-G-86 KA-06-G-2187	Good
Dumper Placer	KA06-B-1418	Good
Dumper Placer	KA06-B-1421	Good
Dumper Placer	KA06-B-1417	Good
Dumper Placer	KA06-B-1419	Good
Dumper Placer	KA06-B-1420	Good

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Annexure 6

Present Staffing details for MSW management, Tumkur City

Sl.No.	Cadre	Total number	Number deployed	Deployment
1.	Pourakarmikas	91*	51	For slum/low income pockets
2.	Pourakarmikas	91*	30	Task force
3.	Pourakarmika	91*	10	Malaria work
4.	Supervisors	8	2	For management of slum collection & low income pockets
5.	Supervisors	8	2	Malaria work
6.	Supervisors	8	4	Supervising the Pourakarmikas
7.	Driver- tractor	3	2	For task force tractor trailer
8.	Drivers- tractor	3	1	For water Supply
9.	Driver- DP	1	1	For dumper placer (TCMC owned)
10.	Sr. Health Inspector	3	3	
	Jr. Health Inspector	2	2	
	O. O. D. Basis	2	2	
11.	Environmental Engineer	1	1	Supervision of overall SWM activities.

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Annexure 7

Details of Cost of development of T&D facility

	Description	Cost
1	**Land and site development**	**41.63**
	a. Cost of laying road	25.60
	b. Cost of fencing and compound wall	10.03
	c. Horticulture and landscaping Soil investigation, survey etc.	4.00
	d. Cost of site clearing and tree cutting	1.00
	e. Cost of site clearing and tree cutting	1.00
2	**Buildings**	**73.53**
	a. Factory building for the main plant and equipment	Nil
	b. Buildings for auxiliary services	0.88
	c. Administrative building	8.10
	d. Godowns, warehouses and open yard facilities	46.86
	e. Misc. non-factory buildings, like time office, Toilet Blocks, security, etc.	3.16
	f. Quarters for essential staff	Nil
	g. Sump, tanks etc.	8.87
	h. Garages & parking	2.16
	i. Cost of sewers, drainage etc.	3.50
3	**Plant and machinery**	**131.60**
	a. FOB Cost of Daily Cell Operation Machinery	69.69
	b. FOB Cost of Landfill Excavation Machinery	27.37
	c. FOB Cost of Daily operation Machinery	26.00
	d. Sales Tax & others	0.62
	e. Excise Duty	
	f. Octroi & Other Taxes	
	g. Freight and transport charges to site	0.57
	h. Foundation and installation charges	1.5
	i. Erection	1
	j. Commissioning	0.5
4	**Miscellaneous Fixed Assets**	**111.55**
	a. Furniture & Fittings for Factory & Office	4
	b. Office Equipments	4.05
	c. Internal Movement system	3
	d. Electrical systems	27.5

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	e. Water supply systems	5
	f. Laboratory equipment	2.5
	g. Workshop equipment	3
	h. Fire Fighting equipment and system	0.5
	i. Effluent collection, treatment, disposal arrangement	50
	j. Other Miscellaneous Assets etc	12
	Total Cost	**358.31**

Annexure 8

Financial Assumptions

Sl. No.	Particulars	Assumptions
1	Debt/Equity ratio	2.33:1
2	Implementation period	1 year
3	Interest rate on loan	17%
4	Loan Tenure	10 years
5	Moratorium period	2 years
6	Interest during construction	17%
7	Interest on working capital	17%
8	Depreciation rate- straight line	
9	Civil work	3%
10	Plant and machinery	5%
11	Depreciation rate-written down value	
12	Civil works	10%
13	Plant and machinery	25%
14	Corporate tax rate	38%
15	Dividend tax	10%
16	MAT	8%

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Annexure 9

Details of O&M expenses

Sl. No.	Description	Assumptions/Details
1	**Annual Salary Expenses**	**181.0**
a.	**Primary Collection**	**102.4**
	Annual Salary Expenses per employee (lakhs)	0.42
i.	**Annual salary expenses- auto tippers (lakhs)**	**49.1**
a	Number of auto tippers	39
b	Manpower per auto tipper	3
c	Manpower required	117
ii.	**Annual salary expenses- push carts (lakhs)**	**98.3**
a	Number of push carts	117
b	Manpower per push cart	2
c	Manpower required	234
b.	**Street Sweeping**	**72.7**
i.	**Annual salary expenses PKs-(Lakhs)**	**72.7**
a	PKs required	173
c.	**Transportation**	**5.9**
i.	**Annual salary expenses**	**3.4**
a	No. of Dumper placers required	4
b	Manpower per dumper placer	2
c	Manpower required	8
ii.	**Annual salary expenses**	**2.5**
a	No. of Tractor placers required	2
b	Manpower per tractor placer	3
c	Manpower required	6
2	**R&M Expenses**	**46.2**
a.	**Primary Collection**	**21.4**
i.	Auto Tippers	11.7
ii.	Push carts	9.7
b.	**Street Sweeping**	**19.3**
c.	**Transportation**	**5.5**
i.	Twin Load Dumper Placer	4.5
ii.	Tractor Placers	1
3	**Fuel Expenses**	**49.9**

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a.	Primary Collection	39.9
b.	Transportation	10

Annexure 10

Key Assumptions for Estimating Tipping Fee

Sl. No.	Particulars	Assumptions
1	Capital cost of landfill(Rs. Lakhs)	358.30
2	Capital cost of compost facility (Rs. Lakhs)	250.0
3	Number of days of operation	365
4	O&M cost Treatment and disposal	15% of Project cost
5	Capacity of compost facility	125 TPD
6	Compost produced	20% of MSW
7	Sale of compost	Rs 1000 per MT
8	User charges	Rs 20 per household

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