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Abbreviations	
ASM	Area Sabha Member
BOT	Build Operate Transfer
CD	Conservancy Dafedar
CDP	City Development Plan
CE	Commercial Establishments
CN	Carbon Nitrogen
CPM	Critical Path Method
DMA	Directorate of Municipal Administration
DPR	Detailed Project Report
DSCR	Debt-Service Coverage Ratio
EE	Environmental Engineer
GoK	Government of Karnataka
HDPE	High-Density Poly Ethylene
HO	Health officer
IHSDP	Integrated Housing & Slum Development Programme
IT	Information Technology
ITES	Information Technology Enabled Services
JHI	Junior Health Inspector
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
KSPCB	Karnataka State Pollution Control Board
KTPP	Karnataka Transparency in Pubic Procurement
KUIDFC	Karnataka Urban Infrastructure Development and Finance Corporation
KUIDP	Karnataka Urban Infrastructure Development Project
MCC	Mysore City Corporation
MoEF,	Ministry of Environment and Forests
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MT	Metric Tons
NEERI	National Environmental Engineering Research Institute
NGO	Non Governmental Organization
NH	National Highway
O&M	Operations and Maintenance
PERT	Program Evaluation Review Technique
PKs	Pourakarmikas
PMC	Project Management Consultant
PPP	Public Private Partnership
PWD	Public Works Department
REIA	Rapid Environmental Impact Assessment
RWA	Residents Welfare Association
SHG	Self Help Group
SHI	Senior Health Inspector
TPD	Tons Per Day
ULB	Urban Local Body

1. SECTOR BACKGROUND CONTEXT & BROAD PROJECT RATIONALE

a. Mysore, the administrative seat of Mysore District is one of the largest cities in Karnataka and is situated in the southern part of the state at 770 m above sea level at latitude of 12°18' N and longitude of 76°42' E. The city is located at a distance of about 135 km from Bangalore, the capital of the state. The administrative area of Mysore City Corporation (MCC) is approximately 128 square kilometers. The city is known for its palaces and proximity to several tourist attractions. Mysore is also well known for its ten-day Dasara festival, a hallmark of the old Kingdom of Mysore, which occurs during the month of September-October.

b. Mysore is an educational, commercial and administrative centre and also an important tourist and heritage destination. It is well connected to the adjoining states of Kerala and Tamil Nadu through road network. A summary of the key statistics of the city is presented in the table below.

Table 1: City Statistics

SL No	City features	Status
1	Height (MSL)	770 M
2	Latitude	12°18' North
3	Longitude	76°39' East
4	Population (2001 Census)	Male : 398730 Female : 387070
		Total : 785800
5	Female Population per 1000 Male (1991 Census)	967.41
6	Population growth(1991-2001)	20.48%
7	SC Population (2001 Census)	85,574
8	ST Population (2001 Census)	27,695
9	Labourers (1991 Census)	Male-1,12,534

SL No	City features	Status
		Female-19,260
10	Rate of Literacy (2001 Census)	Male – 88.6%, Female – 80.2%
		Total – 84.5%
11	Area	128.42 sq. km
12	Dwelling Families 2001 census	1,65,815
13	Average family size	4.8
14	Rate of Literacy (2001 Census)	Male – 88.6%, Female – 80.2%
		Total – 84.5%
15	Road Length (km)	Corporation – 1093
		PWD – 57.78
		NH – 5
		University – 26
		Total – 1761.53
16	Number of Street Lights	36,863
17	Average street lights per km	40
18	Number of Wards	65
19	Average rainfall per annum	789.20 mm

Source: MSW Action plan, DMA 2006

c. The population of Mysore has experienced a spike in the last 4 decades with the population increasing to 7.86 lakhs in 2001[1] from 2.54 lakhs in 1961[2]. While the growth in the period up to 1971 is attributable to industrialization like automobile and engineering, the growth in the period from 1971 to 1991 is due to the increase in heritage, culture, spiritual tourism and Mysore becoming a regular feature on the tourism circuit. Mysore has multiple industrial zones such as Hebbal, Metagalli, Belagola, Belavadi and Hootagalli. The growth in the decade of 1991-2001 and in the last five years is largely due to the growth of IT and ITeS industry in the city. The decadal decline in growth rate during 1991-2001 was due to slowing down in the industrial investments. The table below depicts the historical population trends.

Table 2: Historical Population Trends

Year	Population (Lakhs)	Average decadal growth rate (%)
1901	0.68	
1911	0.71	4%
1921	0.84	18%
1931	1.07	27%

[1] Source: Census, 2001
[2] Source: Census, 1961

Year	Population (Lakhs)	Average decadal growth rate (%)
1941	1.5	40%
1951	2.44	63%
1961	2.54	4%
1971	3.56	40%
1981	4.79	35%
1991	6.53	36%
2001	7.86	20%
2006	8.90	-

Source: City Development Plan, Mysore

d. The area of the Mysore city has also increased significantly over the last 2 decades and the details of the same are set out in the table.

Table 3: Population Growth Trends

Census year	Area (Sq. Km)
1981	82.3
1991	91.73
2001	128.42

Source: DMA Action Plan, 2006

e. The city has been divided into 65 municipal wards and the approximate population in each of the wards is set out in **Annexure 1**. While there are 38 notified slums in the city, 13 more slums have been identified. A map of the Mysore city is set out below.

f. The Government of India (GoI) proposes to provide impetus to the development of urban infrastructure in India through the Jawaharlal Nehru National Urban Renewal Mission (JNNURM). GoI has selected Mysore as one of the heritage cities to be developed under JNNURM. As required under JNNURM guidelines a City Development Plan (CDP) was prepared giving therein details of various infrastructure projects proposed to be undertaken in the future. One such project identified in the CDP, is the development of an integrated strategy for management of municipal solid waste (MSW) in the City.

g. Municipal Solid Waste Management (MSWM) is an obligatory function of the Urban local bodies (ULBs) under the Karnataka Municipalities Act, 1964. Also, the Municipal Solid Waste, (Management and Handling) Rules, 2000 ("MSW Rules") made it mandatory for an Urban Local Body (ULB) to practice sanitary treatment and disposal of the MSW generated.

h. The estimated quantum of MSW currently generated in the city is approximately 385 MT. MCC has been carrying out collection and transportation of MSW in the city by deployment of its own resources and through private operators. A compost facility of 200 TPD capacity was also set up for treatment of MSW in the year 2001. The operations of the facility have however been intermittent over the past few years. Also, there is no sanitary landfill facility for disposal of MSW at present in the city.

1.1. Existing status of physical infrastructure

1.1.1. MSW generation

The various sources of MSW generation include domestic households, commercial establishments, hotels, markets, marriage halls and nursing homes. A primary quantification survey was carried out in MCC to estimate / validate the MSW generation. The results of the study are set out in this section. The quantification of waste generate is based on 100 TPD and the same is presented in **Annexure 2**.

a. Domestic Households

The waste generated in the domestic households forms the major component of the total MSW generated in the city. The number of households in the city is 1,93,761 assuming an average family size of 4.8 and the total estimated population of the city as 9.3 lakhs[3]. The estimated number of

[3] Source: CDP, Mysore (Year 2007)

households in the city is set out in **Annexure 3**. While there are 38 notified slums in the city, 13 more slums have been identified and the details of the same are set out in **Annexure 4**. Based on the waste quantification studies undertaken, the average per capita MSW generation is approximately 360 grams per capita per day. The estimated quantum of MSW generated by the domestic households considering the per capital waste generation levels and the estimated population is 338[4] TPD. The estimated quantum of MSW generated in each of the 65 wards is set out in **Annexure 5**.

b. Commercial Establishments

There are approximately 20,000 commercial establishments in the city, majority of which are general shops, petty shops, bakeries, juice shops, electrical & electronics, wholesale and retail stores. The ward wise details of the same are set out in **Annexure 6**. Based on the waste quantification studies undertaken, the MSW generation rate is approximately 1.0 kg per establishment per day and the estimated quantum of MSW generated is 20 TPD.

c. Marriage and Function Halls

There are approximately 124 marriage and function halls in the city. The marriage and function halls generate 50 kg of MSW everyday based on which MSW generation has been estimated at 6 TPD.

d. Hotels, Restaurants and Lodgings

Hotels, restaurants and lodgings mainly generate biodegradable waste. There are approximately 415 hotels in the city. The MSW generation rate is approximately 50 kg per unit per day and the estimated quantum of MSW generated by the hotels is 21 TPD. The ward wise details of the same are set out in **Annexure 6**.

e. Markets

Vegetable, meat shops and other market areas are the other sources of waste generation in the city. There are approximately 387 markets in the city which generate an estimated quantum of 28 TPD of MSW.

[4] Including floating population

f. Street Sweepings & Drain Cleanings

Street sweepings and drain cleanings are the other major components of total MSW generated in urban areas. The street sweepings range from 60 kg per km road length in high density areas to around 15 kg per km road length in less density areas. The quantum of street sweeping waste generated per day has been estimated at 17 TPD based on the above generation levels.

g. Hospitals, clinics, industries and other generators such as schools and institutions, temples, generated an estimated quantum of 13 TPD of MSW. The ward wise details of the same are set out in **Annexure 6**.

h. Total Quantity of Waste Generated

The total quantity of MSW generated in the city is approximately 385 tonnes per day (TPD) and the details of the same are set out in table 4.

Table 4: Total quantity of MSW generated

Sl No	Generator	Number	Unit generation per day	Estimated quantity (MT)
1	Population	9,38,386[5]	360 gram/ capita/day	338
2	Commercial establishments	20,000	1.0 kgs per unit per day	20
3	Hotels and Restaurants	410	50 kg / unit	21
4	Marriage and Function halls	124	50 kg / unit	6
Total MSW generated per day in MT				385
7	Street sweepings and silt (TPD)			17
Total MSW generated per day including Street sweepings and silt in MT				**402**

Source: Field Surveys

1.1.2. MSW Transportation

a. The MSW collected from the generators is transported to the compost facility by deployment of 51 vehicles of which, 26 are owned by MCC and 25 are deployed by private contractors.

[5] Including floating population

b. The quantum of MSW transported in the vehicles has been weighed at the compost facility over a period of fifteen (15) days and the details of the same are set out in the table below.

Table 5: Quantity of MSW transported

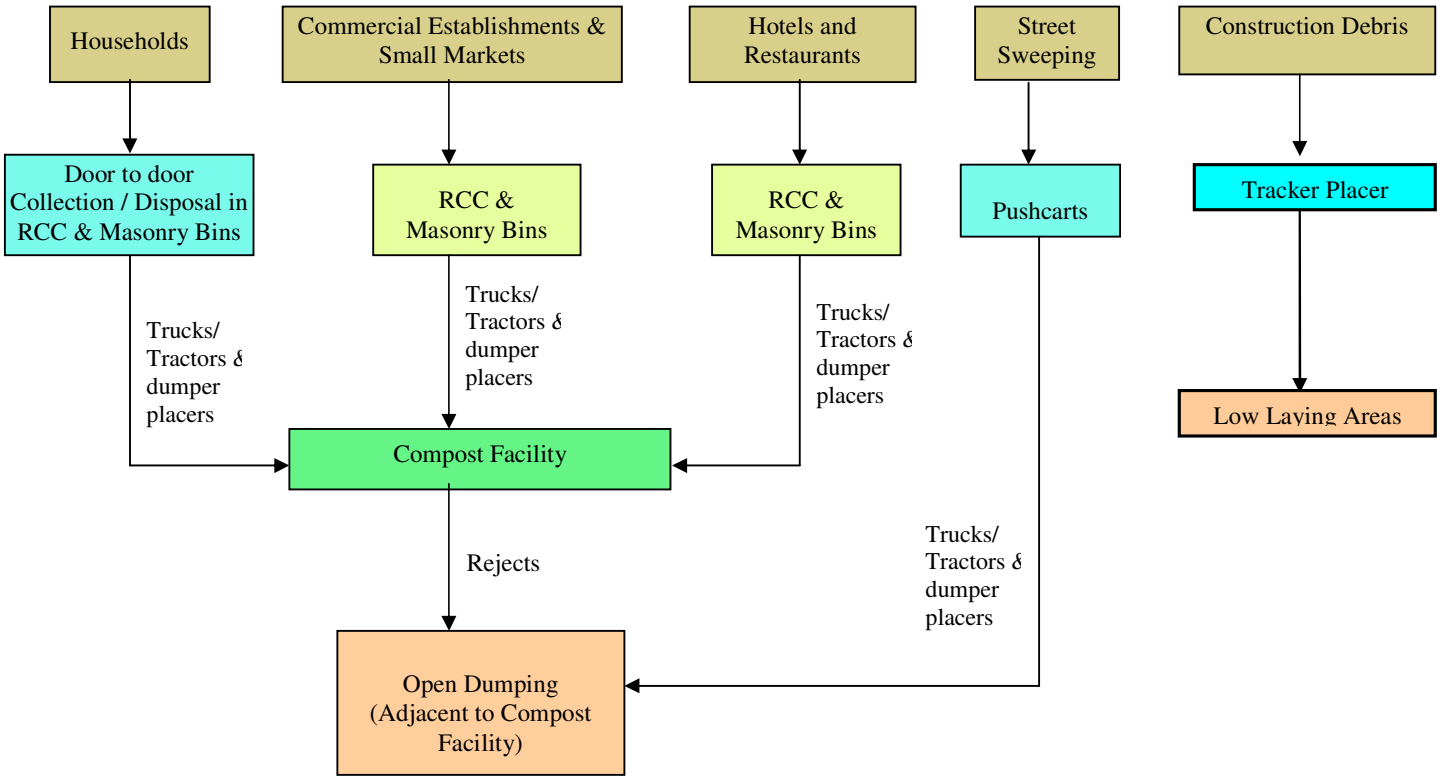
Sl No	Day	No. of trips	Tons / day	Average ton / trip
1.	Saturday	90	284	3.15
2.	Sunday	66	226	3.42
3.	Monday	81	261	3.22
4.	Tuesday	88	295	3.35
5.	Wednesday	71	244	3.43
6.	Thursday	86	252	2.93
7.	Friday	84	273	3.25
8.	Saturday	72	269	3.73
9.	Sunday	58	246	4.24
10.	Monday	83	292	3.51
11.	Tuesday	84	321	3.82
12.	Wednesday	65	255	3.92
13.	Thursday	84	291	3.46
14.	Friday	87	321	3.68
15.	Saturday	70	260	3.71

Source: Field Surveys

c. While the average waste transported is approximately 270 TPD, the minimum and maximum amounts transported are 226 TPD and 320 TPD respectively.

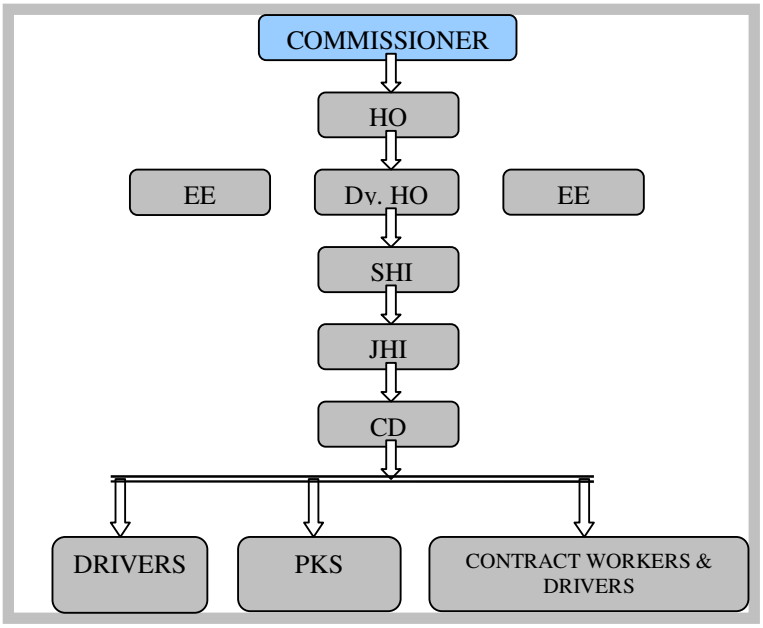
1.1.3. Current MSW Management practices

a. The current MSW management practice in the city is set out in the figure below.



1.1.4. Organization structure for MSWM

a. The MSW management activities in the city are supervised by the health department of MCC, which is headed by a Health Officer and the organization structure of the department is set out in the figure below.



Source: *Mysore City Corporation*

b. The Health Officer is assisted by a Deputy Health Officer, two Environmental Engineers, two Senior Health Inspectors and 18 Junior Health Inspectors.

c. Each Health Inspector is responsible for management of MSW activities in a set of wards and is assisted by Conservancy / Dafedar who in turn is responsible for supervision of Pourakarmikas (PKs) and the private contractors.

d. The staffing pattern of the department is set out in the table below.

Table 6: Staff Deployment

Sl. no	Staff category / designation	Manpower
1	Health Officer	1
2	Deputy health Officer	1
3	Environmental Engineers	2
4	Senior health Inspector	2
5	Junior health Inspector	18
6	Health Inspector – on contract basis	6
7	Conservancy Dafedars	36
8	Pourakarmikas (PKs) - Permanent	786
9	Pourakarmikas (PKs) - Timescale	7
10	Pourakarmikas (PKs) - private contract service deployment	586
11	Pourakarmikas (PKs) - on contract services basis with MCC	40
12	Drivers – MCC (26 vehicles)	26
13	Drivers – contract services for 25 vehicles	25

Source*: MSW Action plan, DMA 2006*

1.2. Baseline information

1.2.1. Collection and Transportation of MSW

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

a. MCC has introduced door-to-door collection of MSW from domestic households by deploying 90 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).

b. Street sweeping activity in the city is carried out by the PKs. 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 and transferred to tractor placers for disposal. The estimated road length in Mysore is 1764.53 km, which has been classified into three categories depending upon the frequency of sweeping. The same is set out in the table below.

Table 7: Road classification

Sl No	Classification of Roads	Road length (Km)
1	Type A (sweeping on a daily basis)	684.68
2	Type B (sweeping twice a week)	610.95
3	Type C (sweeping once a week)	468.90
Total Road length		**1764.53**

Source: MSW Action Plan, DMA 2006

The details road length and length of road side drains for each of the wards is set out in **Annexure 7.**

c. 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 8**. In ward number 18 (Kuvempunagara South) and ward number 37 (Lashkar MohalIa) the number of bins required is high due large number of commercial establishments and high population density as indicated in **Annexure 8**.

d. In order to facilitate collection of MSW from the bulk generators, 20 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 MCC and the condition of the vehicles are set out in **Annexure 9.**

e. The MSW collected from bins / open collection points is transported to the compost facility.

f. MSW management practices in other cities in India are set out in **Annexure 10**.

1.2.2. Treatment of MSW

a. 

The MSW generated within the limits of the MCC area, prior to year 2001, was dumped in an ad-hoc manner at several locations as convenient in the peripheral area of the city. As a part of MSW Management Program taken up under Asian Development Bank assisted Karnataka Urban Infrastructure Development Project (KUIDP), it was decided to set up a MSW treatment facility with a capacity of 200 TPD, under an appropriate public private partnership framework, to treat the MSW generated in the city.

b. 

M/s Excel Industries, Mumbai in association with M/s Vennar Organic Fertilizers Limited was identified as the developer for setting up of the compost facility under a Build – Operate – Transfer (BOT) framework through a competitive bid process. The facility was set up at Vidyaranyapuram and has been in operation since August 2001. The operations of the facility have been intermittent right from commencement of operations and Vennar had abandoned the project in June 2005. Subsequently, MCC has been operating the facility by deploying its own staff and resources. The salient features of the facilities and the processes in the compost facility are set out below.

i. The MSW transported to the facility is weighed at the weighbridge wherein details such as number of truck loads, weight of each load and the lorry number are recorded.

ii. The MSW received at the facility is dumped in the adjacent vacant land. The untreated MSW is piling up at the facility, due to intermittent operation of the compost facility.

iii. The biodegradable components of the untreated MSW dumped in the facility have been inertised (due to elapse of time), without any windrow management or turning operations or application of innoculum etc.

iv. Currently large non biodegradable waste (inert) like tyres, big bottles, steel materials etc are not being separated. Construction debris and street sweepings are also not being screened.

v. Drains are constructed on the periphery of the facility to collect the leachate generated.

vi. There are 3 screens for processing the inertised MSW:

- 35 mm Trommel Screen: The inertised MSW is fed to the 35 mm trommel screen. The output of the screen is then taken to the next stage of processing through a conveyor belt. The rejects are carried by a separate conveyor belt, collected and stored for disposal.

- 16 mm Trommel Screen: The inertised MSW output of the 35 mm trommel screen is fed to a 16 mm trommel screen. The processed output is transported through a conveyor belt to the next screen, while the rejects are moved on a separate conveyor belt, collected and stored for disposal.

- 4 mm Trommel Screen: This is the final screen prior to bagging and storage. This activity is carried out based on the order position for the compost. The output of 16 mm trommel screen is processed through a 4 mm trommel screen. The rejects of 4 mm trommel screen along with that of 16 mm trommel screen are used to cover the fresh windrows being formed (to increase the rate of decomposition and to prevent foul odour).

vii. The output of the 16 mm trommel screen is fed to an asparator and then a de-stoner. Air-drying of the compost at ambient temperature is then carried out. The above process is carried out to reduce the moisture content and to remove sand/stones from the compost.

viii. A Quality Control Lab was constructed at the site to assess the parameter to govern the quality of compost like CN ratio, PH value, etc. The lab is however currently non-operational and no quality checks are being carried out for the compost produced.

ix. The compost produced is stored loosely and is packed only when orders are received for their delivery. The packing is being carried out manually using weighing scale & stitcher.

c. Project Facilities

i. The facility comprises civil structures and infrastructure, plant and machinery and electrical equipment. As the facility was developed in the year 2001, the structures, plant & machinery and electrical equipment can be utilized for operations for a further period of approximately 10 years with suitable modifications. The present condition of the various facilities has been assessed based on which the rehabilitation requirements have been identified. The salient features of the current status of civil structures, plant and machinery and electrical equipment is set out in **Annexure 11, Annexure 12 and Annexure 13** respectively.

1.2.3. Disposal of MSW

At present, there is no sanitary landfill facility in the city for disposal of the MSW generated and processed in the compost facility. The non-biodegradable component of the MSW collected and the rejects from the compost facility are being dumped in the open areas adjacent to the compost facility.

1.2.4. Performance Indicators

While the 65 wards in MCC are covered by the solid waste management program, the MSW is not collected on a daily basis from a few localities. The delivery level performance indicators for current municipal solid waste management services are set out in table below.

Table 8: Current status of MSW practices

Parameters	Current Status
Coverage	75%
Collection Efficiency	80%
Segregation	10%
Treatment and Disposal Facilities	Treatment facility of 200 TPD capacity being operated by MCC. No sanitary landfill facility.
Recovery of Costs	Practiced in select few wards

Source: City Development Plan, Mysore

1.3. Projects proposed for the MSW sector in the CDP

MCC endeavors to provide a safe and environmentally benign sanitation and municipal solid waste services to its citizens. To this extent many initiatives have been taken up including setting up of composting process facilities and improving MSW collection practices. The provision of services in future would be in compliance with the applicable statutes including the "Municipal Solid Waste Management and Rules, 2000 and the Karnataka State Policy on Integrated Solid Waste Management.

The projects proposed for MSW sector in the City Development Plan are set out in this section.

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

Rehabilitation of the existing compost facility and development of a sanitary landfill facility in accordance with the MSW Rules. The rehabilitation and development works could be undertaken under an appropriate public private partnership framework.

c. In the city investment plan presented in the CDP, the investment requirement for delivery of MSW management services in the city was

estimated over the investment period. The investment requirement during the JNNURM period (FY 07 – FY 12) was estimated as Rs. 42 Crores.

d. The proposed project for MSW management system in the city includes streamlining of MSW collection & transportation system, rehabilitation of compost facility and development of a sanitary landfill facility. The project aims at achieving 100% efficiency in collection & transportation of MSW, implementation of source segregation and development of an efficient treatment & disposal system. The proposed project is hence in line with the strategy for MSW management set out in the CDP.

1.4. Other capital expenditure projects (Ongoing & Sanctioned)

Directorate of Municipal Administration (DMA), as part of its initiative to improve solid waste management practices in Urban Local Bodies (ULBs) in Karnataka had developed strategies for collection, transportation, treatment and disposal of MSW. Under the program an Action Plan for collection & transportation strategy was prepared for Mysore. DMA had sanctioned amount of Rs. 4.00 Crores in two installments, towards procurement of tools / equipment / vehicles for implementation of collection & transportation activities as per the action plan.

MCC has utilized Rs 3.0 Crores till date, from the allotted funds towards procurement of tools/equipments for primary collection and street sweeping activities. The equipments purchased include pushcarts and other street sweeping equipments. The remaining Rs 1.0 crore would be spent by MCC on procurement of dumper placers and auto tipper.

1.5. Existing tariff & cost recovery methods

The existing cost recovery scenario for the services provided by MCC with respect to MSW management is discussed below.

a. Past five year trends

For the services provided by MCC for collection and transportation of MSW, there are no service charges / user charges that have been collected from various generators in the past five years. However, MCC has been collecting user charges from January 2007 from various generators as per the tariff set out in the resolution dated 8-12-06.

b. Existing cost recovery methods

In order to recover part of the service delivery costs incurred for delivery of MSW management services, MCC had passed a resolution dated 8-12-2006, specifying the user charges payable by the citizens/bulk generators. The resolution is under implementation and the collections of user charges from various generators have commenced from January 2007. The copy of resolution is attached in **Annexure 14**.

1.6. Areas of private sector/ community participation

MCC has taken initiatives towards privatizing MSW management activities in parts of the city. Twelve (12) packages were formed and private operators were identified for carrying out the MSW management activities, the details of which are set out in the table below. The scope of work of the operators involves sweepings of roads and streets in the wards, temporary storage of waste in the bins & other open collection points and transportation of the waste to the processing facility or any other designated disposal point, as indicated by MCC. The wards where collection and transportation of MSW are privatized are set out in Table 9.

Table 9: Details of privatized MSW management activities

Package	Wards	Value (Rs)	PK's Deployed by the operators	Vehicles engaged by the operators
1	12,13,14	2,10,000	40	2
2	21,22,23	2,15,000	40	2
3	33,34,36	2,30,000	40	2
4	46,47,48	2,25,000	40	2
5	55,56,57	2,25,000	40	2
6	58,59,60	2,35,000	40	2
7	63,64,65	2,35,000	40	2
8	15,16,17	2,18,000	60	2
9	18,19,20	2,79,549	66	2
10	37,38,39	2,34,870	60	3
11	Main Roads	1,70,000	60	2
12	3 Markets	2,09,999	60	2
Total		**26,87,418**	**586**	**25**

Source: MSW Action Plan, DMA 2006

1.7. Other qualitative information

The key issues with respect to the current MSW management practice in Mysore are set out below:

a. Segregation of different MSW streams is not being practiced in the city.

b. The current collection and transportation practice involves multiple handling of MSW which is not in accordance with the MSW Rules.

c. The road length to be covered per sweeper in street sweeping is about 2.2 km per sweeper, which has resulted in inadequate sweeping of the main roads, while interior roads and bylanes are often left unattended.

d. Lack of periodic medical checkups for PKs and absence of standard accessories/equipment for street sweeping, has resulted in PKs being exposed to health hazards.

e. The PKs are predominantly from economically weaker sections involving mostly women. Any restructuring of the existing activities would have a direct impact on their livelihood.

f. The MSWM activities are being overseen by a Health Officer. However, collection & transportation activities are logistics oriented while treatment & disposal activities need an engineering focus.

g. The waste piled up at the facility is being treated currently while the fresh MSW supplied daily is being dumped in adjacent areas.

h. The non-biodegradable component of MSW and the rejects from compost facility are being dumped in the open areas adjacent to the compost facility and sanitary land filling is not being practiced.

2. PROJECT DEFINITION, CONCEPT AND SCOPE

a. A state policy on integrated MSW management ("State Policy") has been prepared by the DMA and KUIDFC under the Nirmala Nagara program of GoK. Under the 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 management MSW. The touchstone principles of the State Policy are set out below.

The touchstone principles, which govern the future approach to provision of MSWM services, include the following:

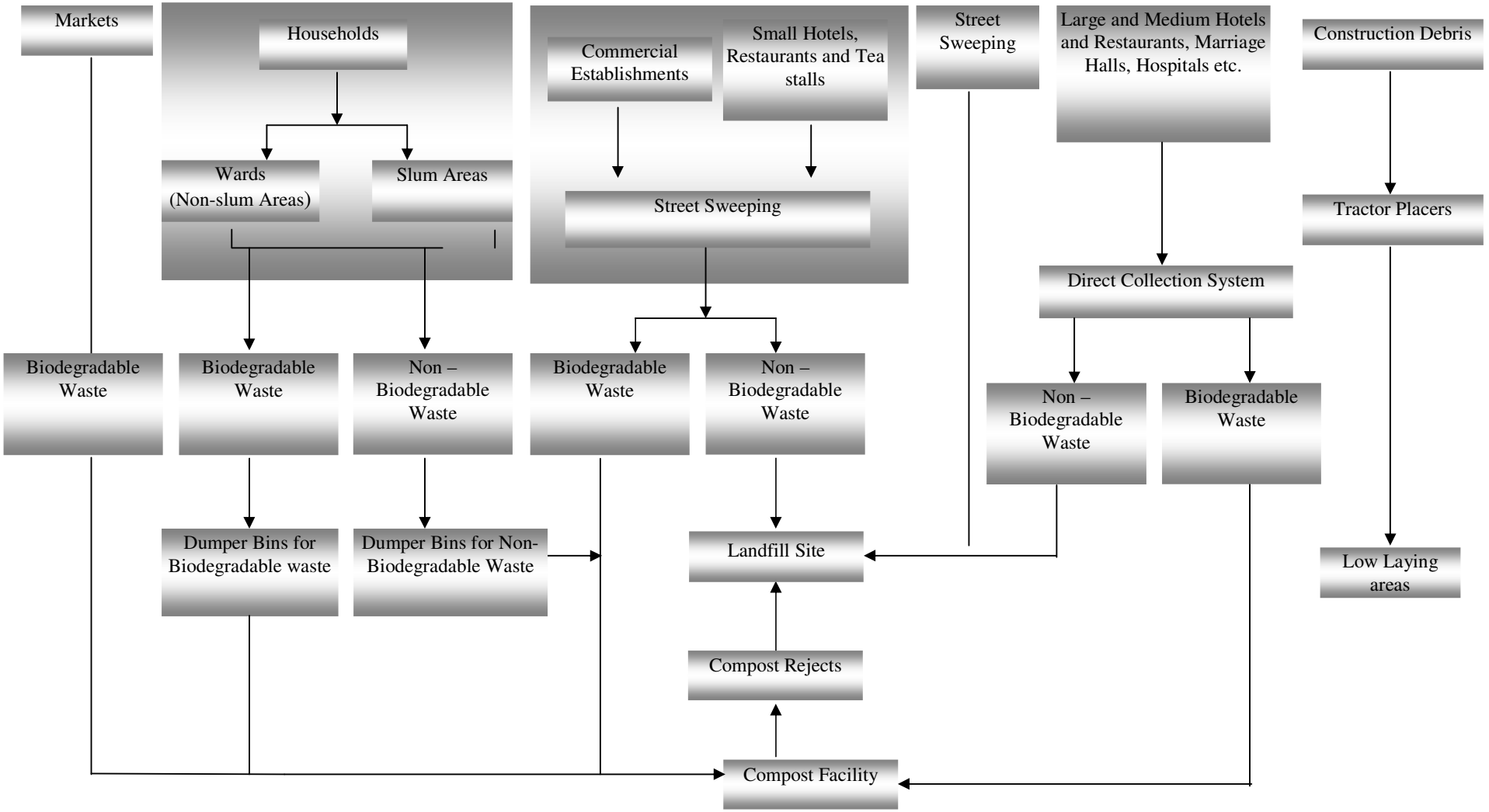
- Promoting awareness of waste management principles among citizens and other stakeholders.
- Minimizing multiple and manual handling of waste, and designing a system to ensure that MSW does not touch the ground till treatment and final disposal.
- Defining the roles and responsibilities of various stakeholders and putting in place an operating framework, which would include appropriate contractual structures.
- Developing systems for effective resources utilization and deployment.
- 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 State Policy and the IEC programme for SWM is attached as **Annexure 15.**

b. Management of MSW, to reduce the impact on the environment, requires an integrated approach involving components such as collection from various generators, segregation of MSW at source, recycling of the waste, reuse, 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 need to be adopted to amalgamate three stages of MSWM, namely collection & transportation, treatment and disposal. The adoption of this approach would stream line MSWM

c. Based on the guidelines set out in the MSW Rules, the State Policy and the action plan prepared for management of MSW in Mysore city. An integrated strategy has been developed for MSW management in the city. The tools and equipment recommended for implementation of the collection & transportation system is in accordance with the action plan. Door to door collection systems as per the action plan would be through the use of auto tippers and pushcarts. Street sweeping silt would be directly transferred to the sanitary landfill site using tractor placers.

d. The proposed MSW strategy is set out in the diagram below.


Markets
Households
Wards (Non-slum Areas)
Slum Areas
Commercial Establishments
Small Hotels, Restaurants and Tea stalls
Street Sweeping
Street Sweeping
Large and Medium Hotels and Restaurants, Marriage Halls, Hospitals etc.
Construction Debris
Tractor Placers
Direct Collection System
Biodegradable Waste
Biodegradable Waste
Non – Biodegradable Waste
Biodegradable Waste
Non – Biodegradable Waste
Non – Biodegradable Waste
Biodegradable Waste
Dumper Bins for Biodegradable waste
Dumper Bins for Non-Biodegradable Waste
Landfill Site
Low Laying areas
Compost Rejects
Compost Facility

2.1. Land

For delivering the MSW services, the primary requirement of land would be for transfer station, compost facility for treatment of MSW and sanitary landfill facility for disposal of MSW.

2.1.1. Collection and transportation of MSW

With respect to collection of MSW and its transportation to treatment facility / sanitary landfill facility, there is no requirement of land. However, with respect to secondary storage of MSW in secondary containers, the same would need to be placed on the road sides, for which indicative locations have been identified. As such lands belong to MCC; hence, there is no requirement for additional land / land acquisition for implementation of proposed collection and transportation activities.

2.1.2. Transfer Station

Though immediately there is no requirement for a transfer station in the city, it may be necessary in the coming few years as the city is poised to grow rapidly. Hence transfer stations are proposed to be set up in 2010. Land available with MCC would be used for these purposes and hence no additional land would be required for setting up of transfer stations.

2.1.3. Processing of MSW

MCC has developed a compost facility at Vidyaranyapuram on 2 acres of land, at a distance of 4 kilometers from the city. This existing compost facility is proposed to be rehabilitated and hence additional land would not be required.

2.1.4. Disposal of MSW

MCC has identified 34.5 acres, bearing the survey numbers Nos 180 & 181 of Kasapa Village, Mysore Taluk of land adjacent to the existing compost facility for development of a sanitary landfill. This land is in possession of MCC.

2.2. Physical Infrastructure Components

The MSW management strategy has been designed for the estimated generation of MSW in year 2013. As per the CDP the population of the city was assumed to grow at the rate of 4.5% (high growth rate scenario). This has been suitably escalated to estimate the population in 2013. The estimated population of the city by 2013 would be approximately 12.1 lakhs.

The number of households and estimated MSW generation in year 2013 is set out in **Annexure 16**. MSW that would be generated by other sources in the city has been set out in **Annexure 17.** 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.

2.2.1. The proposed collection and transportation plan includes the following.

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

b. 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. The list of SHGs identified in the city is set out in **Annexure 18.** As per the State Policy, the primary collection would be carried out by deploying a combination of auto tippers and pushcarts. The design specifications for Pushcarts and auto tippers are set out in **Annexure A.**

c. HDPE bins would be placed at heritage areas and areas where floating population would be concentrated. Litter collection crews would collect the waste from these HDPE bins and transfer the same to secondary containers. The design specifications for HDPE and secondary containers are set out in **Annexure B.**

d. Street sweepings would be transferred to sanitary landfill facility by tractor placers. The tools and design specification for street sweeping are set out in **Annexure C.**

e. The MSW from large generators such as hotels, restaurants, marriage and function halls would be collected directly and transported to the compost facility/ sanitary landfill facility by dumper placers. The design specification for dumper placers is set out in **Annexure D.**

f. Need based allocation of beats and staff would be carried out.

g. Secondary containers would be placed at identified locations for secondary storage of segregated MSW collected from various sources.

h. The transportation of secondary containers to the compost facility would be through dumper placers.

2.2.2. Collection and transportation strategy and estimation of vehicles and equipment

The process of collection and transportation of MSW is one of the significant activities that have concurrent implication on the treatment and disposal of MSW. The sources of generation of MSW are from diverse segments in an area/ward and are categorized on the quantum of MSW generated per day.

a. The activities proposed to be carried out for collection and transportation of the MSW is 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.

<u>Primary collection of MSW from non-slum areas</u>

Collection of Biodegradable and non-biodegradable MSW

- 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 primary collection activity would commence at 7 am and is proposed to be completed by 11 am.

- Biodegradable and non-biodegradable MSW from households would be collected daily, while the MSW stored separately (predominantly hazardous MSW) could be collected once a week.

- The MSW collected in auto tippers and pushcarts would be transported to secondary containers.

- The secondary containers containing the biodegradable waste would be transported to the compost facility and the non biodegradable waste would be transported directly to the sanitary landfill facility.

Collection of hazardous waste

- Hazardous waste generated in the households comprise dry cells, medicines, tubes, paints, pesticide bottles/ cans, shoe polish, etc.

- The households would be required to segregate and store the hazardous waste separately. The same shall be collected by the primary collection crew once a week (Sundays) after collection of biodegradable and non-biodegradable MSW components.

- The hazardous waste collected would not be mixed or stored in secondary containers.

- The hazardous waste so collected would be taken to an identified area (earmarked in the landfill facility area), and temporarily stored. Further segregation of the hazardous waste would be carried out at the facility to separate the recyclables.

- The recyclable wastes such as batteries, bottles, cans, etc, would be separated and sold to the recyclers. The balance waste would be disposed in the landfill facility. The method of household hazardous waste disposal being practiced in other countries is set out in **Annexure 19**.

- The primary collection crew would be responsible for promoting awareness among citizens for segregation of hazardous waste.

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 litter bins of 40 liters capacity, with the residents being required to dispose the MSW in these bins.

- Only pushcarts are proposed to be deployed for collection of MSW from these areas, as accessibility of such areas by auto tippers would be a constraint.

- The MSW from litter bins would be transferred to the pushcarts and then to the secondary container bins by the primary collection crew.

ii. Bulk Generators

Markets

- In large markets, it is proposed to place secondary containers 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 secondary containers. Containerized push carts are proposed to be used by the PKs in small markets.

Hotels, restaurants, choultris etc.,

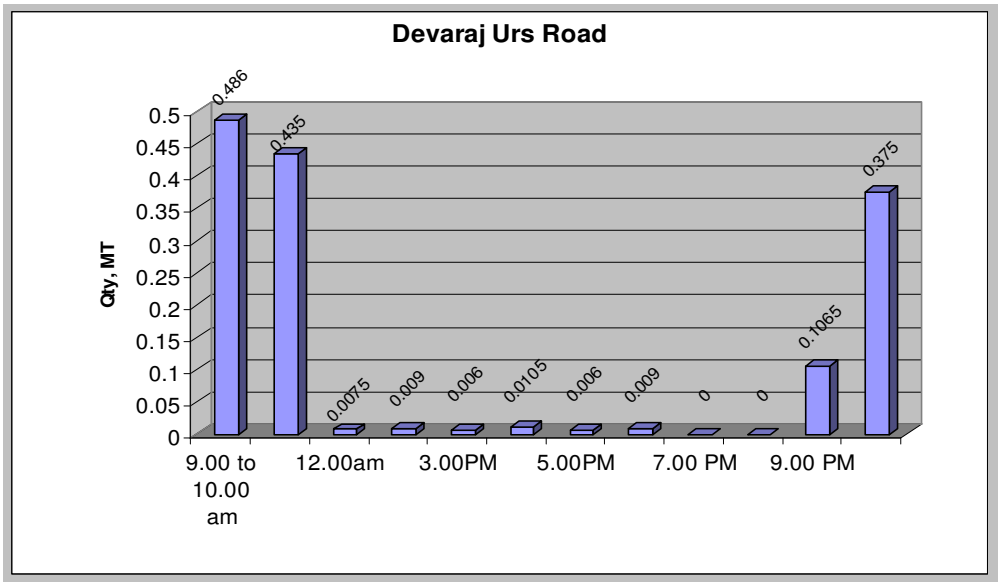
- Bulk generators would need to maintain secondary containers and dispose the MSW only in the secondary containers, which would later be colleted by the dumper placers.

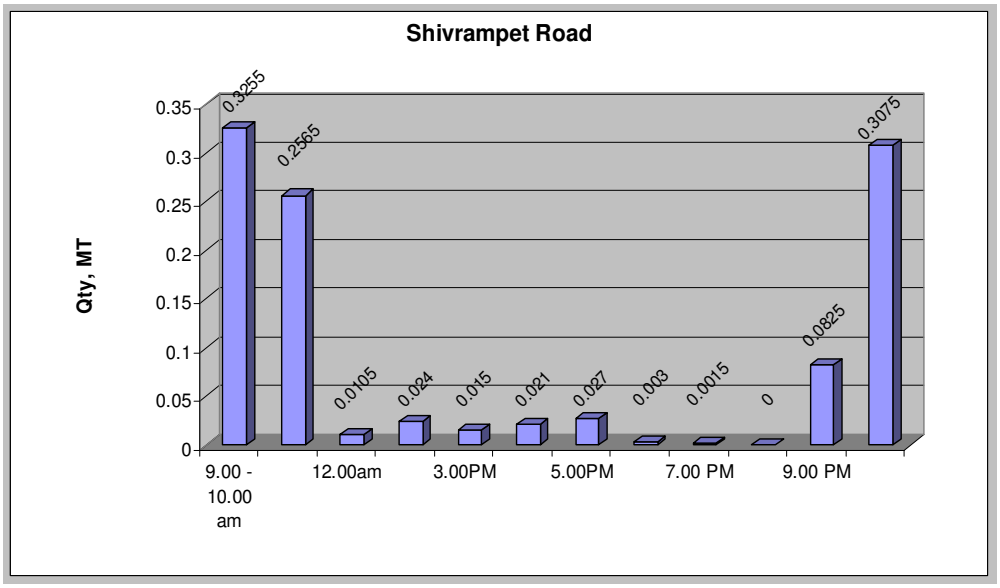
- The waste collected would be transported to compost / sanitary landfill facility through dumper placers.

iii. Commercial Establishments

- To estimate the quantum of waste and the trend in disposal of waste from commercial establishment's a survey was undertaken at Shivrampet and Devaraj Urs road. The survey was conducted between 9AM - 1PM and 3PM - 11PM.

- The findings from the survey are presented in the graphs below.





- From the graphs it can be inferred that, maximum waste on these streets is being disposed between 9 – 11 AM and 9 – 11 PM.

- Shops and commercial establishments would need to compulsorily use waste bins to store their waste. The waste from these bins would be picked up by the street sweeping staff after the completion of street sweeping activity.

- The waste collected would be transferred to secondary containers and transported to the treatment / disposal facility using dumper placers.

- The shop owners associations would be made responsible for advocating the disposal of waste only into waste bins.

iv. Street sweepings

- The roads in the city have been categorized into three types, and the same has been set out in table 10, based on the street sweeping requirements.

Table 10: Mode of street sweeping activities

Type	Classification	Length (km)	Ward name	Locations (Ward Numbers)
A	Sweeping on a daily basis	475.72	Agrahara, Lakshmipuram, Ittigegudu	1, 3-62
B	Sweeping twice a week	554.70	Sunnadakeri, Ramachandra Agrahara, Krishnamurthypu	1,2,4,5,7-24,26,28,30-40,42-65
C	Sweeping once a week	691.05	Rajendranagara, Tilaknagara, Gokulam, Vidyaranyapuram, J P Nagar, Meena Bazar, Ittigegudu	1,2,4,7-10,12-23,26,28,31-38,40,43-46,48-65

- Street sweeping is expected to commence by 6.00 am and would be completed by 9.00 am.

- Pushcarts carts are proposed to be used for collection of street sweeping silt. The silt collected from sweeping would be directly transferred through tractor placer to the disposal facility.

v. Heritage Areas

- MCC has identified specific areas in the city to be demarcated as "litter free zones" including Devaraj Urs Market and Heritage walk areas.

- Since these areas would be visited by bulk of the floating population, it becomes necessary to provide litter bins for disposal of waste by these people. In case of waste disposed on the streets, the same would need to be collected in litter bins. Special collection crew would be deployed by MCC to ensure continuous cleaning in these areas. To preserve the heritage ambience in these areas, it is proposed to place aesthetic litter bins on either side of these streets at a distance of approximately 200 meters.

- The waste collected in these bins shall be transferred to the secondary containers using auto tippers.

vi. Other sources

- The current collection system adopted by MCC would be streamlined for other generators (large institutions, construction waste, hospitals, marriage halls etc).

b. Estimation of vehicles and equipments

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

i. Primary collection

<u>From non- slum areas</u>

- Auto tippers and pushcarts are proposed to be deployed for collection of MSW from households. The proposed coverage by auto tippers and pushcarts would be approximately 70% and 30% respectively.

- In areas with narrow lanes, pushcarts would be deployed for primary collection.

- As per the state policy, the coverage of auto tippers and pushcarts is 1000 and 160 households respectively.

- The requirements of auto tipper and pushcarts in each of the wards have been estimated assuming these coverages.

- The ward wise requirement of auto tippers and pushcarts in the non slum areas is set out in **Annexure 20**. The total requirement is set out in table 11.

Table 11: Primary Collection Equipment and Vehicles for non slum areas

Sl. No.	Description	Numbers
1	Total number of households in non-slum areas	**2,54,447**
2	Coverage of the primary collection vehicle (No. of households)	
A	*Auto tippers*	*1000*
B	*Pushcarts*	*160*
3	Estimated requirements	
A	*Auto tippers*	*149*
B	*Pushcarts*	*443*
4	Estimated requirements including contingency	
A	*Auto tippers*	*156*
B	*Pushcarts*	*465*

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.

- The ward wise deployment of pushcarts and litter bins in the slum areas is set out in **Annexure 21** and the total requirements is set out in the table 12.

Table 12: Primary Collection Equipment and Vehicles for slum areas

S. No.	Description	Numbers
1	Total number of households in slum areas	18,687
2	Mode of collection of waste from households	
A	*Pushcarts*	*37*
B	*Litter Bins*	*943*
3	Number of primary collection vehicles including contingency requirement of 10%	
A	*Pushcarts*	*38*
B	*Litter Bins*	*943*

- Currently Government schemes such as Ashraya and IHSDP are being implemented in slum areas for providing dwelling units and other essential infrastructure. With the implementation of these schemes an overall development in slum areas is envisaged. Hence in 2010, it is proposed to deploy auto tippers for primary collection in slum areas as well.

- The requirement of auto tippers has been estimated based on the number of dwelling units which would be the number of existing slum households i.e. 18,687. Each auto tipper would cover approximately 1000 households and based on the above assumptions, a total of 19 auto tippers would be required. The cost estimation for the same is based on the quotation received for various tolls/equipments from suppliers. The lists of quotations received are set out in **Annexure 22.**

ii. 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 of size 450 mm and would transfer the same to tractor placers.

- For continues collection of street sweepings the tractors placers would be going rounds and collecting the street sweepings from identified locations where the street

sweepings would be stored/collected in a pushcarts by the PKs.

- 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 778.

- The street sweepings (waste) would be collected in pushcarts and one pushcart would be deployed for two PKs. The ward wise details for deployment of PKs and requirement of pushcarts are set out in **Annexure 23**. The overall requirements are set out in the table below.

Table 13: Total number of PKs deployed and pushcarts required for street sweeping

S. No.	Description	Numbers
1	Total number of PKs deployed for street sweeping	778
2	Total number of pushcarts required	389

The road length for street sweepings in each ward for various types of roads as classified above is set out in the table below:

Table 14: Road length in Kilo meters

Ward No	Road length in km			Total
	A	B	C	
1	10.00	7.64	6.52	24.16
2	0	7.6	4.64	12.24
3	13.05	9.02	0	22.07
4	3.45	10.83	3.98	18.26
5	7.88	10.72	0	18.6
6	12.6	6.71	0	19.31
7	17.32	2.04	2.91	22.27
8	6.32	2.13	4.04	12.49
9	9.5	1.45	2.59	13.54
10	9.02	2.05	0.56	11.63
11	22.05	16.13	0	38.18
12	9.5	10.76	36.05	56.31

	Road length in km			
13	17.54	12.1	5.84	35.48
14	9.01	5.47	15.89	30.37
15	5.89	12.22	6.23	24.34
16	7.29	18.08	15.17	40.54
17	11.76	2.97	4.85	19.58
18	8.6	8.41	12.45	29.46
19	2.4	10.69	10.03	23.12
20	8.31	10.28	4.39	22.98
21	4.11	10.22	9.79	24.12
22	9.06	18.31	19.32	46.69
23	9.32	27.11	5.41	41.84
24	59.35	3.55	0	62.9
25	58.27	13.16	0	71.43
26	20.83	12.8	7.17	40.8
27	18.19	20.58	0	38.77
28	16.51	0.72	0.65	17.88
29	29.24	2.75	0	31.99
30	13.08	15.72	7.29	36.09
31	3.59	12.88	4.79	21.26
32	9.53	14.72	8.59	32.84
33	3.46	1.88	3.67	9.01
34	5.77	4.56	15.97	26.3
35	2.7	9.69	18.24	30.63
36	3.8	6.99	7.5	18.29
37	4.28	5.99	9.45	19.72
38	1.78	6.44	3.39	11.61
39	8.34	1.02	0	9.36
40	1.99	4.13	1.71	7.83
41	9.5	4.9	0	14.4
42	9.64	4.34	0	13.98
43	10.55	6.38	3.69	20.62
44	3.98	4.88	8.79	17.65
45	7.57	8.59	15.19	31.35
46	6.13	4.47	18.01	28.61
47	10.99	0.8	6.17	17.96
48	9.69	7.19	2.35	19.23
49	3.49	11.4	2.25	17.14
50	6.69	3.92	1.85	12.46
51	4.81	7.94	0.81	13.56
52	8.54	6.83	4.63	20
53	23.68	22.79	8.53	55
54	7.23	9.23	13.64	30.1
55	11.04	6.63	3.04	20.71
56	18.4	36.79	25.57	80.76
57	6.91	15.89	2.67	25.47
58	3.67	6.1	2.72	12.49
59	8.74	10.95	3.92	23.61
60	1.5	2.31	2.08	5.89
61	10.31	1.97	1.84	14.12

	Road length in km			
62	19.05	11.42	8	38.47
63	7.88	10.94	10.17	28.99
64	0	7.82	10.93	18.75
65	0	35.95	49.97	85.92
Total	**684.68**	**610.95**	**465.9**	**1761.53**

Source: DMA Action Plan, 2006

The available PKs in the municipality are 793. A redeployment plan has been provided in the action plan which states that 336 staff would be available for street sweeping activity. The sweeping to be handled by the additional requirement of 442 would be met through task based sweeping contracts.

iii. Secondary Collection

- The MSW collected from all the sources would be stored in secondary containers. The secondary containers would be placed to store both, biodegradable and non-biodegradable MSW generated. The number of secondary containers have been estimated based on the total quantum of MSW generated and would be placed in groups of two (one for biodegradable and one for non-biodegradable waste). The ward wise requirements of secondary containers are set out in **Annexure 24**.

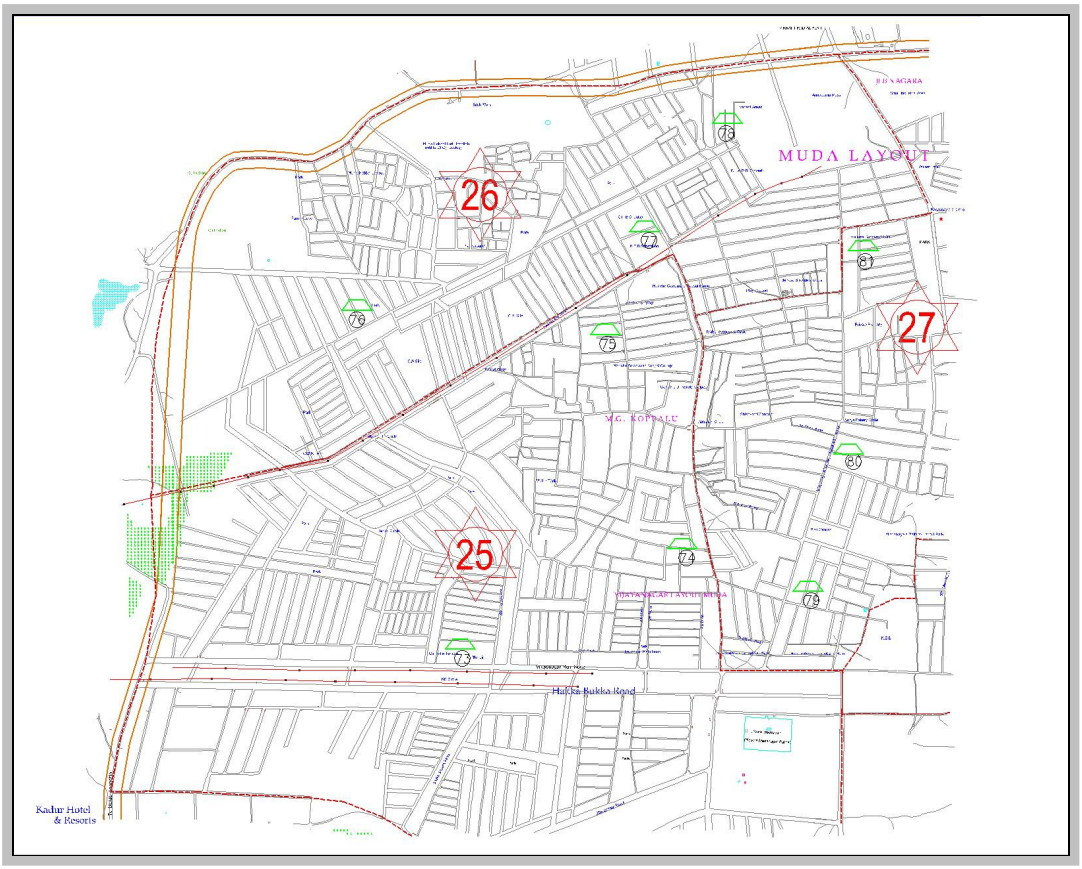
- In line with the state policy, it has been proposed to use secondary containers of 4.5 cubic meter and 7.0 cubic meter (volumetric capacity). The capacity of secondary containers is measured in terms of quantum of MSW that it can hold in MT (Metric Tons). The secondary containers accordingly would have would have a capacity of 1.8 MT and 2.8 MT.

- 4.5 cubic meter capacity secondary containers would be placed for collection of biodegradable and non biodegradable waste.

- For collection of non biodegradable waste from bulk generators like hotels, choultris, function halls etc, 7.0 cubic metric secondary containers would be placed based on the quantum of waste generated.

- The indicative locations for placement of the secondary containers in ward number 25, 26 and 27 are set out below. The detailed map is set out in **Annexure E.**

- Two Compactors would be deployed for transportation of MSW from important roads to the landfill facility. The area / street would be identified at the bidding stage in consultation with MCC.



- The indicative locations for placement of the secondary containers in each of the wards are set out in **Annexure F** and the total estimated requirement is set out in the table below.

Table 15: Requirement of secondary containers

Sl. No.	Description	Parameters
1	Volumetric Capacity of secondary containers for Households(cubic meters)	4.5
2	Volumetric Capacity of secondary containers for Bulk generators (cubic meters)	7

Sl. No.	Description	Parameters
3	Capacity of DB for Waste from households (MT)	1.8
4	Capacity of DB for Waste from Bulk generators (MT)	2.8
5	Number of 4.5 cubic meter secondary containers required	205
6	Number of 7.0 cubic meter secondary containers required	66
7	Number of litter bins required	50
8	Number of compactors	2

iv. Transportation of MSW

- The secondary containers would be transported to the compost facility / sanitary landfill facility in dumper placers. A combination of single carrier dumper placers (for transporting 7 cubic meter secondary containers) and twin load dumper placers (for transporting 4.5 cubic meter secondary containers) are proposed to be used for transportation of MSW.

- The biodegradable waste collected would be transported to the treatment facility and the inert from the treatment facility would be disposed into the sanitary landfill.
- The non biodegradable waste collected would be directly transported to sanitary landfill facility.
- The silt from street sweeping activity would be transferred to the sanitary landfill facility by way of tractor placers.
- The transportation route map of dumper placers from each ward is set out in **Annexure G** and the estimated total requirements are set out in the table below. The quotation for physical infrastructure components for collection and transportation of MSW is set out in **Annexure 22.**

Table 16: Requirement of dumper placers

S. No.	Description	Numbers
1	Dumper Placers	
A	Number of secondary containers to be transported	271
B	Number of secondary containers carried per trip	2
C	Number of trips made per vehicle (7.0 cubic meter secondary containers)	5
D	Number of single carrier Dumper placers required (7.0 cubic meter secondary containers)	14
E	Number of trips made per vehicle (4.5 cubic meter secondary containers)	5
F	Number of twin load dumper placers required (4.5 cubic meter secondary containers)	21

2.2.3. GPS (Global Positioning System) based vehicle tracking and management system

The transportation vehicles involved in transferring the waste from the collection points to the treatment and disposal sites would be performing multiple trips in a day. Monitoring and tracking these vehicles is a vital activity which cannot be carried out by manual methods. Therefore, a GPS based vehicle tracking and management system is proposed for monitoring these MSW transportation vehicles. Each of the transportation vehicles would be fitted with a GPS device and operations would be centrally controlled at MCC. The system would help optimize vehicle routes and improve the efficiency of the transportation system, thereby reducing the overall cost of the SWM system. The key benefits of using the GIS system are set out below.

i Possible to continuously monitor and track the transportation vehicles.
ii Useful to identify the deviations in operations.
iii Useful to identify the vehicles idling during operation.
iv Helpful in computing the kilometers operated by the private transportation vehicles.
v Helpful in route optimization – shortest path from the collection point to the treatment & disposal facility.

2.2.4. Total Requirement of tools / equipment / vehicles

The total requirement of tools / equipment / vehicles for implementation of the proposed MSW management strategy is set out in the table below.

Table 17: Requirements of Vehicles (in numbers)

Sl. No.	Component	Proposed	Existing	Required
1	Primary Collection			
a	Auto Tippers	168	0	168

Sl. No.	Component	Proposed	Existing	Required
b	Pushcarts	480	0	480
c	Litter bins	943	0	943
2	Street Sweeping			
a	Pushcarts	409	90	319
b	Other Equipment			Lumpsum
3	Secondary storage			
a	4.5 cubic meter secondary containers	205	0	205
b	7.0 cubic meter secondary containers	66	0	66
c	Litter Bins for Heritage Walk area	50	0	50
4	Transportation Vehicles			
a	Twin Dumper Placers	21	2	19
b	Single load Dumper Placer	14	0	14
c	Tractor Placers	11	19	0
d	Compactor	2	0	2

2.2.5. Manpower Requirement for implementation of MSW strategy

The manpower requirement for implementation of the proposed MSW management strategy is set out in the table below.

Table 18: Manpower Requirement

Sl. No.	Component	Proposed	Existing	Manpower Requirement
1	Primary Collection			
A	*Auto Tippers*	*504*	*0*	*504*
B	*Pushcarts*	*960*	*0*	*960*
2	Street Sweeping			
A	*Street Sweeping*	*778*	*392*	*386*
3	Transportation Vehicles			
A	*Dumper Placers*	*103*	*26*	*77*
B	*Compactor*	*2*	*0*	*6*
	Total			**1933**

Under the strategy, it is proposed to use the services of available street sweeping staff (existing 392) for street sweeping activity. However this staff would be gradually phased out and would be redeployed by MCC for carrying out other activities.

2.2.6. Transfer station

As the city would grow diametrically, the population density would also increase resulting in increased MSW generation. Hence, transportation of MSW from the wards to final processing facility / sanitary landfill facility may become difficult in

terms of movement of vehicles through city streets and at these times Transfer Station at strategic locations will become necessary.

Considering the present location of processing facility in Mysore city, the distance from following wards to the facility will warrant a Transfer Station by 2010.

Table 19: MSW generated from wards in year FY13 and FY20

Ward No	Waste Generation TPD
25	7.74
26	8.15
27	9.86
28	11.32
29	7.07
30	5.62
31	5.22
32	8.37
34	24.86
41	5.68
42	7.88
43	6.44
44	7.13
45	12.69
46	7.81
47	10.39
Total Quantity – FY 2013	**146.22**
FY 2020	**244.73**

The ward wise MSW collection has been considered for FY 2013 and the total quantity has been extrapolated for 2020 for sizing of transfer station. The suitable location for sitting this transfer station shall be identified at appropriate time and the cost for establishment is provided in the cost estimate. The parameters of the transfer station are as set out in Table 20.

Table 20: Parameters of Transfer Station

Description	Unit	Quantity
MSW Collection in FY 2020	TPD	244.73
MSW density	MT / Cum	0.8
Volume of MSW	Cum Per Day	305.91
Storage period assumed	Days	3
Total volume of MSW	Cum	917.74
Average height of MSW to be stored	m	1.50
Area required	Sqm	611.83
Additional area required for movement & support facilities		100%
Total Area Required	Sqm	1 ,223.65

2.2.7. Treatment of MSW

Treatment of MSW would be beneficial in many ways and some of the immediate benefits that could be envisaged is extraction of useable products such as compost, reduction in quantity of waste for disposal at sanitary landfill facility and elimination of decomposition of MSW due to open dumping.

i. The MSW collected from various generators would need to be treated before disposal. A compost facility was set up at Vidyaranyapura for this purpose in 2002 for treatment of MSW.

ii. The management, operations and maintenance of the compost facility at Vidyaranyapuram was entrusted to M/s Vennar Organic Fertilizer Private Ltd, Bangalore (Vennar) for which a license agreement was entered into on August 12, 2002, between MCC and Vennar.

iii. The maintenance of plant & machinery was not adequate and the input supplied also varied in quality. Thus, the compost produced was not of good quality (due to presence of plastic particles and finer dust) which directly had an impact on the sales, thereby increasing operating costs. The operations of the facility have been intermittent right from commencement of operations and Vennar had abandoned the project in June 2005. Subsequently, MCC has been operating the facility by deployment of its own staff and resources.

iv. For rehabilitation of the existing facility and carrying out the operations and maintenance of the compost facility, a private operator would be selected in accordance with the KTPP act.

a. Review of technical/ management practices adopted at the facility

A broad review of the technical and management practices with specific attention to the biological process requirements would be carried out. A detailed analysis would include the following issues.

- Process technology
- Windrow operations
- Plant operations
- Packing & Storing
- Modifications / repairs / replacement required

- Platform, buildings, infrastructure like roads, drains, leachate tanks etc
- Equipment – process machinery, hydraulic packs, material handling machinery, packing machinery
- Electrical equipment – DG, MCCs, LT switch gears etc
- Manpower – present level, qualification, training, future requirement
- General Maintenance of Plant & Machinery
- Product Quality
- Environmental Issues
- Safety & Hygienic conditions.

v. Rehabilitation and Resettlement

The activities required for reviving the operations of the compost facility include rehabilitation of the project facilities and other cost saving measures. The rehabilitation works required have been assessed based on the current status of the project facilities, as discussed in the previous section, based on which the costs towards the same have also been estimated. The rehabilitation works required for civil structures & infrastructure, plant & machinery and electrical equipment are set out in the table below.

Civil Structures and Infrastructure

The rehabilitation works envisaged under civil structures and infrastructure comprises:

Table 21: Civil structures and infrastructure for compost facility

Sl.No	Building / component	Modification / repairs required
A	**Windrow platform**	
1	Platform	No modifications / repairs are required
2	Leachate drains	The garbage to be removed & good leachate drain along the northern end of the platform to be constructed as per the msw rules, 2000
3	Water lines / leachate recycle line	It is preferable to have permanent water line & leachate recycle lines provided along the periphery of the platform, from where flexible hoses can be used
B	**Digested garbage storage shed**	
1	Structure	White washing of underside of ac sheet roofing

Sl.No	Building / component	Modification / repairs required
2	Flooring	No modifications / repairs are required
C	**Preparatory section**	
1	Structure	No modifications / repairs are required
2	Flooring & side walls	No modifications / repairs are required
D	**Semi finished product storage shed**	
1	Structure	White washing of underside of ac sheet roofing and changing of few ac sheets to translucent frp sheets to improve the lighting condition
2	Flooring & side walls	No modifications / repairs are required
E	**Finishing tower**	
1	Outer structure	White washing of underside of ac sheet roofing and changing of few ac sheets to translucent frp sheets to improve the lighting condition
2	Finishing tower structure	Generally in good condition but flooring needs repair at some places
3	Flooring & side walls	No modifications / repairs are required
F	**Finished product (loose & pack) storage**	
1	Structure	White washing of underside of ac sheet roofing
3	Flooring & side walls	No modifications / repairs are required
G	**Weigh bridge & gate house**	
1	Weigh bridge	Needs minor maintenance like scrapping of rust & repainting
2	Gate house	Needs repainting
H	**Office & laboratory**	
1	Structure	Bath room needs renovation especially plumbing works
2	Flooring & side walls	No modifications / repairs are required
I	**Dg room & mcc**	
1	Structure	No modifications / repairs are required
2	Flooring & side walls	No modifications / repairs are required
J	**Slurry tanks**	
1	Structure	No modifications / repairs are required
2	Plumbing work	Needs minor repair
K	**Over head tank**	
1	Structure	No modifications / repairs are required
L	**Labour rest room**	
1	Structure	No modifications / repairs are required
M	**Compound wall & gate**	
1	Structure	
2	Gate	Needs painting & minor repair work
N	**Roads**	
1	Structure	Needs cleaning & re-topping
O	**Strom drains & greenery**	
1	Strom drain	Needs realignment & minor repair
2	Greenery	Can be improved with tree plantation

Plant and Machinery

The rehabilitation works envisaged under plant and machinery comprises:

Table 22: Plant and machinery for compost plant

Sl. No	Section / Machinery	Modification / Repair Required
A	**PREPARATORY SECTION**	
1	**Chain drag Conveyor "Z" type - 10 TPH** Length – 7.7 m Cen – Cen Width – 1.1 M Height 1.5 m hopper Speed 2 m / min Type-hydraulic operated Power – 3.75 HP	Entire chain link with belt and side flop need to be replaced. Laminated chain pitch 75 mm rolled section with UHMW Line
		3 ply Buta Nitrile Rubber Belt
		MS Side cover need to be replaced. 14 SWG thick CRCA sheet
2	**Trommel screen - 35 mm - 10 TPH** Length – 7.0 m Dia – 1.65 M Speed – 6-8 RPM Type-hydraulic operated Power – 3.75 HP	MS Side cover need to be replaced. 14 SWG thick CRCA sheet
3	**35 mm Accept conveyor "Z" Type - 8 TPH** Length – 12.0 m Cen – cen Width – 0.9 M Speed 20 m / min Type-hydraulic operated Power – 3.75 HP	Entire chain link with belt and side flop need to be replaced. Laminated chain pitch 75 mm rolled section with UHMW Line
		3 ply Buta Nitrile Rubber Belt
4	**35 mm Reject conveyor "L" Type - 2 TPH** Length – 7.25 m Cen – Cen Width – 0.9 M Speed 20 m / min Type-hydraulic operated Power – 2.5 HP	Entire chain link with belt and side flop need to be replaced. Laminated chain pitch 75 mm rolled section with UHMW Line
		3 ply Buta Nitrile Rubber Belt
5	**Trommel screen - 16 mm - 8 TPH** Length – 7.0 m Dia – 1.65 M Speed – 6-8 RPM Type-hydraulic operated Power – 3.75 HP	MS Side cover needs to be replaced. 14 SWG thick CRCA sheet

Sl. No	Section / Machinery	Modification / Repair Required
6	**16 mm Accept conveyor "L" Type - 8 TPH** Length – 12.0 m Cen – cen Width – 0.9 M Speed 20 m / min Type-hydraulic operated Power – 1.25 HP	Entire chain link with belt and side flop need to be replaced. Laminated chain pitch 75 mm rolled section with UHMW Line
		3 ply Buta Nitrile Rubber Belt
7	**16 mm Reject conveyor "L" Type - 2 TPH** Length – 7.25 m Cen – cen Width – 0.9 M Speed 20 m / min Type-hydraulic operated Power – 1.25 HP	Entire chain link with belt and side flop need to be replaced. Laminated chain pitch 75 mm rolled section with UHMW Line
		3 ply Buta Nitrile Rubber Belt
8	**Bucket elevator - 8 TPH** Length – 0.6 m Width – 1.0 M Height – 11.5 m Speed 42 RPM Bucket – 125 x 175 x 415 mm Type-electrically operated Power – 5 HP	Entire chain link with belt and side flop need to be replaced. Laminated chain pitch 65 mm with K-2 attachment,EN-8 laminated
		All the buckets are to be replaced with new MS fabricated buckets / PVC with lined buckets - 125 x 175 x 415 mm size buckets needed
		New Vibro bypass chute to be provided
B	**FINISHING SECTION**	
1	**Vibro Screen - 6mm – 7TPH** Length – 1.8 m Width – 1.2 M Speed 900 RPM Type-electrically operated Power – 3 HP	New screen to be fixed with proper supports
2	**Vibro Accept / Bucket elevator feeder conveyor "L" Type - 7 TPH** Length – 7.5 m Cen – cen Width – 0.4 M Height – 0.4 m Speed 20 m / min Type-hydraulic operated Power – 2.5 HP	Entire chain link with belt and side flop need to be replaced. Laminated chain pitch 75 mm rolled section with UHMW Line
3	**Vibro Reject conveyor "L" Type - 2.5 TPH** Length – 5.75 m Cen – cen Width – 0.65 M Speed 20 m / min	Entire chain link with belt and side flop need to be replaced. Laminated chain pitch 75 mm rolled section with UHMW Line

Sl. No	Section / Machinery	Modification / Repair Required
	Type-electrically operated Power – 2.0 HP	3 ply Buta Nitrile Rubber Belt
4	**Bucket elevator - 7 TPH** Length – 0.6 m Width – 1.0 M Height – 12.5 m Bucket – 125 x 175 x 415 mm Speed 42 RPM Type-electrically operated Power – 5 HP	Entire chain link need to be replaced. Laminated chain pitch 65 mm with K-2 attachment, EN-8 laminated. Sprocket need to be reconditioned
		Delivery chute to be replaced
5	**Asperator separator-7TPH** Length – 1.8 m Dia – 1.2 M Drum Speed 25 RPM Blower speed 1600 RPM Air Lock – 25 RPM Type-electrically and hydraulically operated Hydraulic Power – Drum hydraulic – 1.25 HP Power – blower – 15 HP Airlock – 1 HP	Entire cover of the Asperator separator should be replaced
		Cyclone separator cover should be replaced
6	**Destoner - 2TPH** Length – 0.75 m Width – 0.75 M Speed - 900 RPM Type-electrically operated Power – 5 HP	Delivery chute need to be modified to provide suitable packing facility
7	**Bucket elevator - 3 TPH** Length – 0.4 m Width – 0.9 M Height – 8.6 m Bucket – 125 x 200 x 415 mm Speed 42 RPM Type-electrically operated Power – 3 HP	Entire chain link need to be replaced. Laminated chain pitch 65 mm with K-2 attachment, EN-8 laminated. Sprocket need to be reconditioned Delivery chute to be replaced
C	**Storage Section**	
1	**Storage conveyors**	This conveyor is not required for the present operation and hence no need to rectify the same
	Length – 6.0 m Cen – cen Width – 0.5 M Speed 20 m / min Type-Hydraulically operated Power – 1.25 HP	
	Length – 22.5 m Cen – cen Width – 0.4 M	

Sl. No	Section / Machinery	Modification / Repair Required
	Speed 20 m / min Type-Hydraulically operated Power – 5.0 HP	
2	**Vibro Screen - 4mm** Length – 1.8 m Width – 1.2 M Speed 900 RPM Type-electrically operated Power – 3 HP	New screen to be fixed with proper supports
3	**Vibro Accept / Bucket elevator feeder conveyor "L" Type – 1.3 TPH** Length – 5.75 m Cen – cen Width – 0.4 M Speed 20 m / min Type-electrically operated Power – 2.0 HP	Entire conveyor need to be replaced
4	Liquid Add Mixer Length – 6.0 m Cen – cen Width – 0.6 M Speed 10 m / min Type-electrically operated Power – 5.0 HP	No modifications / repairs are required
D	**Hydraulic Power Packs**	Entire hydraulic line with hose pipes need to be replaced Leakage in the cooling water line to be arrested
	750 x 750 x 600 mm Power - 10 HP – 2 nos 750 x 750 x 1200 mm Power - 15 HP	

Electrical Equipment

The rehabilitation works envisaged under electrical equipment comprise:

Table 23: Electrical works for compost facility

Sl. No	Section / Machinery	Modification / Repair Required
A	**Vibro Screen - 6mm**	
		Incoming cable from the cable tray to be clamped as per industrial practice
B	**LIGHTING**	
1	Yard	No modifications / repairs are required
2	Digested Garbage Shed	All the non working (4 nos) including entire switch boards needs to be replaced

Sl. No	Section / Machinery	Modification / Repair Required
3	Process Area	Light fitting reflector dooms, holders, lamps, covers to be replaced where ever is required
3	Three phase 20 A metal clad socket	Adequate size of twin earth conductor to be laid from the near by earth grid.
C	**MCC Panel**	
1	MCC Panel for Plant	The entire MCC panel to be reconditioned, replacing the defective components in the feeders / Starters.
2	Cable Trench Cover	MCC room Cable trench to be cleaned, cover to be provided with concrete slab of suitable size
D	**DG Set**	
1	Diesel Engine	Engine to be taken for periodic over hauling
2	Alternator	Alternator need to be over hauled for periodic maintenance.
E	**MV Panel**	
1	MV panel	Periodic maintenance to be carried, Bus bar connections needs to be tightened
2	APFC panel	Power capacitor needs to be replaced with same size of capacitors.

vi. The capacity of the existing compost facility is 200 tonnes per day (TPD) with an increase in population of the city over the years along with an increase in geographical spread, there could be a need for an additional compost facility and hence it is proposed to develop and additional compost facility in the year 2011. The locations for the same would be identified during the same period.

2.2.8. Incinerator for disposal of dead animal carcass

The composition of waste that is generated in the city comprises bio degradable waste, municipal solid waste, hazardous waste (from hospitals) and dead animal carcass. As the strategy is focused towards only collection, transportation, treatment and disposal of MSW generated from various sources, the treatment and disposal of hazardous waste is undertaken in the existing bio medical plant. However, there is a need for disposal of dead animal carcasses.

A provision for installation of incinerator facility has been proposed in the project for disposal of animal carcasses. The purpose of an incinerator is to reduce the toxic

waste from animal carcasses by controlled combustion at high temperature thereby reducing the product into a disposable material.

The design of the incinerator is categorized into two stages based on the combustion process. The first stage would be primary combustion chamber wherein the dead carcass would be further processed by drying, physical separation of water & carbon dioxide, decomposition of all compounds and combustibles and burning the carbon in a controlled environment.

The second stage would be intensive process of combustion wherein the semi blistered matter would be partially burnt in gaseous form, resulting in complete conversion of dead carcass into ashes. This stage would also result in destruction of pathogens in a controlled environment.

Capacity of the incinerator

The capacity of the incinerator ranges from 100 kg to 500 kg. The capacity of the incinerator that would be installed would be of 300 kg. The end product weight obtained after the combustion by incinerator would be 10% of the original weight. To operate the incinerator with 300 kg capacity, a total of 50-70 liters of diesel would be required.

For operating and maintaining the incinerator facility a private operator would be selected by MCC through a competitive bidding process as per the KTPP Act.

2.2.9. Sanitary Landfill facility

Disposal of MSW is an essential requirement for a city like Mysore as 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 90 MT capacity, adjacent to the compost facility on an area of approximately 34 acres. The detailed design such as sanitary landfill design life / standards for land filling / planning and design process / landfill layout plan / landfill soil properties / leachate drainage, collection and removal system / liner system and final cover system of the proposed sanitary landfill facility is set out in **Annexure 25.**

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 Municipal Solid Wastes (Management and Handling) Rules, 2000, Schedule III, 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 25 years after the "active" period is completed.

The active life period for the present project is calculated for mixed garbage scenario with compost plant.

Table 24: Active Life Span of Sanitary Landfill Site

Year	From Segregation Platform in MT/Day		Non - Biodegradable MSW to Landfill in MT		Total Quantity per Year in Cum	Cumulative Quantity in Cum
	In MT	In Cum	In MT	In Cum		
1	74.23	92.79	78.50	56.07	54337	54,337
2	79.90	99.88	79.98	57.13	57309	111,646
3	86.00	107.50	81.58	58.27	60507	172,153
4	92.57	115.71	83.29	59.49	63950	236,102
5	99.64	124.55	85.13	60.81	67655	303,757
6	107.24	134.06	87.12	62.23	71643	375,401
7	115.43	144.29	89.25	63.75	75936	451,337
8	124.25	155.31	91.55	65.40	80557	531,894
9	133.73	167.17	94.03	67.16	85530	617,425
10	143.94	179.93	96.69	69.07	90884	708,308
11	154.93	193.67	99.56	71.12	96645	804,954
12	166.76	208.45	102.65	73.32	102847	907,801

Year	From Segregation Platform in MT/Day		Non - Biodegradable MSW to Landfill in MT		Total Quantity per Year in Cum	Cumulative Quantity in Cum
	In MT	In Cum	In MT	In Cum		
13	179.49	224.37	105.97	75.69	109523	1,017,323
14	193.20	241.50	109.55	78.25	116707	1,134,031
15	207.95	259.94	113.40	81.00	124441	1,258,472
16	223.83	279.78	117.54	83.96	132765	1,391,237
17	240.92	301.14	122.00	87.14	141724	1,532,961
18	259.31	324.14	126.80	90.57	151368	1,684,329
19	279.11	348.89	131.96	94.26	161748	1,846,077
20	300.42	375.52	137.52	98.23	172920	2,018,997

Considering the above, the "active" design life of Vidyaraniyapuram site is 17 years & 8.40 months. Though, it does not meet the MSW 2000 Rules recommendation of 25 years of "active" life cycle, in the coming years it is expected that the non bio degradable volume will come down due to implementation of source segregation at household level and greater segregation of bio degradable waste at segregation platform of microbial compost facility.

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)
h. Landfill gas management facilities
i. Leachate monitoring wells

Though, the Vidyaranyapuram site can be considered as integrated municipal solid waste management plant, 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 plan and Vidyaranyapuram site is rectangular in shape. The shape and the design of the sanitary landfill facility is set out in **Annexure H.**

2.2.10. Information, Education & Communication (IEC) Strategy

Stakeholders' involvement in the waste management activity of the city is crucial for the success of the proposed MSW strategy. Towards enhancing the stakeholders' involvement in municipal solid waste management, IEC activities are proposed to be carried out. The selected private operator(s) would be responsible for implementing the IEC activities in their respective zones/ wards.

i. Development of IEC material

The IEC material required for the campaign would be developed by The State Resource Centre for planning and designing in Mysore. The material would include manuals, flipcharts, posters, audio visual tapes, etc.

ii. Target Groups

The target groups identified for the IEC activities include general public, bulk generators/ commercial establishments, restaurants, markets, educational institutions, youth clubs, social clubs like Rotary Club & Lion Club, RWAs/ SHGs etc. The informal sector such as rag pickers, waste recyclers, etc would also form an important target group.

iii. IEC Activities

The various IEC activities could include:

- Door to door campaigns
- Workshops and training programmes for SWM staff, Area Sabha Members, RWAs/ SHGs, etc.

- Dissemination of IEC Material such as pamphlets, posters, etc
- Erection of Radium boards with messages related to SWM
- Interactive sessions with the press
- Short plays in schools/ colleges for educating children and youth on the importance of solid waste management, segregation of waste, proper treatment and disposal methods, etc

iv. Mass Media & Electronic Media Campaigns

- Promotional campaigns on radio channels (40 seconds of airtime spread out in 10 second intervals during the day)
- Promotional campaigns on television. (10 second slots between 8 and 10 pm on any three locally popular television channels)
- Daily announcement in autos regarding waste management themes, such as segregation of waste, hazards of using thin plastic covers, etc.
- Advertisements in newspapers

For effective implementation of the proposed IEC activities and campaigns, an NGO would be identified to coordinate with the private operator(s), MCC, the community and SHGs/ RWAs of the various wards. The terms of reference for the NGO would be as set out in Appendix 2 of the State SWM Policy.

2.3. Environmental compliance / Protection measures / improvement measures

2.3.1. MSW and Environment

With rapid urbanization and growth of industry & business has led to increased waste generation but the infrastructure development for solid waste 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 waste 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.

2.3.2. Environmental Impact Assessment

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 mitigative measures

Table 25: EIA and mitigative 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 4. Water contamination 5. Disposal of excess earth. 6. Disturbance to other services 7. Safety of residents and road users in the implementation area. 8. Noise pollution due to the use of machinery and movement of traffic in sensitive locations	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 construction equipments 4. Any construction activity should ensure that the water bodies are not contaminated 5. The excess earth should be transported to designated place and shall be used for filling and covers 6. Any shifting of cable / utility lines should be attended with minimum period of disturbance. 7. Provision of temporary crossings/bridges wherever necessary to facilitate normal movement. 8. Use of less noise generating equipment and avoiding activities during night.
Operation and Maintenance		
Open storage of Solid waste before landfilling	1. Flying of waste materials and emission of dust particles 2. Bad smell and odour and generation of methane gas 3. Menace of flying birds and breeding of houseflies and mobility of stray dogs in the area	1. Coverage of storage area with polythene sheets to prevent the spread of waste materials and generation of dust. 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. Covering of the temporary dump areas with polythene sheets, use of repellents and close fencing of the area.

2.3.3. 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.

Table 26: Potential Impacts and Mitigative Measures

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

2.3.4. Project specific impacts and mitigative measures

The impact due to disposal of MSW at the landfill site and the mitigative measure are set out in this section.

(i.) Impact due to Emission of Green House Gases such as Methane and Carbon Monoxide

Impact Statement

The anaerobic decomposition of organic part of solid waste 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.

(ii.) 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 Measure

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.

(iii.) Impact due to Vehicle Exhaust Emissions

Impact Statement

A number of vehicles would ply every day from MCC 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.

(iv.) Odour Impacts due to Landfill Activities

Impact Statement

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

Mitigative Measure

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.

(v.) 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 Mysore. 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

(vi.) 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.

(vii.) 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.

(viii.) 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.

2.4. Rehabilitation & Resettlement

For the collection and transportation of MSW from various wards, the rehabilitation and resettlement of existing physical structures would not be required. Rehabilitation of the existing compost facility is envisaged for treatment of biodegradable waste. The rehabilitation works would be required for electrical works, civil works, plant and machinery. For landfill, rehabilitation and resettlement would not be required as the land identified is unoccupied and has no physical infrastructure or any settlements that would require rehabilitation.

2.5. Specialized Services for Design, Independent Supervision & Quality Assurance

MCC could utilize the services of the private operator in various stages for providing MSW services, like procurement of vehicles & equipments for primary collection & street sweeping, designing, operating & maintaining compost and landfill facilities. The private operator would be selected based on the transparent bidding process according to the KTPP act. For monitoring the services of the

private operator, an independent consultant / project engineer would be appointed by MCC.

(a) Design

MCC has procured the services of a Consultant for preparation of an Integrated MSW management strategy & DPR under a public private partnership framework. The consultant has undertaken separate studies for each of the activities in the SWM chain, i.e., collection & transportation, rehabilitation of existing compost facility and development of a landfill facility. Strategy reports for each of the activities were prepared and presented to the stakeholders. The same are enclosed in **Annexure 25.** An integrated DPR was then prepared incorporating the strategies of the various components.

(b) Supervision

A Project Management Consultant (PMC) would be engaged by MCC for overall supervision and monitoring of collection, transportation, treatment and disposal activities in the SWM chain. The broad responsibilities of the PMC are as follows:

- Monitor collection and transportation activities in each ward that would be undertaken by private contractors.

- For rehabilitation of the existing compost facility the private operator would be selected by MCC to undertake various activities such as designing, procuring, constructing, operating and maintaining the compost facility. The PMC would over see the performance during the construction phase and operating period to meet the design construction requirements and MSW rules in treatment and disposal activities.

The draft scope of work for PMC is set out in **Annexure 26**.

2.6. Other information

2.6.1. Surveys & Investigations

The surveys carried out for development of landfill facility includes topographic survey and soil survey. A brief description of the surveys is set out in this section

1 Topography survey

A detailed topography survey had been carried out covering boundary survey, which included taking spot levels at every 5m intervals, topographic survey of locating various permanent structures such as buildings, trees, roads etc and, preparation of survey drawing & spot levels, contour map at 0.50 m interval and identification of approach road

2 Soil Survey

The soil survey included boring in all types of soil upto 6m depth or upto the refusal stratum with N value over 50 & conducting permeability test to determine the "k" value of the soil (2 soil samples) including various laboratory tests like Atterberg's Limits, sieve analysis, hydrometer analysis, natural moisture content, specific gravity etc

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

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

Table 27: List of clearances from statutory bodies

Statutory Body	Requirement
1) Mysore Municipal Corporation	Concession Agreement, building plan approvals
2) KSPCB	Under Air & Water Act
3) Department of Environment, Karnataka	As the project comes under Category B as per MoEF Act for EIA, Public consultation etc
4) Water supply and Sewerage Board	Water supply and Sewerage Projects, related, pipelines and other constructions

3. PROJECT COST

3.1. Land acquisition

Land required for storage of MSW from primary collection, compost facility and landfill facility for disposal of MSW has been identified and the same has been in possession of MCC. Hence the cost for land acquisition is not considered in estimation of the services delivered for MSW activities.

3.2. Physical Infrastructure Component-wise Cost

The cost for provision of MSW management services has been estimated for the four components namely collection of MSW from households / bulk generators / street sweeping, transportation, secondary storages and disposal.

3.2.1. Collection & Transportation

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

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

b. Pushcarts and litter bins for primary collection form slum areas;

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

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

The total cost for procurement of the tools/equipments/vehicles is set out in Table 28.

Table 28: Additional investment estimated for MSW management

Sl. No.	Component	Estimated Requirement	Per Unit Cost (Rs. Lakhs)	Total Cost (In Lakhs)
1	Primary Collection			
A	Auto Tippers	168	2.50	420.0
B	Pushcarts	480	0.083	40.0
C	Litter bins	943	0.003	3.0
2	Street Sweeping			
A	Pushcarts	389	0.083	32

Sl. No.	Component	Estimated Requirement	Per Unit Cost (Rs. Lakhs)	Total Cost (In Lakhs)
B	Other Equipment	Lumpsum		42
3	Secondary Storage			
A	4.5 cubic meter capacity secondary containers	205	0.45	92.25
B	7 cubic meter capacity secondary containers	66	0.58	38.28
C	Litter Bins for Heritage Walk area	50	0.05	2.5
4	Transportation Vehicles			
A	Dumper Placers			
	Twin load dumper placer	21	11.2	236.0
	Single Load dumper placer	14	13.0	182.0
	GPS(Control terminal and instrument cost)	lumpsum		28.7
B	Tractor Placers	11	5.00	55.0
C	Compactor	2	11.0	22.2
Grand Total				**1191.8**

The estimates have been done based on the quotations received for physical infrastructure components for collection and transportation of MSW from various suppliers and the same has been set out in **Annexure 22**.

For carrying out MSW services, MCC has acquired some equipments and vehicles; the same is listed out in the table below.

Table 29: Tools and equipments with MCC

S No.	Description	Available with MCC
1	**Street Sweeping**	
A	Push Carts	90
B	Other street sweeping equipment	0
	Sub - total	90
2	**Transportation of MSW**	
A	Twin Load dumper placers	2
B	Single carrier dumper placers	0
C	Tractor Placers	19
	Sub - total	21

The estimated cost for net requirements of vehicles and equipments required for collection & transportation services of MSWM are set out in Table 31.

Table 30: Estimated cost for Net requirement for tools and equipment (in lakhs)

S No.	Description	Estimated Requirement	Cost (Rs. Lakhs)
1	**Primary Collection**		

S No.	Description	Estimated Requirement	Cost (Rs. Lakhs)
a	Auto Tippers	168	420.0
b	Push Carts	480	40.0
c	Litter Bins	943	3.0
2	**Street Sweeping**		
a	Push Carts	299	25.0
b	Other street sweeping equipment		42.0
3	**Secondary Storage of MSW**		
a	4.5 cubic meter capacity DBs	205	92.2
b	7 cubic meter capacity DBs	66	38.2
c	Litter Bins for Heritage Walk area	50	2.5
4	**Transportation of MSW**		
a	Twin Load dumper placers	19	213
b	Single carrier dumper placers	14	182
c	Tractor Placers	0	0.0
d	Compactor	2	*22.0*
	Grand Total		**1079.5**

3.2.2. Transfer Station

For setting up a transfer station the infrastructure required includes civil works, machinery and electrical works. As the transfer station would be designed for storage period of three days, the total volume of MSW is estimated to be 917.74 cubic meter. The total capital cost for setting up of a transfer station is set out in the table below.

Table 31: Capital cost for setting up a transfer station *(In Rs lakhs)*

Sl. No	Detail	Quantity	Cost per Unit	Total Cost (Rs. Lakhs)
1	Civil Works	1223.65 Sq m	Rs. 4500 per Sqm	55.00
2	JCB for shifting MSW	1 No	Rs. 22.00 Lakhs	22.00
3	Electrical & Yard Lighting	Lot	Rs. 8.50 Lakhs	8.50
	Total for One Transfer Station			**85.50**

3.2.3. Rehabilitation of existing compost facility

The physical infrastructure components required in the rehabilitation of the existing compost facility would include the following:

a. Equipments for civil works
b. Electrical equipments for the compost facility and

c. Machinery for compost facility.

The estimated cost for procuring the above is set out in the table below.

Table 32: Cost of procurement for tools/equipments/vehicles

Sl. No	Component	Cost (Rs. Lakhs)
I	**CIVIL WORKS (BUILDING AND INFRASTRUCTURE)**	
A	Windrow Platform	
1	Leachate drain (75m long, 0.5m wide)	0.86
2	Water line & leachate line (250 m long)	1.00
B	Digested Garbage Storage Shed	
1	White washing of AC sheets	0.14
C	Semi Finished Product Storage Shed	
1	White washing of AC sheets	0.41
2	Providing GRP sheets for lighting (10 sqm)	0.09
D	Finishing Tower	
1	White washing of AC sheets	0.13
2	Providing GRP sheets for lighting (5 sqm)	0.04
3	Steel flooring repair	0.50
E	Finished product (loose & pack) storage	
1	White washing of AC sheets	0.15
F	Office & Laboratory	
1	Plumbing works, tiling etc	0.50
G	Roads	
1	Strom drain realignment	0.75
	Total for Buildings & Infrastructure	**4.56**
II	**MACHINERY WORKS**	
A	Pre-sorting Section including feeder, cage drum, reject / sorting / transfer conveyors, power pack etc	71.12
B	Preparatory Section	
1	Chain drag Conveyor "Z" type - 10 TPH	
2	Trommel screen - 35 mm - 10 TPH	
3	35 mm Accept conveyor "Z" Type - 8 TPH	
4	35 mm Reject conveyor "L" Type - 2 TPH	
5	Trommel screen - 16 mm - 8 TPH	
6	16 mm Accept conveyor "L" Type - 8 TPH	
7	16 mm Reject conveyor "L" Type - 2 TPH	
8	Bucket elevator - 8 TPH	51.26
C	Finishing Section	
1	Vibro Screen - 6mm – 7TPH	114.04

Sl. No	Component	Cost (Rs. Lakhs)
2	Vibro Accept / Bucket elevator feeder conveyor "L" Type - 7 TPH	
3	Vibro Reject conveyor "L" Type - 2.5 TPH	
4	Bucket elevator - 7 TPH	
5	Asperator separator-7TPH	
6	Destoner - 2TPH	
7	Bucket elevator - 3 TPH	
D	Storage Section	
1	Storage conveyors	
2	Vibro Screen - 4mm	
3	Vibro Accept / Bucket elevator feeder conveyor "L" Type – 1.3 TPH	
4	Liquid Add Mixer	
5	Distributor chain conveyor	
E	General	
	Total for Machinery	**236.42**
III	**ELECTRICAL WORKS**	
1	150 KVA Transformer	0.28
2	Switch board unit	1.39
3	DG SET	2.30
4	Internal and external lighting	1.81
5	Saftey equipments	0.20
6	Lab equipments, furniture and utilities	3.48
7	Backhoe excavator loader	4.00
8	Skid steer loader	3.17
	Total for Electrical	**16.62**

3.2.4. Incinerator for disposal of animal carcass

The cost for installing an incinerator for disposal of animal carcass is estimated at Rs. 80 lakhs.

3.2.5. Development of Landfill facility

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

Table 33: Cost of development of landfill facility *(in Rs. lakhs)*

Sl. No	Description	Cost (Rs. Lakhs)
1	Civil & Landfill works	1,371.73
2	Electrical & Street Lighting Works	11.20
3	Landfill Machinery	182.50
4	Lysimeters, tubewells etc	39.54
5	Contingency @ 5% of cost	80.25
	Total	**1,685.21**

The detailed BOQ and the schedule of rates for each of the components described above are set out in **Annexure 27.**

It has been assumed that the capital expenditure for development of the facility would be paid to the private operator in two installments. An upfront payment equal to 50% of the JNNURM assistance for treatment and disposal facilities would be provided to the private operator and subsequently the remaining 50% would be released to the private operator on the 1st anniversary upon completion of the construction. This would reduce the tipping fee and thereby the strain on the finances of MCC and the private operator.

3.3. Environmental Compliance Cost

Once the compost and landfill facility is in operation, routine monitoring and quality control of environmental parameters would need to be carried out. The project proponents would make arrangements for the necessary monitoring programme as per the guidelines of MSW Rules 2000. For ensuring quality standards, the existing laboratory at the composting facility will be upgraded and suitably staffed to meet the requirements of both compost facility & sanitary landfill as per the provisions of MSW Rules 2000. For effective environmental management of the proposed compost & sanitary landfill facility, a full-fledged 'Environment Cell' will be set up with trained staff. The cell will be staffed with an Environmental Engineer having a civil engineering background, a chemist and laboratory assistant with experience in compost testing, and other O&M staff. All employees in O&M would be trained on environmental safety aspects. If required, assistance from external Consultants would also be considered. A green space would also be maintained around the facility, under the expert advice of qualified local Agriculturist / Horticulturist / Botanist. About 3000 saplings would be planted in the 6 m green cover area and other open spaces at the compost and landfill facility.

To monitor the implementation of the proposed EMP a core committee involving project management proponents, representatives from nearby villages, citizen's committee and NGOs would be formed. The estimated cost for environmental compliance is set out in Table 35.

Table 34: Total cost for environmental compliance

Description	Unit cost (in Rs)	Total cost (Rs/year)
1. Cost of planting and maintenance		
Local species such as Neem, Jack fruit, shrubs & Tulsi (in between trees)	125 + 3000 (maintenance)	1,90,500
Local species such as Amaltas, Gulmohar, Mango	125 + 4000 (maintenance)	1,91,500
2. Manpower cost for Environmental Management		
Salary of Environmental Engineer with 5 years of experience including all perks	15,000 per month	1,80,000
3. Cost for laboratory equipment		2,50,000
3. Monitoring cost		
Micrometeorological Monitoring (Including Ambient air quality monitoring - Two times per year @ two locations)	20,000	80,000
Ground Water Sample Analysis (1 sample @ 3 locations, six times per year)	8000	1,44,000
Noise Level Monitoring (4 times per year @ 3 locations)	3000	36,000
Soil sample collection and analysis (twice a year)	2000	4000
Grand Total		**10,76,000**

3.4. Rehabilitation & Resettlement Cost

The rehabilitation and resettlement cost for various MSWM services is set out below.

3.4.1. Collection and transportation

As MSW from various generators would be collected by the pushcarts and auto tippers, there would be no rehabilitation of existing physical infrastructure and resettlement of any facilities, and hence the cost for rehabilitation and resettlement is not envisaged.

3.4.2. Secondary storage

The land required for secondary storage of MSW collected from various generators would be stored in secondary containers at the street corners. Cost for rehabilitation and resettlement of existing physical infrastructure for this service is not envisaged.

3.4.3. Compost facility and landfill facility

The compost facility developed by MCC at Vidyaranyapura would need to be rehabilitated for which a private operator would be selected. The cost for rehabilitation of the compost facility is detailed in section 3.2.3.

For the development of landfill facility, the land has been identified (adjacent to existing compost facility) and is in possession with MCC, hence rehabilitation and resettlement cost for the same is not envisaged.

3.5. Cost of Surveys & Investigations

Surveys and investigations would need to be carried out for various activities of MSWM services. The cost for the same is set out below.

Table 35: Cost of Surveys & Investigations

Sl. N.o	Description	Cost (Rs. Lakhs)
1	Topography Survey	0.25
2	Geophysical Survey	4.50
3	Geotechnical Survey	1.00
4	Ground Water Characteristics	0.50
5	REIA	7.50
Total		**13.75**

3.6. Cost of shifting utilities

As the development shall takes place only in the existing composting plant & landfill site, which is a barren virgin land, no utilities need to be shifted and hence no provision has been made towards this head.

3.7. Cost of consultancy services

(i) Design

MCC has prepared an Integrated MSW management plan & DPR under a public private partnership framework. About 2% of the total project cost has been spent in

the design and conducting of technical studies. The expenditure incurred for the same is being met out of the Project Development Fund (PDF) vested with Infrastructure Development Department (IDD), Government of Karnataka. This amount would need to be replenished to the PDF.

(ii) Supervision

A Project Management Consultant (PMC) would be engaged by MCC for overall supervision and monitoring of collection, transportation, treatment and disposal activities in the MSW chain. The cost for engaging a PMC is estimated at 2.5 per cent of the total project cost.

3.8. Other statutory compliance costs

Other costs towards statutory compliance include travel, application fees, deposits, documentation, etc, which is estimated at Rs. 3 lakhs.

3.9. Finance/ interest cost during construction

Interest cost during construction is estimated at 12 per cent of the total project cost.

3.10. Contingency

Five percent of the total project cost has been proposed for contingency purposes.

Other assumptions for estimation of project cost for integrated MSW management is set out in **Annexure 28**.

3.11. Other costs / Summary of costs

The summary of the cost for implementation of Integrated MSWM services is set out in Table 36.

Table 36: Summary of Project Cost *(in Rs Crores)*

SL No.	Description	Amount (Rs. Crores)
1	Land Acquisition	0.0
2	Physical Infrastructure Components	32.2
a	*Collection and Transportation*	*10.8*
b	*Compost Facility*	*2.6*
c	*Landfill Facility*	*16.9*
d	*Incinerator for dead animals*	*0.8*

SL No.	Description	Amount (Rs. Crores)
e	*Transfer Station*	*0.9*
f	*GPS*	*0.3*
3	Environmental Cost	0.1
4	Rehabilitation and resettlement cost	0.0
5	Surveys and Investigations	0.1
6	Cost of Shifting utilities	0.0
7	Consultancy Services	0.8
8	Other staturay compliance cost	0.03
9	Contingency	1.6
	Grand Total	**34.85**

4. PROJECT INSTITUTION FRAMEWORK

4.1. Roles of different institutions

Effective provision of MSW management services would require co-ordinated effort by various stakeholders. The stakeholders in the project comprise RWAs, ULBs, citizens, and private operators. The roles of each stakeholder are presented in the matrix below.

Stakeholder	Role
Citizens	• Carry out segregation of waste at household level • Handover the segregated waste to the primary collection crew at the pre-notified time • Pay user fee for the door-to-door collection service offered • Avoid throwing of waste on streets
Area Sabha Members	• Inform the residents about the proposed MSW Management Plan • Ensure that the residents co-operate and follow all the principles • Appoint primary collection crew for door-to-door collection service • Monitor performance of service providers, wherever required
Private Operator	• Carry out their roles and responsibilities as per the contractual arrangement between them and MCC. • Ensure that the MSW is handled in the manner set out in the contractual arrangement and is not disposed in any other manner whatsoever. • Obtain compliance certificate from the authorities concerned
MCC	• Set out MSW Management Plan • Monitor the works being performed by the private operator • Ensure compliance by RWAs and citizens • Make payments to the private operator

4.1.1. Clean City Campaign

MCC plans to create awareness regarding solid waste management and has scheduled campaigns that would high light the Solid Waste Management, their implications and the methods to reduce and dispose the same in an organized manner. The Clean City Campaign is scheduled to begin on January 1st, 2008 to educate the citizens, Students and other people from other disciplinaries.

4.1.2. Citizens

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

a. Households

The citizens would need to carry out segregation of waste at the household level and hand over the segregated waste to the primary collection crew at the pre-notified time. For availing this service, the citizens shall pay a monthly user fee. Unhygienic disposal of waste on streets would need to be avoided by the citizens.

b. Bulk generators

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

4.1.3. Area Sabha Members (ASM)

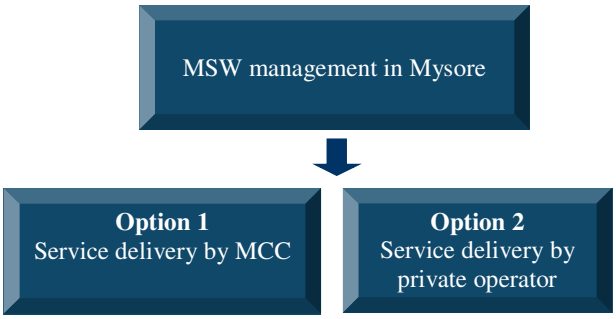
ASM would need to inform the residents about the proposed strategy for MSW management and ensure that the residents co-operate and follow all the principles of safe disposal of waste. ASM shall appoint primary collection crews for door-to-door collection service (either select private operators or utilize the services of Self Help Groups). The residents would need to segregate the waste into biodegrable and non-biodegrable waste and handover the same to the primary collection crew. ASM shall also monitor the performance of the private operators, wherever required. A list of ASM is enclosed in **Annexure 29**.

4.1.4. Mysore City Corporation (MCC)

MCC shall select the private operator based on the contractual agreement and monitor the functions carried out by the private operator. MCC shall also co-ordinate with RWAs in collection and transportation of MSW. MCC shall ensure the private operator performs the daily task of waste collection and transportation from all the sources and also pay the private operator for the services rendered in collection, transportation and disposal of the waste generated.

4.2. Manner of undertaking implementation works

The provision of MSW management services in the city could be carried out under any of the two options set out below.



The advantages of a PPP framework include:

- Private sector stake in project which guarantees their commitment to economic efficiency while serving the public interest
- Equitable risk allocation with reduced level of risk for Government and taxpayers for a rate of return to the private investor
- Access to latest technology and enhanced efficiency
- Better customer focus and delivery
- Access to broader funding sources

Option 1 – Service delivery by MCC

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 MCC in the following manner.

(i) Collection and transportation of MSW

- Procure tools / equipment and vehicles such as auto tippers, pushcarts, secondary containers, 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 rehabilitation of the compost facility and develop the landfill facility
- Hire skilled manpower for carrying out the operations and management of the developed facilities

Option 2 –Service delivery through ASM/ private operator(s) with MCC 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 MSWM would be undertaken by ASM / private operator(s). The ASM / private operator(s) would need to carry out their roles and responsibilities as per the contractual agreement signed with MCC. The involvement of ASM / private operator(s) in various stages in the MSW management chain is detailed below.

i. Primary Collection

Primary Collection of MSW from the households would be carried out by Area Sabha Members (ASM). The ASM could either utilize the services of Self

Help Groups or select private operator(s) for collection of MSW. The ASM would be responsible for door to door collection of waste from the households and transferring the same to the secondary containers from where it would be transported to the treatment/ disposal facility. The ASM would be responsible for identification of collection crew, procurement of tools/ equipment/ vehicles by utilizing the funds provided by MCC and operation & maintenance of the same. The ASM would be required to collect the user charges from the households for provision of door to door collection services as per the resolution dated December 8, 2006 and would be required to meet the O&M expenses within the revenue generated from user charges.

ii. Secondary Collection & Transportation of MSW

MCC would identify private operator(s) for carrying out this activity. The secondary containers, transportation vehicles and other equipment would be procured by the private operator(s) who would also be responsible for O&M of the same. The funds required for procurement would be provided by MCC and the duration of service agreement (between MCC and the private operator) would be co-terminus with the age of the vehicles. The private operator would also be required to make arrangements for parking its vehicles. The tender document (comprising Request for Proposal document and service agreement) for the selection of private operator is set out in **Annexure 30**.

iii. Treatment and landfill facility

MCC would identify private operator(s) for rehabilitation of the existing compost facility and development of landfill facility. The project could be implemented on a BOT concession framework and the salient features of the BOT concession framework is set out **Annexure 31**. 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 MCC. The tender document (including request for proposal and service agreement) for the selection of private operator is set out in **Annexure 32**.

The capital expenditure for development of the facility would be paid by MCC to the private operator in two installments. The first installment would be equal to 50% of the JNNURM assistance for treatment and disposal facilities and would be paid to the private operator on completion of construction of the landfill facility, and subsequently the remaining 50% would be released to the private operator on the 1st anniversary from commercial operations date (COD). The payment mechanism has been structured as it would reduce the

tipping fee and thereby the strain on the finances of MCC and the private operator.

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:

Table 37: Risk Analysis

Options	Parameters	Impact
Service delivery by MCC	Manpower	Recruitment & management of operational staff by MCC
	Skill set	MCC would need to appoint technical consultants for developing a strategy for integrated MSW management and for design and construction of MSW treatment & disposal facilities. MCC 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	MCC would need to mobilize finances for procurement of tools / equipment and vehicles and for development of treatment and disposal 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 MCC.
Service delivery under PPP frameworks	Manpower	MCC 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 MCC, 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 treatment and disposal 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, MCC 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 MCC implements the

project under Option 2, it would need to appoint private sector operators 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 SWM in the city, Option 2 is more suitable for Mysore. Implementation as per Option 2 would ensure utilization of area based resources and private operator(s) in such a mix as to bring in more accountability to the citizens while making monitoring of service delivery easier for MCC.

4.3. Involvement of the implementation entity in the subsequent O&M activities

4.3.1. Collection and transportation

For collection and transportation of MSW no construction entity is required. However, the private operator shall be responsible for operating and maintaining the tools/equipments and vehicles.

4.3.2. Treatment facility

The private operator shall be responsible for undertaking the rehabilitation of the existing facility along with operations and maintenance of the treatment facility.

4.3.3. Landfill facility

Private operator shall be the responsible for development of the sanitary landfill facility along with operating and maintaining the facility and shall comply with the O&M conditions set out in the agreement between MCC and the private operator.

4.4. Areas of involvement of the private sector in the implementation phase

For delivery of MSW services in a cost effective and environmental friendly manner, following are the areas identified for active participation of private sector.

4.4.1. Primary collection

- Door to door collection of segregated waste, storage of segregated MSW in secondary containers.
- Street sweeping, drain cleaning and storing transportation of MSW.

4.4.2. Bulk waste generators

Collection of waste from bulk generators and transferring the same to secondary storage containers demarcated as biodegradable and non biodegradable containers.

4.4.3. Transportation of waste

Transportation of MSW from secondary storage containers by dumper placers to the identified treatment facility / sanitary landfill facility.

4.4.4. Development and maintenance of treatment and disposal facility

Rehabilitation of the existing compost facility and development of landfill facility including operation and maintenance of both the facilities.

Table 38: Areas of involvement of the private sector

Sl No	Areas of Involvement	Whether Applicable	Details
1.	Project Feasibility Study	x	x
2.	Project Engineering Design	✓	Landfill facility and rehabilitation of treatment
3.	Specialized Surveys	✓	Development of landfill facility
4.	Construction Works	✓	Construction of landfill and rehabilitation of treatment facility
5.	Supervision Consultants	✓	During the construction of landfill and treatment facility
6.	Quality Assurance Consultants	✓	Both for treatment facility and landfill facility during construction and O&M period
7.	Any Other	x	x

4.5. Implementation "Packages" for implementation of SWM activities

The various packages envisaged for MSWM services from collection, secondary storage, transportation and disposal of MSW is set out below.

4.5.1. Collection and transportation

For collection and transportation of MSW from various generators and street sweeping, the wards would be designed into packages based on the area and quantum of waste generated. Each package would have designated primary

collection crew responsible for collection and transportation of MSW. MCC could privatize the packages by selecting a private operator(s) based on a competitive bidding process.

4.5.2. Treatment and disposal facility

The compost facility and landfill facility would be operated and maintained by the private operator selected by MCC through a competitive bidding process. The private operators would be responsible for rehabilitation of the existing compost facility, construction of landfill facility and operating & maintaining the compost and landfill facility.

5. PROJECT FINANCIAL STRUCTURING

5.1. Overall Financial Structuring of the Project

The financial structuring is proposed as per the details given in following table. Other than grants from both State and Central government, the project cost is being funded from the internal resources of MCC. The proposed financial structuring for the project is as set in the table below.

Table 39: Financial Structuring of the Project

Sl No	Government	Project contribution source	Amount (Rs. Crores)	% share by specific source	% share by Govt. entity	Remarks (when & how state and ULB shares would be arranged)
1.	Central	ACA Grant	27. 9	80%	80%	JNNURM Grant
2.	State	Grant towards its share in project	3.5	10%	10%	The State government would allocate funds from budgetary allocations.
3.		Loan taken by state govt. towards its share in project	-	-		
4.	ULB/ Parastatal	Devolved funds	1.05	30%	10%	Allocation of funds from Directorate for municipal Administration (DMA) towards procurement of tools and equipments for MSW management activities.
5.		Own surplus resource	2.45	70%		User charges would be collected from various generators as per the Government order. And Funds would be allocated from municipal allocations (budgetary allocation/MSW cess).
6.		Debt/ Term Loan taken from State Govt.	-	-		
7.		Debt/ Term Loan taken from bank/ FI	-	-		

Sl No	Government	Project contribution source	Amount (Rs. Crores)	% share by specific source	% share by Govt. entity	Remarks (when & how state and ULB shares would be arranged)
8.		Debt: from accessing capital market	-	-		
9.		Private equity/ community resource funding; others	-	-		
Total			34.85	100%	100%	

5.2. Review of Options

Institutional debt

For any infrastructure project, use of debt would enable development of more number of projects for given amount of equity source. However, while it is beneficial to use debt funding for the project from the project/promoter's point of view, the decision of the lender/debt financier to provide fund to the project depends on the project cash flows and the debt service coverage provided. In case the project's cash flows do not comfortably support the debt servicing then tying up of debt funds for the project may not be possible. As MSWM projects have limited / no returns, the project is envisaged to be developed through grants from central and state government.

6. PROJECT PHASING

6.1. Schedule for tendering/ selection for procurement of services

The tendering process which includes notice inviting tender, issue of tender documents, pre-tender meeting and subsequent issue of clarifications to bidders is expected to be completed in a month. The bids that are received by the proposal due date will be evaluated as per the terms and conditions set out in the tender document and the preferred bidder would be selected. A Letter of Acceptance would be issued to the preferred bidder and subsequently the agreement would be entered into between the BOT operator and the preferred bidder by MCC. The selection of the preferred bidder and the agreement formalities are expected to be completed within 15 days from the proposal due date. The tentative tendering schedule is set out in the table below.

Table 40: Tendering schedule

Sl No	Activities	Implementation Time frame (2007)											
		October		November					December				
		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
1	Selection of Private operators for Collection and transportation of MSW												
a	Issue of Tender document												
b	last date for receipt of Queries												
c	Submission of Proposal												
d	Evaluation of Technical Proposal												
e	Evaluation of Financial Proposal												
f	Selection of Private operator												
2	Selection of Private operator for rehabilitation and O&M of compost facility and development and O&M of landfill facility												
a	Issue of Tender document												
b	last date for receipt of												

Sl No	Activities	Implementation Time frame (2007)											
		October		November					December				
		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
	Queries												
c	Submission of Proposal												
d	Evaluation of Technical Proposal												
e	Evaluation of Financial Proposal												
f	Selection of Private operator												

6.2. Schedule for bringing in State level and ULB level contributions to the project

It is expected that the DPR submitted to JNNURM would be finalized within 10 days from the date of submission. Funds by JNNURM will be released to the state within 15 days of finalization of the DPR and subsequently the state share of funds would be released.

6.3. Schedule for obtaining all clearances (along with list of major clearances)

The clearances from the Karnataka State Pollution Control Board and MoEF are the important clearances that would be required for implementation of the project which is expected to be obtained within 45 days of receiving the final project approval from JNNURM. Simultaneously, internal approvals required for project implementation will be obtained by MCC. The schedule for obtaining these clearances is set out in the table 44.

Table 41: Schedule for obtaining clearances

Activity	Duration
KSPCB & MoEF	45 days
Local body approval for construction	30 days

6.4. Schedule for shifting utilities

No shifting of utilities is envisaged during implementation of various components of the project

6.5. Project infrastructure component-wise implementation

As provided in section 1.6.

6.6. PERT Chart / CPM diagram

PERT chart and CPM chart for the project are as set out in this section.

7. PROJECT O&M PLANNING

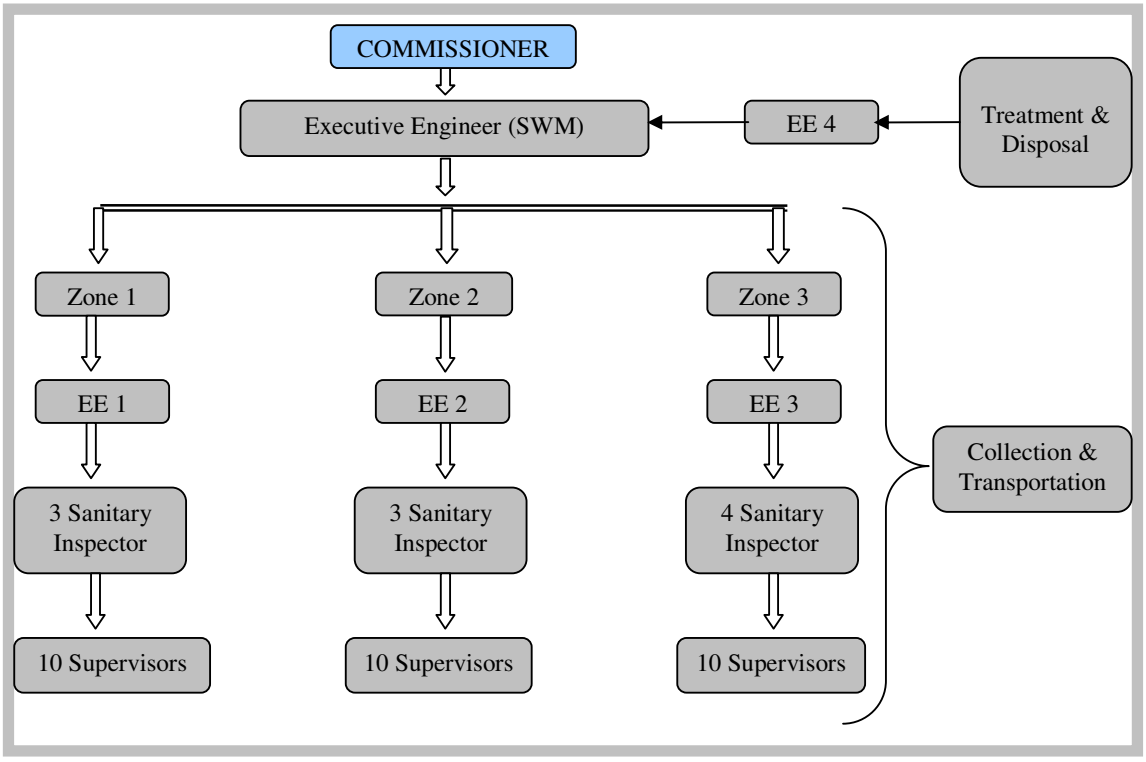
7.1. Institution Framework (organization & operations) Strategy

The project implementation and subsequent operation & maintenance are proposed to be undertaken under suitable public private partnership frameworks. MCC would play the role of a facilitator in enabling the private operator(s) to deliver the required services. MCC would supervise and monitor the operations of the private operator(s)/ Area Sabha Members in service delivery. The proposed organization structure wherein MCC would act as a facilitator is set out in the following section.

7.1.1. Organization structure

MSW management activities would require constant monitoring and setting standards by MCC, as the sector demands daily collection, transportation, treatment and disposal of MSW. In line with the proposed strategy the role of MCC would be more than an enabler of service rather than a service provider and to provide overall effectiveness of MSW management system, the existing organization structure of SWM department in MCC would need to be enhanced.

The proposed organizational structure of SWM department in MCC is set out below.



The new organization structure would comprise of Executive Engineer, Environmental Engineers, Sanitary inspectors and Supervisors. The hierarchy of the organizational structure is explained below.

a. The Executive Engineer (SWM) would be the Divisional Head of SWM services.

b. The 65 municipal wards in the city would be classified under three zones, each headed by an Environmental Engineer.

c. The Environmental Engineers in each zone would be assisted by a Sanitary Inspector.

d. Each Sanitary Inspector is responsible for management of MSW activities in their respective zone and is assisted by two Supervisors who in turn would be responsible for supervision of collection & transportation crew and the private contractors.

e. The staffing pattern of the department would be as set out in the table below.

Table 42: Staff Deployment

Sl. no	Staff category / designation	Manpower
1	Executive Engineer (SWM)	1
2	Environmental Engineers	4
4	Sanitary Inspector	10
5	Supervisors	30

i. Roles, Responsibilities & Skills required

<u>Environmental Engineers</u>

The minimum technical qualification for the post would be a Post graduate degree in Environmental Engineering and Management. Environmental Engineer would report to Executive Engineer (SWM).

- At least two years of experience in SWM sector
- A good understanding of the various activities involved in the SWM chain, norms and standards to be adopted
- Monitor the activities of Sanitary Inspector & Supervisors & regularly hold meetings with them

- Monitor contract performance of private operator(s)
- Design reporting formats/ templates
- Good interpersonal and documentation skills
- Ability to work in a team and handle issues that may arise on the field
- Designing & Monitoring IEC interventions

Sanitary Inspector

The minimum technical qualification required for the post would be a Graduate in any discipline and would report to the Environmental Engineer of the respective zone.

- Field inspection of collection & transportation activities
- Ability to communicate and interact with private operators/ collection & transportation crew/ RWAs
- Ability to convince people on MSW practices, norms and procedures to be followed.
- Carry out IEC activities
- Monitor the operations of the Supervisors
- Maintain field records on a daily basis and submit regularly reports/ monitoring formats.

Supervisors

The minimum technical qualification required for the post would be a Class XII pass and would report to Sanitary Inspector & Environmental Engineer

- Monitor the work of collection & transportation crew
- Ensure that the collection & transportation & street sweeping activities in residential areas as well as in busy commercial/ market areas are carried out efficiently, as per the norms and timings stipulated
- Report problems/ issues identified in the filed
- Submit field reports to Sanitary Inspector
- Carry out IEC activities

The estimated salary expenses for the proposed organization structure could be approximately are Rs 43.2 Crores.

The framework for implementation of the activities envisaged is set out below.

A. Collection & Transportation of MSW and Street Sweeping

This activity in the MSW management chain would be undertaken by MCC through private operators under service contracts. MCC would procure the required equipment and vehicles and hand it over to the private operators. The various activities such as door-to-door collection of waste, collection of waste from bulk generators & commercial establishments and street sweeping for different wards would be formed into packages for inviting tenders. Self Help Groups (SHGs) could be identified to assist in door-to-door waste collection activities.

MCC would make fixed monthly payments to the operators, which would essentially be the bid parameter for selection of the operators. At the end of the contract period, the equipment would be handed back to MCC.

The roles and responsibilities of various stakeholders in the O&M of collection and transportation of MSW have been detailed out in Section 4.1.

B. Compost & Landfill Facility

The rehabilitation and O&M of the compost facility and the development and O&M of landfill facility would be carried out by a private operator under a BOT Concession framework as detailed out in Section 4.2.

7.1.2. Tariff and user cost recovery

With an objective of making the MSW management activities self sustainable and to enable recovery of O&M costs to the extent possible, a resolution for collection of user charges from various generators had been issued by MCC, vide resolution No.186:2006-07 dated 8-12-2006.

The user charges proposed to be collected from various categories of waste generators are set out in the table below.

Table 43: User charges for various generators

Description	User Charges (per month)
Households	
Less than 1000 sq ft	Rs 10
More than 1000 sq ft and less than 3000 sq ft	Rs 30
More than 3000 sq ft	Rs 50
Commercial establishments	

Description	User Charges (per month)
less than 1000 sq ft	Rs 50
More than 1000 sq ft upto 5000 sq ft	Rs 100
More than 5000 sq ft	Rs 200
Hotels, choultires and marriage halls	
Less than 10,000 sq ft	Rs 300
More than 10,000 sq ft upto 50,000 sq ft	Rs 500
More than 50,000 sq ft	Rs 600
Industrial establishments	
Less than 1000 sq ft	Rs 100
More than 1000 sq ft upto 5000 sq ft	Rs 200
More than 5000 sq ft	Rs 300

The average user charges has been estimated at Rs 26 per month per household assuming 40% of the households to be less than 1000 sq ft area and 40% with area more than 1000 sq ft but less than 3000 sq ft and 20% with area more than 3000 sq ft. The basis for user charges has been estimated on two scenarios (Including capital expenditure and excluding capital expenditure). The same is set out in **Annexure 33**.

The estimate of user charges for meeting the expenses towards primary collection of MSW from the households in non slum areas (proposed to be implemented by ASM) are set out below:

Table 44: User Charges

Sl. No.	Description	Amount
1	Capital investment (Rs Lakhs)	409.3
2	Recurring expenses (Rs Lakhs)	
a	Salary payments (Rs Lakhs)	560
b	Repairs and Maintenance (Rs Lakhs)	37.3
c	Fuel expenses (Rs Lakhs)	95.2
	Total Recurring Expenses	692
3	Service delivery cost in rupees per household per month (including capital investment)	31
4	Service delivery cost in rupees per household per month (excluding capital investment)	28

As the service delivery cost per month per household is more than the average user charge, there would be a need for upward revision in the user charges as per the resolution issued on December 8, 2006.

The estimate of user charges for meeting the expenses towards collection and transportation of MSW are set out below:

Table 45: User Charges (Rs)

Sl. No.	Description	Primary collection	Secondary collection and transportation	Total
1	Capital investment (Rs Lakhs)	409.3	439. 6	848.86
2	Recurring expenses (Rs Lakhs)			
a	Salary payments (Rs Lakhs)	560	32.0	592
b	Repairs and Maintenance (Rs Lakhs)	37.3	44.0	81
c	Fuel expenses (Rs Lakhs)	95.2	142.0	237
	Total Recurring Expenses (Rs Lakhs)	692	218.0	910
3	Service delivery cost in rupees per household per month (including capital investment)	31	11	42
4	Service delivery cost in rupees per household per month (excluding capital investment)	28	9	37

8. PROJECT FINANCIAL STRUCTURING

8.1. Overall project perspectives

Financing of the capital expenditure for providing MSWM services would be through grants from both Central and State government. The funds allocated would be used towards procurement of tools, equipments, vehicles and other services such as rehabilitation of compost facility and development of landfill facility, resulting in cash outflows of Rs 34.6 Crores in FY 08. These would be funded to an extent of Rs. 27.69 Crores by Central government grant, Rs 3.46 Crores by State government and Rs. 3.46 Crores by MCC. However there is no cash inflow envisaged from these assets, therefore, the concept of IRR will not be applicable.

The total project cost for MSWM services and the funding pattern is as set out in the table below.

Table 46: Funding pattern for project cost

Sl. No.	Description	Percentage of funding	Cost (Rs Crores)
1	**Total Capital Cost**		**34.85**
2	**Share of Government and MCC**		
A	Central Government	80%	27.9
B	State Government	10%	3.5
C	MCC	10%	3.5

The project fund flow from central government, state government and Mysore City Corporation during the mission period is set out in the table below.

Table 47: Fund flow during mission period (Rs Crores)

SL No.	Description	FY 08	FY 09	FY 10	FY 11	FY 12	FY 13
1	Total Project Cost	32.7	2.2	0.0	0.0	0.0	0.0
2	Share of Government and MCC						
a	Central Government	7.0	7.0	7.0	7.0	0.0	0.0
b	State Government	3.5	0.0	0.0	0.0	0.0	0.0
c	MCC	3.5	0.0	0.0	0.0	0.0	0.0
3	Financing of O&M expenses						
a	O&M expenses	4.0	21.4	22.5	23.6	24.8	26.0
b	User charges	1.6	7.0	7.7	8.4	9.2	10.1
c	O&M expenses to be funded by MCC	2.4	14.4	14.8	15.2	15.6	15.9

The funds requirement from Central Government, set out in the table above, is indicative and the amounts would be released in accordance with the time lines and the conditions as envisaged under the JNNURM process. One of the conditions to be adhered to by the ULB for availing the funds includes achievement of milestones agreed for implementation of mandatory and optional reforms. As the time frame for the same has been set out as four year in the CDP, the fund flow from the Central Government during the Mission Period has been assumed to be four years.

The O&M expense for the MSWM services includes salary expenses, repair and maintenance, fuel expense and tipping fee. The estimated O&M charges for the mission period are set out in the table below.

Table 48: Financing of O&M expenses for the MSWM services *Rs (in Crores)*

Sl No.	Description	FY 08	FY 09	FY 10	FY 11	FY 12	FY 13
a	O&M expenses	4.0	21.4	22.5	23.6	24.8	26.0
b	Revenue by way of User charges	1.6	7.0	7.7	8.4	9.2	10.1
c	O&M expenses to be funded by MCC (a-b)	2.4	14.4	14.8	15.2	15.6	15.9

For making the MSW management activities self sustainable and to enable recovery of costs to the extent possible, MCC has issued a resolution vide resolution No 186.2006-007 dated 8-12-06. As the user charges are fixed for various generators, the remaining expenses would be funded by MSW Cess and surplus municipal allocation.

The cash flow from user charges have been estimated on the basis of break even costing and these would be utilized fully towards the O&M expenditure, which includes, tipping fee, salary expenses, repair and maintenance. Therefore no cash inflow is envisaged.

The estimated salary expenses for the proposed organization structure are as set out below.

Table 49: Estimated Salary expenses

Sl. no	Staff category / designation	Manpower	Salary expenses per month	Salary expenses per annum
			(Rs)	(Rs Lakhs)
1	Executive Engineer (SWM)	1	30,000	3.6
2	Environmental Engineers	4	20,000	9.6
3	Sanitary Inspector	10	10,000	12
4	Supervisors	30	5,000	18
Total Cost (Rs Lakhs)				**43.2**

Component wise Operations & Maintenance expenses for year 2008.

Sl No	Description	Rupees Lakhs
1	**Annual Salary Expenses**	
A	Primary Collection	615
B	Street Sweeping	327
C	Transportation	54
2	**R&M Expenses**	
A	Primary Collection	**61.9**
	Auto Tippers	42.0
	Push carts	19.9
B	Street Sweeping	**74.1**
C	Transportation	**49.5**
	Twin Load Dumper Placer (4.5 cubic meters capcacity)	23.6
	Single carrier vehicle (7 cubic meters capcacity)	18.2
	Tractor Placers	5.5
	Compactors	2.2
3	**Fuel Expenses**	
A	Primary Collection	107.3
B	Transportation	184.0

8.2. ULB level perspectives and financial situation assessment

As per the guidelines of the DPR toolkit the impact of the proposed projects on MCC's financial position is analyzed. The cash flow statement in the required format has been set out in **Annexure 34**. The impact has been assessed with following grades:

Table 50: Impact assessment

Sl No	Impact	Grade
1	+/- 20% and more	High
2	+/- 5% to 20%	Medium
3	+/- 5% and Less	Low

Cash flows of MCC are presented below:

As per the projected cash flow statement, at the end of Financial Year 2008, there would be closing cash balance of Rs. 25.74 Crores.

Table 51: Summary of Projected Finances (In Rs Crores)

Description	FY 08	FY 09	FY 10	FY 11	FY 12	FY 13
Opening Balance (a)	11.38	14.36	34.05	31.19	47.81	39.89
Total Receipts (b)	101.81	125.11	126.01	148.71	144.95	150.20
Total Expenditure (c)	87.46	91.06	94.82	100.90	105.06	109.41
Cumulative Closing Balance (a+b-c)	25.74	59.80	90.99	138.80	178.69	219.48

Source: CDP for Mysore, 2006

The impact on municipal finances has been estimated as a percentage of O&M cost.

On the revenue account the project would have minimal impact in FY2008 as the construction of the landfill facility would be completed by year end of FY 08. However the impact would be high thereafter due to payment of tipping fee and there is no cash inflow envisaged from the MSW assets that would be owned by MCC for delivering the MSW services.

However, on the capital account, the impact during the year FY 08 would be medium. From FY 09 the impact would be high due to the tipping fee factor and increased supply of MSW for land filling.

Table 52: Impact of the project on the Municipal finances

Impact						
Financial Year end	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Revenue	Low	Medium	Medium	Medium	Medium	Medium
Expenditure	Low	High	High	High	High	High

Debt situation assessment

Since the capital cost of the project is funded by the central, state government and MCC as explained in Section 8.1, the concept of debt financing for the project is not applicable. Also from the above observations the impact on the municipal finance is high and hence, it would be very difficult to get a loan on attractive financing terms for the project.

It is proposed that the O&M expenses would be entirely funded through internal cash flows such as user charges MSW cess and from municipal allocations. The project is being proposed to be funded entirely on equity. Hence the DSCR analysis has not been carried out for the project.

8.3. Other Financial Information

MCC has not been credit rated as of today. However MCC is likely to get the credit rating done in the near future.

9. PROJECT BENEFITS ASSESSMENT

9.1. Benefits from the societal perspective

The social benefits on 12 parameters have been enlisted and the qualitative impacts of the same are listed in the table below.

Table 53: Social benefits and quantitative impacts

Sl. No.	Benefits Description	Comments	Qualitative Impacts	Underlying Assumptions
1.	Access	For collection of MSW from non slum areas auto tippers and pushcarts would be used. In slum areas where access to narrow road is not possible be auto tippers, pushcarts would be used.	The collection and transportation of the MSW from various generators would be efficient.	The assumption is that, the citizens /RWAs/ CEs think rationally to reduce the spread of epidemic diseases and also adhere to the MSW practices.
2.	Coverage	All the areas in the city would be covered. including residential, commercial and slum areas. The strategy integrates the complete chain such as collection, storage transportation, treatment and disposal	MSW from households and bulk generators would be substantially covered resulting in systematic disposal of MSW. The exact quantitative assessment is very difficult.	Same as above.
3.	Service Quality	Enhanced MSW services in collection and transportation, as competent private operators would be rendering the services. Enhanced MSW services as the compost facility and landfill facility would be operated by the private operator.	Although, quantification is not possible, long term, benefits are envisaged like environmental benefits, health benefits and social benefits.etc	Involvement of the citizens would benefit in improvement of citizen's health and also city's ambience, thereby resulting in social and environmental value additions.
4.	Income for poorer sections	Creation of direct and indirect employment for poorer section of the society.	The non skilled manpower would get an opportunity to earn their livelihood.	

Sl. No.	Benefits Description	Comments	Qualitative Impacts	Underlying Assumptions
			Value extraction from MSW generated would enhance the business opportunity for the private operators (for e.g compost). This also would generate direct employment for poorer sections of the society.	
5.	Supply continuity	As MSW would begenerated on a daily basis the process of treatment and disposal would also be done on a daily basis.	Management of MSW is a continues process and when practiced would result in multiple benefits.	
6.	Safety	Implementation of the strategy would result in safe disposal of MSW. And the safety standards followed at different levels, would result in safe working environment for the PKs	Elimination of road side disposal would reduce the health hazards caused due to open decomposition.	Systematic disposal by the citizens would reduce the environmental impact. (for e.g ground water pollution). Providing protective gears to PKs would prevent injuries when in contact with unsafe waste disposed.
7.	Cost Savings	Due to treatment and disposal of MSW in an area outside the city, air pollution and ground water contamination would be prevented, resulting in indirect cost savings		
8.	Improved Efficiency	Integrated process of MSWM would minimize the travel time and improve the efficiency at each activity in the MSW management chain. (collection, storage, transportation, treatment and disposal)	For example: Having vehicle depot at various zones of the city reduces the time and cost of transportation. Vehicle depots would decongest the roads rather than parking on the road side.	

Sl. No.	Benefits Description	Comments	Qualitative Impacts	Underlying Assumptions
9.	Time Savings	Transfer station would reduce the time and transportation cost of MSW from each ward.	Time saving would improve the efficiency of the system.	Time has monetary value.
10.	Environment Improvement	Reduced open dumping would result in reduced environmental impact.	In the short term although the improvement might not be visible, in the long run, lesser pollution would ensure cleaner environment and improve the ambiance of the city.	
11.	Employment	Employment opportunity would be generated at various levels. eg. PKs would be employed for MSW collection and street sweeping, skilled machinery operators would be employed for operating the compost and landfill facility.	In an indirect way, increased disposal of MSW would increase the employment requirements at various levels.	
12.	Improved Quality of life etc	Reduced air pollution, water pollution would result in hygienic living standards.		

9.2. List of Negative Externalities (i.e. adverse impact)

As the project is environmental oriented, the impact and the negative externalities of the proposed strategy has been listed in the table below.

Table 54: Negative externalities and impacts

Sl. No.	Benefits Description	Comments	Quantitative Impacts
1	Pollution, environmental distortions, reduced green cover etc	Project would reduce the pollution levels and will not have any adverse impact on environmental aspects.	No pollution.
2	Reduced access to any specific user segments	Project would not lead to any such effect.	Not applicable.
3	Supply interruptions (especially during	Construction activity is being planned properly to ensure alternative plan for	No supply interruption.

Sl. No.	Benefits Description	Comments	Quantitative Impacts
	project construction phases etc)	regular management and there would be no interruption during construction phase.	
4	Displacement of inhabitants	Compost facility is already developed and is currently maintained by MCC .The landfill facility is being developed adjacent to the existing compost facility owned and possessed by MCC. No new land is being acquired. Hence no displacement of inhabitants would occur.	No displacement would take place.
5	Disruption of livelihood / reduced employment /labour redundancy	No such effect is expected to occur since it is expected that more opportunities would come up in both direct and indirect category of employment.	Not disruption.
6	Possible Haphazard development around/adjacent project site areas	Since the project is being developed on the outskirts of the city on a barn land area, no adjacent development is expected.	No slums, commercial properties (malls) ,etc

9.3. Economic Internal Rate of Return

Not Applicable as the Total Project cost is less than Rs 100 crores (Rupees hundred crores)