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Effective Municipal Solid Waste Management Practices: A Case study of Shimla, Himachal Pradesh, India

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ABSTRACT Management of Municipal Solid Waste is an essential and obligatory function of an Urban Local Body. But even today several ULBs are budget deficit, lack technical staff and clear conceptual understanding to discharge this function effectively. An attempt has been made to assess the existing solid waste management system, environmental concerns, and the future interventions with respect to environmental and social well being. Study of the Shimla urban local body, a civil society organization and increasing private sector participation in waste management arena highlights the issues of effectiveness, institutional weaknesses and relevant planning. Successful implementation of the door to door garbage collection in challenging terrains, optimized route planning, scientific treatment and disposal planning of inert on regional landfill model in Shimla city is documented. The user charges model with effective recovery mechanism is presented as a solution to the rising SWM associated costs. This paper emphasizes the stringent enforcement of the Municipal Solid Waste Management and Handling Rules, 2000 through systematic planning process and emphasizes the need to take holistic view of state toward municipal solid waste management.

Keywords: Municipal Solid Waste Management (MSWM), User Charges, Urban Local Body (ULB), Public Private Partnership (PPP).

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1.0 Introduction:

Government of India has launched various initiatives through Ministry of Urban Development for ensuring effective solid waste management at Urban Local Body (ULB) level. The 74th Constitutional Amendment Act (1992) based National Urban Sanitation Policy (NUSP, 2006) provides draft framework for the states to develop its own state sanitation strategy and city sanitation plan (CSP) based on respective peculiar conditions. Urban Infrastructure Governance (UIG) component of Jawaharlal Nehru National Urban Renewal Mission (JnNURM) gave impetus to achieve overall urban hygiene within a city. The JnNURM programme and the Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT) provide the much needed financial support to the budget deficit ULBs for infrastructure development whereas capacity

building initiatives for ULBs are also exercised through MoUD support.

Himachal Pradesh is the least urbanized state of India with 59 urban agglomerations reported by Census Operations (2011). Waste quantities arising in the steadily expanding urban areas of Himachal Pradesh are at much lower rates than the other metropolitan Indian cities. The quantities of municipal solid waste (MSW) generated in Himachal Pradesh is 300-350 tonnes per day (SOER, 2007); an insignificant contribution to 100,000- 120,000 tonnes per day produced by the country (World Bank, 2006 and HPSoER, 2007). Mismanagement of even small waste quantity in fragile ecosystem of Himalayan state may lead to serious environmental and health problems. Various studies have also reported more than 5%

annual increase in total quantities of solid waste (Asnani, 2006; Goel, 2008 and SAR, 2013).

1.1 Study area

Shimla is situated in the Central Himalayas at 31°4' to 31°10' north latitude and 77°5' to 77°15' east longitude. Discovered in 1819 by the British, Shimla has evolved from a small hill settlement to one of the popular tourist destinations in India. Part of Himachal Pradesh was carved out of erstwhile the Punjab state in 1966 and Shimla became the capital of newly formed state of Himachal Pradesh in 1971. The topography of Shimla is characterised by rugged mountains, steep slopes and deep valleys. Shimla is located at an altitude of 2130 meters above mean sea level. It experiences cold winters during December – February, with temperatures ranging from 0-13°C. Shimla receives snowfall around Christmas or the last week of December. The summers (May – June) are mild with temperatures varying from 20-30°C. The monsoon period extends from June to September and records moderate rainfall. The average rainfall recorded for the last 25 years (1980 – 2005) in Shimla is 1437 mm. As per Census (2011), Shimla is the only Class I City in the State of Himachal Pradesh with total population of 1,69, 758 persons. The total area under the jurisdiction of MC Shimla also has increased after merger of New Shimla, Totu (including some parts of Jutog) and Dhalli areas to 35.00 sq km. At present, Municipal Corporation of Shimla (MCS) is divided into 25 wards covering urban core and urban fringes (Fig. 1).

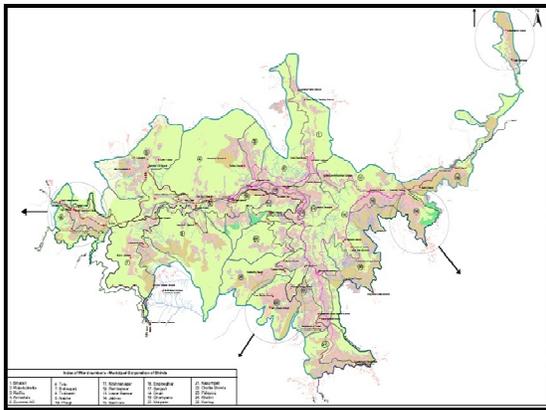


Figure 13: Municipal Limits of Shimla City and Growth Patterns

The problems associated with solid waste in hilly terrain are numerous. Urban forest within the city is most vulnerable as growth of the samplings are severely hampered. The natural and manmade stormwater drainage is clogged due to indiscriminate dumping of waste leading to unmanageable situation especially during monsoon season. Piled heap of garbage disturbs the aesthetic view and create scavenging problems. Various studies have reported the human-monkey conflict in Shimla city (Chauhan & Pirta, 2010 and UNDP, 2012). The dog and monkey menace problem can be limited to great extent by effective waste management. The tourism industry growth is also intangibly linked to the aesthetic beauty of the city.

1.2 Functionaries

Solid Waste Management is an essential and obligatory function of Municipal Corporation Shimla (MCS). The Municipal Solid Waste (Management and Handling) Rules, 2000 entrusted Shimla ULB to establish a proper system of waste management. The Health Department of MCS is working towards developing a sound municipal waste management system through proper collection, transportation, treatment and disposal of solid waste in a planned and phased manner. A public interest litigation in the High Court of Himachal Pradesh addressing the dismal situation of solid waste collection, treatment and disposal directed MCS to reconsider its approach for discharging its functions in SWM sector. MCS has adopted various models wherein either MCS; an agency or a private operator are responsible for different components of SWM. Municipal Corporation Shimla through Himachal Pradesh Municipal Corporation Act, 1994 enacted Door to Door Garbage Collection Bye-laws in 2006. The enforcement of these bylaws is ensured by Shimla Environment, Heritage Conservation and Beautification (SEHB) Society's door to door garbage collection initiative. Waste processing and treatment facility is operated on public private partnership (PPP) by Hanjer Biotech Energies Pvt. Ltd and secured landfill facility is also proposed to be developed on PPP model.

The overall monitoring and supervision is carried out by MC Shimla and the Himachal Pradesh State Environment and Pollution Control Board (HPSPCB) in an regulatory role. The duties and responsibilities of the various stakeholders include door to door collection of MSW, segregated storage of the waste at secondary storage and collection points, treatment of MSW and disposal at a designated dumpingsite. The Table 1 shows the roles and responsibilities of various stakeholders involved in Solid Waste Management system.

Table 1: Roles and Responsibilities for Solid Waste Management

Sl. No.	Functional Element of SWM	Responsible Agency/ Organization	Monitoring Authority
1	Collection	SEHB Society	MC Shimla/ SEHB Society
2	Transportation	Health Department MC Shimla	MC Shimla/ HPSPCB
3	Processing and Treatment	M/s Hanjer Biotech Energies Pvt. Ltd	MC Shimla/ HPSPCB

Sl. No.	Functional Element of SWM	Responsible Agency/ Organization	Monitoring Authority
4	Cost Recovery and Recycling	SEHB Society and M/s Hanjer Biotech Energies Pvt. Ltd	MC Shimla/ HPSPCB
5	Disposal	Scientific disposal yet to evolve	MC Shimla/ HPSPCB

Shimla City has successfully banned usage of plastic in the form of plastic carry bags with thickness less than 75 microns consequent to the HP Non-Biodegradable Garbage (Control) Act, 1995 and latest Notification on Plastic Waste (Management & Handling) rules, 2011. MC Shimla through Himachal Pradesh Non- Biodegradable Garbage (Control) Act, 1995 has also made a provision of fine ranging from Rs. 500 to Rs. 5000 for creating nuisance by littering of garbage.

The Figure 2 is a schematic representation of the Municipal Solid Waste Management system within the boundary limits of Municipal Corporation of Shimla. The left column depicts the process flow for waste and the right column shows how the municipal and hazardous waste is being handled within the city.

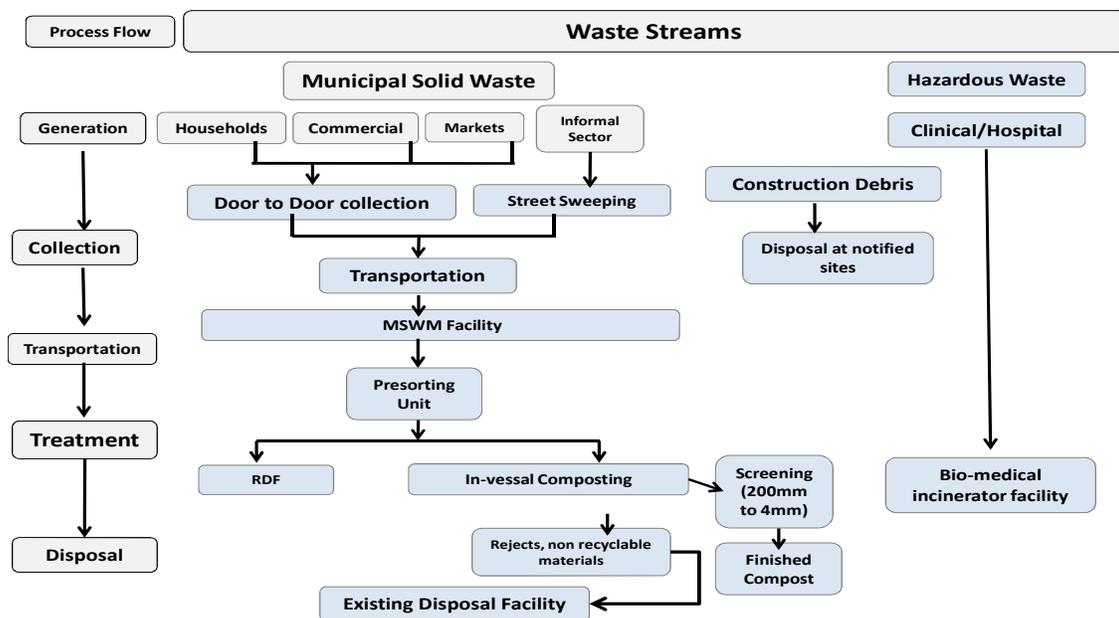


Figure 2: Flow Chart for Current SWM Practices Followed in Shimla City

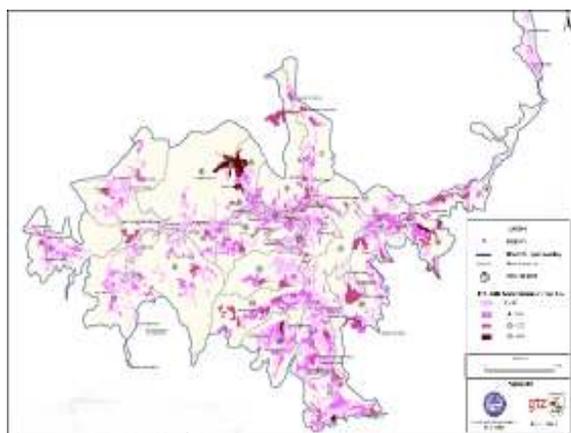
1.0 Generation

The daily waste generation in Shimla City is approximately 93.0 MT. This depicts that waste generation per capita per day is 350 gm/capita/day in the city. The collection of the waste through door to door collection and community bins is approximately 70-75 MT. Table 3 present the population projection and solid waste generation. This type of growth rate may be witnessed in the current decade. Figure 3 depicts the spatial variation of solid waste generation within the city.

Table 3: Population growth and SWM generation in SMC area

Head/ Years	2011	2021	2031	2041
Resident Population (nos)	1,69,758	2,56,883	3,49,361	4,18,296
Floating Population	76,000	1,00,000	1,25,000	1,50,000
Solid Waste Generation (MT)	86.01	124.91	166.03	198.90

Source: City Sanitation Plan of Shimla, 2011



Source: City Sanitation Plan of Shimla, 2011

Figure 3: Spatial variation of Solid Waste Generation in Shimla City

3.0 Storage and collection

Various attempts were made by MC Shimla for effectively implement door to door garbage collection since formulation of Door to Door Garbage Collection Bye-laws in 2006. Table 4 presents the door to door garbage collection initiatives by various organizations and limiting factors in their success.

Table 4: Implementation of Door to Door Garbage Collection in various years

Year	1999	2007	2008
Motivation	Growing garbage menace and lost aesthetic value of hills	MSW (M&H) Rules, 2000 and HC Directions, 2006	MSW (M&H) Rules, 2000 and HC Directions, 2006
User Charges	Rs.20 per household and equal amount contributed by MCS	Based on User Category	Based on differential charging
Agencies Involved	MCS and Yuvsatta (Chandigarh based NGO)	MCS and Center for Development Communication (CDC), Jaipur	Four NGOs having local knowledge
Limiting Factors	With the increased coverage MCS did not cope-up with the financial subsidy. MCS first reduced its share to Rs.10 per household and then withdrew the subsidy completely. User charges were raised to Rs.35	CDC was mandated to cover the entire city within nine month period. Various complaints were received about CDC's functioning. The project could not take off on a full scale.	Cost of collection was higher than user charges. The scheme didn't become financially viable even after revising the rates of user charges.

3.1 Primary storage and collection system by SEHB society

Shimla Environment, Heritage Conservation and Beautification (SEHB) Society was registered in 2009 under the Himachal Pradesh Societies Registration Act 2006. This society is responsible for the door to door collection from households under the supervision of Commissioner (President) and Corporation Health Officer (Member Secretary). Each household/ commercial establishment or educational institute and other institutes handover garbage SEHB Society. The society has provided two colored bins – yellow and green to households/ commercial establishments/ institutions, etc. for primary storage and segregation of garbage. The yellow bin is for non-biodegradable waste and green

bin are for biodegradable waste storage within the establishments. The establishment can be debarred from civic amenities like disconnection of water, electricity and other basic amenities for not giving waste to garbage collector. As per MCS record, 86 % of the residential population is covered under door to door waste collection system, followed by 14% population dependent on the community bins for waste disposal. This initiative met with immediate success due to micro-planning, administrative prudence, financial sustainability, legal provisions and the acceptance amongst the end users. The SEHB Society has made significant efforts in management of its human resources. The garbage collectors are provided personal protective equipment. The woman workers are assigned with clusters close to their homes. Married couples are kept in the same ward operations. Vaccination drives are conducted from time to time for workers. The efforts of the SEHB Society are appreciated at national level and it has been awarded by “Skoch- Order of Merit” India’s best for 2013 for implementing door to door garbage collection scheme in difficult terrains.

However, the system for segregation at household level is still not well established and needs a lot of support from the community, the SEHB Society workers as well as the Municipal Staff to prevent it from reaching and the processing site is in mixed form. Various pilots for improving primary collection and segregation of waste have been conducted with help from external development agencies like GIZ and European Union. The informal waste recovery and recycling mechanism is also existing within municipal limits. The recyclables extracted at the household level earn incentives for the garbage collector through this informal mechanism.

3.2 Secondary collection system

The community bin system comprising of 8 concrete dust bins 148 numbers of dumper containers of 4.5 cum capacity and 54 numbers of dumper containers of 3.5 cum capacity. The frequency of clearing of these bins varies from daily, alternate day, twice a week or even once a week depending on the area. These concrete bins and dumper containers are placed at

convenient locations for the residents to access and dispose their waste in an appropriate manner. MCS efforts to extend 100% ward level door to door garbage collection are supported by declaring the ward as dumper free. MCS is in process of replacing this conventional system of secondary storage with wire mesh structures which makes secondary storage of waste inaccessible to monkey and other scavengers.

4.0 Transfer and transport

4.1 Routing plan and transfer station

The ward level routing and loading plan has been developed by MC Shimla with help of GIZ. The ward level route and waste collection point are plotted at the ward level map. Additional information like domain of the garbage collector, street sweeping beat, collection timings, frequency, road category, landmarks and land use is compiled at ward level. The collection vehicles run on a predefined and optimized route. The routing and loading plan for waste transportation is shared with each vehicle and exercised in coherence with door to door garbage collection. Manual loading is practiced at primary level. MCS also plan to set up a waste transfer station at Darni ka Bagicha where discharged treatment facility was in operational earlier. This transfer station will also support the optimizing of the routing and loading activities of the city. The waste from north eastern and centrally located wards collected by smaller pick-ups can be transferred in the compactors; transfer containers and transported to the new commissioned treatment plant. MCS also propose to install the chute systems for directly putting up the waste in collection vehicle in inaccessible areas.

4.2 Fleet

Transportation of waste from the secondary collection points to the treatment plant and landfill is the operated and managed by MC Shimla. The entire city’s waste is collected and transported through 40 different vehicles with varying capacities. Table 5 gives description of the different types of transportation vehicles currently being used by MC Shimla. The design, dimensions and the capacities of the vehicles have been given due consideration for plying on narrow municipal roads on the hilly terrain.

The vehicles are serviced at regular intervals for ensuring effective waste transport.

Table 5: Details of Solid Waste Transportation Vehicles

Sl. No.	Type of Vehicle	Quantity	Capacity (in tonnes)
1.	Pick-Ups (Hydraulic)	25	1-1.5
2.	Pick-Ups (Non Hydraulic inspection vehicle)	1	-
3.	Dumper Placer	5	Single
4.	Dumper Placer	2	Twinned
5.	Auto Tipper	3	1
6.	Auto Tipper	3	5
7.	Compactors	2	8
8.	Backhoe-Loader	1	-

5.0 Processing and treatment

Municipal Corporation Shimla established its first scientific waste processing and treatment unit with Norwegian assistance in 2001 at the Darni-ka-Baghicha at foothill of the central Shimla which later created nuisance for the public and tourists. After intervention of the HP High Court, the Government decided to set up a new treatment and disposal facility outside the municipal limits on Public Private Partnership (PPP) model. The proposal faced acute resistance from the nearby villages and matter were finally put up to the National Green Tribunal which give clearance later for setting up the facility in 2012. The new waste treatment facility was commissioned in June, 2013 after successful trial run. Private operator M/s Hanjer Biotech Energies Pvt. Ltd charge tipping fee of Rs. 150/- per MT of solid waste processed with the increase of 8% every year. The scope of work under the project at Bharial includes design, development, construction, operation and maintenance of municipal solid waste processing facility with aerobic in-vessel compost unit along with material recovery facility and leachate management system. The plant is equipped with weighbridge and mechanized separation of the MSW fraction. The financial viability of the project is ensured by sale of the compost, RDF material to the nearby cement manufacturing units and payment of processing charges. The concession

agreement signed between MC Shimla and private operator is for a period of 20 years.

6.0 Disposal

Scientific disposal of the inert material generated from the treatment facility is at planning phase. Rejects from the processing unit and other non-biodegradable waste are currently being landfilled in a valley near the compost plant at Darni ka Bagicha. Funds have been secured for the implementation of secured landfill adjoining the treatment plant from the Ministry of Urban Development in 2012. The stipulated time for the construction and operation of the sanitary landfill is estimated as two years. The engineered disposal facility is proposed to be developed on Public Private Partnership (PPP) model. The scientific disposal of the municipal waste will mitigate the environmental hazards associated with open dumping.

7.0 Complaint redressal

The complaint redressal system within MC Shimla is a centralized three way approach which highlights some of the good initiatives taken by the authorities. This system is supported in English, Hindi and Pahari (Himachali) languages. A dedicated Complaint Cell in the office of the Corporation Health Officer has been created, wherein citizens can get their complaints lodged. Contact details of all officials related to SWM are available on the official site of MC Shimla. A consumer can lodge complaint anytime during the office hours telephonically or by visiting the ward level office or by submitting a written complaint. Complaints can also be lodged through the e-smadhan portal or through e-mail available on MCS websites. After the complaint is registered, officials first cross check whether there is actually a problem in the area and then complaints are routed to the concerned sanitary inspector and further on as depicted in Figure 4. The concerned official has to report the status of complaints within 24 hours otherwise complaint is reviewed by the higher level officials based on the hierarchy. The Chief Sanitary Inspector and Office Superintendent are accountable for the complaint redressal mechanism at MC Shimla and SEHB office respectively. Majority of the complaints are redressed through this

formal mechanism. A helpline number has also been widely notified under the system and complaints can be made on the dedicated landline numbers. The complaint and ward level supervisors contacts are displayed in public area of the respective wards and also published in the local newspaper from time to time. A Citizen’s charter in this regard is also prepared by Health Department.

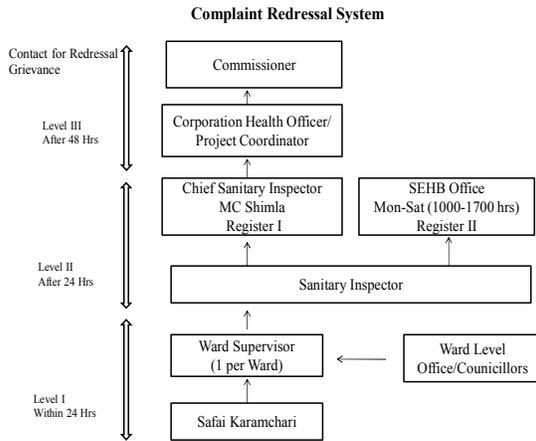


Figure 4: Complaint Redressal System followed by MC Shimla

8.0 Revenue and Expenditure

8.1 Financial Health

MC Shimla receives funds under 13th Finance Commission and State Grants for sustaining and improving Solid Waste Management services. Under the Jawaharlal Lal Nehru National Urban Renewal Mission (JNNURM), an integrated Solid Waste Management Project has been approved for Rs. 1,604 Lacs by MoUD, Government of India. MC Shimla has utilized this grant in improving SWM infrastructure through purchase of 30 pickup vans, compactors, garbage bins, constructing new treatment plant and consultancy fees for preparation of DPRs.

There is no separate budget head for SWM within MC Shimla and it is difficult to assess the exact amount of expenditure. A study was conducted by GIZ in 2009-2010 to estimate the annual expenditure on account of various heads (Table 6). The GIZ (2011) study reported Rs 4, 632 as the total cost per tonne for waste management.

Table 6: Cost heads for SWM in Shimla

Sl. No.	Cost Head	Annual cost (in Crores) 2009-10
1	Regular staff and administration	7.65
2	Outsourced/Contract staff costs	0.42
3	Electricity charges/fuel costs	0.32
4	Chemical costs	0.0003
5	Repair and maintenance costs	0.09
6	Contracted services cost	0.689
7	Other Costs-advertisements	0.0054
8	Total cost of solid waste management	9.184

8.2 Recovery Mechanism

Cost recovery for collection, transportation, treatment and disposal is a requirement under the JNNURM reforms. The current solid waste management within MC Shimla can be broadly categorized into four sections: costs incurred by MCS, costs incurred by SEHB, costs incurred by treatment site operator/ tipping fee to the Operator (M/s Hanjer Biotech Energies Pvt. Ltd) and cost incurred by the landfill site operator (after the operator is appointed). Currently the SWM cost is borne by MCS through a combination of user earmarking an amount from the property tax revenue of the city and funds received under various grants.

The concept of user charges was introduced in MC Shimla area in 1999. In lieu of door to door collection of waste from households and other establishments (commercial as well as non-commercial) collected at that time by different NGOs. After the conception of SEHB in 2010, these user charges are now collected on a monthly basis by the SEHB representatives against receipt. The user charges are levied after they are endorsed by the Electoral Council and notified from time to time. The current charges are divided across 28 categories. Table 7 below shows the current user charges for door to door collection as notified by MCS in February, 2012.

SEHB Society charges Rs. 50 towards the membership charge of the door to door

collection scheme offered by it. Till March 2012, SEHB Society has enrolled 36,211 members in various categories which generate an estimated income of Rs. 25.0 Lac per month from user charges. The SEHB Society is presently running the door to door garbage collection scheme on sustainable basis.

Table 7: User Charges notified by MC Shimla on February 1, 2012

Sl. No.	Category	Rate/ Month (Rs.)
1	Households	40
2	Dhaba	350
3	Restaurants	1500
4	Pan Shop/ Tea Shop	75
5	Hotels/Guest Houses/ Dharamshala up to 10 Rooms	1000
	Hotels/Guest Houses/ Dharamshala 11 to 20 Rooms	1500
	Hotels/Guest Houses/ Dharamshala 21 to 30 Rooms	2000
	Hotels/Guest Houses/ Dharamshala above 30 Rooms	2500
6	Offices (2 rooms)	100
	Offices (3-5 rooms)	250
	Offices (6-10 rooms)	1000
	Offices (11-20 rooms)	2000
7	Factories/ Workshops	1000
8	Shops	75
9	Cinema Hall	1200
10	Bakeries/ Food Joints & Bakery Out Lets	500
11	Hostels up to 50 Rooms	500
	Hostels with more than 50 Rooms	500
12	Banks	250
13	Fast Food	500
14	Sweet shop	350
15	Vegetable/fruit shop	200
16	Schools (Government)	200
	Schools (Private)	1000
	Colleges (Government)	1000
	Colleges (Private)	1500
17	All other Establishments	500

9.0 Service Level Benchmarking for SWM

The Ministry of Urban Development has introduced Service Level Benchmarking (SLB) as one of the appropriate systems for information management, performance monitoring and benchmarking. This system is aimed at improving not only the service provision but also the delivery of services to the consumers. These are indicators to measure the

stepwise performance in MSWM at ULB level. Under the 13th Finance Commission, Service Level Benchmarking is a key criteria for performance grant of ULBs. Each ULB has to declare its current level of services as well as the target for improvements for the next year on the basis of defined criteria. Table 7 below shows the current status of MC Shimla as against the required benchmarks set under the criteria and Figure 5 shows the graphical representation of performance indicator. It is evident from the indicators that MCS has gradually improved in the areas of household level coverage, collection of waste; associated charges. Grievance redressal is the only indicator performing above the desired benchmark. Extent of segregation, waste and cost recovery needs attention and scope for improvements. Indicator on the extent of scientific disposal is none in the absence of secured landfill but will be achieved in the coming time.

Table 7: Service Level Benchmark Indicators for Solid Waste Management

Performance Indicator	Bench-marks	Base Levels April 2011	Target March 2012	Target March 2013	Target March 2014
Household level coverage of solid waste management services	100 %	84.8	90	88	88
Efficiency of collection of municipal solid waste	100 %	77.8	80	78	82
Extent of segregation of municipal solid waste	100 %	10	20	20	20
Extent of municipal solid waste recovered	80 %	15	30	30	35
Extent of scientific disposal of municipal solid waste	100 %	0	50	0	0
Extent of cost recovery in solid waste management services	100 %	9.9	15	15	22

Performance Indicator	Benchmarks	Base Levels April 2011	Target March 2012	Target March 2013	Target March 2014
Efficiency in collection of solid waste management charges	90 %	44.4	60	95	88
Efficiency in redressal of customer complaints	80 %	74.1	80	85	90

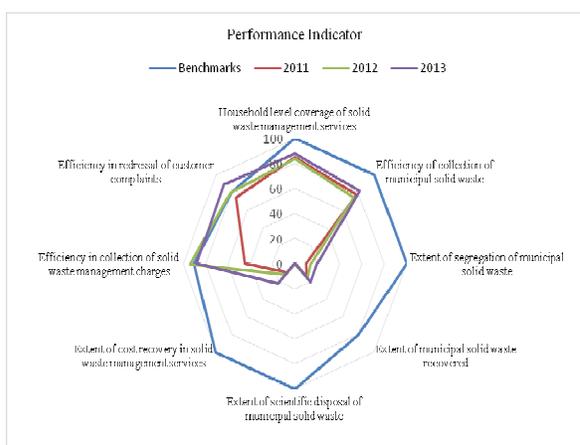


Figure 5: Graphical representation of SLB performance indicator

10.0 Conclusions and recommendation

Shimla city witnessed large scale urban expansion in the last one decade. The municipal limits have expanded tremendously putting extra load on the existing infrastructure. The city has gradually improved SWM infrastructure through various MoUD programmes. In the last three years technical expertise has been brought in by private sector, development organizations and capacity building measures of MoUD. MSW (M&H) Rules, 2000 enforcement is ensured through High Court interventions, stringent byelaws and public participation results in improved aesthetic value and environmental health of the city. Monkey menace problem is reduced to much extent.

It was experienced that realistic data on the population and waste generation are prerequisite for planning sound sanitation system. These data management and SLB

reporting capacities of within the city need to be strengthened. The routing and loading plan has to be reworked for optimal use of the transfer station. Stringent monitoring can be deployed by using technological options like global positioning system for vehicular movement, radio frequency based system for effective door to door garbage collection and use of geographical information system (GIS) remote sensing for future proposals. Management of the PPP contractual obligation is still a challenge. The technical capabilities of human resource MC Shimla is low in this regard and needs immediate capacitating measures. Sanitation being a state subject, it is pertinent that the state government needs to take a holistic view towards solid waste management. Capacity building measures, state specific technological options, up scaling of the best practices to the other ULBs will be helpful for attaining desired outcomes. A state level solid waste management strategy is recommended to strengthen and empower ULBs for providing sustainable solid waste management services in efficient way. Information exchange workshops and communication plan targeting behavioral change should be steered at state and ULB level in coordination.

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