23-JAN

2015

Urban Development Directorate

Dehradun

उत्तराखण्ड शासन

[*STATE'S MUNICIPAL WASTE MANAGEMENT STRATEGY & ACTION PLAN…*]

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1) Executive Summary:

The National Green Tribunal (NGT), Principal Bench of Hon'ble Supreme Court of India, New Delhi passed an order on Application No. 199 of 2014 Almitra H. Patel & Anr. Vs. Union of India & Others dated 15/01/2015 directed the State Government to come forward with complete action plan that will deal with the project of establishment of MSW plants either backed by power generation or otherwise. Also expected from the authorities concerned to wake up and act expeditiously to ensure safety of the public health and public good. The proposed action plan should be self contained and site specific, identifying the clusters, time bound action plan and fully providing for plan budget expenditure of the State in that behalf.

The Tribunal in their order has also suggested the State Government to study the project which had been upheld by the Tribunal in its judgement of Capt. Mall Singh & Ors. Vs. Pujab PCB & Ors. – Appeal No. 70 of 2012 dated 25/11/2014. The proposed model MSW plan not only dealt with collection, transportation and disposal of MSW but even utilization of the waste for the purpose of generating power and bringing the municipal solid waste to the minimum. The model also suggests formation of clusters within the States to economize as keeping in view the financial limitations of the State and their geographical situation.

It was further directed to submit the report to the Tribunal, one week prior to the date of the hearing i.e. 05th February, 2015.

In compliance with the aforesaid directions Urban Directorate, Government of Uttarakhand prepared a State Level Action Plan for the management, handling and disposal of municipal solid waste in accordance with the Municipal Solid Waste (Management and Handling) Rules, 2000.

This action plan is based on 30years projection, designed in phased manner to achieve the set goal plans in next 6 years i.e. 2015-21. It focuses on the existing MSW projects, challenges and constraints before the Urban Local Bodies (ULB), provide solutions that are measurable, reliable, practicable and sustainable beside other supportive studies and analysis that can help the ULB to opt the best suitable technology and approach for ensuring scientific disposal of its municipal wastes in accordance with the laid provisions under the MSW Rules, 2000.

Uttarakhand State's which is having combined rural and urban population over a crore have its municipal solid waste management system in a state of disarray. State is generating approx.3000metric tons of municipal solid waste every day of which only 40-50% is only being managed and disposed of through unscientific traditional means.

Practically all municipal waste is either burned, dumped or buried illicitly on vacant land throughout the urban local bodies of the state, causing significant environmental damage and threatening human health. Apart from the MSW there are other wastes like – hazardous, industrial and medical wastes whose scientific management are either inadequate or not as per the prescribed norms. Uttarakhand municipal waste generation is estimated to accelerate to approx. 9500 tons per day by 2040, resulting in an estimated total of 9.0 million tons of municipal waste being generated during 2014-41, thus solutions are needed urgently.

To design strategy to counter the state's current SWM situation, following guiding principles of waste management has been considered:

1) Waste is a resource
2) Individuals must accept responsibility for and cost of their own waste

3) Resource recovery and recycling is a priority
4) Segregation at source must be maximized
5) The informal sector plays a critical role in recycling
6) Public participation is essential
7) Residual waste must be properly handled, treated and disposed to minimize the load on landfill
8) The system must be run on incentivized, performance based principles and
9) All stakeholders have different responsibilities and each should be effectively integrated
10) Land is limited, thus should be utilized as minimum as possible

The SWM action plan is designed to rapidly transform SWM sector functions, operations and implementing institutions. Under the plan, by 2021 the SWM system will provide a reliable, sustainable house to house municipal waste collection service to every waste generator in the state, achieve a recycling efficiency, ensure that all residual waste is transported and disposed of in an environmental safe and socially responsible manner and in conjunction with other implementing stakeholders, make progress in initiating and improving the state's waste system. The plan has been designed to deliver the results in three phases, as under;

Phase	Implementation Time Period	Category	Total Projects	Total No. of ULBs
I	Upto – Dec. 2016	Pre-approved JnNURM and NGRBA funded project	07	20
II	Upto – Dec. 2019	Cluster & Priority ULBs under Integrated Approach	33	52
III	Upto – Dec. 2021	Other ULBs	09	09
Total			**49**	**81**

As the above table describes – total 49 projects have been planned under the three phases, which covers almost every ULBs of the State i.e. 81. The phases were planned according to category of town on priority list. The phase wise details along with its criteria of selection are highlighted in forthcoming chapter. The process approach at the disposal end is planned phased wise as under;

Project Descriptions			
Phase	**Approach**	**No. of Project**	**No. of ULBs Covered**
I	Integrated MSWM	4	4
	Cluster Based MSWM	3	16
II	Integrated MSWM	24	24
	Cluster Based MSWM	9	28
III	Integrated MSWM	9	9
	TOTAL	**49**	**81**

It is presumed that if phase wise plan is executed in a proper manner, then by end of Phase – III i.e. year 2021 at least 95+ % compliance can be achieved. This will surely enhance the State's aesthetic and healthy surrounding looks. The outcome of the above phased wise plan implementation would benefits the state in following manner;

Phase	**Total ULB's MSW (MTPD)**	**Total ULB's Population Catered (In Lacs.)**	**Anticipated Project Cost (Cr.)**	**Compliance Achievement (%)**	
				MSW Mgmt	**Population Cater**
I	985	17.65	223.00	70.00%	68.00%
II	394	7.61	515.00	28.00%	29.00%
III	027	0.59	062.00	2.00%	3.00%
TOTAL	**1406**	**25.85**	**786.00**	**100.00%**	**100.00%**

The proposed action plan includes the following components;

(1) Prioritizing of ULBs and formation of clusters to economise the project operation

(2) Development and implementation of waste management infrastructure, machineries, handling equipments and tools, extensive IEC programs in order to promote public awareness and support development of the private sector led waste recycling industries in the State.

(3) Installation of a new waste collection and transfer system to provide waste collection for every waste generator in the state and consisting of direct vehicle collection and manual community collection methods.

(4) Selection of suitable land, land transfer, Geo-technical survey, Environmental approvals, design, construction, contract procurement, operation and maintenance for SWM facilities of the state etc.

(5) Funding Plan and Capacity building of ULBs

The total estimated cost in implementing the complete planned projects is estimated approx. Rs.786.00Crore, which excludes the Operation and Maintenance cost. The funding of O&M for initial 5years is also suggested in the proposed action plan, so to make the whole approach acceptable and financially sustainable. To make the project financially viable, fund inflow too has been planned which does include – recovery of expenses under Polluters to Pay Principle as User fee, resource recovery by maximizing recycling and resale of the processed waste, providing subsidized services and through external funding to meet the gap etc.

Currently under "Namami Ganga" i.e. National Ganga River Basin Authority (NGRBA) and SPA (Special Plan Assistance) funds are available with the State which is proposed to be utilized for the municipal solid waste management projects. Other fundings are anticipated from the Central Government under various Swachh Bharat Mission Schemes, 13th finance and from Asian Development Bank financed projects.

2) Objective:

(1) To ensure compliance with **Municipal Solid Waste (Management and Handling) Rules, 2000** notified in September 25, 2000

(2) To bridge the gap that exists between the current solid waste being generated, collected, transported, processed and scientifically disposed off by the year 2021

(3) To use a holistic integrated and cluster based approach to make the SWM sector self sustainable and viable based on the **Principles of 5R's** i.e. Reduce, Recycle, Recover, Reuse and Restrict

(4) To promote the principles of **Polluter to Pay** and enhance collection of user fee

(5) To address the current needs, constraints and capacity limitations so to achieve "**100% scientific disposal of MSW by the year 2025**" goal

(6) To modernize and mechanize the operation and maintenance of Civic and Public Health Facilities in all the ULBs of the State to provide better and healthy living environment for the citizens of the State

(7) To develop the strategy that provides a 'road map' to completely transform State's SWM sector, transitioning it to an integrated, fully functioning and sustainable system which will serve the ULBs for coming decades

(8) To generate "**civic sense**" amongst the mass to uplift the city's sanitation and personal hygiene condition and raise the hopes for a sustainable common future through extensive IEC programs

(9) To preserve precious lands by creating regional scientific landfills

(10) To provide extensive job, research and development opportunities in MSWM sector

3) Introduction:

Solid Waste Management is one of the essential obligatory functions of the Urban Local Bodies in India. This service is falling too short of the desired level of efficiency and satisfaction resulting in problems of health, sanitation and environmental degradation. Most urban areas in the country are plagued by acute problems related to solid waste. Due to lack of serious efforts by town / city authorities, garbage and its management has become a tenacious problem and this notwithstanding the fact that the largest part of municipal expenditure is allotted to it.

Barring a few progressive municipal corporations in the country, most local bodies suffer, due to non-availability of adequate expertise and experience, thereby the solid waste is not properly handled resulting into creation of environmental pollution and health hazards. Therefore, a need to handle this problem in a concerted manner and adopt strategies to tackle all aspects of waste management scientifically involving private sector wherever necessary and possible is need of the hour.

In the year 2000, the Government of India enacted "Municipal Solid Waste (Management and Handling) Rules, 2000" stipulating compliance criteria for collection, segregation, storage, transportation, processing and disposal of municipal wastes. The Ministry of Environmental and Forest, Government of India vide their Notification dated 25th September 2000 made it effective from the date of its publication in the Gazette of India. These rules are therefore applicable throughout the country.

Uttarakhand, a State located in the Northern part of India, often referred as "Dev Bhumi" was carved out of the Himalayas and adjoining North-Western districts of Uttar Pradesh on November 09, 2000, becoming the 27th State of India. During the

same period Municipal Solid Waste (Management and Handling) Rules, 2000 was also notified. The State is also the first choice of tourists as perfect nature's destination apart having religious importance. The floating population of the States almost equals double the total population of the State in a year. Thus, giving an aesthetic look to every State's city is a big challenge before the State Government, when it has limited operational lands.

Though Government of Uttarakhand is committed to improve the health, sanitation and aesthetic presentation of the ULBs, still, certain challenges as of land put state in miserable situation. Now since NGT has been constituted by Hon'ble Supreme Court of India, which is monitoring the progress of every States in India, thus MSW Rules compliance has shifted back on State's top priority list.

4) Current Status of Solid Waste Management:

With the launch of prestigious JnNURM project by Government of India, in year 2007, Uttarakhand too initiated its three ambitious pilot solid waste management projects for city of Dehradun, Haridwar and Nainital under the said scheme. These projects were awarded in year 2008-09 as under, having total projected cost of Rs.50.63 Crore and benefiting approx. 9.00Lac population.

ULB	Population	MSW Generation (MTPD)	Project Value (In Cr.)	ISWM Contract Awarded on PPP
Dehradun	583679	291.840	24.60	M/s SPML, New Delhi
Nainital	41377	20.689	09.31	M/s A2Z Group, Gurgaon
Haridwar	231139	218.056	16.72	M/s KRLIPL, Calcutta

Of the first two, PPP partners left the projects in between because of land unavailability and rise in operational expense, after delivering the services of door to door collection and waste transportation to the landfill for over 3 years.

The current status of the above 3 project ULBs are as under:

Sr.	ULB Name and Project Cost	Updated Status
1	**Dehradun** Dtd.: 16/05/2008 ▪ Project Cost: Rs.24.60Cr; ▪ Released: Rs.16.09Cr; ▪ Utilized: Rs.09.66Cr;	▪ Vehicles procured– waste compactors, dumper placers, auto tippers, tricycle and bins etc., ▪ D-2-D collection in entire 60wards started ▪ Private Partner has given a final notice of termination, on ground of non-feasibility of the project ▪ Nagar Nigam is currently undertaking the entire C&T operation with its own resources ▪ Land could not be handed over to the PPP operator ▪ EIA could not be completed, thus no processing facility could be setup and wastes are being simply dumped at previous landfill site ▪ Nagar Nigam has now proposed a revised DPR for approval from NGRBA

2	**Nainital** Dtd.: 16/6/2010 ▪ Project Cost: Rs.9.31Cr; ▪ Released: Rs.2.33Cr; ▪ Utilized: 02.15Cr;	▪ Vehicles procured– waste compactors, dumper placers, auto tippers, tricycle and bins etc., ▪ D-2-D collection in 11wards was started but soon closed by the Private Partner. ▪ Nagar Nigam itself is now managing the entire C&T operation, due to non-sustainability the contractor has served notice of termination. ▪ EIA was issued, but the land dispute remains unresolved with the Forest Dept. ▪ Waste continues to be dumped at old sites.
3	**Haridwar** Dtd.: 22/01/2009 ▪ Project Cost: Rs.16.72Cr; ▪ Released: Rs.7.02Cr; ▪ Utilized: Rs.07.02Cr;	▪ Vehicles procured– waste compactors, dumper placers, auto tippers, tricycle and bins etc., ▪ D-2-D collection in only 10wards started ▪ Private Partner has served the notice, because of non availability of landfill site and feasibility in operations ▪ Currently C&T operation is being managed by Nagar Nigam from its own available resources ▪ EIA not conducted yet, thus no processing facility setup ▪ Land could not be handed over to the PPP operator

		▪ A fresh look is needed to work out the viability gap.

Apart from the above Government of Uttarakhand indentified 47ULBs in order to restructure its SWM system through SPA (Special Plan Assistance) which have 25ULBs in Hill region and 22ULBs in Plain region, but the fund was sanctioned for Rs.16.10Cr., of which Rs.6.61Cr. were released to 26ULBs which include 07ULBs in Kumaon and 19ULBs under Garhwal region. Details of the ULBs are given in the table below. Most of the ULBs have spent entire funds made available to them by procuring the vehicles, equipments and erecting civil infrastructure required in compliance with the MSW Rules, 2000.

FINANCIAL ASSISTANCE PROVIDED UNDER SPA		
Garhwal Region (19)	**Kumaon Region (7)**	**Grant Support Details**
Vikasnagar, Mussoorie, Doiwala, Swargashram, Kotdwara, Srinagar, Muni-Ki-Reti, Chamba, Narendra Nagar, Uttarkashi, Gauchar, Nandprayag, Karanprayag, Chamoli-Gopeshwar, Dwarhat, Didihat, Landhora, Jhabrera, Laksar	Shaktigarh, Mahuadhabra, Mahuakheragang, Kelakhera, Khatima, Ram Nagar, Bhawali	Rs.16.10Cr. were sanctioned and First instalment of Rs.6.61Cr. has been released to all ULBs

Rest of the ULBs have been managing the municipal waste from the funds available to them under 13th finance and ULB's own resources. Many ULBs have created little infrastructure for their MSW management, which are inadequate and also does not comply with the laid provisions under the act.

Thus a fool proof plan was required to implement good practices and create sustainable model for management of municipal solid wastes. To initiate a step further to achieve State's Objectives behind preparation of this Action Plan, essential components based on past, present and future analysis are required as under;

(a) Estimate Future Population and Waste Generation Quantities

(b) Waste assessment and audit

(c) Geographical Conditions, Land Status and Availability

(d) Resource Availability and Limitation with ULBs

(e) Identifying the regulatory entities within the planning area

(f) Waste handling and disposal technologies options, availability and necessity

(a) Estimate Future Population and Waste Generation Quantities:

The town wise current and projected population and waste generation details are appended below;

SR	NAME OF THE ULB	ULB Status	Population		MSW Status (MTPD)	
			2011	2041	2014	2041
1	Gauchar	NP	7955	14631	10.000	18.000
2	Nandprayag	NP	1641	3200	0.821	3.000
3	Karanprayag	NP	8283	14268	8.000	12.000
4	Chamoli-Gopeshwar	NPP	21447	42879	10.724	29.000
5	Joshimath	NPP	16709	29997	8.355	21.000
6	Badrinath	NP	2307	8405	2.500	7.000
7	Pokhari (New)	NP	6119	8854	3.060	5.000
8	Gairsain (New)	NP	8665	11265	4.333	5.632
9	Dehradun	NN	583679	1168101	291.840	584.051
10	Vikasnagar	NPP	13927	20840	6.964	14.000
11	Mussoorie	NPP	28897	38396	14.449	26.000
12	Harbartpur	NP	9771	13966	4.886	8.000
13	Rishikesh	NPP	70499	149542	35.250	91.000
14	Doiwala	NP	8705	11317	4.353	5.658

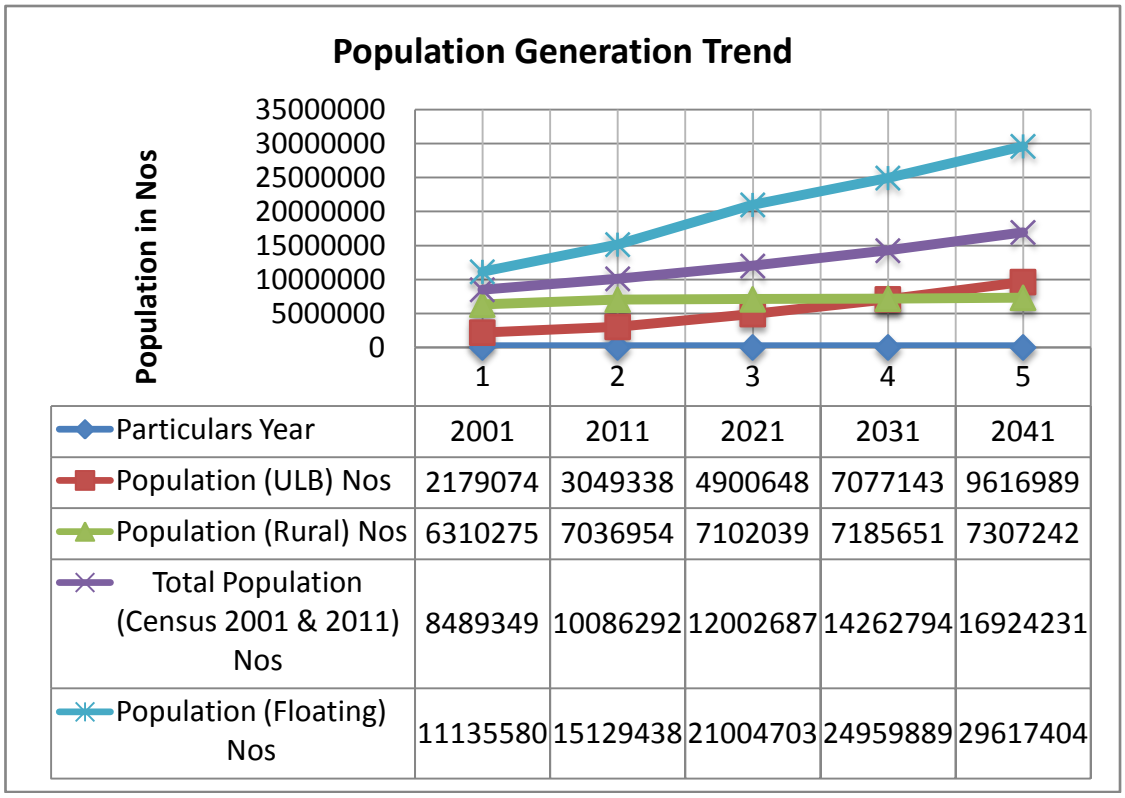
15	Shivalik Nagar (New)	NPP	17307	22499	8.654	11.250
16	Haridwar	NN	231139	423618	218.056	368.363
17	Roorkee	NN	118188	185676	59.094	113.000
18	Manglaur	NPP	52994	68892	26.497	34.446
19	Jhabrera	NP	11186	14542	5.593	7.271
20	Laksar	NP	21760	28288	10.880	14.144
21	Landhore	NP	18370	23881	9.185	11.941
22	Bhagwanpur (New)	NP	17304	22495	8.652	11.248
23	Pauri	NPP	25440	40925	12.720	28.000
24	Kotdwara	NPP	33031	45527	20.000	30.000
25	Srinagar	NPP	20091	26118	10.046	13.059
26	Satpulli (New)	NP	4226	5494	2.113	2.747
27	Dogadda	NPP	2423	3150	1.212	1.575
28	Swargasharam Jauk (N)	NP	4669	6070	2.335	3.035
29	Rudraprayag	NPP	9313	15000	4.657	7.500
30	Sri Kedarnath	NP	612	1720	4.000	12.000
31	Ukhimath (New)	NP	2920	3796	1.460	1.898
32	Augustmuni (New)	NP	7367	9577	3.684	4.789
33	Muni-ki-Reti	NPP	28636	43000	14.318	21.500
34	Narendra Nagar	NPP	6034	8608	3.017	6.000
35	Chamba	NP	7771	10102	3.886	5.051
36	New Tehri	NPP	24012	31216	12.006	15.608
37	Ghansali (New)	NP	7775	10108	3.888	5.054
38	Kirti Nagar	NP	1517	1972	0.759	0.986
39	Dev Prayag	NP	2868	3442	1.434	1.721
40	Barkot	NP	6720	8736	3.360	4.368
41	Gangotri	NP	1100	3168	0.550	2.000
42	Chinyalisaur (New)	NP	8844	11497	4.422	5.749
43	Uttarkashi	NPP	17480	22724	8.740	11.362
44	Nauvgaon (New)	NP	3875	5038	1.938	2.519
45	Purola (New)	NP	5306	6898	2.653	3.449
46	Dwarahat	NP	2749	3574	1.375	1.787
47	Almora	NPP	34125	47178	17.063	32.000
48	Chaukutiya (New)	NP	4796	6235	2.398	3.117
49	Bageshwar	NPP	9079	11803	4.540	5.901
50	Kap Koth (New)	NP	5365	6975	2.683	3.487
51	Champawat	NPP	11029	24878	5.515	17.000
52	Lohaghat	NP	7926	10304	3.963	5.152
53	Tanakpur	NPP	17622	22909	8.811	11.454
54	Banbasa (New)	NP	7990	10387	3.995	5.194

55	Nainital	NPP	41377	45712	20.689	28.000
56	Haldwani	NN	171351	222756	85.676	111.378
57	Lalkuan	NP	7644	9937	3.822	4.969
58	Bhimtal	NP	7722	10039	3.861	5.019
59	Ramnagar	NPP	54787	102615	27.394	70.000
60	Bhowali	NPP	6308	8200	3.154	4.100
61	Kaladhungi	NP	7611	9894	3.806	4.947
62	Didihat	NP	6522	8479	3.261	4.239
63	Pithoragarh	NPP	56044	133036	28.022	90.000
64	Dharuchula	NPP	7039	9151	3.520	4.575
65	Beri Naag (New)	NP	7641	9933	3.821	4.967
66	Gangolihaat (New)	NP	7112	9246	3.556	4.623
67	Munsiyari (New)	NP	3620	4706	1.810	2.353
68	Kiccha	NPP	41810	108885	20.905	66.000
69	Rudrapur	NN	154514	404705	77.257	273.000
70	Kashipur	NN	121610	233060	60.805	158.000
71	Jaspur	NPP	50520	87820	25.260	60.000
72	Mahuadhabra	NP	7326	9524	3.663	4.762
73	Bazpur	NPP	25513	33167	12.757	16.583
74	Khatima	NPP	15087	25139	7.544	17.000
75	Shaktigarh	NP	6309	7239	3.155	3.620
76	Mahuakheragang	NP	12584	28022	6.292	17.000
77	Kelakhera	NP	10929	13149	5.465	8.000
78	Sitarganj	NPP	19978	28455	9.989	20.000
79	Dineshpur	NP	11342	23663	3.000	14.000
80	Sultanpur Patti	NP	9848	11753	4.924	7.000
81	Gadarpur	NPP	19289	25076	9.645	12.538
Total			**3049338**	**4417037**	**1406.00**	**2692.737**

The previous table is representing only about the Urban Local Bodies, not of the area which comes under peri-urban and rural area. If the total is taken into consideration then following table would highlight the current exact status of the State;

Particulars	**Year**	**2001**	**2011**	**2021**	**2041**
Population (ULB)	Nos	2179074	3049338	4900648	9616989
Population (Rural)	Nos	6310275	7036954	7102039	7307242
Total Population (Merged)	Nos	8489349	10086292	12002687	16924231

Population (Floating)	Nos	11135580	15129438	21004703	29617404
MSW Generation (ULB)	MTPD	545	915	1715	3847
MSW Generation (Rural)	MTPD	557	1135	2100	4443
MSW Generation (Floating)	MTPD	1733	2929	4881	9751
Total State MSW Generation	MTPD	606	1465	4393	9556
Handling (Gap)	MTPD	2179074	3049338	4900648	9616989



Particulars Year	2001	2011	2021	2031	2041
Population (ULB) Nos	2179074	3049338	4900648	7077143	9616989
Population (Rural) Nos	6310275	7036954	7102039	7185651	7307242
Total Population (Census 2001 & 2011) Nos	8489349	10086292	12002687	14262794	16924231
Population (Floating) Nos	11135580	15129438	21004703	24959889	29617404

Based on the above facts and graphical representation, it is well understood that the gap is huge and can be filled with effective planning only, with limited land availability. Also after 2025, rapid urbanization is foreseen, which will expand the ULBs area and will also increase the per capita waste generation and will also overcome the rural population by year 2030.

(b) Waste Assessment and Audit:

Two of the below ADB funded studies were conducted during year 2010-13 by Uttarakhand Urban State Development Investment Program:

1) Quantification and Characterization Study of Municipal Solid Wastes in 28 Program ULBs of UUSDIP
2) Behaviour in Handling and Disposal of Solid Waste Management in 31 ULBs under UUSDIP

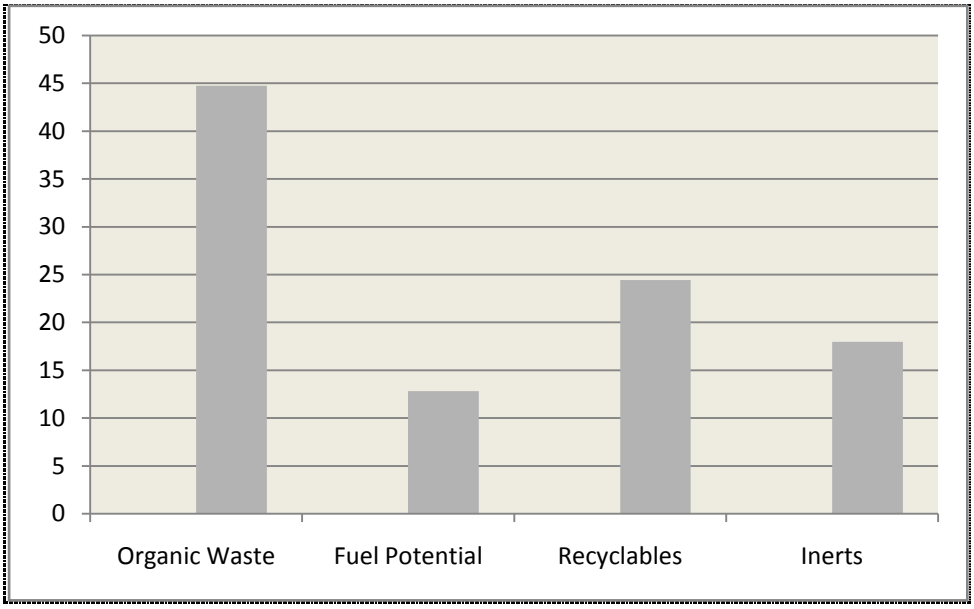
The above program ULBs identified were 51% from Garhwal and 49% from Kumaon region. The objective was to ascertain the chemical properties, quantification and characterization of the municipal solid waste generated from the State on daily basis and to help in decision making process for the proposed Municipal Solid Waste Management practices.

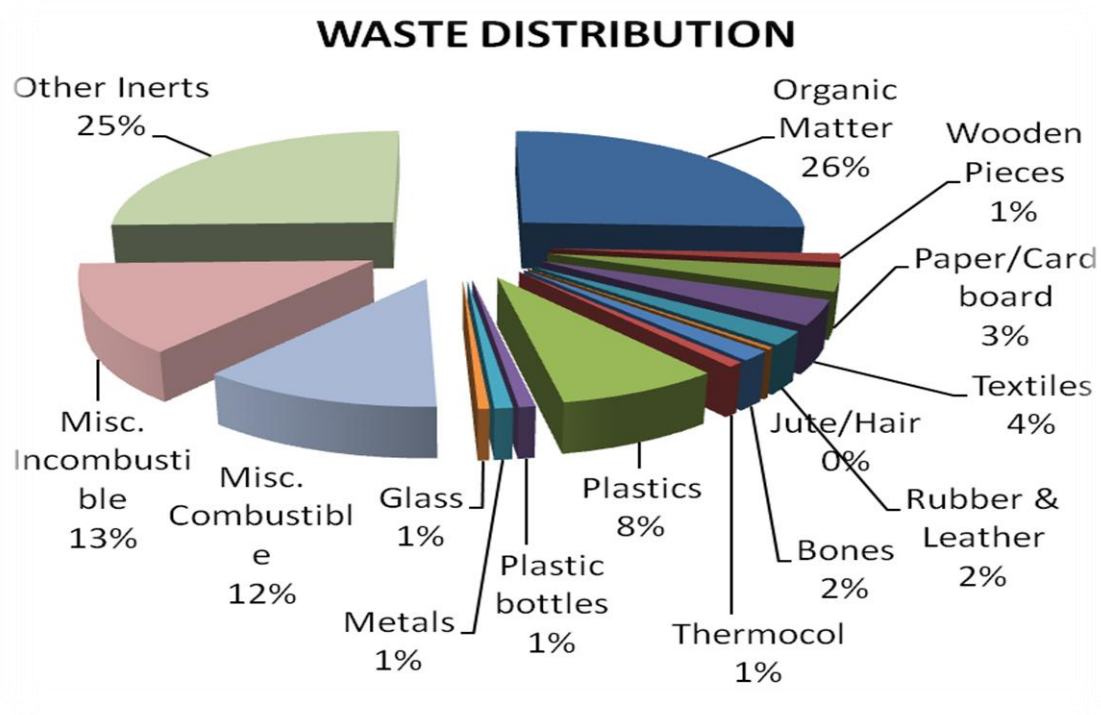
This also brings to focus the necessity of synergy in the design, construction and maintenance of the SWM infrastructure, tools and machineries etc.

(i) Quantification and Characterization Study of Municipal Solid Wastes in 28 Program ULBs of UUSDIP

The outcomes of the studies were as under;

Physical Characterization of the MSW	
Organic Waste	44.76
Fuel Potential	12.83
Recyclables	24.43
Inert	17.98
Total	100.00





To ascertain the chemical properties of the municipal solid wastes, various chemical tests were performed on following parameters;

ANALYZED CHEMICAL CHARACTERISTIC PARAMETERS THE MUNICIPAL SOLID WASTE		
Sr.	**Chemical Test Parameters**	**Code/ Guideline Method/ Protocol - Followed**
1	pH	IS:3025
2	TVS	IS: 10158-1982/ Gravimetric Method
3	TS	IS: 10158-1982/ Gravimetric Method
4	Moisture Content	IS: 9235-1979
5	Organic Carbon	IS: 228 (Part-1) or using C-H-N-S analyzer
6	Organic Matter	
7	Nitrogen	Kjeldhal or using C-H-N-S analyzer
8	Potassium	
9	C/N Ratio	IS: 10158-1982 or using C-H-N-S analyzer
10	Phosphorus	IS: 228 (Part-3)
11	Sulphur	IS: 228 (Part-9)
12	Chloride	Titrimetric/ EPA method 9253
13	Calorific Value	Bomb Calorimeter (kcal/ Kg)
(a)	Kitchen Waste	
(b)	Mixed Waste	
(c)	Fuel/ Combustible Matter	
14	Biochemical Oxygen Demand	IS: 3025 (P-44)- 1993; for 3days at 27Deg. Cel., (mg/ Kg)
15	Heavy Metal	Atomic Absorption Spectrophotometer (mg/ Kg)
(a)	Arsenic (As)	
(b)	Selenium (Se)	
(c)	Zinc (Zn)	
(d)	Iron (Fe)	
(e)	Magnesium (Mg)	
(f)	Nickel (Ni)	
(g)	Cadmium (Cd)	
(h)	Copper (Cu)	
(i)	Mercury (Hg)	

(j)	Lead (Pb)	
(k)	Chromium (Cr)	

The outcome of the above test conducted on wastes, are indicated as below;

CHEMICAL PROPERTIES OF MSW		**Results of Different Sample**					
Sr.	**Chemical Test Parameters**	**1**	**2**	**3**	**4**	**5**	**Average**
1	pH	5.9	6.5	7.2	7.1	5.7	6.48
2	TVS	20.20%	17	18.3	15.96	19.5	14.1924
3	TS	79.80%	83	81.7	84.04	80.5	66.0076
4	Moisture Content	28.30%	26.2	25	27.6	30	21.8166
5	Organic Carbon	13.50%	10.6	16.5	14.7	10.3	10.447
6	Organic Matter	67.40%	59.5	61.2	53.2	65.2	47.9548
7	Nitrogen	0.87%	0.65	0.72	0.63	0.54	0.50974
8	Potassium	0.65%	0.71	0.63	0.57	0.7	0.5233
9	C/N Ratio	15.50%	16.82	22.9	23.3	19	16.435
10	Phosphorus	0.48%	0.56	0.4	0.5	0.65	0.42296
11	Sulphur	0.22%	0.32	0.32	0.26	0.24	0.22844
12	Chloride	0.29%	0.27	0.26	0.3	0.28	0.22258
13	Calorific Value						
(a)	Kitchen Waste	2876	2856	3067	2438	2630	2773.4
(b)	Mixed Waste	1210	1190	1130	1377	1256	1232.6
(c)	Fuel/ Combustible Matter	3144	3368	3288	3068	3187	3211
14	BOD	122331	97680	109058	87780	127390	108847.8
15	Heavy Metal						
(a)	Arsenic (As)	Not Detected					
(b)	Selenium (Se)	Not Detected					

(c)	Zinc (Zn)	23.6	26.1	26.9	44.8	71.2	38.52
(d)	Iron (Fe)	1967	1828	2557	1870	2530	2150.4
(e)	Magnesium (Mg)	2452	3485	2840	3252	3762	3158.2
(f)	Nickel (Ni)	0.98	1.6	1.7	3.2	4.4	2.376
(g)	Cadmium (Cd)	Not Detected					
(h)	Copper (Cu)	2.8	2.1	3.6	1.9	2.9	2.66
(i)	Mercury (Hg)	Not Detected					
(j)	Lead (Pb)	1.4	1.1	1	0.71	0.98	1.038
(k)	Chromium (Cr)	Not Detected					

	PROXIMATE ANALYSIS	**Mixed**	**Organic**	**Fuel & Recyclable**	**Average**
1	Moisture Content % by mass	30	58.3	22.5	36.93
2	Total Volatile Substance % by mass	17.2	60.2	64.1	47.17
3	Ash Content % by mass	75.7	27.5	20.2	41.13
4	Fixed Carbon % by mass	7.1	12.3	15.7	11.70

The above waste's chemical analysis thus authenticates that Waste to Energy projects i.e. either converting waste to compost or waste incineration combined with recovery of recyclable resources will help in reducing the load on landfills and can make project environment friendly and sustainable.

(ii) Behaviour in Handling and Disposal of Solid Waste Management in 31 ULBs under UUSDIP

The study was done in order to understand the status of disposal of municipal solid waste, segregation of garbage, pattern of waste disposal, special category of waste disposal, status of toilet and other sanitation system, frequency of road and drain

cleaning, availability of resources for handling and management of the waste, complaints redressal mechanism, level of satisfaction amongst the stake holder, community view on current practices, need and their willingness to pay the user fee to avail their choice of services and their understanding over the penal clauses against littering and non-cooperation towards effective waste management etc.

The summarized status was presented as under;

(1) Waste Segregation: In existing practices only dry recyclables like – newspaper, glass bottles, plastic bottles and metal scrap are separated out from the waste stream at generation level, that too by 30-40% of the waste generator in order to earn some monetarily benefits sale the same to rag pickers or Kabariwala. Whereas, commonly the entire waste is outsourced in non-segregated manner. It is also witnessed that the different type of wastes viz. biomedical, hazardous, industrial and e-waste including Construction debris all are been mixed with municipal wastes and dumped at the same site.

(2) Waste a Resource: Awareness about converting waste to resource is very less amongst the generator, thus efforts to segregate the waste at source is not made. Efforts in this direction if made will yield significant results.

(3) Waste Disposal: No efforts are made to recover the resources from the waste. In 16 ULBs though compactor system for the recyclable waste is installed, but hardly utilized to its best to yield benefits. No compost are produced from the organic waste though at many places NADEP pits are been made. It shows either the ULBs staffs are not properly trained and motivated or there is lack of staff to operate and maintain the system. Rest ULBs are adopting the old practice of waste collection, handling and disposal at unidentified and unscientific dumpsites. Such practices could be termed as illegal waste

management practices and need immediate attention, before it becomes hazardous for the surrounding flora and fauna.

(4) Waste Collection: Hardly at few of the places, with the help of NGOs door to door waste collection approach is adopted. Whereas, in most of the places the waste are routed directly to community bins or adjoining empty lands or naalas (drains). The collection and storage system within the ULBs are also found inadequate to receive and store the waste in a proper manner. It is witnessed that either the receptacles are very old (discarded one), small sized or placed at very far place, that travelling to that point will be too much time consuming. The dhalows are also having access to birds, fly and animals, since there wall are either collapsed or it lack gate provision.

(5) Complaint redressal: ULBs lack proper administrative and infrastructure setup to address the complaints lodged by the public regarding the waste disposal. Because of this no proper records are maintained and followed.

(6) Satisfaction Level: The unhygienic and un-aesthetic surroundings with deteriorating health and environmental conditions have put the public satisfaction level to its least. The poor waste management infrastructure and administrative setup of ULBs too has worsened the situation further.

(7) User fee, willingness to pay and make attitudinal change: The good part of the above situations is that people who are looking for a change are willing to share some monetarily helps with ULBs in form of user fee, if the ULB approach the society/ community and provides them with some better and reliable waste management solutions. Since the existing situation not only affecting the image and economics of the ULB but also the tourists flooding in from all over the world. The old mind sets, that waste is the responsibility of the ULB only has also now slowly getting changed. People are not accepting it as their own responsibility to safely store and get it disposed through legalized means. The

IEC activities will surely help in bringing vast attitudinal change towards waste management.

(c) Geographical Conditions, Land Availability Status at ULB:

A summarized status of State is laid as under;

- Total area of State 53,484 Km2
- State's Total Population as per census (2011) – Approx. 1.086Cr.
- Total 81 ULBs Population, as per 2011 census - 33.00Lacs
- Total Urban Population - Urban - 30.3% &
  Rural - 69.7%
- Total forest area – Approx. 34,651 Km2 (64%)
- Total Revenue Land – Approx. 6.33Lac Hec. (11.1%)
- Total Agricultural Land – Approx. 13.37Lac Hec. (23.6%)
- Urban Development & Infrastructure – Approx. 2.17Lac Hec. (3.8%)
- Floating Population – 200 to 300Lac / Year (As per MoT, 2010)
- Total No. of ULBs (including 18 newly formed) : 81 + 3
- Breakup - Nagar Nigams : 06
  Nagar Palika Parishad : 31 + 1 (Proposed)
  Nagar Panchayat : 44 + 2 (Proposed)
- Total No. of ULBs in Plains : 40 (47%)
- Total No. of ULBs in Hilly region : 44 (53%)
- Total floating Population (2001) : 1,11, 35, 580 (Source – MoT)
- Population Density – 189 person/ Km2

The State's 93% area is mountains and recorded forest area 65%, State left with only 35% urban land over which all infrastructural urban and industrial development need to be planned. Thus to identify a suitable Land for MSW management in compliance

with the said rules becomes the toughest task for the Urban Local Bodies. Also the land, if any identified, are either inadequate or not complying with the norms, since most of the lands are situated at the bank of stream, rivers and its tributaries.

The 13 District Magistrate have been informed about the requirement of the land in their concerned ULBs and have thus been directed to identify and help the ULB to get one suitable land either of forest or revenue, if not available with the concerned local body. Till date two D.O. Letters from Principal Secretary, Urban have been issued to all the District Magistrate and many of them have even complied with the directions.

Though many of the ULBs have complied with the directions of DO Letters, but the land identified by them, is either Forest or Revenue, thus is pending to get transferred on their name. Moreover, still over 50ULBs have yet to identify suitable site for setting a compliance landfill and processing facility for the MSW.

Recently a meeting chaired by Principal Secretary, Forest and Environment, Government of Uttarakhand on dated 05/11/2014 and second on 11/01/2015 has directed ULBs to coordinate with Forest Department and SPCB authorities to expedite the process of site identification and allocation fast. In an another meeting chaired by Secretary, Urban Development, GoU with various ULBs on dated 17/01/2015, clear and strict instructions were passed to identify the suitable sites at the earliest and report to the Directorate for further needful action. Hope in coming months ULBs may get some lands for undertaking the proposed activities.

The land status of all ULBs in compliance to the aforesaid directions is detailed as further:

SR	NAME OF THE ULB	Land Status (In Acre)		Identified Location/ Ownership	Current Status
		Required	Identified		
1	Gauchar	2.00	0.79	NP	
2	Nandprayag	2.00	0.00		Yet to identify
3	Karanprayag	2.00	0.99	Forest Land	Yet to transfer
4	Chamoli-Gopeshwar	4.00	0.49	Forest Land	Yet to transfer
5	Joshimath	4.00	0.50	State Government	
6	Badrinath	2.00	0.00		Yet to identify
7	Pokhari (New)	2.00	0.05	Forest Land, 2Km from Pokhari	Yet to transfer
8	Gairsain (New)	2.00	0.00		Yet to identify
9	Dehradun	76.00	20.00	Sheesham Bara, Dehradun	EIA approved
10	Vikasnagar	2.00	0.57	Nagar Palika Parishad	
11	Mussoorie	4.00	5.00	Byepass Road	
12	Harbartpur	2.00	2.37	Forest Land	Yet to transfer
13	Rishikesh	10.00	10.00	Khadari Karagmaaf of Revenue	File is pending at Sec. Revenue for approval
14	Doiwala	2.00	0.59	Forest Land	Yet to transfer
15	Shivalik Nagar (New)	2.00	0.00		Yet to identify
16	Haridwar	30.00	20.00	Sarai Village, Haridwar	EIA approved
17	Roorkee (ADB)	15.00	15.00	Saliar Village, Near Saloni River	EIA yet to perform
18	Manglaur (ADB)	6.00	0.00		Yet to identify
19	Jhabrera	2.00	0.00		Yet to identify
20	Laksar	2.00	0.00		Yet to identify

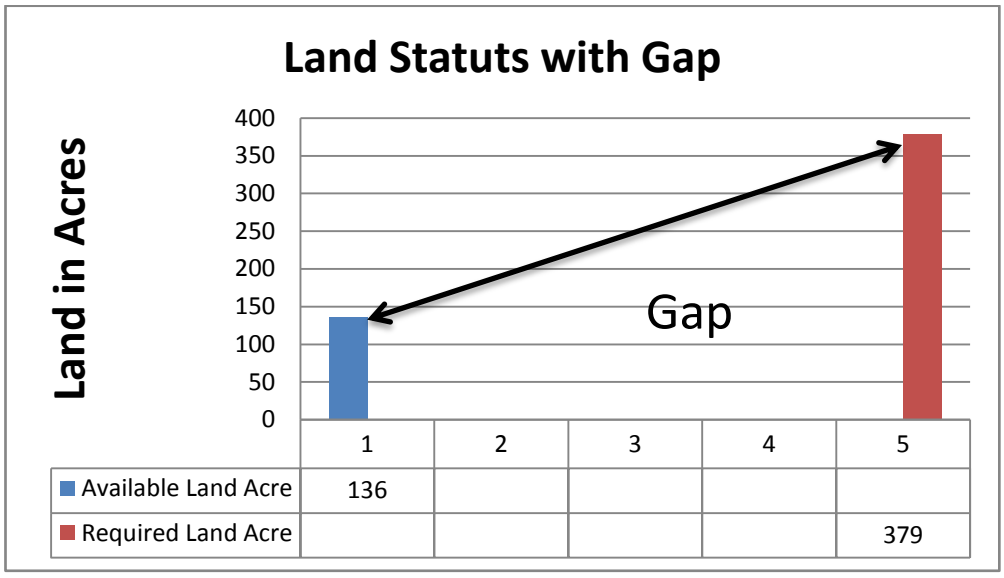
21	Landhore	2.00	0.00		Yet to identify
22	Bhagwanpur (New)	2.00	0.00		Yet to identify
23	Pauri	5.00	1.51	Mandakhal of Palika	Case is pending before Hon'ble NGT
			0.30	Khasra No.3681 of Nazul	DM has forwarded the request to Sec. UDD for approval of transfer of land
24	Kotdwara	5.00	2.00	Revenue	
25	Srinagar	2.00	0.00		Yet to identify
26	Satpulli (New)	2.00	0.00		Yet to identify
27	Dogadda	2.00	0.00		Yet to identify
28	Swargasharam Jauk (New)	2.00	0.00		Yet to identify
29	Rudraprayag	2.00	0.19		Yet to transfer
30	Sri Kedarnath	2.00	0.00		Yet to identify
31	Ukhimath (New)	2.00	0.00		Yet to identify
32	Augustmuni (New)	2.00	1.80	Forest Land	Yet to transfer
33	Munni-ki-Reti	3.00	0.25	Forest Land	Yet to transfer
34	Narendra Nagar	2.00	0.0018	Forest Land	In progress
35	Chamba	2.00	0.0000		Yet to identify
36	New Tehri	2.00	0.0000		Yet to identify
37	Ghansali (New)	2.00	0.0000		Yet to identify
38	Kirti Nagar	2.00	0.0000		Yet to identify
39	Dev Prayag	2.00	0.0000		Yet to identify
40	Barkot	2.00	0.0000		Yet to identify

41	Gangotri	1.00	0.0000		Yet to identify
42	Chinyalisaur (New)	2.00	0.0000		Yet to identify
43	Uttarkashi	2.00	0.0000		Yet to identify
44	Nauvgaon (New)	2.00	0.0000		Yet to identify
45	Purola (New)	2.00	0.0000		Yet to identify
46	Dwarhat	2.00	0.0000		Yet to identify
47	Almora	5.00	1.4900	NPP area reserved forest	Transfer of land is under progress
48	Chaukutiya (New)	2.00	0.0000		Yet to identify
49	Bageshwar	2.00	0.0980	NPP area reserved forest	DM has forwarded the request to DFO on 29.06.11
50	Kap Koth (New)	2.00	0.0000		Yet to identify
51	Champawat	3.00	0.4900	Forest area	DM has requested for the land transfer to NPP
52	Lohaghat	2.00	0.0000		Yet to identify
53	Tanakpur	2.00	0.0000		Yet to identify
54	Banbasa (New)	2.00	0.0000		Yet to identify
55	Nainital	5.00	3.7000	Narayan Nagar of Nazul	As per GO 29-May-1976, Nagar Palika shall have the rights to dump its waste in the said land, under the continous monitoring and supervision of Forest Dept.
56	Haldwani	12.00	0.0000		Yet to identify
57	Lalkuan	2.00	4.9500		
58	Bhimtal	2.00	0.0000		Yet to identify
59	Ramnagar (ADB)	8.00	2.3700	Tarai West of Forest Dept	Approval pending at Secretary Level

60	Bhowali	2.00	0.0000		Yet to identify
61	Kaladhungi	2.00	0.0000		Yet to identify
62	Didihat	2.00	0.0000		Yet to identify
63	Pithoragarh	9.00	0.0000	Nagar Palika Parishad	
64	Dharuchula	2.00	0.0000		Yet to identify
65	Beri Naag (New)	2.00	0.0000		Yet to identify
66	Gangolihaat (New)	2.00	0.0000		Yet to identify
67	Munsiyari (New)	2.00	0.0000		Yet to identify
68	Kiccha (ADB)	6.00	10.00	Revenue Land	NPP has requested DM for the needful
69	Rudrapur	22.00	10.00	Behind Inter College of Nazul	DM has forwarded the request to Sec. UDD for approval of transfer of land
70	Kashipur	17.00	2.00	Nagar Nigam owned	Land transferred to Nagar Nigam
			2.50	Private land	Land Agreement has been signed, yet to transfer
71	Jaspur	7.00	0.54		
72	Mahuadhabra	2.00	0.00		Yet to identify
73	Bazpur	3.00	0.00		Yet to identify
74	Khatima	3.00	2.50	Forest area	Request for approval and transfer made
75	Shaktigarh	2.00	1.00	Kichha Road, Barakoli range	DM has forwarded the request to Forest Dept. for approval and transfer of land to NPP
76	Mahuakheragang	3.00	0.79		
77	Kelakhera	2.00	0.00		Yet to identify
78	Sitarganj	3.00	0.00	Yet to identify	In process

79	Dineshpur	2.00	0.00		Yet to identify
80	Sultanpur Patti	2.00	0.00		Yet to identify
81	Gadarpur	2.00	0.00		Yet to identify
	TOTAL Required/ Existing	**379.00**	**136.00**		

From the above fact sheet it is quite evident that yet 60% of the ULBs have to identify the landfill site in compliance with the rules and 25% of the ULBs, who have identified some land either of forest or revenue yet to get it transferred, rest 15% of the ULBs having lands are inadequate to meet their 30year waste management plan and just 2-3 of the ULBs have adequate lands to initiate with proposed action plan.



The above graphical representation clearly indicates the serious concern, that need to be addressed fast with the help of all concerned departments viz. Pollution Control, Forest, Revenue and Urban.

(d) Resource Availability and Limitation with ULBs:

It was witnessed that almost all the ULBs have sever resource challenges, may it relates to;

(a) Competent ULB Staffs

(b) Waste Infrastructure – Storage community bins, transfer stations, waste processing facility, landfills

(c) GIS mapping of wastes, waste collection vehicles and route plan

(d) Complaint redressal Cell (24 x 7)

(e) Monitoring Mechanism etc.

In the survey it was found that most of the ULBs are operating without any Executive Officer and support staff like JE, Account Officer or Clerks. The sanitation staffs situation is more than worse in various ULBs. The roles of the above raised issues are critical in uplifting the image of any ULB, whereas, the same is lacking below the minimum laid criteria set under the Municipal Acts and Rules.

Thus capacity building is utmost important of entire ULBs. All planning should be made on long term basis.

(e) Summarized Existing SWM Practices and Key Constraints:

- Average current Waste Per Capita MSW Generation: 500gms/day
- Average ULB's Current Municipal Solid Waste Generation (tons / day): 1400
- Current daily lifting and dumping of MSW at dumpsites is approx. 50%
- Suitable Land for developing Landfill site is almost 85% short of its requirement
- The awareness level among the ULB officials and public about the waste management is also not adequate

- Lack of continuous funding to ULBs for sustainable SWM
- The staff, tools and infrastructures that are required in compliance with the MSW rules at ULB level are inadequate, need urgent attention
- Lack of inter-departmental coordination, makes it even more difficult to identify a suitable land and meet legal compliances
- Lack of waste management infrastructure for other wastes are also a threat, which is getting mixed with municipal waste and is getting diverted to dumpsite
- Lack of transparency, expertise and inefficiency in handling and disposal of solid wastes.

5) Proposed Action Plan and Strategy to overcome the SWM Challenges:

The State Government has laid out certain goal plans and strategies to overcome the challenges in compliance with the Municipal Solid Waste (Management & Handling) Rules, 2000. The main priority under the proposed action plan is summarized as under;

Priority # 1: To ensure that the already sanctioned projects under Phase – I, are completed before December, 2016 and to put efforts to make it run successful with the support of Private Partners, State Government inter-departmental coordination and proven technologies.

Priority # 2: To replicate the success & learnings of Phase – I in implementing Phase – II proposed projects. The foremost important efforts will be to ensure that the suitable land are acquired before the Phase – I completion and DPRs to be prepared and completed along with the EIA on the acquired landfill in compliance with the Environmental Acts and Rules before December, 2018. The bid process

management will also follow simultaneously so to ensure that before April, 2019 entire project gets awarded and project commissioning is initiated.

Priority # 3: To ensure that the DPRs and land acquisition for Phase – III projects are completed before June, 2020 and bid process is initiated along with EIA, so that before December, 2020 the project takes and shape and flagged off before April, 2021.

Priority # 4: Extensive awareness campaigns with IEC activities to be initiated shall be a regular part of entire 3 Phases, but will be dedicatedly implemented and monitored after December, 2023 once all projects have started and key infrastructures for effective implementation of MSW Rules are provided to ULBs. Various Capacity building programs for ULBs and other supportive rules are implemented effectively for meeting the set goals of action plan with major two goals i.e. "100% handling and scientific disposal of MSW" & "5R's practices" including research activities to further minimize the waste load to landfill.

To achieve the above below goals and strategies are proposed:

1: Waste Segregation at Source

2: Maximize reuse, recycling and material recovery

3: Recover energy from the waste stream after material recycling and through proven advanced technologies like – Biomethanization, Gasification, Pyrolysis, Mechanical Composting, Refuse Derived Fuels (RDF) etc.

4: Diversion of Construction Debris to another site for future application

5: Waste Management - financially self sustainable

6: Developing a Community Education and outreach services plan to solicit Public Inputs

7: Capacity building of ULBs, Governance Roles and Responsibilities

8: Implement disposal bans on materials that limit opportunities to achieve reuse, recycling or energy recovery

9: Expand the monitoring and enforcement of disposal bans and enhance with effective communications to raise awareness of the bans

#10: Investigate financial and regulatory barriers which prevent or discourage the reuse of materials

11: Rigorous IEC activities in all the ULBs to create community awareness regarding effective waste management

12: Providing necessary infrastructure, tools and equipments to all ULBs for effective SWM management

13: Defining the role and responsibility of Stake holders, State Level Committee and having quarterly review meetings

14: Stringent Monitoring in the field

15: Strict implementation of supporting acts and rules like – Plastic Waste (Management and Handling) Rules, 2011; Biomedical Waste (Management and Handling) Rules, 1998; Hazardous & E-Waste Management and Handling Rules; UP Municipality / Environment Act and Rules

16: Notifying of the supporting bills to fill the gap, if there any like – Anti Littering and Anti Spitting Bill; Construction Debris Management and Handling Bill

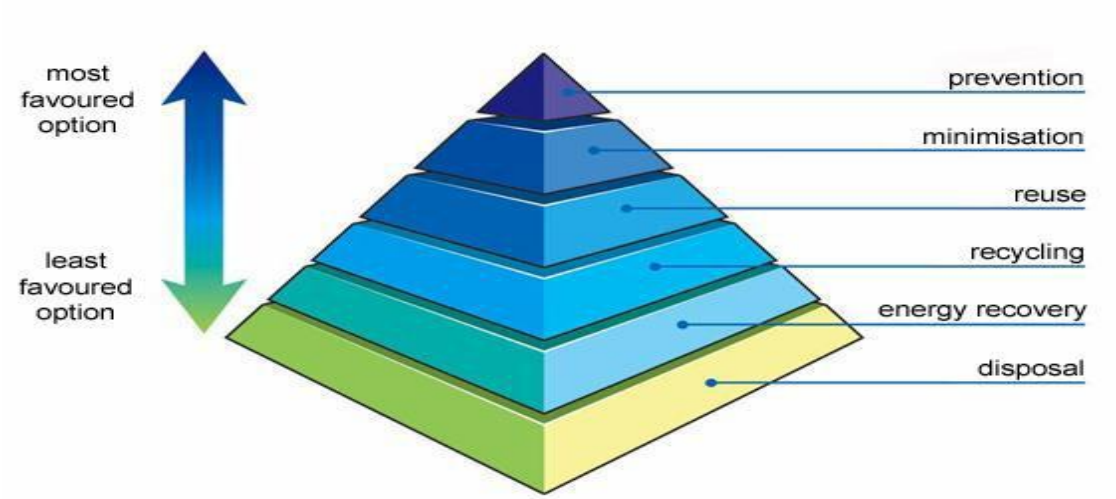
17: State to provide technical and administrative support to the ULBs in compliance with the Environmental Acts and Rules

18: Waste research and audits at frequent intervals

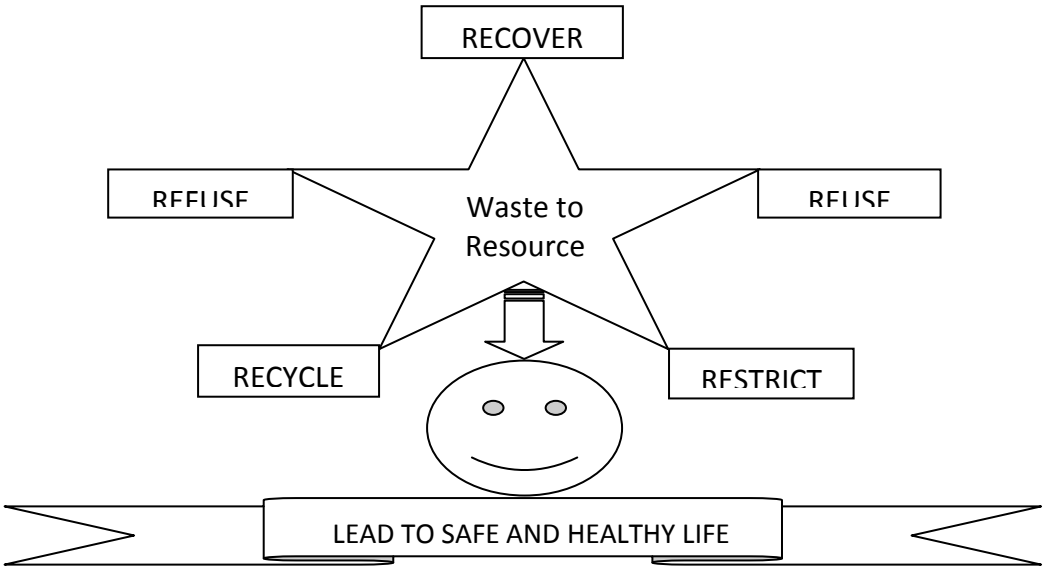
19: Environmental Plan Management etc., and

20: Adopting Pyramid Approach for effective waste management

The pyramid approach of the waste hierarchy management is the need of the hour. This has to be planned and implemented at every step towards safe and sound waste management practices.



The waste through various means whether scientific or traditional need to be minimized, to restrict growth in per capita waste generation i.e. 4-500gms/day if not able to minimize, at least for next 21years. This can further be achieved by adopting the principles of 5R's.



The State Government in consultation with the stake holders and consultants have set forth few strategies to counter the challenges of MSW Rules compliance with the limited resources as under;

(i) Strategy # Zero Waste by 2040:

With a goal of Zero Waste by 2040, it is essential for every sectors and commodities to adopt various means and strategies for increased waste prevention, reduction and diversion. Under a zero waste model, those materials that currently cannot be recycled or composted (roughly 20-30%, depending on the sector), will be redesigned so they can become an input via reuse, recycling, composting. Recognizing the need to re-think waste as a resource is essential now, and in doing so extend the life of the precious and limited landfill.

Zero waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use. Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health.

(ii) Strategy # Construction & Demolition Debris Wastes:

Earlier construction demolition debris were considered as a part of municipal waste, but with many recycling advancements these are now considered as resource component. The sources of its generation and types are:

a) Residential
b) Non-residential

Types:

a) Wood

b) Drywall
c) Concrete
d) Brick & other mixed debris
e) Cardboard
f) Metals
g) Asphalt
h) Plastic & Foam
i) Other packaging material
j) Textiles etc.

In most of the physical characterization/ analysis performed on Indian C&D wastes found at dumpsites are:

DEBRIS TYPE	**PERCENT**
Wood	42.4%
Drywall	27.3%
Concrete	12.0%
Brick & Other Mixed Debris	7.3%
Cardboard	5.4%
Metals	1.8%
Asphalt	1.4%
Plastics & Foam	1.4%
Other Packaging	0.6%
Textiles	0.4%
TOTAL	**100%**

Types and Diversion Mechanism:

⇒ Ferrous and non-ferrous metal—9%: Ferrous and non-ferrous metals are among the most valuable materials in the construction and demolition waste stream. Ferrous metals are extracted from bits of concrete with hydraulic excavating equipment, and deposited into containers. Small bits of ferrous metal are collected with electromagnets positioned over the sort line belt, and grabbed manually. Non-ferrous metals, predominantly aluminium, are collected with a reverse magnet

known as an Eddy current separator, and grabbed manually. Metals consistently demonstrate the highest diversion rate of all the recoverable materials.

⇒ Cardboard and Paper—3%: Cardboard and paper recovered from construction and demolition debris waste have value as recyclable materials, however are generally of a lower grade than cardboard collected at curb side, as a result of consequential exposure to water, and contamination with dusts. Cardboard and paper are usually baled for economical transport to paper and cardboard mills.

⇒ Plastic—1%: Post-consumer plastics 1 (PET) & 2 (HDPE) are valuable commodities. Plastics 3 through 7 are generally recyclable but have less value. Generally plastics are not recycled into material of the same type and grade (down-cycled). PET is readily converted into a wide variety of products. HDPE is down-cycled into plastic lumber, trash receptacles, etc. Plastic film is a nuisance material that impedes efficient picking and sorting of all other materials. When prices of the recycled commodities are low, plastic materials may be exported and or combusted for their energy-producing potential. Plastic may be granulated or chopped into flakes and placed in industrial tote bags for transport.

- Polyethylene terephthalate (PET)
- High-density polyethylene (HDPE)
- Polyvinyl chloride (PVC)
- Low-density polyethylene (PE-LD)
- Polypropylene (PP)
- Polystyrene (PS)
- Other (O)

⇒ Wood—30%: Wood is a predominant material for waste streams in North America, and is highly useful in a wide variety of industrial processes including

manufacturing of high recycled content products. Wood is a valuable commodity and merits diversion. Wood waste can also be processed to make feedstock for biomass and combined heat and power plants.

⇒ Concrete—5%: Concrete is crushed, and embedded metals removed for recycling. Rock and cement pieces are crushed, screened and separated to produce useful aggregates of various dimensions. It is advisable to characterize painted concrete and concrete which has been contaminated with wastes before recycling.

⇒ Industrial Waste Stabilizer (IWS)—25%: IWS is a form of diversion or disposal in some parts of India whereby materials with no economic value between 0.75 to 8 inches dimension are disposed in industrial waste landfills, to promote physical stabilization of the landfill.

⇒ Gravel, aggregate and fines—20%: Gravel, small stones, concrete chips and similar materials can be diverted from disposal with trammel screens positioned before the inclined chain belt, or debris roll screens positioned at the end of the sort line belt.

⇒ Disposal as refuse—5%: Refuse passes off the end of the sort line belt. Generally the proportion of refuse should be less than 10%.

⇒ Window glass—0.15%: Window glass is a nuisance material with a nominal value as a recyclable commodity. Its relatively high weight per volume is a factor in restricting economical transport. Window glass usually ends up in a landfill unless a recycler is located in the vicinity of the diversion facility.

⇒ Carpeting—0.85%: Diversion of carpet from the landfill is very significant in reducing greenhouse gas emissions associated with manufacture of new carpet. Carpeting is a nuisance material in the picking and sorting process, complicating the efficient recovery of materials with higher values. Carpeting is generally picked from stockpiles on the receiving floor, and deposited in containers for transport to manufacturers who can make use of the fibre materials to make new products.

⇒ Drywall—3%: Drywall is 100% recyclable. Gypsum is a nuisance material in picking and sorting operations, producing dust which discomforts labour, and reduces the value of recyclable materials through contamination. Gypsum may be incorporated into new drywall, or used as a soil amendment.

⇒ Asphalt roofing—5%: Asphalt roofing shingles may be ground, sized and graded for re-melting in asphalt paving applications, road base, new roofing, and fuel oil. Asphalt shingles consist of felt saturated with asphalt, and with mineral stabilizers and rock granules added. Asphalt constitutes 20 to 35% of the product weight. Contaminants including metal items and any wood waste must be removed.

Following of the waste are recyclable under the C&D category:

a) Asphalt
b) Asphalt & Dirt Mix
c) Asphalt Composition Shingles
d) Bricks: Broken
e) Built-Up Roofing: Tar & Gravel
f) Ceiling Tiles
g) Ceramic Tiles - Recycle
h) Cinder Blocks - Recycle
i) Clay Roofing Tiles - Recycle
j) Concrete
k) Concrete Roofing Tiles
l) Concrete With Rebar
m) Dirt / Clean Fill
n) Dirt with Gravel & Rock
o) Dry Wall / Gypsum / Sheetrock
p) Garage Doors
q) Lava Rock
r) Rock / Gravel: Clean
s) Roof Shingles: Wood
t) Roof Tile: Asphalt
u) Sheetrock / Drywall
v) Sinks: Porcelain/Broken - Recycle
w) Toilets: Broken - Recycle
x) Wood: Treated / Painted

(iii) Strategy # Extended Producer Responsibility (EPR):

EPR is an environmental policy approach in which a producer's responsibility, physical and/ or financial, for a product is extended to the post-consumer stage of a product's life cycle. There are two key feature of EPR Policy:

1) Shifting responsibility upstream to producers and away from municipalities.
2) To provide incentive to producers to take environmental considerations into the design of the product.

(iv) Strategy # Composting:

Mechanical composting shall be recommended for the ULBs or cluster generating/ receiving waste above 150MTPD and have adequate land for setting up a processing facility with landfill provision.

NADEP or Vessel composting option is available for the ULB/ Cluster generating/ receiving municipal waste maximum upto 50MTPD, depending upon the availability of the land and its size.

(v) Strategy # Waste to Energy:

Waste to Energy (Either Incineration or Gasification) shall be recommended for the ULBs or cluster generating waste between 100 - 200MTPD, but have limited land availability. The motive behind is to bring down the volume of the waste below 10% and increase the shelf life of the landfill.

Biomethanization option is available for cluster or ULB producing less than 100MTPD waste in total, with limited land.

(vi) Strategy # Major Festival Seasons and Tourism inflow:

During the Char-Dham Yatra, Aradh Kumbh, Kumbh, Nanda Rajjath Yatra, Ganga Isnan, Kawar, winter snow-fall season, increases the waste load many a times. As per

the MoT record 2010-11 the tourist inflow to State was recorded between 250-310Lacs/ Annum, which is almost 2.5times of the total state population.

(vii) Strategy # ULB Clustering:

Cluster was formed to utilize the limited available lands with the ULBs to its best in compliance with the laid rules. The criteria of cluster formation were based on following parameters;

- Land Availability
- Distance from Points
  - Proposed for Combined Waste Processing & Landfill
  - Proposed for Combined Waste Processing
  - Proposed for Combined Sanitary Landfill only
- Waste Generation
- Land Road Approach
- Site suitability
- Financial feasibility & sustainability
- Other factors (Legal, Environmental & social aspect)

Following will be the benefits of forming of cluster;

- Waste minimization
- Health benefits
- Production of compost material
- Income from compost, waste paper and recyclables such as plastic and glass.
- Reduced litter
- Reduced pressure on landfill sites
- Reduced impact on waterways and general environment.

The distance matrixes were also made to understand the approach in much detailed manner, which are highlighted as below:

Sr.	Name of the ULB	Distance Matrix (Km)					
1a	Rishikesh	0.0					
1b	Munni-ki-Reti	5.4	0.0				
1c	Narendra Nagar	20.7	15.8	0.0			
1d	Swargasharam Jauk	12.3	12.6	26.8	0.0		
1e	Doiwala	25.5	24.3	36.5	36.4	0.0	
1f	Shivalik Nagar	30.1	35.5	50.7	41.2	43.5	0.0
	FROM	1a	1b	1c	1d	1e	1f
Sr.	**Name of the ULB**	**Distance (Km)**					
2a	Tanakpur	0.0					
2b	Banbasa	10.4	0.0				
2c	Khatima	23.2	15.2	0.0			
2d	Sitarganj	50.6	42.6	27.3	0.0		
2e	Shaktigarh	62.0	54.0	38.8	11.9	0.0	
	FROM	2a	2b	2c	2d	2e	
Sr.	**Name of the ULB**	**Distance (Km)**					
3a	Haldwani	0.0					
3b	Lalkuan	17.1	0.0				
3c	Bhimtal	28.4	41.7	0.0			
3d	Kiccha	37.1	20.0	61.7	0.0		
Sr.	**Name of the ULB**	**Distance (Km)**					
3e	Rudrapur	31.3	22.9	57.0	13.1	0.0	
	FROM	3a	3b	3c	3d	3e	
Sr.	**Name of the ULB**	**Distance (Km)**					
4a	Kashipur	0.0					
4b	Jaspur	15.6	0.0				

4c	Ramnagar	27.1	42.2	0.0				
4d	Mahuadhabra	19.2	3.8	45.8	0.0			
4e	Bazpur	24.3	42.0	49.2	45.6	0.0		
	FROM	4a	4b	4c	4d	4e		
Sr.	**Name of the ULB**	**Distance (Km)**						
5a	Roorkee	0.0						
5b	Manglaur	7.6	0.0					
5c	Jhabrera	17.3	11.0	0.0				
5d	Laksar	21.1	18.7	29.0	0.0			
5e	Landhaura	10.1	3.3	13.8	17.1	0.0		
5f	Bhagwanpur	13.1	20.6	18.7	34.2	23.2	0.0	
5g	Shivalik Nagar	23.4	31.0	41.9	34.8	33.5	32.0	0.0
	FROM	5a	5b	5c	5d	5e	5f	5g
Sr.	**Name of the ULB**	**Distance (Km)**						
a	Shivalik Nagar	0.0						
b	Haridwar	10.3	0.0					
	FROM	a	b					
Sr.	**Name of the ULB**	**Distance (Km)**						
6a	Lohaghat	0.0						
6b	Champawat	23.4	0.0					
	FROM	6a	6b					

Sr.	Name of the ULB	Distance (Km)			
7a	Berinag	0.0			
7b	Gangolighat	23.8	0.0		
	FROM	7a	7b		
Sr.	**Name of the ULB**	**Distance (Km)**			
8a	Kapkot	0.0			
8b	Bageshwar	22.7	0.0		
	FROM	8a	8b		
Sr.	**Name of the ULB**	**Distance (Km)**			
9a	Chaukutiya	0.0			
9b	Dwarahat	17.0	0.0		
	FROM	9a	9b		
Sr.	**Name of the ULB**	**Distance (Km)**			
10a	Kaladhungi	0.0			
10b	Nainital	35.2	0.0		
10c	Haldwani	22.4	31.5	0.0	
	FROM	10a	10b	10c	
Sr.	**Name of the ULB**	**Distance (Km)**			
11a	Mahuakheraganj	0.0			
11b	Sultanpur Patti	16.8	0.0		
11c	Kelakheraganj	32.0	17.3	0.0	
11d	Gadarpur	41.3	26.5	10.3	0.0
	FROM	11a	11b	11c	11d
Sr.	**Name of the ULB**	**Distance (Km)**			
12a	Kotdwar	0.0			
12b	Dogadda	16.2	0.0		
	FROM	12a	12b		

Sr.	Name of the ULB	Distance (Km)	
13a	Vikasnagar	0.0	
13b	Herbertpur	5.4	0.0
	FROM	13a	13b

(viii) Strategy # Use of modern and mechanized collection system (Underground bin Concept)

The State Government of Uttarakhand has decided to adopt unique practices of waste handling that can improve the sanitation condition drastically and uplift the State's overall image. Thus, Government has predominantly decided to create entire city of the State as "Bin less State".

Hence, the management of waste through underground developed infrastructure, the "**LEAN WASTE MANAGEMENT SYSTEM"** is looked as an important evolution which would allow for the efficient and cost-effective tackling of one of the more pressing needs of the State of Chhattisgarh..

By introducing LEAN WASTE COLLECTION MANAGEMENT SYSTEM (LWCMS) Government intents to optimise rapidly the traditional approach, where waste containers are replaced by underground or semi-underground waste collection containers/ bins. These bin systems have their greater portion placed underground, having only their inlets above ground surface.

Standalone underground or semi-underground collection bins offer great advantages over traditional collection bins, as:

➔ greater holding capacity than of the same area's surface dumpsters/ bins

➔ compaction of the waste, increasing their effective capacity by 1.5 to 2.5 times

- ➔ improved aesthetics
- ➔ high hygienic standards, controlling bacterial development and odor problems
- ➔ limited maintenance requirements
- ➔ non-flammable thus superior protection against vandalism
- ➔ Reduces the frequency of frequent collection and transportation of the waste

The above features can allow for a considerable increase in the collection interval that can lead to the reduction of the operating cost (transportation, labor, etc.) of the service, ranging from 5% to 30%. Furthermore, the minimal capital expenditure required as well as the flexibility in its siting requirements make such systems ideal for the instant replacement of the wheel containers. Especially for the case of Thambaram, the implementation of stand-alone semi-underground collection scheme seems to be the most sensible strategy.

The entire municipality is developing on a very fast pace and along with the development of the city the infrastructure and beautification of the city is vital. An efficient solid waste management system is to be essentially designed so as to avoid littering of the city and to avoid spreading of epidemics. The lean waste management system is an innovative solution which deals with both minimizing the littering and increasing the efficiency of waste collection system. The fact that the waste is not exposed to the public, adds to the aesthetics of the city.

Based on the fast growth rate of the city the higher capacity of the bins would also serve for the future needs of the city. In addition the higher capacity bins will also

ensure that the bins don't overflow during festival seasons when the waste generation is much higher than the average waste generation. Since capacity of bins is more the municipality can reduce the frequency of collection which will help in reduction of operation, maintenance and transportation cost.

With the installation of the "Lean waste management system" the municipality can ensure better hygiene conditions for their workers as they don't have to manually handle the waste which in turn leads to lesser hazardous working conditions and increased man hours. The automated system ensures that the emptying of the bins is performed in a very short duration ensuring that no interference is caused to the traffic nor the pedestrians. Based on the waste generation data, ease of access, and frequency of waste collection four types of semi underground bins are proposed for "Lean Waste Collection System".

Existing Conditions of Waste Storage Depots

The bin with size 1.5CuM is ideal for the streets that can be placed at every 3-400Mtrs, with road having a width of 3-4Mtrs at least.

Installation Procedure:

- Pit excavation
- Construction of concrete casing
- Installation of edge protection metallic ring
- Loose filling and closing of the pit surroundings
- Installation of the container

Bin allocation planning in for the Municipality

Some of the important considerations while identifying the location of Lean Waste Collection bins are:

- Free access from the streets: i.e. direct accessibility for a crane mounted tipper truck (min. 5m from the road level)
- Paved Streets
- If possible free of elevated electric and telephone lines
- Free of parking vehicles to have free access to the bins
- Information on underground infrastructure like Sewage lines, cable shafts or other lines
- Existing and proposed location of bins/ open littering locations

Suggestion of collection and transportation infrastructure
Truck and Crane system

It is suggested to purchase two tipper trucks (TATA 1613 / Ashok Leyland 1616 / similar versions) mounted with telescopic cranes (Palfinger PK 15500 A or similar capacities) which should be connected to a specialized bin floor trap door opening system (double-hook grab '*GEJO 5 Rev. A*' of M/S Bakker Hydraulics or similar). One

of the tipper trucks could be used exclusively for handling wet waste while the other one could be used for dry and e-waste. For house hold hazardous waste it is advisable to go for daily collection using a Tata Ace or similar vehicles preferably with a tipping option.

Installation of Bins

The semi-underground models (GTE 1.5) have to be installed after proper excavation and concrete grouting.

Particular	GTE 1.5
Volume (approx. in m3)	1.5
Height (not inclusive of pickup) (approx. in mm)	2100
Height Visible Section	1150
Built in dimensions (∅ x h)	1950 x 950
Weight Concrete outer (approx. in Kgs)	2605
Weight Steel Collection Container (approx. in Kg)	410
Total Weight (approx. in Kg)	3015

Product details and selection logic

A variety of product options were considered as part of the exercise before arriving at the final product mix. The key considerations were

1. Accessibility for local population
2. Availability of space
3. Waste generation at the locality
4. Maximum possible storage duration
5. Increase in waste generation over a period of time etc.

For wet and dry waste, a higher volume bin would have meant that the collection locations would be too far apart. Accordingly, smaller sized 1.5m3 bins are proposed for the collection of wet and dry waste so as to improve the accessibility.

Pick-up system

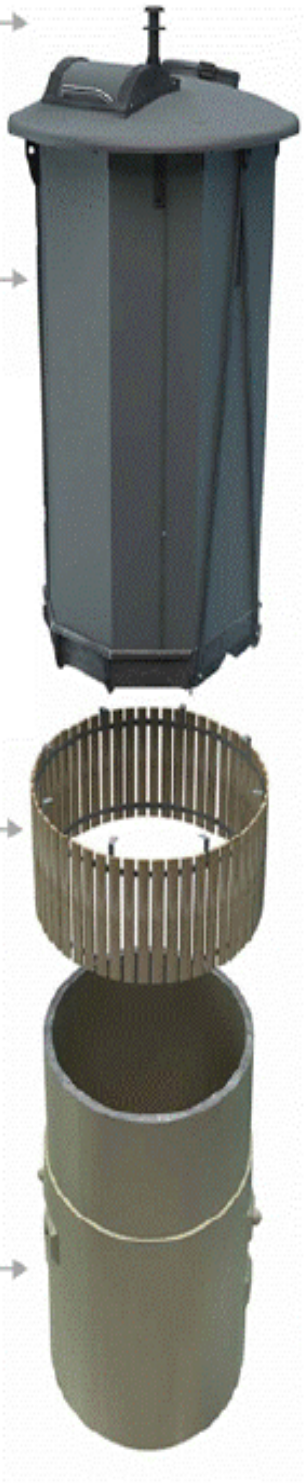
Collecting container

Made of galvanised steel chambers
(intake capacity 2000 kg)
Basin-like trap doors retain any remaining liquid
Capacity of the basin: 150 litres

- Paper/household refuse: trap doors held and operated by traverse/ leverage system which is connected to pick-up system.

Outer container appearance

- smooth concrete
instead of wood panels



Capacities available: from 3cbm – 5 cbm

Outer container

Concrete outer: cast in one piece, watertight, pump sump, built-in lifting loops, metal ring for edge protection,
Steel outer

(ix) Strategy # Phase wise Plan of SWM program implementation:

Since lot of work related to planning, sourcing, procurement and execution etc. are required to implement any program successfully. Thus, with limited resources phased wise planning for implementing State wide SWM practices has been made, which are detailed in table below. Before that it's essential to explain that on what basis/ criteria the phase wise plan was proposed. The criterion was based on following:

(1) Already Approved/ Sanctioned Projects and funds available

(2) Priority ULBs and DPRs in final stage

(3) ULBs producing very little amount of waste and are difficult to club with any ULB because of distance and other geo-technical issues

PROJECT UNDER PHASE – I (COMPLETION TIME PERIOD: December 2016)

Funding Agency (FA)		SR #	ULB	Project Cost (Cr.)	Population	MSW Generation
Existing	Proposed					(MTPD)
JnNURM	GoI / GoU	1	Nainital	9.31	41377	25.00
	NGRBA	2	Haridwar	16.72	231139	220.00
	GoI / GoU	3	Dehradun	24.6	583679	295.00
(FA) JnNURM UIDSSMT CLUSTER – 1		4	Haldwani	34.88	171351	85.676
		5	Lalkuan		7644	3.822
		6	Bhimtal		7718	3.859
		7	Kiccha		41810	20.905
		8	Rudrapur		154514	77.257

FUNDING AGENCY	SR #	ULB	Project Cost (Cr.)	Approach	Population	MSW (MTPD)
GoI & GoU	9	Kashipur	68.76	CLUSTER-2	121610	60.805
	10	Jaspur			50520	25.260
	11	Ramnagar			54787	27.394
	12	Mahuadhabra			7326	3.663
	13	Bazpur			25513	12.757
	14	Roorkee	56.88	CLUSTER-3	118188	59.094
	15	Manglaur			52994	26.497
	16	Jhabrera			11186	5.593
	17	Laksar			21760	10.880
	18	Landhore			18370	9.185
	19	Bhagwanpur			17304	8.652
	20	Pauri	11.39	Integrated	25440	12.720

PROJECT UNDER PHASE – II (COMPLETION TIME PERIOD: December 2019)

Funding Agency	ULB Sr. #	Name of the ULBs	Total MSW (MTPD)	Population Benefitted	Project Cost (Cr.)
NGRBA	1	Rishikesh**	35.250	70499	**50.00**
	2	Munni-ki-Reti**	14.318	28636	
	3	Narendra Nagar	3.017	6034	
	4	Swargasharam Jauk**	2.335	4669	
	5	Doiwala	4.353	8705	
CLUSTER - 4		**TOTAL**	**59.272**	**118543**	
Funding Agency	**ULB Sr. #**	**Name of the ULBs**	**Total MSW (MTPD)**	**Population Benefitted**	**Project Cost (Cr.)**
GoI / GoU	6	Tanakpur	8.811	17622	**35.00**
	7	Banbasa	3.995	7990	

	8	Khatima	7.544	15087	
	9	Sitargunj	9.989	19978	
	10	Shaktigarh	3.155	6309	
CLUSTER – 5		**TOTAL**	**33.493**	**66986**	
Funding Agency	**ULB Sr. #**	**Name of the ULBs**	**Total MSW (MTPD)**	**Population Benefitted**	**Project Cost (Cr.)**
GoI / GoU	11	Lohaghat	3.963	7926	**15.00**
	12	Champawat	5.515	11029	
CLUSTER - 6		**TOTAL**	**9.478**	**18955**	
GoI / GoU	13	Berinag	3.821	7641	**10.00**
	14	Gangolighat	3.556	7112	
CLUSTER - 7		**TOTAL**	**7.377**	**14753**	
GoI / GoU	15	Kapkot	2.683	5365	**15.00**
	16	Bageshwar	4.540	9079	
CLUSTER – 8		**TOTAL**	**7.222**	**14444**	
Funding Agency	**ULB Sr. #**	**Name of the ULBs**	**Total MSW (MTPD)**	**Population Benefitted**	**Project Cost (Cr.)**
GoI / GoU	17	Chaukutiya	2.398	4796	**10.00**
	18	Dwarahat	1.375	2749	
CLUSTER – 9		**TOTAL**	**8.105**	**16210**	
GoI / GoU	19	Mahuakheraganj	6.292	12584	**35.00**
	20	Sultanpur Patti	4.924	9848	
	21	Kelakhera	5.465	10929	
	22	Gadarpur	9.645	19289	
CLUSTER – 10		**TOTAL**	**26.325**	**52650**	
Funding Agency	**ULB Sr. #**	**Name of the ULBs**	**Total MSW (MTPD)**	**Population Benefitted**	**Project Cost (Cr.)**
GoI / GoU	23	Kotdwar	20.000	33031	**30.00**
	24	Dogadda	1.212	2423	
CLUSTER – 11		**TOTAL**	**21.212**	**35454**	
GoI / GoU	25	Vikasnagar	6.964	13927	**15.00**
	26	Herbertpur	4.886	9771	

CLUSTER – 12		TOTAL	11.849	23698	
OPTION-1	27	Kaladhungi^	3.806	7611	**12.00**
OPTION-2	28	Shivalik Nagar^	8.654	17307	
TOTAL			**12.460**	**24918**	

PHASE – II PROJECTS, UNDER INTEGRATED APPROACH:

Funding Agency	Sr #	ULB	MSW (MTPD)	Benefitted Population	Project Cost (Cr.)
GoI / GoU	29	Almora*	17.063	34125	25.00
	30	Pithoragarh*	28.022	56044	28.00
	31	New Tehri*	12.006	24012	15.00
	32	Mussoorie*	14.449	28897	25.00
	33	Barkot*	3.360	6720	10.00
	34	Gairsain	4.333	8665	05.00
	35	Munsyari	1.810	3620	05.00
	36	Dharchula	3.520	7039	05.00
Total			**84.561**	**169122**	**118.00**
Funding Agency	**Sr #**	**ULB**	**MSW (MTPD)**	**Benefitted Population**	**Project Cost (Cr.)**
NGRBA	37	Rudra Prayag**	4.657	9313	15.00
	38	Chinyalisaur**	4.422	8844	6.00
	39	Joshimath**	8.355	16709	10.00
	40	Srinagar**	10.046	20091	12.00
	41	Badrinath**	26.497	52994	10.00

	42	Sri Kedarnath**	4.422	8844	24.00
	43	Uttarkashi**	20.689	41377	15.00
	44	Dev Prayag**	1.434	2868	10.00
TOTAL			80.520	161040	102.00
Funding Agency	**Sr. #**	**ULB**	**MSW (MTPD)**	**Benefitted Population**	**Project Cost (Cr.)**
NGRBA	45	Augustmuni**	3.684	7367	8.00
	46	Gauchar**	10.000	7955	10.00
	47	Karnaprayag**	8.000	8283	10.00
	48	Chamoli Gopeshwar**	10.724	21447	10.00
	49	Ukhimath**	1.460	2920	5.00
	50	Nandprayag**	0.821	1641	5.00
	51	Kirti Nagar**	0.759	1517	5.00
	52	Gangotri**	0.550	1100	15.00
TOTAL			36.00	52230	68.00

Option – 1: Kaludhungi can either join with the Nainital project or Haldwani Cluster Project, since either of the two cities are within 35Kms, but Nainital would be the best option.

Option – 2: Shivalik Nagar can either join with Haridwar, which is just 10Kms (Best Option); Can be clubbed with Roorkee Cluster or Rishikesh Cluster.

***** Represent ULBs whose Master Plans are already prepared under ADB

****** Represent ULBs under pre-approved NGRBA plan

^ Kaladhungi may join Nainital and Shivalik Nagar with Haridwar

PROJECT UNDER PHASE – III (COMPLETION TIME PERIOD: December 2021)

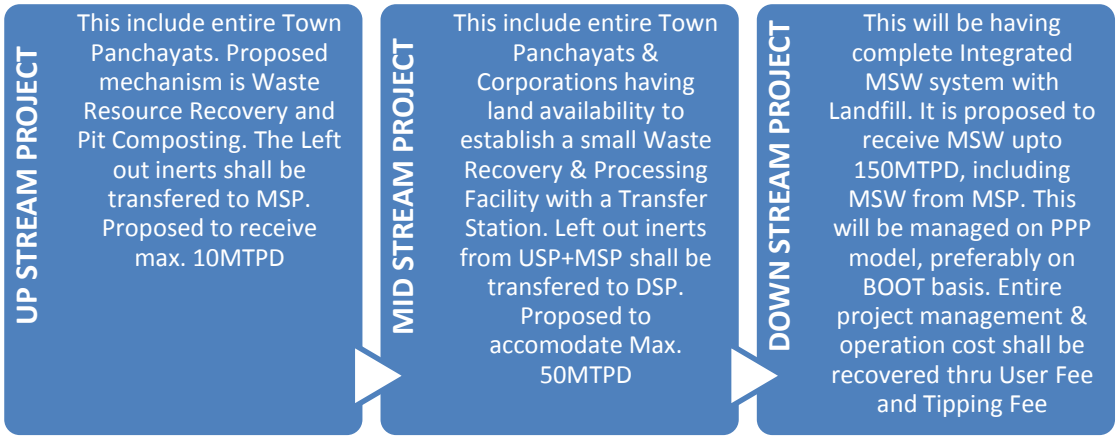
Phased – III projects are all based on integrated approach. Details are appended as below;

Funding Agency	ULB Sr. #	Name of the ULBs	MSW (MTPD)	Population Benefitted	Project Cost (Cr.)
GoI / GoU	1	Ghansyali	3.888	7775	**5.00**
	2	Pokhri	3.060	6119	**5.00**
	3	Satpuli	2.113	4226	**5.00**
	4	Didihat	3.261	6522	**5.00**
	5	Purola	2.653	5306	**5.00**
	6	Nav Gaon	1.938	3875	**5.00**
	7	Chamba	3.886	7771	**8.00**
	8	Bhowali	3.154	6308	**5.00**
	9	Dineshpur	3.000	11342	**5.00**
GRAND TOTAL			**26.951**	**59244**	**48.00**

(x) Strategy # Model of 3 Staged Operations:

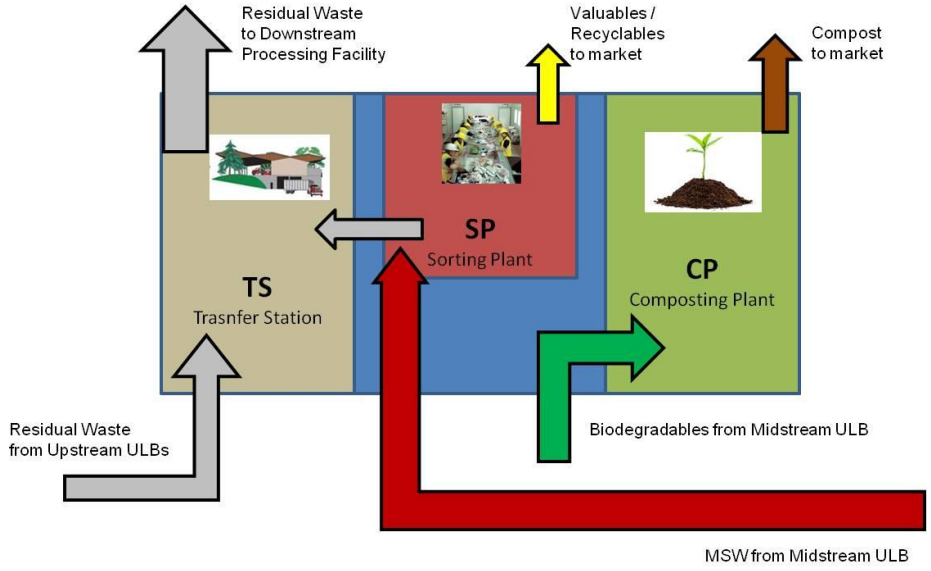
The uniqueness of this 3-stage waste management model is that – it's cost effective, practical, easy to design & operate and last but not the least is Sustainable. This model is based on win : win approach and is so flexible that it can be modified at any stage as the need arises.

- Up Stream,
- Mid Stream and
- Down Stream



The Upstream will consist of the ULBs having not adequate land with them and produces very less amount of municipal waste. The Mid Stream will have the ULBs having land for setting up of transfer station and compost facility without landfill and the Downstream will have the Landfill facility. All these streams shall have coordinating efforts to minimize the operational cost and maximize the resource recovery from the waste with an objective to reduce the load on the landfill.

Recommended technology options for Midstream and Downstream Projects



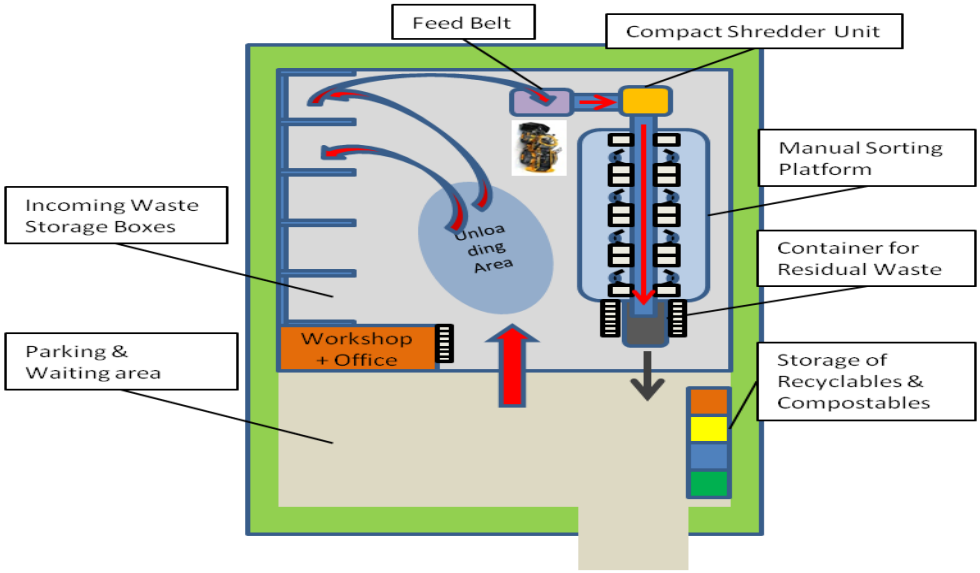
Conceptual design of a MSP site

1. Transfer Stations
2. Biological Treatment Facility
3. Mechanical / manual Sorting

The purpose of the midstream sorting facility is to segregate the hazardous waste and the recyclables from the MSW fraction which is not delivered to the biological treatment facility. This fraction contains

- Recyclables: Paper, plastics, metals, glass, etc.,
- Hazardous domestic waste: batteries, chemicals, cartridges, etc.,
- Inerts: construction and demolition waste, sand and rocks, etc. and still some
- Biodegradables: food and kitchen waste from households, etc.

The MSW is delivered and unloaded on the ground floor in the sorting building. In smaller scaled sorting plants, which have a daily input of less than 5 tpd, the hazardous materials and the recyclables are segregated manually on the floor. Bigger facilities with a daily input of more than 5 tpd should have equipment like moving belts, a shredder and an elevated sorting platform. The different fractions of recyclables are stored in different storage bins and sold to recycling factories or to recycling traders. The hazardous materials have to be stored in appropriate secure bins. These bins should be collected routinely by the hazardous waste collector.



Conceptual design of a mid scale sorting plant

Downstream Waste Projects

In the regional MSW management concept the downstream level represents the last of the three stages. On this level the MSW management has to take care of the MSW generated and collected in the district's capital city itself and of the residual MSW that is transferred from the surrounding clusters and ULBs to the district's capital to be processed and finally deposed.

In order to define the downstream projects it is necessary to

(i) Define the waste streams which have to be processed and deposed and to

(ii) Determine the treatment technologies and processes with consideration of the principles of the regional MSW management concept.

There are three waste streams which have to be taken care of:

(i) Biodegradable MSW from the downstream city, segregated at source (e. g. at hotels, restaurants, markets, commercial units, etc.).

(ii) Residual MSW from the downstream city, still containing some biodegradables which were not segregated at source (e. g. in households, public bins, etc.) and containing recyclables, inerts and hazardous materials.

(iii) Residual MSW from the other clusters and ULBs, still containing some biodegradables which were not segregated at source, inerts and a few recyclables and hazardous materials (they were already segregated at the ULBs' sorting facilities).

There are the following main principles of the regional MSW management concept, which have to be taken into consideration while planning the downstream projects concept:

(i) The amount of biodegradable waste processed locally should be maximized.

(ii) The amount of recyclables segregated locally should be maximized.

(iii) The volume of waste being disposed should be minimized.

(iv) Only inert and stabilized materials should be disposed.

(v) The proposed technologies should be state of the art and suitable to the local conditions.

(vi) The concept should be economically and ecologically sustainable.

(vii) The concept should obey all relevant laws and regulations and the processes, emissions and products should satisfy all legal requirements

Technologies

Of the above mentioned principles and the different waste streams result the following different tasks which have to be realized by the downstream projects:

1. treatment of the biodegradables with production of compost and / or biogas,

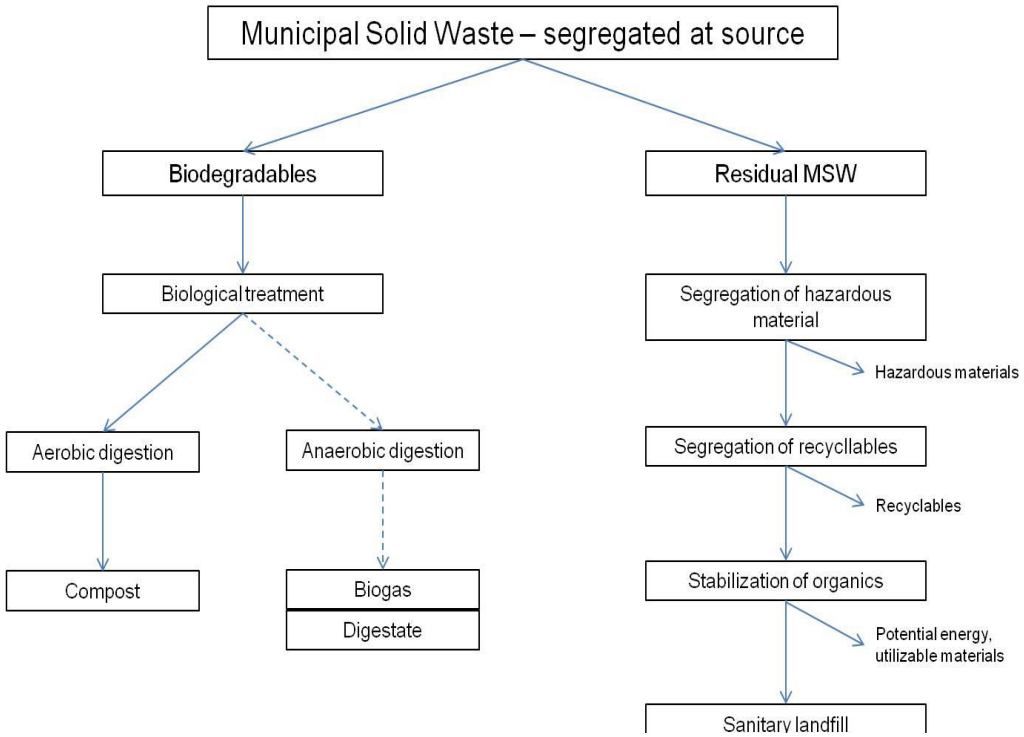
2. recovery of recyclables,

3. segregation of hazardous materials,

4. stabilization of the residual MSW,

5. deposing of inert and stabilized material and

6. Commercialization of the products.



Handling of the biodegradables segregated at source:

Biological Treatment

The main purpose of biological treatment of waste is to render inert the organic substances in the waste. The rendered inert material then can be deposed without showing any harm to health or environment. The inertization takes place by degradation of the organic substances by several microorganisms.

Because of the segregation at source the biodegradables serve as a resource to produce compost or biogas and fertilizer by the means of biological treatment. Hence, almost half of the total MSW is not being deposed as before.

The degradation of the organics happens with air supply (aerobic) or without air supply (anaerobic). The characteristics of both methods are shown below. Both

methods can be applied by various kinds of technology, which are worldwide used and proven.

	Aerobic Digestion	Anaerobic Digestion
Technology	Composting (open or closed)	Fermentation (dry or wet)
Products	Compost	Biogas and fertilizer
Space requirement	++ - ++++	+
Investment	+ - ++	++ - +++
Operational cost	+ - ++	++ - +++
Revenue from products	0 - +	++ - +++

For the downstream treatment of this waste stream, the biodegradable MSW which is segregated at source, thus recommends the installation of an anaerobic digestion plant, because of the following advantages

- much less space requirement, especially in view of the high amounts,
- better odor control
- higher valuable products (fertilizer and biogas)
- the byproduct heat can be used for drying the residual MSW if necessary
- the biogas can be used for the generation of electric power which would provide the whole site.

These advantages outweigh the higher investment and operational cost. Both financial aspects vary a lot depending on the technical design, the supplier and of course of the quantity and quality of the input material.

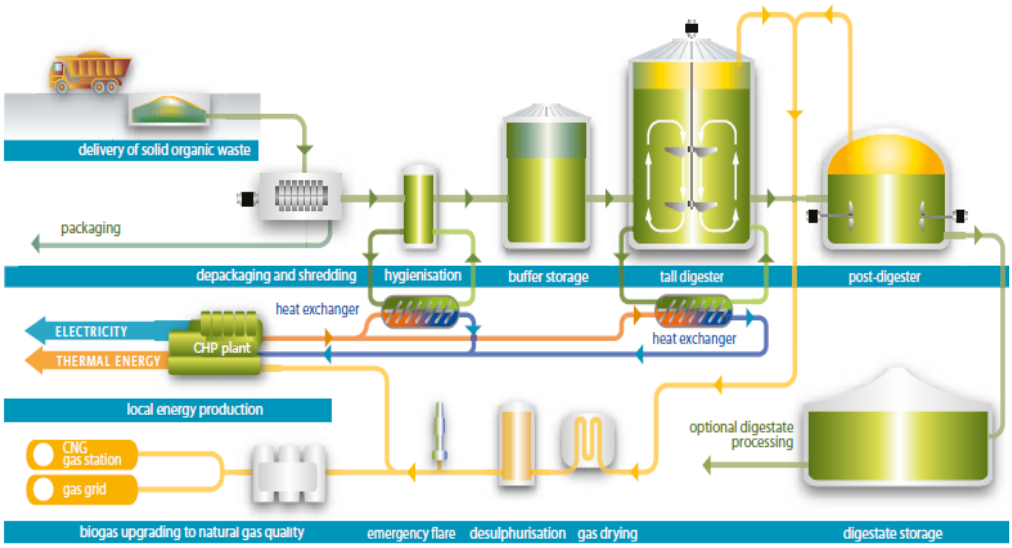


Diagram of a biogas plant

Handling of the residual MSW:

To handle the residual MSW there are various options to fulfill the purposes of material recovery, segregation of hazardous material and stabilization of the organics. After segregation of hazardous materials and recyclables the following methods of stabilization are most commonly used:

- mechanical-biological treatment
- thermal treatment

Because of segregation at source, almost all of the biodegradables are processed directly in the ULBs or in the biogas generation facility. Therefore, a thermal treatment of the residual MSW would be more effective, regarding the volume reduction and the higher value of the output product. The thermal treatment can be done as part of the regional MSW management concept in a new facility or it can be outsourced to the already existing infrastructure of co-incinerators, e. g. of the cement industry.

After all, there are two different alternatives of handling the residual waste:

a) Waste to Fuel

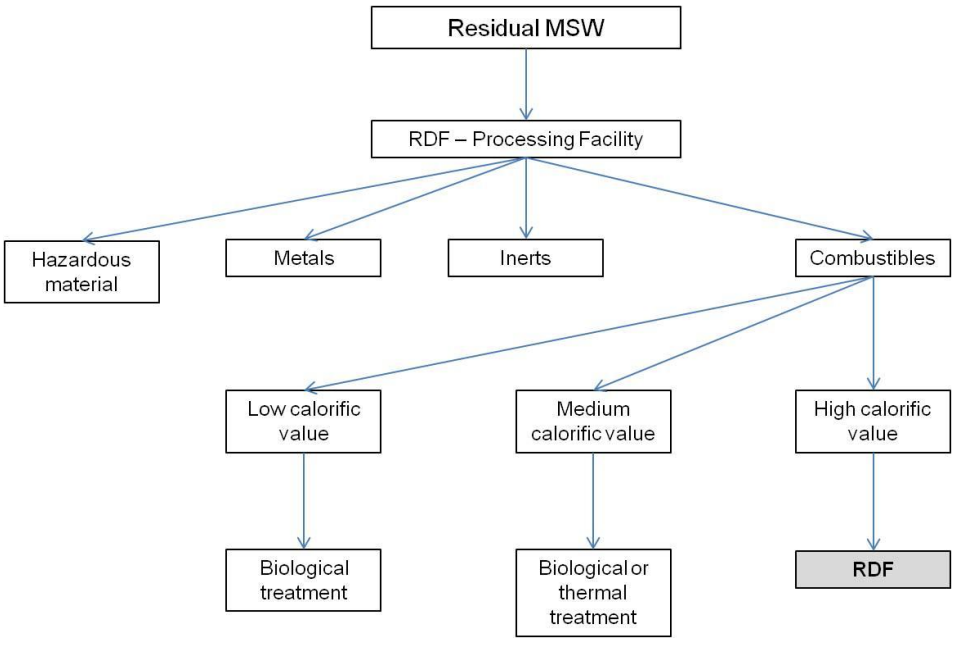
b) Waste to Energy

Both alternatives have in common that the combustible fraction is separated from the non-combustible fraction and the hazardous and recyclable materials are segregated.

The last step of the MSW management activities is the disposal of the inert and stabilized materials -which do not find any more use – on the sanitary landfill.

a) Waste to Fuel

The first alternative, the Waste to Fuel, has the core project the production of RDF (Refuse derived fuel). In the so called RDF-processing facility the hazardous materials, the metals and the inerts are segregated from the residual MSW. The remaining, the combustible fraction, is then divided into a high calorific fraction and a fraction with lower calorific value. The high calorific material can be pelletized if needed.



According to the requirements to the output product of RDF a higher degree of automation is needed than in usual sorting plants. It is absolutely necessary to separate as most of the high calorific material from the residual MSW. In general, RDF-processing plants are equipped with several crushers, magnetic separators, air separators and sometimes a pelletizer. Here, a dryer would be needed, too, as the residual MSW still has a moisture content of about 50%. The heat and biogas produced in the biogas-plant nearby can be used as resource for the dryer.

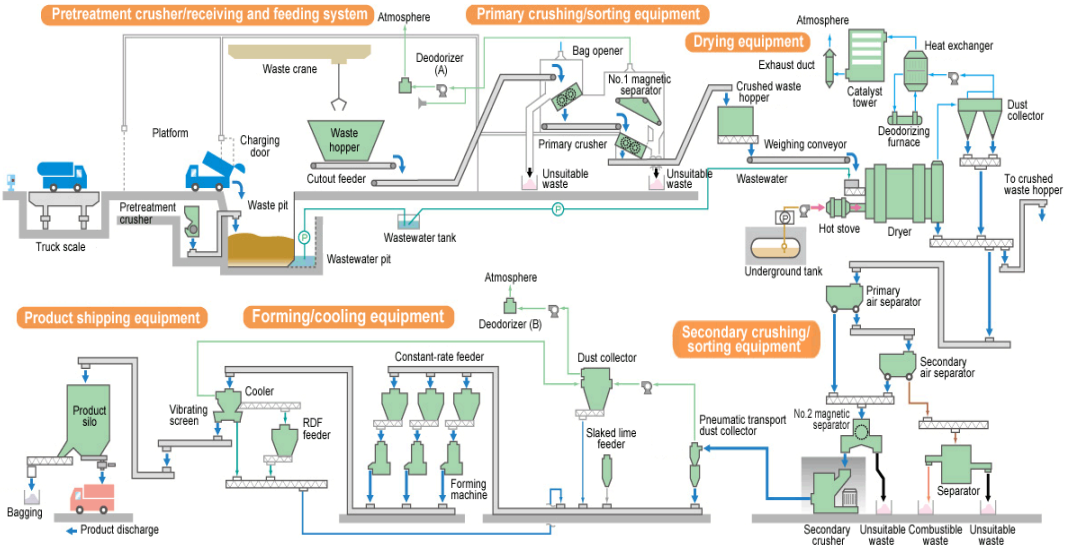


Diagram of a RDF-processing plant with dryer and pelletizer

Whereas the metals and the RDF are sold and the hazardous materials are taken away by the hazardous waste collector, the inerts can be further segregated and the lower calorific materials have to be treated.

The inerts can be deposed totally or materials like glass or ceramics can be segregated for recycling and other materials can be segregated for reutilization as construction material.

The material with low and medium calorific value has to be stabilized before going to the landfill. This can be done by a mechanical-biological treatment plant. It can also be separated into a fraction with low calorific value (mainly biodegradables) for composting – in most cases, these biodegradables are not suitable for the anaerobic digestion. The other fraction with medium calorific value (e. g. textiles) should be treated thermally. By adding material with high calorific value from external sources the textiles can remain and do not have to be treated separately.

Examplary requirements for RDF

Gross Calorific Value (on air dry basis):	2500 Kcal / Kg (Minimum)
Physical size linear:	40-70 mm (Maximum)
Moisture:	15% (Maximum)
Ash content (on air dry basis):	35% (Maximum)

Depending on the equipment and the requirements to the output product the installation cost of such a RDF-processing plant range from Rs.4000TPA to Rs.15000TPA or even more. Moreover, the other treatment activities have to be implemented into the calculations.

b) Waste to Energy

The main purposes of thermal treatment are the inertization of the organics in the MSW and the reduction of the deposed quantity. Secondary purposes are the generation of energy and the production of material for commercialization. Today, the following three methods are most common used:

1. Incineration
2. Gasification and Pyrolysis

All three of them have in common that they need a certain pretreatment of the input material and a certain treatment of the emissions.

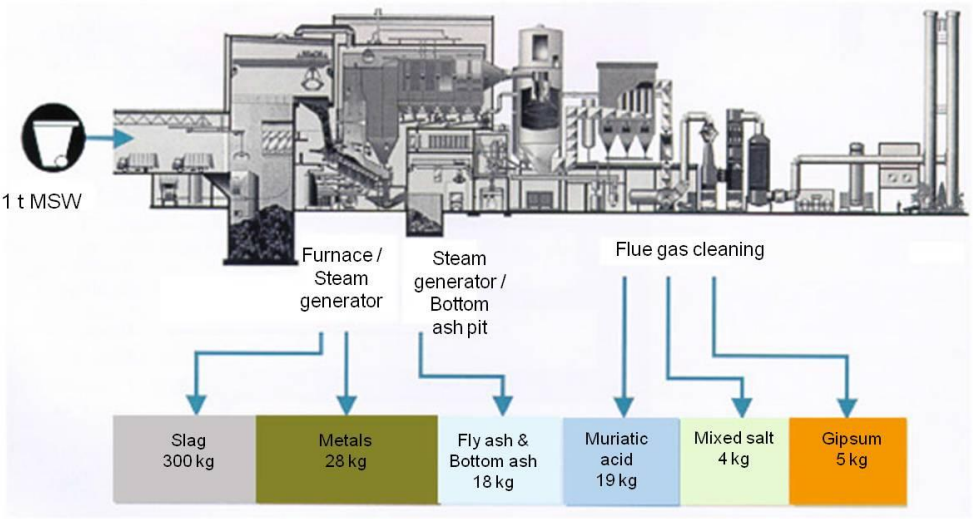
1. Incineration

Classic incineration of MSW is the most common practice in Europe, Japan and Northern America. It comprises the following functional units:

- Waste reception
- Storage and pretreatment
- Feed-stock and combustor
- Slag extraction / treatment of residuals / storage
- Boiler / steam usage
- Flue gas cleaning
- Chimney

The pretreatment of waste for classic incineration does not demand much effort. In this case, the simplest pretreatment would be segregate the hazardous materials and the recyclables manually, shred the residual MSW and dry it with the heat generated at the biogas plant. Big inert materials should be segregated manually, too. The remaining inerts and metals are extracted with the slag, from where the metals can be segregated with a magnetic separator. Parts of the slag can be used as construction material for roads, dykes, etc.. Parts of the residues from the flue gas cleaning can also be used as secondary products, like the gypsum. Depending on the regulations about 10 – 30 % of the input volume has to be deposed on a sanitary landfill as inert material.

The costs for installation and for operation of a conventional incineration plant differ immensely. Again the costs depend very much on the technical design, the supplier and the quantity and the quality of the input material. Very important aspects to be considered in the financial calculations are the legal requirements concerning the flue gas cleaning and the recoverable prices for energy (electric power, steam, warm water or even for refrigeration).



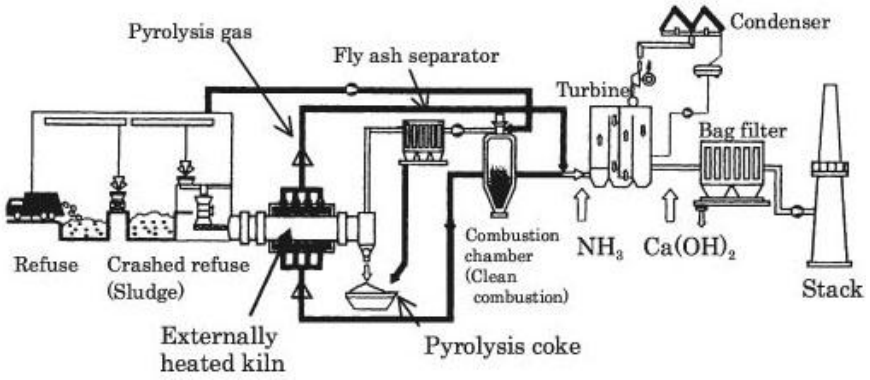
Exemplary picture of a classic incineration plant

2. Gasification and Pyrolysis

By these two technologies the organic material is transferred into combustible and storable material by thermal decomposition. This happens with air supply (gasification) or with exclusion of air. The application of both technologies as a thermal treatment for MSW is still in a stage of development and not really proven in a commercial and industrial operation mode.

A pyrolysis plant with generation of electric power comprises the following functional units:

- Waste reception
- Storage and pretreatment
- Feed-stock and reactor
- Slag extraction / treatment of residuals / storage
- Combustion chamber / Boiler / steam usage
- Flue gas cleaning
- Chimney



Exemplary picture of a pyrolysis plant

In contradistinction to the conventional incineration the pyrolysis and gasification plants require more pretreatment of the input material. It needs low moisture content and has be freed completely of inorganic materials. This would just allow biodegradables, plastics, papers and textiles to remain. Moreover, the emissions from incineration of the char and the gas have to be cleaned from pollutants and the process water has to be treated, too. The energy consumption of the plant itself is quite high because of the kiln which has to be heated externally.

Concerning the costs for installation and for operation of a conventional incineration plant differ immensely, too. Again the costs depend very much on the technical design, the supplier and the quantity and the quality of the input material. Very important aspects to be considered in the financial calculations are the legal requirements concerning the flue gas cleaning and the recoverable prices for energy (electric power, steam, warm water or even for refrigeration). Most quotations of the technical suppliers do not include the flue gas cleaning, the process water treatment and the pretreatment of the input material.

An exercise to briefly explain about the 3-stage model is detailed as below;

STAGE	ACTIVITIES	RESPONSIBLITIES	OBJECTIVE	BENEFITS / THREATS
UP STREAM PROJECT	1. PROCESSING MECHANISM ➢ Weighing of In/ Out going waste ➢ Aerobic Pit Composting (for organic waste) ➢ Recovery of Recyclable / Resource Material thru semi-mechanical/ manual sorting mechanism 2. TRANSPORTATION ➢ Transfer of rejects / mixed / comingled waste to be transported to Transfer Station at MSP 3. REQUIRED CIVIL INFRASTRUCTURE ➢ Boundary Wall (Barbed fencing) ➢ Security Room / Store Room / Administration Block / Rest Room ➢ Weighing Platform ➢ Tipping Platform (Primary Storage	➢ ULB to erect basic & a good MSWM Infrastructure ➢ Single Operator to look into the O&M and also to ensure the transportation of the rejects to Transfer Station ➢ ULB to decide the user fee collection mechanism thru the private operator to meet his partial O&M cost & rest from the sale of compost and resource – recyclable materials. ➢ ULB to provide Land atleast approx. an acre to set up the entire processing facility	➢ Achieving the objective of Most Preferred (Sustainability) Waste Hierarchy Model ➢ To process the maximum received MSW ➢ **Less the Waste transferred, Less the tipping fee to pay** ➢ **Waste Rejects Reduction, increase landfill sustainability** ➢ Less Load	➢ Reduces Risk of – Volume / Composition / Transportation/ Market Linkage/ Productivity ➢ Effective management/ monitoring/ transparency in Operation ➢ Generate Employment ➢ O&M Cost Recovery ➢ ULB if fail to deliver the MSW to

	Area) ➢ Pre-sorting Area with conveyor belt ➢ Storage Area of Recovered Resource Material ➢ Compost Area with Curing/ Tipping Platform ➢ Storage Area of ready compost ➢ Storage Area for rejects (to be collected and transported to Transfer Station) ➢ Parking Area with Vehicle washing Platform ➢ Fresh Water Tank (Reservoir), OHT, Safe Pits, Leachate Collection / Slurry Storage Tank ➢ Internal Road, Water & Electricity (LT) Supply (5KW) ➢ Green Belt (30%)	➢ ULB to monitor & ensure the activities of Operator in compliance with the MSW Rules, 2000 and conditions of the concessional agreement ➢ ULB to ensure primary collection and transportation of MSW up to the facility (Free of Cost) ➢ Continuous Awareness & Education campaigns (IEC activities) – Joint Responsibility of ULB and Operator	on ULB ➢ Sustainable Infrastructural Model for next 25-30yrs	facility for some unknown reasons? ➢ Segregation
MID STREAM	1. PROCESSING MECHANISM ➢ Weighing of In/ Out going waste	➢ ULB to erect basic & a good MSWM Infrastructure	➢ Achieving the objective of	➢ Heavy O&M Cost Load

PROJECT	➢ Aerobic Pit / Semi Mechanical Composting (for organic waste) ➢ Recovery of Recyclable / Resource Material thru semi-mechanical/ manual sorting mechanism ➢ Transfer Station with waste compaction facility to receive rejects from USP & Self Pre-Post Processed MSW ➢ Shredding & Plastic Compaction Unit 2. TRANSPORTATION ➢ Transfer of rejects / mixed / comingled waste directly to SLF / Processing facility (if W2E) at DSP 3. REQUIRED CIVIL INFRASTRUCTURE ➢ Boundary Wall (Barbed fencing) ➢ Security Room / Store Room / Administration Block / Rest Room ➢ Weighing Platform	➢ Single Operator to look into the O&M and also to ensure the transportation of the rejects to Transfer Station ➢ ULB to decide the user fee collection mechanism thru the private operator to meet his partial O&M cost & rest from the sale of compost and resource – recyclable materials. ➢ ULB to provide Land atleast 3-5acres to set up the entire processing facility ➢ ULB to monitor & ensure the activities of Operator in compliance with the MSW Rules, 2000 and	Most Preferred (Sustainability) Waste Hierarchy Model ➢ To process the maximum received MSW ➢ Less the Waste transferred, Less the tipping fee to pay ➢ Waste Rejects Reduction, increase landfill sustainability ➢ Less Load on ULB ➢ Sustainable Infrastructural	

	➢ Tipping Platform (Primary Storage Area) ➢ Pre-sorting Area with conveyor belt ➢ Storage Area of Recovered Resource Material ➢ Compost Area with Curing/ Tipping Platform ➢ Storage Area of ready compost ➢ Transfer Station with waste compaction facility ➢ Storage Area for rejects (to be collected and transported to Transfer Station) size to accommodate the waste of USP & MSP with atleast (3day storage capacity**) ➢ Parking Area with Vehicle washing Platform ➢ Fresh Water Tank (Reservoir), OHT, Safe Pits, Leachate Collection / Slurry Storage Tank	conditions of the concessional agreement ➢ MSP to recover the Transfer Station O&M & Transportation cost from USP (Operator) on per ton basis (30% of the agreed tipping cost) ➢ ULB to ensure primary collection and transportation of MSW up to the facility (Free of Cost) ➢ Continuous Awareness & Education campaigns (IEC activities) – Joint Responsibility of ULB and Operator	Model for next 25-30yrs ➢ Avoid multiple processing of the rejects (reduces O&M cost)	

	➢ Internal Road, Water & Electricity (LT) Supply (65KW) ➢ Green Belt (30%) ➢ ** (Emergency Reasons / unavoidable circumstances etc)			
DOWN STREAM PROJECT	4) PROCESSING MECHANISM ➢ Weighing of In/ Out going waste ➢ Aerobic Mechanical Composting (for organic waste) ➢ Recovery of Recyclable / Resource Material thru semi-mechanical/ manual sorting mechanism ➢ RDF Unit ➢ Transfer Station with waste compaction facility to receive rejects from USP & Self Pre-Post Processed MSW ➢ Shredding & Plastic Compaction Unit ➢ Sanitary Landfill Site (Capacity to be designed @1.5times i.e. anticipating 30% the	➢ Partially financed by ULB (20%) Subsidy from MoEF (30%)& Private Operator Investment (50-80%) ➢ ULB to decide the user fee collection mechanism thru the private operator to meet his partial O&M cost & rest from the sale of compost and resource – recyclable materials. This user fee can also be recovered along with electricity bill or property tax	➢ Achieving the objective of Most Preferred (Sustainability) Waste Hierarchy Model ➢ To process the maximum received MSW ➢ Waste Rejects Reduction, increase landfill sustainability ➢ Less Load	➢ Heavy O&M Cost Load ➢ Quality of Compost & other bye products ➢ Market for RDF ➢ Management of C&D Waste, drain silts & slaughtered wastes ➢ Mixed hazardous / biomedical waste

	load of actual local comingled waste going to landfill) ➢ **Best Technology Option shall be – Waste to Energy (Gasification / Pyrolysis)***** 5) TRANSPORTATION ➢ Primary & Secondary Collection ➢ Processing & Disposal at SLF 6) REQUIRED CIVIL INFRASTRUCTURE ➢ Boundary Wall (Barbed fencing) preferably with two gates for IN & Exit purpose for easy movement of the vehicles ➢ Security Room / Store Room / Administration Block / Rest Room ➢ Weighing Platform / Operation Control Room ➢ Laboratory Setup / Vehicle Workshop Area ➢ Sanitary Landfill with Leachate	so to achieve 70-80% collection efficiency. ➢ ULB to provide Land atleast minimum 30 acres to set up the entire Integrated processing facility for MSW ➢ ULB to monitor & ensure the activities of Operator in compliance with the MSW Rules, 2000 and conditions of the concessional agreement ➢ DSP to recover the SLF O&M cost from MSP (Operator) on per ton basis (30% of the agreed tipping cost) ➢ Primary Collection (D2D) management of	on ULB ➢ Sustainable Infrastructural Model for next 25-30yrs ➢ Avoid multiple processing of the rejects (reduces O&M cost)	➢ Getting Environmental Clearances / NoCs

	treatment unit / ETP ➢ Tipping Platform (Primary Storage Area) ➢ Pre-sorting Area with conveyor belt ➢ Storage Area of Recovered Resource Material ➢ Compost Area with Curing/ Tipping Platform/ Monsoon Shed ➢ Storage Area of ready compost / Packaging ➢ Transfer Station with waste compaction facility ➢ Tipping Area for (3day Tipping / storage capacity**) ➢ Parking Area with Vehicle washing Platform ➢ Fresh Water Tank (Reservoir), OHT, Safe Pits, Leachate drains, rain / storm water runoff Tank	secondary storage points to final transportation upto facility, entire responsibility lies with the Private Operator ➢ Proposed PPP Model on BOOT basis ➢ Continuous Awareness & Education campaigns (IEC activities) – Joint Responsibility of ULB and Operator ➢ **An appointment of a full time Project Management Consultant Unit with partial authorities along with a Steering Committee to be constituted for routine monitoring & resolving of the operational**		

	➢ Internal CC Road, Water & Electricity (LT) Supply (350KW) ➢ Green Belt (30%) ➢ ** (Emergency Reasons / unavoidable circumstances etc) ➢ ***** Entire load coming from USP, MSP & DSP can be processed in single channel. The output will be an Ash (300 times reduction of volume). Increases SLF life.** ➢ **Less land requirement, Less Processing Cost (Closed Loop Operation)** ➢ **Financial Viability & Environmental Feasibility**	**issues between the ULBs & Operators – A must.**		

(xi) Strategy # Use of Consultant:

It was observed that most of the ULBs have prepared the SWM Detailed Project Report without the help of external consultant, thus such DPRs lack the important components required to preparing a fool proof project report.

Designing and building a landfill, transfer station, recycling center, operation plan etc will require the expertise hand, thus obtaining the help of a consultant is necessary and time saving.

Though the consultants often do have expertise in developing plans in general, they still do not have as much expertise and knowledge of the ULB as a member of that ULB does. Thus, a combined motivated effort should be made to prepare long term action plans. Have a get acquainted meeting. Make sure the consultant understands your needs and exactly what you want. Encourage them to ask questions about your town, your community; this will ensure that you receive a plan or design that meets your ULBs specific needs and situation. Ask consultant for suggestions, and carefully weigh the advice and accept it, if find suitable.

(xii) Strategy # Determining Role and Responsibility of Stake Holders:

Since waste management is the responsibility of every individual not solely of particular community or ULB. Thus, it's must that role and responsibility of all stake holders should be clearly defined and timely monitored. Solid Waste Management has been a neglected subject for the past several decades. Systems have, therefore, not developed to improve the service. Knowledge of new technologies and methods coupled with training at all levels is necessary. No specialized courses have so far been designed to meet need of different levels of staff. Special training and refresher courses would be suggested for unqualified supervisory staff. Short and medium term courses would be suggested for the sanitation workers and supervisory staff

focusing on SWM related aspects, like proper use of tools, good practices of sanitation, knowledge about SWM Rules, 2000 health, safety and hygiene related issues, work by involving the community etc. Elected representatives and officers of implementing agencies need training on good practices of SWM, Private sector participation, Management Information Systems, and other issues related to finance, legal and institutional strengthening.

(xiii) Strategy # Capacity Building of ULB, Community Education and outreach plan:

Due to rapidly growing urban population, current institutions are unable to provide an adequate level of services, posing a serious threat to public health and environment. It is experienced that even after setting up of a good system, it is not always necessary to obtain desired results. No city can remain clean, if sanitation work is left entirely on civic body with no cooperation or very little cooperation of people.

Thus Communities should be motivated enough to solve their common problems at local level. Community participation is the process by which individuals and families understand responsibility for their own health and welfare of societies. Communities should be motivated enough to solve their common problems at local level. This enables them to become agents of their own development instead of positive beneficiaries of development aid. The key to the success of a solid waste management system in any city is the cooperation of citizens. Citizens ought to be involved in proper storage, collection and safe disposal of waste.

Communities should also be made aware of health risks associated with improper solid waste management practices. At the same time training and refresher courses are essential for municipal staff and public representatives.

Therefore for effective implementation of SWM practices, three pronged action is

required:

(i) Setting up of an efficient system by ULB in association with State Government

(ii) Capacity building of staff, public representatives, NGO etc and

(iii) Mass awareness campaign for waste generators/ community. Ensuring Public Participation, through consistent mass awareness campaign is key to success for SWM. People need to know about the duties of Municipalities, rules and regulations /obligatory functions of Municipality; as well as their participatory role towards city's cleanliness. Information, Education and Communication (IEC) mechanisms would be used to ensure effective public participation.

This would be along drawn exercise as it involves attitudinal changes in people and will have to be done with careful planning, in a phased manner.

(i) Training of the Executive officer, technical staff and sanitary inspectors in understanding the fundamental difference between "scavenging and cleansing" and solid waste management, with adequate stress on end use disposal of garbage. The concept of recovery of resource and energy conservation should remain the focus of the programme.

(ii) Training of the field staff in scientific collection of waste through proper segregation to keep the waste stream un-mixed.

(iii) Immediately practicing the discipline of collecting inert (road dust, drain silt, debris), littered plastics and its likes, the biodegradable waste in separate trips.

(iv) Organizing workshops and awareness programs in schools, community based organizations for seeking their opinion and support for evolving and practicing waste handling and management.

(v) Evolving relevant literature for circulation backed up with one to one interaction of waste collectors with the community.

(vi) To monitor the effective operation as proposed, we can have a State Level Steering Committee (SLSC) for SWM and PMU at DSP level which will monitor the activities of all 3-stages and can propose remedial actions to the concerned ULBs and also put forth the penalization recommendation to the SLSC, in case if

the operator or the ULB continuous fails to meet the necessary compliance as proposed under the Concessional Agreement and MSW Rules, 2000.

(vii) Key Strategies:

a) Design education and technical assistance program with and for key stake holders to support behaviour and systems change.

b) Create clear, fair regulations (via bylaws and permits) that provide a strong financial incentive for waste prevention and diversion activities.

c) Support the private sector to expand or create new collection and processing services for enhanced recycling and composting.

(xiv) Strategy # Fund Allocation:

It's a key component of every action plan. The fund allocation for the smooth and trouble free project commissioning and operation is required in two stages;

1) Capital Expenses (One time/ Phased wise) – Short term
2) Operation and Maintenance (recurring/ continuous) – Ongoing

The Capital expenses which include the Pre-project planning expenses, planning period expense, cost on various civil, mechanical, automobile infrastructure and legal expense etc. These costs can be met through three means:

a) Grant from Central (upto 50% or more)
b) Grant from State (upto max.50%)
c) Investment by the private partner (upto 100%)

Currently the state has following sources of funding i.e. NGRBA, UDISSMT/JnNURM, SPA and ADB. The State Government has recently decided that the entire SWM project shall be funded from NGRBA which will also include 3 years operation and maintenance. In case NGRBA has any technical constraints to fund these SWM project then the same will got funded from ADB. Thus, external funding for meeting the current capital expenses of these projects is not an issue or constraint for State.

(xiv) Strategy # Determining of User Fee:

One of the serious most concern for the state is to ensure that each of its proposed SWM projects become financially self sustainable. This is possible only when the waste resource is fully capitalized by means of sale of compost, recyclables, RDF and recovering 100% user fee from the waste generators under Polluters to pay principal. This is one of the toughest tasks, as most of the failure of SWM project was because of this factor only.

The Government has to understand that only in bigger SWM projects i.e. where the waste generation capacity is above 100MTPD, will be beneficial to a PPP operator, if he invest partially on the project else in rest of the case, ULB have to meet the expense on its own. Thus a budgetary provision needs to be taken to meet the gap and keep the project in operational mode.

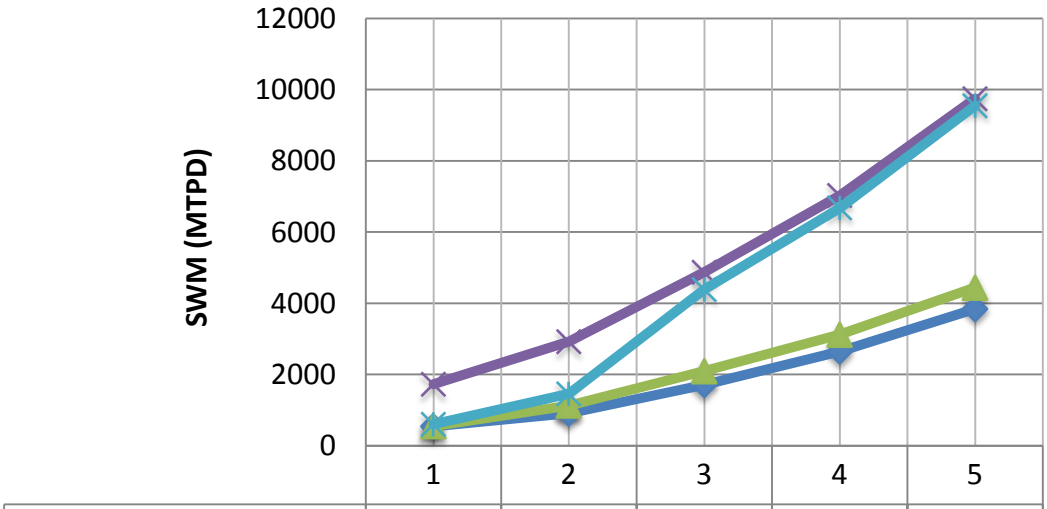
Recovery of user fee from waste generator would be practical only through merging the total expense in the utility bills of the waste generator either in water or electricity; else recovering petty amount from door to door will be too costly to the operator.

6) Aftermath of the implementation of Proposed Action Plan:

Following results are expected if the proposed action plan it put at place;

- Clean and Green Cities
- Decentralized approach of primary collection system through Resident Communities
- Sustainable Development through Resource Recovery.
- Meeting International hygiene and sanitation city standard
- Pollution free rivers
- Effective compliance of Municipal Solid Waste (Management & Handling) Rules, 2000

- Rise in civic sense awareness, personal and community hygiene
- Reduction of waste generation per capita, and maximize the diversion to waste to resource
- Achieving 98% compliance of waste generation and disposal



	1	2	3	4	5
Generation (ULB) MTPD	545	915	1715	2654	3847
Generation (Floating) MTPD	557	1135	2100	3120	4443
Total State Generation (SWM) MTPD	1733	2929	4881	7031	9751
Handling MTPD	606	1465	4393	6680	9556

7) Good Practices Initiated by the State towards SWM Compliance and in line with the proposed Action Plan:

- Launch of Rastriya Swachata Abhiyane, by Hon'ble Chief Minister of State
- Restructuring of the ULBs – proposed creation of extra 1800 post of Safai Karamchari, which has now been renamed as "Paryavaran Mitra"

- Allocation of funds under the 13th Finance Commission for undertaking SWM activities in ULBs
- Direction issued to all ULBs to identify the suitable land fill sites on priority basis
- Plastic Compacting Machines at 16 ULBs have been installed, Joshimath a success story
- Under SPA, funds were released to many ULBs for sourcing tools, equipment, vehicle and erecting necessary infrastructure in compliance with MSW Rules, 2000
- State Government has made a State Policy in compliance with the Municipal Solid Waste Management & Handling Rules, 2000.
- State Government has made a Draft bill on Anti Littering & Anti Spitting, which is under review and will soon be notified.
- State Government has issued directions in the form of following GOs from time to time to follow MSW Rules, 2000 few are listed as below:
    a) Direction has been issued to all ULBs for the constitution of Mohalla Sanitation Committees in order to ensure door to door collection of solid waste through GO # 205 dated 3/07/2003.
    b) Generation of waste has been categorized into 10 categories and directives for solid waste management have also been issued through GO # 558 dated 4/4/2007.
    c) State Govt vide GO # 86-IV-03-2010-13(11)/2001 dated 9/8/2010 has prohibited the burning of plastic material and waste.
    d) GO # 1174 dated 9/9/2009 regarding the clustering the city to comply with the Solid waste management rules 2000,
    e) State Govt. vide its GO # 1801 dated 14/12/2009 has issued directions for the arrangement of trenching ground in cluster approach for disposal of municipal solid waste.
    f) GO # 770 dated 28/4/2010 regarding solid waste and sanitation,

g) GO # 85 dated 17/1/2011 regarding Sanitation arrangements.

h) GO # 15 dated 01/2/2011 regarding implementation of MSW Rules 2000,

- There is one densification and flaking plant at Srinagar and a plastic processing and recycling plant at Kathgodam (Haldwani) which is handling post consumer non-biodegradable waste.
- Direction has been issued by Chief Secretary, Govt of Uttarakhand vide GO # 85 dated 17/1/2011 to ensure awareness drive and community participation for solid waste management and environmental sanitation.
- The State Government has implemented Nirmal Nagar Puraskar Yojana in 2010 to encourage ULBs for SWM works. Proposals of six ULBs have been selected out of total 18 proposals submitted by ULBs through District Magistrate. These selected ULBs were awarded with cash price of Rs.1.40Cr. ranging from Rs.50.00 to 10.00Lacs.
- GO # 86 Forest and Environment Section-3 dated 9/7/2010 issued to comply Recycled Plastics Manufacture and Usage Rules, 1999 and Recycled Plastics Manufacture and Usage (Amendment) Rules, 2003.
- GO # 713 dated 30/9/2009 dated issued to comply the UP Plastic and other Non-Bio degradable Garbage (Regulation of use and disposal) Act, 2000 For compliance of offences under this act, authorization has been given to ULB officials vide GO # 713 (2) dated 30/9/2009.
- GO # 1835 dated 01/11/2010 regarding the ban of use of carry bags in the state issued to comply UP Plastic and other Non-Bio degradable Garbage (Regulation of use and disposal) Act, 2000.
- Capacity Building Programmes have regularly been organized for ULB officers, staff and elected representatives, few are as under:

  a) 8 days training on Management Awareness Programme (MAP) for E.Os and elected representatives at IIT Roorkee in September 2005

b) 5 days training on Solid Waste Management & Environment at ATI Nainital from 26-30th April 2005.

c) 5 days training on Solid Waste Management & Environment at ATI Nainital from 19-23th December 2005.

d) Two Workshops, one each in Kumaon and Garhwal Division, on solid waste management has been organized on 17-19th November 2009.

e) 5 days training on Municipal Solid Waste in context to Community Participation at ATI Nainital from 5-9th January 2010.

8) Way Forward:

- Detailed town specific survey to be undertaken
- Meeting with Stake holders and inter-departmental officers
- Preparation of Detailed Project Reports
- Landfill site identification
- Geo hydro technical & Contouring survey of the proposed compost and landfill site
- EIA for the proposed landfill facility
- Detailed drawing and cost estimation
- PIC review, approval
- Submission of final DPR & RFP, incorporating the feedbacks
- Preparation of Bid Documents and
- Post Bid process management and supervision