



**MINISTRY OF LOCAL DEVELOPMENT  
HIS MAJESTY'S GOVERNMENT OF NEPAL**



**JAPAN INTERNATIONAL  
COOPERATION AGENCY**

# **ACTION PLAN ON SOLID WASTE MANAGEMENT**

**September 2005**



**Solid Waste Management  
&  
Resource Mobilization Center**

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## **Abbreviations**

### **<Organizations>**

BKM	Bhaktapur Municipality
CBO	Community Based Organization
ENPHO	Environment and Public Health Organization
GTZ	German Technical Cooperation Agency
HMG/N	His Majesty's Government of Nepal
JICA	Japan International Cooperation Agency
KMC	Kathmandu Metropolitan City
KRM	Kirtipur Municipality
KVTDC	Kathmandu Valley Town Development Committee
LSMC	Lalitpur Sub-Metropolitan City
MOEST	Ministry of Environment, Science and Technology
MOHP	Ministry of Health and Population
MOICS	Ministry of Industry, Commerce and Supplies
MOLD	Ministry of Local Development
MTM	Madhyapur Thimi Municipality
NGO	Non Governmental Organization
OSLSMCC	Okharpauwa Sanitary Landfill Site Main Coordination Committee
ST/C	Steering Committee
SWMRMC	Solid Waste Management and Resource Mobilization Center
T/F	Task Force
TWG	Technical Working Group

### **<Metric Units>**

g	Gram
g/L	Gram per liter
ha	Hectare
kg	Kilogram
kg/day	Kilogram per day
kg/d-capita	Kilogram per day per capita
km	Kilometre
km <sup>2</sup>	Square Kilometer
L	Liter
mm	Millimeter
m <sup>2</sup>	Square Meter
m <sup>3</sup>	Cubic Meter
mg/L	Milligram per liter
m	Meter
°C	Centigrade
t	Ton
t/d	Ton per day

### **<Currency>**

JPY	Japanese Yen
Rs	Nepalese Rupee
US\$	US Dollar

**<Others>**

A/P	Action Plan
BCC	Behavior Change Communication
CEO	Chief Executive Officer
CKV	Clean Kathmandu Valley
CSO	Civil Society Organization
EIA	Environmental Impact Assessment
FY	Fiscal Year
GDP	Gross Domestic Product
GDS	German Development Services
HH	Household
HRD	Human Resource Development
IEC	Information, Education and Communication
IEE	Initial Environmental Examination
KVTDP	Kathmandu Valley Town Development Plan
LB	Local Body
LF	Landfill
L/T	Long-term
LFS	Landfill site
M & E	Management and Evaluation
OFP	Overall Facility Plan
O & M	Operation and Maintenance
OVI	Objectively Verifiable Indicators
PSO	Private Sector Organization
P/H	Public Hearing
PP	Pilot Project
PPP	Public-Private Partnership
PR	Public Relations
PSO	Private Sector Organization
S/T	Short-term
STV	secondary transportation vehicle
SW-C	Solid Waste Compost
SWM	Solid Waste Management
TNA	Training Needs Analysis
TOR	Terms of References
T/S	Transfer Station
UGR	unit generation rate
VDC	Village Development Committee
WPF	waste processing facility

## **CHAPTER 1 INTRODUCTION**

### **1.1 Background of the Study**

Solid waste management (SWM) in The Kathmandu Valley faces great challenges not only in relation to the management system but also in gaining public awareness and participation of the people. In order to improve the current situations, His Majesty's Government of Nepal (HMG/N) and the Government of Japan have launched on a joint study titled "The Study on the Solid Waste Management for the Kathmandu Valley (the Study)" with the technical assistance of the Japan International Cooperation Agency (JICA). The Study commenced in January 2004 (Magh 2060<sup>1</sup>) and ran for a total of 20 months until August 2005 (Bhadra 2062).

### **1.2 Objectives of the Study**

The objectives of the Study were;

1. To formulate Action Plans (A/Ps) on solid waste management for five municipalities in the Kathmandu Valley, namely Kathmandu Metropolitan City (KMC), Lalitpur Sub-Metropolitan City (LSMC), Bhaktapur Municipality (BKM), Madhyapur Thimi Municipality (MTM), and Kirtipur Municipality (KRM), and
2. To pursue technology transfer regarding SWM for the Nepalese counterpart (C/P) personnel.

Through the formulation of the A/Ps, which aimed to strengthen management capability for the solid waste of each municipality and encourage public participation for solid waste management, the management ratios<sup>2</sup> of solid waste are expected to increase, toward the target year of 2015. In particular, capacity development of the Nepalese C/P personnel for planning and management of solid waste was carried out over the study period, which included the implementation of a series of pilot projects.

### **1.3 Study Area**

The Study covered the jurisdiction of the five municipalities in the Kathmandu Valley, namely KMC, LSMC, BKM, MTM and KRM. In addition, "Okharpauwa" where a landfill site is proposed was also covered.

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<sup>1</sup> Nepalese Year

<sup>2</sup> Management ratio is the ratio of "the quantity of waste" that is managed by waste generators or municipalities in the appropriate ways such as source reduction, recycling, appropriate collection, treatment and disposal after it has been generated from the sources to "the total quantity of generated waste".

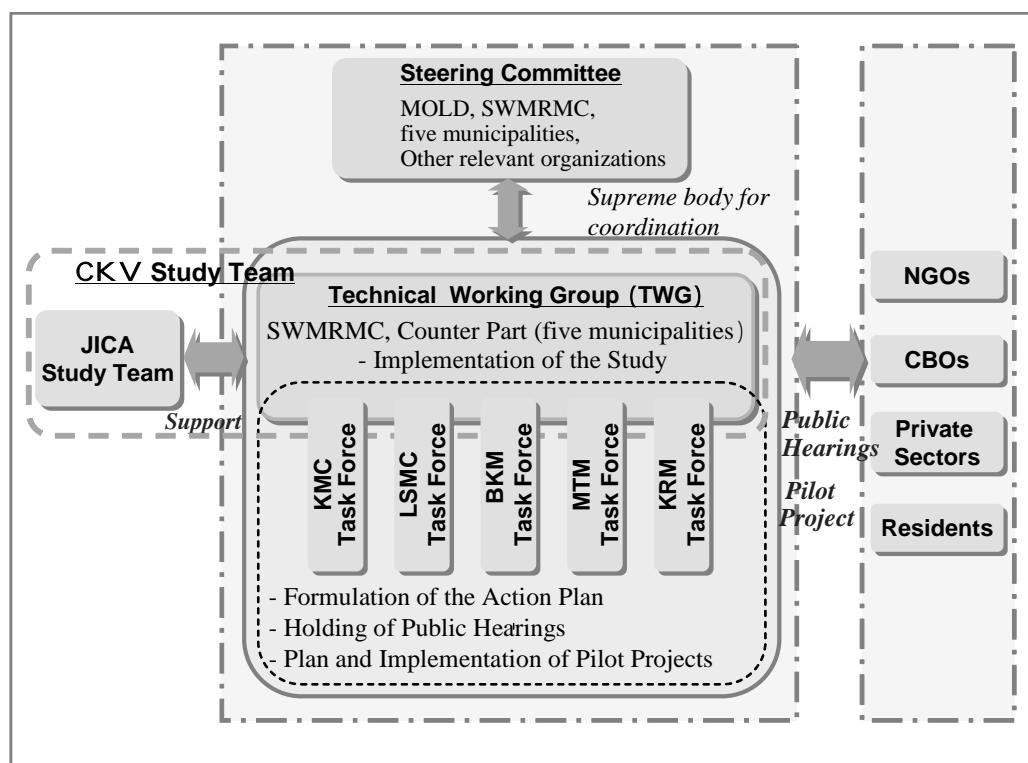
## 1.4 Target of the Study

In the Study, solid waste was broadly classified into four categories by generation source, i.e. 1) Municipal solid waste, 2) Industrial solid waste, 3) Medical solid waste, and 4) other solid waste including agricultural and construction waste.

The target solid waste of the Study was mainly municipal solid waste, non-hazardous waste that would be collected by the Municipality. However, the Study also made recommendations for industrial, medical and other solid wastes, but the management of night soil was not included in the Study.

## 1.5 Organization and Staffing of the Study

The Study established three implementation organizations on the Nepalese side, which are the Steering Committee (ST/C), Technical Working Group (TWG) and Task Force (T/F). The implementation organizations of the Study and their roles, tasks and members are shown in Figure 1.5-1 and Table 1.5-1, respectively.



**Figure 1.5-1 Implementation Organization of the Study**

Source: JICA Study Team



**Table 1.5-1 Roles, Tasks and Members of Organizations of the Study**

Organi- zation	Roles	Tasks	Members
ST/C	Coordination of relevant organizations	<ul style="list-style-type: none"> <li>- To confirm the overall policies and progress of the Study</li> <li>- To confirm and approve the contents of the reports to be submitted to the Nepalese side by the JICA Study Team</li> <li>- To discuss and approve the contents of the action plan to be prepared during the Study and to make a commitment to implement the action plan as policy makers</li> <li>- To coordinate the concerned organizations for SWM in the Kathmandu Valley and exchange information and opinions between the organizations of central and local governments</li> </ul>	<ul style="list-style-type: none"> <li>- Ministry of Local Development (MOLD)</li> <li>- SWMRMC</li> <li>- Five municipalities</li> <li>- Ministry of Environment, Science and Technology (MOEST) (formerly MOPE)</li> <li>- Ministry of Physical Planning and Works (MOPPW)</li> <li>- Ministry of Industry, Commerce and Supplies (MOICS)</li> <li>- Ministry of Education and Sports (MOES)</li> <li>- Ministry of Agriculture and Cooperative (MOAC)</li> <li>- Ministry of Health and Population (MOHP)</li> <li>- Members of TWG (as observers)</li> </ul>
TWG (C/P)	Implementation of capacity development and technology transfer from the JICA Study Team	<ul style="list-style-type: none"> <li>- To carry out the Study together with the JICA Study Team.</li> <li>- To prepare necessary documents and materials which are to be discussed at the ST/C</li> <li>- To organize and operate a T/F</li> </ul>	<ul style="list-style-type: none"> <li>- MOLD</li> <li>- SWMRMC</li> <li>- Staff of KMC</li> <li>- Staff of LSMC</li> <li>- Staff of BKM</li> <li>- Staff of MTM</li> <li>- Staff of KRM</li> </ul>
T/F	Coordination of opinions within the relevant departments, formulation of action plan, formulation and implementation of pilot projects	<ul style="list-style-type: none"> <li>- To formulate an Action Plan of the municipality and conduct pilot projects under the support from the JICA Study Team.</li> <li>- To coordinate opinions among the relevant sections of each municipality</li> <li>- To carry out Public Hearings with an aim to collect opinions from the residents</li> </ul>	<ul style="list-style-type: none"> <li>- Members of TWG</li> <li>- Planning relevant section</li> <li>- Environmental and Public Relations relevant sections</li> <li>- Community mobilization/development section</li> <li>- Financial section</li> <li>- NGOs/CBOs</li> <li>- Private sectors</li> <li>- Intellectuals</li> </ul>

Source: JICA Study Team

## 1.6 Acronym and Slogan of the Study

Based on the discussions of the TWG members, the Study adopted the acronym “CKV” which stands for “Clean Kathmandu Valley” to make the Study easier to promote and to be identifiable by relevant organizations and residents of the Kathmandu Valley as part of the public relations activities.

The Study also put up a slogan, “Sapha Sahar Hamro Rahar” in Nepalese, which means “clean city is our desire”.

Both the acronym and slogan have been spreading gradually by relevant organizations.

## **CHAPTER 2 CONDITIONS OF MUNICIPAL SOLID WASTE MANAGEMENT OF THE KATHMANDU VALLEY**

### **2.1 Current Framework of Solid Waste Management**

#### **2.1.1 Policy, Legislation and Guideline**

The current institutional arrangements for SWM at national level are stipulated in the following acts and policy.

- 1) **Solid Waste (Management and Resource Mobilization) Act and Regulations, 1987 (Amended 1992):** The Act and Regulations stipulate the establishment of SWMRMC as the authorized body to make all arrangements in regard to solid waste storage, collection, transportation, disposal and resource recovery activities within three districts in the Kathmandu Valley, Kathmandu, Lalitpur and Bhaktapur Districts<sup>1</sup>.
- 2) **Solid Waste Management National Policy, 1996:** HMG/N issued the policy with the objectives of a) to make management work of the solid waste simple and effective; b) to minimize environmental pollution caused by the solid waste and adverse effect thereof to the public health; c) to mobilize the solid waste as a resource; d) to privatize the management work of the solid waste; and e) to obtain public support by increasing public awareness in the sanitation works. This policy and the above Act and Regulations stipulate that solid waste collection and disposal should be organized and managed at the local level, whereas the policy also advocates centralizing institutional responsibility for “the management works of solid waste on the basis of their quantity and nature produced in towns and villages where there is a problem”.
- 3) **Local Self Governance Act, 1999:** The act was issued within the context of decentralization. It stipulates that all responsibilities for solid waste management (SWM) including collection, transportation and final disposal have been transferred over to the municipalities, together with other duties and authority to protect the local environment.

The current institutional status creates much room for debate and uncertainty in regards to institutional arrangements and delineation of responsibilities between the central and local bodies. This is because the Solid Waste Act and Regulations and the National Policy have not been repealed nor amended in line with the Local Self Governance Act.

Other noticeable points which form the SWM institutional framework in Nepal can be summarized as follows.

- The 10th National Plan (2002-2007) highlighted the problem of final disposal site as the major challenge in SWM, especially in the Kathmandu Valley.
- The Dhaka Declaration 2004 on SWM conformed to a consensus on technical recommendations in the SWM sector among South Asian Association for Regional Cooperation (SAARC) delegates including Nepal.
- The Environmental Protection Act and Environmental Protection Rules are fundamental laws aiming at proper pollution control and management of environmental quality of life

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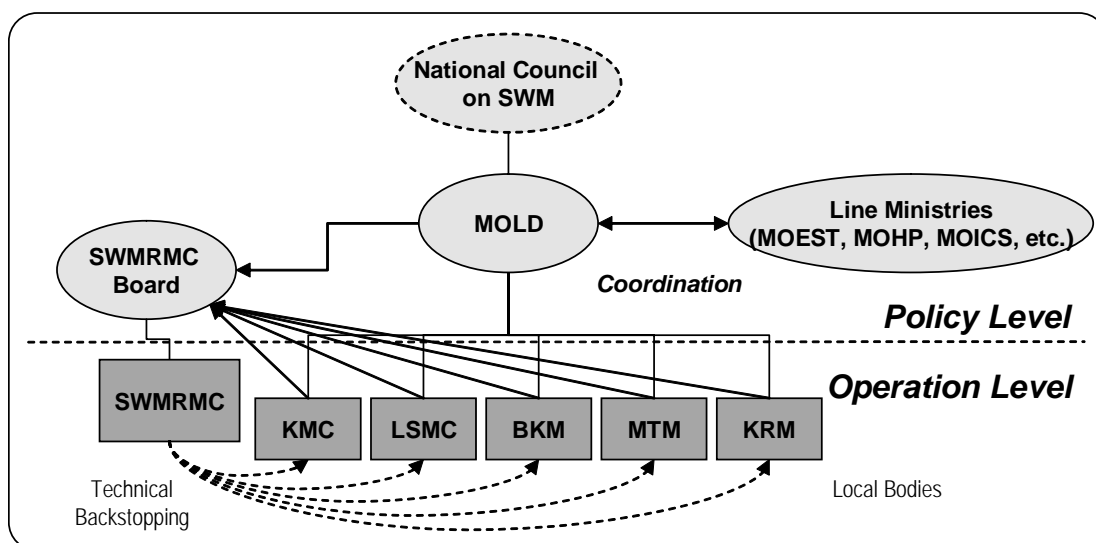
<sup>1</sup> Kathmandu District comprises Kathmandu Metropolitan City and Kirtipur Municipality, Lalitpur District comprises Lalitpur Sub-Metropolitan City, Bhaktapur District comprises Bhaktapur Municipality and Madhyapur Thimi Municipality.

in Nepal. The Act and Rules also provide the IEE/EIA system to be applied for development projects including SWM facilities and activities.

- SWMRMC established EIA Guidelines for Solid Waste Management Project in the Municipalities of Nepal in 2004.

## 2.1.2 Organization and Responsibility

Due to the inter-disciplinary nature of SWM, various HMG/N organizations are designated to be involved in SWM issues in the policy and operational levels as shown in Figure 2.1-1.



**Figure 2.1-1 Organizations Involved in SWM in the Kathmandu Valley**

Source: JICA Study Team

At the policy level, the Ministry of Local Development (MOLD) is the primary ministry responsible for municipal SWM. The SWMRMC Board was formed in 1987 to supervise and manage all functions and operations of SWMRMC. The Board meetings are held as and when required. However, the National Council on SWM<sup>2</sup> and the Environmental Protection Council<sup>3</sup> have not been convened in recent years.

At the operational level, SWMRMC, which was established in 1980 under the GTZ's SWM Project, is acting as the operational arm for MOLD in the SWM sector with a mission to carry out SWM responsibilities on behalf of Kathmandu, Lalitpur and Bhaktapur Districts. With the decentralization of SWM responsibilities, the role of SWMRMC has evolved from the regional and technical viewpoints.

As stipulated in the Local Self Governance Act of 1999, local bodies, especially municipalities with substantial urban population, have the core operational responsibilities in

<sup>2</sup>The National Council on SWM was established with the 1996 National Solid Waste Management Policy as the ultimate policy making body on SWM at the national level. The members of council include Minister of Local Development, National Planning Commission (NPC), MOEST (formerly MOPE), Ministry of Physical Planning and Works, MOHP (formerly Ministry of Health), Ministry of Finance and Ministry of Tourism and Civil Aviation. The Council has not been convened for at least the past five years, and is not functioning to date.

<sup>3</sup>The Environmental Protection Council has the mandate to deliberate at the highest level, environmental issues of national concern. It is constituted by Cabinet members, but it has not been assembled in recent years.

managing solid waste within their jurisdictions. However, the SWM capacities of local bodies, in spite of the decentralized authority and responsibility, are much underdeveloped in terms of both technical capacity and human resources, except such mega cities as KMC.

### **2.1.3 Annual Budget and Budgeting Procedures**

#### **(1) National Level**

Expenditure allocated for a local development area, which MOLD is responsible to implement, was Rs 4.8 billion in FY2003/04 (2060/61<sup>4</sup>), and Rs 6.2 billion in FY2004/05 (2061/62) accounting for 5.2% and 5.6% of total Government expenditures, respectively.

Budget for SWM at national level is allocated solely to SWMRMC. In FY2004/05 (2061/62), Rs 85 million was allocated to SWMRMC accounting for about 13% of the total budget of MOLD. In addition to this allocation, SWMRMC spent Rs 12 million in FY2004/05 (2061/62) from its own revenue sources, so called “internal sources”.

The Reserved Fund (the Fund) was established in 2000 according to “Local Development Fund Regulation 1999”. The Local Development Fee is the source of the Fund which aims to encourage and support local bodies for the development project implementation on a cost sharing basis. The Fund can be provided to 26 development sectors, in which development of **“landfill site and compost plant construction and management”** is included. The Fund can be provided up to 70% of the development cost or Rs 5 million. In case of joint project of two or more local bodies, more than Rs 5 million can be provided to local bodies.

#### **(2) Municipality Level**

The Local Self-Governance Act, 1999, stipulates the budget preparation process by Municipality. In general, the budget should be started in early May and approved in the middle of July by the Council prior to the beginning of the forthcoming fiscal year. However, the actual timeframe of the preparation is not corresponding to the Act. In the case of FY2004/05 (2061/62), the approvals by the Councils other than LSMC were made from October to December. The new fiscal year used to start without budget approval by the Council for several months. For smooth administration and operation of the new fiscal year, the municipalities have to prepare provisional budgets based on the previous year’s result with approval of top management of the municipalities.

Actual revenue and expenditure of FY2003/04 (2060/61) of the five municipalities have been summarized in Table 2.1-1, and the SWM related expenditure components of them were estimated as shown in Table 2.1-2.

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<sup>4</sup> Nepalese Year

**Table 2.1-1 Actual Revenue and Expenditure of FY2003/04**

Items	KMC		LSMC		BKM		MTM		KRM	
	m. Rs	%	m. Rs	%	m. Rs	%	m. Rs	%	m. Rs	%
Revenue	554	100	116	100	128	100	24	100	17	100
1) Local Dev. Fee	238	43	52	45	21	16	12	50	12	71
2) Own Revenues	288	52	62	53	106	83	7	29	3	18
3) Grant	28	5	2	2	1	1	5	21	2	11
Expenditure	580	100	121	100	123	100	21	100	12	100
1) Current	553	95	68	56	96	78	10	48	7	58
2) Capital	27	5	53	44	25	20	11	52	5	42
3) Debt	0	0	0	0	2	2	0	0	0	0

Note: 1) Opening balance is excluded from revenue. 2) m. Rs=million Rs

Source: Budget Report of each municipality, 2004

**Table 2.1-2 Estimated SWM Expenditures of Five Municipalities**

Municipality	Expenditure	Remarks
KMC	Rs 120 million	Based on cash excluding depreciation and interest 23% of total expenditure (US\$3/capita)
LSMC	Rs 22 million	23% of total expenditure (US\$2/capita)
BKM	Rs 15 million	12% of total expenditure (US\$3/capita)
MTM	Rs 0.7 million	3% of total expenditure (US\$0.2/capita)
KRM	Rs 0.3 million	1% of total expenditure (US\$0.1/capita)

Note: KMC, BKM, MTM and KRM as of 2001/02, LSMC as of 2002/03

Source: Information from UDLE of GTZ and each municipality

Among the main sources of the revenue of municipalities, i.e. Local Development Fee, Own-source Revenues and Government Grant, the revenue of the municipalities, except for BKM, mostly comes from a Local Development Fee distributed by the Government which accounts for 43% to 71% of the total. However, it should be noted that Local Development Fee is scheduled to be abolished by the end of December 2013 because of the participation of Nepal as a member of the World Trade Organization (WTO). In this connection, KMC and LSMC have already started efforts to enhance and improve the overall revenue system of the municipality, especially for property tax.

## 2.1.4 Environmental Education

In Nepal, formal environmental education has been introduced and incorporated in social studies in an integrated way in primary levels (Grade 1-5) and secondary levels (Grades 6-10).

With regard to SWM, most of the topics in formal education at the primary levels concentrate on keeping the home and school environment clean. At the secondary levels, the environmental concerns are raised for much larger areas like the toles (hamlets), villages and towns. Textbooks are used at the higher secondary level with a much more detailed explanation of the various aspects of SWM. They present several ways to contribute to minimizing the solid waste, namely reuse, recycling and composting.

The curriculum on formal environmental education greatly focuses on provision of knowledge or information on SWM by means of lectures and textbooks. Practical and

interactive activities on SWM through demonstration, hands-on learning or training are hardly given in the school curriculum due to the lack of resources and materials on SWM and limited teaching capability in this area among teachers.

On the other hand, non-formal education related to environmental issues has been provided by many government offices, international organizations, NGOs and CBOs with a focus on practical skills and knowledge through interactive activities. In the field of SWM, creation of an awareness campaign and training through various communication channels and media including interpersonal, small and mass media are the most popular ways of non-formal environmental education. This approach includes group formation, provision of training and demonstration on composting and recycling, peer education, conducting street drama and clean-up campaigns.

## **2.2 Overview of Solid Waste Management of the Study Area (Kathmandu Valley)**

### **2.2.1 Situation of Solid Waste Management in the Kathmandu Valley**

#### **(1) Recent History of Solid Waste Management in the Kathmandu Valley**

Solid waste was not such a big problem in the old days in the Kathmandu Valley. People in the Kathmandu Valley had their own method to get rid of their household waste, including a kind of circulation of organic waste between city and rural areas nearby. In line with increasing population in the Valley and changing life style and consumption habits, SWM has been increasingly recognized as one of the major environmental issues in the Valley as a result of the increasing amount of waste generated and the change of waste compositions.

Thanks to GTZ, the collection and disposal of solid waste started in some systematic way especially in KMC and LSMC, along with the operation of Gokarna Landfill (LF) which was developed in 1986. However, after closure of Gokarna LF in 2000 due to the opposition of the surrounding local people, final disposal could not help going to river side dumping on a temporary basis, e.g. Bagmati River dumping. BKM and MTM and have also been dumping their waste into the rivers nearby.

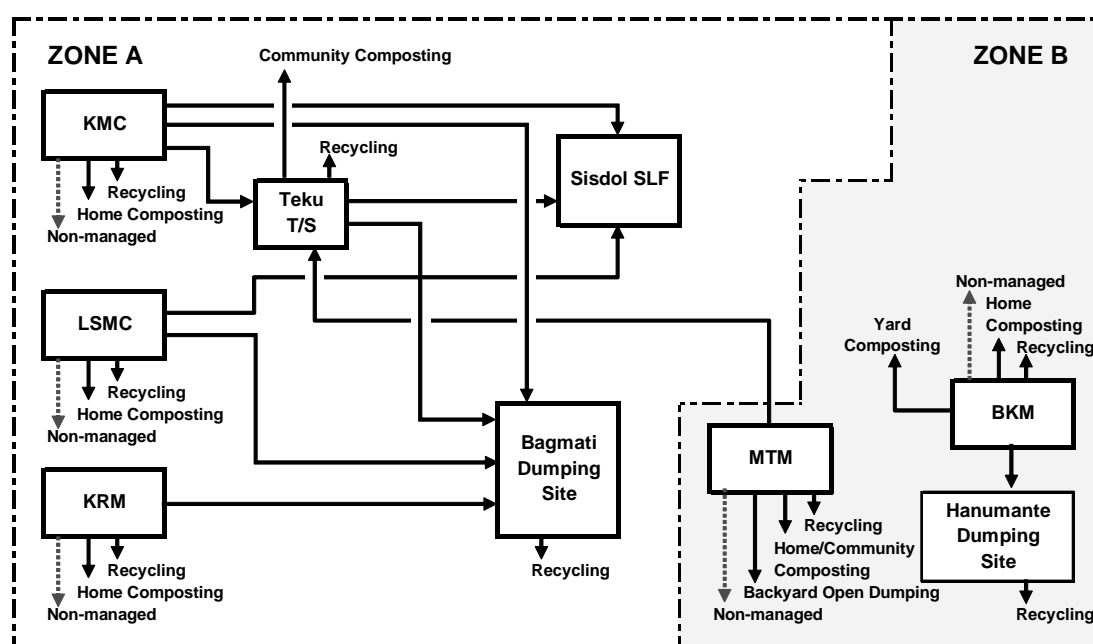
#### **(2) Current Conditions of Municipal Solid Waste**

The current conditions with municipal solid waste in the valley are summarized as follows, while current waste flow in the Kathmandu Valley and the existing and proposed facilities regarding SWM in the Kathmandu Valley are shown in Figure 2.2-1, Figure 2.2-2 respectively.

- The unit generation rate of solid waste is estimated at 0.416 kg/day-capita in KMC and LSMC, 0.316 in Bhaktapur Municipality (BKM), and 0.266 in Madhyapur Thimi Municipality (MTM) and Kirtipur Municipality (KRM). The total generation quantity of waste in the five municipalities is estimated at 435 ton/day. Composition of household waste shows a similarity among the five municipalities, which has a very high portion, 65 to 75%, of organic waste, while recently increasing the proportion of plastic waste up to more than 10% of the total.
- In KMC, LSMC and BKM, a curb-side and on-ground collection system has been widely introduced. Bell and door-to-door collection systems have also been introduced,

sometimes involving private sector operators or NGOs/CBOs. Almost all waste is collected with all components mixed together, while source-separated collection is quite rarely practiced for special use like community composting. More than 70% of waste is collected in KMC, LSMC and BKM, while the other two municipalities still collect only about 40%. In accordance with the policy change of solid waste collection in February 2005<sup>5</sup>, the five municipalities now have a responsibility of night-time collection (by 7:00 a.m.).

- Because of the relatively high composition of organic materials in the waste, a variety of composting activities at household and community levels as well as municipal level has been tried in the Kathmandu Valley. For example, BKM has more than 20 years experience of composting around 6 ton/day, whereas vermi-composting has been introduced at household level and home composting activities have become more popular among the people in cooperation with NGOs/CBOs.
- The various kinds of recyclable materials are collected, such as paper, plastic and iron. A total of about 116 tones of the recyclable materials is daily exported from the Valley, excluding bottles, feathers and waste oil from automobiles. In the case of KMC, it is said that about 30 to 35 groups of waste pickers have been identified, who are operating mainly at Teku Transfer Station (T/S) and the Bagmati River dumping site with a total of more than one hundred persons.



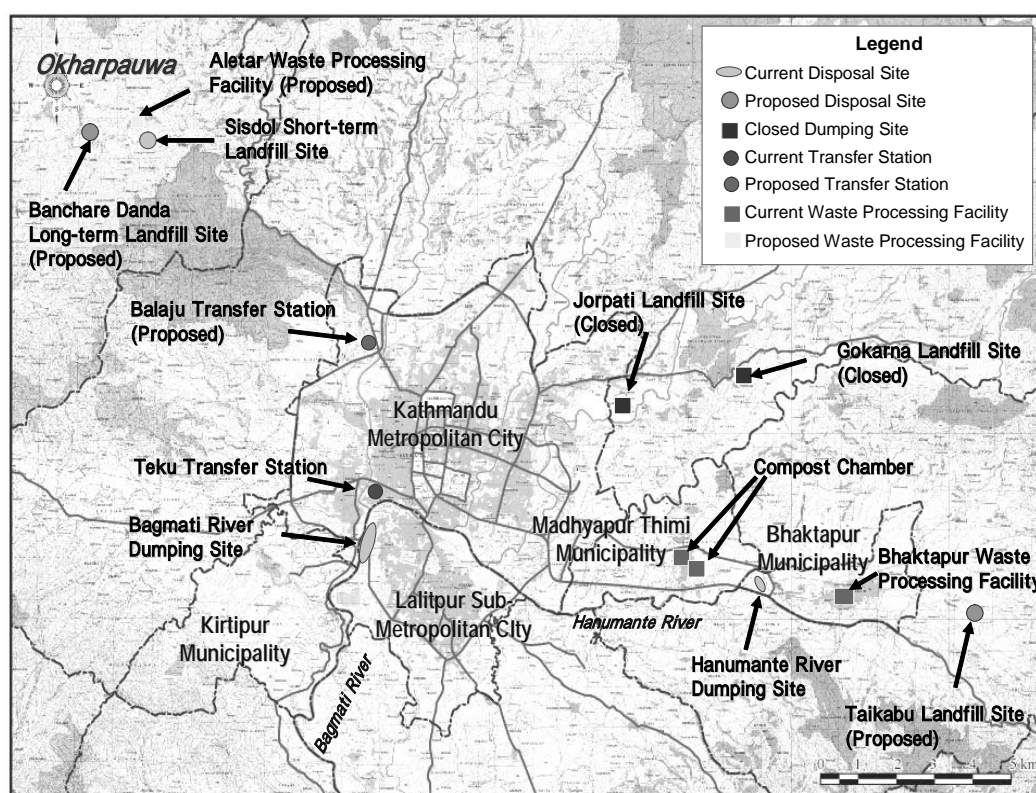
**Figure 2.2-1 Current Waste Flow in the Kathmandu Valley**

Source: JICA Study Team

- Unfortunately no municipality has been able to prepare an appropriate engineered landfill site in the Kathmandu Valley since Gokarna Landfill site was stopped from accepting the waste. KMC, LSMC and KRM have started to dispose of their waste along the bank of the Bagmati River since 2000. BKM is presently dumping the waste

<sup>5</sup> Nepal Government announced on February 7, 2005 that the collection and transportation service for waste should be finished by 7 a.m. for the five municipalities in the Kathmandu Valley.

at some sites along the Hanumante River and MTM is disposing of waste on the back yards of core areas.



**Figure 2.2-2 Facilities Regarding SWM in the Kathmandu Valley**

Source: CKV Study Team

- Within the five municipalities of the Kathmandu Valley, it has been noted that a significant number of private organizations are involved in SWM practices, especially in primary collection of solid waste. These organizations consist of a mixed bag of private enterprises, NGOs and CBOs. As of June 2005, aside from the most recent Public Private Partnership (PPP) initiative in MTM, most private organizations are working on their own or under some kind of verbal understanding with the municipalities.

### (3) Current Conditions of Industrial Solid Waste

According to the “Industrial Pollution Inventory of the Kathmandu Valley and Nepal (1994)”, the total solid waste generation from the factories in the Kathmandu Valley was estimated at 1,421 ton/year, of which 495 tons was generated from the leather industry, 417 tons by distilleries and 173 tons from canning and preserving of fruit and vegetables. Industrial waste is either discharged to open spaces or mixed with the municipal waste or burned openly within or outside the factory premises. Discharged waste in the municipal containers located in or near the factory is collected by the municipality and transported to the final disposal site.



#### (4) Current Condition of Medical Waste

According to the survey report by the Environment & Public Health Organization (ENPHO) in 2000, the generation rate of medical waste in the Kathmandu Valley was estimated at 1.7 kg/day/bed, of which the infectious waste generation rate is 0.48 kg (28%). With an estimation of 3,905 hospital beds in the Kathmandu Valley, the total infectious waste generated comes up to around 1,874 kg/day. Although the National Health Care Waste Management Guidelines direct the proper handling of medical waste, only limited health care institutions carry out appropriate segregation and treatment of waste. In many cases, infectious waste and sharps are mixed with general waste without any segregation or treatment, and disposed of into municipal containers. An incinerator was constructed at Teku Transfer Station (T/S) for treatment of medical waste generated from small-scale health care institutions. However, it has never started its operation due to a public movement against the smoke, bad smell and dioxins.

### 2.2.2 Short-term Landfill Site

#### (1) Short-term Landfill Site for KMC, LSMC and KRM

It was recognized that the Bagmati River dumping should be discontinued as soon as possible, considering the remaining available space as well as environmental and social problems<sup>6</sup>. Urgent launching of a new landfill site operated in an appropriate manner became indispensable. Accordingly, a basic strategy was proposed as follows for final disposal planning for KMC, LSMC and KRM<sup>7</sup> during the Study period.

First: A short-term landfill to commence operation at the same time as closure of the Bagmati River dumping site.

Second: Within the serviceable term of the short-term landfill site, a long-term landfill site is to be prepared.

Third: At the time of expiry of the life of the short-term landfill site, the long-term landfill is to commence to provide disposal service.

In order to ensure a short-term landfill, the three candidate sites were listed, i.e. at Sisdol, Chobhar, and Gokarna (re-opening), for receiving the waste from KMC and LSMC. Finally, Sisdol landfill was selected as a short-term landfill (S/T-LF) based on the result of evaluation of candidates from the technical, environmental, and social viewpoints as well as the required time to the operation.

#### (2) Facilities of Sisdol Short-term Landfill

Sisdol S/T-LF has been developed by SWMRMC by dividing into two valleys. Valley 1 was developed as a semi-aerobic landfill first with necessary improvement works under the pilot project of the Study. The major facilities designed and installed at the site under the pilot project were i) landfill site development including leachate collection system and gas

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<sup>6</sup>The Bagmati River dumping site has been facing the problems of water pollution by leachate and odor from waste as well as the limitation of the remaining areas for dumping in the Bagmati riverbank.

<sup>7</sup> KRM has been discussing with KMC for KRM to commission KMC to receive waste collected from KRM at Teku T/S and transport the waste from Teku T/S to Sisdol S/T-LF.

vents, ii) clay liner system installation, iii) leachate pond preparation with aerator and recirculation system, and iv) procurement and installation of a weighbridge. SWMRMC was responsible for such works as waste dam heightening, fencing, preparation of power supply, office building, and administrative utilities.

Using these facilities, the Valley 1 started its operation on June 5, 2005 and is being operated in a sanitary manner. SWMRMC is now proceeding with the design for Valley 2 for which facilities are to be provided similar to those of Valley 1.

### (3) Collection and Transportation of Waste to Landfill

In line with the commencement of Sisdol S/T-LF operation, 21 secondary transportation vehicles comprising hook lift equipment including spare parts and 18 extra containers are in the process of procurement and are planned to be delivered to Kathmandu by the end of September 2005. A scheme of Japan Non-Project Grant Aid has contributed for the procurement in response to an application to GOJ from HMG/N and MOLD.

KMC and LSMC are now transporting some portions of collected waste, approx. 30-50 ton/day, to Sisdol S/T-LF temporarily by using the existing equipment and a few rental trucks.

### (4) Operation and Maintenance

There are three main stakeholders involved in the Sisdol S/T-LF, namely KMC and LSMC as the beneficiaries and operators, the central government (SWMRMC) as the developer and land owner, and the surrounding communities represented by the Okharpauwa Sanitary Landfill Site Main Coordination Committee (OSLSMCC). The three parties have entered into an agreement which details the roles of each concerning the operation and maintenance (O&M) of the site. The demarcation of roles covers daily/regular O&M of the site, communication with the surrounding people and communities, environmental monitoring, post closure management, management of the local development fund, etc. Requirements and allocations of staff and equipment were also examined among the three parties in order to operate the Sisdol S/T-LF in a sustainable manner.

### (5) Environmental and Social Considerations

The EIA report for Sisdol S/T-LF prepared by SWMRMC covered various components of the physical, biological and socio-economic environment. The mitigation measures and monitoring plan have been also developed in line with the likely impacts, thus it can be said that the scope discussed in the EIA is in general sufficient. The EIA concluded that i) it was essential to examine the next L/T-LF development in Okharpauwa subsequent to Sisdol S/T-LF from the viewpoint of practical use of the access road, and ii) Sisdol S/T-LF development could be judged to be environmentally sound as long as mitigation measures and monitoring activities would be appropriately put into practice. However, in the EIA, several mitigation measures are hardly practical considering the current technical and engineering capabilities in Nepal, such as geo-membrane installation and a leachate treatment plant associated with a chemical treatment process. Technical examination and adjustment of the above were made in the Study.

From the procedural viewpoint, it can be said that SWMRMC offered fair opportunities to the local people for public consultation in the EIA process, including the public notice/hearing required by the legislation as well as ad hoc communications directly with the local people for unofficial opportunities. It can be considered, therefore, that sufficient opportunities have been provided for stakeholder involvement so far. In addition, OSLSMCC has been established not only for coordinating the Sisdol-related issues among the locals but also for consulting on the issues with SWMRMC and LFS operators (KMC/LSMC). OSLSMCC is expected to fulfill an important function in ensuring the continuous involvement of key local stakeholders in operational issues for Sisdol S/T-LF.

In the operation stage of Sisdol S/T-LF, environmental monitoring necessary for such items as groundwater quality, surface water quality and leachate is planned to be conducted by SWMRMC. It is planned that the monitored data be shared among the members of Environmental Coordination Committee, which will be established by representatives of SWMRMC, KMC, LSMC, intellectuals, and OSLSMCC.

## **CHAPTER 3 FUTURE FRAMEWORK FOR ACTION PLAN**

### **3.1 Socio-economic Framework (Projection of Future Population)**

In Nepal, the official document which can be an aid to project future socio-economy at the national level is the Tenth Plan (Poverty Reduction Strategy Paper) 2001/02 (2058/59<sup>1</sup>)-2006/07 (2059/60), May 2003, National Planning Commission (NPC) of HMG/N. The Tenth Plan is the government's main medium-term strategic planning document which provides sharply focused strategies for poverty alleviation.

This Tenth Plan discussed two alternative scenarios. The Normal Case scenario aims to reduce the overall poverty ratio from 38% estimated at the end of the Ninth Plan (2001/02) to 30% by 2006/07, while an alternative Lower Case scenario was 33%. This lower case scenario was used as the basis for formulating the budget and the Medium Term Expenditure Framework (MTEF) FY2003/04-05/06.

On the other hand, at the Valley level, the Kathmandu Valley Town Development Committee (KVTDC) under the Ministry of Physical Planning and Works (MOPPW) and the Department of Urban Development and Building Construction (DUDB) has a responsibility for preparing a physical development plan of the Kathmandu Valley.

The Kathmandu Valley Town Development Plan (KVTDP) 2020 was prepared in the year 2002 by KVTDC to establish a broad regional framework plan (strategic plan) for the Kathmandu Valley integrating both land use and the urban transportation network, which guides the valley's future growth in a planned manner.

The KVTDP 2020 had estimated that if a gross density of 300 persons per hectare could be achieved within the existing urban areas, the demand for urban land in the 20 years would be slightly over 3,600 ha. However, considering the difficulty in effecting public perception about apartment housing and overturning the current trend of owner occupied single housing, demand for urban land could be much higher than envisaged.

Since the 2001 national census data has become available recently, the JICA Study Team together with the TWG members examined these annual growth rates taking into account the actual growth rate between 1991 and 2001, and has decided to adopt this KVDTC study's rates except for MTM. For MTM, the actual growth rate between 1991 and 2001 was assumed to continue up to 2015 because MTM has relatively large potential for urbanization in land use in the future.

The projected future population based on the 2001 population is shown in Table 3.1-1.

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<sup>1</sup> Nepalese Year

**Table 3.1-1 Projected Population of Five Municipalities**

Municipality	Actual Population	Projected Population	Annual Growth Rate (%)	
	2001 (2058)*	2015 (2072)	2001-2011 (2058-2068)	2011-2015 (2068-2072)
KMC	671,846	1,055,591	3.32	3.18
LSMC	162,991	260,790	3.44	3.35
BKM	72,543	117,380	3.52	3.44
MTM	47,751	83,696	4.09	4.09
KRM	40,835	54,400	2.07	2.07
Total Municipality	995,966	1,571,857	3.34	3.24
VDCs	525,498	603,891	0.95	0.84
Total Valley	1,521,464	2,175,748	2.61	2.54

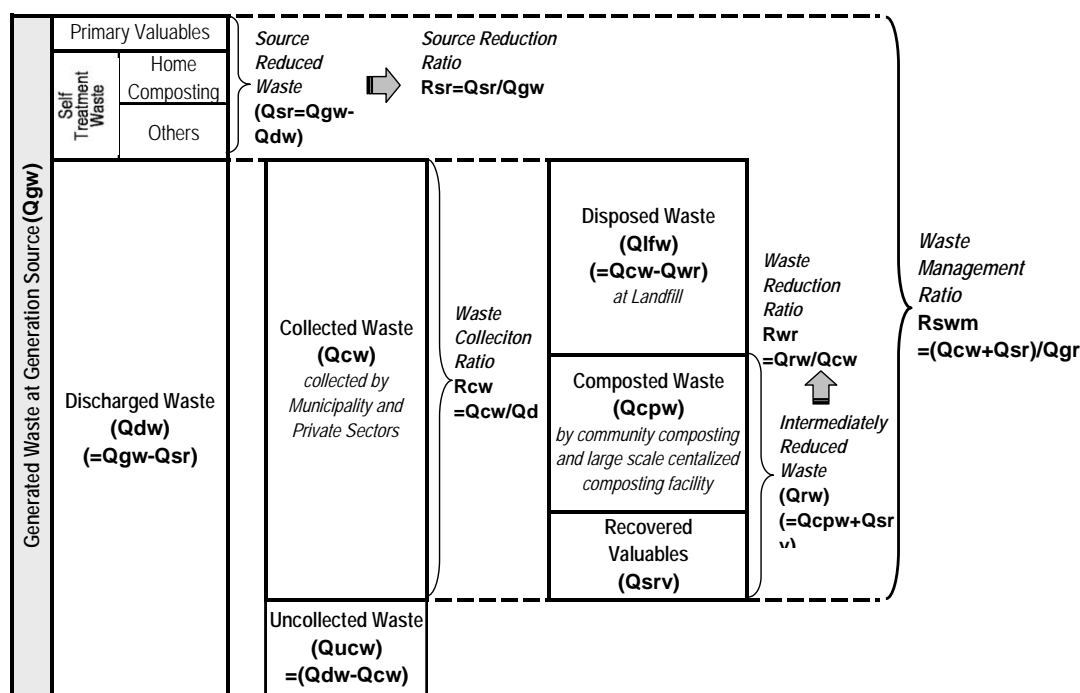
Note: \*Nepalese Year

Source: Draft Kathmandu Valley Development Plan 2020, KVTDC, July 2000  
JICA Study Team

## 3.2 Solid Waste Management Ratio

For clear understanding of the solid waste management, the definition of waste index was proposed as follows and as shown in Figure 3.2-1.

- Generated waste: Material that has become useless and valueless for the owner if it is to keep it at the source
- Discharged waste: Part of generated waste that is discharged out from the owner's territory
- Self treatment waste: Part of generated waste that is treated, disposed of or utilized within the owner's territory
- Collected waste: Part of discharged waste that is collected by the municipality or a private sector operator
- Uncollected waste: Part of discharged waste but not collected and disposed of somewhere
- Disposed waste: Part of collected waste that is disposed of at the designated final disposal site
- Primary Valuables: Materials that become useless but may be valuable for the owner in exchange for cash or for some recyclable collector. The owner intends to separate that material from the waste and bring it directly to recycling dealers for sale or to a municipal/community recycling center. Private recyclable collectors can also visit each generation source to pick up those valuables as their business activity. Returnable bottles for deposit refund are also included in this category.
- Secondary Valuables (Recovered Valuables): Valuable materials that are collected and recovered for reuse and recycling after waste is discharged, from the various stages such as from streets, collection points, transfer stations, waste treatment facilities, or final disposal sites. This includes the recyclable waste collected by recyclable waste pickers.



**Figure 3.2-1 Definition of Waste Management Ratio**

Source: JICA Study Team

It was proposed to introduce the concept of “Solid Waste Management Ratio” in the Study. Solid Waste Management Ratio can be estimated by the following formula.

$$\frac{(\text{Collected waste quantity} + \text{Source reduced waste quantity})}{\text{Generated waste quantity}}$$

One of the major purposes of solid waste management is to reduce the uncollected waste amount for improvement of the cleanliness, beautification and sanitation of the city. The wastes other than such uncollected waste are the waste reduced at source and that collected from the source. This means that the solid waste is managed by some organization like the municipality, the private sector, or the waste generator itself. Therefore, the “Solid Waste Management Ratio” has been set up as the waste index that collectively shows how much waste can be managed appropriately in various ways.

### 3.3 Projection of Future Generation of Solid Waste

#### 3.3.1 Future Waste Generation without Measures

Considering the existing data of waste generation quantity in the Kathmandu Valley by various past studies, the result of the waste quantity and quality survey done by the Study, and an assumption of an annual increasing rate of unit generation rate which of 2%, the waste generation quantity of each municipality is estimated to be as shown in the following table.

**Table 3.2-1 Projected Solid Waste Generation Quantity**

Municipalities	Population		Municipal UGR (kg/d-capita)		Average daily generated quantity (tons/day)	
Year (Nepalese Year)	2004 (2061)	2015 (2072)	2004 (2061)	2015 (2072)	2004 (2061)	2015 (2072)
KMC	741,008	1,055,591	0.416	0.519	308.4	547.9
LSMC	180,397	260,790	0.416	0.519	75.1	135.4
BKM	80,476	117,380	0.316	0.394	25.5	46.2
MTM	53,853	83,696	0.266	0.332	14.3	27.8
KRM	43,424	54,400	0.266	0.332	11.6	18.1
Total 5 municipality	1,099,158	1,571,857	-	-	434.9	775.4

Source: JICA Study Team

### 3.3.2 Scenario Analysis

The 2% of annual increasing rate of waste unit generation predicted in the previous section is based on the future economic growth in the Kathmandu Valley as well as other country's experiences. In this assumption, total generated waste will be increased up to 1.8 times more than it is at present. Therefore, waste reduction at source such as home composting or material recycling activities is very important to reduce the waste generation. In the Kathmandu Valley, such source reduction activities have just been started promotion together with community development activities, and further waste reduction at source can be expected. Considering these circumstances, the following scenarios for the Study<sup>2</sup> was proposed and it is expected that for reach municipality will make an effort to reduce the waste at source to shift to Scenario 2 from Scenario 1 by promoting source reduction activities under the concept of waste management ratio.

*Scenario 1: without measures (with 2% annual increase of the unit generation rate)*

*Scenario 2: with measures for source reduction by home composting and source recycling.  
Target reduction ratio in 2015 is around 85% of total generated quantity.*

<sup>2</sup> Since there is no existing data or record that can be used to estimate the annual increasing rate of waste unit generation in the past, the JICA Study Team suggested that all municipalities to carry out regular waste generation quantity surveys, at least once a year, to get an understanding of the changes of unit generation rate from the practical experience during the Study.

## CHAPTER 4 UMBRELLA CONCEPT FOR FORMULATION OF ACTION PLAN

### 4.1 Umbrella Concept of Solid Waste Management in the Kathmandu Valley

Action plans (A/Ps) of each of the five municipalities should be developed reflecting their characteristics in terms of solid waste flow, waste quality and quantity, collection methods, waste minimization activities and the associated requirements such as promotion of public awareness and behavior change, and organizational and institutional arrangements. However, it is recommended that some activities to be included in the respective A/Ps should be conducted in a valley-wide in order to maximize the effect of these activities. In addition, in terms of facilities and equipment for intermediate treatment or landfill, the developments need to be done taking into consideration potential for inter-municipal coordination and sharing of these facilities and equipment so that development loads as well as investment and O&M costs be minimized. Table 4.1-1 indicates the components of the A/Ps that need to be discussed for each respective municipality or that may be combined for more than one municipality (zone).

**Table 4.1-1 Components of Action Plans**

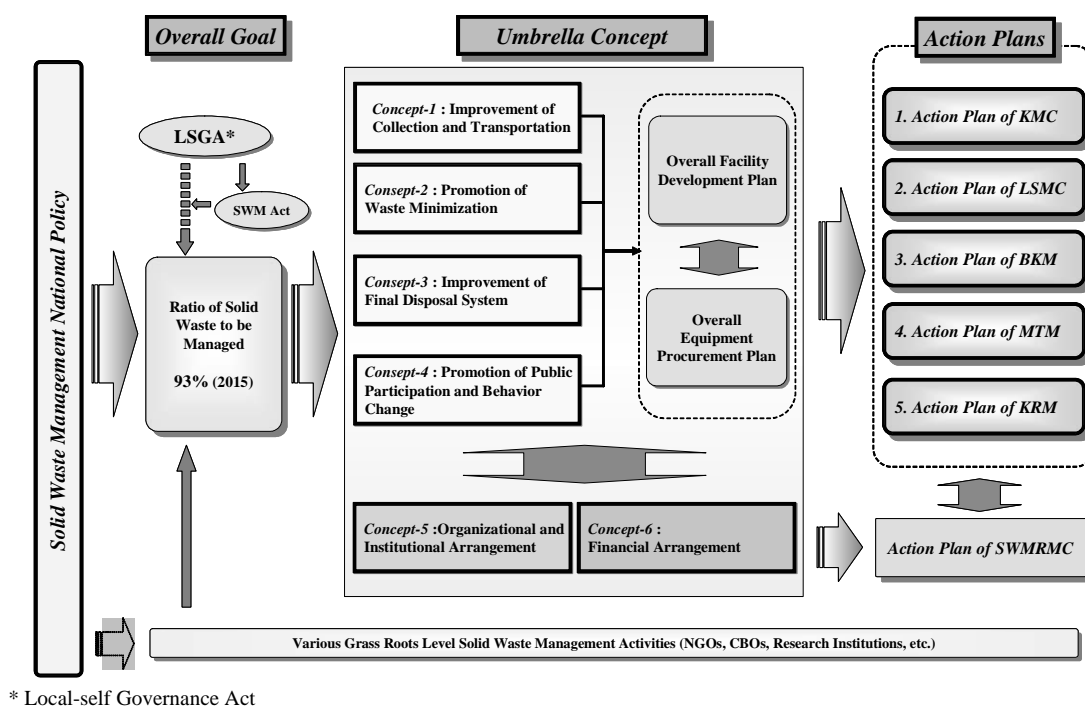
Components of A/Ps	Individual Municipality or Zone
1. Primary and secondary collection	Individual municipality
2. Transportation (transfer haul)	Individual municipality or zone
3. Waste minimization (composting and recycling)	Individual municipality or zone
4. Waste disposal	Zone
5. Public participation and behavior change	Individual municipality and zone
6. Organizational and institutional arrangement	Individual municipality and zone

Source: JICA Study Team

In this connection, a basic concept common for all five municipalities, *an umbrella concept of solid waste management in the Kathmandu Valley (Umbrella Concept)*, has been proposed to clarify the administrative responsibilities of each municipality and to show a basic direction (road map) for effective solid waste management.

As parts of the Umbrella Concept, four basic concepts, i.e. improvements of collection and transportation and final disposal system, and promotion of waste minimization and public participation and behavior change have been proposed. In order to achieve these basic concepts, an overall facility plan (OFP) and overall equipment plan (OEP) in the Kathmandu Valley have been discussed. In addition, the directions for financial arrangement as well as organizational and institutional arrangement including the involvement of the private sector regarding SWM have been proposed. The overall framework of the Umbrella Concept is shown in Figure 4.1-1.





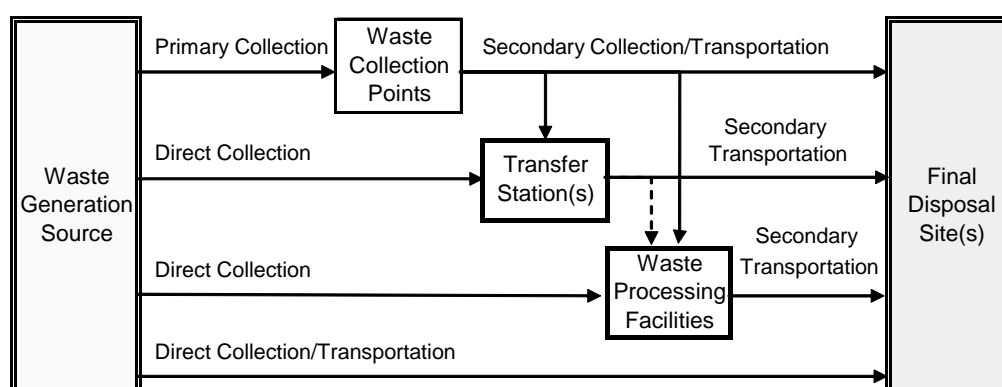
**Figure 4.1-1 Overall Framework of the Umbrella Concept of the Kathmandu Valley**

Source: JICA Study Team

## 4.2 Basic Concept for Improvement of Collection and Transportation

### 4.2.1 Collection and Transportation Practices and Coverage Improvement

The collection and transport systems are broadly identified in the Kathmandu Valley in the as shown in Figure 4.2-1.



**Figure 4.2-1 Definition of Collection and Transportation**

Source: JICA Study Team

Accordingly, a basic concept for improvement of collection and transportation are summarized in the Table 4.2-1.

**Table 4.2-1 Basic Concept for Improvement of Collection and Transportation**

Activity	Basic Concept	Descriptions
Primary Collection	Decrease of street sweepers	Number of municipal sweepers: less than present
	More utilization of private sector	Share of private sector for primary collection: 60% in KMC, LSMC, 100% in KRM.
	Improvement of waste collection point	No direct manual loading point with shovels in the Valley
Direct Collection	Promoting of Door to Door collection	Preparation of private door to door collection service guideline
	Promoting bell collection system	Bell collection in all the collection area except the area of Door to Door collection and container collection
Secondary Collection	Abolishment of municipal tractor	100% of municipal tractors will be replaced by small sized compaction trucks
Secondary Transportation	Procurement of new secondary transportation vehicles	The existing equipment will also be replaced by the same type of new vehicle.
Others	Introduction of source-separated collection	In BKM, all waste to the existing composting facility should be separated at the generation source. In future including other municipalities, at least 50% of waste is separated at the source and the rest is separated at the facility by waste pickers.
	Improvement of mechanical workshop	All the equipment should be maintained appropriately with minimum cost.

Source: JICA Study Team

## 4.2.2 Collection and Transportation Facilities (Transfer Stations)

The streets of the five municipalities are mostly narrow and cannot accommodate large collection trucks, making smaller collection trucks, tractors and tri-cycles more suitable. These small trucks need to be served by small transfer stations or mini transfer points (depos) and are directly related to the primary collection activities.

As for larger transfer stations, as a basic concept, KMC should push forward with construction of another transfer station in Balaju in addition to the improved Teku T/S, and LSMC should secure the land and construct a temporary transfer station in Afadol and then should utilize a waste processing facility as a transfer station.

## 4.3 Basic Concept for Promotion of Solid Waste Minimization

### 4.3.1 Promotion of 3Rs Activities

In order to realize effective SWM, it is important that the residents should promote 3Rs activities as follows:

- Reduce: To minimize generated or discharged waste
- Reuse: To use goods or materials that can still be used a number of times
- Recycle: To recover waste as raw material and use it for reproduction

In order to promote 3Rs activities smoothly, cooperation of the private sector and support from municipalities are needed as shown below:

- 1) Cooperation of Private Sector
  - Produce and sell easy-to-recycle goods
  - Produce and sell long-life goods
  - Minimize packing and packaging for goods
  - Improve quality of recyclable and recycled goods and develop new products
- 2) Support by Municipality
  - Increase awareness for reduction of waste to residents and private sector
  - Establish more recycling centers (places for purchasing recyclable materials)
  - Develop and improve distribution pipeline for recyclable materials
  - Provide subsidies for the private sector involved in recycling activities
  - Develop legislation to establish a recycling-based society

### 4.3.2 Promotion of Waste Processing and Composting

Since approximately 70% of the generated solid waste is organic, composting has been actively conducted in the Kathmandu Valley. Composting activities can be broadly divided into three types as discussed in Table 4.3-1.

**Table 4.3-1 Composting Activities conducted in the Kathmandu Valley**

No.	Items	Composting Plant	Community Composting	Home Composting
1	Experience in the Kathmandu Valley	Composting plant in Bhaktapur Old composting plant in Teku	Compost chamber in Thimi 3,000 L compost bins in KMC	100 L compost bins of KMC Vermi-composting
2	Source separation of organic waste	Necessary for plant operation	Necessary for community composting operation	Necessary at each house
3	Waste collection and transportation to facility	Wide collection area and long distance transportation	Limited collection area and short distance transportation	Not necessary
4	Separation of non compostable material at facility site	To be required	To be required	Not necessary
5	Operating labor	Many exclusive operators are required.	Exclusive operators not required.	Household members operate
6	Operation and maintenance technique	Harder than community composting	Harder than domestic composting	Easy
7	Installation area	Large area with public consensus is required.	Limited area with community consensus is required	Small space is required in house
8	Investment cost	Large	Medium	Little
9	Running cost	Medium	Little	Little
10	Advantage for public participation	Getting produced compost or revenue by selling compost	Getting produced compost or revenue by selling compost	Getting produced compost or revenue by selling compost
11	Other related	Selection of installation area Financial balance	Cooperation of community	Expansion of number of cooperative households

Source: JICA Study Team

Considering necessary investment and O&M costs, ease of operation and environmental impact, home composting is considered to be the most practical in the Kathmandu Valley. For community composting, a pit method is recommended because of ease of operation and maintenance. For planning purposes, the suitable method or best combination of the above three types of composting should be examined.

From the viewpoint of reduction of waste transportation cost, a composting plant should be constructed in or near the city area of KMC or LSMC. The windrow method should be adopted because Nepal has experience in operation of the BKM composting plant with this method. This method may be enhanced through:

- Separated waste being received at the composting plant as much as possible.
- At the sorting area, uncompostable materials being removed manually, while compostable materials are piled up at the fermentation yard by using a wheel loader.
- During composting the heap being turned over several times and exposed to air for accelerating fermentation
- After about 60 days, raw compost being screened for the final product to be ready

### **4.3.3 Considerations to Waste Pickers**

Waste pickers, one third of the estimated number of 2,500 who are below 15 years of age, are considered as the primary recyclable waste collectors. The main items salvaged by waste pickers are plastic bags and milk and oil pouches. The government and related authorities need to harness their contribution and efforts.

In several places, it was observed that waste pickers help with loading and unloading works. However, sometimes waste picking activities may obstruct waste collection or landfilling works and scatter the waste on the roads. It is apparent that waste pickers are working in a dirty, dangerous and health-hazard environment. Furthermore waste pickers are alienated from social communities and sometimes subject to many forms of discrimination. There is also a specific linkage between waste work and children. As the market for recyclables have increased, a number of children previously involved in begging have turned to rag-picking/scavenging as a means of survival.

For improvement of effective SWM in the Kathmandu Valley, the following consideration should be given to waste pickers.

- Improve working conditions among waste pickers
- Disseminate effectively information targeting waste pickers
- Gradually abolish child labor as waste pickers
- Incorporate waste pickers within new SWM facilities

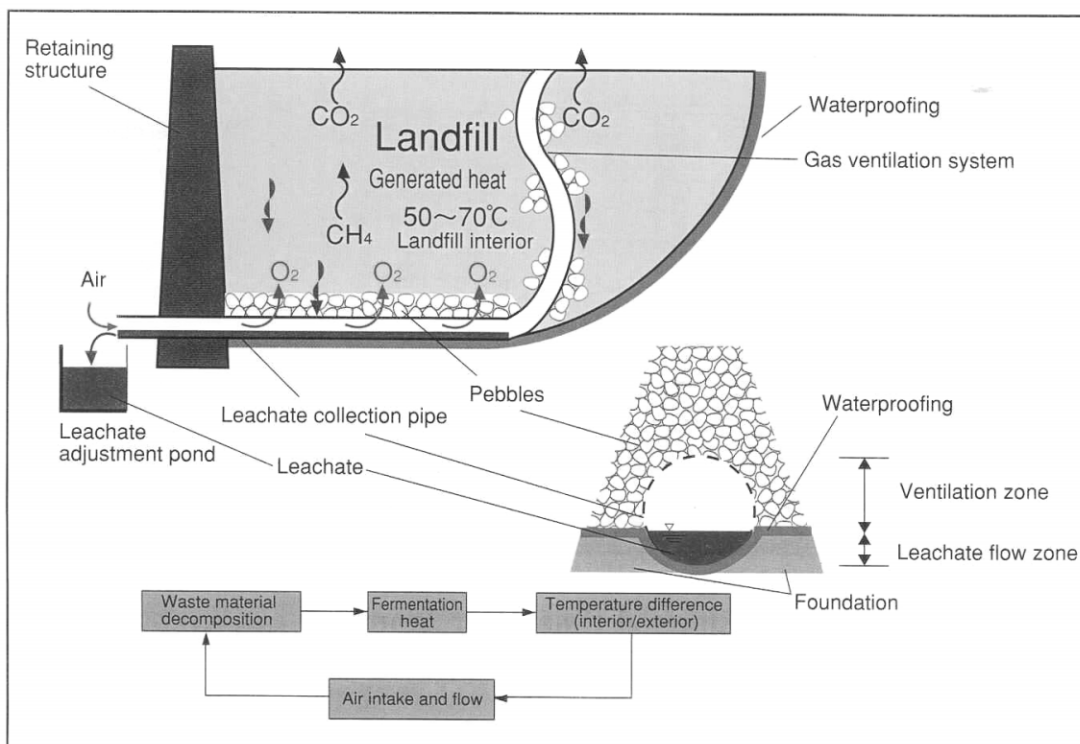
## **4.4 Basic Concept for Improvement of Final Disposal System**

### **4.4.1 Landfill System**

The new landfills for the valley should be developed under clear standards. Two of these standards; landfill type and landfill level are described hereafter.

### (1) Semi-aerobic Landfill Type

Anaerobic decomposition of organic matter produces methane and water, and the decomposition is slow and leachate content is large. On the other hand, under aerobic decomposition, organic matter decomposes into carbon dioxide and water and the decomposition is rapid. Aerobic decomposition requires a supply of oxygen to be pumped into the landfill, but this is a costly system. To cope with these problems, a particular type of semi-aerobic landfill known as “Fukuoka Method” was developed as a joint project of Fukuoka City and Fukuoka University. The semi-aerobic system is schematically presented in Figure 4.4-1.



**Figure 4.4-1 Schematic Presentation of Semi-aerobic System**

Source: The Fukuoka Method, Fukuoka City Environmental Bureau

It is proposed to develop the landfills using the semi-aerobic system. The Sisdol S/T-LF has been designed under this concept and has started operation since June 2005. The operation of the Sisdol S/T-LF should be carefully monitored to determine the suitability of the semi-aerobic landfill system.

### (2) Landfill Level

In past JICA studies in other developing countries, four landfill levels have been discussed as shown in Table 4.4-1. Level 4 offers the best countermeasures for mitigation of impact on the environment and therefore it is proposed that the Nepali decision makers aim to achieve that level in future. However considering the issues of high construction and operation costs for leachate treatment facilities and liner installation, and difficulty in treating the resulting chemical wastes from the leachate treatment, level 3 may be acceptable in the short term.

**Table 4.4-1 Sanitary Landfill Levels**

Facility	Level 1	Level 2	Level 3	Level 4
Description	Controlled tipping	SLF with bund and daily cover	SLF with leachate recirculation	SLF with leachate treatment facilities
Soil cover	O (Periodic)	O	O	O
Embankment		O	O	O
Drainage facility		O	O	O
Gas venting		O	O	O
Leachate collection			O	O
Leachate re-circulation			O	O
Leachate treatment				O
Liners				O

Source: JICA Study Team

In the case of the Sisdol S/T-LFS, it is expected to be operated for only 3-4 years and therefore application of natural liner and leachate re-circulation with natural attenuation treatment was recommended. This may be considered as Level 3 (+).

#### 4.4.2 Post Closure Management of Landfill Sites

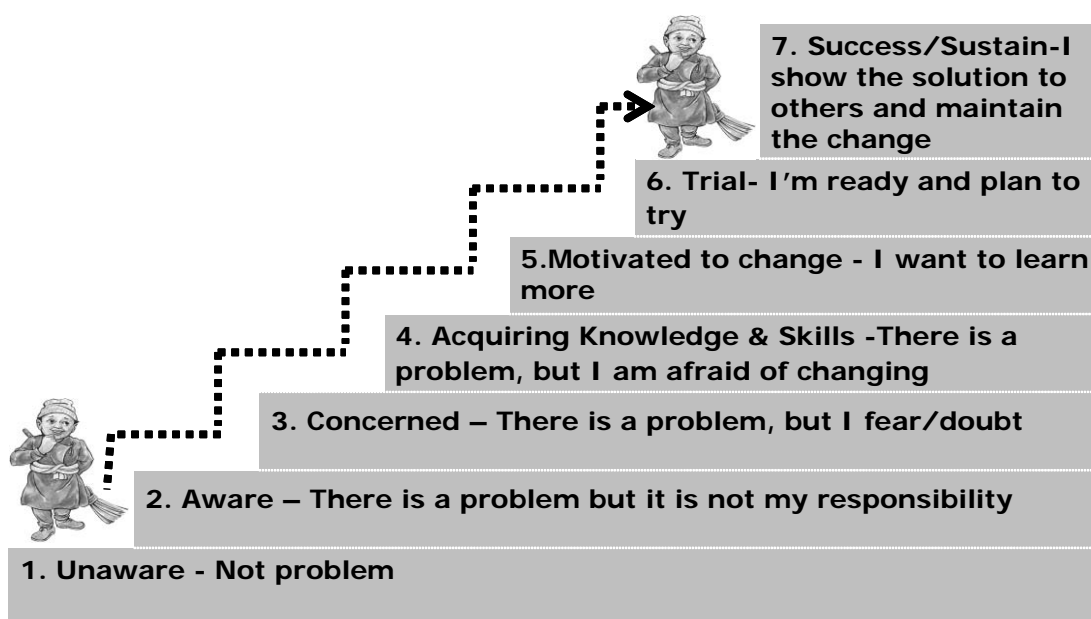
Management aspects with respect to closed landfills include collection and monitoring of landfill gas and leachate, landfill settlement, land use and access control and dissemination of information on the use of the site as a landfill.

A detailed mapping of the dump sites along the Bagmati River should be prepared and the priority sections for safe closure identified. For these sites river bank slope reformation, and installation of leachate collection pipes, landfill gas vents and storm water drains are considered.

### 4.5 Basic Concept for Public Participation and Behavior Change

#### 4.5.1 Public Awareness and Behavior Change for Effective SWM

A successful SWM requires various forms of community mobilization and participation. The following Figure 4.5-1 provides a framework of stages of behavior change of the people. Most people go through these steps, sometimes moving forward or backward and sometimes skipping steps. Even when people adopt new behaviors, they may revert to old behaviors, at least under certain circumstances.



**Figure 4.5-1 Behavior Change Stages**

Note: The process of changing behaviors and attitudes may happen in the sequence. Most people move back and forth between steps before achieving success. Source: JICA Study Team, adopted from “A manual for communication for water supply and environmental sanitation programs” (UNICEF, 1999), and “How to create effective communication project” (AIDSCAP/FHI/USAID).

Behavior Change Communication (BCC) is considered to be an effective component of a comprehensive SWM program. It can impart information and knowledge regarding environment friendly behaviors and SWM issues and promote essential attitude change. It can also contribute to creating a demand for relevant information and services related to SWM, and to improving skills and sense of self-efficacy, which are required to stimulate behavior change. In order to integrate a BCC component into A/Ps effectively, the following steps<sup>1</sup> need to be taken.

- 1) Identification of the Program’s Goal and Target Group/Audience
- 2) Formative BCC Assessment and Definition of Behavior Change Objectives
- 3) Development of Messages
- 4) Communication Channels
- 5) Pre-testing
- 6) Implementation, Monitoring and Evaluation

#### **4.5.2 Mass Communication and Education**

Mass communication and education is a useful approach that reaches large groups of people quickly and effectively. It includes mass media, small media including print media, social marketing and public/educational events. However, producing awareness programs on SWM through mass media is relatively expensive. Thus, it requires inter-municipality

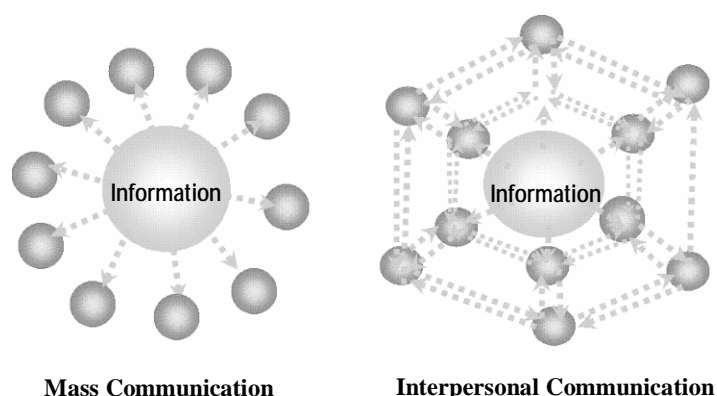
<sup>1</sup> These steps have been developed by FHI (“BCC for HIV/AIDS A Strategic Framework, FHI/USAID, 2002) and adopted by a number of BCC programs and projects in the world. Since they can be applied to SWM programs, Interpersonal Communication and BCC Skill Training conducted as part of Pilot Project D-1 for municipal staffs also highlighted and recommended these steps.

coordination among the five municipalities and technical as well as financial support from SWMRMC/MOLD, or other external organizations. On the other hand, since print media such as brochures, posters and flip charts are not so expensive, each municipality can produce them with their own financial resources. Social marketing, which uses similar commercial marketing techniques for stimulating public behavior change, is useful for promoting commodities with effective messages on SWM.

Public events are effective to disseminate basic information on SWM quickly and increase the level of knowledge on SWM among a large number of people. It is expected that all municipalities in coordination with SWMRMC carry out these events at least once a year on an occasion such as Earth Day or Environment Day according to their A/P for SWM.

### 4.5.3 Interpersonal Communication and Education

An approach using Interpersonal communication and education is recognized as an effective two-way communication channel that encourages the interactive dialogue between individuals or among group members. Figure 4.5-2 illustrates the difference between interpersonal and mass communications. The interpersonal communication and education approach, based on personal communication sources and channels, can disseminate, improve and reinforce the acquired knowledge, skills, attitude and behavior between individuals or among diverse group members.



**Figure 4.5-2 Difference between Mass Communication and Interpersonal Communication**

Source: JICA Study Team

## 4.6 Overall Facility Plan in the Kathmandu Valley

### 4.6.1 Principle for Overall Facility Plan in the Kathmandu Valley

The principles adopted to develop the OFP were threefold:

Principle 1 : Waste Hierarchy; The SWM facilities should contribute to a more balanced SWM system that first works to reduce the waste at source, re-use, recycle and recover, treat and finally dispose of the waste.

Principle 2 : Sustainable Facilities; Facilities should be sustainable both financially and technically and should suit the existing Nepalese conditions.

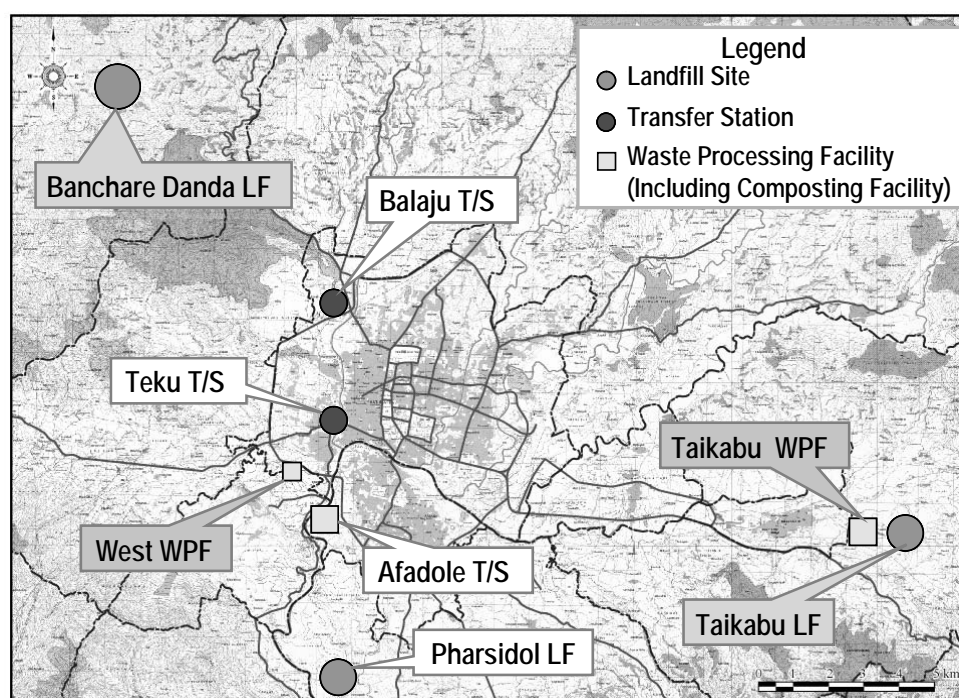


**Principle 3 : Urgent Implementation:** To avoid delays in providing needed facilities, a step-wise approach was adopted. The past studies and plans were taken into consideration as much as possible.

#### 4.6.2 Alternative Evaluation of OFP

As a first step, a short list of candidates for long-term landfill sites (L/T-LFSs) was prepared based on the 1998 study by the Department of Mines and Geology (DOMG). It is noted that six years have passed since the implementation of that study and development has been rapidly progressing. The four candidate sites, Pharshidol South, Pharshidol North, Taikabu, and Okharpouwa, for development of long-term sanitary landfill were selected. Ranking of these sites was made taking into account field visits and available information.

The facilities to be incorporated in the formulated alternatives mostly reflect existing plans and nine alternatives, based on the number of landfills, were analyzed. Alternatives 1a, b and c call for one sanitary landfill to serve the whole the Kathmandu Valley with provision of WPFs. Alternatives 2a, b and c call for two landfills to be developed. Alternative 2c is an offshoot of Alt. 2b but without WPFs. Alternatives 3a and b provide three landfills, and once more Alt. 3b is an offshoot of Alt. 3a but without WPFs. Alternative 4 has each individual municipality developing its own SWM facilities in the absence of the Umbrella Concept. Figure 4.6-1 shows the locations of these facilities.



**Figure 4.6-1 Facilities Incorporated in the Alternatives 1-3**

The developed alternatives are described in the following Table 4.6-1.

**Table 4.6-1 Alternatives Formulation**

Alt	LF	WPF	T/S	Comments
1a	Okharpauwa	West Taikabu	Teku Balaju Taikabu	<u>Alt. 1a:</u> examines one landfill for the total valley, located outside the valley and the effect of waste reduction by two composting facilities. Three transfer stations are required.
1b	Taikabu	West Taikabu	Teku Balaju	<u>Alt. 1b:</u> locates one landfill within the valley at Taikabu LF candidate site which is under EIA process. WPF is proposed on an unidentified site west of the two cities to reduce transfer haul distances.
1c	Pharsidol	West Taikabu	Teku Balaju	<u>Alt. 1c:</u> locates the sole landfill for the valley at a site proposed in the Pharsidol area, Pharsidol of LSMC, and close to the municipalities.
2a	Okharpauwa Taikabu	West Taikabu	Teku Balaju	<u>Alt. 2a:</u> proposes two landfills, in Okharpauwa outside the valley and Taikabu. Two WPFs are also proposed.
2b	Taikabu Pharsidol	West Taikabu	Teku Balaju	<u>Alt. 2b:</u> proposes two landfills, Taikabu and Pharsidol, both located within the valley, and two composting facilities.
2c	Taikabu Pharsidol		Teku Balaju West	<u>Alt. 2c:</u> is an offshoot of Alt. 2B without WPFs, in order to study the effect of waste reduction.
3a	Okharpauwa Taikabu Pharsidol	West Taikabu	Teku Balaju	<u>Alt. 3a:</u> proposes three landfills and two WPFs.
3b	Okharpauwa Taikabu Pharsidol		Teku Balaju Afadole	<u>Alt. 3b:</u> is an offshoot of Alt. 3A without the WPFs, in order to study the effect of waste reduction.
4	Okharpauwa Taikabu Pharsidol Thimi Kirtipur	Aletar Afadole Taikabu Thimi Kirtipur	Teku Balaju	<u>Alt. 4:</u> proposes that each municipality achieves its targets through construction of its individual composting facility and sanitary landfill.

Source: JICA Study Team

The main comparison items considered were:

- SWM aspects: How the alternative reflected the proposed waste hierarchy and satisfied the “Proximity Principle”<sup>2</sup>
- Transportation aspects: The transfer haul costs represent the largest portion of the O&M cost and this is reflected in the ton • km produced by each alternative

#### 4.6.3 Overall Facility Development Plan in the Kathmandu Valley

Since the analysis indicated that two landfills and two WPFs would provide stable and sustainable SWM service for the Kathmandu Valley, Alt. 2b or 2a should be considered.

<sup>2</sup> The principle whereby waste should be treated and disposed of nearby the generation area as much as possible to nourish responsibility of the waste generator for its management, uphold environmental justice, and decrease transportation costs

In terms of waste transportation and related costs; Alt. 2a would entail an added O&M cost of Rs. 278.9 million over the period of 2007 to 2015 or average Rs.24.9 million annually. On the other hand Alt. 2a holds an edge over Alt. 2b in terms of the site allocation. Out of the two sites required to be identified, EIA for Taikabu site is already in process and barring any unforeseen circumstances is expected to be found suitable for construction of the landfill there. This study has narrowed the candidates for the remaining landfill site to two sites; in Pharsidol and the Banchare Danda site in Okharpauwa.

Pharsidol north site was preferred over Banchare Danda in view of the shorter transport distance and other factors. However three major issues may delay the development of this site. These are the Pharsidol wellfields, the direction of Tribhuvan Airport runway and the close proximity of the culturally important village of Khuipa. A long time may be required to resolve these issues. On the other hand the major advantage that Banchare Danda site has is the commitment of the Central Government to develop this site as a landfill (as underlined in the Government's National Plan). Social and cultural issues are much less critical here and development is expected to be much faster. However the Government needs to carefully discuss with the beneficiaries of the site, namely KMC and LSMC on how to bridge the high haulage costs. The Overall Facility Plan (OFP), therefore, has been developed based on Alt. 2a in order to expedite the process of developing long-term landfill by building on all the effort that has been applied so far and also to clarify the costs incurred.

Accordingly the OFP is discussed in Zone A (KMC, LSMC and KRM) and Zone B (BKM and MTM) as shown in Table 4.6-2.

**Table 4.6-2 Overall Facility Plan under the Umbrella Concept**

Facilities		Descriptions
<b>ZONE A – KMC, LSMC and KRM</b>		
1	Sisdol LF	
	(1) Valley 1	Valley 1 will be operated for about 12-14 months
	(2) Valley 2	Valley 2 to be developed and operated for about 12 months
	(3) Post closure	Upon completion of disposal operations at Sisdol proper site closure will be implemented and environmental monitoring will continue until as required
2	Bagmati River Dumping Site	Bagmati River dumping site will cease operation once the new transfer trucks arrive (around Oct. 2005) and all the waste is transported to Sisdol LF. For a couple of years thereafter, safe closure works will be implemented along the Bagmati River banks where waste has been deposited.
3	Banchare Danda L/T-LF	This LF is expected to be developed within the next three years. It will be operated as a Level 3, semi-aerobic landfill.
4	West WPF	A WPF, basically for compost production but that will also include recyclable materials separation facilities to be developed west of KMC and LSMC and within 7-10 Km distance. The facility will be developed in three phases, starting with an input capacity of 100 t/d and reaching 300 t/d. Residues will be transported from the plant to the landfill
5	Teku T/S	Teku T/S has been improved with a capacity of 200 t/d (40 t at peak hour). Tipping at the station will continue to be mixed with some loading by wheel loaders.
6	Balaju T/S	Balaju T/S will be developed on the allocated land within 2006. It will be a split level unloading system without compaction. It will have a capacity of 120 t/d.
7	Afadole Temporary T/S	For the first 2-3 years of the Action Plan period, a temporary T/S will be developed for LSMC waste at Afadole. Upon completion of the waste processing facility the LSMC waste will be transported there.

Facilities		Descriptions
<b>Zone B – BKM and MTM</b>		
1	Hanumante River dumping site	For the next 2-3 years waste will continue to be dumped at Hanumante River bank, with the application of cover soil.
2	MTM temporary LF	The solid waste collected in the central areas will be transported to Teku T/S, while remaining waste will be disposed of a temporary landfill with the application of cover soil.
3	Taikabu LF	The Taikabu LF will be developed within the next 2-3 years as a Level 3, semi-aerobic landfill.
4	Taikabu WPF	Within the same Taikabu LF site, a compost plant will also be developed. The plant will have an initial capacity of 10 t/d and expand to 15 t/d.

Source: JICA Study Team

#### 4.6.4 Facility Operation Schedule and Cost Estimation

Bearing in mind that Sisdol LF has a short life of around 3 years, the operation schedule for the facilities has been prepared. Figure 4.6-2 shows the operation schedule, while the estimated costs for the period of 2005 to 2015 are shown in Table 4.6-3.

YEAR		Short-term			Mid-term		Long-term				
		2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
<b>ZONE A - KMC, LSMC and KRM</b>											
1	Sisdol S/T-LF										
	(1) Valley 1										
	(2) Valley 2										
2	Banchare Danda L/T Sanitary LF										
3	West Waste Processing Facility										
	(1) Phase 1 (100 t/d)										
	(2) Phase 2 (200 t/d)										
	(3) Phase 3 (300 t/d)										
4	Teku T/S										
5	Balaju T/S										
6	LSMC Temporary T/S (Afadole)										
<b>ZONE B - BKM and MTM</b>											
1	Hanumante River Dumping Site (BKM)										
2	Temporary LF (MTM)										
3	Taikabu LF										
4	Taikabu WPF										
	(1) Phase 1 (10 t/d)										
	(2) Phase 2 (15 t/d)										

**Figure 4.6-2 Operation Schedule of Overall Facility in the Kathmandu Valley**

Source: JICA Study Team

**Table 4.6-3 Estimated Costs of the Facility Plan (million Rs)**

SN	Facility	Investment Costs
<b>1</b>	<b>Improvement/Development of Transfer Station</b>	
	1.1 Teku T/S (Improvement)	2.0
	1.2 Balaju T/S	44.2
	1.3 Afadol Temporary T/S	19.7
	<b>Sub-total 1</b>	<b>65.9</b>
<b>2</b>	<b>Development of Waste Processing Facility</b>	
	2.1 West WPF (including equipment)	219.8
	2.2 Taikabu WPF (including equipment)	80.2
	<b>Sub-total 2</b>	<b>300.0</b>
<b>3</b>	<b>Development/Closure of Landfill</b>	
	3.1 Sisdol LF (Closure of Valley I and development of Valley II)	26.4
	3.2 Banchare Danda LF (including equipment)	906.1
	3.3 Taikabu LF (including equipment)	272.0
	<b>Sub-total 3</b>	<b>1,204.5</b>
<b>4</b>	<b>Closure of Dumping Site</b>	
	4.1 Bagmati River dumping site (Closure)	5.0
	4.2 Hanumante River dumping site (Closure)	0.5
	4.3 MTM temporary LF (Closure)	0.2
	<b>Sub-total 4</b>	<b>5.7</b>
<b>TOTAL</b>		<b>1,576.1</b>

Source: JICA Study Team

## **4.7 Overall Equipment Procurement Plan in the Kathmandu Valley**

### **4.7.1 Basic Concept of Overall Equipment Procurement Plan**

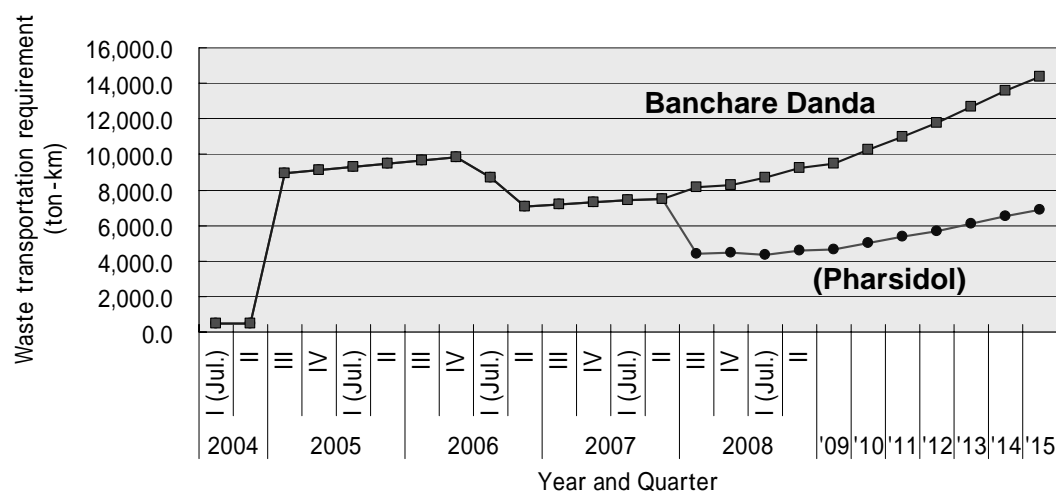
The equipment to be procured for implementing the OFP is mainly divided into the equipment for secondary transportation, LF operation, T/S operation, WPF operation and there is maintenance for that equipment.

Considering that operation has already commenced at Sisdol S/T-LF, the first priority should be given to the procurement of secondary transportation equipment because no suitable large-capacity vehicles are presently available for effective operation. As for the equipment for landfill operation, the current equipment may be utilized in Sisdol S/T-LF. Therefore, the immediate priority for procurement of this equipment is a little bit lower than for the secondary transportation vehicles, although in the near future replacement of that aging equipment will be necessary.

### **4.7.2 Secondary Transportation Vehicle**

The total transportation requirement increases explosively up to about 9,000 ton-km per day when the Sisdol S/T-LF starts accepting all collected waste from KMC and LSMC. The requirement then decreases step by step by shortening the transportation distance or reducing the waste quantity by each facility's operation as shown in Figure 4.7-1. From the second quarter of 2007, the upper curve shows the ton.km produced in case of Banchare Danda LF

while the lower graph depicts the ton.km in case of Pharsidol North LF. In the case of Banchare Danda LF, 25 secondary transportation vehicles (STVs) are required.



**Figure 4.7-1 Future Projection of Transportation Requirement**

Source: JICA Study Team

### 4.7.3 Heavy Equipment for Landfill and Transfer Station Operation

The equipment available in KMC and LSMC and required for the landfills to be developed under the OFP, such as compactor (one unit), dozers (two units) and excavator (one unit), are very old and were procured over 16 years ago (with the exception of one dozer procured over 9 years ago). On the other hand wheel loaders, required for the transfer stations and WPFs are relatively new and may be used in the new facilities to be developed under the OFP. Therefore, KMC and LSMC should concentrate on procurement of dozer and compactor for the landfills.

### 4.7.4 Workshop Equipment

Daily or regular maintenance and minor repair work of light vehicles such as tractor trailer and tippers are implemented at the KMC mechanical workshop, while repair or maintenance work for large vehicles or heavy equipment are carried out outside. However, because the LSMC mechanical workshop is not adequate to maintain all vehicles and equipment, some major maintenance work for LSMC should be considered to be entrusted to KMC. As for STVs, as special devices such as hydraulic parts are not available at the KMC workshop, such special work may be entrusted to the private sector or the STV manufacturers.

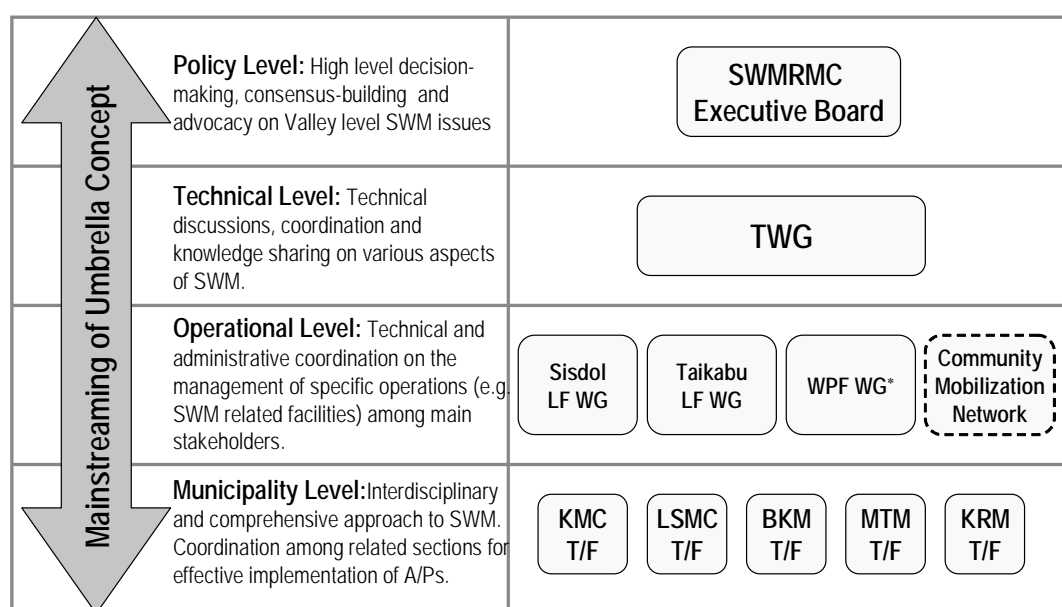
## 4.8 Basic Concept for Organizational and Institutional Arrangement

Institutionalization of the Umbrella Concept is critical in ensuring the sustainability of its operation, and subsequently its implementation. It is worthy to highlight those issues of

lack of institutional mandates and unclear demarcation of responsibilities among SWMRMC, KMC, and LSMC that are some of the major constraints that lead astray policy dialogue on SWM for over a decade. The principles of the Basic Concept for Organizational and Institutional Arrangement for the Umbrella Concept are:

- Institutional/organizational arrangements should build on existing organizational set up.
- There should be clarity in the mandate and terms of reference for each of the institutions.
- Linkages among various levels of institutions should be identified.
- The specific role and mandate of SWMRMC should be determined.

The basic concept is conceptualized in Figure 4.8-1. Institutional and organizational arrangement is divided into four levels, each with specific significance in guaranteeing the smooth implementation of the Umbrella Concept.



\* In case of adoption of public-private partnership approach in development and operation of WPF, this WG will be responsible for Supervision and Management of operations.

**Figure 4.8-1 Basic Concept for Institutional and Organizational Arrangement as Umbrella Concept**

Source: JICA Study Team

For not only monitoring the implementation of the Umbrella Concept but also preparing the A/Ps based on reliable data, formulation of the solid waste data management system should be quite crucial with the following Basic Concept.

- At the commencement stage, a semi-manual system should be introduced, and then it will be gradually upgraded to an online system or other advanced system
- Each municipality and SWMRMC should modify the common database program based on the data that should be managed respectively
- The data at each municipality should be finally concentrated at SWMRMC to monitor the overall SWM progress and to prepare the SWM white paper

## 4.9 Basic Concept for Financial Arrangement

### 4.9.1 Estimated Cost to be Allocated for Umbrella Concept

Costs for the Umbrella Concept consist of investment cost and incremental operation and maintenance (O&M) cost which are estimated separately by each zone and summarized in Table 4.9-1. The total cost until FY2014/15 is estimated at Rs 2,559 million; consisting of Rs 1,742 million on investment and Rs 817 million on incremental O&M.

**Table 4.9-1 Estimated Cost for the Umbrella Concept (million Rs)**

Cost Items	Zone	2005/06 (2062/63)	2006/07 (2063/64)	2007/08 (2064/65)	2008/09 (2065/66)	2009/10 (2066/67)	2010/11 (2067/68)	2011/12 (2068/69)	2012/13 (2069/70)	2013/14 (2070/71)	2014/15 (2071/72)	Total
I. Investment Cost	A	129.0	859.4	141.2	78.8	89.1	18.4	0.0	17.6	13.0	5.0	1351.5
	B	298.3	34.1	18.0	3.8	2.1	3.2	6.4	24.5	0	0	390.4
	Total	427.3	893.5	159.2	82.6	91.2	21.6	6.4	42.1	13.0	5.0	1,742.0
1. Collection & Transportation	A	6.3	59.9			33.8	7.2		8.4		5.0	120.5
	B			17.7	3.8	2.1	3.2	6.4	4.3			37.5
	Total	6.3	59.9	17.7	3.8	36.0	10.4	6.4	12.6	0	5	158.1
2. Transfer Station	A	65.9										65.9
	B											0
	Total	65.9	0	0	0	0	0	0	0	0	0	65.9
3. Waste Processing Facility	A	14.3	150.4		45.9				9.2			219.8
	B	80.2										80.2
	Total	94.5	150.4	0	45.9	0	0	0	9.2	0	0	300.0
4. Landfill (including closure works)	A	34.8	649.1	141.2	32.9	55.3	11.2			13.0		937.6
	B	218.1	34.1	0.3					20.2			272.7
	Total	252.9	683.2	141.5	32.9	55.3	11.2	0	20.2	13.0	0	1210.2
5. Workshop	A	7.8										7.8
	B											0
	Total	7.8										7.8
II. Incremental O & M Cost	A	45.5	56.1	59.2	74.7	78.2	70.2	77.2	78.7	72.1	75.0	686.8
	B	2.8	9.7	13.9	14.7	15.4	14.4	14.8	15.2	14.6	15.2	130.6
	Total	48.3	65.8	73.0	89.4	93.7	84.6	92.0	93.9	86.7	90.1	817.5
1. Collection & Transportation	A	27.8	36.8	43.2	58.7	63.9	57.0	63.6	67.1	60.1	63.0	541.1
	B	2.3	2.6	6.8	7.7	8.4	7.7	8.0	8.5	7.9	8.4	68.2
	Total	30.0	39.4	50.0	66.4	72.2	64.7	71.6	75.6	68.0	71.4	609.3
2. Transfer Station	A	3.2	4.9	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	36.5
	B											0.0
	Total	3.2	4.9	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	36.5
3. Waste Processing Facility	A			-1.6	-1.6	-3.3	-3.3	-3.3	-4.9	-4.9	-4.9	-27.9
	B		-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-5.6
	Total	0	-0.6	-2.3	-2.3	-3.9	-3.9	-3.9	-5.5	-5.5	-5.5	-33.5
4. Landfill	A	12.4	12.4	12.0	12.0	12.0	12.0	12.4	12.0	12.4	12.4	122.3
	B	0.0	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	64.3
	Total	12.4	19.6	19.2	19.2	19.2	19.2	19.6	19.2	19.6	19.6	186.6
5. Public Awareness /Community Mobilization	A	1.8	1.8	1.8	1.8	1.8	0.9	0.9	0.9	0.9	0.9	13.5
	B	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	3.0
	Total	2.2	2.2	2.2	2.2	2.2	1.1	1.1	1.1	1.1	1.1	16.5
6. Institutional/ Organizational Strengthening	A	0.3	0.3	0.3	0.3	0.3						1.3
	B	0.2	0.2	0.2	0.2	0.2						0.8
	Total	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	2.0
III. Total (= I + II)	A	174.5	915.5	200.4	153.5	167.3	88.6	77.2	96.3	85.1	80.0	2038.3
	B	301.1	43.8	31.8	18.5	17.6	17.6	21.2	39.7	14.6	15.2	521.1
	Total	475.6	959.3	232.2	172.0	184.9	106.2	98.4	136.0	99.7	95.1	2559.4

Source: JICA Study Team

### 4.9.2 Concept for Cost Sharing Among the Organizations Concerned

#### (1) Concept for Cost Sharing between Municipality and Government

The municipalities are continuously facing financial difficulties because the revenue amount is not enough to satisfy the increasing costs of municipality services. In addition, the



municipalities may face serious financial problems when the Local Development Tax fades out by December 2013. Although KMC and LSMC have started to strengthen their revenue systems, much remains to be done. Accordingly the Government (SWMRMC) is required to bear the costs for development of landfill, transfer station, waste processing facility and closure of LF. On the other hand, municipalities should bear the rest of the costs from their own revenues, i.e. equipment procurement and O&M costs. The costs for public participation and behavior change, and institutional and organizational arrangement should also be borne by the respective municipalities.

Consequently, the cost sharing concept under the Umbrella Concept is summarized as shown in Table 4.9-2, but external financial support may be expected for some areas.

**Table 4.9-2 Cost Sharing Concept under the Umbrella Concept**

Action Plan	Component	Municipality	Government	Ref: External Sources
Transport & Haulage	Vehicles and Container Carrier	Full	-	Expected
	Container	Full	-	-
	O&M	Full	-	-
Transfer Station	Construction	-	Full	-
	Improvement works	-	Full	-
	Equipment	Full	-	Expected
	O&M	Full	-	-
Compost Plant	Land acquisition	-	Full	-
	Construction	-	Full	-
	Equipment	Full	-	Expected
	O&M	Full	-	-
Landfill	Land acquisition	-	Full	-
	Construction	-	Full	Expected
	Equipment	Full	-	Expected
	Closure	-	Full	-
	O&M	Full	-	-
Workshop	Facilities	Full	-	-
	Machinery & equip.	Full	-	-
Public Awareness/community mobilization		Full	-	-
Institutional/organizational strengthening		Full	-	-

Note: Full means full share, and Expected means financial aid to be expected

Source: JICA Study Team

Based on the above concept, the costs to be shared by SWMRMC and the municipalities can be estimated as shown in Table 4.9-3. SWMRMC should bear 56% of the total cost, while 44% should be borne by the municipalities.

**Table 4.9-3 Costs for SWMRMC and Municipalities (million Rs)**

Zone	Activities	SWMRMC	Municipalities		
		Facilities	Equipment	O&M	Total
A	Transportation	-	120.5	541.1	661.6
	Transfer Station	65.8	-	36.5	36.5
	WPF	203.8	16.0	-27.9	-11.9
	Landfill	892.4	45.2	122.3	167.5
	Workshop	-	7.8	-	7.8
	Public Awareness	-	-	13.5	13.5
	Institutional	-	-	1.3	1.3
	Total	1,162.0	189.5	686.8	876.3
B	Transportation	-	37.5	68.2	105.7
	WPF	38.2	42.0	-5.6	36.4
	Landfill	218.8	53.9	64.3	118.2
	Public Awareness	-	-	3.0	3.0
	Institutional	-	-	0.8	0.8
	Total	257.0	133.4	130.7	264.1
Total		<b>1,419.0</b>	322.9	817.5	<b>1,140.4</b>

Source: JICA Study Team

## (2) Concept for Cost Sharing among the Municipalities

In principle, equipment procurement cost and incremental O&M cost become burdens on municipalities. Each municipality has to bear the cost originally generated by the municipality itself. Meanwhile, the costs generated by joint work among municipalities should be principally discussed and decided among the municipalities concerned. However, the costs generated by joint work is proposed to be separated to each municipality concerned on the basis of solid waste amount transported from the municipality to the destinations of transfer station, WPF and landfill.

### 4.9.3 Concept for Necessary Financial Procurement of Each Municipality

Judging from the actual financial capacity of municipalities, it is difficult to expect municipalities to cover the entire costs. The municipalities need to develop sources of funds as follows:

- 1) Enhancement of revenue generation capability especially on Property Tax
- 2) Utilization of the Reserve Fund
- 3) Other alternatives
  - Introduction of Public Private Partnership on SWM to reduce the SWM cost
  - Introduction of new charges on SWM services

## **CHAPTER 5 ACTION PLAN ON SOLID WASTE MANAGEMENT OF SWMRMC**

### **5.1 Solid Waste Stream for Formulation of Action Plans**

The most elementary but indispensable process to develop the Action Plans (A/Ps) on solid waste management is “to clarify the solid waste stream” as well as “to clarify the solid waste amount”. Since social conditions such as population, economic growth or people’s life style, pattern of consumption may be correlated closely with solid waste generation, such social factors were considered when municipalities analyzed the solid waste amount for their A/Ps. On the other hand, solid waste is the material that is inevitably generated by human activities and that should have its own destination at the end of its material life. Under the Umbrella Concept for the solid waste management in the Kathmandu Valley, there are some remarkable turning points, i.e. facilities development such as waste processing facilities and long-term landfill sites, up to the target year of 2015 which should be taken into consideration in preparation of waste stream flows. In order to formulate the A/Ps, solid waste flows of each municipality were prepared as per attached in Appendix 3.

### **5.2 Necessary Activities on Action Plan**

In addition to each municipality, an A/P for SWMRMC has been prepared based on the suggestions by the JICA Study Team and discussions among the relevant organizations at the Board of SWMRMC as well as at the TWG meetings. Two kinds of A/Ps have been developed. One is for organizational and institutional arrangement so that SWMRMC could become a “Solid Waste Management Technical Center (tentative name)”, and the other is for actual implementation of necessary activities under the Umbrella Concept (development of sanitary landfill sites and waste processing facilities in the Kathmandu Valley). The developed A/Ps are summarized in Table 5.2-1 and -2. The Implementation schedule of short-term activities is shown in Table 5.2-3.

**Table 5.2-1 Action Plan of SWMRMC (for Organizational and Institutional Development)**

Related main issues to be tackled	Necessary Activities		
	Short-term (2005/06-2007/08) (2062 Shrawana -2065 Ashadha)	Mid-term (2008/09-2010/11) (2065 Shrawana -2068 Ashadha)	Long-term (2011/12-2014/15) (2068 Shrawana -2072 Ashadha)
<ul style="list-style-type: none"> <li>- Unclear demarcation of responsibilities between SWMRMC and Local Bodies (LBs)</li> <li>- Unclear relation with MOLD (status of SWMRMC)</li> <li>- Limited jurisdictional area (inside the Kathmandu Valley)</li> <li>- Lack of skilled manpower</li> <li>- Lack of equipment and facility</li> </ul>	<p>S1: Clarification of demarcation between SWMRMC and Local Bodies by issuing a new policy and amendment of the Solid Waste Act</p> <p>S2: Clarification of legal status and change of jurisdictional area by amendment of the Act</p> <p>S3: Establishment of a strategic plan for SWMRMC (future organizational and institutional development plan)</p> <p>S4: Change of name and organizational (such as setting up environmental section, training section, etc.)</p> <p>S5: Recruitment of skilled personnel and reservation of resource persons (inc. training)</p> <p>S6: Procurement of basic equipment (computer, software, etc.) and facility (including arrangement of office building, training room)</p> <p>S7: Implementation of Public Relations (PRs) activities (development of web-site and issues of newsletter, etc.)</p> <p>S8: Implementation of studies and research (waste minimization technology, final disposal sites selection) as part of training</p>	<p>M1: Continuous recruitment of skilled personnel and reservation of resource person (inc. training)</p> <p>M2: Continuous procurement of equipment and facility (mainly for training implementation)</p> <p>M3: Implementation of PRs activities (usage of web-site and issues of newsletter, etc.)</p> <p>M4: Starting training program to LBs and NGOs/CBOs</p> <p>M5: Preparation of a subsidy system to LBs (including setting up relevant section)</p> <p>M6: Preparation of public participation/community mobilization (including setting up relevant section)</p> <p>M7: Preparation of establishment of information network for SWM (including setting up relevant section)</p> <p>M8: Continuous implementation of study and research on waste minimization (as part of training)</p> <p>M9: Implementation of necessary support to LBs</p>	<p>L1: Continuous recruitment of skilled personnel and reservation of resource person (inc. training)</p> <p>L2: Continuous procurement of equipment and facility (mainly for information network)</p> <p>L3: Implementation of PRs activities (usage of web-site and issues of newsletter, etc.)</p> <p>L4: Implementation of training program to LBs and NGOs/CBOs</p> <p>L5: Implementation of a subsidy system</p> <p>L6: Implementation of public participation/community mobilization activities</p> <p>L7: Utilization of information network of SWM</p> <p>L8: Continuous implementation of study and research on waste minimization and final disposal</p> <p>L9: Implementation of necessary support to LBs</p>

**Table 5.2-2 Action Plan of SWMRMC (for SWM Facilities Development)**

Related main issues to be tackled	Necessary Activities		
	Short-term (2005/06-2007/08) (2062 Shrawana -2065 Ashadha)	Mid-term (2008/09-2010/11) (2065 Shrawana -2068 Ashadha)	Long-term (2011/12-2014/15) (2068 Shrawana -2072 Ashadha)
<ul style="list-style-type: none"> <li>- Need of long-term sanitary landfill sites</li> <li>- Need of large scale waste processing plant</li> <li>- Safety closure of existing dumping sites and used landfill site</li> </ul>	S1: Development of Sisdol Short-term LF S1-1: Development of Sisdol LF Valley II (2005/06) S1-2: Handover Valley II to operator S1-3: Periodic environmental monitoring  S2: Development of Waste Processing Facility (KMC, LSCM, KRM) S2-3: Land selection and assessment S2-4: Site investigation works S2-5: Land acquisition S2-6: Concept design and Feasibility study S2-7: EIA process S2-8: Detailed design S2-9: Landfill development of Phase I S2-10: Handover site to operator S2-11: Periodic environmental monitoring	M1-1: Receiving Sisdol site from operators M1-2: Regular environmental monitoring of closed Sisdol site M1-3: Maintenance and repairs for closed Sisdol site  M2-1: Periodic environmental monitoring M2-2: Development of Phase II M3-1: Periodic environmental monitoring M3-2: Development of Phase II M4-1: Regular environmental monitoring	L1-1: Regular environmental monitoring L1-2: Maintenance and repairs for closed Sisdol site  L2-1: Periodic environmental monitoring L2-2: Development of Phase III L3-1: Periodic environmental monitoring L3-2: Development of Phase III L4-1: Regular environmental monitoring
	S3: Development of Long-term LF (KMC, LSCM, KRM) S3-1: Construction of the access road S3-2: Identification of the capacity S3-3: Site investigation works S3-4: Land acquisition S3-5: Concept design S3-6: EIA process S3-7: Detailed design S3-8: Landfill development of Phase 1 S3-9: Handover site to operator S3-10: Periodic environmental monitoring		




Related main issues to be tackled	Necessary Activities		
	Short-term (2005/06-2007/08) (2062 Shrawana -2065 Ashadha)	Mid-term (2008/09-2010/11) (2065 Shrawana -2068 Ashadha)	Long-term (2011/12-2014/15) (2068 Shrawana -2072 Ashadha)
	<p>S4: Development of Long-term LF (BKM, MTM)</p> <p>S4-1: Site investigation works (EIA, Topography survey, Soil investigation)</p> <p>S4-2: Land acquisition</p> <p>S4-3: Detailed design</p> <p>S4-4: Development of Phase I</p> <p>S4-5: Handover Phase I to operator</p> <p>S4-6: Periodic environmental monitoring</p> <p>S5: Closure of Bagmati River dumping site</p> <p>S5-1: Design of Bagmati River dumping site closure plan</p> <p>S5-2: Implementation of Bagmati closure plan</p> <p>S5-3: Regular environmental monitoring</p>		

**Table 5.2-1 Implementation Schedule of Short-Term Activities (SWMRMC)**

Strategies	Short-Term Activities	Related Organizations	2005/2006				2006/2007				2007/2008			
			I (July 16)	II	III	IV (July 16)	I (July 17)	II	III	IV (July 16)	I (July 17)	II	III	IV (July 15)
			2062/2063				2063/2064				2064/2065			
			Shrawan			Ashadh	Shrawan			Ashadh	Shrawan			Ashadh
Organizational and Institutional Arrangement	S1: Clarification of demarcation between SWMRMC and Local Bodies by issuing a new policy and amendment of the Solid Waste Act	MOLD, Related Local Bodies												
	S2: Clarification of legal status and change of jurisdictional area by amendment of the Act	MOLD												
	S3: Establishment of a strategic plan for SWMRMC (future organizational and institutional development plan)	MOLD												
	S4: Chang of name and organization (such as setting up environmental section, training section, etc.)	MOLD												
	S5: Recruitment of skilled personnel and reservation of resource persons (inc. training)													
	S6: Procurement of basic equipment (computer, software, etc.) and facility (including arrangement of office building, training room)													
	S7: Implementation of Public Relations (PRs) activities (Management of web-site and issues of newsletters, etc.)													
	S8: Implementation of studies and researches (waste minimization technology, etc.) as part of training	MOAC, MOEST												
SWM Facilities' Development	S1: Development of Sisdol Short-term LF	KMC, LSMC, KRM												
	S1-1: Development of Sisdol LF Valley II													
	S1-2: Handover Valley II to operator													
	S1-3: Periodic environmental monitoring													
	S2: Development of Waste Processing Facility (WPF)	KMC, LSMC, KRM												
	S2-1: Land selection													
	S2-2: Site investigation works													
	S2-3: Land acquisition													
	S2-4: Concept design and feasibility study													
	S2-5: EIA process													
	S2-6: Detailed design													
	S2-7: Development of Phase I													
	S2-8: Handover site to operator													
	S2-9: Periodic environmental monitoring													

Strategies	Short-Term Activities	Related Organizations	2005/2006				2006/2007				2007/2008			
			I (July 16)	II	III	IV (July 16)	I (July 17)	II	III	IV (July 16)	I (July 17)	II	III	IV (July 15)
			2062/2063				2063/2064				2064/2065			
			Shrawan			Ashadh	Shrawan			Ashadh	Shrawan			Ashadh
SWM Facilities' Development	S3: Development of Long-term LF (KMC, LSMC, KRM)	KMC, LSMC, KRM												
	S3-1: Construction of access road													
	S3-2: Identification of the capacity and service areas													
	S3-3: Site investigation works													
	S3-4: Land acquisition													
	S3-5: Concept design													
	S3-6: EIA process													
	S3-7: Detailed design (Basic design)													
	S3-8: Landfill development of Phase 1													
	S3-9: Handover site to operator													
	S3-10: Periodic environmental monitoring													
	S4: Development of Long-term LF (BKM, MTM)	BKM, MTM												
	S4-1: Site investigation works (EIA, Topography survey, Soil investigation)													
	S4-2: Land acquisition													
	S4-3: Detailed design													
	S4-4: Development of Phase I													
	S4-5: Handover Phase I to operator													
	S4-6: Periodic environmental monitoring													
	S5: Closure of Bagmati River dumping site	KMC, LSMC, KRM												
	S5-1: Design of Bagmati River dumping site closure plan													
	S5-2: Implementation of Bagmati closure plan													
	S5-3: Periodic environmental monitoring													

**Legend**

-  : Continuous work  
 : Periodic work  
 : Spot work



### 5.3 Financial Plan

SWMRMC as the Central Government is expected to be required to be burdened with necessary costs for development of landfills, transfer stations, waste processing facility (WPF) and closures of landfills. On the other hand, in principle, municipalities should bear the rest of the costs from their own revenues, that is, equipment procurement and incremental O&M costs.

Consequently, SWMRMC's financial burden is estimated at Rs 1,419 million in total as shown in Table 5.3-1 that consists of Rs.65 million for transfer stations, Rs.242 million for WPF and Rs 1,112 for landfills.

**Table 5.3-1 Projected Facilities Development Costs to be borne by SWMRMC (million Rs)**

Area	Facility	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	Total
Zone A	T/S	65.8										65.8
	WPF	14.3	146.4		41.9				1.2			203.8
	LF	34.8	649.1	120.2	32.9	55.3						892.4
	Total	114.9	795.5	120.2	74.8	55.3	0	0	1.2	0	0	1,162.0
Zone B	T/S											0
	WPF	38.2										38.2
	LF	218.1	0.4	0.3								218.8
	Total	256.3	0.4	0.3	0	0	0	0	0	0	0	257.0
Total	T/S	65.8										65.8
	WPF	52.5	146.4		41.9				1.2			242.0
	LF	252.9	649.5	120.5	32.9	55.3						1,111.2
	Total	371.2	795.9	120.5	74.8	55.3	0	0	1.2	0	0	1,419.0

Source: JICA Study Team

### 5.4 Monitoring and Evaluation Plan for Action Plan

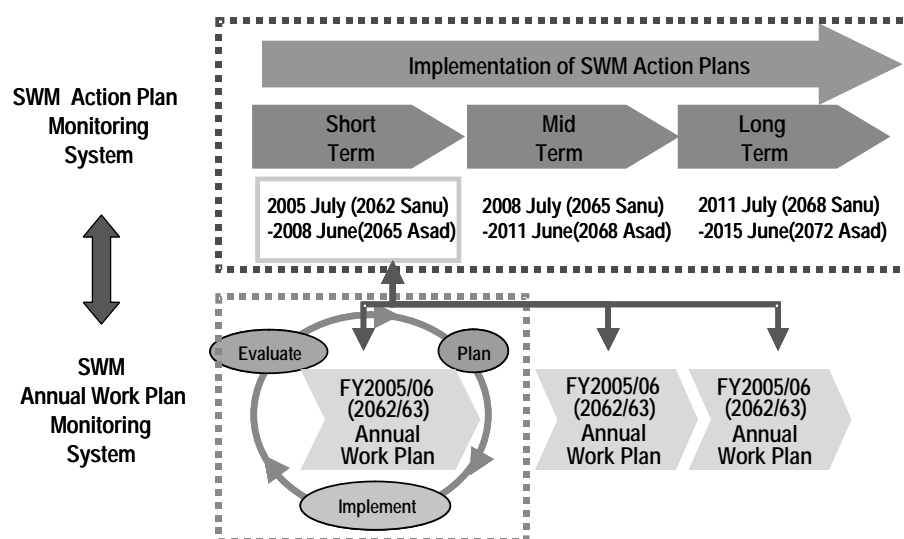
The A/P is a long-term strategic plan to be implemented starting fiscal year 2005/06 (2062/63) to 2014/15 (2071/2072). In order to ensure that the Action Plan is implemented in an effective and sustainable manner, monitoring and evaluation systems need to be put in place that bind together both individual and collective achievements of SWMRMC and the five municipalities. Such systems should be installed both at the municipal level, as well as the Valley level, in line with the institutional arrangements as discussed under the Umbrella Concept.

In the case of the A/Ps, OVIs were identified with target for the year 2015. Through the implementation of the A/Ps, collectively, the municipalities and SWMRMC will aim to increase the total solid waste management rate from existing 76% to 93%. Each municipality's target, solid waste management ratio, is as specified within the respective A/Ps.

**Monitoring:** Monitoring of A/P implementation should be conducted at two levels. First, the solid waste management ratio should be calculated at individual municipalities, to measure the effectiveness of SWM activities as indicated in the targets of the respective A/Ps. It is suggested that each municipality's benchmark the target solid waste management ratio that they should achieve by the end of short, medium and long term activities of the A/Ps.

Every three or four years, the actual percentage of the solid waste management rate should be measured against the benchmarked target ratio to assess progress.

The second level of monitoring of the A/Ps should be conducted when each municipality formulate their respective annual work plans, which in fact is a breakdown of activities as identified for short, medium, and long term. Based on the existing policy priorities, availability of resources, influences from external factors, and lessons learned from the past implementation of activities, the contents of A/Ps themselves should be reviewed and modified. This process should allow enough flexibility so that the activities stipulated in the A/Ps could be changed, dropped or added insofar as the overall effect of the SWM program would increase the solid waste management ratio. Furthermore, this exercise would serve to update the A/Ps so that it would enhance the relevance of the A/Ps for continued sustainability. The linkage between the Action Plan monitoring system and Annual Work Plan is as illustrated in Figure 5.4-1.



**Figure 5.4-1 Linkage between Action Plan Monitoring System and Annual Work Plan**

Source: JICA Study Team

**Evaluation:** During the benchmarked years of 2008 and 2011, which are also the final fiscal years within short and mid terms, respectively, end of term evaluations are recommended to holistically review the A/Ps implementation from the perspectives such as relevance, effectiveness, efficiency, impact and sustainability of municipal activities. In 2015, the final evaluation should be conducted to examine whether the ultimate target of 93% solid waste management ratio was achieved, and to draw best practices and lessons learned for future SWM programs.

For the end of term evaluations, it is envisaged that a joint evaluation team be formed for each municipality among the representatives from municipal T/Fs, SWMRMC, and MOLD. The results of the evaluations should be disclosed and shared with other municipalities at TWG and other forums so that the major lessons learned and recommendations could be shared with a wider audience.

# APPENDICES

- APPENDIX 1      Members of Technical Working Group, Task Force and Committee
- APPENDIX 2      Solid Waste Stream Flow of Five Municipalities (Current and Future)
- APPENDIX 3      Annual Work Plan of Fiscal Year of 2062/63 (SWMRMC)

## **APPENDIX 1**

### ***Members of Technical Working Group, Task Force and Committee***

## APPENDIX 1 MEMBER OF TECHNICAL WORKING GROUP, TASK FORCE AND COMMITTEE

### CKV Study Team

#### Technical Working Group (Total 18 members)

As of July 20, 2005

Organizations	Name	Designation / Organizational Position
MOLD	Mr. Babu Ram Gautam (Mr. Prem Raj Giri up to Nov, 2004)	Under Secretary
SWMRMC	Mr. Surya Man Shakya (Chairperson up to June 23, 2005)	Former General Manager
	Mr. Ashok Shahi (Chair person after June 24, 2005)	Acting General Manager
	Mr. Ram Sharan Maharjan	Civil Engineer
	Mr. Nirmal Darshan Acharya	Civil Engineer
KMC	Mr. Rajesh Manandhar	Chief, Solid Waste Management Section
	Mr. Kiran Ulak	Engineer, Solid Waste Management Section
	Mr. Purusotam Shakya	Chief, Mechanical Section
LSMC	Mr. Rudra Prasad Gautam	Chief, Public Works Division
	Mr. Pradeep Amatya	Chief, Environment and Sanitation Section
BKM	Mr. Laxman Kisiju	Chief, Planning and Technical Section
	Mr. Moti Bhakta Shrestha	Chief, Social Welfare & Sanitation Section
	Mr. Dinesh Rajbhandari	Sanitation Engineer, Planning and Technical Section
MTM	Mr. Satya Narayan Shah	Chief, Planning and Technical Section
	Ms. Krishna Kumari Shrestha	Assistant, Community Development and Sanitation Section
	Mr. Surendra Shrestha	Junior Engineer, Planning and Technical Section
KRM	Mr. Anuj Pradhan	Chief, Solid Waste Management Unit
	Mr. Gyan Bazra Maharjan	Assistant, Solid Waste Management Unit/Accounting

#### Task Force (Total 54 members)

As of July 20, 2005

Organizations	Name	Designation / Organizational Position
SWMRMC (8)	Mr. Surya Man Shakya (Up to June 23, 2005)	Former General Manager
	Mr. Ashok Shahi	Acting General Manager
	Mr. Ram Sharan Maharjan	Civil Engineer
	Mr. Nirmal Darshan Acharya	Civil Engineer
	Mr. Lal Bahadur Karki	Account Officer
	Mr. Topa Ram Acharya	Administration Officer
	Mr. Ashok Ratna Tuladhar	Consultant Engineer
	Dr. Nawa Raj Khatiwada	Environmental Engineer, SchEMS
KMC (15)	Mr. Indra Man Suwal	Head, Environment Department
	Mr. Rajesh Manandhar	Chief, Solid Waste Management Section
	Mr. Kiran Ulak	Engineer, Solid Waste Management Section
	Mr. Purusotam Shakya	Chief, Mechanical Section
	Ms. Shriju Pradhan	Community Mobilization Unit
	Ms. Sanu Maiya Maharjan	Community Mobilization Unit
	Mr. Deepak Kansakar	Engineer, Solid Waste Management Section
	Mr. Krishna P. Kafle	Department of Mines and Geology
	Mr. Puskar L. Shrestha	LIUD (NGO)
	Mr. Basu Upreti	Kathmandu Mahanagar SWM Services
	Mr. Padma S. Joshi	IOE/TU
	Mr. Shirish Singh	ENPHO (NGO)
	Mr. Prakash M. Sharma	PROPUBLIC

Organizations	Name	Designation / Organizational Position
LSMC (8)	Mr. Drona Raj Ghimire	Nefeej
	Mr. Shankar Raj Kandel	Head, International Cooperation and Coordination Department
	Mr. Komal Prashad Kafle	CEO
	Mr. Rudra Prasad Gautam	Chief, Public Works Division
	Mr. Pradeep Amatya	Section Chief, Environment and Sanitation Section
	Mr. Prabin Shrestha	Division Chief, Town Development Division
	Mr. Mukunda Ranjit	Overseer, Environment Section
	Mr. Ashok Shrestha	Division Chief, Administrative Division
	Ms. Laxmi Prasad Rajbhandari	Section Chief, Community Development Section
BKM (9)	Ms. Sabina Maharjan	Community Development Section
	Mr. Badrinath Ghimire	CEO
	Mr. Laxman Kisiju	Chief, Planning and Technical Section
	Mr. Moti Bhakta Shrestha	Chief, Social Welfare & Sanitation Section
	Mr. Dinesh Rajbhandari	Sanitation Engineer, Planning and Technical Section
	Mr. Dilip Kumar Suwal	Chief, Sanitation Sub-section
	Mr. Krishna Prasad Suwal	Assistant, Social Welfare & Sanitation Section
	Mr. Revid Kusma	Chief, Store Sub-section
	Ms. Ambika Dhauvadel	Chief, Administration Section
MTM (8)	Ms. Ratnamaya Shrestha	Chief, Financial Section
	Mr. Satya Narayan Shah	Chief, Planning and Technical Section
	Ms. Krishna Kumari Shrestha	Assistant, Community Development and Sanitation Section
	Mr. Tulsi Bhakta Tako	Section Chief, Community Development and Sanitation Section
	Mr. Surendra Shrestha	Junior Engineer, Planning and Technical Section
	Mr. Shiva Man Shrestha	Policy Management / Lawyer
	Mr. Kai Prasad Waije	Architect/ Urban Planner
	Ms. Shanti Karanjit	Environmentalist
	Mr. Krishna Sundar Thapamagar	Sub Accountant, Account Section
KRM (6)	Mr. Bal Krishna Maharjan	Chief, Planning and Technical Section
	Mr. Anuj Pradhan	Assistant, Planning and Technical Section
	Mr. Gyan Bazra Maharjan	Assistant, Solid Waste Management/Accounting
	Mr. Krishna Bhola Maharjan	Junior Engineer, Planning and Technical Section
	Mr. Sanu Babu Pariyar	Account Officer, Administration Section
	Mr. Swodesh Maharjan	Unique Group (NGO)

## Steering Committee Members of the CKV Study

As of July 20, 2005

Organizations	Name	Position
MOLD	Mr. Som Lal Subedi	Joint Secretary
MOLD, Environmental Management Section of Municipal Management Division (as member secretary)	Mr. Babu Ram Gautam	Under Secretary, Chief of Environmental Management Section
SWMRMC	Mr. Surya Man Shakya	General Manager
KMC	Mr. Hem Sharma Pokharel	CEO
LSMC	Mr. Komal P. Kafle	CEO
BKM	Mr. Badri Nath Ghimire	CEO
MTM	Mr. Bhuwan Prasad Bista	CEO
KRM	Mr. Naresh Regmi	CEO
Ministry of Environment, Science and Technology	*	
Ministry of Physical Planning and Works	Mr. Hari Ram Koirala	Joint Secretary
Ministry of Industry, Commerce and Supplies	Mr. Baikuntha Bd. Adhikari	Department of Industry, director
Ministry of Education and Sports	Mr. Narayan Pd. Kafle	Under Secretary
Ministry of Agriculture and Cooperative	Ms. Bidya Pandey	Horticulture Development Officer
Ministry of Health and Population	Dr. Bishnu Prasad Pandit	Chief Specialist, Curative Division

Note: \*Because of restructuring of Ministry of Population and Environment, this position is now vacant.

## **Board Member of SWMRMC**

*As of July 20, 2005*

<b>Position of Board</b>	<b>Name</b>	<b>Organization, Position</b>
Chairman	Mr. Dolakh Bahadur Gurung	Acting Secretary, Ministry of Local Development
Member	Mr. Hem Sharma Pokharel	CEO, KMC
Member	Mr. Komal Prasad Kafle	CEO, LSMC
Member	Mr. Badri Nath Gimire	CEO, BKM
Member	Mr. Gyanesh Nanda Bajracharya	Deputy General Manager, Nepal Water Supply
Member	Mr. Indra Bahadur Shrestha	Member Secretary, KVTDC
Member	Mr. Kedar Bahadur Adhikari	Under Secretary, Ministry of Finance
Member	Mr. Tej Kuma Pokharel	Section Officer, Ministry of Physical Planning and Works
Member	Mr. Ashok Shahi	Acting General Manager, SWMRMC

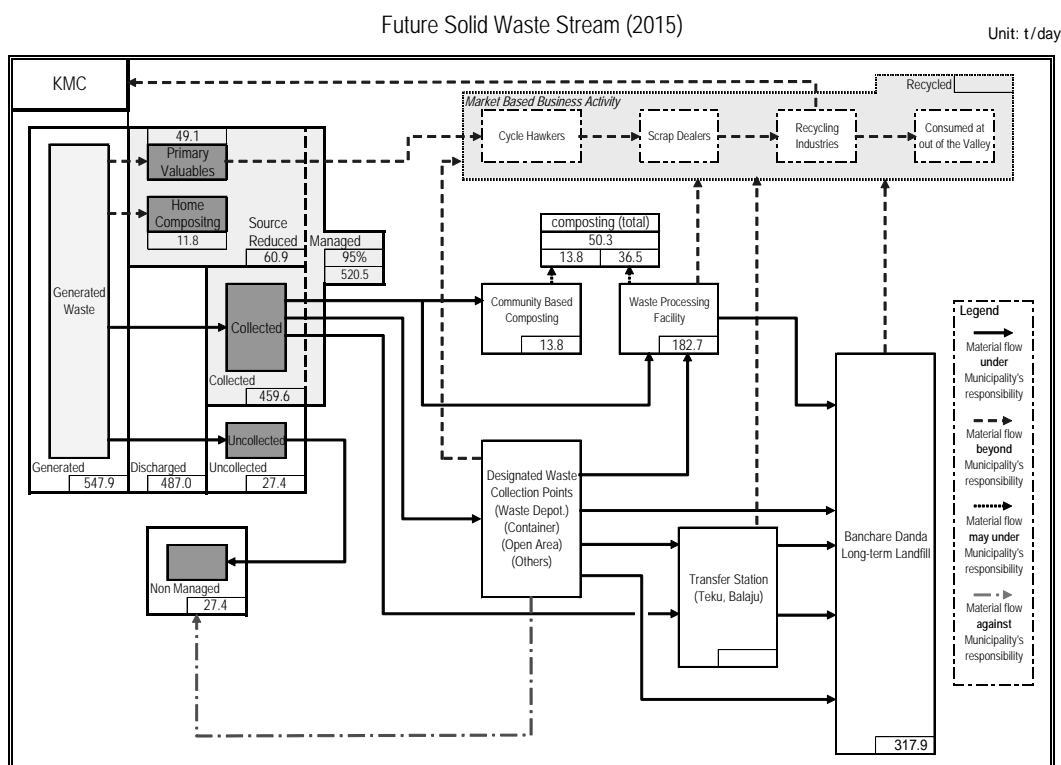
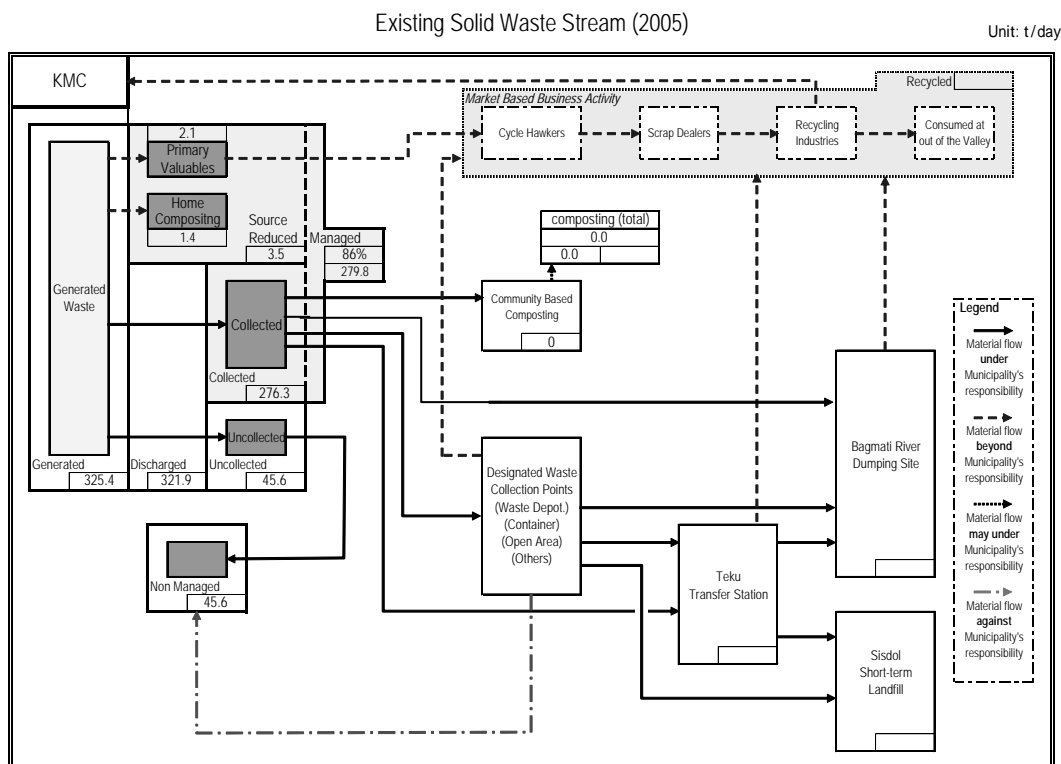
## **APPENDIX 2**

### ***Solid Waste Stream Flow of Five Municipalities (Current and Future)***



## APPENDIX 2 SOLID WASTE STREAM FLOW OF FIVE MUNICIPALITIES (CURRENT AND FUTURE)

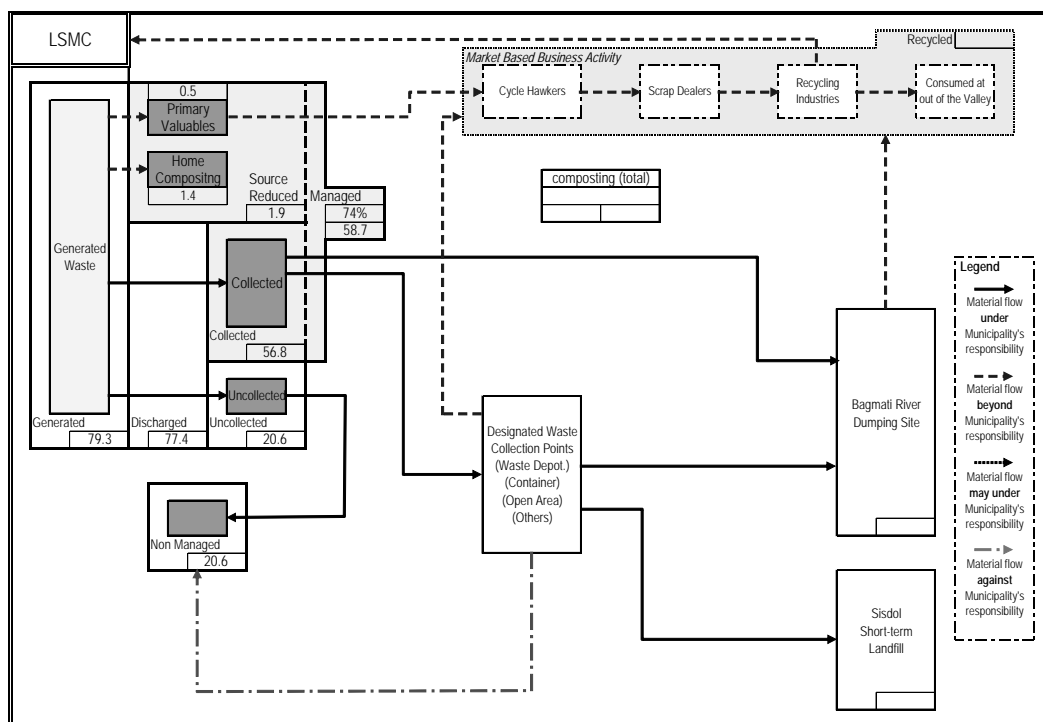
### 1. Kathmandu Metropolitan City



## 2. Lalitpur Sub-Metropolitan City

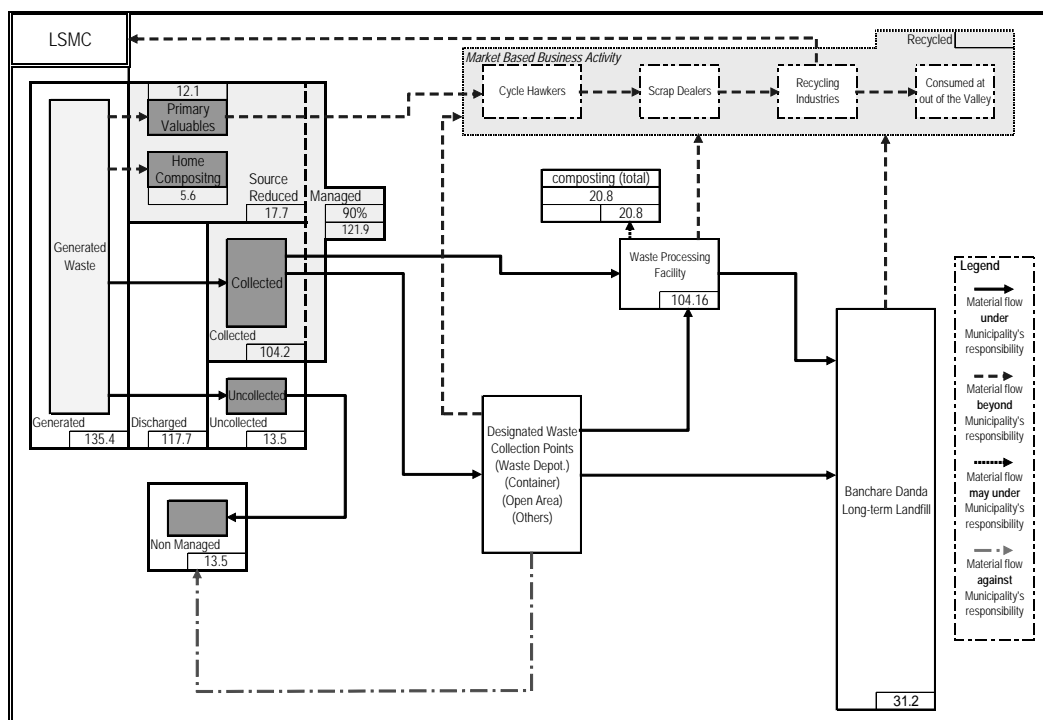
Existing Solid Waste Stream (2005)

Unit: t/day

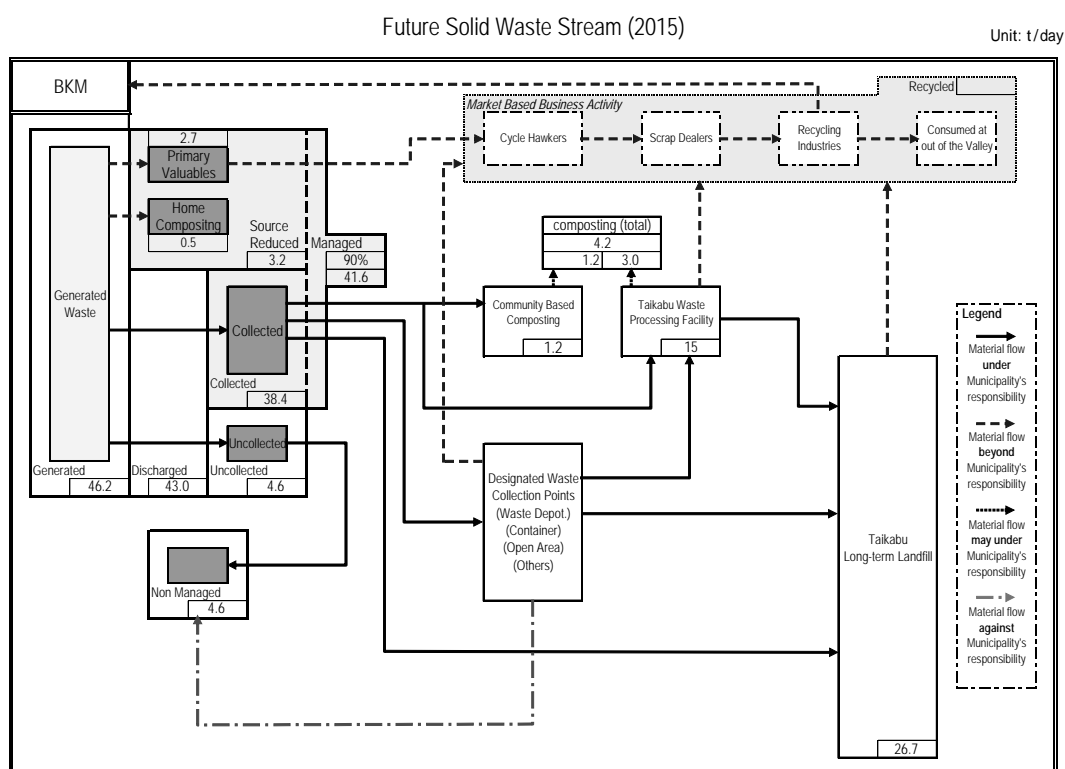
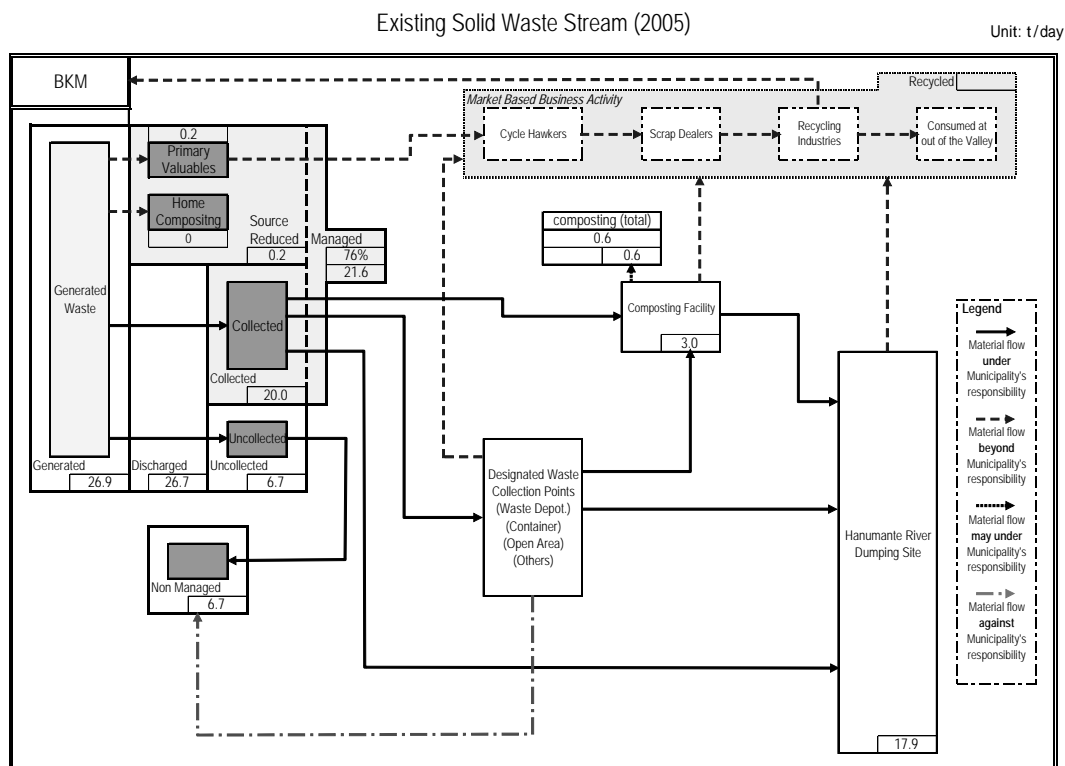


Future Solid Waste Stream (2015)

Unit: t/day



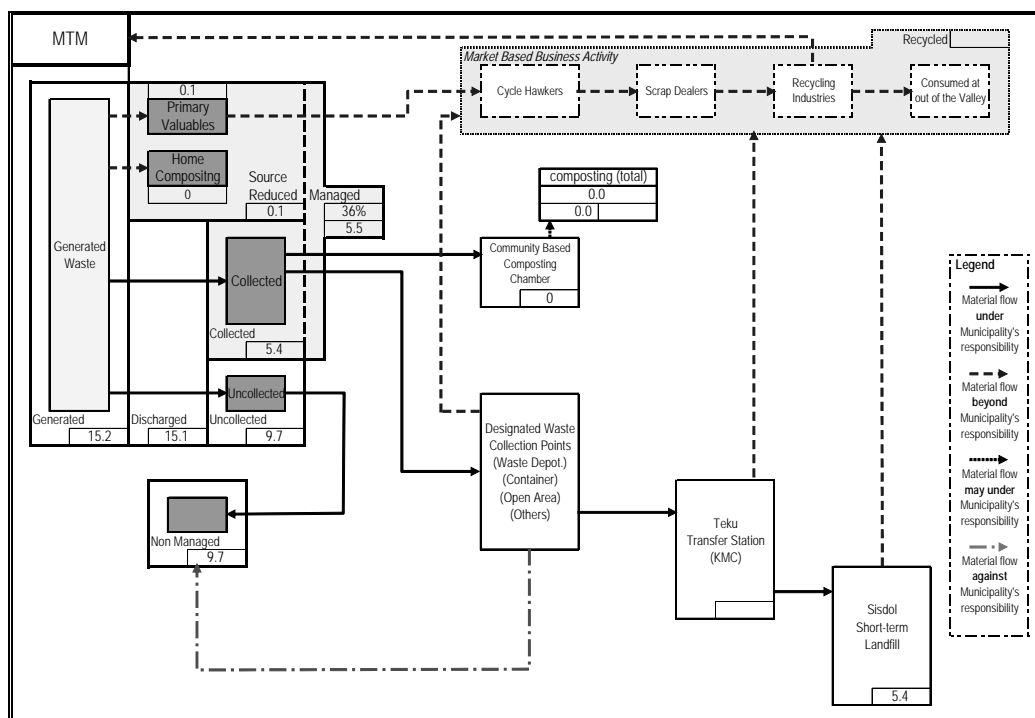
### 3. Bhaktapur Municipality



#### 4. Madhyapur Thimi Municipality

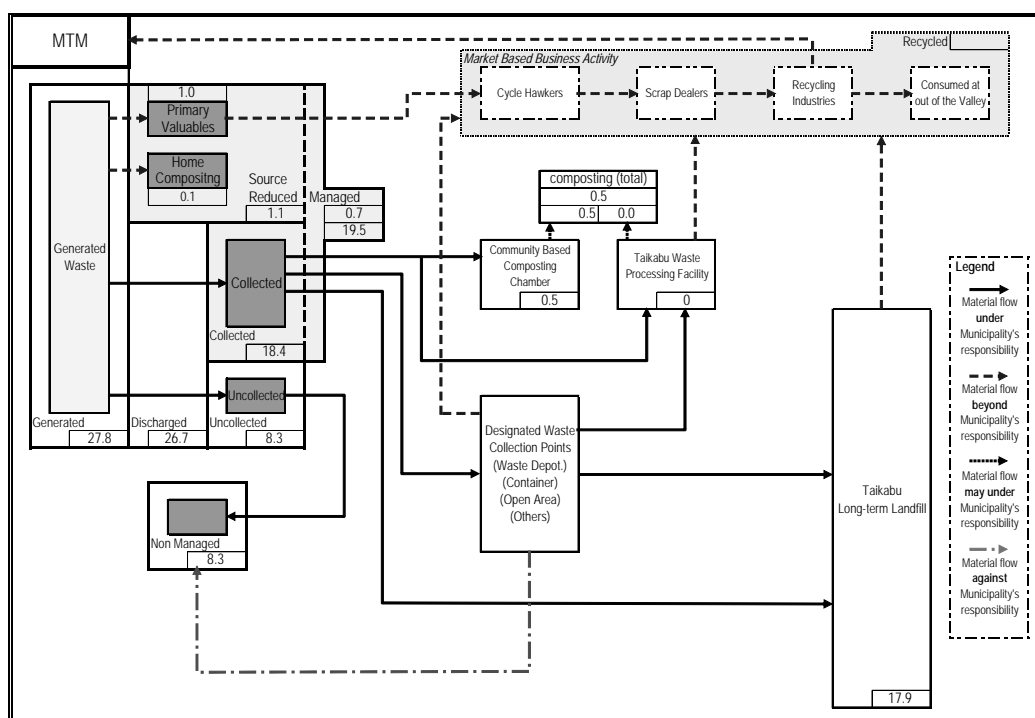
Existing Solid Waste Stream (2005)

Unit: t/day



Future Solid Waste Stream (2015)

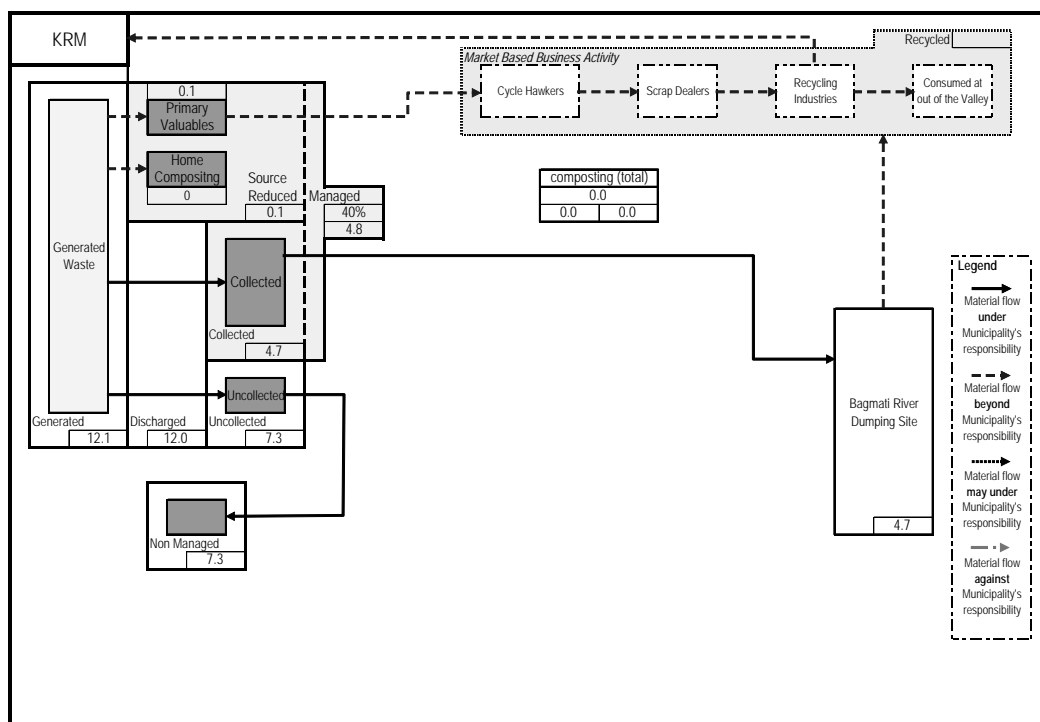
Unit: t/day



## 5. Kirtipur Municipality

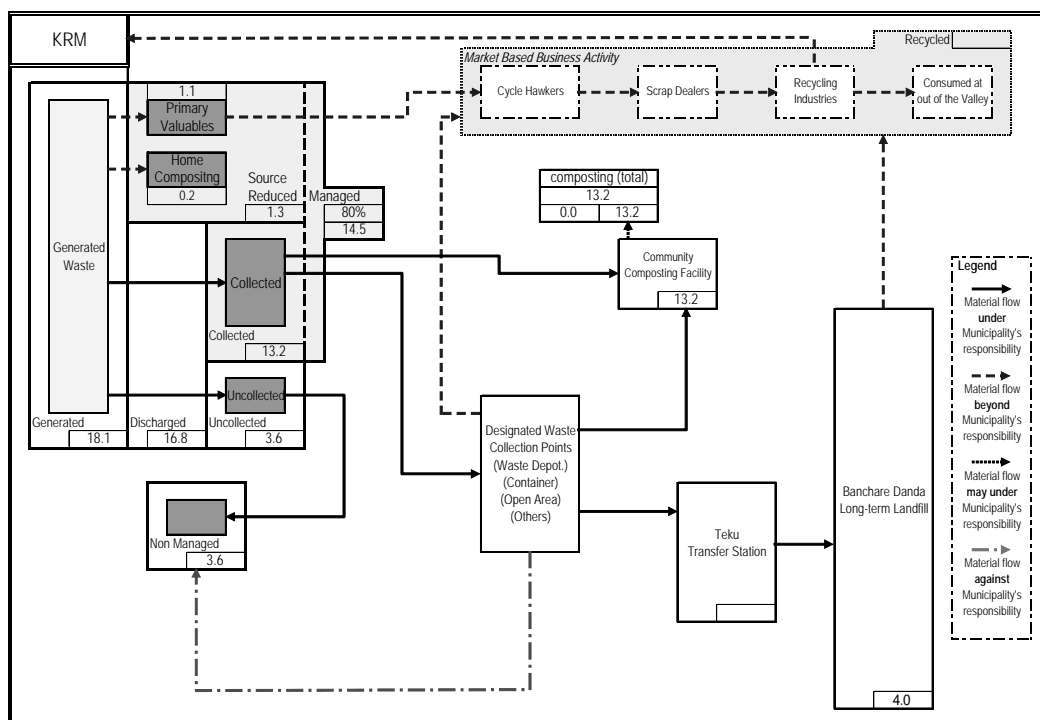
Existing Solid Waste Stream (2005)

Unit: t/day



Future Solid Waste Stream (2015)

Unit: t/day



## **APPENDIX 3**

***Annual Work Plan of  
Fiscal Year of 2005/06 (2062/63)  
Proposed by Task Force (SWMRMC)***

**Table A.3 Annual Work Plan of Fiscal Year of 2005/06 (2062/63) Proposed by Task Force (SWMRMC)**

SN	Short-term Activities to be Conducted in FY 2062/63	Necessary Budget (NRs)	2005						2006																											
			July		August		September		October		November		December		January		February		March		April		May		June		July									
			III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV				
			2062												2063																					
Shrawan		Bhadra		Aswin		Kartik		Mangsir		Poush		Magh		Falgun		Chaitra		Baisak		Jestha		Ashadh														
S1	Clarification of demarcation between SWMRMC and Local Bodies by issuing a new policy and amendment of the Solid Waste Act																																			
S2	Clarification of legal status and change of jurisdictional area by amendment of the Act																																			
S3	Establishment of a strategic plan for SWMRMC (future organizational and institutional development plan)																																			
S7	Implementation of Public Relations (PRs) activities (management of web-site and issue of newsletter, etc.)																																			
S1	Development of Sisdol Short-term LF																																			
S1-1	Development of Sisdol LF Valley II																																			
S1-2	Handover Valley II to operator																																			
S1-3	Periodic environmental monitoring																																			
S2	Development of Waste Processing Facility (KMC, LSMC, KRM)																																			
S2-1	Land selection																																			
S2-2	Site investigation works																																			
S2-3	Land acquisition																																			
S2-4	Concept design and feasibility study																																			
S2-5	EIA process																																			

SN	Short-term Activities to be Conducted in FY 2062/63	Necessary Budget (NRs)	2005												2006																											
			July			August			September			October			November			December			January			February			March			April			May			June			July			
			III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
			2062												2063																											
Shrawan			Bhadra			Aswin			Kartik			Mangsir			Poush			Magh			Falgun			Chaitra			Baisak			Jestha			Ashadh									
S3	Development of Long-term LF (KMC, LSMC, KRM)																																									
S3-1	Construction of access road																																									
S3-2	Identification of the capacity and service areas																																									
S3-3	Site investigation works																																									
S3-4	Land acquisition																																									
S3-5	Concept design																																									
S3-6	EIA process																																									
S4	Development of Long-term LF (BKM, MTM)																																									
S4-1	Site investigation works (EIA, Topography survey, Soil investigation)																																									
S5	Closure of Bagmati River dumping site																																									
S5-1	Design of Bagmati River dumping site closure plan																																									
S5-2	Implementation of Bagmati closure plan																																									

Legend  : Continuous activities  
 : Intermittent activities  
 : Spot activities