MINISTRY OF LOCAL DEVELOPMENT
HIS MAJESTY'S GOVERNMENT OF NEPAL

JAPAN INTERNATIONAL
COOPERATION AGENCY

THE STUDY
ON
THE SOLID WASTE MANAGEMENT
FOR THE KATHMANDU VALLEY

Final Report
Volume I: Executive Summary

September 2005

NIPPON KOEI CO., LTD.

YACHIYO ENGINEERING CO., LTD.

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PREFACE

In response to a request from the Government of Kingdom of Nepal, the Government of Japan decided to conduct a study on “The Study on Solid Waste Management for the Kathmandu Valley” and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr.Toshiyuki UJIIE of NIPPON KOEI Co., Ltd. and consisted of experts from NIPPON KOEI Co., Ltd. and YACHIYO ENGINEERING Co., Ltd. between January 2004 and July 2005. In addition, JICA set up the advisory committee headed by Isamu YOKOTA, Professor at Lab of Environmental Policy, Graduate School of Nutritional and Environmental Sciences, University of Shizuoka.

The team held discussions with the officials concerned of the Government of Kingdom of Nepal and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Kingdom of Nepal for their close cooperation extended to the study.

September 2005

Etsuo KITAHARA
Vice President
Japan International Cooperation Agency

September 2005

Mr. Etsuo KITAHARA
Vice President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are pleased to submit herewith the final report of “The Study on Solid Waste Management for the Kathmandu Valley”.

In the Kathmandu Valley in Nepal, the amount of solid waste generated is increasing and its quantity is changing mainly due to increasing population and changing lifestyles. Because the capability of the municipalities concerned has not kept up with the increased demands of solid waste management, the living environment in the region has been steadily deteriorating.

In order to tackle these problems in solid waste management, the Study aimed at formulating action plans for each of the five municipalities in the Kathmandu Valley, namely Kathmandu Metropolitan City, Lalitpur Sub-Metropolitan City, Bhaktapur Municipality, Madhyapur Thimi Municipality and Kirtipur Municipality, toward 2015. The Study also conducted capacity development of the relevant staff members of the five municipalities and the Solid Waste Management and Resource Mobilization Center, including the implementation of a series of pilot projects.

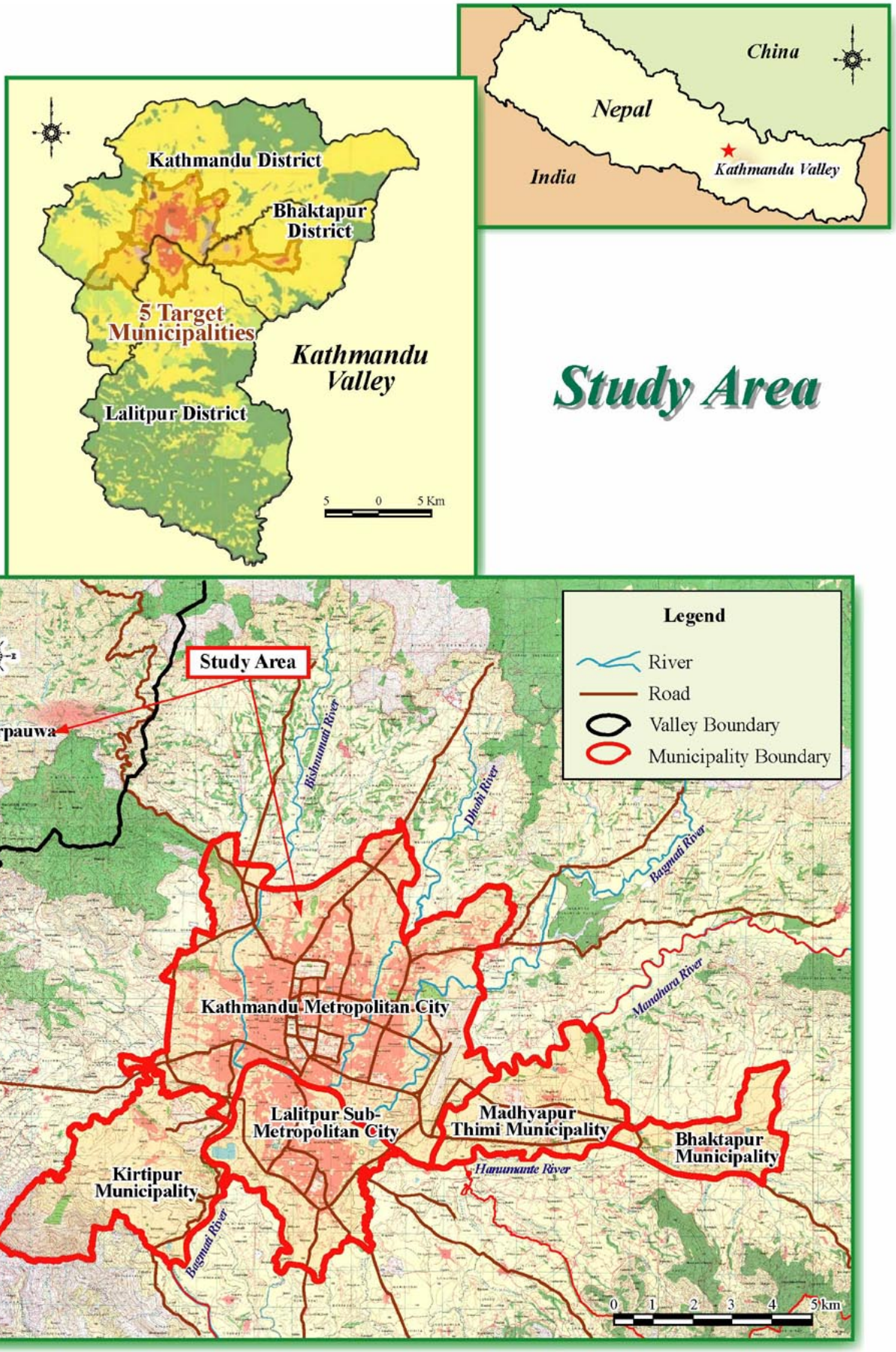
The pilot projects covered a wide spectrum of issues related to solid waste management, such as improvement of collection and transportation, promotion of waste minimization, improvement of final disposal, promotion of public awareness and behavior change, development of action plan operation and management capacity. The Nepalese counterparts developed the action plans themselves taking into consideration the lessons learned from these pilot projects. The activities implemented during the Study are being continued and extended by the counterparts, and the outputs of the capacity development are coming to fruition.

We wish to express our sincere appreciation to the officials of JICA, the JICA Advisory Committee, the Ministry of Foreign Affairs, the Ministry of Environment, the Embassy of Japan for Nepal, and JICA Nepal Office for their continuous support throughout the Study. Also, we would like to express our great appreciation to HMG/N, especially the members of the Steering Committee, Technical Working Group, Task Forces, and NGOs/CBOs concerned for their active participation in the Study.

Finally, we hope that the outputs of the Study will contribute greatly to improve solid waste management in the five municipalities of the Kathmandu Valley and to foster a long lasting partnership and friendship between the two nations of Japan and Nepal.

Yours faithfully,

Toshiyuki UJIIE
Leader for JICA Study Team


China
Nepal
India
Kathmandu Valley
Kathmandu District
Bhaktapur District
5 Target Municipalities
Kathmandu Valley
Lalitpur District
5 0 5 Km
Study Area
Legend
River
Road
Valley Boundary
Municipality Boundary
Okharpauwa
Bishnumati River
Dhobi River
Bagmati River
Manahara River
Kathmandu Metropolitan City
Lalitpur Sub-Metropolitan City
Madhyapur Thimi Municipality
Bhaktapur Municipality
Hanumante River
Kirtipur Municipality
Bagmati River
0 1 2 3 4 5 km

Study Area

SUMMARY OF THE STUDY

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 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 and ran for a total of 20 months until August 2005.

2 Objectives of the Study

The objectives of the Study were;

1. To formulate Action Plans (A/Ps) on SWM 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 of the five municipalities and Solid Waste Management and Resource Mobilization Center (SWMRMC).

3 Study Area and Target Waste

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 proposed was also covered.

The target solid waste of the Study was mainly municipal solid waste, non-hazardous waste that would be collected by the Municipalities.

4 Organization 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).

5 Acronym and Slogan of the Study

The Study adopted the acronym "CKV" which stands for "*Clean Kathmandu Valley"* and also put up a slogan, *"Sapha Sahar Hamro Rahar"* in Nepalese, which means *"Clean City is Our Desire"*.

6 Capacity Development and Public Relation Activities of the Study

The Study opted to prioritize capacity development activities at the individual level with human resource development programs developed based on the results of Training Needs Analysis (TNA), although initiatives were also implemented to strengthen capacities at organizational and institutional levels. The target group of capacity development activities of the Study was mainly TWG and T/F members. Such activities under the Study were

implemented through 1) formulation of action plans on SWM, 2) implementation of a series of pilot projects, and 3) various public relations/participation activities.

7 Pilot Projects of the Study

In the course of the Study, a series of Pilot Projects was designed and implemented based on the proposed activities in the draft Action Plans as shown in the table below:

Pilot Projects of the Study

Pilot Projects	Project Purposes	Outputs (Main Activities)
A. Improvement of Collection and Transportation	Capabilities of relevant staff of five municipalities and SWMRMC regarding waste collection and transportation are strengthened.	A-1: Practice of solid waste collection in model areas A-2: Training for public private partnership (PPP) on solid waste management A-3: Training/Practice of transfer station
B. Promotion of Waste Minimization	Capabilities of relevant staff of five municipalities and SWMRMC regarding waste minimization are strengthened.	B-1: Training for waste minimization facility B-2: Practice of local level waste minimization activities
C. Improvement of Final Disposal Planning and Operation	Capabilities of relevant staff of five municipalities and SWMRMC regarding final disposal planning and operation are strengthened.	C-1: Training for final disposal planning C-2: Tainting/Practice of Semi-aerobic landfill (Sisdol Short-term Landfill site)
D. Promotion of Public Awareness and Behavior Change Communication/ Education	Capabilities of relevant staff of five municipalities and SWMRMC regarding public awareness and behavior change communication/ education are strengthened.	D-1: Training for community mobilization activities D-2: Practice of mass communication and education D-3: Practice of interpersonal communication and education
E. Development of Operation and Management Capacities	Capabilities of relevant staff of five municipalities and SWMRMC regarding technical and operational management on solid waste are strengthened.	E-1: Training for action plan operational management E-2: Practice of solid waste data management E-3: Training for solid waste management policy and technology (JICA Country Focused Training)

8 Future Framework and Target

The waste generation quantity of each municipality at present (2004) and in the future (2015) is estimated as shown in the following table based on the existing data and the results of waste quantity surveys.

Projected Current and Future Waste Generation Quantity

Municipalities	Population		Municipal UGR* (kg/d-capita)		Average daily generated quantity (t/day)	
	2004	2015	2004	2015	2004	2015
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	1,099,158	1,571,857	-	-	434.9	775.4

*Note: UGR stands for Unit Generation Ratio

9 Umbrella Concept on Solid Waste Management in the Kathmandu Valley

Although action plans are to be developed for each of the five municipalities reflecting its characteristics, some activities need to be conducted under the inter-municipal coordination so that activities' loads be minimized as well as effects be maximized. In this connection,

an Umbrella Concept on SWM in the Kathmandu Valley, was established to show a basic direction for the five municipalities and SWMRMC.

An overall facility plan (OFP), in which transfer stations, waste processing facilities and landfill sites are included, was developed under the Umbrella Concept in order to share the limited resources for the SWM facilities' development as the results of the comparative analysis of the alternatives. Facilities are proposed to be developed in two zones, namely Zone A of KMC, LSMC and KRM, and Zone B of BKM and MTM according to landfill sites requirements. The development of schedule for the overall facilities is prepared as shown in the table below:

Operation Schedule of Overall Facility

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
ZONE A - KMC, LSMC and KRM											
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)	━	━								
ZONE B - BKM and MTM											
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)					━	━	━	━	━	━

Source: JICA Study Team

The costs which are required to conduct activities discussed in the Umbrella Concept are estimated. As the municipalities have been facing the financial difficulties, the central government, SWMRMC, should bear investment costs of the facilities, while municipalities should bear the equipment and operation and maintenance costs in principle.

Estimated Costs for Umbrella Concept Activities and its Sharing between SWMRMC and Municipalities (million Rs)

Zone	Umbrella Concept Activities	SWMRMC	Municipalities		
		Facilities	Equipment	O&M	Total
A	Transportation (haulage)	-	120.5	541.1	661.6
	Transfer station	65.8	-	36.5	36.5
	Waste processing facility	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	13.3
	Organization and institution	-	-	1.3	1.3
	Sub-total	1,162.0	189.5	686.8	876.3
B	Transportation	-	37.5	68.2	105.7
	Waste processing facility	38.2	42.0	-5.6	36.4
	Landfill	218.8	53.9	64.3	118.2
	Public awareness	-	-	3.0	3.0
	Organization and institution	-	-	0.8	0.8
	Sub-total	257.0	133.4	130.7	264.1
Total		1,419.0	322.9	817.5	1,140.4

Source: JICA Study Team

10 Action Plans on Solid Waste Management

Based on the Umbrella Concept and lessons learned from the implementation of the Pilot Projects, Action Plans on SWM toward target year of 2015, consisting of vision, approached, strategies and necessary activities, were developed by respective T/Fs of the five municipalities and SWMRMC. The determined vision and targets are as shown in table below. The solid waste management ratios are adopted as objectively verifiable indicators.

Vision and Target of Each Municipality

Municipalities	Visions	Present	Targets (solid waste management ratios)		
			Short-term	Mid-term	Long-term
KMC	Clean, Green Kathmandu City	81%	85%	90%	95%
LSMC	Clean City through Efficient Management of Waste Collection on Streets, Public Places and Households	70%	80%	85%	90%
BKM	To Promote Bhaktapur City as a Tourist Destination through Better Solid Waste Management	75%	80%	85%	90%
MTM	Madhyapur Thimi City Co-existing Sound Environment and Organic Agriculture	35%	40%	50%	70%
KRM	Neat, Clean, Pollution Free City, Kirtipur Municipality	35%	50%	70%	80%
Total		76%	82%	87%	93%

Note: 1) Management ratio is the ratio of waste quantity that is managed either by waste generators or municipalities in appropriate ways such as source reduction by recycling, collection and final disposal.
2) Short-term: 2005/06-2007/08, Mid-term:2008/09-2010/11, Long-term:2011/2015
Source: Task Force

The adopted approaches on the Action Plans are A: Improvement of Collection and Transportation, B: Promotion of Waste Minimization, C: Improvement of Final Disposal Manner, D: Raising of Public Awareness/Community Mobilization, E: Organizational and Institutional Development, and F: Others. Various activities necessary short-, mid- and long-term activities are proposed with its respective implementation plans in order to achieve

the targets. From the respective Action Plans, activities were broken down into the Annual Work Plans with responsible staff assignment and necessary budgets.

11 Evaluation of Capacity Development

Since the Study is a 'Capacity Development Type Study' of which an important aim is to assist the capacity development of SWM of the five municipalities and SWMRMC, the study process has been emphasized.

Through the Study, it can be set a high valuation on the fact that all concerned, especially TWG and T/F members, could stand up and work together under the Umbrella Concept, although the mutual cooperation forward an appropriate SWM among SWMRMC and the five municipalities could be not always functioned well. Popularization of an acronym of "CKV" among not only TWG or T/F members, but also other related organizations like NGOs, CBOs, is also the result of development of the social capacity that understands what we should do for SWM.

For technical aspects, most developed part is the theoretical and practical experiences for sanitary landfill together with semi-aerobic landfill system, effective transferring at transfer station, various waste minimization activities, etc. It can be said that most of TWG members now surely understood these technologies. Other than A/Ps formulation and a series of training sessions under the Pilot Projects, presentation opportunities at Public Hearings and Seminars have contributed to develop presentation and communication skills as well as to improve understanding on technical aspects of SWM.

By and large, capacity development on SWM of the relevant staff of the five municipalities and SWMRMC has emerged through all of the activities under the Study, and is recognized as being still progressing.

12 Recommendations

For effective and steady implementation of the respective Action Plans, the following are recommended.

- TWG meetings should be held regally under the coordination of SWMRMC so that five municipalities cooperate the implementation of the Umbrella Concept including sharing responsibilities and costs
- Institutional and organizational arrangements should be designed in a way that is in alignment with various strategies and activities of the Action Plans
- Program based budgeting and expenditure monitoring should be introduced for more effective financial management and efficient use of resources
- Applicable mechanism for sustainable human resource management and development should be established such as appointment of a leaning manager and promotion of knowledge sharing
- For strengthening network on SWM with and among stakeholders including NGOs/CBOs, private sectors, local consultants, academics, mass media, line ministries, regular sharing meetings should be organized.
- Careful environmental and social considerations should be paid for development of the proposed facilities through IEE/EIA study and enough public involvement/consultation

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Abbreviations

<Organizations>

BKM	Bhaktapur Municipality
CDS	Community Development Section
CDSS	Community Development and Sanitation Section
CEN	Clean Energy Nepal
CKV	Clean Kathmandu Valley
CMU	Community Mobilization Unit
DOMG	Department of Mines and Geology
ECCA	Environmental Camps for Conservation Awareness
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
MOAC	Ministry of Agriculture and Cooperative
MOEST	Ministry of Environment, Science and Technology
MOES	Ministry of Education and Sports
MOHP	Ministry of Health and Population
MOICS	Ministry of Industry, Commerce and Supplies
MOLD	Ministry of Local Development
MOPE	Ministry of Population and Environment
MOPPW	Ministry of Physical Planning and Works
MTM	Madhyapur Thimi Municipality
NEPCO	National Environment Pollution Control
NGO	Non Governmental Organization
NPC	National Planning Commission
OSLSMCC	Okharpauwa Sanitary Landfill Site Main Coordination Committee
SAARC	South Asian Association for Regional Cooperation
ST/C	Steering Committee
SWMS	Solid Waste Management Section (KMC)
SWMRMC	Solid Waste Management and Resource Mobilization Center
T/F	Task Force
TWG	Technical Working Group
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UDLE	Urban Development through Local Efforts
WEPCO	Women Environment Preservation Committee
WTO	World Trade Organization

<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^2	Square Kilometer
L	Liter
mm	Millimeter
m^2	Square Meter
m^3	Cubic Meter
mg/L	Milligram per liter
m	Meter
ton/day	Ton per day
ton/year	Ton per year
%	Percentage

<Currency>

JPY	Japanese Yen
Rs	Nepalese Rupee
US$	US Dollar

<Others>

A/P	Action Plan
AWP	Annual Work Plan
BCC	Behavior Change Communication
BOD	Biochemical Oxygen Demand
CBO	Community Based Organization
CEO	Chief Executive Officer
CKV	Clean Kathmandu Valley
COD	Chemical Oxygen Demand
CoMoN	Community Mobilization Network
C/P	counterpart
CRC	Community Recycling Center
CSO	Civil Society Organization
DADO	District Agriculture Development Office
DfA/P	Draft Action Plan
DF/R	Draft Final Report
EIA	Environmental Impact Assessment
E/N	Exchange of Notes
ESPS	Environment Sector Programme Support
F/R	Final Report
FY	Fiscal Year
GIS	Geographic Information System
GRDP	Gross Regional Domestic Product
HCI	health care institution
HH	Household
HRD	Human Resource Development
IC/R	Inception Report
IEC	Information, Education and Communication
IEE	Initial Environmental Examination
IT/R	Interim Report
KVMP	Kathmandu Valley Mapping Project
KVTDP	Kathmandu Valley Town Development Plan
LF	Landfill
LFS	Landfill site

L/T	Long-term
M&E	Management and Evaluation
M/M	Minutes of Meeting
MTEF	Medium Term Expenditure Framework
OD	Organizational Development
ODA	Official Development Assistance
OEP	Overall Equipment Plan
OFP	Overall Facility Plan
OJT	on-the-job training
Off-JT	off-the job trainings
O&M	Operation and Maintenance
OVI	Objectively Verifiable Indicators
PCM	Project Cycle Management
PDM	Project Design Matrix
PSO	Private Sector Organization
P/H	Public Hearing
PPP	Public Private Partnership
PPPUE	Public Private Partnership for Urban Environment
PR	Public Relations
PSO	Private Sector Organization
S/T	Short-term
S/T-LF	Short-term Landfill
STV	Secondary Transportation Vehicle
SWM	Solid Waste Management
STA	Technical Assistance
TNA	Training Needs Analysis
TOR	Terms of References
T/S	Transfer Station
UGR	Unit Generation Rate
VDC	Village Development Committee
WEID	Women's Initiative for Environment and Development
WG	Working Group
WPF	Waste Processing Facility
3R	Reduce, Reuse, Recycle

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[1]) 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[2] 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.

[1] Nepalese Year

[2] 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.

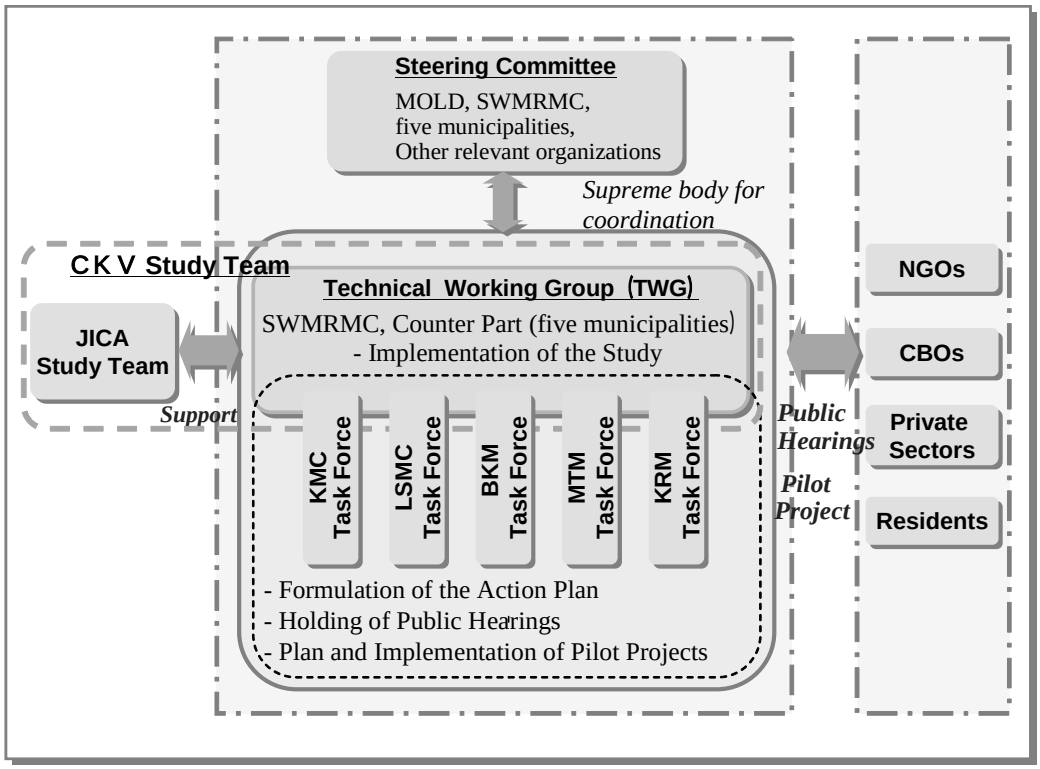


Figure 1.5-1 Implementation Organization of the Study

Source: JICA Study Team

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

Organization	Roles	Tasks	Members
ST/C	Coordination of relevant organizations	- To confirm the overall policies and progress of the Study - To confirm and approve the contents of the reports to be submitted to the Nepalese side by the JICA Study Team - 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 - To coordinate the concerned organizations for SWM in the Kathmandu Valley and exchange information and opinions between the organizations of central and local governments	- Ministry of Local Development (MOLD) - SWMRMC - Five municipalities - Ministry of Environment, Science and Technology (MOEST) (formerly MOPE) - Ministry of Physical Planning and Works (MOPPW) - Ministry of Industry, Commerce and Supplies (MOICS) - Ministry of Education and Sports (MOES) - Ministry of Agriculture and Cooperative (MOAC) - Ministry of Health and Population (MOHP) - Members of TWG (as observers)
TWG (C/P)	Implementation of capacity development and technology transfer from the JICA Study Team	- To carry out the Study together with the JICA Study Team. - To prepare necessary documents and materials which are to be discussed at the ST/C - To organize and operate a T/F	- MOLD - SWMRMC - Staff of KMC - Staff of LSMC - Staff of BKM - Staff of MTM - Staff of KRM
T/F	Coordination of opinions within the relevant departments, formulation of action plan, formulation and implementation of pilot projects	- To formulate an Action Plan of the municipality and conduct pilot projects under the support from the JICA Study Team. - To coordinate opinions among the relevant sections of each municipality - To carry out Public Hearings with an aim to collect opinions from the residents	- Members of TWG - Planning relevant section - Environmental and Public Relations relevant sections - Community mobilization/development section - Financial section - NGOs/CBOs - Private sectors - Intellectuals

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 FRAMEWORK OF THE STUDY

2.1 Approaches to the Study

The JICA Study Team set following six approaches to accomplish all components of the Study as shown in Figure 2.1-1.

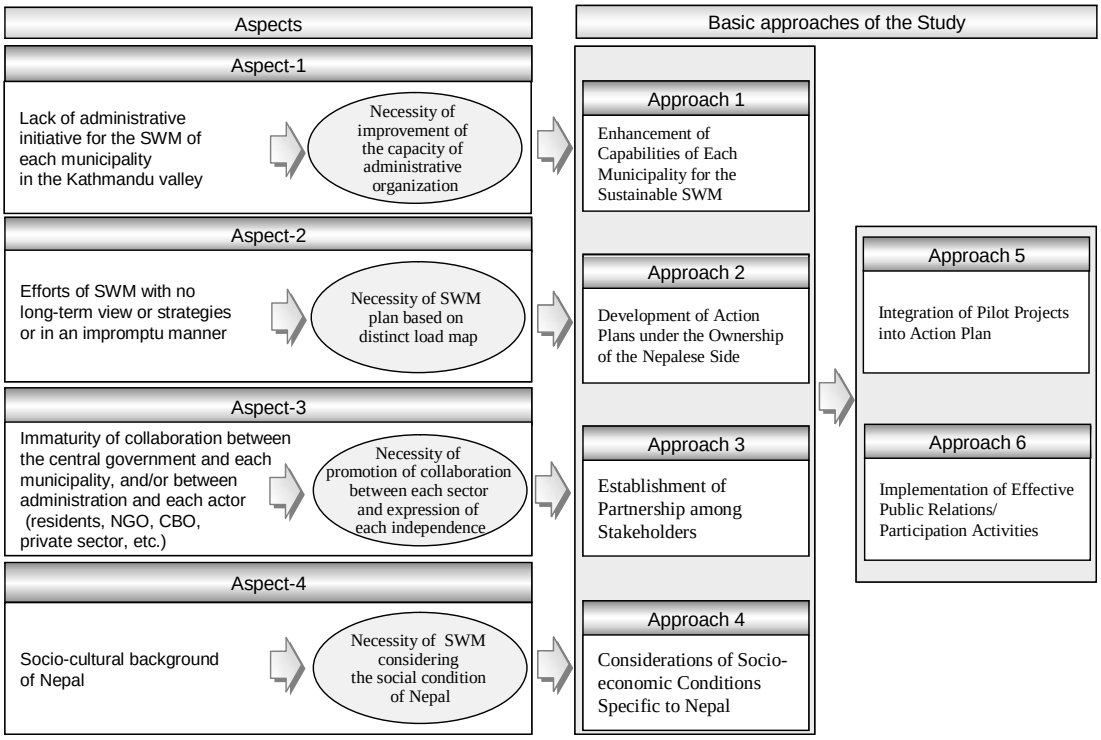


Figure 2.1-1 Approaches to the Study

Source: JICA Study Team

2.2 Overall Work Flow of the Study

The Study was carried out in the following four phases, Phases 0 to 3, as shown in Figure 2.2-1.

Phase 0: Preparatory Work: January 2004

The JICA Study Team prepared the Draft Inception Report of the Study in Japan based on available information.

Phase 1: Organizational Arrangement for the Study: January 2004

The ST/C, TWG and T/F in each municipality and in SWMRMC were organized as implementation organizations of the Study. The Draft Inception Report was finalized as the result of discussion between the JICA Study Team and the Nepalese side.

Phase 2: Grasping of Current Situation, Analysis of Problems, and Formulation of Draft Action Plans : February 2004 – May 2004

A series of surveys regarding the current condition of SWM including waste quantity and quality, 3Rs and final disposal activities, public awareness, organizations and institutions were conducted by TWG and T/F members together with the JICA Study Team. Through the TWG meetings, the TWG members discussed the future framework of SWM, an Umbrella Concept, which is a common concept for SWM for the five municipalities of the Kathmandu Valley, contents of Draft Action Plans (DfA/Ps) based on the problem analysis and suggestions by the JICA Study Team, and designed pilot projects. A training needs analysis (TNA) exercise was also implemented for development of a human resource development (HRD) program.

In the process of formulating DfA/Ps, each municipality organized the 1st Public Hearing (P/H) in March, 2004 and 2nd P/H in May, 2004 to collect people's opinions. As part of public relations/participation activities, the 1st Seminar of the Study was held in March, 2004.

Phase 3: Implementation of Pilot Projects and Formulation of Action Plan: June, 2004 – August, 2005

The following Pilot Projects for SWM were implemented in Phase 3. As for focal points, the people who were in charge of implementation of the Pilot Projects were assigned from each of the five municipalities and SWMRMC.

A. Improvement of Collection and Transportation
B. Promotion of Waste Minimization
C. Improvement of Final Disposal Planning and Operation
D. Promotion of Public Awareness and Behavior Change Communication/ Education
E. Development of Operation and Management Capacities

The lessons learned from the Pilot Projects were taken into consideration to finalize the A/Ps for SWM with support from the JICA Study Team.

TWG meetings were held to discuss the problems and share the experiences of the Pilot Projects. Three seminars and two P/Hs were held to collect various opinions and suggestions for the Pilot Projects' activities and revised A/Ps.

In addition to the above, monitoring and follow-up of the activities proposed in the A/Ps is planned to be conducted as Phase 4 of the Study.

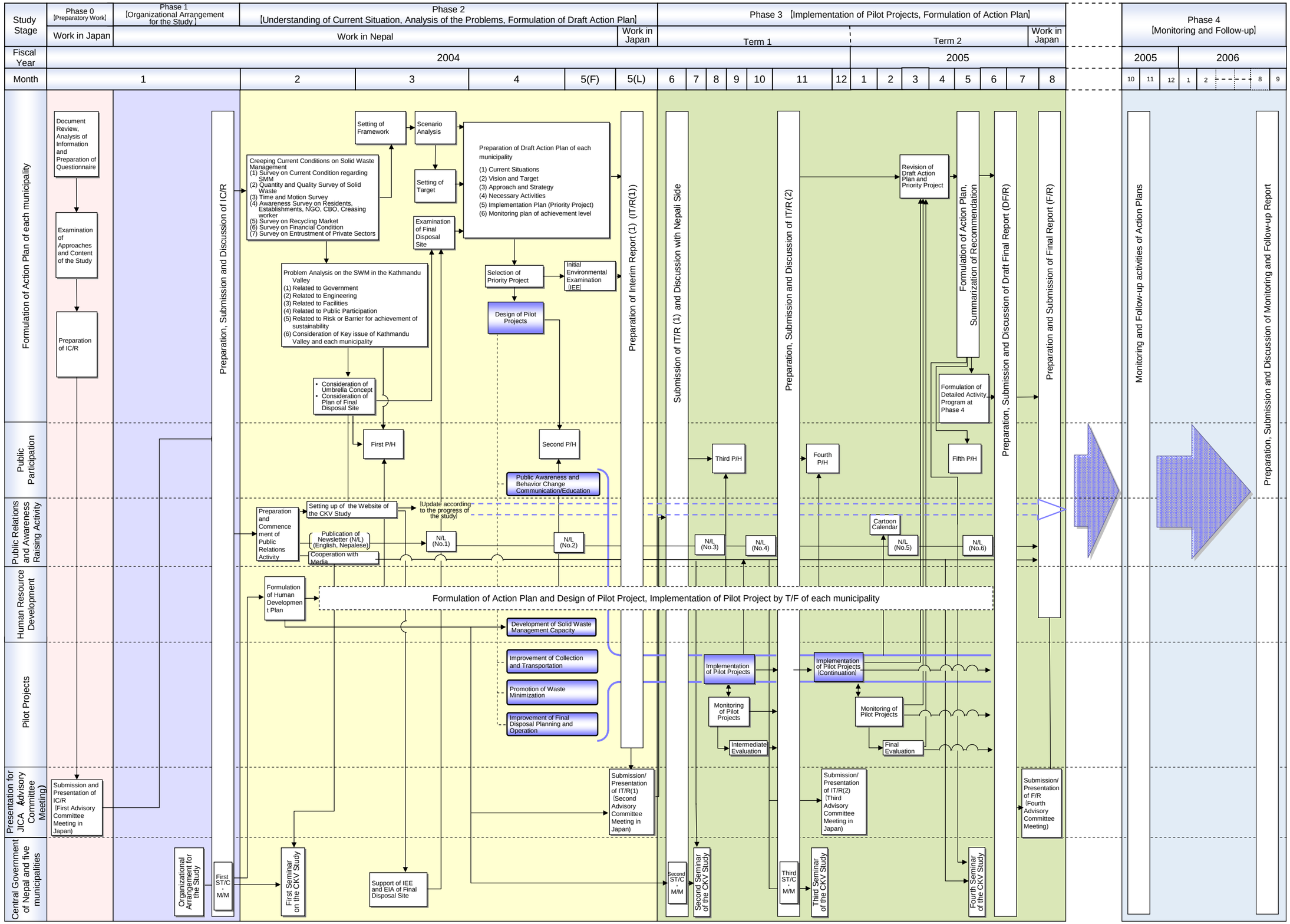


Figure 2.2-1 Overall Work Flow of the Study

2.3 Capacity Development Activities of the Study

The target groups for capacity development through the Study were the relevant staff of the five municipalities and SWMRMC, mainly TWG and T/F members. Such activities implemented under the Study were categorized into the following three areas, 1) formulation of A/P of the each municipality, 2) implementation of a series of Pilot Projects, and 3) public relations/participation activities as shown in Table 2.3-1.

In addition, technology transfer to the Nepalese C/P personnel was conducted through twenty TWG meetings.

Table 2.3-1 Capacity Development Activities of the Study

Areas	Activities of the CKV Study Team	Capacity Development Activities of Nepalese C/P
Formulation of A/Ps	Review of current condition of SWM 1) Collection and transportation 2) Recycling and composting 3) Final disposal 4) Entrustment to private sectors 5) Organizations and institutions 6) Financial condition Field surveys on SWM 1) Waste quantity and quality 2) Time and motion survey 3) Recycling market 4) Interview and questionnaire on SWM practices of households, establishments and NGOs/CBOs	- Collected relevant data and information - Joined a series of field surveys in order to learn the methods of investigation - Discussed the result of field surveys such as waste quantity and quality, time and motion and unit ratio of waste generation - Surveyed the dumping areas to grasp the current situation - Prepared a report on the current situation of SWM - Visited Okharpauwa landfill site and other candidate sites together with the JICA Study Team and examined alternatives
	Problem analysis on SWM in each municipality 1) Technical aspect 2) Social aspect 3) Managerial aspect	- Analyzed the current situations - Presented the surveyed current situation at P/Hs and exchanged opinions and ideas - Analyzed the current situations regarding public participation in SWM activities by means of PCM method
	Examination of Umbrella Concept including overall facility plan	- Discussed at TWG meetings the necessity of the umbrella concept including an overall facility plan in the Kathmandu Valley, collection and transportation ways, composting concept, public participation strategies, etc.
	Preparation of DfA/Ps 1) Setting socio-economic framework 2) Examination of vision and target 3) Examination of approaches, strategies and necessary activities 4) Examination of implementation plan	- Conducted scenario analysis for setting target - Discussed the formulation of DfA/Ps at TWG meetings based on the problem analysis - Formulation of DfA/Ps discussing among T/F members with support from the JICA Study Team
	Design of Pilot Projects	- Selected priority and effective activities as Pilot Projects - Designed Pilot Projects activities
	Finalization of Umbrella Concept and A/Ps	- Discussed the finalization of Umbrella Concept and A/Ps on account of feedback from the Pilot Projects

Areas	Activities of the CKV Study Team	Capacity Development Activities of Nepalese C/P
Implementation of Pilot Projects	Planning of Pilot Projects	- Developed implementation plans of Pilot Projects
	Implementation of Pilot Projects	- Conducted a series of Pilot Projects activities with support from the JICA Study Team
Public Relations/ Participation Activities	Determination of Acronym and Slogan	- Discussed the acronym and slogan and re-realized importance of PR activities
	Holding of Seminars (1st – 4th)	- Presented the current situation of each municipality which helped to summarize their own situation and to acquire presentation skills - Presented DfA/Ps by TWG member of each municipality and SWMRMC - Presented the progress of each Pilot Project activities by Focal Point(s)
	Holding of Public Hearings (1st – 5th)	- Coordinated to organized P/Hs - Invited stakeholders, prepared program and presentation materials, and facilitated opinion exchange - Analyzed the collected comments and opinions to be taken into consideration to A/Ps and Pilot Project activities
	Setting up of Website of the Study	- Provided the articles and materials for website - Used website for PR activities
	Publication of Newsletters in English and Nepalese (1st – 6th)	- Provided the articles for Newsletters - Used (distributed) Newsletters for PR activities
	Development and distribution of the promotional and PR goods (CKV goods)	- Designed and used (distributed) T-shirts, cloth bags for PR activities - Design and used (distributed) cartoon calendar as educational aid for illiterate people

Source: JICA Study Team

2.4 Public Relations/Participation Activities of the Study

Various activities for public relations/participation were implemented during the Study as shown in Table 2.4-1.

Table 2.4-1 Public Relations/Participation Activities of the Study

Main Targets (receivers)				Contents	Media of Communi-Cation	Activity of the Study
People in the KV	Relevan rganiza tions	Other donor	People n Japa			
○	○	○		Improvement of awareness for SWM and image of the Study	Logo-mark, Slogan of the Study	- Creation of "CKV" logo and slogan at the beginning of the Study with TWG - Utilization of "CKV" at various stages of the Study such as in promotional materials
○	○	○		Improvement of awareness for SWM and image of the Study	Mascot of the Study	- Creation through the discussion among relevant organizations including NGOs/CBOs and TWG members - Utilization of "Ashakaji" as a Mascot at public events, in promotional materials, etc.
	○	○		Contents, progress, and results of the Study	Seminars	- 1st Seminar in March, 2004 - 2nd Seminar in July, 2004 - 3rd Seminar in November, 2004 - 4th Seminar in June, 2005

Main Targets (receivers)				Contents	Media of Communi-Cation	Activity of the Study
People in the KV	Relevan rganiza tions	Other lonor	People ı Japa			
○	○			Contents, progress, and results of the Study	Public Hearings (each municipality)	- 1st P/Hs in March, 2004 - 2nd P/Hs in May, 2004 - 3rd P/Hs in July-Aug, 2004 - 4th P/Hs in February, 2005 - 5th P/Hs in July-August, 2005
○	○	○		Introduction of the Study and basic knowledge on SWM	Newsletters	- Publication of Newsletters (six times, both in English and Nepali)
○*				Improvement of public awareness for SWM	Cartoon Calendar	- Publication of Cartoon Calendar of 2062 with Ashakaji and various messages on SWM
	○	○	○	Introduction of the Study activities	Website	- Establishment of the website of the Study under MOLD
	○	○	○	Introduction of the Study activities	Video documentary	- Video shooting of the Study activities - Creation of video documentary and projection at the 4th Seminar
○	○			Improvement of public awareness for SWM	Radio Jingle on FM Stations	- Broadcasting of Radio Jingle on FM Stations from December 2004 to June 2005 as part of the activities of Pilot Projects - Appearances of the member of the JICA Study on FM programs
○	○			Improvement of public awareness for SWM	Public Events, etc.	- Holding of exhibitions by each municipality in October- November, 2004 and April- May 2005 as part of the activities of Pilot Projects - Holding of clean up campaign in each municipality in June 2005
	○	○		Introduction of the Study activities	Workshops	- Presentation of the Study at SWM related workshops organized by other donors, NGOs and universities
○	○			Introduction of the Study activities, improvement of public awareness for SWM	Articles of the Study	- Appearances of articles on the Study in several kinds of magazine - Appearances of articles on the Study in several newspapers
○	○			Introduction of the Study activities, improvement of public awareness for SWM	Radio/TV programs	- Appearances of the Study on various radio and TV programs and news

Note: * The cartoon calendar was prepared especially for housewives, children and illiterate people.
Source: JICA Study Team

CHAPTER 3 CURRENT FRAMEWORK FOR SOLID WASTE MANAGEMENT

3.1 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[1].
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.

- The10th 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 in Nepal. The Act and Rules also provide the IEE/EIA system to be applied for development projects including SWM facilities and activities.

[1] 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.

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

3.2 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 3.2-1.

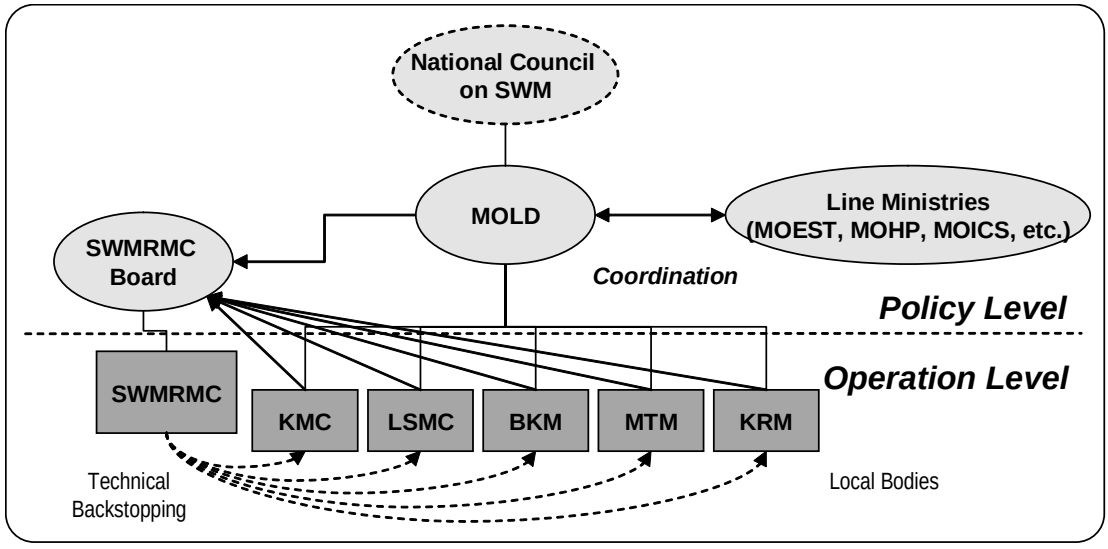


Figure 3.2-1 Organizations Involved in SWM in the Kathmandu Valley

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[2] and the Environmental Protection Council[3] 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 managing solid waste within their jurisdictions. However, the SWM capacities of local

[2] 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.

[3] 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.

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.

3.3 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[4]), 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 3.3-1, and the SWM related expenditure components of them were estimated as shown in Table 3.3-2.

[4] Nepalese Year

Table 3.3-1 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 3.3-2 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.

3.4 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.

CHAPTER 4 OVERVIEW OF SOLID WASTE MANAGEMENT OF THE STUDY AREA (KATHMANDU VALLEY)

4.1 Situation of Solid Waste Management in the Kathmandu Valley

4.1.1 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.

4.1.2 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 4.1-1, Figure 4.1-2 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[1], the five municipalities now have a responsibility of night-time collection (by 7:00 a.m.).

[1] 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.

- 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.

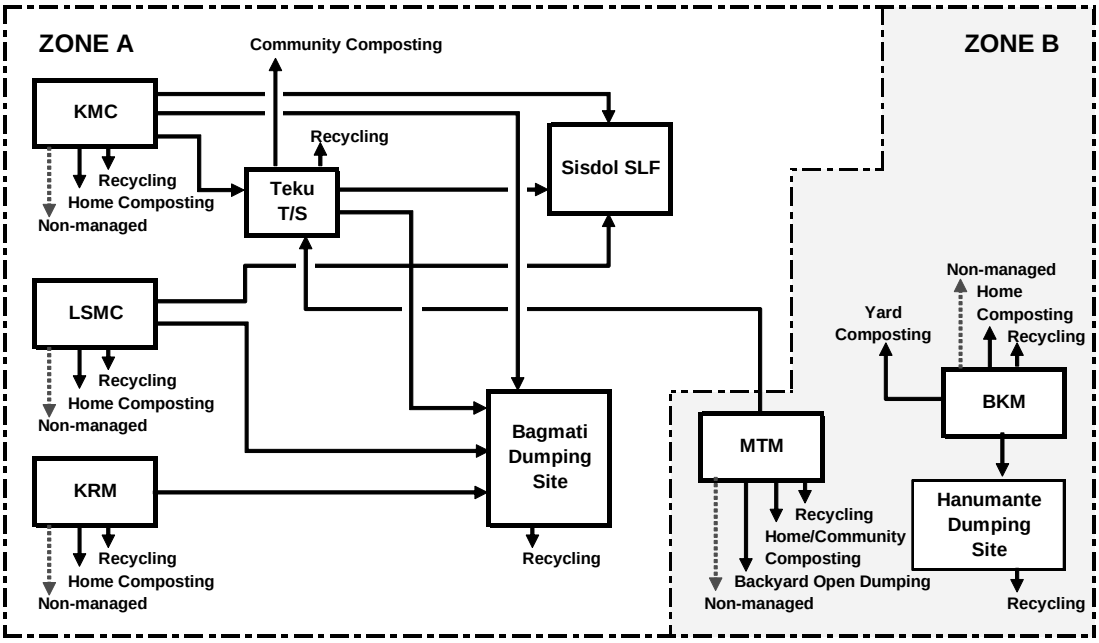


Figure 4.1-1 Current Waste Flow in the Kathmandu Valley

Source: JICA Study Team

- Unfortunately no municipality has been able to prepare an appropriate engineered landfill site in the Kathmandu Valley since Gokaruna 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 at some sites along the Hanumante River and MTM is disposing of waste on the back yards of core areas.

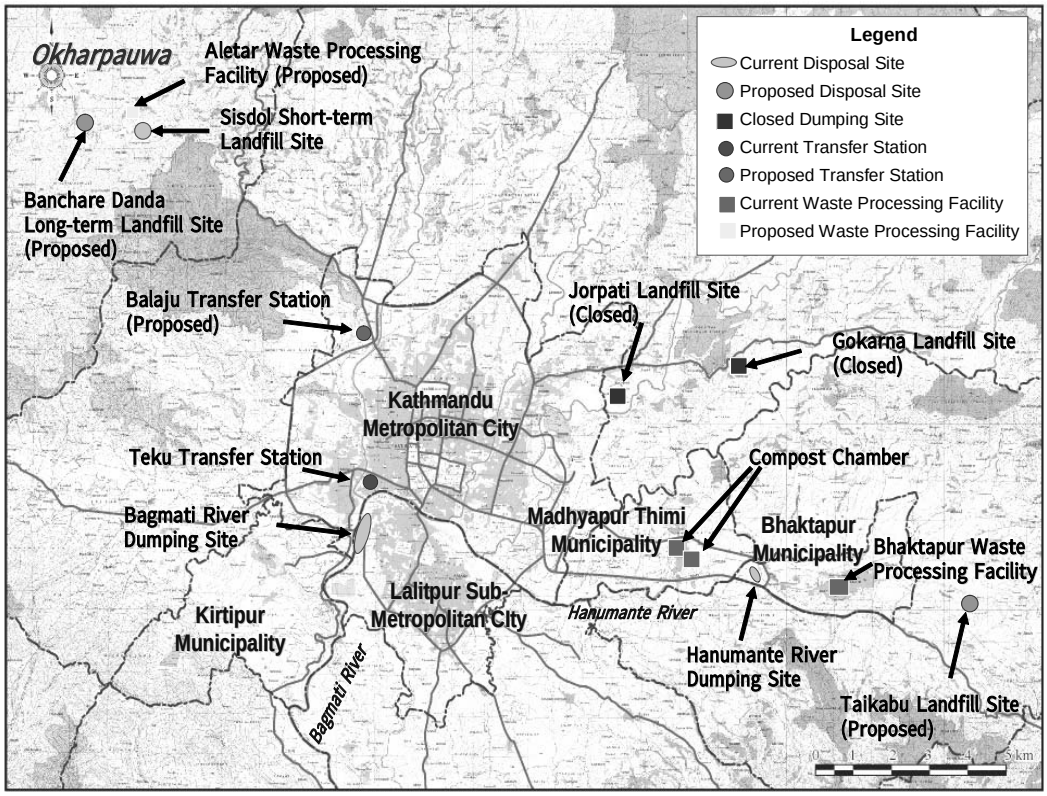


Figure 4.1-2 Facilities Regarding SWM in the Kathmandu Valley

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.

4.1.3 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.

4.1.4 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.

4.2 Short-term Landfill Site

4.2.1 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[2]. 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[3] 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.

4.2.2 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 vents, ii) clay liner system installation, iii) leachate pond preparation with aerator and recirculation system, and iv) procurement and installation of a weighbridge. SWMRMC

[2] 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.

[3] 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.

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.

4.2.3 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.

4.2.4 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.

4.2.5 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 5 CONDITIONS OF MUNICIPAL SOLID WASTE MANAGEMENT OF EACH MUNICIPALITY

The current conditions and key issues of municipal SWM of each of the five municipalities are summarized in the tables below, from the technical, social and managerial viewpoints. Overviews of valley-wide issues are also depicted in the subsequent table.

Table 5.1-1 Current Conditions and Issues of KMC

Item	Current Conditions	Key Issues
Collection and Transportation	- KMC has about 950 street sweepers for daily sweeping. - Residents normally deposit their waste at a designated location on the roadside or in a public container. Those wastes are picked up by KMC or private sector operators and transported to Teku Transfer Station (T/S) or the Bagmati River dumping site. - A total of 81 units (tipper, tractor, etc.) are available for primary collection, and 8 units (7 multi compactor and 1 container) for secondary transportation.	- Improvement of primary collection system through tackling frequent breakdown and aged equipment. - Countermeasures for inefficient waste transfer system at Teku T/S, and low capacity of secondary transportation.
Solid Waste Minimization	- Composting activities have been experimented with at the household level mainly by using compost bins. Vermi-composting has also been also experimented with as a popular composting method. - Most of the recyclable materials are collected from households, commercial premises, restaurants, etc by recycle hawkers sold to recycling dealers so called "kabadi". Altogether it has been advised that there are 30 to 35 groups of waste pickers in the KMC, who are working mainly at Teku T/S and Bagmati River dumping site. - Establishment of a community recycling center has been encouraged by KMC.	- Spread of community-based or home composting. - Preparation for large-scale waste processing facility in cooperation with LSMC as well as central government.
Final Disposal	- KMC is disposing of the waste mainly in/along the Bagmati River, in addition to some open dumping in open spaces and self burning. - The problems associated with this disposal include i) floodplain dumping and river channel encroachment, ii) no environmental control, iii) uncontrolled access to the dumping site, etc.	- Preparation for going to a new sanitary landfill (LF) and safely closing safely Bagmati, in cooperation with LSMC and central government (SWMRMC).
Social Aspect	- 89% of sample households (HHs) responded that waste collection services were available in their areas. The majority of HHs reported having knowledge about waste separation, and 41% of respondent sample HHs have shown a positive attitude towards making compost. - It has been gradually realized by KMC that community participation is the key to improvement of the urban environment, after the epoch establishment of CMU. - A number of NGOs/CBOs have been involved in various SWM activities including collection services, awareness, and 3R activities.	- More diversification and expansion of community-based SWM activities. - Tackling the shortage of staff in CMU. - Information collection on SWM-related activities conducted by a number of NGOs/CBOs for better practice of community participation.

Item	Current Conditions	Key Issues
Managerial Aspect	- The Solid Waste Management Section and Mechanical Section under the Environment Department are managing the solid waste generated within KMC. KMC is the only municipality in Nepal that has a section with a mandate to comprehensively address various aspects of SWM. - The total number of staff under the Environment Department involved in SWM is 1,262 persons, which is about 60% of overall municipal staff.	- Tackling the continual changes of municipal leadership leading to instability and inconsistency from managerial viewpoints. - Development of streamlined administrative procedure.
Financial Aspect	- KMC spends about Rs 145 million for SWM services, which represents 30-35% of total municipal expenditure. SWM costs for KMC are characterized by a high percentage of street sweeping cost and personnel cost.	- Sustainable securing of budget

Key indicators of KMC: [Area] about 50 km^2, [Population] nearly 700 thousand, [Nos. of ward]: 35, [UGR estimated as of 2004] 0.416 kg/d-capita, [Generated waste estimated as of 2004]: 308 ton/day

Table 5.1-2 Current Conditions and Issues of LSMC

Item	Current Conditions	Key Issues
Collection and Transportation	- There are altogether 170 sweepers in LSMC, out of which 100 sweepers work in street sweeping. About 70% of sweepers are female. - 11 tippers, 2 dumpers and 2 tractors are being operated by LSMC for collection and/or transportation of waste. - All collected waste is transported to Bagmati River dumping site together with the waste from KMC.	- Improvement of secondary transportation capacity with T/S development to go to a new sanitary LF. - Efficient loading of waste from the ground to the collection vehicle.
Solid Waste Minimization	- Composting activities using compost bin method and vermi-composting method are carried out. - Although LSMC does not have a record of kabadi, there should be more than a dozen of their shops. About 150 waste pickers are working at Bagmati River dumping site. - Community Development Section (CDS) of LSMC is promoting awareness for composting and recycling to women's groups and sometimes cooperating with NGOs/CBOs.	- Spread of community- based or home composting. - Preparation for a large-scale waste processing facility in cooperation with KMC and central government.
Final Disposal	- It is reported that about 200 m^3/d of waste is disposed of at Bagmati River dumping site where overall operation is overseen by KMC. Many open dumping areas and wide area of waste burning are noticed.	- Preparation for going to a new sanitary LF and safely closing Bagmati, in cooperation with KMC and central government (SWMRMC).
Social Aspect	- 96% of sample HHs responded that waste collection services were available in their areas. 55% of sample HHs responded having knowledge about waste separation, and one fourth of sample HHs reported having experience in making compost. - For community participation in SWM, CDS has carried out awareness programs, clean-up activities, 3 or 4-day trainings, etc. - In the field of SWM, no partnership program with NGOs/CBOs is being carried out despite preparation of a plan.	- Coordination and communication between CDS and other sections such as the Environment Section for better practice of SWM activities.

Item	Current Conditions	Key Issues
Managerial Aspect	- In 2004, LSMC approved a new organizational structure where it designated the Environment Section, comprising of the Sanitation Sub-section and Mechanical Sub-section, to be responsible for SWM activities. The total number of staff in the Section is 206 persons (about 40% of all LSMC staff), of which over 80% are field level staff. - CDS has been implementing a community mobilization program including waste minimization training, etc.	- Integration of efforts of related sections into SWM activities.
Financial Aspect	- LSMC spends about Rs 25 million on SWM services, which represents 25% of total municipal expenditure.	- Sustainable securing of budget

Key indicators of LSMC: [Area] about 15 km^2, [Population] more than 160 thousand, [Nos. of ward]: 22, [UGR estimated as of 2004] 0.416 kg/d-capita, [Generated waste estimated as of 2004]: 75 ton/day

Table 5.1-3 Current Conditions and Issues of BKM

Item	Current Conditions	Key Issues
Collection and Transportation	- 26 permanent sweepers work in two shifts and 57 sweepers on contract work in three shifts. - 88 handcarts are used for primary collection and 8 vans and 2 tractors transport the waste transferred from handcarts to final disposal site. About 10 % of collected waste is transported to a municipal composing facility.	- Effective sorting of organic and in-organic wastes at the source and in the collection system. - Efficient unloading of waste from the collection ban track.
Solid Waste Minimization	- BKM is the only city that has a compositing facility under operation with 6 ton capacity. However, there are few composting activities at the household and community levels. - Cycle hawkers collect recyclable materials door-to-door by bicycle or rickshaw and take them into 6 cycle hawker's shops. Several waste pickers can be found at the Hanumante River dumping site. There is a paper recycling factory in BKM.	- Appropriate operation of composting facility for better quality and better sales price of product.
Final Disposal	- Except for the waste transported to a composting facility, the majority of the waste is directly dumped in the Hanumante River, where no cover soil is applied and there are no staff assigned.	- Preparation of Taikabu LF in cooperation with MTM and central government (SWMRMC).
Social Aspect	- 94% of sample HHs responded that waste collection services were available in their areas. 56% of sample HHs responded having knowledge about waste separation and 81% know what compost is. - BKM has not promoted specific community mobilization, although BKM distributed buckets to households for source separation in 2002. - Very little involvement of NGOs/CBOs into SWM is observed.	- Development of network with NGOs/ CBOs, schools, etc. for enhancement of community mobilization and community-based SWM activities.
Managerial Aspect	- There is a sub-section responsible for sanitation activities under the Social Welfare and Sanitation Section. This section accommodates 219 persons (about 50% of all BKM staff).	- Recognizing importance to have partnership opportunities with external bodies.
Financial Aspect	- BKM spends nearly Rs 15million on SWM services, which represents 12-13% of total municipal expenditure.	- Sustainable securing of budget

Key indicators of BKM: [Area] about 7 km^2, [Population] more than 73 thousand, [Nos. of ward]: 17, [UGR estimated as of 2004] 0.316 kg/d-capita, [Generated waste estimated as of 2004]: 26 ton/day

Table 5.1-4 Current Conditions and Issues of MTM

Item	Current Conditions	Key Issues
Collection and Transportation	- MTM does not have any motorized vehicle for solid waste management but has 4 rickshaws and 17 handcarts. 20 municipal sweepers collect waste. Besides this, 4 private sector operators are providing collection services without any consultation with MTM.	- Development of collection/ transportation system including equipment procurement. - Appropriate management system for private sector operators.
Solid Waste Minimization	- Two composting chambers were constructed under a community based SWM program but both are now out of use because of structural defects. Home composting using metal drums is being done on a small scale. - There are some cycle hawkers, but they take recyclable materials away to outside the municipality.	- Preparation for future community-based composting by using lessons learned from compost chambers.
Final Disposal	- The collected waste is disposed of by open dumping in open spaces very near to the settlement area, or along the rivers flowing in through the municipality.	- Coordination with BKM and central government to prepare for going to Taikabu LF.
Social Aspect	- About 60 % of sample HHs dump their waste on vacant lands, roads, riverbanks or channels. The proportion of those who received collection service remained at a low of 35% of sample HHs. - CDSS is partially in charge of community mobilization in SWM. It has promoted a few small-scale SWM activities. - Several NGOs/CBOs' activities focusing on awareness, clean up programs and composting have been observed.	- Strengthening of Community Development and Sanitation Section (CDSS) for enhancement of community- based SWM activities
Managerial Aspect	- CDSS has the primary responsibility with regard to sanitation activities, and manages 20 sweepers. Recently, a SWM Sub-Section has been established under CDSS.	- Tackling the serious shortage of trained and skilled human resources.
Financial Aspect	- MTM spends nearly Rs 0.3-0.7million for SWM services, which represents 2-3% of total municipal expenditure.	- Sustainable securing of budget

Key indicators of MTM: [Area] about 11 km^2, [Population] nearly 50 thousand, [Nos. of ward]: 17, [UGR estimated as of 2004] 0.266 kg/d-capita, [Generated waste estimated as of 2004]: 14.3 ton/day

Table 5.1-5 Current Conditions and Issues of KRM

Item	Current Conditions	Key Issues
Collection and Transportation	- Though KRM has not collected any waste, a few NGOs and CBOs are collecting waste from some wards by themselves.	- Appropriate management system for private sector operators.
Solid Waste Minimization	- Conventional home composting methods are still common in some areas. - There are some cycle hawkers, but they take recyclable materials away to outside the municipality.	- Spread of home composting along with segregation of recyclable materials.
Final Disposal	- Waste collected in KRM is open dumped on the western bank of Bagmati River near the site being operated by KMC. Some open dumping areas are observed within the city.	- Coordination with KMC for waste transportation to Teku T/S for appropriate final disposal.
Social Aspect	- The proportion of those who receive collection service remain at 56% of sample HHs. Only 16% of sample HHs have participated in CBOs' activities of SWM. - KRM has not taken the initiatives in community mobilization programs for SWM by its own effort.	- Enhancement of community-based activities including public awareness and behavior change.

Item	Current Conditions	Key Issues
Managerial Aspect	- For SWM, the Planning and Technical Section has the overall responsibility within KRM. A SWM unit has been newly established under the section.	- Institutional strengthening for self-independent SWM, particularly in order to cope with waste transportation to Teku T/S.
Financial Aspect	- KRM spends about Rs 150,000 for SWM services which represents 1% of total municipal expenditure, because private sector operators cover the services.	- Sustainable securing of budget

Key indicators of KRM: [Area] about 15 km^2, [Population] about 40 thousand, [Nos. of ward]: 19, [UGR estimated as of 2004] 0.266 kg/d-capita, [Generated waste estimated as of 2004]: 12 ton/day

Table 5.1-6 Common Issues in the Kathmandu Valley Regarding SWM

Item	Valley-basis Key Issues
Collection and Transportation	- Urgent measures for re-arrangement for nighttime/early morning collection. - Increasing or expanding the waste collection ratio. - Introduction of suitable waste collection and transportation equipment. - Improvement for more efficient waste collection system under the condition of nighttime/early morning shift. - Development of acceptable and fair management system for private collection
Solid Waste Minimization	- Continuing and expanding home composting for waste minimization. - Continuing and improving the vermi-composting along with developing the composting product demand. - Development of a large-scale waste processing facility. - Enhancement of public awareness for recycling.
Final Disposal	- Allocation of suitable sites for facilities (sanitary landfill) development. - Development of landfill design standards considering such maters as a semi-aerobic system. - Formalization of waste picking activities. - Consideration of VDCs' waste into designing the facilities' capacities.
Social Aspect	- Enhancement of sense of self-responsibility for SWM among the public. - Promotion of not only public awareness but also behavior change communication (BCC). - Development of adequate strategies for effective community mobilization, including stakeholder/target group analysis, sufficient institutional building and external assistance, and gradual scale up of interventions in communal/inter-communal levels.
Managerial Aspect	- Clarification of current functional ambiguities among SWM-related sections within each of municipalities. - Development of a standard operational mechanism for healthy and rigorous partnership with private sector operators. - Development of an appropriate system for staffing and human resource management. Development of a useful solid waste data management system.
Financial Aspect	- Examination of cost sharing among the central and local bodies not only for SWM-related facilities development and O&M but also for the whole SWM system. - Improvement of the comprehensive revenue collecting system as a basic need for stable financial conditions.

CHAPTER 6 HUMAN RESOURCE DEVELOPMENT PLAN

6.1 Issues Concerning Human Resource Development

Human Resource Development (HRD) is a major concern as well as a critical measure to address the recurrent problem of human resource deficit. Without due consideration, it could easily undermine the successful implementation of any priority activities to be prescribed in the A/Ps. It is for this reason that under the guidance of the Study, a HRD plan was developed based on a set of core principles that promote HRD in a strategic, practical and sustainable manner. Such HRD plan, as with financial planning, would be a key in order to ensure long-term viability and applicability of the A/Ps. The following issues were considered for development of the HRD plan.

(1) Shortage in Human Resources

The decentralization process, fast-tracked with the enactment of the Local Self-Governance Act of 1999, placed a heavy burden on already limited human resource base of some municipalities. The municipalities are still struggling to take over numerous responsibilities that accompanied the devolution of authority related to various public services. The municipalities have had to deal with these additional responsibilities without any significant increase in their work force.

(2) Need for Qualified Human Resources

Securing qualified human resources is as much of a challenge to the municipalities as employing sufficient number of staff. Several inherent conditions within the municipalities exacerbate the situation. First, due to less than an adequate number of job posts, municipalities cannot afford to hire specialists. Second, since staff often have to take on additional responsibilities beyond their background/expertise, the municipalities cannot provide a working environment that allows staff career development focusing on a specific field of expertise. Finally, there is a problem of working conditions for municipality staff. Recruitment as well as retention of skilled and trained personnel in the municipal work force imposes serious challenges to HRD.

(3) Limited Institutionalization of Training Benefits: Transfer Problem

Due to the high donor interest in the field of decentralization and capacity development of local bodies, there are a relatively high number of training opportunities existing both inside and outside the country. The majority of the current municipality staff involved in SWM operations, majority of them have received some kind of training. With officers, it is not rare to see overseas experience in their training history. In the Nepalese context, it could be assumed that institutional underdevelopment of the municipalities has caused the institutionalization of training benefits to fall far behind the increasing levels of technical

capacity development of individuals. Unless the institutional weakness[1] causing the transfer problem is addressed, no amount of individual technical training and other HRD schemes will lead to desired results, or enhanced capacities at the organizational level.

6.2 Analysis of Existing Human Resource Development Needs

Under the Study, a comprehensive training needs analysis (TNA) exercise was conducted targeting key staff envisioned to be involved in the implementation of the A/Ps on SWM. The exercise consisted of three steps: assessment of organizational priority HRD areas, subjective assessment of individual training needs, and objective assessment of individual training needs. The results of the TNA exercise shed light not just on the various priority areas for HRD but also on the different target levels and approaches that need to be taken into consideration for effective HRD planning.

At the organizational level, the priority HRD area that was identified and agreed upon was strategic planning and operational management. This signifies that irrespective of the level of individual capacities, as a whole, current municipal strategic planning and operational management capacities were perceived to be very low. In response to such TNA results, HRD plans prioritize organizational learning programs to strengthen SWM operational matters.

At the individual level, some inconsistencies emerged between the results of the questionnaire and interviews, or between subjective and objective assessment of training needs. While the questionnaire results showed equal demand for operational and technical training, the interview results underscored the highest deficiency of staff capacity in SWM technical areas 1) EIA and environmental monitoring, 2) solid waste collection, 3) composting and recycling.

6.3 Core Principles for Human Resource Development Planning

(1) Strategic Human Resource Development

To avoid an uneven and sometimes haphazard approach to HRD, all decisions (i.e. selection of programs and participants) should be based on a comprehensive HRD plan which would be linked with the respective A/Ps of the municipality. Matching of participants with the training programs should be strategic and selective, with much consideration given to the training objectives and expected outcomes.

(2) Practicality and Applicability of Training Contents

All training programs selected for attendance by municipality staff should be screened in advance to guarantee the practicality and applicability of the skills/knowledge to be attained within the specific context within each municipality. Sending staff to irrelevant training

[1] Examples of such institutional weakness are lack of HRD planning and follow up, inappropriate selection of trainees for a given training program, lack of sharing of training experiences and learning, lack of encouragement from the management for the practical application of new learning, absence of operational systems in which to apply the new learning, etc.

programs only fortify the impression that training only provides informal benefit or perquisites, to be equally shared by all staff, irrespective of job responsibilities.

(3) Sustainability

For any results of training to be sustained in staff performance and provide benefits at the organizational capacity level, there must be an enabling environment that supports that trainee in applying new skills and knowledge. This means that after training, the trainee should be given some leverage (e.g. new responsibilities, position) necessary to initiate new endeavors and test new learning. Such support should be systematically integrated into the training package by the municipality office together with a regular monitoring session between the supervisor and trainee in order to ensure the benefits of training are institutionalized and sustained.

6.4 Human Resource Development Framework

The following Figure 6.4-1 provides a framework of how HRD programs should be planned and implemented within the five municipalities up to 2015. Four phases are envisioned until 2015 (Ashadha, 2072[2]), starting with the Study Phase (2004-2005). It is expected that the municipalities should mobilize both external and internal resources to fund HRD interventions up to 2015 (Ashadha, 2072).

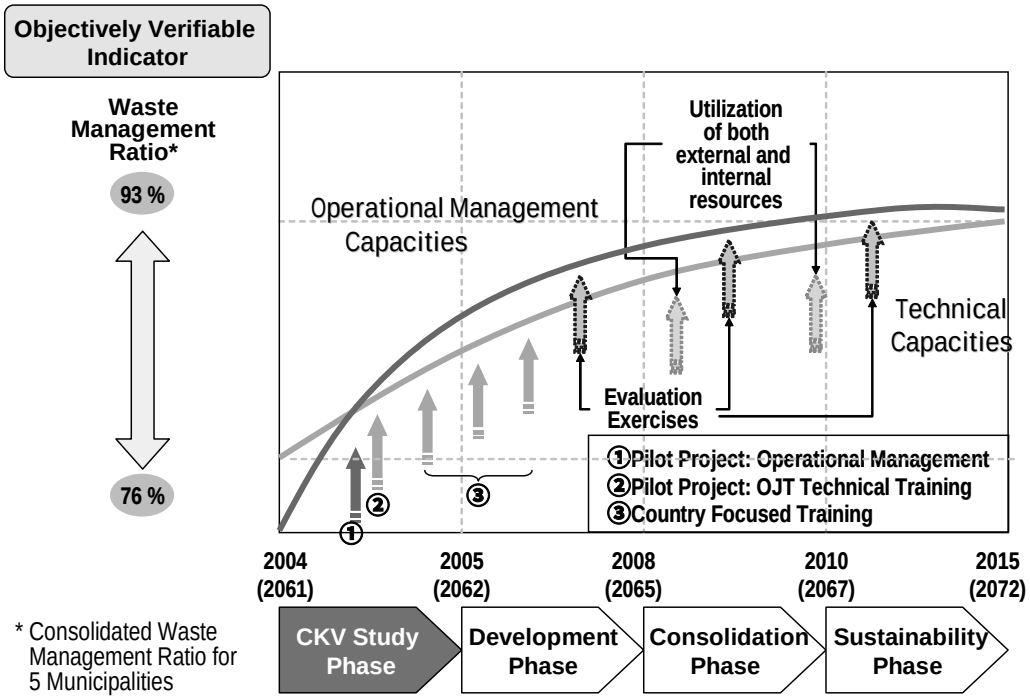


Figure 6.4-1 Human Resource Development Framework

Source: JICA Study Team

[2] Nepalese Year

6.4.1 Strengthening SWM Technical Capacities

For specific technical areas such as ***EIA application for landfill construction, Waste collection planning, and Composting and recycling***[3], a practical and applicable training curriculum should be prepared through accessing in-country[4] as well as international expertise. Especially in view of plans to develop various SWM facilities in the pipeline from 2004 (2061) to 2010 (2067), development of technical capacity in EIA application for landfill site(s) should take precedence over other topics at least in the Study Phase and Development Phase. Such programs will be much more feasible if developed in partnership and on a cost-sharing basis with SWMRMC and/or other municipalities.

Developing SWM technical skills and knowledge is one area where during the initial stage, external resources should be well utilized for HRD. As the cornerstone of technical training, the JICA Country Focused Training Course on Solid Waste Management would be a primary opportunity to provide SWM technical focal points and a comprehensive overview of main technical issues in SWM administration practices. This training program will also allow exposure to the best SWM practices in Japan. This program, which started in 2002, has implemented three rounds of training courses with over twenty graduates. Most graduates now are playing an important role in SWM in each municipality or SWMRMC.

6.4.2 Strengthening SWM Operational Management Capacities

Operational and management capacity development involves strengthening a broad range of functions that are necessary to effectively implement SWM. Most basic of all functions is to develop an operational cycle of planning, implementation and evaluation of SWM activities with appropriate resource planning (human resources and financial) and monitoring to ensure consistent service delivery. The A/Ps on SWM will provide the strategic framework until 2015. This then should be broken down into annual work plans for actual implementation and monitoring. Other operational practices need to be strengthened such as monitoring and evaluation of SWM activities, program based budgeting, conflict management, private sector partnerships and human resource development.

Development of operational and management capacity, in order to become effective, cannot be achieved only through conventional training programs. Rather it would require interventions at the organizational level, where appropriate processes and procedures need to be introduced, standardized, internalized, and implemented by various levels of human resources. HRD plans that cater to such an approach need to involve all staff in the operational units; and should provide opportunities for discussion and consensus building on new approaches. Nevertheless, such a kind of training that would cater specifically to each organization would be difficult to find externally. It is recommended that while municipalities continue to mobilize resources for external support, they continue to review and improve various operational systems on their own through trial and error.

[3] These were areas where highest gaps in skills and knowledge existed, as identified during the TNA exercise.

[4] Training centers within Kathmandu, such as the Institute for Environmental Management provide technical courses in EIA, and a special course on SWM, which municipality staff are invited to attend at subsidized rates.

6.4.3 Sensitization of High Level Policy Makers

To complement the HRD plans to strengthen technical and operational capacities, interventions should also be introduced targeting the policy level. The core target group would be the municipal representatives (e.g. Mayors, Deputy Mayors, Chief Executive Officers, Municipal Board/Council Members) who are given the primary decision-making authority in SWM as well as all other municipal programs.

6.5 HRD Programs in the Study Phase

During the Study Phase, various HRD activities were mainstreamed in respective Pilot Projects as well as in the process of formulation of A/Ps.

On-the-job training (OJT) as a practice of activities was one approach the JICA Study Team adopted in order to ensure the applicability of the knowledge and skills transferred to the C/P personnel. Especially in projects related to SWM facilities development, SWM staff gained first hand experience on how to technically plan, design, implement and evaluate SWM projects.

In addition, a variety of off-the-job trainings (Off-JT) were organized focusing on specific areas in SWM, such as Behavior Change and Communication, Public Private Partnership Orientation and Community-based Waste Minimization. These in-class trainings not only imparted technical knowledge and skills, but also acted as a forum to share best practices and lessons learned.

Consequently, through these opportunities, coordination among the five municipalities and SWMRMC was enhanced substantially.

CHAPTER 7 PILOT PROJECTS OF THE STUDY

7.1 Pilot Projects of the Study

7.1.1 Design of Pilot Projects

The Pilot Projects of the Study were designed aiming at the following, based on the formulated Draft Action Plans (DfA/Ps) of each of the five municipalities.

- Objective I: To establish and enhance the essential technical and operational capabilities on SWM of the five municipalities and SWMRMC in order to practice the activities to be determined in A/Ps
- Objective II: To obtain baseline data as well as lessons learned in order to obtain feedback to A/Ps
- Objective III: To put into practice some of the short-term activities of DfA/Ps which are recognized as more urgent ones

The activities of the Pilot Projects are planned based on: i) contribution and effectiveness toward capacity development to practice A/Ps, and ii) high priority ones which are required to be implemented urgently among the short-term ones of DfA/Ps by combining selected various short-term activities and associated requirements (e.g. human resource development) for the activities' steady implementation. Consequently, a series of five broad Pilot Projects have been envisaged as shown in Table 7.1-1. The JICA Country Focused Training was incorporated into a part of the Pilot Project activities.

Project Design Matrixes (PDMs) have been developed by the CKV Study Team for the five broad Pilot Projects, respectively. The project purposes, targets and main activities have been written in the respective PDMs. In order to show a clear direction for the whole Kathmandu Valley, an overall common goal has been set commonly as a result of consolidation of the achievements of project purposes as shown below:

"SWM Service of Respective Municipalities is Improved through Capacity Development"

After the commencement of the Pilot Projects, the design was often modified to adjust to changes in circumstances such as delays on activities due to "banda" or "curfew" and addition of new activities which were not incorporated in the original design. The modified PDMs are attached in Appendix 2.

Table 7.1-1 Contents of Pilot Projects of the Study

Projects	Project Purpose	Targets	Main Activities	Implementation
A. Improvement of Collection and Transportation	Capabilities of relevant staff of the five municipalities and SWMRMC regarding waste collection and transportation are strengthened.	**A-1** A-1.1: BKM staff A-1.2: MTM staff **A-2:** Staff of KMC, LSMC and KRM **A-3:** KMC staff (SWMRMC, LSMC)	**A-1: Practice of Solid Waste Collection in Model Areas** A-1.1: Practice of source-separated collection in BKM A-1.2: Practice of collection and transportation in MTM **A-2: Training for Public Private Partnership (PPP) on Solid Waste Management** **A-3: Training/Practice of Transfer Station (Teku T/S)** A-3.1: Training for planning of T/S A-3.2: Training for designing of T/S A-3.3: Training for construction supervision of T/S A-3.4: Practice of operation of T/S	**A-1** A-1.1: Guidance by the JICA Study Team A-1.2: ditto **A-2:** Guidance by JICA Study Team and local consultants **A-3:** A-3.1: Guidance by the JICA Study Team A-3.2: Guidance by the JICA Study Team, supported by local consultants A-3.3: ditto A-3.4: Guidance by the JICA Study Team
B. Promotion of Waste Minimization	Capabilities of relevant staff of the five municipalities regarding waste minimization are strengthened.	**B-1:** Staff of KMC, LSMC and SWMRMC **B-2:** B-2.1: KMC staff B-2.2: KMC staff B-2.3: LSMC staff B-2.4: KRM staff	**B-1: Training for Waste Minimization Facility** **B-2: Practice of Local Level Waste Minimization Activities** B-2.1: Practice of community-based waste minimization activities in a model area (in KMC) B-2.2: Practice of medium-scale vermi-composting (in KMC) B-2.3: Practice of promotion of home composting (in LSMC) B-2.4: Practice of plastic separation (in KRM)	**B-1:** Guidance by the JICA Study Team, supported by local consultants and resource persons **B-2:** B-2.1: Guidance by JICA Study Team, supported by NGOs and local resource person B-2.2: ditto B-2.3: ditto B-2.4: ditto

Projects	Project Purpose	Targets	Main Activities	Implementation
C. Improvement of Final Disposal Planning and Operation	Capabilities of relevant staff of the five municipalities and SWMRMC regarding final disposal planning and operation are strengthened.	**C-1:** Staff of the five municipalities and SWMRMC **C-2:** Staff of SWMRMC, KMC, LSMC (BKM)	**C-1: Training for Final Disposal Planning** C-1.1: Training for site selection C-1.2: Training for environmental/social considerations at landfill site **C-2: Training/Practice of Semi-aerobic Landfill (Sisdol Short-term LFS)** C-2.1: Training for planning C-2.2: Training for designing C-2.3: Training for construction supervision C-2.4: Practice of O&M including environmental monitoring	**C-1:** C-1.1: Guidance by the JICA Study Team, supported by local consultants and resource persons C-1.2: ditto **C-2:** C-2.1: Guidance by the JICA Study Team, supported by local consultants C-2.2: ditto C-2.3: ditto C-2.4: ditto
D. Promotion of Public Awareness and Behavior Change Communication/ Education	Capabilities of relevant staff of the five municipalities and SWMRMC regarding public awareness and behavior change and communication and education are strengthened.	**D-1:** Staff of the five municipalities and SWMRMC **D-2:** Staff of the five municipalities and SWMRMC **D-3:** BKM staff	**D-1: Training for Community Mobilization Activities** **D-2: Practice of Mass Communication and Education** **D-3: Practice of Interpersonal Communication and Education**	**D-1:** Guidance by the JICA Study Team, supported by local resource persons **D-2:** Guidance by the JICA Study Team supported by NGO **D-3:** Guidance by the JICA Study Team supported by NGO
E. Development of Operation and Management Capacities	Capabilities of relevant staff of the five municipalities and SWMRMC regarding technical and operational management capacities on SWM are strengthened.	**E-1:** Staff of the five municipalities **E-2:** Staff of the five municipalities and SWMRMC **E-3:** Staff of the five municipalities and SWMRMC	**E-1: Training for Action Plan Operational Management** **E-2: Practice of Solid Waste Data Management** E-2.1: Practice of solid waste quality and quantity survey E-2.2: Practice of solid waste data management **E-3: Training for SWM Policy and Technology**	**E-1:** Guidance by the JICA Study Team, supported by local consultant **E-2:** E-2.1: Guidance by the JICA Study Team, supported by local consultant E-2.1: ditto **E-3:** JICA Country Focused Training

Source: JICA Study Team

7.1.2 Implementation Framework of Pilot Project

As a first step for the implementation of Pilot Projects, focal points of each broad Pilot Project (A-E) who are/will be in charge of these fields, were assigned as shown in Table 7.1-2 with consideration of respective specialties, backgrounds and positions. Their daily experiences on SWM were expected to be utilized and enhanced though the respective Pilot Projects.

Table 7.1-2 Focal Points of Pilot Projects Implementation

Focal Points	A. Collection and Transportation (Inc.Data Management)	B. Waste Minimization (Composting, Recycling)	C. Landfilling (Inc.Env. Monitoring)	D. Public Awareness and Behavior Change	E. Operational Management
KMC	Mr. Rajesh	Mr. Rajesh (Central level)/ Ms. Shriju (Community level)	Mr. Kiran	Ms. Shriju/ Ms. Sanu	Mr. Rajesh
LSMC	Mr. Pradeep	Mr. Pradeep (Large)/ Ms. Laxmi/Ms. Sabina (Community)	Mr. Rudra	Ms. Laxmi/ Ms. Sabina	Mr. Rudra
BKM	Mr. Dinesh	Mr. Moti	Mr. Laxman	Mr. Dilip Mr. Krishna	Mr. Laxman
MTM	Mr. Satya	Mr .Surendra/ Ms. Krishna	Mr. Satya/ Mr. Shiva	Mr. Tulsi/ Ms. Krishna	Mr. Tulsi
KRM	Mr. British	Mr. Gyan	Mr. Bal	Mr. Anuj	Mr. Bal
SWM RMC	Mr. Nilmar(Data)/ Mr. Ram (T/S)	Mr. Ashok	Mr. Ram	Mr. Nirmal	Mr. Ashok

Source: JICA Study Team

In principle, the technology and know-how on SWM have been transferred directly from the JICA Study Team as part of the Pilot Projects activities. In addition, local resources including local consultants and local NGOs were fully utilized since training and other kinds of activities can be implemented based on the actual local conditions as well as in the Nepalese language, Nepali and Newali. Consequently, the technology and know-how on SWM could also be transferred to the local consultants and resources and they would be able to support the central and local bodies on SWM continuously even after the Study.

7.2 Results of Pilot Project A: Improvement of Collection and Transportation

7.2.1 A-1: Practice of Solid Waste Collection in Model Areas

(1) A-1.1: Source-separated Collection in BKM

Since the kick-off meeting was held on July 9, 2004, it had taken a long time to start actual activities due to the confusion by change of appointment of the CEO, and the drastic shifting to the nighttime/early morning collection by national SWM policy change in February 2005. In addition, as it was also necessary for BKM to take a time to communicate carefully with the target communities so that the participants from the communities could understand the purpose of this Pilot Project concretely. The actual collection and transportation activity was finally launched at last on May 22, 2005.

BKM selected three target areas, Bharbacho with 138 households, Itachhen with 136 households and Khauma with 50 households, from 18 candidate areas as shown in Figure 7.2-1. The first trial was started from 50 to 100 households from Bharbacho in Ward 17.

BKM distributed two different colors of buckets for waste bin, green for compostable organic and red for others to the participating households in addition to provision of brochures.

After one month's implementation, BKM held an evaluation meeting with participation of core group members on June 20, 2005.

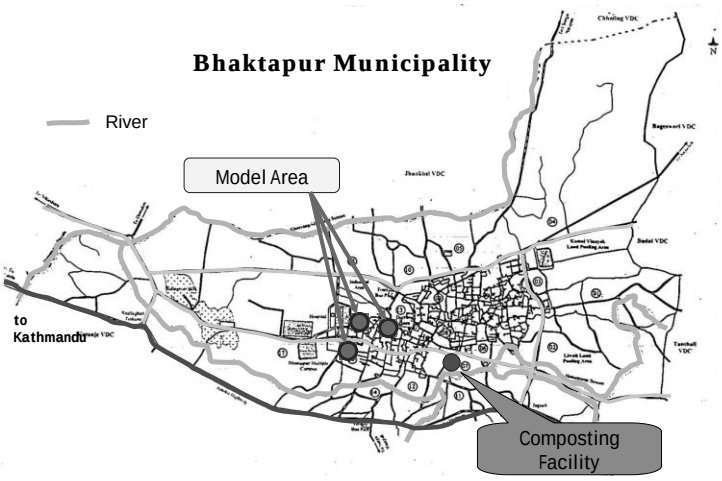


Figure 7.2-1 Selected Target Areas in BKM

In the meeting, it was reported about 50 kg of organic waste and 20 kg of other waste were collected separately in one and a half hours, but still some issues to be improved were discussed such as "a few households have not properly separated waste". Therefore necessary improvement such as implementation of further on site trainings and instructions, and numbering of distributed buckets were proposed. As for further activity, 1) decrease of collection frequency, 2) more clear classification of the waste, 3) provision of a notice board at the target areas and 4) arrangement for provision of gloves, mask and special uniform for waste collectors, were discussed to be introduced.

Significant improvement observed so far was that collected organic waste was not contaminated with broken pieces of glass, blades pins which are a nuisance when making compost.

(2) A-1.2: Practice of Collection and Transportation in MTM

Although a kick-off meeting was held on August 13, 2004, it took a long time to take the necessary procedure regarding tax exemption for provision of a collection truck. Under this situation, the JICA Study Team hired a rental truck with tipping capacity of not less than 3 m^3 for implementing the activity for one month and the actual collection activity was finally launched at last on June 14, 2005.

The target areas for collection were determined by MTM at the core area of the municipality that was covered by the municipal sweeping service and at the bustling area along the Aliniko Highway. Collection points were also set and confirmed at the on-site preparatory meeting on June 2, 2005.

Core Area:

1) Bhimsen Sthan,
2) Chapacho,

3) Hatiman Kal,
4) Dui Pokhari,
5) Balkumari,
6) Naya Thim

Highway Area:
7) Gatthaghar,
8) Kausaltar,
9) Lokanthali

Collection is conducted from 6:00 to 7:00 am, and about two tons of waste were collected and transported to Teku T/S in MKC.

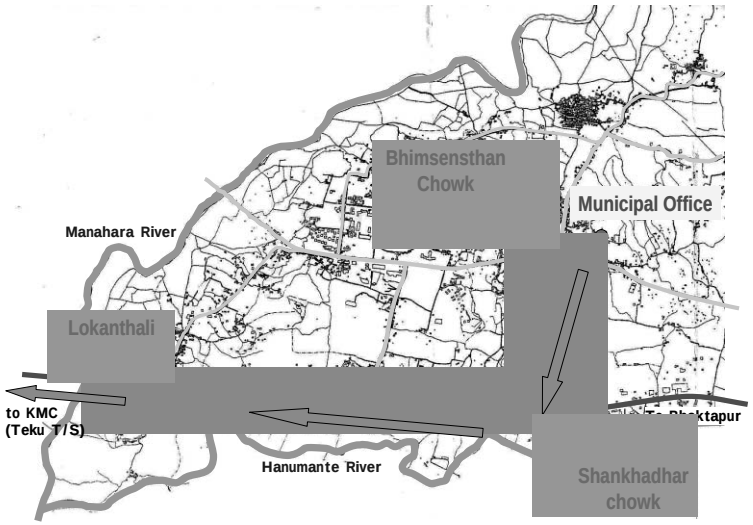


Figure 7.2-2 Selected Target Areas in MTM

This may be still just about 60 % of all generated waste in the target areas. MTM announced this activity through a microphone at the collection time and FM program once a week. The first follow-up meeting was held on June 19, 2005 and this discussed the problems and future activities as shown below.

Table 7.2-1 Result of First Follow-up Meeting

Raised Problems	Future Activity
Dispute of collection point	Fixed place for collection point, development of well platform
Unequipped and untrained labor	Training of staff and labor
Lack of awareness	Promotion for raising public awareness regarding waste collection
Unmanaged collection point	Preparation of rule for the collection system
Lack of manpower	Arrangement of manpower

Source : MTM and JICA Study Team

7.2.2 A-2: Training for Public Private Partnership on Solid Waste Management

The following activities were implemented under the Pilot Project A-2.

1) PPP Policy Assessment

Situation analysis on the policy environment for Public Private Partnership (PPP) and municipal needs assessment regarding PPP in SWM were conducted. A report was compiled based on the assessment of situation analysis on the policy environment surrounding PPP. Mainly the report outlined the legal basis and requirements that need to be included in a given PPP process, as well as the gaps existing in the current policy framework.

2) Development of Operational Tools to Enhance PPP

In alignment with the current legal requirements, the standardization of PPP process in SWM among the five municipalities was discussed and the guideline was developed in the form of

a user-friendly handbook, the Operational Handbook on PPP in SWM, with ready to use forms so that any municipal staff could manage a PPP process. The prototype contractual framework was attached with supporting tools to the handbook.

The Operational Handbook outlined in the following five stages, the necessary procedures that need to be undertaken by the municipality, as well as on the part of the private sector, for development of mutually beneficial and legally sound PPP in SWM. The following summarize the major steps required for each stage as suggested within the Operational Handbook.

- Preparatory Stage: Introduction to PPP in SWM
- Stage 1: Planning for PPP
- Stage 2: Procuring PPP
- Stage 3: Preparation and award of partnership contract
- Stage 4: Implementation of partnership projects

3) Orientation Forum for PPP in SWM

Municipal staff were oriented on the standardized operational guideline by using the Operational Handbook. At least two focal points from each municipality were imparted with basic knowledge on the methodology in procuring a PPP agreement. Municipality-specific matters were raised and discussed during the follow up program to enhance the applicability of the Operational Handbook.

4) Application of PPP Agreement

KRM began discussions with UNIQUE to review their existing partnership, and renew their agreement that expired in 2004. The focus of partnership fell on two areas: collection and transportation, and development of a waste processing facility. Since more immediate needs existed in the finalization of agreement on collection and transportation, facilitating the negotiations to frame the contents of the agreement was started as part of the activities. A point of contention to be resolved was the cost-sharing arrangement for the transport of waste from KRM to Teku T/S after the expected closure of Bagmati dumping site. UNIQUE stressed that on their own, they do not have such capacity to transfer waste any further than their current dumping area, and demanded that the municipality bear the responsibilities. Financial feasibility was conducted to assess the actual transportation costs. The negotiation process was supported to the extent that a PPP agreement could be reached between these two parties in the near future.

7.2.3 A-3: Training/Practice of Transfer Station (Teku Transfer Station)

As activities, detail design and improvement works for Teku T/S, as well as a series of workshops, were implemented. The results of these activities are briefly described as follows:

1) Planning of Improvement of Teku Transfer Station

Through the series of discussions at the workshops among the focal points, JICA Study Team and other concerned people, the improvement concept was developed as follows:

- The open top - direct loading system was selected for the improvement of Teku T/S
- The scale of the improved transfer station was set at 200 t/d with two un-loading stations.
- The improved station layout selected involved one-directional traffic with the unloading stations above ground.
- Measurement was discussed on the issues identified including the odor to the surrounding residents and the activity of waste pickers

2) Improvement Works of Teku Transfer Station (Design and Construction Supervision)

The detailed design was completed as per the concept discussed at the workshops. The main facilities, designed were unloading platform, approach and exit ramps, weighbridge and scale house, road widening, drainage system, demolition works, and road marking. Development of an area for waste picking activity was also considered. Natural conditions surveys were implemented with minor modifications in the soil surveys to deepen the investigation there as part of the detailed design.

The improvement works commenced from October 2004, and were completed in March 2005 with construction supervision by the focal point. The layout of the improved Teku T/S is shown in Figure 7.2-3.

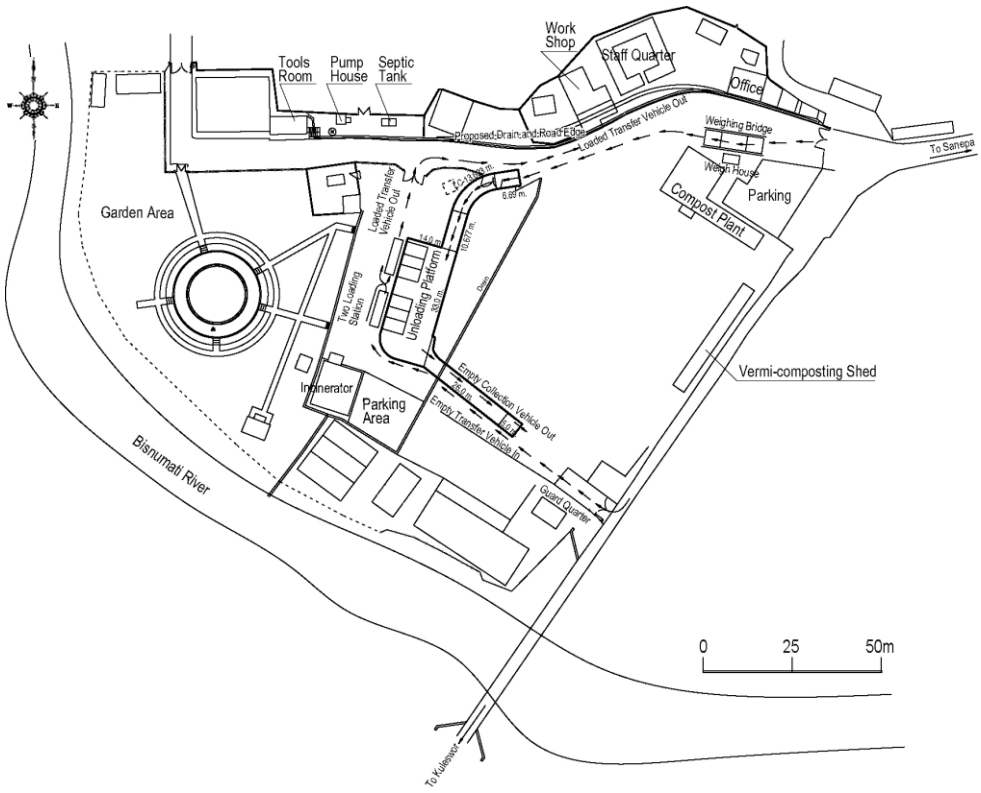


Figure 7.2-3 Layout of Improved Teku T/S

Source: JICA Study Team

3) Practice of O&M of Teku Transfer Station

Partial operation of the improved Teku T/S commenced on June 5, 2005. Three transfer trucks were operated daily, and each made 1-2 trips per day. Records of the trips production were maintained. Speed of unloading was gradually improved.

4) Examination of Other Possible Transfer Stations

The new transfer station candidate site of Balaju in the north of KMC, was visited and the possibility for its development as a transfer station discussed. In addition, the site visit to the candidate site, proposed by LSMC as a transfer station indicated that the site may serve as a temporary facility, by using a storage load system. The site location, on the bank of Bagmati River, over reclaimed waste did not encourage construction of extensive facilities such as platform. An option recommended for consideration by both KMC and LSMC was to receive the waste from LSMC at the improved Teku T/S for a certain period, until perhaps the construction of the waste processing facility.

7.3 Results of Pilot Project B: Promotion of Solid Waste Minimization

7.3.1 B-1: Training for Waste Minimization Facility

The following activities were implemented under B-1 Pilot Project.

1) Review of Existing Technology for Large-scale Composting Facility

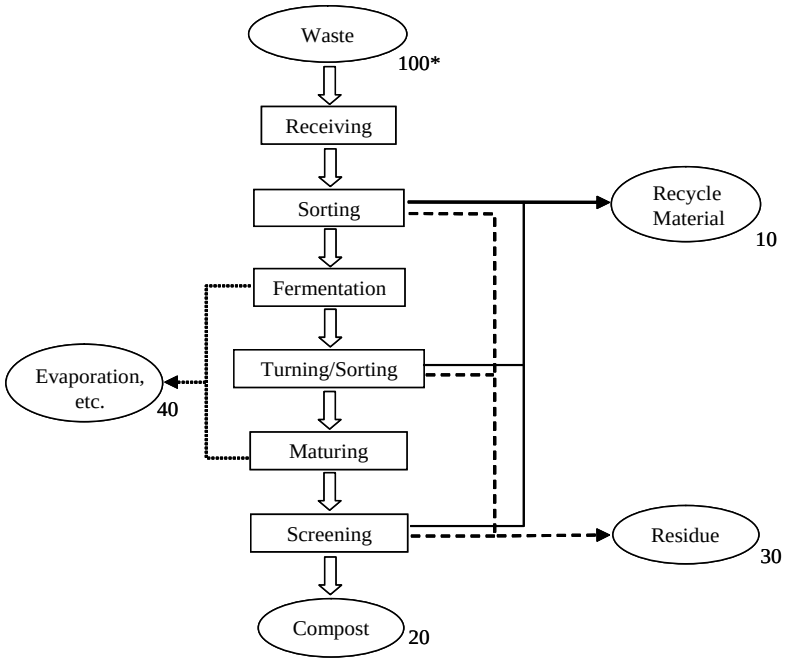
The existing technology for a large-scale composting facility was reviewed by considering a) composting rate in the world, b) Large-scale composting plants in India, c) Specification of a composting plant in Alexandria constructed by Japanese Grant Aid, d) Past proposals on composting plant in the Kathmandu Valley.

In order to learn Indian good practices on composting activities, a five-day study tour to India was conducted on November 7-11, 2004 and it visited the following major large-scale composting facilities.

- Karnataka Compost Development Corporation (KCDC) in Bangalore
- Terra Firm in Bangalore
- Excel Industries Ltd in Ahmedabad

2) Data Collection at a Composting Facility in BKM

Data regarding the composting process, actual treatment capacity, compost production and sales records, material balances, processing period, and necessary human resources for the operation at a composting facility in BKM were collected and analyzed. Confirmed composting process flow at the composting facility is shown in Figure 7.3-1.



*Note) Numbers are estimated material balance

Figure 7.3-1 Process Flow of BKM Composting Facility

Source: JICA Study Team

3) Market Research Survey on Solid Waste Compost

Based on the survey result of the current situation of using compost produced from solid waste (SWC), demand for SWC was estimated at approximately 20,000 to 40,000 ton/year in the Kathmandu Valley with the assumption of increasing the using rate of SWC or conversion from manure to SWC. Market price was observed to be Rs.1.2/kg for both SWC and manure, while it was Rs.15 to 25/kg for chemical fertilizer except the sales price of BKM compost that is only Rs.0.15 to 0.2/kg.

4) Development of a Basic Plan of Large-scale Composting Facility as a Waste Processing Facility

A basic plan for large-scale composting facility was discussed through five times through workshops with focal points. It was concluded that the facility was should be developed step-wise from a treatment capacity of 50-100 t/day as shown in Table 7.3-1. The capacity could be increased to 300 t/day based on experience of O&M of the facility.

Table 7.3-1 Basic Plan of Large-scale Composting Facility

No.	Items	Description
Basic conditions	Treatment capacity	50 and 100 t/d
	Receiving waste	Mixed waste
	Composting process	Aerobic fermentation in windrow
Material balance	Receiving waste)	100 %
	Recycle material	10 %
	Compost products	20 %
	Residue	30 %

No.	Items	Description
Operation/Equipment	Control of waste amount	Weighbridge
	Sorting	50 mm Trommel* + Hand sorting
	Aeration / Turning	Wheel Loader
	Finishing	10 mm Trommel* + Manual glass removal

Note) * Trommel is a kind of rotary type screen.
Source: JICA Study Team

5) Pre-Feasibility Examination on Large-scale Composting Facility

The pre-feasibility examination on the large-scale composting facility was conducted for two cases, treatment capacities of 50 t/day (Case-1) and 100 t/day (Case-2) respectively based on the obtained data. If the sales price of compost product is set at Rs 1.2/kg, both cases are in deficit, while if the sales price is set at Rs 3.0/kg, both cases convert to the surplus as shown in Table 7.3-2.

Table 7.3-2 Result of Pre-Feasibility Examination on Large-scale Composting Facility

No.	Items		Case-1		Case-2	
Capacity	Receiving waste (t/d)	(t/d)	50		100	
		(t/y) *	15,000		30,000	
	Compost product	(t/d)	10		20	
		(t/y)*	3,000		6,000	
Cost	Investment cost (Rs.)		Approx. 43,400,000		Approx. 60,000,000	
	Expenditures (Rs./y): A		Approx. 5,200,000		Approx. 7,800,000	
	Expected compost sales price (Rs./kg)		1.2	3	1.2	3
	Revenue (Rs./y): B		3,600,000	9,000,000	7,200,000	18,000,000
Benefits (Rs/y): B-A			- 1,600,000	3,800,000	- 600,000	10,200,000

Note: * It is assumed that annual working days are 300 days
Source: JICA Study Team

7.3.2 B-2: Practice of Local Level Waste Minimization Activities

The following four components have been done under B-2 Pilot Projects.

(1) B-2.1: Practice of Community-based Waste Minimization Activities in a Model Area (in KMC)

This component aimed to practice community-based waste minimization activities in Ward 21 in KMC as a model area, which consisted of the following two activities.

1) Promotion of home composting to target 500 households

a. Training on home composting
b. Distribution of home-composting bins (CKV compost bins)
c. Promotion of home gardening to utilize compost

2) Promotion of community recycling activities

a. Encouragement of people for separation of recyclable waste at sources
b. Establishment of a community recycling center (CRC)
c. Promotion of utilization of the CRC to people
d. Sale of recyclable waste collected at the CRC

A total 500 sets of CKV compost bins was distributed with training sessions and almost all households have succeeded making compost product which was used in their pot plants and/or home gardening.

(2) B-2.2: Practice of Medium-scale Vermi-Composting (in KMC)

During the study tour in India, successful larger scale vermin-composting practices could be seen, particularly in cases of where the waste is homogenous such as waste from a vegetable market. In addition, in Nepal, vermi-composting has been tried at household level by using a special species of earthworms to convert kitchen waste into relatively higher quality compost product. KMC therefore has started a medium-scale vermi-composting at a developed shed in Teku with support from NGOs by receiving the waste from a vegetable market, Kalimati. The operational situation of vermi-composting is as shown in Table 7.3-3.

Table 7.3-3 Operational Situation of Vermi-Composting in Teku

No.	Items	Description
1.	Start of operation	March 21, 2005
2.	Planed capacity (received waste amount)	500 kg/d
3.	Waste to be composted	Vegetable market waste from Kalimati
4.	Expected compost products	200 kg/d
5.	Expected sales price	20 Rs/kg

Source: JICA Study Team

(3) Practice of Promotion of Home Composting (in LSMC)

LSMC discussed home composting with various organizations concerned, especially NGOs, and examined the current situation of waste generation and activities of NGOs. With the JICA Study Team, LSMC prepared a strategic plan for promoting home composting aiming at distributing 600 compost bins.

In the course of the planning of this Pilot Project, various types of home compost bins were discussed among the focal points from KMC, BKM, KRM, SWMRMC, the JICA Study Team and local resource persons. As a result of the discussions, focal points agreed to use unified home compost bins, namely a "CKV Compost Bin", in the relating municipalities under the coordination of SWMRMC. The CKV home compost bin was designed and developed as a 100-liter plastic vessel bin with a tool set such as fork, spatula and mesh. The CKV compost bins were also used in Pilot Projects B-2.1 (KMC), B-2.4 (KRM) and D-3 (BKM).

(4) B-2.4: Practice of Plastic Separation (in KRM)

KRM has implemented the practice of plastic separation in order to raise awareness about the 3R concept through collecting plastics using a suiro[1]. The targets are youth groups and women in Ward 1 as a core area, Ward 5 as a semi-market area and Ward 14 as a rural area.

[1] Suiro is metal and one side is formed sharp from which plastic bags are stuck to dry. The other side is suitable shape to hang on the wall.

1) Training for Youth Groups and Women

As a first step, KRM organized and facilitated a three-day training regarding the 3Rs concept, plastic separation by using "Suiro" and home composting for the youth group members from three target areas. Following that, two-day training for women in every target ward was conducted by KRM in cooperation with the trained youth groups. At last, suiro and cotton bags were distributed to every participant together with CKV compost bins. As promotional materials, KRM collaborated to design a brochure that mentions the methods of plastic separation collection.

2) Setting up and Utilization of a Store House

Because it is necessary to store the plastic collected by youth groups till the amounts become enough to sell to a Kabadi shop (scrap dealer), a store house has been set up in Ward 6. The store houses are managed by KRM and KRM monitor the amount of collected plastics and keep them till KRM sell to a Kabadi.

3) Plastic Collection Activities

In March, 2005, KRM collected plastics from each of three wards for the first time. In each ward, youth groups collected plastics which were totaled more than 100 kg from the houses in the three target wards. Because there were several kinds of collected plastics, recyclable materials were separated again by youth group members and 77 kg of the materials were sold for Rs. 745 to the Kabadi. KRM now is collecting the plastics from each ward monthly.

4) Two-day Refresher Training

Two-day Refresher Training for both youth groups and women was conducted by KRM in June, 2005 in order to share the experience and problems with plastic collection among participants including visiting other youth groups in KMC Ward 21, to share their experiences.

5) Development of Implementation and Monitoring System

KRM in cooperation with youth groups is monitoring activities of plastic separation collection and is going to make a plan for the next step.

7.4 Results of Pilot Project C: Improvement of Final Disposal Planning and Operation

7.4.1 C-1: Training for Final Disposal Planning

(1) C-1.1: Training for Site Selection

The training sessions for site selection of landfill site were implemented targeting candidate sites for long-term landfill sites for the five municipalities of the Kathmandu Valley as follows. The practice of IEE was also implemented as part of the site selection.

1) A workshop for introducing methodologies of landfill site selection in Japan including strategic environmental assessment (SEA) was held.
2) Site visits to Pharsidol candidate sites (Pharsidol North and South) confirmed that both

sites satisfied most of the selection criteria. Requirements of the Civil Aviation Authority of Nepal (CAAN) were cleared only for Pharsidol North site. However, some critical social and cultural issues were identified. Impact on Pharping well fields needs to be considered as well.

3) The checklist with rating system introduced in the SWMRMC EIA Guidelines was employed for preliminary comparison among Banchare Danda, Pharsidol North and South sites. On the other hand, technical examination showed that i) Banchare Danda was superior from the viewpoints of life time and unit rate (Rs./m^3) of development, followed by Pharsidol North, whereas ii) Pharsidol North and South were advantageous in terms of the cost of transfer haul operation.
4) Based on the discussion of workshops and ad hoc meetings, it was understood that both sites (Banchare Danda and either of the two candidates in Pharsidol) had advantages and disadvantages, and some of them were antithetical between both sites. The practices for preparing a draft scoping report and TOR for EIA was followed targeting Banchare Danda and Pharsidol North, respectively.
5). The option of Banchare Danda development for long-term LF was adopted for examination under the Umbrella Concept, since a decision at the national level for its development had already been made in the middle of the 1990s which gave this site a real advantage including precedent development works and social acceptance in local communities.

(2) C-1.2: Training for Environmental and Social Considerations at Landfill Site

The training sessions for environmental and social considerations on landfill site were implemented targeting candidate landfill site at Taikabu as follows. The practice of EIA was also implemented as part of the training sessions.

1) In response to officially organizing the Taikabu Landfill Site Study Assisting Committee on March 13, 2005, the kick-off meeting was held on April 26, 2005, for discussion on the plan of operation and schedule as well as the site arrangement for the field investigation. Focal points from SWMRMC and BKM, members of the committee, a local consultant and the JICA Study Team participated. However, site investigations such as topography survey and soil investigation were cancelled, due to the opposition by local communities against Taikabu LF development.
2) Conceptual design for Taikabu LF was examined by using the existing data such as topographic maps and aerial photos. Meetings for technical discussion were held with focal points regarding the required facilities, landfill type and level, layout plan, capacity, environmental countermeasures, rough cost estimation, and so on. Table 7.4-1 shows the major project description for Taikabu LFS derived from the conceptual design.

Table 7.4-1 Major Description of Conceptual Design of Taikabu LFS

Total area:	29.9 ha
Landfill area:	10.2 ha
Area for facility/equipment:	4.6 ha
Buffer zone:	15.1 ha
Capacity for landfilling	Approx. 2.06 million m^3
Expected life time:	32 years
Service coverage:	BKM, MTM, and surrounding VDCs
Major facilities	- Waste dam height of 4 m - Composite geo-membrane and clay liners - Leachate collection and recirculation system - Biological treatment plant - Sorting facility for recyclable materials, composting plant, site office, buffer zone, access road, etc.

Source: JICA Study Team

3) Water quality in and around the LFS was analyzed twice as a supplementary environmental survey in order to understand the current conditions. Integrating the analytical results, the EIA recommendations were prepared including the overview of environmental baseline, conceivable impacts identification, and basic framework for environmental management.
4) MOLD and BKM received the approval from MOEST on the scoping document and TOR for EIA on Taikabu LF development on May 25, 2005. BKM was preparing the official EIA study in line with the approval, and it was recommended that BKM integrated the EIA recommendations produced into the official EIA report. In addition, stakeholder consultation with the local communities was suggested for BKM and SWMRMC, considering i) sufficient sharing of information among stakeholders, ii) step-by-step process, and iii) experiences and lessons learned from the LF development in Sisdol S/T-LF.

7.4.2 C-2: Training/Practice of Semi-aerobic Landfill

The training sessions and practice for semi-aerobic landfill system were implemented at Sisdol S/T^LF as follows through the improvement works the Valley 1 of the site including planning, detailed design, construction supervision, O&M, and environmental monitoring.

1) A site visit to Pokhara LF was helpful in understanding the importance of planning and gradual implementation of landfill. The Pokhara Landfill just recently commenced operation, the delay being due to lack of heavy equipment and operation budget. Furthermore the landfill construction was substantially delayed because of opposition of the surrounding community.
2) A site visit to Malaysia provided an opportunity to interact with participants from Malaysia and other countries at the seminar and workshop. Application of the semi-aerobic landfill system was extensively discussed.
3) The semi-aerobic landfill system was adopted for Valley 1 of Sisdol S/T-LF as a Pilot Project. The major facilities and equipment provided in the detailed design are shown in Table 7.4-2.

Table 7.4-2 Major Facilities/Equipment of the Valley 1 of Sisdol S/T-LF

Demarcation	Major facilities and equipment designed
Pilot project activities	- Landfill area development including excavation, liner basement, clay liner installation, internal service road, etc. - Leachate collection pipe network and re-circulation system including retention pond, aerator, pumping, etc. - Landfill gas vents. - Weigh bridge installation.
Works by SWMRMC	- Heightening of west waste dam. - Utility works including site office, heavy equipment parking, gate, fence, power supply, etc.

Source: JICA Study Team

4) Improvement works of Valley 1 started from October 1, 2004. Civil works were completed and handed over to SWMRMC on March 17, 2005, whereas procurement and installation of equipment were handed over on June 9, 2005. The layout of the improved Valley 1 as semi-aerobic landfill is shown in Figure 7.4-1.

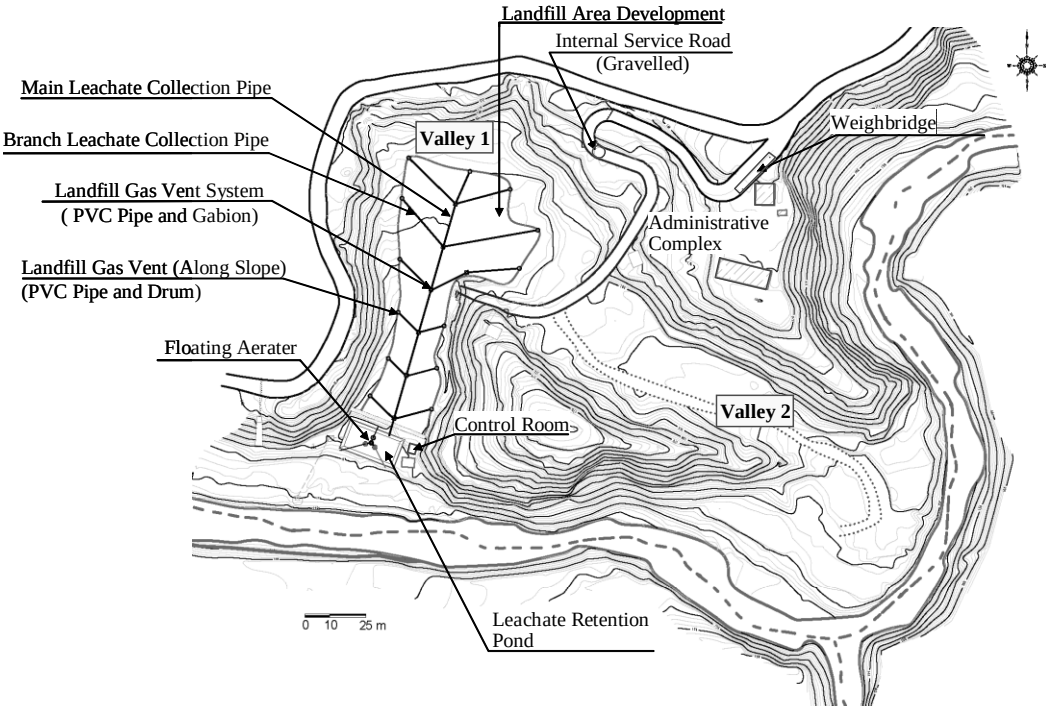
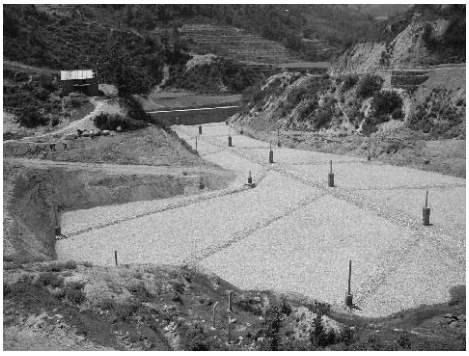


Figure 7.4-1 Layout of Improved Valley 1 of Sisdol S/T-LF

Source: JICA Study Team

	
Landfill area of Valley 1	**Leachate retention pond with aerator and pump**

5) Prior to commencement of operation, a local committee, OSLSMCC, was formed and legally registered as a body to coordinate the LF operation with SWMRMC, KMC, and LSMC. Agreement for operation among them was made on May 15, 2005, and the opening ceremony of Sisdol S/T-LF was held on June 5, 2005 (Environmental Day).
6) Environmental monitoring especially for water quality was conducted as one of the Pilot Project C-2 activities. Water quality of the adjacent rivers, groundwater of bore holes, and leachate were analyzed twice before operation, and three times after operation. Also, the Environmental Coordination Committee is under formulation. Therefore, a sharing meeting on the results of environmental monitoring was held, inviting the focal points from SWMRMC, KMC, and LSMC as well as the key members of OSLSMCC and a local consultant.
7) The detailed design including supplementary surveys of the natural condition for developing Valley 2 of Sisdol S/T-LF is on going under the SWMRMC initiative, based on the experience and technical knowledge obtained through the Pilot Project C-2.

7.5 Results of Pilot Project D: Promotion of Public Awareness, Behavior Change Communication/Education

7.5.1 D-1: Training for Community Mobilization Activities

In order to provide the basic knowledge and skills of strategic planning, implementation, monitoring or supervision and evaluation regarding public awareness, behavior change communication and education on SWM, various training sessions and a study tour were implemented for the focal points and the other staff of the five municipalities in charge of community mobilization or community development and SWMRMC. They included Interpersonal Communication and Behavior Change Communication (BCC) Skill Training, Training of Trainers (TOT) and Social Marketing. The study tour to Hetauda was also organized, where the local stakeholders have promoted community-based composting and plastic collection activities.

It was revealed at the time of evaluation that this training and the study tour were very useful and relevant to their work. As the results of self-assessment and competency assessment that were conducted before and after the Pilot Project also illustrated, there was significant increase in the level of knowledge and understating of technical topics among the targeted municipal staff.

The D-1 component has contributed to not only improving the level of knowledge and skills regarding public awareness and BCC for SWM but also promoting the sharing of experience and the inter-municipal coordination and cooperation among the five municipalities and SWMRMC in the areas of community mobilization. A series of sharing meetings have brought about some positive effects. For example, CDS/LSMC and CDSS/MTM have planned to introduce a City Volunteer Program being undertaken by CMU/KMC in order to mobilize youth as volunteers to be involved in various municipal activities including SWM without payment. The know-how of group formation and mobilization of women has been also transferred from CDS/LSMC to KRM by sharing their own experiences and useful approaches. It was also decided that the Community Mobilization Network (CMN) would be established with the objectives of sustaining the effects of sharing meetings, in which the five municipalities and SWMRMC will take turns serving as facilitator. It was expected that the CMN would hold sharing meetings on a regular basis and help provide interactive learning and sharing opportunities for particular issues and concerns related to the BCC component, community mobilization and community-based SWM activities.

7.5.2 D-2: Practice of Mass Communication and Education

The Pilot Project D-2 started with the selection of the mascot of the Study. The focal points of the five municipalities in coordination with SWMRMC and the JICA Study Team, with the technical support of Clean Energy Nepal (CEN), identified a boy named "Ashakaji", which literally means "hope", as a mascot of the Study. They also identified particularly both children and housewives among the general population as the target audience of mass communication and the education program. In addition, they specifically defined the desired attitude and behavior changes to be focused on during the implementation of the Pilot Project as follows.

Table 7.5-1 Identified Key Elements for BCC Program

Target Audience	General Population (Special focus will be given to *housewives and children*)
Desired Attitude Change:	Self-responsibility for SWM "SWM is not only the municipality's responsibility but also our responsibility"
Desired Behavior Change:	3R Activities (Reduce, Reuse, Recycle) "Solid waste should not be just dumped. Waste should be recycled and managed properly."

Source: JICA Study Team

Based on the knowledge and skills acquired by Interpersonal Communication and BCC Training, the focal points were involved in designing promotional materials such as stickers, notebooks and leaflets and creating effective messages on SWM.

The 1st Public Events were organized by the five municipalities in October to November 2004 with the objectives of enhancement of self-responsibility on SWM and promotion of waste minimization, waste segregation, making compost, recycling and safety as well as appropriate disposal of solid waste. The 1st Public Events included a two-day exhibition program with a street drama on SWM as well as hands-on training on 3R activities, a painting workshop targeting school children, installation of art work hoarding boards and wall painting, and broadcasting radio jingles on effective SWM.

For the two-day exhibition, around 3,200 to 4,700 visitors were registered in each municipality. According to the results of a rapid questionnaire filled in by visitors, most respondents learned about reuse and composting, and showed their willingness to participate in training on SWM if such opportunities are given. Although it was the first time for the municipalities except for KMC to organize such an exhibition, all municipalities were more or less satisfied with their achievement and gained a degree of confidence. At the same time, they acknowledged that there was still a room for further improvement in terms of content and management.

The painting workshop was held in each of the five municipalities in order to familiarize school children in grades 8 to 10 with SWM issues, to make them feel responsibility in SWM and to explore their talents through art work. These art works were then studied and developed by professional artists to make a final product for hoarding boards and wall painting. Wall paining of size 15m x 2m was conducted in LSMC. In the other four municipalities, hoarding boards of size 2.5m x 5m were hung in the ideal locations of the respective four municipalities.

For a radio jingle, the most popular actor of Nepal, Mr. Hari Bannsha Acharya and Ms Sabitri Sharma, had given their popular vocal. The jingle has been aired on the most popular FM stations in the Kathmandu Valley and contributed to delivering one of the key messages that waste can be managed by responsible citizens.

On the occasion of Earth Day on April 22 and Environment Day on June 5, 2005, the 2nd set of Public Events for effective SWM including a two-day exhibition program were organized with the initiative of the five municipalities. Based on the experiences, feedback and lessons learned from the 1st Public Events, a particular focus was given to the provision of relevant skills on 3R activities for SWM and the presentation of a comprehensive picture from overall waste flow to 3R activities.

During the two-day exhibition, altogether around 1,500 to 6,400 visitors were registered in each municipality. If including unregistered visitors, it was estimated that 3,000 to 7,000 people might have visited this program in each of the five municipalities. The results of the rapid questionnaire filled in by visitors revealed that a large number of people were willing to take action for source separation and making compost after the exhibitions.

The Clean-up Campaign was conducted in certain areas of the five municipalities on the occasion that Sisdol Landfill came into operation in June 2005. There were 165 to 350 participants in each municipality including municipal staff, NGOs and CBOs, women groups, Nature Clubs, city volunteers, youth clubs, colleges and schools. Most of the collected waste which had a volume between half a truck and 6 trucks was carried to Teku T/S and then to Sisdol landfill for its disposal. Although it was a one-day clean-up campaign, it contributed to encouraging local people to keep their city clean and not to dump their waste haphazardly.

7.5.3 D-3: Practice of Interpersonal Communication and Education

Mass communication and education is an effective approach in terms of imparting information and knowledge on SWM to large groups of people quickly. However, it is a one-way communication channel, which is considered to have relatively little effective for behavior change. On the other hand, the interpersonal communication and education

approach is recognized as an effective two-way communication channel that encourages the interactive dialogue and stimulates behavior changes between individuals or among group members.

The practice of interpersonal communication and education has been conducted on a pilot basis in BKM with the support of Environmental Camps for Conservation Awareness (ECCA). This Pilot Project focused on children since they were expected to be effective agents as social mobilizers or facilitators for SWM activities among their friends, family members and community members.

It started with the identification of target areas for formation of Nature Clubs comprising child members at the school and community levels. BKM decided that three toles in three wards would be selected as target areas for Pilot Project D (same area as Pilot Project A-1.1). Furthermore, a core group comprising 11 to 19 members was formed in each target ward, and both one group leader and one facilitator who had a strong desire to support Nature Clubs and other SWM activities were selected in each core group.

A three-day camp was undertaken for school children in September 2004 in order to give them information about the current situation with SWM in BKM and the concept of 3Rs as well as source separation. In the last day of this camp, a total of six Nature Clubs were established. As shown in Figure 7.5.1, three clubs were formed in schools and the rest were formed in each tole. Once Nature Clubs were established, BKM in coordination with ECCA provided various supporting programs such as the one-day field visit regarding SWM, the workshop on product making from waste, distribution of handbooks on SWM, the interaction program with Nature Clubs in KMC, the spot inter-school essay competition related to SWM issues, talk programs and training with street drama. Besides these activities, each Nature Club prepared three-month action plans as group activities and undertook a variety of activities with a small amount of provided money as seed money equivalent to Rs. 5,000. Such activities included door-to-door campaign for disseminating information on SWM, clean up programs in schools and communities, publication of a handbook covering SWM and environmental articles and prize distribution of product made from waste materials.

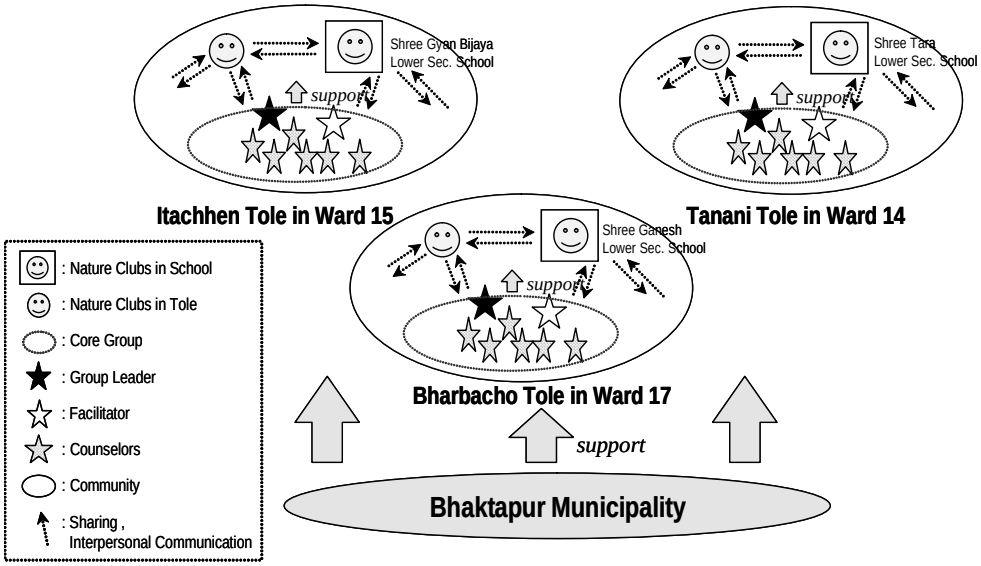


Figure 7.5-1 Nature Clubs and Supporting Stakeholders

Source: JICA Study Team

Successful Nature Clubs call for a supporting mechanism in schools or communities. Thus, the orientation program and the interaction program were carried out for these stakeholders in order to promote the better understanding of and support for the Nature Clubs and their activities.

It was revealed that members of Nature Clubs disseminated basic information and skills on SWM that they learned to their family members first, and then their friends. Most of them felt that participating in Nature Clubs contributed to increasing their self-confidence and improving their studies. Although they perceived that the school and community have supported Nature Clubs' activities, they responded that they would discuss and seek for practical solutions among members if they face certain challenges or problems. It is too early to identify visible effects as a whole through the interpersonal communication and education approach of Nature Clubs. However, it should be noted that one Nature Club was newly established in the nearby school after participating in the interactive program with Nature Clubs. The people in the community evaluated that the Nature Clubs' activities contributed to raising awareness of SWM among the public to some extent, and to keeping the communities cleaner than before.

7.6 Results of Pilot Project E: Development of Operation and Management Capacities

7.6.1 E-1: Training for Action Plan Operational Management

(1) Activities Implemented

Pilot Project E-1 consists of the Training Component with eight modules and supplementary Support to Organizational Development (OD Support) packages, aimed to develop applicable management tools and/or operational systems/procedures (e.g. restructuring plan and staffing arrangement, operational manuals, budget monitoring systems, information management strategies, etc.) that would facilitate SWM operations.

1) Training Components

Eight training modules were completed. Each module consisted of one to two day training and half-day follow up sessions after an interval period. All sessions were held at each municipality office to encourage maximum participation.

Table 7.6-1 List of Eight Training Modules

Module	
1	Operationalization Of Action Plans (SWM Action Plan Kick Off Workshop)
2	Setting up of SWM Monitoring and Evaluation (M&E) System and Introduction of Management by Accountability
3	Program Based Budgeting and Expenditure Monitoring
4	Leadership Development and Office Management
5	Engendering Public Private Sector Partnerships (PPP)
6	Human Resource Management and Development
7	Managing Stakeholder Expectations and Conflict Management (Target municipality: KMC, LSMC, BKM only)
8	Self Evaluation Exercise and Formulation of Annual Work Plan and Budget for FY2062

2) Support to Organizational Development (OD Support)

The OD Support component is aimed to supplement the training component under E-1 to initiate some specific improvements in municipal operational management systems. The contents of the support packages were usually identified through the discussions held at the training sessions and were developed in full consultation with the municipal task force members.

Table 7.6-2 List of OD Support Packages

Municipality	Requested Support
KMC	Restructuring and preparation of staffing arrangements for Environment Dept.
LSMC	Enhanced coordination among SWM task force members within the municipality
BKM	Support and guide to prepare TOR of the SWM Task Force
MTM	Restructuring of MTM and preparations of TORs
KRM	Support to Kirtipur Municipality for restructuring organization with reference to SWM

Source: JICA Study Team

(2) Results of the Pilot Project E-1

The following are specific outputs achieved in the **E-1 Training Components**:

- Job Responsibilities Matrix for the Action Plan Implementation of each municipality
- SWM Annual Work Plans and Program-Budgets for FY 2061
- SWM Annual Work Plans and Program-based Budgets for FY 2062
- Monitoring and Evaluation Framework for the SWM Annual Work Plans
- SWM Public Private Partnership Short-term Strategies
- Conflict Maps and Basic Strategic options/consideration for conflict transformation on municipal-specific topics
- Mid-year and End Year Monitoring Report of SWM Programs in Five Municipalities for FY2061
- Self Evaluation by Each Municipality for FY2061
- Restructuring Plan, Staffing Arrangements and Job Descriptions for KMC
- Terms of Reference of the SWM Task Force in LSMC and BKM
- Restructuring Plan, Staffing Arrangements and Job Descriptions for MTM and KRM

1) Individual Learning

The most immediate outcome of the Training Component was the individual learning achieved by each of the participants. At each of the follow up sessions, the participants were requested to take a simple test that would indicate how much learning was achieved on training content. The results were quite promising as the participants on the average scored in the rage between 85 to 95%.

Despite the high learning achievements at the individual level, as reflected in the results of the Training Course Evaluations, how to increase the application of such learning would be key in inducing organizational change and improvements in performance of each municipality. For this, institutional support, especially from the municipal leadership would be essential in utilizing the enhanced knowledge and skills of the T/F members obtained during the Pilot Project.

2) Structures in place in Municipalities for Action Plan Implementation

As observed in the current organizational set up of the five municipalities, all but KMC had no clear designation of a section that could address areas necessary for implementing SWM Action Plan. In order to address this, two strategies were taken by the project. For mid-size municipalities such as LSMC and BKM with sections already well established within respective areas, i.e. Planning, Community Development, Sanitation, rather than proposing a new organigram, Terms of Reference (TOR) of the Task Force were developed to strengthen the Task Force as the inter-sectoral coordination mechanism. The TORs also placed the Task Forces as the primary responsible body to implement SWM A/Ps. For the smaller municipalities, MTM and KRM, where there was some flexibility on the part of the municipality to revise the current organigram, a new institutional set up was proposed.

3) Mechanisms in place in Municipalities for Action Plan Implementation

After the DfA/Ps were formulated in May 2004, no mechanisms existed in the five municipalities to ensure that the SWM programs are implemented in alignment with the DfA/Ps. In order to address this gap, the practice of formulating SWM Annual Work Plans and Monitoring and Evaluation Framework was introduced so that the responsible staff would be able to navigate respective municipal programs to be directed toward achieving objectives identified under the A/Ps. Results of such intervention at the outcome level were mixed.

4) Increased SWM Budgets Programmed and Allocated for Fiscal year 2061

One of the main positive outcomes from this Pilot Project was the increased amount of budget provision for SWM activities based on the formulation of Program-based budgets. For FY2061, all five municipalities attached a program-based budget to their official budget proposals submitted to the Municipal Board and Council, and received sufficient budget provision to support the activities outlined in the Annual Work Plan. Budget increases were most prominent in MTM and KRM. The municipalities commented that the fact that they had prepared a program based budget provided stronger grounds to fulfill their budgetary requirements.

7.6.2 E-2: Practice of Solid Waste Data Management

The activities consisted of two major components, which are: i) waste quantity and quality surveys, and ii) solid waste data management including provision of sets of computer and printer to all five municipalities and SWMRMC.

(1) E-2.1: Practice of Solid Waste Quality and Quantity Survey

For the practice of solid waste quality and quantity survey, a total 1,000 samples during weekdays and weekends for seven consecutive days were collected involving focal points from each of the five municipalities, making it a total of 7,000 samples for waste quantity survey. Out of these samples, 44 samples each for weekdays and weekends (total 88 samples) were selected for the waste quality survey. As a result of the surveys, Unit Generation Rates (UGRs) of household waste itself (Household UGRs) were estimated. However, there are other wastes generated from different sources to be counted in municipal

waste such as commercial waste (waste from restaurants, hotels, etc.), street waste (littered waste on the streets) and the waste brought from the surrounding VDCs. For example, in BKM, it was observed that approximately 5.6 tons of waste was brought from the surrounding VDCs to the BKM's waste collection system, which was more than 25% of total generation waste quantity inside the municipality, and also the relatively large amount of commercial waste was generated in the core area of the World Heritage tourist zone. Consequently, the Municipal UGRs were set as shown in Table 7.6-3 by the focal points in order to estimate actually amount of waste generated from each of the five municipalities.

Table 7.6-3 Unit Generation Ratio of Municipal Solid Waste

Municipalities	Household SW UGR*	Additional Index	Municipal SW UGR**
	Kg/d-capita		Kg/d-capita
KMC	0.250	66.4 %	0.416
LSMC	0.285	46.0 %	0.416
BKM	0.120	163.3 %	0.316
MTM	0.160	66.3 %	0.266
KRM	0.150	77.3 %	0.266

Note: * Based on Waste Quantity and Quality Survey by JICA Study Team in September 2004
** Municipal Unit Generation Rate = Household Unit Generation Rate (weight) x Additional Index
Source: JICA Study Team

Regarding the waste composition at household level, 70 to 80 % is organic kitchen waste, while 5 to 10% is plastic and paper respectively.

(2) E-2.2: Practice of Solid Waste Data Management

For effective solid waste data management, sets of computer and printer were installed to all five municipalities and SWMRMC and training for computer skill was provided to focal points. In parallel, the customized data base and management system (DBMS) for SWM has been developed discussing its contents and structure among the focal points. The developed DBMS was used on a trial base at once and then improved as the user-friendly system. The activities implemented are as follows:

- Training needs assessment on solid waste data management
- Capability assessment of human resources
- Workshop and training sessions for computer skill and operation of DBMS
- Development the customized DBMS, installation and operation of DBMS

Input windows of the developed DBMS which uses MS-Access are shown below.

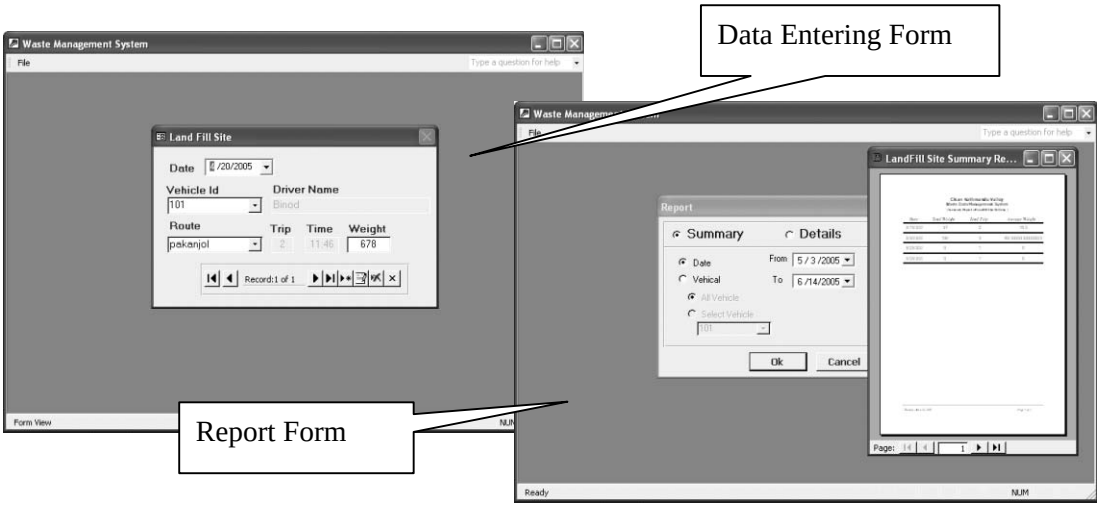


Figure 7.6-1 Operation Windows for Solid Waste Data Management System

Source: JICA Study Team

It was confirmed among the focal points that the installed and arranged solid waste data in the DBMS in the five municipalities would be send to SWMRMC for policy development and publication at the web site of SWMRMC.

7.6.3 E-3: Training for Solid Waste Management Policy and Technology

The third country focus training in Japan for Nepalese counterpart was conducted for 26 days in Kitakyushu City in Fukuoka Prefecture and other neighboring cities in Japan, from 1 to 26 December, 2004. For the training this time, a total seven engineers from the Nepalese side, two from KMC and one from each of the other four municipalities and SWMRMC, were invited to study the solid waste management system in Japan.

The curriculum of the training included many different fields such as course orientation, general environmental outline in Japan, community level environmental education, and a lecture for time and motion study. In addition, trainees could visit various SWM related facilities like the landfill and waste treatment facility in Fukuoka city, private composting in Nagasaki City, and municipal collection activity, hospital waste management, and material recycling facilities for metals and paper in Kitakyushu. Through the course, SWM trainees prepared an action plan by themselves reflecting what they observed during the training.

7.7 Evaluation of Pilot Projects

Based on the results and achievements of the Pilot Projects displayed after a one-year implementation period, the CKV Study Team conducted a final evaluation of the activities of the Pilot Projects from the view point of five criteria, i.e. relevance, effectiveness, efficiency, impact, and sustainability. The results of evaluation are summarized in Table 7.7-1 on the respective Pilot Projects.

Table 7.7-1 Summarized Evaluation of Pilot Projects

Pilot Projects	Relevance	Effectiveness	Efficiency	Impact	Sustainability
A: Improvement of Collection and Transportation	The activities are quite relevant to the needs of target Municipalities. MTM needed for the pilot for their waste collection system while BKM needed separated organic waste for their compost plant. A clear system of PPP is to be established urgently in KMC and KRM. The effective transfer of waste at Teku T/S is urgent need of KMC.	The outputs could contribute to achieve the overall goal of the Pilot Project by removing the waste that used to be dumped in the city area in MTM out to the designated destination. BKM could gain the expected skills and knowledge for extending the area for source-separated collection. Teku T/S has been improved for effective transfer.	There were external conditions affecting MTM/BKM activities, i.e. the delay of procurement of a new collection truck in MTM, and no preparatory meeting with staff due to shifting to night time/early morning collection in BKM. However, a PPP hand book was prepared in time and Teku T/S is also improved quickly.	It is very remarkable that a greater willingness to improve the solid waste management by MTM staff has been generated. That BKM people's awareness will be raised to think what waste or environment is when they separate the waste at the source, is the expected impact. Other than the Pilot Project, MTM has started PPP for collection.	MTM should keep continuous agreement for transporting its waste to KMC or BKM, inline with further effort to procure a new collection truck. For BKM, the sustainability should be carefully secured by more frequent communication with local people. The PPP handbook and Teku T/S are being used by target municipalities.
B: Promotion of Solid Waste Minimization	In order to minimize the waste to be handled, waste minimization is an urgent need of the Valley. The target areas for the Pilot Project were suitably selected by each municipality considering the accessibility, active community participation, etc.	The project purpose of the Pilot Project has been successfully achieved. Especially in KRM, a great improvement can be achieved for self- independent SWM.	Most of the necessary inputs have been made as planned from the Japanese side and Nepalese side.	It can be said that the management ratio of target areas in KMC, LSMC and KRM are improved through the pilot project. There are many requests from other wards in KMC, LSMC and KRM to introduce the same kinds of activities.	KMC and LSMC has already tried to expand the program to other areas and they have also allocated the budget for the program in this fiscal year. This tendency will make the project sustainable.
C: Improvement of Final Disposal Planning and Operation	It can be said that the Pilot Project has met the basic and keen needs of the Nepalese side on technical knowledge and experiences for developing a semi aerobic landfill.	The focal points and TWG members can be considered to have obviously strengthened their capability for semi-aerobic landfill system through Sisdol operation, Taikabu EIA practice and the JICA Country Focused Training.	The outputs regarding Taikabu LFS and Sisdol Valley 1 were obtained as planned. It can be said that the activities to produce the outputs were sufficient, and that inputs were provided properly in terms of input amount and timing.	Through Sisdol operation, the solid waste disposal ratio to sanitary landfill site(s) was increased from the current level of 0%. Considering the Taikabu development, the overall goal of the project C is expected to be achievable.	In order to ensure the sustainability of LFS planning as well as operation of a semi-aerobic landfill, successive technical support and following up will be essential.

Pilot Projects	Relevance	Effectiveness	Efficiency	Impact	Sustainability
D: Promotion of Public Awareness, Behavior Change and Communication / Education	The Pilot Project met the needs of target groups and had highly validity of approaches, since the target groups had put what they learned from the training into actual practices.	Since the target groups acknowledged that they learned through the practical implementation of the Pilot Project, the effects of the outputs were sufficiently recognized.	Most of the necessary inputs have been made as planned from the Japanese side and Nepalese side. However, much effort for budget allocation needs to be made by the Nepalese side when similar interventions are to be undertaken by municipalities in the future.	It could be said that the Pilot Project successfully stimulated the public to create a demand for information and skill training on SWM.	It is highly recognized that the Pilot Project has improved the relevant knowledge and skills in public awareness, education, and behavior change among the target groups. It is expected that the effects could be sustained from the technical viewpoint if the necessary budget and the appropriate allocation of the staff were to be secured.
E: Development of Operation and Management Capacities	Since the main purpose of the Study was to install the A/Ps in each municipality, it was indispensable to establish structures and mechanisms to implement those plans in a sustainable manner including SW data management. Thus, the Pilot Project was well aligned with the overall strategy of the Study.	The Pilot Project contributed to achieving the project purpose on SWM Administration capacity development, by facilitating the development of Annual Work Plans for FY2062 and development of databases on SWM in all five municipalities.	The efficiency of the pilot project was relatively high due to the flexible design and the manner in which the inputs were provided by the Team. Whenever a specific need was identified by a municipality, it was encouraged that the Pilot Project addressed it for immediate results. In addition, waste Q&Q survey was conducted smoothly and finally that data has been input to the developed database.	To date, if the commitment of the five municipalities remains strong to continue capacity development activities, and if trained staff stay within the system, it is foreseeable that the long-term goal of "SWM service delivery of respective municipalities is improved" would be achieved. As a positive impact, through the sampling survey, participating households could feel some interest in SWM.	The Pilot Project was successful in introducing the knowledge and tools to improve SWM operational capacities of the five municipalities. However, additional efforts are necessary in the future at practical levels, in order to sustain the effects of the project. It is recommended that regular waste Q&Q surveys and frequent database system operations be carried out.

Source: JICA Study Team

7.8 Lessons Learnt from Pilot Projects

7.8.1 Pilot Project A: Improvement of Collection and Transportation

In the early stage of the pilot project activity in BKM, it was unclear how the local people participated in the activity because the communities of BKM were said to be quite different and unique from those of other municipalities in the Kathmandu Valley. However, it could be said that people were relatively cooperative to the source separation of waste. Although some of participated households discharged the waste mixed together against the segregation rule, it was considered to be improved through the re-training of those people. One of the most remarkable progresses of this activity was that quality of compost product from the source-separated collected waste had been significantly improved as no unsuitable materials for composting such as glass and metal particles were included to the collected waste. This fact leads to produce more valuable quality of compost product and also leads to increase the production capacity by extending the source-separated collection cover area with the explanation of this successful result.

The activity in MTM was the first municipal waste collection and transportation practice. Though some of residents who are living near the new waste collection points complained about littering the street, most of the people seemed to welcome this activity. At the moment, MTM tentatively transport the collected waste to Teku T/S under the agreement between both municipalities. MTM still has the issue of securing its own designate landfill site to continue transporting the collected waste. It was clarified that MTM can carry out more efficient waste collection such as bell collection system with appropriate equipment through the continuous effort of current waste collection and transportation activity.

There were various issues in which the PPP process was discussed, such as the orientation program that included the private sector organizations (PSOs), training, and facilitation sessions with municipalities, and these became opportunities to raise awareness on the benefits of entering a PPP agreement. Especially among the PSOs, strong interests were expressed not only by former municipal contract holders, but also by new entities. The municipalities also are taking advantage of the momentum created to reengage with partners to explore various PPP options. However, in the practical stage of KRM case, it was learnt that detail demarcation of cost and responsibility between municipality and private sector should be negotiated and determined prior to the commencement of the PPP activity.

Teku T/S was improved and used partially with some rental dump trucks and KMC's compactor trucks. According to this activity, transfer efficiency was improved by using the new platform and it resulted in recognition of importance of transfer station among the municipalities. Original design condition of improvement of Teku T/S was based on the day-time waste collection and transportation system as it was before. Therefore, the appropriate arrangement between collection shift to the transfer station and transportation shift from there to Sisdol S/T-LF is crucial issue for KMC because at present all municipalities should collect the waste at night till early morning but Sisdol S/T-LF can be only operated in day time.

7.8.2 Pilot Project B: Promotion of Waste Minimization

The proposed capacity of waste processing facility for its initial stage was 50 tons per day or 100 tons per day as the result of discussions at the workshop and other occasions. In both cases, the revenue of compost product sales could make positive profit when the unit sales price is set to be Rs. 3/kg. However, it can not help stopping to be in red when the unit price is Rs. 1.2/kg that is the same price as the existing low quality compost. It can be said that improvement of compost quality should be an issue to be tackled.

Introduction of home composting was considered to be difficult in Nepal at the beginning of the Pilot Projects because of religious custom that kitchen waste, which accounts 60 to 70% of the waste composition and locally called "Jutho", was socially or culturally an untouchable matter from the view of "uncleanness concept". However, against such anxiety, distribution of home composting bins was done quite smoothly and most of all participated families tried to make compost and to use it at their home garden. In fact, there were still some households who never touch their kitchen waste but majority of households can be the potential for introducing home composting activity.

Segregating plastic waste from the household was surely implemented as the activity of the Pilot Projects, but such collected plastics had to be separated again more strictly by each plastic type like HDPE, LDPE, and PVC because some of them can be sold in the market but some not. In addition, it is also learnt that the market condition to such valuable plastic is always fluctuated and needed to be monitored carefully.

On the other hand, it was confirmed that vermi-composting could be applied in the medium scale about 500kg/day through the activity. However, as lessons learnt, it was pointed out that careful temperature control should be done in each primary and secondary fermentation stage because earthworms were easily affected by the temperature change. Furthermore, careful evaluation of compost product quality with biological and chemical data should be necessary for the development of more reliable vermi-composting.

7.8.3 Pilot Project C: Improvement of Final Disposal Planning and Operation

For the EIA practice at Taikabu LFS by BKM, there were some oppositions occurred from the local people living in and around the target site. On the other hand at the Sisdol S/T-LF, a local committee named "Okharpauwa Sanitary Landfill Site Main Coordination Committee (OSLSMCC)" was established and legally registered. The purpose of this committee is to coordinate to manage Sisdol S/T-LF appropriately among SWMRMC, KMC, LSMC and local communities. Since the commencement of landfill operation at Sisdol, the operation review meeting was held once a week continuously to discuss any issues caused by the operation among those concerned organizations. This approach can be said one of the good lessons learnt from the Pilot Project C.

In the technical aspect, though only one and half months have passed since the commencement of Sisdol S/T-LF operation, it was observed that the sanitary landfill operation work has been carried out well, especially littering of dumped waste and generation of odor have been controlled. However, continuous supply of cover soil became one of the issues to be solved because KMC was using the same volume of cover soil as the disposed waste at the moment. This situation was caused by the difficulty of landfill operation in the rainy season. Both waste transportation truck and soil transportation truck can not enter into

the dumping area due to the muddy condition and have to dump them on the edge of the dumping area. A bulldozer had to move them from that edge to the latest dumping spot and, at that time, bulldozer could not help mixing the soil and waste. Therefore, it was learned that more detail operation manual should be prepared based on the actual field condition so that daily cover soiling can be done appropriately in both rainy and dry seasons.

Continuous environmental monitoring is needed to be implemented although the current leachate quality was much better than that from ordinary waste disposal site. This was because of smaller amount of discharged waste and larger rainfalls in a rainy season in these a few months of operation at Sisdol.

7.8.4 Pilot Project D: Public Awareness and Behavior Communication/Education

It is commonly understand that mass communication and education is a valuable approach to influence many people promptly and effectively. Particularly in the field of solid waste management, it was learnt that these approaches could contribute to raise the public awareness, to give the practical solutions for solid waste problems, and to disseminate the educational messages and fundamental information regarding the solid waste management. Since the municipal staff provided skills for 3Rs attempts at the public events, many people showed deep interest in SWM. Especially it should be noted that request for purchasing the home composting bins or for participating the SWM training course was significantly increased after the public event held as one of the mass communication and education activities. The network between the municipalities, NGOs, CBOs, universities, schools and media has been also strengthened through the activity.

Regarding the promotion of behavior change, interpersonal communication and education was recognized rather effective way of interactive communication so that behavior change could be accelerated through the exchange of communication among individuals or group members. Actually it was observed that children who were members of Nature Clubs told what they learned about basic information or skills/knowledge of SWM to their family first and then to their friends. In addition, interpersonal communication by children was quite effective in BKM where it was considered to be difficult to establish such communication framework due to the social background.

7.8.5 Pilot Project E: Development of Operation and Management Capacities

Ownership for preparation of the DfA/Ps was innovatively improved among each municipality through the review and common understanding of the DfA/Ps and the transfer of the authority to appropriate sections/staffs. Especially it could be said that responsibility sharing in order to clarify the tasks for each strategy proposed in the A/Ps could contribute to improve the ownership slowly but certainly. Required effective procedure for implementing the A/P was to set the place for discussion and public consensus regarding each activity by involving the field staff as much as possible. It was also necessary that various classes of human resources should be systematically involved in introducing, standardizing, internalizing and implementing the appropriate process and procedure.

On the other hand regarding the solid waste data management, the current situation was that the data of municipality's SWM activity was relatively easy to be collected and managed but

that of private activity by private sector or NGOs was quite uncertainly to find their actual situations. It was learnt that the data of such private activities should be disclosed as the duty of involved organizations under the PPP policy.