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 II: Main Report

September 2005

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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.

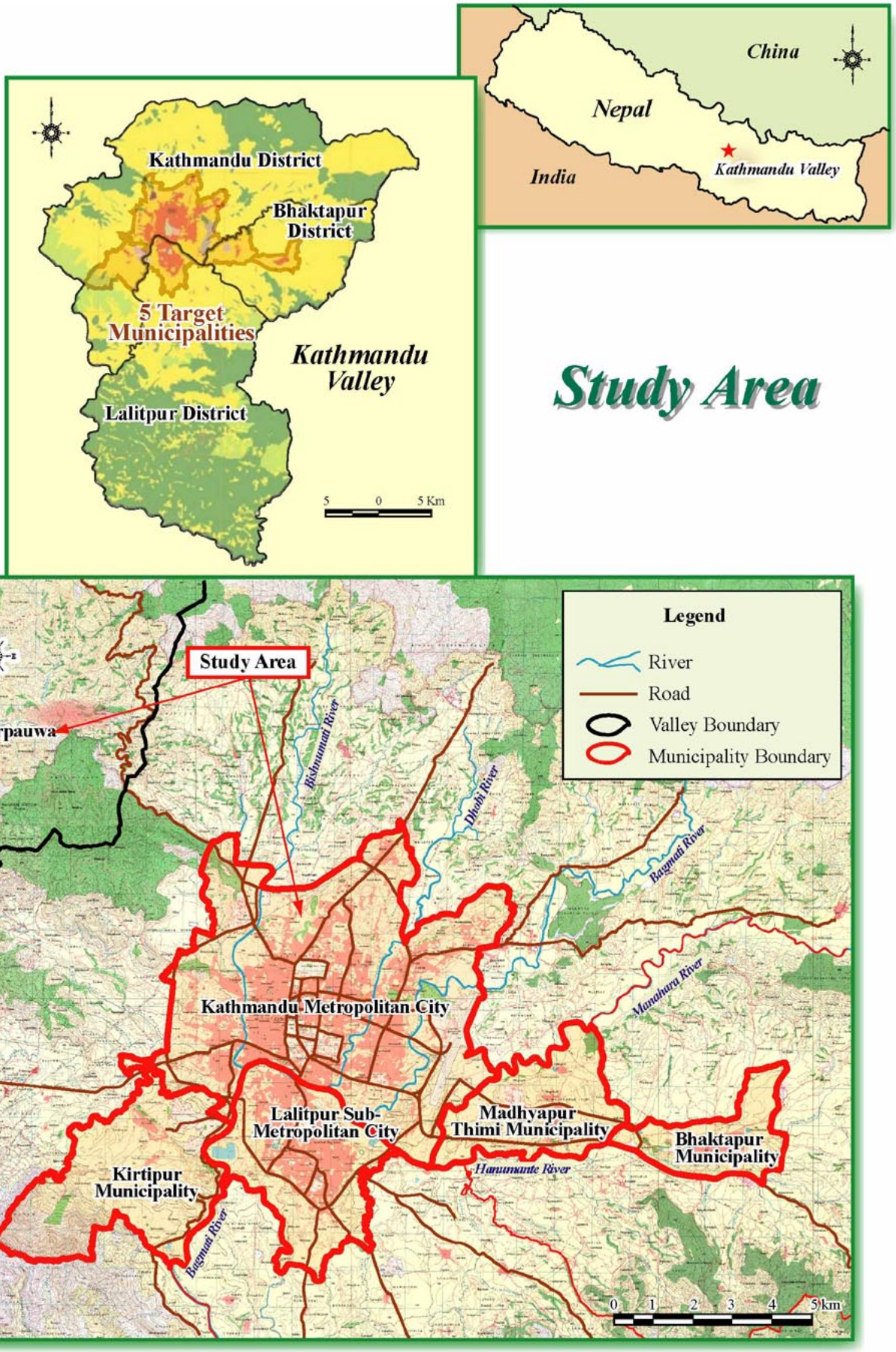
The pilot projects covered a wide spectrum of issues related to solid waste management, such as improvement of collection and transportation, promotion of waste minimization, improvement of final disposal, promotion of public awareness and behavior change, development of action plan operation and management 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
Study Area
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>

ADB	Asia Development Bank
BKM	Bhaktapur Municipality
CAAN	Civil Aviation Authority of Nepal
CDS	Community Development Section
CDSS	Community Development and Sanitation Section
CEN	Clean Energy Nepal
CIAA	Commission for the Investigation of Abuse of Authority
CITES	Convention on International Trade in Endangered Species
CMU	Community Mobilization Unit
DANIDA	Danish International Development Agency
DED	German Development Services
DOMG	Department of Mines and Geology
DUDB	Department of Urban Development and Building Construction
ECCA	Environmental Camps for Conservation Awareness
ENPHO	Environment and Public Health Organization
E/N	Exchange of Notes
EPC	Environment Protection Council
EU	European Union
FHI	Family Health International
GOJ	Government of Japan
GDS	German Development Services
GTZ	German Technical Cooperation Agency
HCI	Health Care Institute
HMG/N	His Majesty's Government of Nepal
ICIMOD	International Centre for Integrated Mountain Development
IEM	Institute of Environmental Management
IUCN	The World Conservation Union
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
MOF	Ministry of Finance
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
MOTS	Ministry of Tourism and Sports
MTM	Madhyapur Thimi Municipality
NEPCEMAC	Nepal Pollution Control and Environment Managing Center
NEPCO	National Environment Pollution Control
NEREPA	Nepal Recycle Producer Association
NHRC	Nepal Health Research Council
NPC	National Planning Commission
NRB	Nepal Rastra Bank
OCCS	Cleaning Campaign & Services

OHSI	Occupational Health and Safety in Industries
OSLSMCC	Okharpauwa Sanitary Landfill Site Main Coordination Committee
RUDO	Regional Urban Development Office
SOUP	Society for Urban Poor
ST/C	Steering Committee
SWMRMC	Solid Waste Management and Resource Mobilization Center
SWMS	Solid Waste Management Section (KMC)
T/F	Task Force
TWG	Technical Working Group
UDLE	Urban Development through Local Efforts
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	United States Agency for International Develpment
WEPCO	Women Environment Preservation Committee
WEG	Women Environmental Group
WEID	Women's Initiative for Environment and Development
WHO	World Health Organization

<Metric Units>

g	Gram
g/L	Gram per liter
ha	Hectare
kg	Kilogram
kg/day	Kilogram per day
kg/month	Kilogram per month
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
m^3/d	Cubic meter per day
mg/L	Milligram per liter
m	Meter
^oC	Centigrade
%	Percentage

<Currency>

JPY	Japanese Yen
Rs	Nepalese Rupee
US$	US Dollar

<Others>

A/P	Action Plan
BCC	Behavior Change Communication
BOD	Biochemical Oxygen Demand

CBO	Community Based Organization
CDPMT	Conservation and Development Programme in MTM
CEO	Chief Executive Officer
CKV	Clean Kathmandu Valley
COD	Chemical Oxygen Demand
CP	Cleaner Production
C/P	counterpart
CRC	Community Recycling Center
CSO	Civil Society Organization
DBMS	data base and management system
DfA/P	Draft Action Plan
DF/R	Draft Final Report
DO	dissolved oxygen
EIA	Environmental Impact Assessment
E/N	Exchange of Notes
ESPS	Environment Sector Programme Support
F/R	Final Report
FY	Fiscal Year
GDP	Gross Domestic Product
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
INGO	International Non Government Organization
IT/R	Interim Report
JOCV	Japan Overseas Cooperation Volunteers
KVMP	Kathmandu Valley Mapping Programme
KVTDP	Kathmandu Valley Town Development Plan
LF	Landfill
L/T	Long-term
LFS	Landfill site
LLDC	Least Among Less Developed Country
M&E	management and evaluation
M/M	Minutes of Meeting
MTEF	Medium Term Expenditure Framework
NGO	Non Governmental Organization
OD	Organizational Development
ODA	Official Development Assistance
Off-JT	off the job training
OFP	overall facility plan
OJT	on the job training
O&M	operation and maintenance
OVI	Objectively Verifiable Indicators
PCM	Project Cycle Management
PDM	Project Design Matrix
P/H	Public Hearing
PP	Pilot Project
PPP	Public Private Partnership

PPPUE	Public Private Partnership for Urban Environment
PR	Public Relation
PSO	private sector organization
S/T	short-term
STV	secondary transportation vehicle
SW-C	Solid Waste Compost
SWM	solid waste management
TA	Technical Assistance
TNA	Training Needs Analysis
TOR	Terms of References
T/S	Transfer Station
UGR	unit generation rate
VDC	Village Development Committee
WPF	waste processing facility

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

Solid waste management (SWM) in the Kathmandu Valley faces great challenges, not only in relation to the management system, collection, transfer and final disposal sites, but also in gaining public awareness. In order to improve the current situation, His Majesty's Government of Nepal (HMG/N) and the Government of Japan launched a joint study titled "The Study on 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 (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.

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 ratios2 of solid waste are expected to increase, toward the target year of 2015. In particular, capacity development of the Nepalese C/P personnel on planning and management of solid waste was carried out over the study period, which included 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 amount of generated waste".

1.4 Target of the Study

1.4.1 Definition of Solid Waste

The definition of "waste" in Nepal was discussed in the "Study of the Solid Hazardous Waste Management, Institutional Development and Monitoring Mechanism in Nepal" published by the Ministry of Population and Environment (MOPE) (currently Ministry of Environment, Science and Technology or MOEST) and Solid Waste Management and Resource Mobilization Center (SWMRMC). Waste was defined in the Study as a substance, object or part of an object for which there is no preliminary direct application or from which the owner wishes or is obliged to rid himself. The waste originates primarily from human activities and can be listed in any of the following categories:

(i) Residues from production or consumption
(ii) Products whose life for application use has expired
(iii) Materials which are spilled or lost having undergone mishap
(iv) Materials which are contaminated or soiled as a result of planned actions (e.g. residue from cleaning operations, packaging materials, containers)
(v) Unusable parts (e.g. used batteries)
(vi) Substances which no longer perform satisfactorily (e.g. contaminated solvents, exhausted tempering salts)
(vii) Residues from industrial process (e.g. slag, still bottoms)
(viii) Residues from pollution abatement processes (e.g. scrubber sludges, baghouse dusts, spent filters)
(ix) Residues from machining and finishing (e.g. lathe turnings, mill scales)
(x) Residue from raw material extraction and processing (e.g. mine residues, oil field slops)
(xi) Adulterated materials (e.g. oils which are contaminated with PCBs)
(xii) Any material, substance or product whose use has been banned by law.
(xiii) Products for which the holder has no further use (e.g. discarded items from agriculture, households, offices, shops, workshops)
(xiv) Contaminated materials, substances or products originating from remedial work with respect to contaminated land.
(xv) Any unwanted substance, material, or product which does not come under the above categories.

The wastes listed above when discarded in the solid or semi-solid state are defined as solid waste.

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

(1) Municipal Solid Waste (Household/ Commercial/ Institutional waste)[3]

Municipal waste includes household, commercial and institutional waste along with street waste such as waste from trees and plants along roadsides and parks, road dust and roadside litter and waste of stray animals.

Household waste is generated from dwellings as a result of human activity in houses. Household waste includes: kitchen waste, paper and cartons, rags, plastics, rubber, leather, bone, glass, crockery, pots, sweepings, metal, substances produced from traditional cooking methods, fecal matter from poor sanitation facilities, and old furniture.

Commercial waste comes from a variety of sources, which include stores, tea stalls, business premises, craft works, restaurants, markets, fruit vendors, vegetable grocery stores, hotels, guesthouses, slaughterhouses, print shops, tourist facilities and service companies (telephone, electricity, water, road, drainage and treatment plants).

Waste generated by schools, government offices, hospitals, community halls, and religious places are placed under the category of institutional waste. Waste from these sources usually contains paper, food waste, boxes, glass, plastic, crockery, pathological waste, plant litter, garden waste and waste from animals and birds.

(2) Industrial Solid Waste[2]

Waste which is generated as result of industrial work such as manufacturing establishments, breweries, leather industries, carpet factories, chemical industries, the food processing industry, repair and maintenance shops are included in this category.

(3) Medical Solid Waste[4]

Medical waste includes all the waste generated by health care institutions, related research facilities and laboratories. This means any waste that is generated during diagnosis, treatment, or immunization of human beings or animals or in research activities thereto or in production or biological testing.

(4) Other Solid Waste

1) Agricultural Waste[2]

Wastes produced from agricultural activities and processes as well as waste generated from cottage type of dairies, chicken farms and livestock rearing and waste generated from forests are included in this category.

[3] MOPE (currently MOEST), SWMRMC "Study of the Solid Hazardous Waste Management, Institutional Development and Monitoring Mechanism in Nepal"

[4] Ministry of Health (currently Ministry of Health and Population) " National Health Care Waste Management Guidelines, 2002"

2) Construction Waste[5]

Construction waste is waste generated as a result of construction activities or from demolition or reconstruction of buildings and facilities. It consists of earth, brickbat, stones, sand, wood, packaging materials, hides[KM1], discarded metals, plastic, rags, and old machine parts.

1.4.2 Target Solid Waste of the Study

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

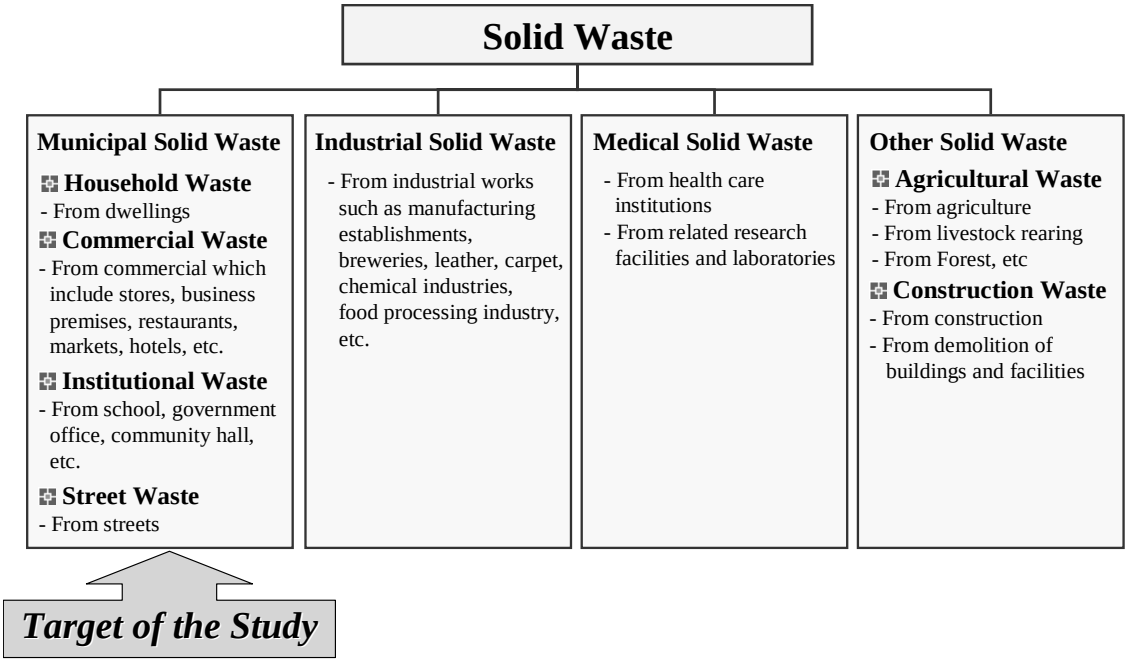


Figure 1.4-1 Classification of Solid Waste in the Study

Source: JICA Study Team

1.5 Organization and Staffing of the Study

1.5.1 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).

ST/C, which is constituted of members of the relevant government organizations, carried out the duty to confirm the overall policies and progress of the Study as well as to coordinate the relevant organizations.

[5] MOPE (currently MOEST), SWMRMC "Study of the Solid Hazardous Waste Management, Institutional Development and Monitoring Mechanism in Nepal"

TWG was established with members of each municipality, the Ministry of Local Development (MOLD) and SWMRMC to implement the Study as well as a target for technology transfer from the JICA Study Team. TWG was the C/P of the Study.

In addition, T/F was organized in each municipality in order to take the initiative, not only to formulate an Action Plan on SWM of each municipality, but also to promote partnerships among the stakeholders by collaborating together and sharing experiences and views in order to tackle various SWM issues.

"CKV Study Team" consists of TWG and the JICA Study Team members in order to conduct the Study together.

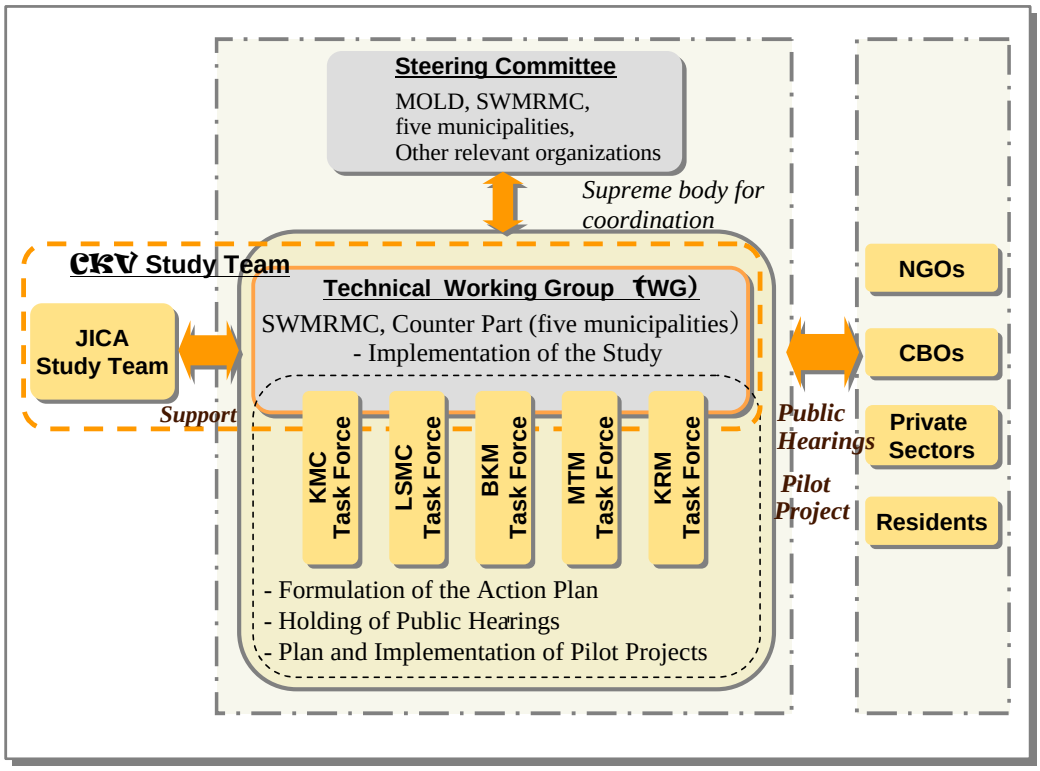


Figure 1.5-1 Implementation Organization of the Study

Source: JICA Study Team

1.5.2 Staffing of the Study

The roles, tasks, and members of each organization are shown in Table 1.5-1.

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 Cooperatives (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 plans, formulation and implementation of pilot projects	- To formulate an Action Plan of the municipality and conduct pilot projects under 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 sector - Intellectuals

Source: JICA Study Team

The members of ST/C, TWG and T/F are listed in Appendix 1.2.

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 promote and to be identifiable by the relevant organizations and residents in 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.

1.7 Structure of Reports

The Final Report of the Study is composed of four parts, that is, the Executive Summary, Main Report, Supporting Report (1) and Supporting Report (2) as shown in Table 1.7-1. In addition, an Action Plan for each municipality and SWMRMC is bound separately from the Main Report so that each municipality can use their Action Plan easily.

Table 1.7-1 Final Reports of the Study

Report	Contents
Executive Summary	- Summary of the Study
Main Report	- Framework of the Study - Current framework for solid waste management - Current condition of municipal solid waste management - Findings, issues and constraints on municipal solid waste management - Pilot projects of the Study - Future framework - Umbrella concept for formulation of Action Plans - Action plans of five municipalities and SWMRMC (approaches, strategies, necessary activities, implementation schedule) - Evaluation of capacity development of the Study - Appendix (related data and documents, photos, etc.)
Supporting Report (I)	- Records of pilot projects
Supporting Report (II)	- Survey data, related data and documents
Action Plan of KMC	- Current situations - Future framework - Vision and target - Action plan (approaches, strategies, necessary activities, implementation schedule) - Appendix (Annual work plan of FY2005/06 (2062/2063), etc.)
Action Plan of LSMC	
Action Plan of BKM	
Action Plan of MTM	
Action Plan of KRM	
Action Plan of SWMRMC	

Source: JICA Study Team

The Study is a 'Capacity Development Type Study' of which important aims are to assist the capacity development of the five municipalities and SWMRMC for SWM. The Study focuses on the process to advance the Study, i.e. formulation of the A/P and implementation of Pilot Projects under the ownership of the Nepalese side (TWG and T/F members). The processes for these activities are reflected in the Final Report as shown in the following Table 1.7-2. That is, the Final Report was prepared by both the Nepalese side (TWG and T/F members) and the JICA Study Team.

Based on the series of surveys by the CKV Study Team, T/F members summarized the current conditions of SWM of each municipality, which are described in Chapter 5. T/F members also analyzed the problems, including problems raised at the Public Hearing (P/H). These problems as analyzed by T/F were finalized by the JICA Study Team in Chapter 6. In Chapter 8, the JICA Study Team summarized the activities of the Pilot Projects, which were designed based on the priority activities selected from the Draft Action Plan (DfA/P) and implemented by the ownership of Nepalese side. On the other side, a socio-economic framework, which is summarized in Chapter 9, was discussed among the CKV Study Team at a series of TWG meetings. In Chapter 10, an Umbrella Concept of SWM in the Kathmandu Valley, which was discussed among the CKV Study Team, was described. In response to the finalized Umbrella Concept and the information and suggestions from the

JICA Study Team, each municipality has finalized the Action Plan, which is described in Chapter 11.

Table 1.7-2 Structure of Main Report

Chapter	Contents	Notes
1	Introduction	Preparation by the JICA Study Team
2	Framework of the Study	Preparation by the JICA Study Team
3	Current Framework for SWM	Preparation by the JICA Study Team
4	Overview of SWM of the Study area (Kathmandu Valley)	Preparation by the JICA Study Team
5	Conditions of Municipal SWM of each municipality	Preparation by Nepalese side and touch up for finalization by the JICA Study Team
6	Findings, issues and constraints on municipal SWM	Preparation by the JICA Study Team based on the problems identified by TWG and T/F and raised at the P/H
7	Human Resource Development Plan	Preparation by the JICA Study Team
8	Pilot Projects of the Study	Summarized by the JICA Study Team based on the activities by the ownership of Nepalese side
9	Future Framework	Finalization by the JICA Study Team based on the discussions among TWG
10	Umbrella Concept for formulation of Action Plan SWM	Finalization by the JICA Study Team based on the discussions among TWG
11	Action Plans on SWM	A/Ps prepared by the T.Fs, which were based on the information or suggestions from the JICA Study Team
12	Preliminary Examination of Environmental and Social Considerations	Preparation by the JICA Study Team
13	Evaluation of capacity development of the Study	Preparation by the JICA Study Team as the final evaluation by taking into consideration of the process of formulation of A/P including P/H, and implementation of a series of pilot projects
14	Recommendations	Preparation by the JICA Study Team

Source: JICA Study Team

CHAPTER 2 FRAMEWORK OF THE STUDY

2.1 Important Aspects of the Study

Based on the current situation in the Kathmandu Valley, four aspects i.e. policy, plan, partnership, and socio-cultural aspects, have been identified as subjects for the Study. The relationships between these four aspects and important points to be considered for solid waste management (SWM) are shown below.

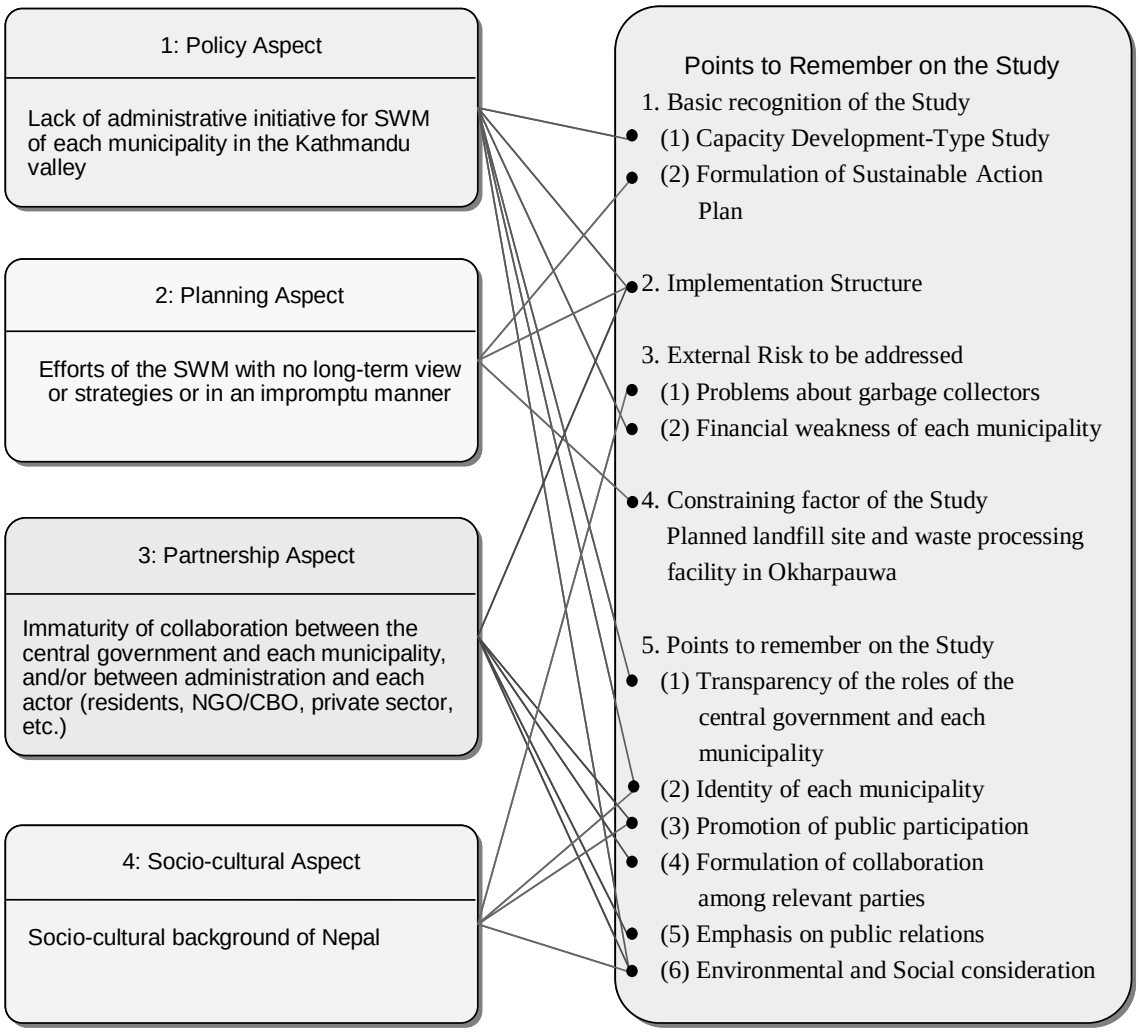


Figure 2.1-1 Four Aspects of the Study

Source: JICA Study Team

2.2 Approaches to the Study

The JICA Study Team has set the following approaches to accomplish the aspects mentioned above. The relationship between the aspects and approaches is shown in Figure 2.2-1.

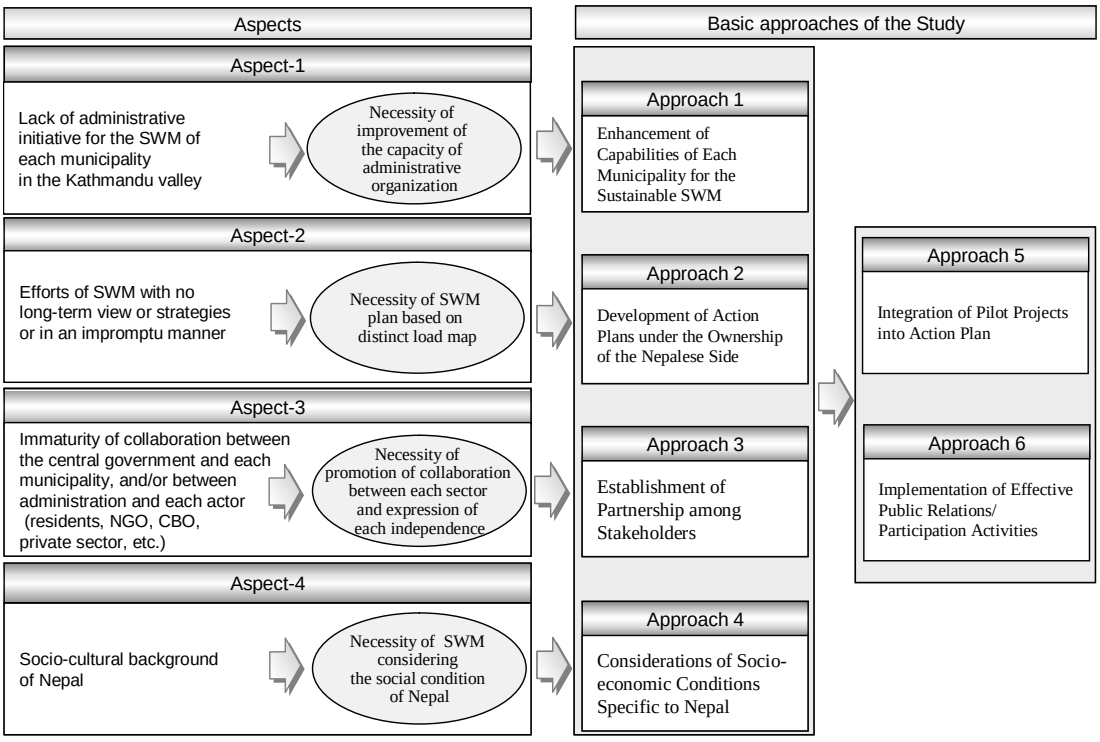


Figure 2.2-1 Approaches to the Study

Source: JICA Study Team

2.2.1 *Approach 1:* Enhancement of Capabilities of Each Municipality for Sustainable Solid Waste Management

Issues to be considered;

- The Study is a 'Capacity Development Type Study' which aims to assist the five municipalities to develop the capacities for SWM through formulation of Action Plans (A/Ps) on SWM.
- Decentralization was introduced with the 1990 Constitution. In spite of the efforts for developing a policy framework for the decentralization, more assistance is still required, especially in capacity development of local bodies.
- Trainees of the "JICA Country Focused Training Course for Solid Waste Management" presented should be assigned as members of Technical Working Group (TWG) or Task Force (T/F) of each municipality.

Implementation Strategy;

(1) Capacity development primarily focuses on human resource development (HRD) vis-à-vis institutional or organizational development.

(2) Training program for HRD is to be created for respective staff levels and implemented by phases.

(3) SWMRMC is expected to become a core organization to provide technical support to the respective municipalities.

2.2.2 *Approach 2:* Development of Action Plans under the Ownership of the Nepalese Side

Issues to be considered;

- The Solid Waste Management Act (1987) delineates the responsibilities between SWMRMC and local bodies. However there is a lack of consensus between the central government (SWMRMC) and local bodies, especially with regards to the final disposal site including the proposed site in Okharpauwa and procurement of necessary equipment.
- Each of the five municipalities has different characteristics such as the area, population, industry, organizations, and number of workers for SWM.

Implementation Strategy;

(1) A Task Force (T/F) is organized in each municipality and is requested to formulate an A/P with the CKV Study Team consisting of TWG and the JICA Study Team.

(2) The A/Ps are formulated based on the current condition of solid waste management of each municipality including waste stream which is confirmed by T/F members.

(3) Suitability of the proposed landfill site in Okharpauwa is evaluated and then location of landfill sites is decided by TWG.

(4) The A/Ps are prepared with objectively verifiable indicators (OVIs) as targets so that each municipality would be able to monitor and evaluate the its achievement levels.

2.2.3 *Approach 3:* Establishment of Partnership among Stakeholders

Issues to be considered;

- Despite the fact that various stakeholders such as NGOs, CBOs, private sector, universities, and donors, in addition to SWMRMC and local bodies have implemented various activities in the filed of SWM, most interventions have not been coordinated with each other due to the absence of an effective network among the stakeholders.
- A SWM system, including final disposal, should be decided by discussion with all stakeholders from the planning stage.

Implementation Strategy;

(1) The A/Ps are to be developed through the participatory approaches and Public Hearings (P/Hs) are to be held by T/F to provide feedback to the A/Ps

(2) Seminars are organized inviting the relevant governmental organizations and other stakeholders to share information and consult on the reports produced during the Study.

(3) Existing waste collection practices by NGOs, CBOs and private sector are reviewed, and partnerships with such initiatives are strengthened.

2.2.4 *Approach 4:* Considerations of Socio-economic Conditions Specific to Nepal

Issues to be considered;

- In Nepal the literacy rate, 40%, is rather low, and the modest GDP of USD 220 per capita places the country in the category of LLDC.
- HMG/N has taken major steps to eliminate any discrimination amongst the different ethnic (caste) groups of the society.
- Each municipality has a different amount of budget for SWM but all the municipalities commonly have a weak financial base.

Implementation Strategy;

(1) A social environment study is implemented through the public awareness survey and analysis, the results of which are reflected in the A/Ps.

(2) Under the existing financial constraints of Nepal, the Study proposes necessary SWM facilities that are suitable for the targets set but do not impose heavy financial burden on the authorities or beneficiaries in terms of investment or operating costs.

(3) An umbrella concept, which means an overall direction on SWM in the Kathmandu Valley, is prepared in order to minimize the development burden to each municipality as well as maximize effects of the activities of the A/Ps.

2.2.5 *Approach 5:* Integration of Pilot Projects into Action Plan

Issues to be considered;

- Pilot projects are to be selected aiming at effective achievements within the Study period but are to be continued after the Study is completed and be expanded as necessary.
- The pilot projects are developed by considering high priority activities in each Draft Action Plan (DfA/P).

Implementation Strategy;

(1) Pilot projects are designed to obtain baseline data in order to feedback to the A/Ps and . are implemented in one of the five municipalities, or on a valley-wide basis.
(2) A Project Design Matrix (PDM) is prepared for each pilot project and monitoring of the achievement of the pilot projects is to be carried out through intermediate as well as final evaluations.
(3) Pilot projects are implemented by each municipality and SWMRMC as the main actor and with support from the JICA Study Team.

2.2.6 *Approach 6:* Implementation of Effective Public Relations/Participation Activities

Issues to be considered;

- To encourage public participation, various tools of public relations (PRs) as well as public participation activities should be exercised.
- Target groups for public relations/participation activities are: 1) counterpart personnel and policy makers related to the Study, 2) residents in the Kathmandu Valley and 3) relevant donors, NGOs and CBOs as well as private sector.

Implementation Strategy;

(1) For the various stakeholders, newsletters are issued and internet website is set up for effective information dissemination.
(2) Seminars and Public Hearings are organized during various stages of the Study as opportunities to conduct public relations/participation activities.
(3) A cartoon calendar is published utilizing illustrations to accommodate children and the illiterate population.
(4) Collaboration with the mass media is actively pursued as part of PR activities.

2.3 Overall Work Flow of the Study

The Study ran for a total of 20 months from January 2004 to August 2005. The Study was carried out by the following phases as shown diagrammatically in Figure 2.3-1.

Phase 0: Preparatory Work: January 2004

The JICA Study Team carried out document review in advance for the works in Nepal. The JICA Study Team also prepared the Draft IC/R 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 Plan: February 2004 – May 2004

A series of surveys regarding the current condition on SWM as shown in Table 2.3-1 and analysis of the current problems were implemented by TWG and T/F members with support from the JICA Study Team.

Table 2.3-1 Surveys Regarding the Current Condition of SWM

Main survey under the Study	Contents of the Surveys
Waste Disposal Condition	- Discussion among relevant organizations - Sweeper survey
Collection and Transportation	- Quantity and quality survey of solid waste - Time and motion survey - Discussion among relevant organizations
Composting and Recycling	- Recycling market survey - Discussion among relevant organizations - Site visit to community composting activities and house-hold level composting activities
Final Disposal	- Discussion among relevant organizations - Site visit to Bagmati River dumping site and Hanumante River dumping site
Awareness of Households, Establishments and NGOs/CBOs	- Interview and questionnaire on SWM practices of households, establishments and NGOs/CBOs
Entrust to Private Sectors	- Interview to relevant organizations
Management of medical or industrial wastes	- Document review
Implementation organization of SWM	- Training Needs Analysis (TNA)
Financial condition on SWM	- Interview with relevant organizations

Source: JICA Study Team

In the process of the analysis, the 1st Public Hearing (P/H) was organized by each municipality in order to discuss the current situation on solid waste management (SWM) in March 2004. Through TWG meetings, the TWG members discussed the future framework for SWM, an Umbrella Concept which is a common concept for SWM for the five municipalities of the Kathmandu Valley, contents of the DfA/P 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 the formulation of the DfA/P, the 2nd P/H was organized by each municipality, in which the members of T/F made presentations regarding vision, target, approaches, strategies and necessary activities as preliminary ideas of the DfA/P. The comments and opinions were taken into consideration to formulate the DfA/P.

As one of the public relations/participation activities, the 1st Seminar of the Study was held on March 19th, 2004, in which almost one hundred stakeholders from many kinds of organizations, including government organizations, donors, NGOs, CBOs, and private sector, participated.

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

Phase 3 is divided into two terms, Term 1 from June to December 2004 and Term 2 from January to August 2005. In Term 1 of Phase 3, a series of Pilot Projects on SWM, which are broadly divided into five kinds of projects as follows, were implemented.

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

Based on the results of mid-term evaluation in November 2004, Pilot Projects were modified and implemented in Term 2 of Phase 3. 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. During Phase 3, TWG meetings were held twelve times to discuss the problems and share the experiences of the Pilot Project.

As public relations/participation activities, three seminars were held in which almost one hundred stakeholders participated. At the Seminars, the TWG members made presentations on pilot project activities and their A/Ps. In addition, Public Hearings were organized by each municipality in order to brief about the Pilot Projects and revised A/Ps.

Phase 4: Monitoring and Follow-up for Action Plan Implementation

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.

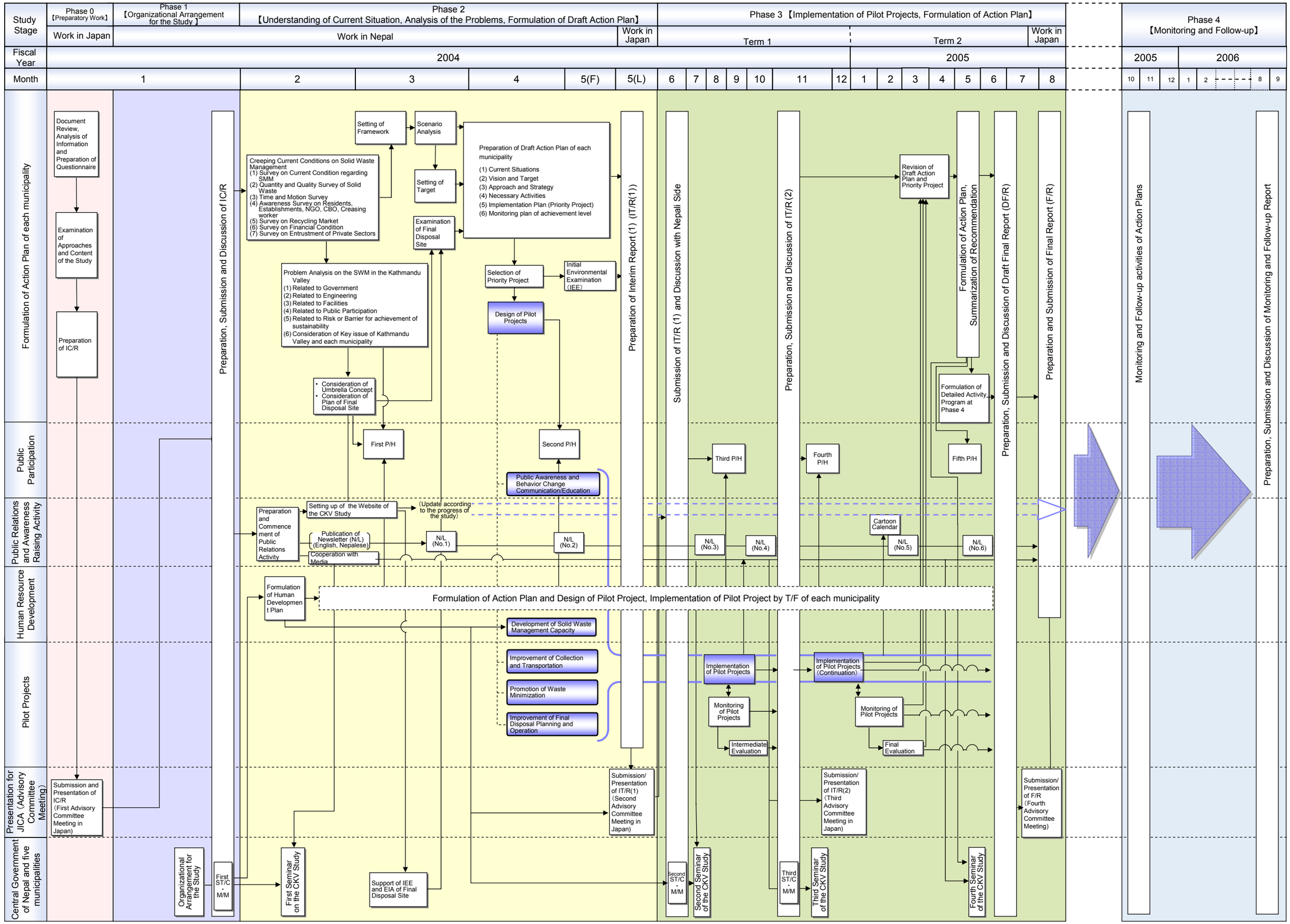


Figure 2.3-1 Overall Work Flow of the Study

2.4 Capacity Development Activities of the Study

2.4.1 Capacities to be Developed under the Study

According to the JICA Handbook on Capacity Development of March 2004, capacity development is defined as follows:

"**Capacity** is the ability of individuals, organization and societies to perform functions, solve problems and set and achieve goals….**Capacity Development** is a sustainable process in which the developing countries (individuals, organizations, institutions and societies) themselves takes on the initiative to enhance such Capacities on its own.[1]"

Since capacity development of the central and local authorities in Nepal in the field of SWM has been identified as the core focus of this Study, a spectrum of initiatives were designed and implemented to address the various levels of capacities, i.e. individual, organizational, and institutional capacities. This is summarized below in Figure 2.4-1.

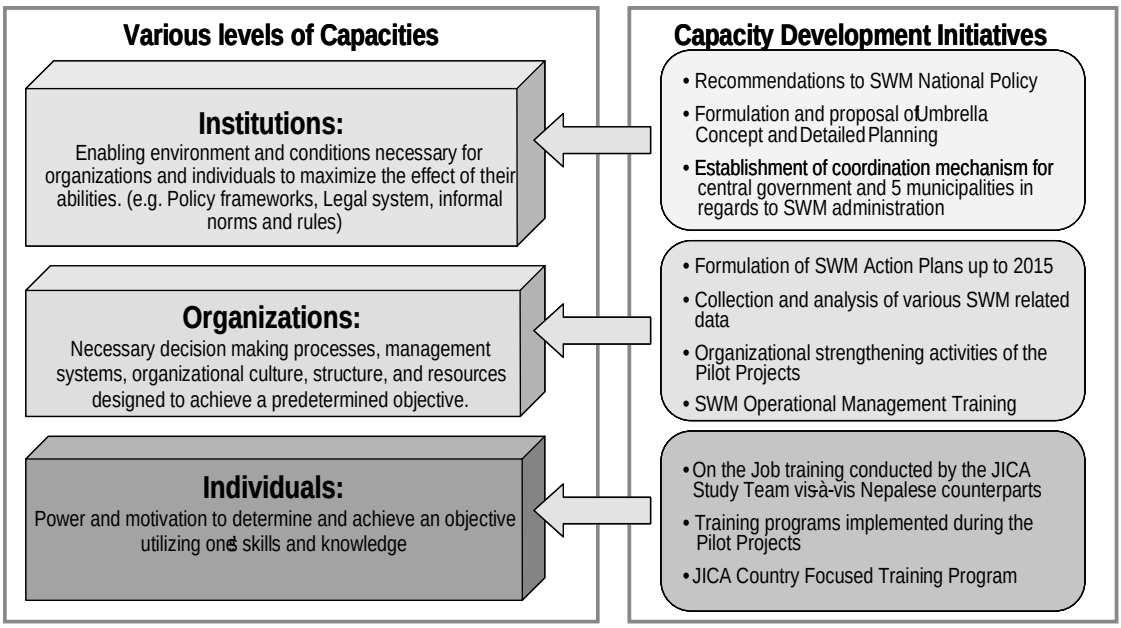


Figure 2.4-1 Three Levels of Capacity Development to be addressed by the Study

Source: JICA Capacity Development Handbook, March 2005 and JICA Study Team

For effective results, capacity development entails a balanced enhancement of capacities at all three levels (individuals, organizations, institutions). However, due to the limitation of time and financial resources, as well as with consideration to the existing conditions in Nepal, the Study opted to prioritize capacity development activities at the individual level through HRD programs, although initiatives were also implemented that strengthened capacities at organizational and institutional levels. For substantial improvements of capacities at those levels, it is expected that individuals trained as a result of the Study will provide further impetus for reforms.

[1] JICA Capacity Development Handbook, March 2004. The definition of capacity is referred to the definition adopted by UNDP.

2.4.2 Capacity Development Activities of the Study

The target group of capacity development activities of the Study was mainly TWG and T/F members. Such activities implemented under the Study were categorized into the following three strategic areas; 1) formulation of an Action Plan for each municipality and SWMRMC, 2) implementation of a series of Pilot Projects (P/Ps) and 3) public relations/participation activities as shown in Table 2.4-1. Descriptions of public relations/participation activities of the Study are separately provided in Chapter 2.5.

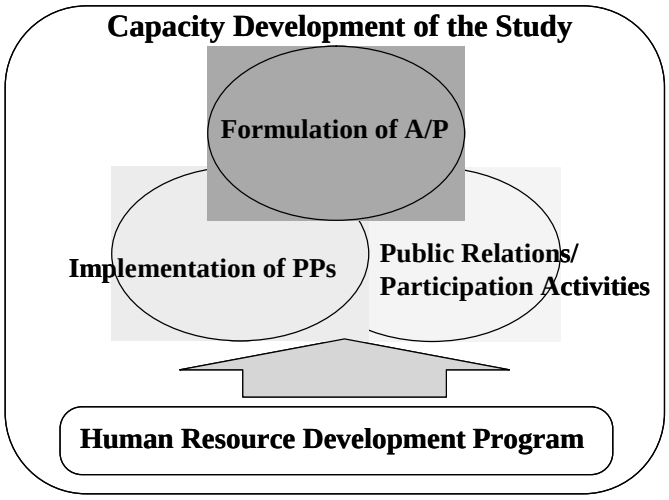


Figure 2.4-2 Three Strategic Areas of Capacity Development Activities under the Study

Source: JICA Study Team

Table 2.4-1 Capacity Development Activities under the Study

Areas	Activities of the CKV Study Team	Capacity Development Activities of Nepalese C/P
Formulation of A/Ps	Review of current conditions in SWM 1) Collection and transportation 2) Recycling and composting 3) Final disposal 4) Entrust 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 results 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, which helped to analyze the problems

Areas	Activities of the CKV Study Team	Capacity Development Activities of Nepalese C/P
	Examination of Umbrella Concept including overall facility plan	- Discussed at TWG meetings about the necessity of the umbrella concept including overall facility plan in the Kathmandu Valley, collection and transportation methods, 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 targets - 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 with Umbrella Concept and A/Ps	- Discussed the finalization of the Umbrella Concept and A/Ps on account of feedback from the Pilot Projects
Implementation of Pilot Projects	Planning of Pilot Projects	- Developed implementation plans for Pilot Projects
	Implementation of Pilot Projects	- Conducted a series of Pilot Project activities with support from the JICA Study Team
Public Relations/ Participation Activities	Determination of Acronym and Slogan	- Discussed the acronym and slogan and reemphasized the 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 know 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 for 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 and cloth bags for PR activities - Design and used (distributed) cartoon calendar for educational material to illiterate people

Source: JICA Study Team

During formulation of the Action Plans following the process as shown in the table above, the Study developed a relationship between TWG and the JICA Study Team as shown in Figure 2.4-3.

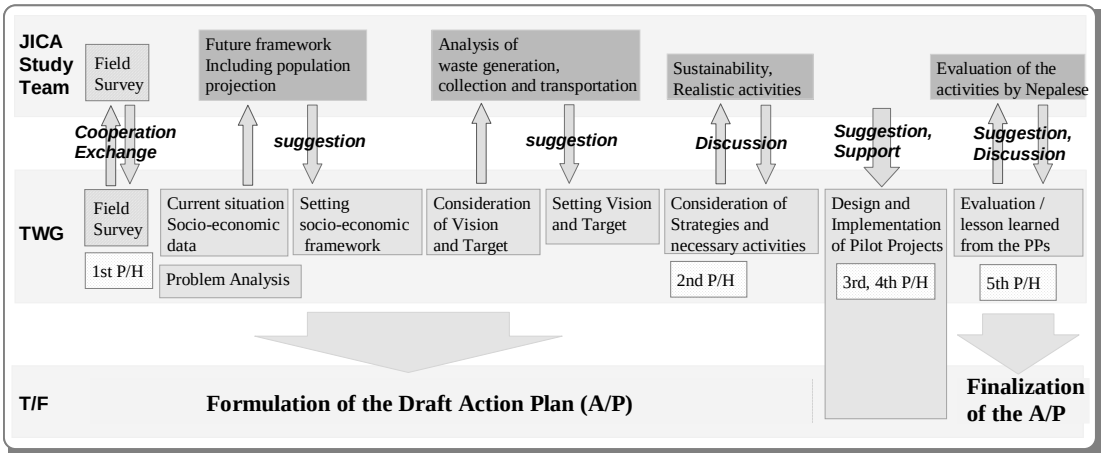


Figure 2.4-3 Formulation Process for the Action Plan

Source: JICA Study Team

Under the Study, a series of TWG meetings were held twenty times to discuss the following topics as shown in Table 2.4-2.

Table 2.4-2 Main Topics of TWG Meetings

TWG	Date	Main Topics discussed
1	February 9, 2004	- Introduction of the Study by the JICA Study Team - Explanation of 1) Umbrella concept of the Study, 2) recycling and composting, 3) PR activities and P/H of the Study, 4) TNA from the JICA Study Team - Explanation of the current situation of each municipality from TWG
2	February 24, 2004	- Explanation of each municipality profile including SWM from TWG - Explanation of history of landfill site from TWG (SWMRMC) - Examination of suitability of Sisdol LF - Discussion of acronym and slogan of the Study
3	March 23, 2004	- Explanation of DfA/P from the JICA Study Team - Examination of waste amount, waste collection and flow including transportation - Determination of acronym and slogan of the Study
4	March 31, 2004	- Examination of definition of "solid waste" - Report of progress of drafting current situation - Examination of setting socio-economic framework, vision and target as DfA/P - Report of results of participatory workshop
5	April 9, 2004	- Report of progress of drafting current situation - Examination of setting socio-economic framework including population projection, vision and target, approaches, strategies and necessary activities as DfA/P - Examination of current collection and transportation of each municipality - Examination of landfill plan, Human Resource Development plan - Examination of the 2nd P/H
6	April 16, 2004	- Explanation of A/P of SWMRMC from TWG (SWMRMC) - Examination of setting socio-economic framework, vision and target - Examination of landfill plan - Determination of the design of T-shirts

WC	Date	Main Topics discussed
7	May 5, 2004	- Wrap up of works in Nepal from the JICA Study Team - Examination of preparation of DfA/P - Discussion of Pilot Projects
8	May 10, 2004	- Examination of waste quantity including unit waste generation ratio and bulk density - Examination of implementation plan of short term activities of DfA/P - Examination of Pilot Projects - Examination of the 2nd P/H
9	May 17, 2004	- Wrap up of phase 2works in Nepal - Summary of DfA/P of each municipality, Pilot Projects
10	June 22, 2004	- Explanation of Interim Report (1) from the JICA Study Team - Discussion of designed Pilot Projects - Explanation of schedule (the 2nd Steering Committee, the 2nd Seminar, the 3rd P/H, Working group) from the JICA Study Team - Explanation of equipment procurement plan by the JICA Study Team
11	July 30, 2004	- Determination of Focal Point(s) of each Pilot Project - Report of Pilot Project activities in July from Focal Point(s)[KM1] - Explanation of the 3rd P/H by the JICA Study Team
12	August 13, 2004	- Report of Pilot Project activities from Focal Point(s) - Confirmation of each schedule for 3rd P/H - Discussion of CKV mascot
13	September 16, 2004	- Report of Pilot Project activities from Focal Point(s) - Explanation of current progress of procurement of secondary transportation vehicles from the JICA Study Team
14	October 14, 2004	- Report of Pilot Project activities from Focal Point(s) - Pre-testing for mass communication/education materials (stickers, brochures, radio jingle)
15	November 15, 2004	- Report of study tour in India (presentation by Focal Points) - Report of study tour in Malaysia (presentation by Focal Points) Confirmation of Pilot Project activities - Discussion on the 3rd ST/C and the 3rd Seminar
16	January 21, 2005	- Report of Country-focused training in Japan by trainees - Report of Pilot Project activities from Focal Point(s) - Discussion of operation of Sisdol short-term Landfill (S/T-LF) and Teku Transfer Station (T/S) - Explanation of the 4th P/H from the JICA Study Team
17	June 21, 2005	- Discussion of Target under the A/P - Discussion of preparation for the 4th seminar - Explanation of the 5th P/Hs from the JICA Study Team
18	June 24, 2005	- Discussion of the contents of M/M - Discussion of finalization of A/Ps - Preparation for the 4th seminar and the 5th P/Hs
19	July 5, 2005	- Demonstration of solid waste data management system - Discussion of finalization of A/Ps - Preparation of the 5th P/Hs
20	July 12, 2004	- Discussion of Draft Final Report

Source: JICA Study Team

2.5 Public Relations/Participation Activities of the Study

2.5.1 Public Relations/Participation to be Covered under the Study

A series of activities for public relations/participation were implemented as the core focus of the Study as shown in Table 2.5-1.

Table 2.5-1 Public Relations/Participation Strategy of the Study

Main Targets (receivers)				Contents	Media of Communi-cation	Activity of the Study
People in the KV	Relevan rganiza tions	Other lonor	People in Japan			
○	○	○		Improvement of awareness of SWM and image of the Study	Logo-mark, Slogan	- 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 of SWM and image of the Study	Mascot	- Creation through discussions 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
○	○			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 of 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 of 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 members of the JICA Study on FM programs
○	○			Improvement of public awareness of 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 of 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

Main Targets (receivers)				Contents	Media of Communi-cation	Activity of the Study
People in the KV	Relevan rganiza tions	Other donors	People in Japan			
○	○			Introduction of the Study activities, improvement of public awareness of SWM	Radio/TV programs	- Appearances of the Study on various radio and TV programs and news

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

2.5.2 Public Relations/Participation Activities of the Study

(1) Seminars

A total of four Seminars were held under the Study as shown in Table 2.5-2.

Table 2.5-2 Summary of Seminars under the Study

Seminar	Date/ Venue	Number and Main Participants	Contents, Discussion items
1st Seminar	March 19, 2004 (Phase 2) LDTA	99 participants Mayor, relevant municipal staff, government organiza- tions, donors, NGOs/CBOs, private sectors, Intellectuals, media/ journalists	- Presentation of introduction of the Study by the JICA Study Team - Presentation of current situation and its analysis by TWG members of each municipality - Discussion on current situation including waste pickers, medical waste, final disposal site
2nd Seminar	July 2, 2004 (Phase 3) LDTA	112 participants relevant municipal staff, government organizations, donors, NGOs/CBOs, private sectors, Intellectuals, media/ journalists	- Presentation of suggestions for overall facility plans and HRD by the JICA Study Team - Presentation of the DfA/P by TWG members of each municipality - Discussions focused on the operational cost issues associated with the final disposal site and necessity of a detailed financial plan
3rd Seminar	November 25, 2004 (Phase 3) LDTA	104 participants relevant municipal staff, government organizations, donors, NGOs/CBOs, private sectors, Intellectuals, media/journalists	- Presentation of progress of each Pilot Project by Focal Point(s) - Presentation of midterm evaluation and suggestion by the JICA Study Team - Discussion related to the activities of the Pilot Projects including feasibility of establishing large scale composting plant and social and environmental aspects of establishing a waste processing facility
4th Seminar	June 27-28, 2005 (Phase 3) Hyatt Regency Hotel	190 participants relevant municipal staff, government organizations, steering committee members, donors, NGOs/ CBOs, private sectors, Intellectuals, media/ journalists	- Presentation of results of each Pilot Project by Focal Point(s) - Presentation of Umbrella Concept by the JICA Study Team - Presentation of A/Ps - Site visit to Teku T/S and Sisdol S/T-LF - Discussions related to the activities of the Pilot Projects including landfilling at Sisdol, compost market and sustainability of each activity.

Note: LDTA; Local Development Training Academy
Source: JICA Study Team

(2) Public Hearings

A total of four Public Hearings (P/Hs) were carried out by each municipality as shown in Table 2.5-3 (See Appendix 2).

Table 2.5-3 Summary of Public Hearings under the Study

P/H	Date	Contents and Discussion Items
1st P/Hs	March, 2004 (Phase 2)	- Background and objectives of P/H including the introduction of the Study - Discussion of the current situations focusing on achievements and constraints in SWM in each municipality - Discussion of various issues of SWM
2nd P/Hs	May, 2004 (Phase 2)	- Report on the progress of the Study - Discussion of the DfA/P - Discussions of the proposed topics of the Pilot Projects
3rd P/Hs	July/August, 2004 (Phase 3)	- Report on the progress of the Study - Discussion of the proposed plans of the Pilot Projects - Discussion of the concrete activities of the Pilot Projects
4th P/Hs	February, 2005 (Phase 3)	- Report on the progress of the Pilot Projects including the results of mid-term evaluation - Discussion of Issues and concerns regarding the Pilot Projects
5th P/Hs	July/August, 2005 (Phase 3)	- Report on the results of final evaluation of the Pilot Projects - Discussion of the lessons learnt from the Pilot Projects - Report and discussion of the A/P

Note: Because of unavoidable circumstances, KRM couldn't hold 2nd P/H, BKM couldn't hold 4th P/H and LSMC couldn't hold 5th P/H.
Source: JICA Study Team

(3) Newsletter

As a publicity and promotional tool, the Study has produced newsletters five times in Nepali and English. The objectives of the newsletter were to report on the current situation of SWM in the Kathmandu Valley, provide an overview of the Study, highlight the activities of Pilot Projects under the Study, identify issues and problems in SWM, and bring them to the attention of stakeholders in the field of SWM and the residents. Approximately 2,000 to 3,000 of each issue were distributed to municipalities, ward offices, schools, NGOs/CBOs, community groups, private sector, press, and other stakeholders.

Figure 2.5-1 Newsletter
Source: JICA Study Team

(4) Website

The website of the Study has been set up under that of MOLD since May 2004 to convey detailed information on the Study. The contents include i. Introduction of the Study, ii. Introduction of the activities of the Study, iii. Team member lists, iv. Links, v. Columns, and vi. Contact addresses. The website has been updated periodically in order to report on the current progress of the Study. The URL is as follows;

http://www.mld.gov.np/swm/ckv/index.html

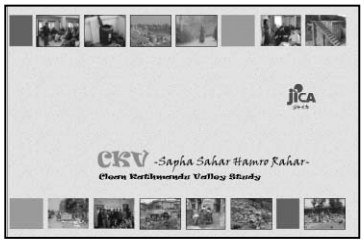


Figure 2.5-2 Website
Source: JICA Study Team

(5) Promotional Materials

The JICA Study Team has produced various promotional materials imprinted with a "CKV" logo and its slogan "Sapha Sahar Hamro Rahar" which means "Clean City is Our Desire" in order to deliver the above message of the Study and attract people's attention to the Study and SWM issues.

Table 2.5-4 CKV Promotional Materials

Promotional Materials	Distribution	Objectives
File 	*Quantity - 600* - Participants of Seminars (1st-4th) - Participants of several P/Hs - Participants of training under the Study (Plastic separation and home composting trainings at KRM, etc.)	- To promote "CKV" logo and its slogan "Sapha Sahar Hamro Rahar" - To promote products of recycled paper
Ballpoint pen 	*Quantity – 2,600* - Participants of Seminars (1st-4th) - Participants of several P/Hs - Participants of training under the Study (Home composting trainings at KMC and LSMC, Plastic separation and home composting training at KRM, training for Nature clubs, etc.)	- To promote "CKV" logo and its slogan "Sapha Sahar Hamro Rahar"
T-shirts (A) 	*Quantity – 225* - TWG members, T/F, relevant municipal staffs - Local consultants involved in the field surveys of the Study, etc.	- To promote "CKV" logo and its slogan "Sapha Sahar Hamro Rahar" TWG member determined the design, which should be effective as promotional material, at the 6th TWG Meeting.
T-shirts (B) 	*Quantity – 800* - TWG members, T/F, relevant municipal staffs - NGOs/CBOs, local clubs, women's groups that participated in the 2nd Public Events as exhibitors or volunteers - Nature Club members in BKM, etc.	- To promote "Ashakaji" mascot with message "Why dump garbage, you can make money."
Calendar 	*Quantity - 5,300* - Schools through orientation program or through training for teachers - Target group members and/or communities of Pilot Projects - Women's groups through interaction program on SWM - Children groups through training related to SWM - Ward offices, clinics, hospitals etc.	- To explain effective SWM focusing on what we can do by ourselves by using illustrations targeting housewives, children and illiterate people - To use as educational material for teaching effective SWM to children The calendars were imprinted with Ashakaji and various messages on SWM as follows: • Clean city is our desire • Say No to plastic bags, let's use cloth bags instead • Let's dispose of waste in an appropriate

Promotional Materials	Distribution	Objectives
		way • Turn your trash into cash • Wait! Think! Waste can be a resource! • Let's separate waste and make compost. Each municipality made distribution plans in order to accomplish the objectives effectively
Cloth bag 	*Quantity – 220* - Participants of 4th Seminar	- To promote cloth bags and to refuse to use plastic bag - To promote "Ashakaji" mascot with message "Say No to plastic bags, let's use cloth bags instead".

Source: JICA Study Team

(5) Other PR Activities

The JICA Study Team has actively collaborated with the mass media and other organizations as part of public relations activities as follows.

Table 2.5-5 Summary of Other PR Activities under the Study

PR Activities	Media	Date/Time	Contents
Appearance of Articles of the Study	Voice of Cities*[1]	November, 2004 May, 2005	- Article of introduction of the Study - Article of introduction of Pilot Projects
	Calendar (2062) published by Municipal Association of Nepal (MuAN)	April, 2005	- Article of introduction of the Study
	Magazine published by Nature Club in BKM	April, 2005	- Article of introduction of the Study
	Monthly magazine published by BKM	Several times	- Article of activities under the Study (prepared by TWG members of BKM)
	Newspapers including website of the news (Himalayan Times, Annapurna Post, Kathmandu Post, Kantipur, Space Time, Nepal Samachar Patra, Rajdhani, The Rising Nepal, local paper, etc.)	Many times	- News of preparation of DA/Ps - News of inauguration of the CKV mascot - News of Public Events - News of operation of Sisdol Landfill - News of Clean Up Campaign etc.
	SPOTLIGHT*[2]	August, 2004	- Article of introduction of the Study
	JICA Newsletter	July, 2005	- Article of introduction of the Pilot Projects activities
Broadcast of Radio Program	Radio Sagarmata	Two times	- Program of Public Events

PR Activities	Media	Date/Time	Contents
Broadcast of TV Program	Hamuro Kathmandu	Several times	- Program of Public Events - Program of the Study - Program of Sisdol Landfill - Program of Clean Up Campaign etc.
	Other news/programs	Many times	- News of Public Events - News of operation of Sisdol Landfill etc.

Note: 1 Voice of Cities is a quarterly development journal published by the Municipal Association of Nepal (MuAN) and aims at stimulating interaction on various topics relevant to urban development and good governance.
2 SPOTLIGHT is the monthly national newsmagazine published by Nepalnews
Source: JICA Study Team

CHAPTER 3 CURRENT FRAMEWORK FOR SOLID WASTE MANAGEMENT

3.1 Policy, Legislation and Guideline

3.1.1 National Policy and Acts on Solid Waste Management

The Solid Waste Management National Policy was published in 1996 by HMG/N, while the Solid Waste (Management and Resource Mobilization) Act and Regulations were introduced even earlier in 1987 (amended 1992). Both the Policy and the Act stipulate that solid waste collection and disposal should be organized and managed at the local level.

The Solid Waste (Management and Resource Mobilization) Act and Regulations stipulates the establishment of a Solid Waste Management and Resource Mobilization Center (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[1]). A project was launched in the urban areas of the Kathmandu Valley by GTZ and SWMRMC, which has responsibility for solid waste management working directly with municipalities of the Kathmandu Valley, under the 1987 Solid Waste Act. While it has been acknowledged by a 1997 Cabinet decision that the 1987 Solid Waste Management Act needs to be reviewed with a view to the redefinition of the role of SWMRMC[2], no further steps have been taken by HMG/N to clarify the institutional arrangements in regards to SWM.

In 1996, HMG/N issued the **Solid Waste Management National Policy** which had the following objectives: a) to make management of the solid waste simple and effective; b) to minimize environmental pollution caused by the solid wastes and adverse effects thereof to the public health; c) to transform the solid waste into resources; d) to privatize the management of the solid wastes; e) to obtain public support by increasing public awareness in the sanitation works. While this policy made it necessary for every local body to establish a separate sanitation unit which should "carryout collection, preservation, movement, site management, transportation and final disposal works of solid wastes," (clause 5.2 a) it advocates a centralized institution at the national level, which, among many functions, will "select the management works of solid wastes on the basis of their quantity and nature produced in towns and villages where there is a problem," (clause 5.1 a).

Since the promulgation of the **Local Self Governance Act** of 1999, within the context of decentralization, all responsibilities that include collection, transportation and final disposal of solid waste, have been transferred to the municipalities (clause 96, c7), together with other duties and authority to protect the local environment. Nevertheless, existence of past legislation and national policy on SWM, which have not been repealed nor amended in line with the Local Self Governance Act, create much room for debate and uncertainty in regards to institutional arrangements and delineation of responsibilities between the central and local bodies.

[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.

[2] In 1997 there was a Cabinet decision to put "on hold" the activities of SWMRMC until further revision of this SWM Act could be reviewed and further advice could be provided.

Under the above circumstances, experience has shown that it has not achieved much success in the past. In practice it is observed that the central government (SWMRMC) has taken the initiative to identify landfill sites for the Kathmandu Valley since the 1990s. Gokarna Landfill site was constructed and operated by the central government agencies before it was handed over to Kathmandu Metropolitan City (KMC) for operation in the later part of the 1990s. The central government also identified the short-term (S/T) and long-term (L/T) landfill sites at Okharpauwa, constructed the S/T site and access road as well as EIA study. On the other hand, in the case of Bhaktapur Municipality (BKM), the municipality has been taking the initiative to develop a site and has already commenced the IEE study for the Taikabu candidate site. BKM has requested that the central government acquire the land and develop the landfill.

The current status of institutional arrangement on solid waste management is stipulated in the following acts and policy.

Table 3.1-1 Status of Solid Waste Management Stipulated in Act and Policy

Act/Policy	Stipulation
The Solid Waste (Management and Resource Mobilization) Act, 1987 (amended 1992)	1.1.2 It shall come into force in the Kathmandu, Lalitpur and Bhaktapur Municipal Areas at once, in other areas, it shall come in to force on such date as may be prescribed by HMG by notification in the Nepal Rajapatra 2.2.1 The Center shall be an autonomous and corporative body with perpetual succession 3.1.1 The functions and duties of the Center shall be as follows (see table below)
Solid Waste Management National Policy 2053 (1996)	5. Institutional Arrangements 5.1 An Institution of National Level His majesty's Government shall build a national level institution for the management of solid wastes with the following functions: (a) To select the management of solid wastes on the basis of their quantity and nature produced in towns and villages where there is a problem. (b) To select the site for final disposal of the solid wastes having minimized pollution in the concerned area and to develop the concept of disposal. (c) To develop a concept of minimum generation of solid wastes on the basis of the nature thereof in the concerned area. (d) To prepare appropriate criteria for the management of solid wastes on the basis of quantity of the solid wastes and their various natures, and also to co-ordinate with the different agencies implementing the same. To execute an environment impact study prior to selecting the site for final disposal. To assist the local bodies in the final disposal of solid wastes, as per necessity. (e) To develop solid waste management technology and concepts suitable to local conditions and to provide consultancy services to the local bodies. (f) To determine a strategy for gathering public participation in the sanitation works. (g) To make suggestions to the local bodies to collect service charges with a view to make sanitation service reliable and economically self-reliant, having made detail study on it. (h) To develop skilled manpower to carryout solid waste management work. (i) To study and research on the various aspects of solid waste management. (j) To safeguard the health of the persons selecting various reusable goods from the solid wastes and to operate various income generating business with a view to make such efforts profitable. (k) To support, as per necessity, the self-reliant groups involved in the sanitation works. (l) To collect or cause to collect service charges for transportation of solid wastes to

Act/Policy	Stipulation
	the final disposal site and for final disposal of such solid wastes by the private sector organizations and any other agencies. (m) To support local bodies to develop manpower required for sanitation works. (n) To identify the equipment required for sanitation works and to suggest or assist the local bodies on the same. (o) To monitor and make evaluations of the various activities concerning solid wastes. (p) To prepare a strategy for discouragement of the production of non-biodegradable goods including plastic goods. (q) If it is found that a local body fails to carry out the management works of solid waste under the accepted criteria and if environmental pollution or adverse effects to the public health have occurred, it may give necessary directives to the concerned local body for its prevention and the local body shall have to follow such directives. (r) To carryout such other works as His Majesty's Government prescribes.
Local Self-Governance Act, 2055 (1999)	**3. An Act Made to Provide for Local Self-Governance** Part-3, Provision Relating to Municipality Chapter-1, Municipal Area 96 Functions, Duties and Power of Municipalities (c) Relating to Water resources, Environment and Sanitation (7) To carry out and manage and to cause to be carried out and managed the acts of collection, transportation and disposal of garbage and solid wastes

Source: The Solid Waste (Management and Resource Mobilization) Act (1987), Solid Wastes Management National Policy 2053 (1996), Local Self-Governance Act, 2055 (1999)

3.1.2 Solid Waste Management in National Five Year Plan

It was not until the **10th National Five-Year Plan** (2002-2007) that SWM was explicitly placed in the forefront of the national planning agenda. As one of six strategies to achieve pollution control and sound environmental management, it is suggested in the current plan that "By establishing necessary indicators for SWM, the management activities will be operated accordingly through various concerned authorities[3]". Also under the section on local development, the 10th Plan highlighted the problem of a final disposal site as the major challenge in SWM, especially in the Kathmandu Valley. It has therefore specifically stated that "priority will be given to the infrastructure development of a long-term landfill site (LFS) in Okharpauwa-Banchare Danda[4]," and this construction is included in the list of priority projects to be implemented by MOLD within the current five-year framework.

3.1.3 Dhaka Declaration 2004 on Solid Waste Management

The Ministry of Environment and Forest, Government of the People's Republic of Bangladesh organized a three day South Asian Association for Regional Cooperation (SAARC) workshop during October 10-12, 2004 at BRAC Center Inn, Dhaka. The workshop was sponsored by the Ministry of Foreign Affaires and SAARC Secretariat. About 35 participants from home and abroad including delegates from the SAARC countries India, Pakistan, Nepal, Bhutan and Bangladesh participated. The workshop had five

[3] National Planning Commission, Tenth Five Year Plan, Ch. 22 Population and Environment
[4] ibid, Ch.30 Local Development

technical sessions that included a Keynote Presentation Followed by Country Paper Presentations, Institutional, Legal and Technical Issues, and Best Practices in solid waste management.

The recommendations presented there are based on discussions in each technical session as well as group meetings among SAARC delegates and unanimous consensus among the participating countries. It was conformed by the participating countries that the recommendations be considered as the "DHAKA DECLARATION ON WASTE MANAGEMENT 2004", the key features of which are as follows:

a. We should promote an effective, efficient, affordable, safe and sustainable waste management system for all the urban/rural settlements of SAARC countries with special attention to addressing the needs of the poor.

b. SAARC countries agree to establish a SAARC network on waste management with the objectives of sharing information and technology transfer on municipal solid waste and hazardous waste management among the SAARC countries. The network will consist of representatives from relevant government organizations, non government organizations, university and research institutions and urban local government authorities from each country. The aforesaid network shall undertake the following activities:

   - Establishing an information exchange mechanism
   - Forming a Technology Advisory Group for resolving technology issues.
   - Developing training programs for regulatory/implementation bodies.
   - Demonstration of technologies in the SAARC countries
   - Developing a database on entrepreneurs/suppliers of equipment/technology providers
   - Developing materials for awareness campaigns
   - Developing institutional cooperation mechanisms
   - Arranging annual meetings on a rotational basis
   - Organizing exchange visits amongst SAARC countries to share experiences of best practices
   - Facilitating development of legislative frameworks and guidelines
   - Undertaking joint research on legal, institutional and technical aspects of waste management
   - Developing newsletters on success stories and a dialogue website

c. SAARC countries agree that open dumping should be stopped immediately and these open dumps should be replaced with new safe disposal options (controlled landfill sites).

d. SAARC countries agree that incineration as well as unproven technologies such as Plasma, should not be considered as an option for the treatment of their municipal solid wastes for low calorific value and environmental pollution potential. However, in absence of an appropriate no-burn technology, incineration may be considered for the treatment of infectious/hazardous bio-medical wastes.

e. SAARC countries agree that present informal waste picking practice be improved as a safe and eco-friendly practice by improving the working conditions of the waste pickers and thereby reducing the occupational health hazard.

f. SAARC countries agree to encourage NGOs and private companies to establish community based segregation at the source, separate collection and resource recovery from wastes with particular focus on composting.

g. SAARC countries agree that hospital waste should be treated as a special waste and managed separately.

h. SAARC countries agree that in order to make the system financially viable the cost of solid waste management should be rationalized with a view to increase revenue.

i. SAARC countries agree that waste collection, treatment and disposal may be privatized to allow greater mobilization of capital. To attract foreign investment in waste management projects financing opportunities under the CDM may be harnessed in all SAARC countries.

3.1.4 Environmental Protection Act and Environmental Protection Rules

The Environmental Protection Act, 1997 (EPA) is a fundamental law aiming at proper pollution control and management of the environmental quality of life in Nepal. EPA provides for a mandate and responsibility for any organizations or individuals which may concern the national environmental management. Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) are also defined in EPA.

The Environmental Protection Rules, 1997 (EPR) is functioning as a bylaw of EPA, especially on IEE/EIA and pollution control. EPR stipulates a procedure for IEE/EIA to be followed by a project proponent involving the external bodies/individuals, technical requirements to be fulfilled in IEE/EIA, and evaluating/approving process of IEE/EIA adopted for the authorized ministries/bodies. Project types and scales are also stipulated on a sectoral base, on which IEE/EIA is legally prerequisite. An overview of the IEE/EIA system for the SWM sector in Nepal is presented in Chapter 12.

3.1.5 National Environmental Impact Assessment (EIA) Guideline for Solid Waste Management Projects for the Municipalities of Nepal

SWMRMC developed EIA Guidelines for Solid Waste Management Projects in the Municipalities of Nepal in 2004. The Guidelines aim at introducing the technical and procedural requirements for SWM-related project planning for developers focusing on IEE/EIA. The Guideline is composed of 12 chapters and appendices, including screening and scoping, impact prediction and management, public involvement, and so on. The overview of the Guidelines is presented in Chapter 12.

3.2 Organization and Responsibility

3.2.1 Organizations[5] relating to Solid Waste Management

Due to the inter-disciplinary nature of SWM, various HMG/N organizations are designated to be involved in SWM issues as shown in Figure 3.2-1. These organizations often are operating in various capacities without mutual understanding of respective responsibilities. It has been observed that compared to the operational organizations with day to day responsibilities in managing solid waste, the organizations at the policy level are not as active in addressing this specific field of SWM.

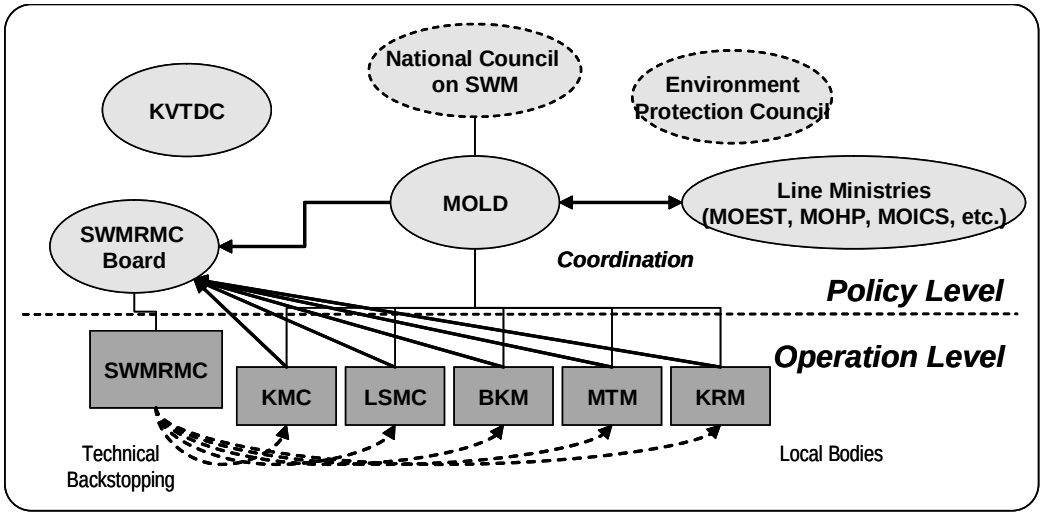


Figure 3.2-1 Organizations Involved in SWM in the Kathmandu Valley

Source: JICA Study Team

(1) Policy Level

National Council on Solid Waste Management: This Council was established with the 1996 National Solid Waste Management Policy as the ultimate policy making body on SWM at the national level. The Council was intended to be chaired by the Minister of MOLD, with other members represented from the National Planning Commission (NPC), MOPE (now Ministry of Environment, Science and Technology or MOEST), Ministry of Physical Planning and Works (MOPPW), Ministry of Health (MOH) (now Ministry of Health and Population or MOHP), Ministry of Finance (MOF) and Ministry of Tourism and Civil Aviation. Despite its significant responsibilities, the Council has not been convened for at least the past five years, and is not functioning as of this date.

Environmental Protection Council (EPC): This policy making body on environmental issues has the mandate to deliberate at the highest level environmental issues of national concern. Its members are mostly constituted of Cabinet members, to be chaired by the Prime Minister. In a decision made by this Environment Protection Council in 1994, Okharpauwa was selected from among three candidate sites as the most suitable long-term

[5] In this section, the description of management hierarchy and responsibilities will include only public organizations involved in SWM. In Nepal, there are numerous organizations that are active in the private sector, and these will be highlighted in other sections of the report.

LFS for the Kathmandu Valley. However, again, this Environment Protection Council has not been assembled in recent years. MOPE served as the secretariat for EPC.

Kathmandu Valley Town Development Committee (KVTDC): This body was established to develop a Master Plan for the sustainable urban development of the Kathmandu Valley up to 2020. Chaired by MOPPW, Secretaries of various line ministries, District Chairpersons of Kathmandu, Lalitpur, and Bhaktapur, five Mayors of the municipalities constitute the members. In 2002, KVTDC produced a long-term plan and a set of action plans that were approved by the Cabinet for implementation. Within these plans, SWM was given great importance, especially in relation to the urgent matter of developing the landfill site for the Valley. It also made general recommendations to make effective provision for SWM in the national and local budgets.

Ministry of Local Development (MOLD): MOLD is the primary ministry responsible for municipal SWM. If and in case there will be any future legislation on SWM, the Environmental Management Section within MOLD, will become the focal point producing the drafts of the bill and advocating them among concerned authorities for submission to the Cabinet. At present, there are no new policy initiatives being presented by MOLD in the area of SWM, however recently MOLD was responsible for issuing the Public Private Partnership Policy (2003, (2060[6])) and Guidelines (2004, (2061)) which may facilitate the participation of the private sector in the realm of SWM.

In addition, MOLD is responsible for preparation of any national budget allocation in the development of SWM facilities, in case it is deemed necessary. MOLD supported the development of Sisdol Landfill, and for FY2005/06 (2062), it has included within their draft budget proposal for the allocation of Rs 20 million for the development of the Taikabu Landfill site.

Finally, for all SWM-related IEE and EIA reports submitted by the municipalities, MOLD conducts a review and needs to approve them prior to submission to the Ministry of Environment, Science and Technology (MOEST).

Executive Board of SWMRMC: This Board was formed in 1987 to conduct, supervise and manage all functions and operations of SWMRMC. Currently, the Secretary of MOLD chairs the Board, and its members consist of representatives from MOF, MOPPW, Nepal Water Supply Corporation (NWSC) and the Mayors of KMC, Lalitpur Sub-Metropolitan City (LSMC), BKM. The Board meetings are held as and when required, usually with the agenda covering both operational matters of SWMRMC and other general SWM policy issues.

Ministry of Environment, Science and Technology (MOEST): On March 31, 2005, the Ministry of Population and Environment (MOPE) was restructured, and the Environment Division of the ministry was incorporated into the Ministry of Environment, Science and Technology (MOEST). As MOEST, since its core functions and organizational structure have not been finalized to date, the following section describes the role of former MOPE in regards to SWM.

Former MOPE was responsible for formulating general environmental policies and regulations in the area of Environmental Conservation and Pollution Control. In addition, this ministry was responsible for setting and enforcing environmental standards, and

[6] Nepalese Year

establishing the system for Environmental Impact Assessments (EIA). According to its Scope of Work identified in 1996, as part of its supportive function, it has included "control pollution through research and encourage recycling and appropriate disposal of waste products," as well as "Assist municipalities to preserve the urban environment.[7]" From this perspective, especially for hazardous waste management, MOPE was identified as the responsible organization, for drafting policies and guidelines, setting standards to promote appropriate handling and treatment, and consequently report externally regarding national obligations to the Basel Convention on hazardous waste.

At the operational level, former MOPE had an important role from the point of view of SWM facilities development. According to the Environmental Protection Policy and Regulations of 1997, MOPE was responsible for convening an inter-ministerial IEE or EIA Review Committee to authorize development of any facilities that may have significant impact on the surrounding environment. Some of the recent SWM cases that are still under review are as listed below in Table 3.2-1[8]. Most recently on May 22, 2005, the Scoping Report and Terms of Reference for the development of the Taikabu Sanitary Landfill site were approved by MOEST on a conditional basis[6].

Table 3.2-1 List of SWM Related IEE and EIA Projects Approve or Under Review at MOEST

SWM related IEE (Scoping and Terms of Reference) or EIA Approvals to date	SWM related IEE or EIA under review
• EIA for Solid Waste Treatment Plant and Development of Sanitary Landfill Site at Okharpauwa • Scoping Report and Terms of Reference (TOR) for development of Landfill Site in Mecchi Municipality, Jhapa District • Scoping Report and TOR for Waste Resource Management Center Biratnagar-Dharan Industrial Corridor • Scoping Report and TOR for Taikabu Sanitary Landfill Site • EIA for Teku Medical Waste Incineration Facility	• EIA for Development of Landfill Site in Mecchi Municipality, Jhapa District

Source: Mr. Bhai Raja Manandhar, Engineer, MOEST, June 2005

Ministry of Health and Population (MOHP): MOHP is responsible for managing medical waste within the health service providers, from the perspective of promoting appropriate handling and treatment to prevent secondary infection. Based on the National Medical Waste Guideline, MOHP also conducted training in selected health institutions to mainstream practices of waste separation and treatment.

Under MOPH, Nepal Health Research Council (NHRC) is actively working on medical waste management related activities with the support of WHO. NHRC is mainly involved in the research work and training on medical waste management to the staffs of the various hospitals. They have developed the National Medical Waste Management Guideline,

[7] Ministry of Population and Environment, Scope of Work. March 1996

[8] Based on information provided by Mr. Bhai Raja Manandhar, engineer at MOEST responsible for assessing EIA reports, 1 June 2005.

Training Manual and Environmental Health Impact Assessment Guideline including many research reports related to medical waste management.

Ministry of Industry, Commerce and Supplies (MOICS): MOICS has an environmental section in the Department of Industry, which is responsible to approve the TOR of IEE to investigate the impact of any new industry. The Department of Industry also has a monitoring unit for monitoring the activities of industry in which there is any complaint or report of pollution. In the past, there was a provision for issuing pollution control certificates annually but it was stopped one year after its implementation.

(2) Operational Level

Solid Waste Management and Resource Mobilization Center (SWMRMC): SWMRMC was established in 1980 by GTZ's Solid Waste Management Project, with a mission to carry out SWM responsibilities on behalf of KMC, LSMC and BKM until the municipalities themselves build enough capacity to take over activities on their own. Since then, with the decentralization of SWM responsibilities, the role of SWMRMC has evolved; today, it mainly acts as the operational arm for MOLD in the following capacities[9]:

- Develop appropriate legislation (on SWM)
- Development of environmental guidelines
- Landfill site development
- Financial support wherever appropriate in all aspects of SWM
- To take the responsibility to provide technical support to respective municipalities
- Enhancement of capabilities of municipalities
- Central organization to act as a link between Ministry and municipal governments.

Currently, major activities are focused on managing the construction works for the development of the Okharpauwa LFS and closing of Gokarna former LFS. Furthermore, in line with their future vision of expanding their mandate to include all municipalities, in 2004, the Center produced a report on the current situation of SWM in all 58 municipalities in Nepal, and is also finalizing the National Environmental Impact Assessment guidelines for SWM targeting local governments.

Local Bodies including Municipalities: 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. In these local bodies, SWM is one of the core services provided to the public; the SWM budget dominates large proportions of annual budgets. However, according to the UDLE report of October 2000[10], even among the 58 municipalities, only the larger 16 have independent sections or sub-sections focusing on sanitation or SWM, and the remaining 42 smaller municipalities usually have a joint Public Health & Sanitation Section responsible mainly for street cleaning and some transportation of waste. Hardly any staff with SWM technical skills and knowledge exist except in the few largest municipalities. In summary, the SWM capacities of these local bodies, in spite of the decentralized authority and responsibilities, are much underdeveloped in terms of both technical capacity and human resources.

[9] From Presentation "Roles and Activities of SWMRMC" by Mr. Surya Man Shakya, at the 1st Seminar on March 19, 2004.
[10] UDLE: Training of Solid Waste Management Technicians for Municipalities in Nepal (October 2000)

3.2.2 Current Situation of Public Private Partnerships in SWM

(1) Policy on Public Private Partnership

Globally, the participation of the private sector[11] has been proven as one of the effective approaches to enhance effectiveness and efficiency of public service delivery in SWM. Even in Nepal, Public Private Partnership (PPP) in SWM is not a new endeavor, with the Biratnagar Municipality and Kathmandu Metropolitan City (KMC) initiating PPP arrangements as far back as 1997 and 1998 respectively. Since then, PPP has always been discussed as an important approach in enhancing Nepal's municipal SWM services. Nevertheless, the results from existing PPP arrangements are mixed, and the volume and maturity of new PPP arrangements have not escalated significantly.

Various bottlenecks obstruct the acceleration of PPP expansion in SWM. First, the institutional capacity among the municipalities to systematically initiate and manage PPP projects, including policies and operational guidelines, is underdeveloped. Second, much of the general public is still skeptical towards private sector involvement in public service delivery, and is not always supportive of the process. Third, the municipal linkages with private operators who may have the potential of entering PPP arrangements are weak, limiting mobilization of qualified private entities from PPP projects. Despite such difficulties, in the 2004 survey on the state of SWM in 58 municipalities of Nepal[12], over 31 municipalities were reported to have some kind of activities by the private sector in managing their municipal waste.

In regards to the policy environment, various frameworks are now in place at the national level to encourage PPP in SWM. Various provisions in the ***Local Self Governance Act 2055 (1999) and Regulations 2056 (2000)*** (including amendments in 2004) promote mobilization of the private sector, including NGOs/CBOs in municipal service delivery and development works. Subsequently HMG approved the ***Public Private Partnership Policy for Local Bodies 2060*** and ***Public Private Partnership Guidelines 2061*** in 2004 and 2005 respectively. Both legal instruments aim to provide basic guidance to the local government bodies to increase PPP initiatives. The Guidelines also focuses on institutional mechanisms that need to be established within the local bodies to support systematic and effective implementation of PPP arrangements.

For advocating PPP in infrastructure development specifically, ***Private Investment in the Construction and Operation of Infrastructures (BOT Act)*** was promulgated by HMG in 2003. This BOT Act would have implications for development of SWM facilities, however, the only such example to date was the attempt to establish a central waste processing plant in the Kathmandu Valley agreed upon by SWMRMC, KMC and Luna Nepal Chemicals & Fertilizers Ltd on BOT basis. This project agreement, entered into practice in September 2003, is now breached.

As for the policy framework at individual municipality level, aside from KMC, no municipality within the Kathmandu Valley has a PPP policy in place although there appears to be a vague but persistent view shared that PPP would be beneficial to the municipal programs. In KMC, several attempts were made to formalize PPP Policy and institutional arrangements, but not much progress has been made to date. With the introduction of UNDP

[11] Unless otherwise noted, Private Sector organizations stated here include private enterprises as well as NGOs and CBOs.
[12] *SWMRMC, A Diagnostic Report on State of Solid Waste Management in Municipalities of Nepal, April 2004.*

PPPUE activities (see Chapter 3.5) in KMC, it is expected that various initiatives would be implemented to institutionalize PPP mechanisms at KMC central level.

(2) Existing Practices of PPP in SWM within the Kathmandu Valley

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 collection and primary collection of solid waste. These organizations consist of a mixed bag of private enterprises, NGOs and CBOs, with various capacities and degrees of affiliation with the municipality. Some of the NGOs and CBOs promote waste minimization through community-based activities as part of their services, but all in all, in regards to provision of collection and transportation services, little disparity exist between the operational modalities of a private enterprises vis-à-vis NGOs and CBOs.

As of June 2005, aside from the most recent PPP pilot initiative in Madhyapur Thimi Municipality (MTM), no PPP agreements exist in the field of SWM within the Kathmandu Valley municipalities. Most private organizations are working on their own, or under some kind of verbal understanding with the municipalities.

1) KMC

It is unknown how many private organizations are providing SWM services within KMC, however, the Environment Department has recognized affiliation with at least 15 organizations. Summary of the activities by these organizations are shown in Table 3.2-2.

Table 3.2-2 Profile of Major Private Sector Organizations Activities in KMC

No	Organization Name	Organizati-onal Status	Ward No.	Member-ship (approx.)	Collection frequency	Street Sweeping	No. of Staff
1	Kathmandu Mahanagar Solid Waste Management Services	Private Company	1	1,000	Daily	18 km (pitched)	57
2	SILT Environmental Services-Nepal	Private Company	13, 14, 15	3,900	Alternately	9 km (pitched)	79
3	A to Z Cleaning Services	Private Company	24, 22, 25	1,100	Daily	New Road Salik to Gate; Ganesh Chowk, Indra Chowk	48
4	KP Cleaning Services	Private Company	2	400	NA	3 km (pitched), 1 km (not pitched)	26
5	B and B Cleaning Services	Private Company	8, 9, 31, 32, 34	500	Daily	10.5 km (pitched), 1.5 km (not pitched)	35
6	Women Environment Avian	NGO	34	500-600	Daily	Sankhamul pool to Niketan	11
7	Jana Jagarukh Safa Suggar Campaign	NGO	10, 34	5,000	NA	30 km (pitched)	53
8	Sarsafai Avian Pvt. Ltd.	NGO	3, 5, 7	1,300	Alternately		20
9	Bouddha Youth	CBO	6	1,500	Alternately	20 km (pitched)	32

No	Organization Name	Organizati-onal Status	Ward No.	Member-ship (approx.)	Collection frequency	Street Sweeping	No. of Staff
10	Nepal Pollution Control and Environment Center (NEPCEMAC)	NGO	3, 4, 5, 16	5,600	Daily	17 km (mostly not pitched)	84
11	Samyukta Sewa Pvt. Ltd.	Private Company	6, 7	1,200	Daily	5 to 6 km	16
12	Nepal Fulbari Pollution Control Centre	NGO	3, 4	600	Alternately	Gongabu chowk to Thamel (not main road)	20
13	Environment Conservation Initiative-Nepal	Private Company	7, 9, 16, 29, 33	3,000	Daily	Within Ring Road (not main road)	36
14	Hamro Sarsafai Avian Pvt. Ltd.	Private Company	35	1,300-1,400	Alternately	No sweeping	31
15	Karmachari Kalayan Kkosh	NA	NA	NA	NA	NA	NA

Note: NA means not available.
Source: KMC Task Force, JICA Study Team

In the past, KMC have officially authorized five private organizations for SWM service in the areas of seven wards as a transition period in order to learn lessons as follows:

- In 1998, KMC issued the first public notice soliciting private sector participation for SWM. As a result of the selection process, SILT Environmental Services Pvt. Ltd was given a contract for door-to-door collections in Wards 13, 14 and 15 and Our Cleaning Campaign & Services (OCCS) was selected for Ward 18. Activities started in 1999, and whereas SILT Environmental Services-Nepal continues its services to date and covers approximately 65% (as of February 2005) of the households within the designated wards, OCCS discontinued its activities in 2001. Within SILT's activities, street sweeping was added in Wards 13 and 14 from year 2003, practicing the lessons learned from the dwellers behavior of the two wards.
- In 1999, KMC signed a one-year service contracts on a trial basis for street sweeping with OCCS, Kuchikar Kalayan Kosh (KKK, sweepers welfare fund), and B&P Cleaning Services based on unit price per km length of the road[13]. Although the agreements were not renewed, currently KKK has taken over the designated area of OCCS and continues to provide their services. Due to this initiative, KMC estimated that it was able to reduce its cost of sweeping by 50%[14].
- In 2001, KMC attempted to contract out an additional six wards, but abandoned those efforts because of sweepers' opposition. After a laborious selection and preparation period, KMC awarded franchise agreements to three organizations (Kathmandu Mahanagar SWM Service, KP Cleaning Service, and A-Z Cleaning Services) in the areas of Wards 1, 2, 24 respectively for collection, transportation and disposal of solid waste, and in some cases waste processing and street sweeping.

[13] For KKK, annual fees to be provided by the municipality for its sweeping contract from Maithigar to Tilganga Eye hospital were fixed to 989,100 Rs. per annum.
[14] KMC, Solid Waste Management Situation Analysis and Strategic Approach, 1999.

KMC maintains a strategy to support the private sector to cover up to 60% of total households of Kathmandu by the year 2015 to address increasing pressures from its growing population. It is important to note that the municipality intends to implement this strategy without any changes in its current human resource base, especially the sweepers.

2) LSMC

It is estimated that more than 30 private organizations are serving SWM in LSMC, mainly providing door-to-door collection of solid waste. According to the 2004 Household Behavior and Attitude Survey on SWM conducted by the JICA Study Team, out of the 162 households surveyed in LSMC, over 73% of the respondent sample HHs identified NGOs and CBOs as service providers. Major NGOs such as Nepal Pollution Control and Environment Managing Center (NEPCEMAC), Women Environment Preservation Committee (WEPCO), and National Environment Pollution Control Nepal (NEPCO) have been reported to service 2,850 HHs, 1,100 HHs, and 800 HHs respectively for a collection fee of about Rs 20 to 75 per household. This signifies that services provided by the private sector is prevalent in LSMC, nevertheless, the municipality has little information or management control over these activities. Meanwhile, LSMC attempted to invite the private sector into SWM services and published a notice in the paper on October 2003. As a result, 15 organizations submitted technical and financial proposals to LSMC. The selection process has been stalled due to the opposition expressed by the sweeper community.

3) KRM

In Kirtipur Municipality (KRM), all solid waste is managed based on the partnership agreement with a local CBO, UNIQUE and NGO, NEPCO signed in 1999 when SWM privatization officially started. Now over 2,500 households are serviced by UNIQUE in Wards 1, 3, 4, 5, 6, 9, 10, 11, 12, 16, 17 and it expects to expand its coverage. NEPCO, which initially had a membership of about 2,000 households, currently collects waste from about 300 households in Wards 1, 2, and 3. Both organizations concentrate on servicing the core part of the municipality area. Households in rural areas are not covered yet except for schools and factories.

4) MTM

Further to the training received on PPP under the Study, MTM embarked upon its first pilot project of PPP in SWM starting 2005. In March 2005, MTM made a public announcement, soliciting partners for door to door collection in its newly developing area of Wards 15, 16, 17, and a part of Ward 7. Four partners submitted their proposals, two of which were already operating without any official agreement with the municipality. The municipality signed a Terms of Reference Agreement with all four organizations for two months until the end of FY2004/05 (2061/62). After a performance review, and an assessment of the reaction from the communities, MTM plans to provide formal PPP agreements to those partners whose operations have proven effective.

3.3 Annual Budget and Budgeting Procedures

3.3.1 Budgeting Procedure at National Level

The new fiscal year of the country begins in mid July, and the Government budget starts simultaneously. Government expenditure budget consists of current expenditures, development expenditures and debt payment. The characteristics of the expenditure budget emphasize that development expenditures have been exceeded by current expenditures since FY1998/99 (2055). Development expenditures aim to develop various sectors and areas of the county; however, its weight in total Government expenditure budget has dropped to the level of less than 30%. Meanwhile, Government revenues have not been enough to cover all the Government expenditures. Consequently, every year, the Government budget has had a negative balance that has been filled by foreign aid and external/internal loans. A summary of the Government budget is presented in Table 3.3-1.

Table 3.3-1 Summary of Government Budget

Items	FY2003/04 (2060/61) (Revised)	FY2004/05 (2061/62) (Initial)	Change
	billion Rs (% of Total amount)	billion Rs (% of Total amount)	%
I. Expenditure	92.1 (100.0%)	111.7 (100.0%)	21.3
1. Current	56.7 (61.6%)	67.6 (60.5%)	19.2
2. Development	24.5 (26.6%)	31.6 (28.3%)	29.0
3. Debt Payment	10.9 (11.8%)	12.5 (11.2%)	14.5
II. Revenue	73.7 (100.0%)	85.7 (100.0%)	16.3
1. Own revenue	62.2 (84.4%)	70.3 (82.0%)	13.0
2. Foreign Aid	11.5 (15.6%)	15.4 (18.0%)	34.0
III. Balance	-18.4	-26.0	-

Source: Public Statement of Income and Expenditure and Item-wise Expenditure Information, 2004/05, MOF

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

3.3.2 Budget for Solid Waste Management at National Level

Budget for SWM at the national level is allocated solely to SWMRWC. In FY2004/05 (2061/62), Rs 85 million was allocated to SWMRWC. That represented 13% of the total budget of MOLD. In addition to this allocation from the Government, SWMRWC spent Rs 12 million in FY2004/05 (2061/62) from its own revenue sources, so called "Internal Sources". As a result, integrated budget for SWM of SWMRWC in FY2004/05 (2061/62) reaches Rs 97 million in total as shown in Table 3.3-2.

Table 3.3-2 Integrated Fiscal Balance and Budget of SWMRWC (million Rs)

Budget Items		FY00/01 (2057/58	FY01/02 (2058/59	FY02/03 (2059/60	FY03/04 (2060/61	FY04/05 (2061/62
		Actual	Actual	Actual	Actual	Budget
I. Allocation from Government		**51.5**	**96.5**	**77.6**	**41.3**	**85.0**
1. Administrative Expenditure	Personnel	2.5	2.5	1.9	1.3	1.8
	Repair & Maintenance	0.3	0.2	0.3	0.2	0.2
	Fuel	0.4	0.4	0	0	0.3
	Others	1.2	0.7	0.8	1.5	0.3
	Sub-Total	4.4	3.8	3.1	2.9	2.6
2. Capital Expenditure		47.1	92.7	74.5	38.4	82.4
II. Expenditure spent from Internal Source		**0.5**	**0.3**	**0.9**	**13.8**	**12.0**
Grand Total (=I+II)		**52.0**	**96.8**	**78.5**	**55.1**	**97.0**

Source: SWMRWC, 2005

Internal sources are summarized in Table 3.3-3, which are spent mainly for public construction works at the discretion of SWMRWC.

Table 3.3-3 Summary of Internal Sources (million Rs)

Items	FY00/01 (2057/58)	FY01/02 (2058/59)	FY02/03 (2059/60)	FY03/04 (2060/61)	FY04/05 (2061/62)
	Actual	Actual	Actual	Actual	Up to mid April
I Revenue	7.9	11.4	7.4	11.4	8.5
1. Scrap Tax	7.3	10.6	7.0	9.9	8.0
2. Others	0.6	0.8	0.4	1.5	0.5
II. Expenditures	0.5	0.3	0.8	13.8	8.1
III. Balance of Year End	n/a	n/a	25.6	23.1	23.5

Source: SWMRWC, 2005

Table 3.3-4 shows breakdown of capital expenditures spent from Government budget allocation.

Table 3.3-4 Breakdown of Capital Expenditures (million Rs)

Items	FY00/01 (2057/58	FY01/02 (2058/59	FY02/03 (2059/60	FY03/04 (2060/61	FY04/05 (2061/62)
	Actual	Actual	Actual	Actual	Budget
1. Land acquisition for Okharpauwa LFS	-	25.9	1.0	2.5	-
2. Land acquisition for Gokarna LFS	0.9	0.2	-	-	-
3. Development of Okharpauwa L/FS	23.7	56.0	58.1	35.9	12.0
4. Development of Gokarna LFS	8.4	-	-	-	-
5. Short-term LFS development program (Gueheshowari* & Gokarna)	2.8	7.1	12.2	-	-
6. Development works from Local Demand	5.0	3.5	3.0	-	-
7. Acquisition of vehicles (Grant)	-	-	-	-	70.0
8. Acquisition of Machinery & tools	-	-	-	-	0.4
Total	47.1	92.7	74.5	38.4	82.4

Note:* Gueheshowari LFS located at Bagmati River bank was proposed as a dumping site for emergencies, though it was not feasible to dump waste because of opposition by local people.
Source: SWMRWC, 2005

3.3.3 Reserved Fund of Ministry of Local Development

The Reserved Fund (the Fund) is considered as a possible financial source for SWM for local governments. The Fund was established in 2000 according to "Local Development Fee Fund Regulation 1999" and operated according to "Reserved Fund Operation Guideline". Local Development Fee is a source of the Fund which aims to encourage and support local governments for project development implementation on a cost sharing basis. The Fund is managed and operated by the Fund Operation Committee chaired by the Secretary of MOLD.

The Fund is provided to 26 development sectors, in which development of "landfill site and compost plant construction and management" is included. The Fund can be provided to this sector for 70% of the development cost, which cannot exceed Rs 5 million; however, for joint projects of two or more local bodies, the amount of Rs 5 million can be provided to each local body. The size of every year's deposit to the Fund reaches Rs 120 million according to the information from MOLD.

3.3.4 Financial Conditions and Revenue System of Municipalities

(1) Budget Preparation

The Local Self-Governance Act, 1999 - Article 130 provides for budget preparation by municipalities and approval by the Council in a prescribed manner prior to the beginning of the forthcoming fiscal year. According to discussions with concerned departments (sections) of the municipalities, the budget procedures and timeframes could be standardized as illustrated in Table 3.3-5.

Table 3.3-5 Model for Budget Procedures and Timeframes

Items	May				June				July	
1) Budget call by Account Department	■									
2) Estimation by relevant departments		■	■	■						
3) Collection and consolidation by Account Department					■	■				
4) Consultation with relevant departments							■	■		
5) Draft budget approval by Mayor									■	
6) Draft budget approval by the Board									■	
7) Budget approval by the Council										■

Source: JICA Study Team (Compiled from discussions with municipalities)

However, the interviews revealed that municipalities have not followed the timeframe prescribed in the Act other than LSMC. The actual timeframe of budget preparation of each municipality is summarized in Table 3.3-6.

Table 3.3-6 Actual Time Frame for Budget Preparation for FY2004/05 (2061/62)

Municipalities	Commencement	Approval Date
KMC	May, 2004	December 13, 2004
LSMC	May, 2004	End of June, 2004
BKM	July, 2004	October 14, 2004
MTM	June/July, 2004	October 28, 2004
KRM	June/July, 2004	December 24, 2004

Source: JICA Study Team (Information from interviews with municipalities)

The new fiscal year used to run for several months without approval of the Council. To achieve smooth administration and operation of the new fiscal year, the municipalities have to prepare advance budgets based on the previous year's data and have to be approved by the top management of the municipalities. Once the budget is approved by the Council, unbudgeted or extraordinary expenditures are disbursed from some another budget head within limited amounts; otherwise they have to be approved by the ad-hoc Council meeting.

(2) Financial Situation

Actual revenue and expenditures of FY2003/04 (2060/61) of the five municipalities are summarized in Table 3.3-7. KMC and LSMC had negative balances that were covered by debts. Meanwhile, other three municipalities had surpluses. Details of actual revenue and expenditures from FY2000/01 (2057/58) and budget of FY2004/05 (2060/61) are presented in Appendix 3.2.

Table 3.3-7 Actual Revenue and Expenditure of FY2003/04 (2060/61)

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) Grants	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

At present, the main sources of revenue are comprised of Local Development Fee, Own-source Revenues and Government Grant. It should be noted that the revenues of the five municipalities mostly come from the Local Development Fee that is temporally distributed by the Government. KMC, LSMC, MTM and KRM depend on that Fee that accounts respectively for 43%, 45%, 50% and 71% of total revenue amounts. BKM, where collection of tourism fee is ranked the largest in the revenues, also depends on the Fee for as much as 16%. Since the Local Development Fee is scheduled to be abolished by the end of December 2013, KMC and LSMC have already started efforts to enhance and improve the overall revenue system of the municipality.

As for the expenditure, personnel expenses were the largest among current expenditures that accounted for 27% in KMC, 65% in LSMC, 18% in BKM, 52% in MTM, and 61% in KRM. In the case of SWM expenditures of the five municipalities, they are estimated as follows according to the data and information of the municipalities:

Table 3.3-8 Estimated SWM Expenditures of Five Municipalities

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

Note: KMC, BKM, MTM and KRM as of 2001/02 (2058), LSMC as of 2002/03 (2059)
Source: Information from UDLE of GTZ and each municipality, and JICA Study Team

(3) Revenue System of the Municipalities

1) Local Development Fee

Before the enactment of the Local Self-Governance Act, the major source of revenue of municipalities was octroi that was a kind of local 1% tax collected on the value of goods entering into the municipalities' boundaries. As the Local Self-Governance Act abolished the octroi, the Government decided instead to provide local bodies with nearly the same amount as the octroi actually collected in the year of 1997/98 as the Local Development Fee, considering the critical financial conditions of the municipalities. However, the Local Development Fee will discontinue in the future because it will lose the earning source as mentioned in the Box bellow:

WTO and Local Development Fee

Nepal has joined the WTO on April 23, 2004 as the 147th member. The Government agreed with WTO to enter into full implementation from January 2007. However, WTO gives a transition period for abolition of Technical Barriers for Trade including 1.5% of Local Development Tax that is collected on imported goods. Local Development Tax is a source of the Local Development Fee. Accordingly, the Local Development Tax will fade out gradually (practically, being abolished yearly by industrial sector based on the Harmonized System (HS) codes that categorizes industrial sectors.) from January 2005 and be completely abolished by December 2013.

Source: MOICS

In this connection, the municipalities should seek other revenue sources to make up for the fading Local Development Fee.

2) Own-source Revenue

At present, the following are the main own-source revenues for municipalities:

-Tax Income : Property Tax, Vehicle Tax, Enterprise Tax, Rent Tax
-Income from Fees : Building Permits
-Income from Property : Rental Income
-Other income : Investment Income, Tourism Charges, Fines

Revenues from Property Tax, Enterprise Tax and Building Permit Fees are the major own-sources for the municipalities, especially for KMC and LSMC. On the other hand, tourism charges are the largest revenue for BKM.

a. Property Tax

The Local Government Act 1999 provides two kinds of property tax systems, the House and Land Tax, and the Integrated Property Tax. Currently, the municipalities have selected the House and Land Tax system which was handed over from the Government to local bodies at the beginning of FY2000/01 (2057).

The Property Tax is considered as the optimum revenue mobilization because it is expected to increase in line with growing urbanization and population. However, in reality, the Tax system has not been reformed enough to catch up with growing urbanization, increasing population and demand for municipality services. Accordingly, now, it is the most crucial matter for every municipality to strengthen the Tax system to make up for the diminishing Local Development Fee.

b. Vehicle Tax

Vehicle Taxes were prescribe in the Vehicle Tax Act in 1974. The five municipalities in the Valley collected a total of Rs.10 million as vehicle tax revenue in the FY2004/05 (2061/62).

c. Enterprise Tax

A municipality may levy and collect enterprise tax on trade, professions or occupations within its jurisdiction based on capital investment and financial transactions. Enterprise tax revenue is also expected to increase along with growing business activities.

d. Rent Tax

The national Government currently collects 15% on rent. In addition, the Local Government Act 1999 allows municipalities to impose 2% on the same rent. KMC has already started to collect this new tax from May 2005.

3) Government Grant

Financial autonomy is the Government policy on municipality management; therefore grants from the Government are limited.

3.4 Environmental Education

3.4.1 Environmental Education in Formal Education

Environmental education can help people become aware of the consequences of their actions and build the human capacity necessary to solve and prevent environmental problems. Particularly, it is imperative to provide opportunity to children in early childhood to acquire knowledge and "develop skills and attitudes necessary to understand and appreciate the

interrelatedness among man, his culture and biological surroundings" [15] through environmental education.

In Nepal, formal environmental education has been introduced and incorporated in social studies in an integrated way in the primary level (Grades 1-5). As a compulsory subject in lower secondary level (Grades 6-8), Population and Environment Education was recommended by the National Educational Commission 1992 after the Earth Summit. Similarly, addition of Health, Population and Environment Education as a compulsory subject for secondary level (Grades 9-10) was recommended by the High Level Commission in 1997. The themes covered by these textbooks are as follows:

- Degradation of land and forest resources
- Air pollution, soil pollution, water pollution and noise pollution
- Natural hazards associated with the monsoon and mountain ecosystem such as landslides and flood
- Conversation of biological diversity
- Global environmental concerns including ozone depletion, global warming and climate change

With regard to SWM, most of the topics concentrate on keeping the home and school environment clean at the primary level. At the lower secondary level, the environmental concerns are raised for much larger areas like the toles (hamlets), villages and towns. Clean environment is presented as a necessity for healthy living and therefore, spreading environmental sanitation messages is deemed important. Grades 8 and 9 textbooks involve a much more detailed explanation of the various aspects of SWM. They also present several ways to contribute to minimizing the solid waste. Grade 8 textbooks describe the connection between environmental sanitation and healthy living by focusing on the necessity of nationwide sanitation campaigns at the household level. Various campaigns based on publicity/information dissemination are also recommended. A variety of media such as posters, pamphlets, audiovisuals etc could be used effectively to deliver relevant messages on environmental sanitation to the people. Grade 9 textbooks have two subunits devoted to SWM exclusively; Management of Solid Waste and Methods of SWM. It may be the first time that students find information on solid wastes found at various sites and ways to manage them. Various collection systems are in place such as the bell collection system and door-to-door collection system that have been introduced. Further, waste minimization through reuse, recycle and making compost in a pit is also described.

Although there are several topics related to SWM covered by the textbooks in different grades, the present scenario on SWM, including the current data on SWM in urban areas or the whole country, is not clearly presented. The curriculum on environmental education greatly focuses on provision of knowledge or information on SWM by means of lectures. On the other hand, the practical and interactive activities on SWM through demonstration, hands-on learning or training are hardly given in school curriculum due to the lack of resources and materials on SWM and limited teaching capability in this area among teachers.

At the higher education level, there are basically three universities which have courses in Environment Science in different levels as follows:

[15] IUCN, 1970

-Kathmandu University- Bachelor's Degree, Master's Degree and PhD.
-Pokhara University (SchEMS)- Bachelor's Degree, Master's Degree
-Tribhuwan Unversity-Bachelor's Degree, Master's Degree

As indicated in Table 3.4-1, various colleges are affiliated under these three universities and affiliated colleges only offer Bachelor's and Master's Degrees.

Table 3.4-1 Colleges having Courses in Environmental Science

Name of University	Name of Affiliated Colleges
Kathmandu University	St. Xavier's College ** University College, Dhulikhl***
Tribuhuwan University	Padma Kanya College** Tri Chandra College** Amrit Science College** Khwopa College*** Vishow Niketan College** University College , Kirtipur***
Pokhara University:	School of Environment Management and Sustainable Development (SchEMS)***

Note: ** Bachelor's Degree
***Master's Degree and Bachelor's Degree
Source: JICA Study Team

3.4.2 Environmental Education in Non-Formal Education

It is critical to encourage and enhance people's participation in activities aimed at conservation, protection and management of the environment, as these things are essential for achieving sustainable development. Non-formal education related to environmental issues, therefore, has been provided by many government offices, international organizations, NGOs, and CBOs. Some of the major schemes implemented for imparting environmental education, creating environmental awareness and involving local communities and people are as follows:

- Conducting health, sanitation and environment awareness programs using traditional and modern media for communication
- Provision of non-formal adult literacy classes, often focused on cleanliness of home, sanitation and responsibility of environmental conservation
- Formation and mobilization of Eco Clubs/Child Clubs/Nature Clubs targeting children
- Formation of various user groups of natural resources by providing them responsibility to conserve
- Demonstration and provision of hands-on training for preservation and protection of the environment

As for mass education in terms of environmental issues, various ministries and institutions such as Man and the Biosphere (MAB) under the Ministry of Education, the National Planning Commission (NPC), Ministry of Environment and Forest (MOEF), former MOPE and MOEST have begun to celebrate the World Environment Day since 1974. However, it has been celebrated more officially since 1996 in conjunction with major NGOs including international NGOs. The major activities include rallies, exhibitions, field visits and on the

spot report writing competition, on the spot art competition, award functions, interaction programs, cultural programs and media campaigns. Similarly, Earth Day has been celebrated by some NGOs. KMC has also been celebrating Earth Day to educate and mobilize public support for environmental protection in coordination with NGOs and CBOs since 2001.

Non-formal environmental education focuses on practical skills and knowledge through interactive activities previously mentioned while formal ones often focus on information transfer in a prescribed curriculum. In the field of SWM, creation of awareness campaigns and training through various communication channels and media including interpersonal, small and mass media are the most popular ways of environmental education. Particularly, a variety of small printing media on SWM such as flip charts, posters and booklets have been produced by UDLE. Furthermore, UDLE have focused on non-formal environmental education related to SWM through group formation, provision of training and demonstrations on composting and recycling, peer education, and conducting street dramas and clean-up campaigns.

3.5 Activities by Other Donors and International Organizations relating to Solid Waste Management

Nepal has been, and continues to be very much a donor-dependent country with almost 40% of its source of Governmental Funding financed by foreign assistance[16]. For FY1998 to 2002, on the average, about 54% of HMG's development budget was supported by foreign aid; this ratio reached 70% in FY2002[17]. Although a majority of such programs focus on the rural population which still composes close to 85% of the national population, there have been some major attempts by both bilateral donors and international organizations to address emerging challenges in urban areas.

Regarding donor activities in general, in May 2004, during the Nepal Development Forum, the international donor community pledged over US$1.6 billion in aid for the period of three years from 2004[18]. However due to the increasing political instability within the country, which lead to the announcement of the State of Emergency by His Majesty King Gyanendra on February 1, 2005, the donors are now facing a situation where urgent development needs persist among the distressed population; nevertheless operational impediments caused by security concerns are obstructing effective implementation of aid projects[19]. On the other hand, after the political transition from February 1, 2005, a few donors expressed their concerns in regards to the deteriorating political situation, and subsequently have adjusted their commitments until further improvements are achieved within the country.

The following are some activities, both historical and current, by donors and international organizations that are related to SWM and the Study.

[16] Central Bureau of Statistics, Statistical Year Book of Nepal 2003

[17] ibid

[18] *AFP, 6 May 2004*. During the Nepal Development Forum, the donors also stressed the urgent need to "have the democratic process restored, the conflict resolved and human rights respected".

[19] On 18 March 2005, a group of concerned donors, including the United Nations and the European Union (EU), issued a statement warning that insecurity, armed activity and blockades enforced by Maoist insurgents were hindering international assistance reaching the most vulnerable population with the greatest needs

(1) German Technical Co-operation (GTZ)

One cannot recount the history of SWM in Kathmandu Valley without referring to the legacy of ***Solid Waste Management Project*** (SWMP) that operated from 1980 to 1993. Within these thirteen years encompassing four phases, the German government redefined the practice of SWM altogether within the Kathmandu Valley. Some of the major achievements of the SWMP are summarized in Table3.5-1.

Table 3.5-1 Summary of Major Achievements of GTZ Solid Waste Management Project

Phase	Major Achievements
Phase 1 1980~ 1983	Creation of a Solid Waste Management Board (chaired by Secretary of the Ministry of Public Works and Transportation + 9 members) which was to carry out solely, all SWM responsibilities for KMC, Patan (then LSMC) and BTM. Established and operated a waste collection system in 16 wards of KMC and Patan
Phase 2 1983 ~1986	Establishment of Teku compost plan Construction and operation of Gokarna sanitary landfill site
Phase 3 1986~1990	Solid Waste Management Act (1987) => Transformation of Solid Waste Management Board into an autonomous unit under the Ministry of Works and Transport, Solid Waste Management and Resource Mobilization Center Passing of SWMRMC By-laws (Financial, Administrative) Attempted to make SWMRMC financially self-reliant through the sale of compost and the collection of service charges from various sources.
Phase 4 1990~1993	GTZ advocated transfer of SWM responsibilities (collection and transfer) to municipalities. GTZ also promoted joint ownership of SWMRMC by KMC, Lalitpur and Bhaktapur Districts while maintaining the Center's legal identity => Such decentralization of SWM responsibilities were not implemented, and GTZ terminated support to SWMRMC on July 1993[20]

Source: GTZ

Currently GTZ has various programs within its portfolio, but the one most relevant to SWM would be the ***Urban Development Through Local Efforts Programme (UDLE)***. UDLE started in 1987 and is about to complete its fifth phase in June 2005. The program aims to provide technical assistance to municipalities to enhance their capacities for the management of their social and physical environment. UDLE played a key role in establishment of a Community Development Section in LSMC, and for implementing a six-month training program for SWM technicians in 20 municipalities, which includes several Task Force (T/F) members from LSMC, BKM, KRM and MTM. A summary of the current UDLE program is as follows:

[20] GTZ stated that the operational shortcomings of the Center were not financial, but attributable to a lack of institutional coordination, clear enunciation of policy functions, efficient operation of control mechanisms, and clear-cut allocation of implementation functions. GTZ advisor stated that SWMRMC was functioning smoothly till it was receiving financial support in its operation from the "Counterpart Fund". Fund flow from this fund was unreliable. By 1993, SWMRMC had been able to consistently garner revenues equivalent to some 40% of its operation costs. (From Demarcation of Responsibilities in SWM between SWMRMC and the Municipalities, April 1994.)

Table 3.5-2 Major Activities of UDLE

UDLE Program Components	Major Activities
Urban Hygiene & Environmental Education Programmes	Development of SWM curricula and materials for formal and informal education programs. Encourage waste reduction through promotion of reuse, recycling and composting. Conduct training programs for SWM focal points (6 month, 20 municipalities).
Financial Management	Support municipalities to manage and collect revenues by introduction of computerized accounting. Introduction of an up-to-date property register linked to taxation records based on House Numbering Information System.
Municipality Organizational Development and Administration	Provide technical assistance in organizational development and administrative management.
Urban Planning	Integrated Action Planning, Local Area Planning, Town Planning legislation and by-laws, Training

Source: UDLE

Finally, as a small component of UDLE, GTZ has been implementing the ***Conservation and Development Programme in MTM (CDPMT)*** with an objective to promote sustainable conservation of cultural heritage and community development through participation of Civil Society Organizations in partnership with the Community Development Section of MTM. For 2005, the annual budget is approximately Rs.2.3 million. CDPMT will also be extended to KRM in the coming year.

For follow up, UDLE II is in the pipeline, to which GTZ has committed up to December 2008. The details of the program have not been finalized yet.

UDLE: SWM Best Practice in Hetauda Municipality

Hetauda Municipality, a medium sized municipality with a population of about 68,000 outside the Kathmandu Valley, is considered to have one of the best practices in community based SWM. The municipal office is closely coordinating with the Environment Improvement Coordination Committee, which is comprised of selected ward representatives to organize and implement activities such as home and community level composting, public awareness raising campaigns, reduction of plastic waste, and promotion of recycling. Under UDLE support, training and some programmatic support have been provided based on specific needs identified by the communities. For example UDLE subsidized home compost bins and distributed them to 600 households with training on composting targeting female household members.

Strong cooperation between the local communities and the municipal office allows dissemination of innovative and effective solutions to SWM problems. The plastic hook system first introduced by a local youth club in Hetauda subsequently has been popularized through public education campaigns as a simple method to separate plastic from other waste. The separated plastics are kept at community collection stations until municipality trucks collect them to be sold to a plastic pipe factory for recycling.

A group of women participating in home composting program

Segregated plastic waste on metal hooks

(2) European Commission

The EC initiated the ***Kathmandu Valley Mapping Project (KVMP)*** in May, 1999. This project was much expected to become a milestone in upgrading the information system of KMC, and to collect primary data of the city (e.g. property surveys and house numbering) for more structured urban development and management planning.

As one component of KVMP, SWM was included involving the Environment Department. Activities were undertaken including the formulation of a SWM action plan, upgrading of Teku Transfer Station and other facilities including an incinerator for medical waste, sweeper welfare programs such as construction of a child care center, and provision of equipment and training. KVMP completed its program in 2002 as scheduled, nevertheless due to the political instability during the fourth year and other inadvertent factors, some of the achievements were not sustained.

Best Practice and Lessons Learned: The KVMP project trained KMC staff on data collection techniques to support SWM activities such as waste quantity and quality surveys and operational cost analysis. Through the project, staff were trained regarding the significance of planning programs based on reliable data. To date, KMC continues to rely for much of their operational information on the SWM data collected during the KVMP project. However, the information is becoming outdated, and due to poor knowledge management practices, various project reports from KVMP are unfortunately either misplaced or not in use.

(3) Asian Development Bank (ADB)

From the middle of 1999 to mid 2001, ADB implemented a technical assistance (TA) project, ***Institutional Strengthening of Kathmandu Metropolitan City***, which aimed to help KMC keep pace with the growing demand for urban services and its increased role and responsibilities in the context of decentralization. The project consisted of four focus areas: a) organizational competence building; b) improved financial management; c) improved operational management of solid waste and infrastructure; and d) promoting private sector participation in urban service delivery. In terms of SWM, the following outputs were achieved

Table 3.5-3 Outputs from ADB Project

Summary of ADB outputs	Status as of April 2004
Output 1: Fixed assets maintenance management system introduced (recording of vehicle repair and maintenance)	Recording of vehicle repair and maintenance is kept regularly, but currently the computerized software introduced is not used.
Output 2: Solid waste transportation and route planning system introduced	Transportation and route planning system not being used.
Output 3: Mechanical section inventory management system introduced	Inventory is kept, but based on a different management system.
Output 4: Performance oriented maintenance management system for sweeper supervisors implemented to improve primary collection and street sweeping.	Supervisors may need refresher courses.
Output 5: Strategic planning on SWM implemented.	Currently no strategic planning is being conducted. SWM guidelines have not been followed.
Output 6: SWM training for top and mid level staff implemented.	Needs continue to exist for training among top and mid level staff.

Source: Institutional Strengthening of Kathmandu Metropolitan City, Final Report (ADB TA 3185-NEP) 13 March, 2001 and interviews with KMC Staff

This ADB TA had significant impact on other KMC institutional issues such as development and promotion of a privatization policy and introduction of a unified and computerized budgetary system. Nevertheless, the TA finished without any follow up projects or loans.

Best Practice and Lessons Learned: In the implementation of the ADB TA, special emphasis was placed on practical "hands on" advice and training that could induce immediate impact on organizational performance. Interactive processes between staff and consultants were valued as well as the level of user-friendliness of the management tools introduced. Subsequently, the TA achieved some results during its implementation period such as the new organizational restructuring and launching of a common computerized budgetary system.

On the other hand, due to the limited timeframe of the project, sustainability of some of the newly introduced initiatives could not be secured. As one major lesson learned, the ADB team underscored the need to take into consideration the participants' absorptive capacity and response time when conducting institutional strengthening interventions. In order for the municipality counterparts to absorb the technical inputs and take corresponding actions to materialize change initiatives, sufficient time needs to be allowed in the implementation plan.

Urban Environmental Improvement Project (US$30 million loan) aims to induce sustainable urban development by improving essential urban and environmental infrastructure and services, and strengthening relevant institutions in the nine urban areas surrounding the Kathmandu Valley (Banepa, Bharatpur, Bidur, Dhadingbesi, Dhukilhel, Hetauda, Kamalamai, Panauti, Ratnanagar). The project will have five main components: a) municipal institutional strengthening and revenue mobilization, b) provision of urban and environmental infrastructure for things such as sanitation and waste water management, c) provision of supplementary urban facilities, d) community development, and e) project implementation assistance. As a small component within the project, a demand survey on organic farming products in the Kathmandu Valley has been implemented, which may shed some light on compost demand and markets.

ADB also assisted construction of a sanitary landfill with compost facility and septage treatment facility nine kilometers from Pokhara city center, along with the access road, under ***the Second Tourism Development Program of Pokhara***. Particulars of the site are described in Section 7.4.

(4) United Nations Development Programme (UNDP)

UNDP's ***Public-Private Partnership for Urban Environment (PPPUE) Programme*** started in March 2002 and is in the midst of its second phase (April 2004-March 2007). This program aims to establish a policy and operational environment in municipalities conducive to introduce Public Private Partnerships (PPP) for the improvement of basic urban services including SWM. During the first phase, PPPUE committees and focal points were identified within five pilot municipalities (Bharatpur, Biratnagar, Hetauda, Pokhara, Butwal) and were trained based on Pro-Poor PPP Tool Kits. PPPUE will support municipalities to identify viable PPP projects, conduct feasibility studies, and ultimately execute PPP arrangements. At the policy level, PPPUE supported MOLD to formulate PPP Policy and Guidelines for Local Bodies in 2004 and 2005 respectively.

PPPUE is now extending its program to 10 new additional municipalities, including KMC where a municipal PPP focal point was identified. BKM is also being considered to be included in the program.

Best Practice and Lessons Learned: In Biratnagar Municipality, privatization of SWM services lead to new and improved services. For example, sweepers from the municipal workforce were placed under the supervision of the private operator, which in turn lead to increased efficiency in sweeping and primary collection. Similarly in Bharatpur Municipality in six pilot wards, a model is being tested where the municipality, private operator and CBOs all have separate but complementary roles and implement activities based on their comparative advantages. Such municipalities shall be considered as destinations of exposure visits for the Study for knowledge sharing.

(5) World Bank

During the period from July 2000 to January 2001, the World Bank supported preparation of the City Development Strategy for KMC, with an objective to provide a planning framework for the municipality. Under this initiative, analysis of existing issues, recommended strategies, and integrated city assistance program packages were developed in the ten strategic areas of Urban Planning, Urban Economics, Institutional development, Urban Transport, Housing and Squatter Settlements, Municipal Services, Heritage Conservation, Community Development, Environment and Municipal Finance. In the area of Environment, eight policies, technical and operational recommendations were made on SWM. In addition, finalization of a landfill site was identified as part of the third prioritized strategic integrated package program.

(6) USAID

USAID's Regional Urban Development Office (RUDO) based in New Delhi has been providing small grants to innovative local initiatives that improve urban environment. In the past, it supported the Environmental Mapping Project in KRM and MTM. Currently,

support has been extended to the KMC SWM section, where a grant of approximately US$25,000 was provided. The Community Mobilization Unit (CMU) has been allocated with approximately US$ 12,000 to implement community participation and training programs. Remaining funds were utilized for the development and publication of municipal medical waste management guidelines. Financial support finished in October 2004 but with the remaining funds, medical waste treatment training is being scheduled for municipal and health care providers in 2005.

(7) Danish International Development Agency (DANIDA)

Since1999,DANIDA has supported the environmental management in Nepal through the ***Environment Sector Programme Support*** (ESPS). ESPS' objective is to involve and build capacity of both government institutions and the private sector in prevention, minimization and control of environmental pollution caused by industrial and urban development. ESPS had the following five inter-linked components with objectives of combining enforcement of pollution standards and other environmental legislation with interventions with immediate results to mitigate existing and future pollution.

i. Institute for Environmental Management, provides training to a range of key stakeholders on related topics concerning the urban and industrial environments.
ii. Cleaner Production (CP)/Occupational Health and Safety in Industries (OHSI): Minimization of water, air and soil pollution, minimization of waste, and reduction of hazardous health impacts on workers.
iii. Wastewater Treatment in Hetauda Industrial District: A wastewater treatment facility was constructed and installed in the special industrial development zone in Hetauda Municipality.
iv. Institutional Strengthening of Environmental Authorities: Capacity building in three line-ministries of MOPE, MOI and MOLD.
v. Air Quality Management in the Kathmandu Valley: Introduction of Electrical Vehicles (Sapha Tempo) and set up 10 ambient air quality monitoring stations, along with formulation and enforcement of vehicle emission standards.

ESPS concluded in mid 2004 and preparations for its extension were initially agreed upon. However due to the events of February 1, 2005, the Danish government decided[21] to suspend the second phase of ESPS until further notice.

(8) German Development Services (DED)

DED has identified support to municipalities and sub-urban local bodies as one of the core areas for its activities. In this context, DED has provided MTM two terms, and KRM one term of services of German urban development experts. These experts usually are stationed at the municipal offices and offer day-to-day operational support in urban planning and development schemes. The expert who was based in KRM until March 2004 took the initiative with the Planning Section staff in drafting land use and road networks maps. A DED expert was also stationed in MTM until early 2005 supporting the municipality in

[21] Announcement from the Royal Danish Embassy of Nepal, 7 April 2005.

upgrading its sewerage network. He also provided a general advisory role in municipal developmental issues.

(9) International Centre for Integrated Mountain Development (ICIMOD)

In 2002 ICIMOD initiated a project addressing the digital data gaps existing within the Kathmandu Valley. The project's objective was to develop a common and integrated GIS database to facilitate the urban planning and decision-making processes. As one component of the study, a case study was implemented in KRM regarding the impact of municipal level GIS application in the municipal planning process. Although the results have not been utilized in any official planning procedures, the GIS maps were produced to enable KRM to conduct spatial planning on locations of facilities such as hospitals and schools, zoning of areas suitable for urban expansion, on solid-waste management and on the development of utility networks.

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

4.1 Overview of the Kathmandu Valley

4.1.1 Socio-Economic Conditions

(1) Administrative Jurisdiction

The Kathmandu Valley consists of three Districts, Kathmandu, Lalitpur and Bhaktapur with an area of about 580 km^2 according to the Study of the Kathmandu Valley GIS Database by UNEP/ICIMOD. It is bordered by the ridgelines of the mountains surrounding the Kathmandu Valley.

The Kathmandu Valley covers 81% of Kathmandu District (395 km^2), 32% of Lalitpur District (385 km^2) and the whole of Bhaktapur District (119 km^2). There are altogether five municipalities and 131 Village Development Committees (VDCs) in the entire jurisdictional boundaries of the three districts: 67 VDCs and two municipalities in Kathmandu District, 41 VDCs and one municipality in Lalitpur District, and 16 VDCs and two municipalities in Bhaktapur District. Municipalities and VDCs are divided into Wards as shown in Table 4.1-1.

Table 4.1-1 Administrative Classification in the Kathmandu Valley

Area	District	Municipality and VDC	Number of Wards
Kathmandu Valley	Kathmandu District	Kathmandu Metropolitan City (KMC)	35
		Kirtipur Municipality (KRM)	19
		67 VDCs	9 Wards in each VDC
	Lalitpur District	Lalitpur Sub- Metropolitan City (LSMC)	22
		41 VDCs	9 Wards in each VDC
	Bhaktapur District	Bhaktapur Municipality (BKM)	17
		Madhyapur Thimi Municipality (MTM)	17
		16 VDCs	9 Wards in each VDC
Total	3 Districts	5 Municipalities and 124 VDCs	110 Municipal Wards

Source: The Study of the Kathmandu Valley GIS Database by UNEP/ICIMOD

The Kathmandu Valley is normally divided into locality categories as follows based on population density:

a. Urban area: urbanized area corresponding to five municipalities with mostly over 100 persons/ha population density

i) Urban Core: The urban area consists of
- KMC: Wards 12, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30
- LSMC: Wards 7, 8, 9, 11, 12, 16, 17, 18, 19, 21, 22
- BKM: Wards 7, 8, 9, 12, 13, 14, 16
- MTM: Wards 1, 4, 6, 8, 9, 10, 11, 12, 13, 14
- KRM: Wards 4, 5, 6, 9, 10, 16, 17

ii) Urban Fringe: remaining municipal area (Wards)

b. Suburban Area: relatively urbanized and adjacent to the five municipalities with 19 VDCs in Kathmandu District, 12 VDCs in Lalitpur District and 6 VDCs in Bhaktapur District

c. Rural Area: non-urbanized area consists of VDCs other than the Suburban VDCs

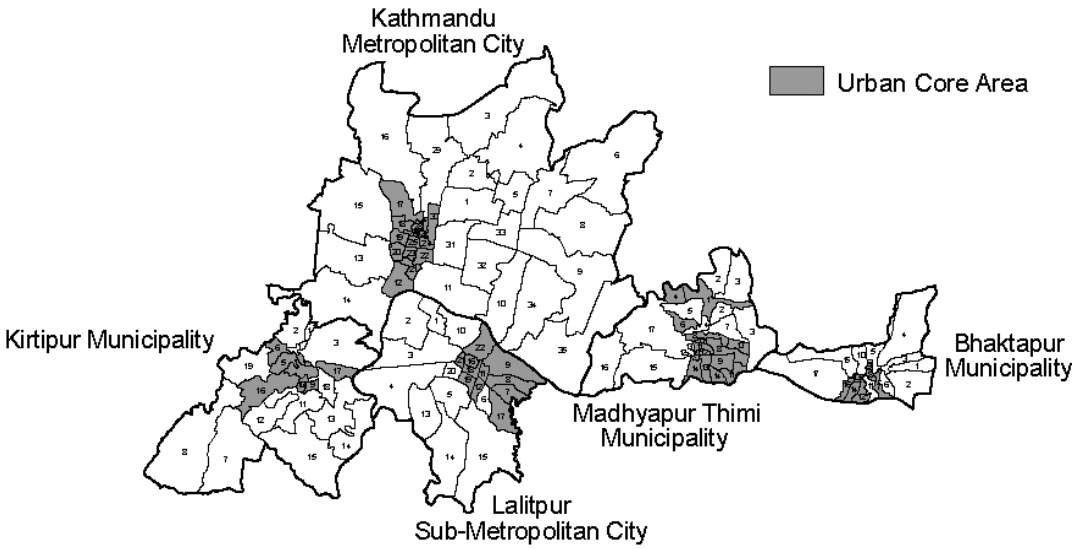


Figure 4.1-1 Urban Core Areas of the Five Municipalities

Source: JICA Study Team

(2) Demographic Condition

The demographic condition of the three districts and five municipalities are shown in Table 4.1-2 and 4.1-3, respectively.

Table 4.1-2 Population of Three Districts

Districts	1981	1991		2001	
	Nos.	Nos.	(%)	Nos.	(%)
Kathmandu	422,237	685,341	(62.3)	1,081,845	(57.9)
Lalitpur	184,341	257,086	(39.5)	337,785	(31.4)
Bhaktapur	159,767	172,952	(8.3)	225,461	(30.4)
Total	766,345	1,115,379	(45.5)	1,645,091	(47.5)

Note: ( ); Growth rate per ten years (%)
Source: Statistical Year Book of Nepal, 2003, Central Bureau of Statistic

Table 4.1-3 Demography of Five Municipalities in 2001

Municipalities	Ward (nos.)	Households (HHs)	Population (persons)			Area (km^2)	Density (per/km^2)
			Total	Male	Female		
KMC	35	152,155	671,846	360,103	311,743	49.45	13,586
LSMC	22	34,996	162,991	84,502	78,489	15.15	10,759
BKM	17	12,133	72,543	36,681	35,862	6.88	11,058
MTM	17	9,551	47,751	24,747	23,004	11.47	4,298
KRM	19	9,487	40,835	21,686	19,149	14.76	2,767
Total	110	218,322	995,966	527,719	468,247	97.03	6,284

Source: Statistical Year Book of Nepal, 2003, Central Bureau of Statistic

(3) Economic Activities

In the three districts it is said that approximately 40% of the total population are economically active. Especially in KMC and LSMC, the proportion of urban-based occupations reaches 80-90% of the economically active population, such as manufacturing, public utility supply, tourism, construction, commerce and transport. On the other hand, in the case of BKM, approximately half of the economically active population is engaged in rural-based occupations, such as agriculture, forestry and mining/quarrying. In the Kathmandu Valley, vegetable farming and animal husbandry are important side incomes of the people in the urban periphery. It is well known that about 80% of Bhaktapur District's vegetable production is sold in Kathmandu and Lalitpur Districts.

The Kathmandu Valley is the most industrially developed region in Nepal. According to the Industrial Census in 1992, approximately 50% of more than 4,000 medium and large scale manufacturing establishments in Nepal are within the Kathmandu Valley. It is noted that carpet, garment, and printing industries are highly concentrated in the Valley. Regarding small scale industries (less than 10 employees per establishment), the Valley accommodated about 27% of the more than 45,000 establishments in Nepal.

The Kathmandu Valley plays an important role in the country's tourism industry. The elevated valley with beautiful surrounding landscape, old temples and other historic architecture has attracted a large number of tourists since the opening of the country in 1950. Kathmandu is the main entry point for tourists visiting Nepal, and this sector is one of the major sources of foreign exchange income.

(4) Income Sources and Levels

Table 4.1-4 shows the income category of households in the five municipalities of the Kathmandu Valley. The majority of households (36%) fall into the highest income-earning group (more than 12,000 Rs/month), while 7% of the households earn less than 3,999 Rs/month.

Table 4.1-4 Household Income in Five Municipalities

Unit: %

Monthly income group	Percentage of households					
	KMC	LSMC	BKM	MTM	KRM	Overall
< Rs 3,999	4	5	25	12	4	7
Rs 4,000-5,999	14	11	12	14	18	13
Rs 6,000-7,999	15	18	20	18	26	17
Rs 8,000-9,999	11	15	10	12	18	12
Rs 10,000-11,999	14	17	11	19	16	15
> Rs 12,000	42	31	22	25	18	36

Source: Environmental Impact Assessment Report on Melamchi Water Supply Project, August 2000

(5) Land Use

According to the Study of the Kathmandu Valley GIS Database by UNEP/ICIMOD, about 55% of the total areas of the three districts are used for agriculture, followed by forest area of about 35%. Table 4.1-5 shows the land use conditions looking over the Kathmandu Valley only. The combination of level and slope terraces, agricultural land occupies about 52% of the total area of the Kathmandu Valley.

Table 4.1-5 Land Use in the Kathmandu Valley

Land use type	1984*1 (%)	1996*2 (%)
Agricultural land	64.0	52.1
Forest	19.5	14.9
Plantation, shrub, grassland	10.9	17.8
Urban area	4.8	13.1
Others (abandoned, water, etc.)	0.8	2.1

Note *1: Measured from the land utilization map, 1984
*2: Aerial photo interpretation of 1992 and land use map in 1996, Department of Topography
Source: Environmental Planning and Management of the Kathmandu Valley, MOPE/IUCN, 1999

The urbanization of the Valley started in the late 1950s. Land use of KMC and LSMC has changed drastically in the last two decades. It is said that the urban areas in the two cities have expanded from 24% in 1971 to 67% in 1991 at the expense of prime agricultural land. Currently, urban area is still expanding in the two cities as well as other municipalities under unregulated conditions.

(6) Infrastructure

During the last two or three decades, the transportation networks have increased especially in urban areas in the Kathmandu Valley. The road network in the Valley is composed of radial roads extending from the central area of KMC and functioning as arterial roads in the Valley. The Ring Road is working as a by-pass and peripheral road. BKM also has some radial roads which connect surrounding areas, but most of these are either unpaved or single-lane roads. The total length of roads in the Valley is reported as 1,260 km as of 1998, of which about 691 km are black topped, 284 km graveled and 285 km of earthen road. The major transportation routes in the Valley connecting inter-regionally are Tribhuvan and Prithivi Highways (Kathmandu-Thankot), Arnico Highway (Kathmandu-Bhaktapur) and Trishuli Road (Kathmandu-Trishuli). Along with the road network development, the urban sprawl occurred via the major routes and radial roads until the middle 1990s. In recent years, the network development could not catch up with the rapid urban sprawl in the Valley.

Lack of proper planning on drainage has caused a severe problem of inundation especially in peripheral urban areas. It is reported that about 60% of households within the city area of KMC and LSMC as well as more than 30% of those in BKM suffer from frequent flood/inundation.

A combined storm water and sanitary sewer system, which is 50 to 80 years old, exists in the core area of KMC, and the system discharges directly into the Bagmati River. It was reported that in 1992 about 17% of the households in KMC and 34% of those of LSMC were under serviced by the existing sewage system.

There are five sewage treatment plants with a total design capacity of more than 35 million liters per day, i.e. Dhobighat, Sallaghari, Hanumanghat, Khodku, and Guhyeswari. The first two plants are practically non-operated, whereas the rest are partially or experimentally operated.

(7) Sanitary and Health Status

Water supply coverage in the districts of Kathmandu, Lalitpur, and Bhaktapur is 57, 59, and 49%, respectively, and the rest depends on the nearby natural sources such as springs and well. Only a few of the water supply systems have treatment facilities while the rest supply raw water directly. A study conducted by the Environment & Public Health Organization (ENPHO) in 1993 reported that over 80% of the sampled water within the urban area in the Kathmandu Valley was polluted by fecal coliform bacteria.

More than 70% of the rural population of Kathmandu District has on-site sanitation facilities while the rest defecate in the open fields. In Lalitpur District about 66% of the rural population has on-site facilities.

Rivers and surface streams in the Kathmandu Valley are heavily polluted due to free discharge of urban and industrial effluents and solid waste. Drinking water supply in the Valley is one of the main causes of the prevalence of water-borne diseases. The sample survey on water-borne diseases conducted by the Melamchi Water Supply Project in 1999 showed that about 31% of family members suffered from diarrhea, followed by stomachache (19%), Dysentery (10%) and Typhoid (8%).

4.1.2 Natural Conditions

(1) Topography

The Kathmandu Valley is a more or less circular valley, and its level has an average altitude of 1,300 m above mean sea level. The mountains to the north and south of the valley stand as towering topographic barriers, whereas to the east and west the mountain rims are subdued and gentler. The floor of the Kathmandu Valley is flat land dissected by a number of streams originating from surrounding mountains. Typically, the general topographic gradient of the valley is directed towards the valley center.

(2) Geology and Soil

The Kathmandu Valley walls are made of hard lithological units whereas the Valley's floor is mainly made up of soft quaternary deposits. These soft lithological formation comprise alluvial/colluvial fan near the mountain fronts, and there are layered sand, silt and black clay deposits toward the center of Valley.

The main soil types found in the Kathmandu Valley's alluvial plain consist of gray to grayish brown clay loam to sandy clay loam soils. These soils are massive in structure and stratified due to the fluvio-lacustrine environment in which the sediments were deposited. The toeslopes of the surrounding mountain and fluvial fan deposits show a wide variety of soil types comprised of clay loam and silty clay loam in the southern, eastern and western areas and sandy clay loam in the northern areas.

(3) Climate

Temperature data available in the Valley stations show that the approximate monthly maximum temperature at an elevation of 1,228 m in Kathmandu is 24^{o}C. In comparison, the approximate monthly minimum temperature occurs in January with 7^{o}C. Almost 80%

of rainfall occurs during the monsoon which starts around the middle of June and continues till the end of August. The mean annual rainfall in the Valley is approximately 1,900 mm.

(4) Hydrology

The Bagmati River is a main water course in the Valley, and originates from the Sivapuri Watershed and Wildlife Reserve. There are number of tributaries which flow into the Bagmati River. The principle tributaries are the Bosan, Balkhu, Bhishnumati, Dhobi, Manohara and Hanumante Rivers.

The discharge of the Bagmati River is at a minimum in April and May, and starts to rise with the onset of the monsoon with the peak usually in July or August. The mean annual discharge at Chobhar is 15.5 m^3/s with an annual water yield of about 400~500 million m^3. The average monthly flow of Bagmati observed at Chobhar is presented in Table 4.1-6. However, it is noted that the data in the table do not show the natural flow, since much water extraction occurs in the upstream of Chobhar.

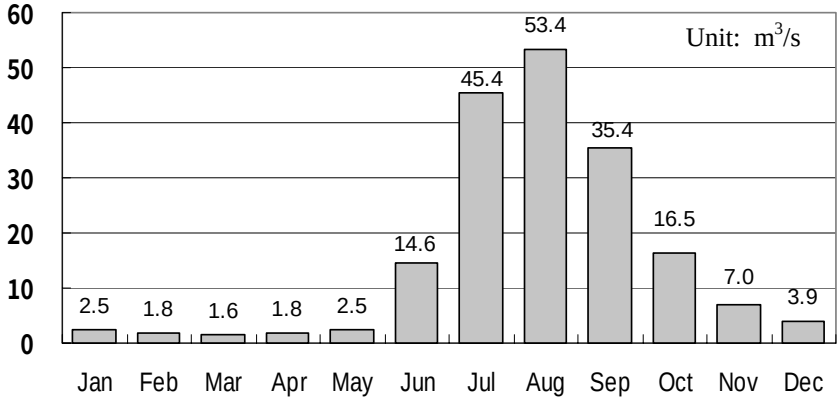


Figure 4.1-2 Average Monthly Discharge of the Bagmati River at Chobhar

Source: Environmental Impact Assessment Report on Melamchi Water Supply Project, August 2000

4.1.3 Environmental Conditions

(1) Water Contamination

Major pollution sources of surface water are industrial wastewater, domestic wastewater, and solid waste dumping, although the contribution of each source to water contamination can not be defined.

The water quality of the Bagmati River and its tributaries is increasingly degrading and heavily polluted especially in the sections within urban areas. The water quality condition in the Bagmati River as shown by numerous studies indicates: i) very low dissolved oxygen (DO), sometime zero, ii) considerably high BOD (about 300 mg/l), iii) high COD particularly due to in effluent from carpet factories, iv) high concentration of chemicals such as nitrates, chlorides, and phosphates, v) heavy metals such as lead, mercury, and chromium, and vi) high coliform counts. The section of Bagmati from Gokarna through Thapathali to Chobhar is considerably contaminated. The sections of major tributaries such as Dhobi and Bishnumati are also highly polluted especially in and around the urban areas.

It is said that groundwater contamination is caused mainly due to seepage from septic tanks. Private septic tanks have been built at most modern houses in Kathmandu, however, insufficient capacity and poor maintenance of tanks seem bring about the ground water contamination in the Valley.

(2) Air Pollution

It was reported that about 150 brick kilns operated in the Kathmandu Valley in 1998, and smoke and dust emitted from these kilns contributed highly (more than 70% out of industrial TSP emission) to air pollution in the Valley especially November to May (the dry season).

The number of vehicles in the Kathmandu Valley has been growing substantially in recent years, and the rapid increase of vehicular traffic is also a major contributor to air pollution. The number of vehicles in the Kathmandu Valley was estimated at around 100,000 according to the data of Ministry of Population and Environment (MOPE) (Currently Ministry of Environment, Science and Technology or MOEST), out of which about 35,000 were four-wheelers and 55,000 were two-wheelers. Besides, solid waste burning and biomass utilization (firewood) at the household level seem to contribute to air pollution in the Kathmandu Valley.

(3) Vegetation and Protected Areas

Forests are mostly found on the ridge tops of the mountains along the Kathmandu Valley boundary. The urban and suburban areas of the Valley have no distinct forest vegetation except thin scattered trees. Except for some patches, most of the natural forests in the Valley have been degraded to forming shrub. The forests in and around the Kathmandu Valley are being used to fulfill fuel, timber and other demands. The overuse of forest resources is leading to a significant loss of forest cover.

The northern part of the Kathmandu Valley is designated as the Shivapuri Watershed and Wildlife Reserve. This protected area was established in 1976 and is spread over an area of 144 km^2. The major vegetation is pine and chestnut. The wild animals reported are deer, leopard, boar, etc. Besides, several reserved forests exist in the Valley or at the rim of the valley, such as Nagarujun (north-western part of the Kathmandu Valley), Gokarna (near the north-eastern boundary of KMC), Tilkot (north-eastern part of BKM), and Bageshwari (at the eastern rim of the valley).

(4) Flora, Fauna and Endangered Species

The conditions of flora and fauna in the Kathmandu Valley can be summarized as below, according to the existing information available.

1) Terrestrial Flora and Fauna

A comprehensive flora list in the Valley was consolidated in 1986 by the Ministry of Forest and Soil Conservation with 1,312 species of vascular plants belonging to 162 families, of which 170 were species of ferns and 7 species of gymnosperms. These represent almost a quarter of the total vascular plants recorded in Nepal. Out of the 1,312 species, only a few species are considered to be endangered by listing in the Convention on International Trade

in Endangered Species (CITES) or IUCN red categories, such as magnolia (*Talauma hodgsonii*), ginseng (*Panax pseudo-ginseng*), and monkshood (*Aconitum ferox*).

Regarding the avian species, wood pecker (*Dendrocopes spp.*), laughing thrush (*Garrnlax spp.*), blood pheasant (*Ithagirsis cruentus*), kalij pheasant (*Lophura leucomelana*), and flycatcher (*Culicipapa ceylonensis*) are commonly found in mixed-broadleaf forests of the valley. Egret (*Egrettle spp*.) are also very common in the plain area of the valley. The mammals found commonly in the forests of the valley are wild boar (*Suscrofa cristabu*), barking dear (*Muntiacus muntjak*), Himalayan black bear (*Selenarctos thibetanus*), rhesus monkey (*Macaca mulata*), wolf (*Caris lupus*), and jackal (*Canis ansens*).

2) Aquatic Biota

The Bagmati River and its tributaries are the principle habitats of aquatic biota in the Kathmandu Valley. Bagmati is an important spring fed river originating in the Shivapuri Watershed and Wildlife Reserve in northeast of Kathmandu and drains the valley due south. Based on its physical characteristics, the Bagmati River can be classified into three different ecological sectors. A stony bottom, high gradient and velocity characterize the upper headwaters of the river. The middle section is comprised of pebbly sandy bottom, moderate velocity and gradient. Both of these sections are somewhat free of intense human encroachment and industrial intervention. The lower section of the river is characterized by a sandy bottom, low gradient and velocity, and passes through densely populated urban and industrial areas.

Since most of the fresh water of the river system is diverted for water supply to urban areas, there is little fresh water flowing into the river channel from the headwaters during the dry season. As the river passes through the urban areas, it receives domestic and industrial wastewater. Obviously, the river's biological resources are under high stress especially in the dry season.

Freshwater species are observed only in the upstream section of the Bagmati River and its tributaries such as Godavari Khola, Nakhu Khola, Manohara Khola, and Kodkhu Khola. Only pollution tolerant fishes are present in the slightly/moderately polluted sections of the Bagmati and Bishnumati Rivers. Freshwater fish are very rare or absent in the extremely polluted sections such as the Hanumante and downstream portions of Bagmati (Pashupati-Teku-Chobhar) Rivers.

The Bagmati River system was historically rich in fish fauna, and the survey by Tribhuvan University in 1979 reported 54 fish species in the river system. However, only 12 fish species were found by the most recent available survey conducted by the Melamchi Water Supply Project in 1999. None of the species belong to the IUCN red categories nor the CITES list.

The fishery activities can be only observed in the upper sections of the river system, and carp, eels, catfish and loaches are major species for fishing. Most of these species survive and grow under poor water quality conditions and low DO level.

4.2 Situations of Solid Waste Management in the Kathmandu Valley

4.2.1 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 getting rid of the household waste, including a kind of circulation of organic waste between city area and rural areas nearby. In line with increasing population in the Valley and changing life style and consumption habits, SWM is coming to be recognized as one of major environmental issues in the Kathmandu Valley.

GTZ started to give assistance to the Kathmandu Valley in 1978, including establishment of the Solid Waste Management Board. After the SWM Board establishment in 1979, the SWM-related projects were initiated under GTZ assistance, and various projects were implemented in the following 10 years such as collection system development in KMC and LSMC (then Patan), development of Teku Transfer Station (T/S) and Gokarna landfill site (LFS), and introduction of the Act and related by-laws.

SWMRMC was established in 1986 and subsequently the SWM Act was enacted in 1987, and then the collection and disposal of solid waste started in some systematic way in the Kathmandu Valley. In 1992, the Municipal Act was put into force in order to entrust the cleansing and waste disposal to the local bodies for the areas under their jurisdiction. However, GTZ discontinued its aid while the project remained uncompleted in 1993, then the SWM system in the Valley was faced with collapse despite the independent efforts by the central government and local bodies as well as other stakeholders such as NGOs/INGOs.

Regarding final disposal in the Kathmandu Valley, Gokarna located a distance of 13 km from Kathmandu city core area was selected as a landfill site in 1976. After GTZ's studies, Gokarna LFS commenced its service in 1986 and was being supervised by SWMRMC and KMC together. The LFS was the only official sanitary LFS at that time, and KMC and LSMC dumped almost all of their waste there. However, after the closure of Gokarna LFS in 2000 due to the opposition of the surrounding local people, final disposal could not be other than river side dumping as a temporary solution since there were no options in the form of LFSs. Following Dhobi River dumping which was discontinued due its contributing bird strike problem at Tribhuvan International Airport, Bagmati River dumping by KMC and LSMC began and has been continuing for almost five years so far.

Looking ahead to the necessity of a new LFS before the closure of Gokarna LFS, SWMRMC has conducted various studies from early 1990s to develop a new LFS within the Kathmandu Valley. However, the sites identified by the studies could not be developed due to strong public opposition as well as due to technical reasons in some cases. Because of the low availability of LFSs in the Valley, the central government and IUCN jointly conducted preliminary alternative analysis as per the request of KMC, and Okharpauwa (Banchare Danda) as a long-term (L/T) LFS came up on the table in 1995. Then the related infrastructure development including access road construction started based on the announcement by the central government for Okharpauwa development.

After closure of Gokarna LFS in 2000, the necessity of a new short-term (S/T) LFS was recognized for receiving the waste from KMC and LSMC instead of Bagmati River dumping. Due to the expected difficulty of LFS development within the Valley, Sisdol in Okharpauwa was identified by the central government as the short-term (S/T) LFS to have an immediate

solution against the Bagmati River dumping. SWMRMC has been conducting the necessary site preparation for Sisdol S/T-LFS so far, including EIA and land acquisition.

4.2.2 Current Conditions of Municipal Solid Waste

(1) Waste Generation

In the past studies, the unit generation rate (UGR) of solid waste, that is the generation quantity or volume per day per capita, has been estimated at about 0.4 kg/day-capita including the waste from commercial areas and streets. As a result of the Study, the UGR has been slightly changed to 0.416 kg/day-capita in KMC and LSMC, 0.316 kg in BKM, and 0.266 kg in MTM and KRM. Based on this estimation, total generation quantity of waste in the five municipalities is estimated at 435 tons per day (see Section 9.3).

Composition of household waste shows a similarity among the five municipalities, which has a very high portion, 65 to 75%, of organic waste such as kitchen waste, and also shows a recent increase of plastic waste to more than 10% of all waste.

(2) Facilities regarding SWM in the Kathmandu Valley

The facilities regarding SWM in the Kathmandu Valley including current dumping practices such as Bagmati River dumping site and some proposed facilities are shown in Figure 4.2-1.

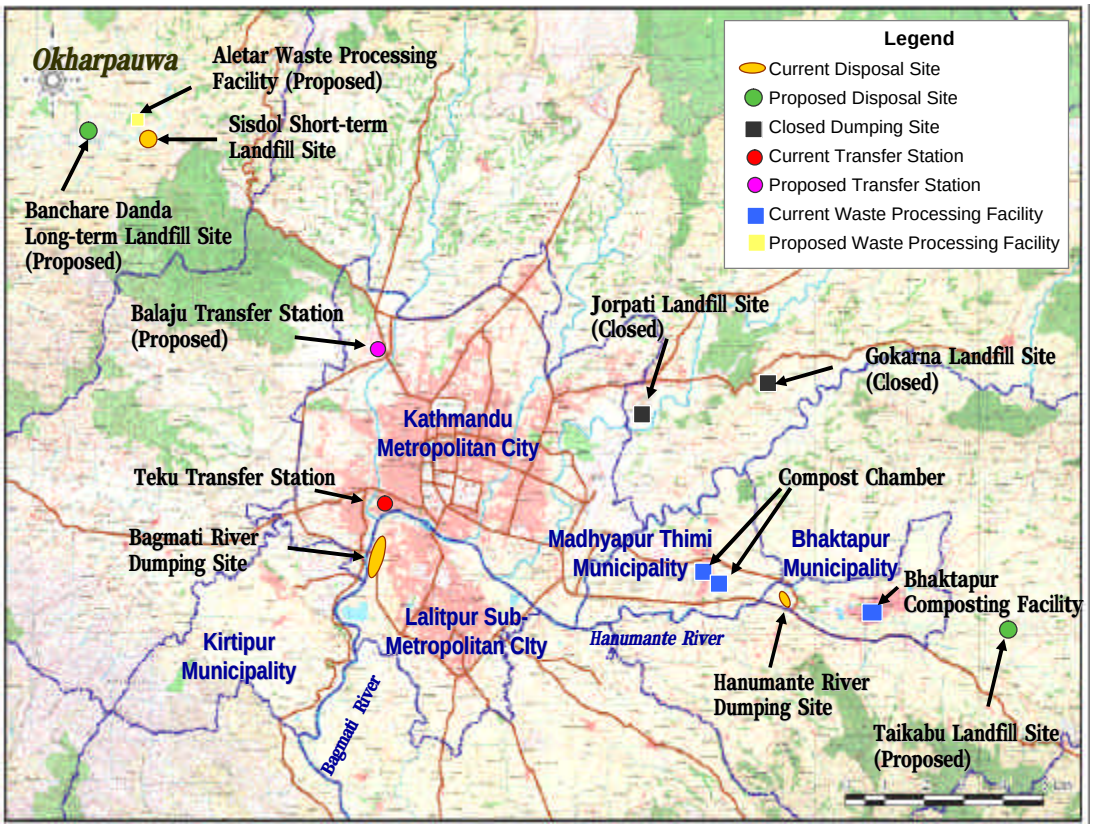


Figure 4.2-1 Facilities Regarding SWM in the Kathmandu Valley

Source: JICA Study Team

(3) Collection and Transportation

Various waste collection activities have been conducted in each municipality. In KMC, LSMC and BKM, a curb-side and on-ground collection system has been widely introduced. In such collection methods, most of the waste that is brought by the waste generators is piled up at the collection points and picked up manually and places in collection trucks with shovels. KMC and LSMC also have introduced a bell collection system[1] so that residents can throw their garbage into the collection truck directly by them. On the other hand, door-to-door collection has also been practiced in many areas mostly by private companies or NGOs who charge a collection fee to the participating waste generators. Almost all waste collected is commingled together, but quit rarely source-separated collection is also quite rarely practiced for special use like community composting in the Kathmandu Valley. Most of the street sweeping is carried out by the municipalities but recently some private sectors also take care of it in KMC, LSMC and KRM.

Due to the policy change of solid waste management in Nepal in February 2005, each municipality now has a responsibility for the garbage collection and to ensure that it shall be done from night time to early morning and completed by 7:00 a.m. According to this policy, municipalities have striven for the re-allocation of collection and transportation equipment, shifting the municipal staff and publishing public notifications.

Regarding the collection rate, more than 70% of waste is collected in KMC, LSMC and BKM, but the other two municipalities still only have collection rate of about 40%.

KMC has Teku Transfer Station (T/S) and approximately 40% of total collected waste is transported to the Bagmati River dumping site through this station.

Waste collection equipment of various capacities are currently used in the Valley, for example, 1.7 m^3 tractor drawn, 3.4-4.5 m^3 tipper truck, 3-6 m^3 dumper. In terms of transportation trucks, KMC only has large capacity trucks like Multi compactor trucks with 14 m^3 bodies and Meiller Hook lift trucks with 20 m^3 containers. More than half of that equipment used for waste collection and transportation is quite superannuated and needs to be replaced in a few years.

(4) Composting and Recycling

Considering the high percentage of organic materials, which are more than 70%, of the waste, a variety of composting activities at the household level, community level and municipal level have been tried in the Valley. KMC used to operate the municipal composting facility in Teku with support of GTZ but stopped operating due to opposition of surrounding people and difficulty of quality control of the compost, especially contamination by small glass pieces being included in the compost product. While BKM has more than 20 years experience of composting with a medium scale facility, 6 tons per day. Household level composting has been promoted to the local people with compost bins and technical training by Community Mobilization Unit (CMU) of KMC. Some NGOs/CBOs have also promoted composting activities so that it has become more popular among the people in the Valley. Community level composting has also been introduced in KMC and LSMC.

[1] The collection method in which the residents who hear the sound of a bell take garbage out and drop it into a collection car or handcart when the collection car or handcart comes. In this collection system, no public waste containers nor bins are required.

MTM has tried to operate very unique community level composting with two brick compost chambers but at present both of them are not in use due to technical and social reasons. Furthermore, vermi-composting has been introduced as both household and community level composting.

Recyclable material collected and reused in the Kathmandu Valley before 1970s were basically old and leaking copper and brass utensils. There weren't any other recyclable products collected and recycled. Obviously, there weren't any plastic products in use. Papers were reused by shopkeepers for making paper pouch ('thunga') to sell groceries. People used to carry cloth bags along with them while going to market. After the 1970s, Indians from the neighboring Bihar State of India came to the Valley for collecting recyclable waste, that is papers and bottles, mainly beer bottles. Nepalese people looked at this occupation as socially low level and dirty untouchable work.

Thereafter, Nepalese begun to enter into the occupation in the form of buying, repairing and reselling old automobiles. Slowly, after late 1980s, Nepalese started to bid for official quotations of buying recyclable materials, such as large iron scraps from power plants and other projects. The occupation grew after establishment of breweries and later, plastic industries.

Figure 4.2-2 shows the current recycling flow in the Valley. The supply chain in the recycling market starts from waste generation points, i.e. mainly households, industrial enterprises, commercial enterprises and institutions. Cycle hawkers, of which there are an estimated 10,000-15,000 working in the Valley[2], collect recyclable material directly from generation points and sell them to small-scale scrap dealers so called "kabadi", of which more than 600 exist in the Valley. Most of cycle hawkers and kabadi shops are registered with the Nepal Recycle Producer Association (NEREPA), an association of buyers of recyclable materials in the Kathmandu Valley.

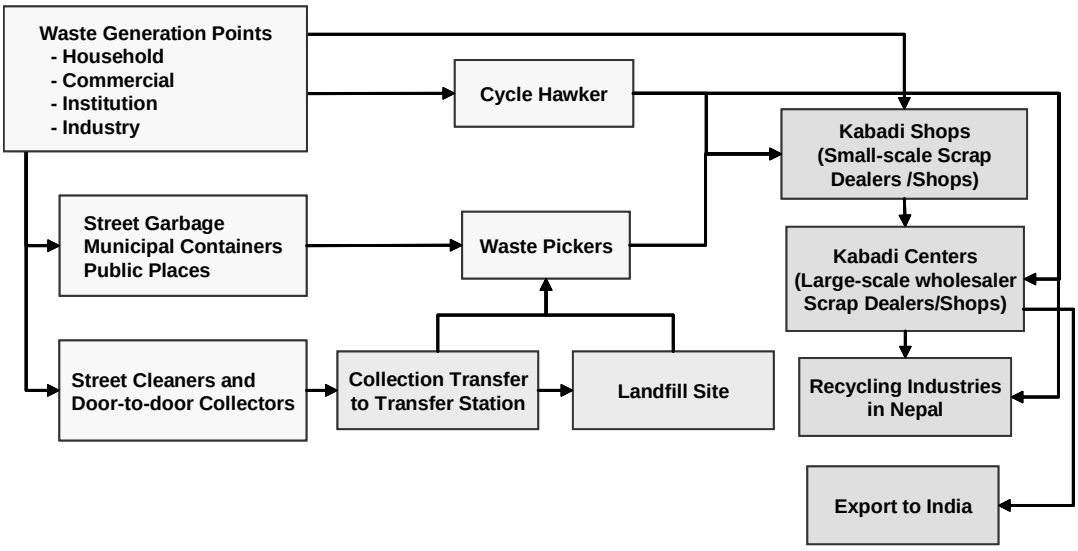


Figure 4.2-2 Recycling Flow in the Kathmandu Valley

Source: JICA Study Team

[2] Hari Pd. Bhattarai, in an article in Gorkahapatra Sanibasariya, Feb 6, 1999

On the other hand, the waste, which is disposed of at generation points, is collected and transported to a transfer station or dumping site where waste pickers collect the recyclable material from the "waste". Waste pickers also sell the recyclable material to kabadi shops. According to KMC, there are 30 to 35 groups of waste pickers operating with a total of more than one hundred persons at Teku T/S and the Bagmati River dumping site. There are other waste pickers, who are not recorded in KMC, collecting recyclable waste from street-side waste dumping sites individually. From another survey[3], it is also estimated that more than 2,500 waste picker are working in the Valley.

After kabadi shops sell the collected recyclable materials to wholesalers so called kabadi centers, which tend to be working in only one or two recyclable materials such as paper only or plastics only or bottles only etc, kabadi centers send the collected scraps to recycling industries either in Nepal or to India. Though kabadi centers were located inside main city previously, they were pressurized by local residents to move out from the core areas when inner roads started to become congested by scrap delivery trucks. Consequently, most of the scrap shops are located around the city fringe, mostly adjacent to the Ring Road. The majority of the scrap shops are located near each other in a cluster.

The selling and buying price of recycled materials at the kabadi shops, which were collected by the Study and by Sharada Shrestha, Kathmandu University (KU), 2002, are presented in Table 4.2-2.

Table 4.2-1 Buying and Selling Prices of Recyclable Goods

No	Items	JICA Study, 2004		S/ Shrestha (KU), 2002	
		Buying Price (Rs)	Selling Price (Rs)	Buying Price (Rs)	Selling Price (Rs)
1.	Paper	4.40 /kg	4.8 /kg	4 /kg	4.45 /kg
2.	Plastics	-	-	-	-
	Polythene bags	3 /kg	3.5 /kg	-	-
	Milk & Oil pouch	6-9 /kg	8.5-10 /kg	4 /kg	5 /kg
	Dalda (high density polythene plastics)	6 /kg	6.5 /kg	-	-
	Gudiya (type of polystyrene)	20.50 /kg	22.25 /kg	17 /kg	20 /kg
3.	Metal	12.3 /kg	14.36 /kg	6 /kg	6.25 /kg
4.	Carton (Package)	1.75 /kg	2.05 /kg	2 /kg	2.5 /kg
5.	Textile	5 /kg	2.50 /kg	-	-
6.	Glass	-	-	-	
	Beer bottle	4 /no.	4.1-4.2 /no.	2.5 /no.	2.75 /no.
	Whiskey bottle	1-1.25 /no.	1.2-1.4 /no.	0.75 /no.	1 /no.

Source: JICA Study Team and Sharada Shrestha (Kathmandu University), 2002

According to the Recycling Market Survey by the JICA Study Team, the various kinds of recyclable materials were collected as shown in Table 4.2-1. While 116 tones of the recyclable materials, which are 84% of the total, are exported from the Valley, excluding bottles, feathers and waste oil from automobiles, 16% of collected recyclable materials are reused and/or recycled within the Valley.

[3] ibid

Table 4.2-2 Daily Export of Recyclable Materials from the Kathmandu Valley

No.	Recyclable Materials Collected	Daily Exported Amount from the Kathmandu Valley
1.	Beer Bottle	21,000 pieces (2 trucks)
2.	Broken Glass (Chur)	22 tones (2 trucks)
3.	Plastic	12 tones (5 trucks)
4.	Paper	12 tones (4 trucks)
5.	Jhindu (wool pieces discarded from carpet factories)	10 tones (3 trucks)
6.	Cotton Cloth	15 tones (4 trucks)
7.	Iron	20 tones (3 trucks)
8.	Animal Leather	15 tones (2 trucks)
9.	Animal Bones	10 tones (2 trucks)
10.	Feather of Chicken and Duck	10 kg
11.	Waste Oil from Automobiles	50 Litter

Source: JICA Study Team

It was said during the recycling market survey under the Study that 70% of the recyclable paper collected is recycled in Nepal and the remaining 30% is exported to India. Similarly, 70% of collected bottles are reused in Nepal and the rest goes to India. In metal, particularly iron, 50% is used in Nepal by iron industries such as Ashok Iron Industry and Jagdamba Iron Industry. The remaining iron scraps are also exported to India. Meanwhile, 85% of aluminum and copper scraps are used in Nepal and the remaining only exported to India. 100% of the collected batteries are exported to India. In plastic recyclable materials, 30% of collected material is utilized in Nepal, while the remaining 70% is exported to India.

It is now also observed that the PET bottles for mineral water and beverages have been collected for recycling since sometime in autumn 2004 due to the growing of the market in Nepal though those bottles were just disposed of not recycled before.

(5) Final Disposal

Since Gokarna Landfill site stopped accepting waste due to the opposition by local people, unfortunately no municipality has not been able to prepare an appropriately engineered landfill site in the Valley. Since 2000 KMC, LSMC and KRM have started to dispose of their waste from the bridge near Balkh along the bank of the Bagmati River, which is believed to be a holy river. The site has extended about 2 km down from Balkh now by wandering use of both the left and right banks. BKM is presently dumping waste at some sites along the Hanumante River in the dry season and at the municipal composting facility in the rainy season. MTM is disposing of waste in the back of core area due to not having its own engineered disposal site at the moment.

To solve this critical situation, SWMRMC has planned and been developing a common landfill site for the solid waste especially from KMC, LSMC in Okharpauwa including an access road. Meanwhile, BKM has completed an IEE for the new sanitary landfill site in Taikabu.

4.2.3 Current Conditions of Industrial Solid Waste

(1) Industries in the Kathmandu Valley

The existing industries in the Kathmandu Valley are shown in Table 4.2-3.

Table 4.2-3 Major Industries in the Kathmandu Valley in FY2001/02 (2058/59[4])

Type of Industry	Approved Operation Capacity of Industries (A)	Production (B)	Capacity Utilization (%) (B/A x 100)	Employees (Persons)
1. Food Processing	819,601	398,303	48.60	21,420
2. Beverage	154,593	80,932	52.35	8,209
3. Tobacco	10,809	9,312	86.15	3,238
4. Textile	115,290	65,821	57.09	10,884
5. Leather & Leather Goods	15,726	3,928	24.98	,524
6. Paper & Stationary Products	54,900	26,851	48.91	1,480
7. Other Chemical Products	82,980	40,324	48.59	3,516
8. Rubber Products	560,400	55,256	9.86	1,207
9. Plastic Products	11,440	5,400	47.20	2,867
10. Non Metallic Mineral Products	808,100	353,297	43.72	5,494
11. Iron & Steel Products	476,560	322,161	67.60	6,303
12. Electrical Goods	77,000	48,000	62.34	457

Source: Central Bureau of Statistics, 2001

For prevention of environmental pollution, the following industries shown in Table 4.2-4 are prohibited from operating inside the Kathmandu Valley under the Industrial Enterprises Act (1992).

Table 4.2-4 Regulated Industry Types to Establish in the Kathmandu Valley

Sector	Pollution Parameters
Tannery	Chromium, sulphides High BOD, Sodium, Odor
Chemical Fertilizer	Ammonia, NH4, CI, SIF4, HF NOx from ammonium Nitrate Reactor
Cement	Particulate (Dust) CO, SOx, NOx
Steel Melting and Foundry (Medium & Large)	Hydrocarbons, Aldehydes, Ketones, CO, fumes, Smoke, SOx, NOx spent pickle liquor Acidic
Pulp and Paper (except traditional handmade paper and small scale recycling plant)	Sulphite waste liquor with calcium bisulphate liquor white water effluent
Caustic Soda Chemical Manufacturing Industries	Mercury from caustic soda production many acidic & alkali wastes
Oil Refineries Petroleum Product (Petrol, Diesel, Kerosene, Lubricant, Furnace oil etc.)	Oil & Grease, Hydrocarbon, phenols fatty acid, nitrogen compounds, sulphur compounds, fire hazard
Dyeing (medium and large)	Alkali wastes from dyestuff high PH, high BOD
Acid Manufacturing	Acidic wastes
Fermentation, Distillation & Blending (Distillery and Beer)	Odor, High BOD, High COD
Electroplating & Galvanization (medium and large)	High pH, BOD, Oil & Grease, metals, phenols, organic
Smelting Ferrous & Non Ferrous (medium and large)	Particulate (Dust)

[4] Nepalese Year

Sector	Pollution Parameters
Sugar Production and Khandasari	Odor, High pH, BOD, COD
Rubber Processing (tube and tire manufacturing)	High pH, COD, Sulphide, Oil and Grease
Paint Industries (medium and large)	-
Bleaching powder	-

Source: Ministry of Industry, Commerce and Supplies

(2) Generation of Industrial Waste

According to the "Industrial Pollution Inventory of the Kathmandu Valley and Nepal (1994)", total solid waste generation in Nepal was estimated at 21,883 tons, of which 6% of the total (1,421) was generated in the Kathmandu Valley, and of which 495 tons of industrial waste was generated from the leather industry, 417 tons by distilleries and 173 tons by canning and preserving of fruits and vegetables as shown in Table 4.2-5. However, most industries in the Kathmandu Valley are small-scale ones that do not use hazardous materials.

Table 4.2-5 Solid Waste Generated by Industry Types in the Kathmandu Valley

Industry	Tons per year (1992)	%
Leather	495	34.8
Distillery	417	29.3
Canning	173	12.2
Others	336	23.6
Total	1,421	100.0

Source: Industrial Pollution Inventory of the Kathmandu Valley and Nepal, 1994

(3) Management of Industrial Waste

Solid waste from the industrial establishment 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.

In the Kathmandu Valley, most of the large-scale industries are located in three industrial estates, Balaju in KMC, Patan in LSMC and Bhaktapur in BKM. The situations of management of solid waste at these three industrial estates are discussed below:

1) Balaju Industrial Estate (KMC)

This industrial estate is located at the north of Kathmandu (Ward 16) with an area of 34.8 ha. Since it was established in 1959, about 90 to 95 industries have been operating in the estate.

The amount of waste generated from the Balaju Industrial Estate is estimated at about 48,000 kg/month as shown in Table 4.2-6. Out of these, bio-degradable organic waste is approximate 12,500 kg/month but it is not utilized for composting at all. Recyclable materials such as paper, plastic, iron, wood, or milk products are not segregated at the generation sources.

Table 4.2-6 Generated Waste at Balaju Industrial Estate

Type of waste	Quantity (kg/month)	
Bio-degradable waste	Food/Kitchen	2,500
	Agriculture	10,000
Recyclable (Not currently recycled)	Paper	10,000
	Plastic	5,000
	Others: Tin/iron/Steel	1,300
	Wood	3,000
	Milk products	200
Non-recyclable	Rubber/Leather	9,500
	Inert Materials + dust	5,000
Other waste	Hazardous	500
	Medical	500
	Chemical	500
Total		48,000

Source: Interview survey of JICA Study Team

Waste generated at Balaju industrial estate is just dumped or burned on each industry's premises. Waste is collected by using bags/sacks and sent to the drums, pits or backyards. There is no waste storage yard and no waste segregation system in the estate. Each business has its own sweepers who clean up the premises every morning and dump or burn the collected waste and discharge it into the municipal containers. Cost for SWM is 40,000 Rs/month.

2) Patan Industrial Estate (LSMC)

This industrial estate was established in 1963 and is located at the Lagankhel area of LSMC with area 14.65 ha. A total of 105 industries are operating in the estate. The amount of waste generated from the Patan industrial estate is estimated at about 50,000 kg/month as shown in Table 4.2-7. Out of these, bio-degradable organic waste is approximately 2,500 kg/month but it is not utilized for composting at all. Recyclable materials such as paper, plastic, iron, wood, or milk products are not segregated from waste.

Table 4.2-7 Generated Waste at Patan Industrial Estate

Type of waste	Quantity (kg/month)	
Bio-degradable waste	Food/Kitchen	500
	Agriculture	2,000
Recyclable (Not currently recycled)	Paper	200
	Plastic	2,300
	Others: Tin/iron/Steel	2,000
	Wood	30,000
Non-recyclable	Rubber/Leather	NA
	Inert Materials + dust	12,800
Other waste	Hazardous	N.A.
	Medical	50
	Chemical	50
	Liquid waste	10
Total		49,910

Note: NA; Not Available
Source: Interview Survey of JICA Study Team

Waste generated from Patan industrial estate is managed similarly to Balaju industrial estate. They sell segregated waste to the Kabadi shops or shop owner directly comes to the factory to collect such recyclable matter. Cost for SWM in the estate is 30,000 Rs/month.

3) Bhaktapur Industrial Estate (BKM)

This industrial estate is located at Bhaktapur with an area of 3.6 ha. The estate was established in 1979 and a total of 37 industries are operating in the estate.

The amount of waste generated from the Bhaktapur industrial estate is estimated at about 6,000 kg/month as shown in Table 4.2-8. Out of these, biodegradable organic waste is approximately 1,000 kg/month but it is not utilized for composting at all. Recyclable materials such as paper, plastic are not segregated in the estate.

Table 4.2-8 Generated Waste at Bhaktapur Industrial Estate

Type of waste	Quantity (kg/month)	
Bio-degradable Waste	Food/Kitchen	500
	Agriculture	500
Recyclable (Not recycled)	Paper	1,000
	Plastic	3,000
	Others	20
Non-recyclable	Rubber/Leather	NA
	Inert Materials	960
Others Waste	Hazardous	NA
	Medical	NA
	Chemical	20
Total		6,000

Note: NA; Not Available
Source: Interview Survey of JICA Study Team

As with the other two estates, waste generated from Bhaktapur industrial estate is just dumped or burned on each industry's premises. Cost for SWM is Rs 5,000-6,000 per month. The estates show interest in community based waste management system and they say that it could be affordable for each industry to pay Rs 200-250 for the service charge by the community system.

4.2.4 Current Condition of Medical Waste

(1) Current Condition of Health Care Institution

According to the "National Health Care Waste Management Guidelines" issued by the Nepal Health Research Council (NHRC) in May 2002, hospitals, clinics, dispensaries and any other institutions involved in care and treatment of patients are defined as health care institutions (HCIs). In the guidelines, an institution where patients are diagnosed and treated is defined as a "hospital" generally consisting of several units such as a laboratory, dispensary, operating theater, indoor and outdoor patients department and blood bank. Some private hospitals are called nursing homes.

There are approximately 61 HCIs in the Kathmandu Valley with 3,905 beds, of which 3,541 beds are in KMC. Most of the governmental HCIs are under the control of the Ministry of Health and Population (MOHP). Some of the large HCIs are managed by respective

Ministries. For example, Tribhuvan University Teaching Hospital is under the control of the Ministry of Education and Sports (MOES), while Birendra Army Hospital falls under the jurisdiction of the Ministry of Defense. Major HCIs in the Valley are shown in Table 4.2-9.

Table 4.2-9 Major Health Care Institutions in the Kathmandu Valley

Hospitals	Number of beds	Location
Tribhuvan University Teaching Hospital	424 beds	Maharjgunj
B. P. Koirala Institute of Health Sciences	550 beds	Ramshahapath
Birendra Army Hospital	300 beds	Tachal
Patan Hospital	300 beds	Lagankhel
Dipendra Police Hospital	150 beds	Maharjgunj
Gangalal National Heart Centre	90 beds	Bansbari

Source: Hazardous Waste Management Nepal Country Report, Tuladhar, WHO, 1999, and Survey Results by JICA Study Team

(2) Generation of Medical Waste

According to the survey report by ENPHO in 2000, the generation rate of medical waste in the Kathmandu Valley was estimated at 1.7 kg per day per bed. Out of these, infectious waste generation rate is 0.48 kg per bed per day. With an estimation of 3,905 hospital beds in the Valley, the total infectious waste generated comes to be around 1,312 kg per day.

(3) Management of Medical Waste

1) Options for Treatment and Disposal for Medical Waste

The National Health Care Waste Management Guidelines provide a framework of management strategies for medial waste not only for planning and management but also for proper treatment and disposal. Table 4.2-10 shows treatment options for different types of medical waste.

Table 4.2-10 Overview of Disposal and Treatment Options for Different Types of Medical Waste

Method	Infectious	Patho-logical	Sharps	Pharma-cutical	Genotoxic	Chemical	Radio-active
Rotary kiln	Yes	Yes	Yes	Yes	Yes	Yes	Low-level infectious waste
Pyrolytic incinerator	Yes	Yes	Yes	Yes	No	Small quantities	Low-level infectious waste
Single-chamber incinerator	Yes	Yes	Yes	No	No	No	Low-level infectious waste
Drum or brick incinerator	Yes	Yes	Yes	No	No	No	No
Chemical disinfection	Yes	No	Yes	No	No	No	No
Wet thermal treatment (Autoclave)	Yes	No	Yes	No	No	No	No
Microwave	Yes	No	Yes	No	No	No	No
Encapsulation	Yes	No	Yes	Yes	Small quantities	Small quantities	No
Safe burial on hospital premises	Yes	Yes	Yes	Small quantities	No	Small quantities	No
Sanitary landfill	Yes	No	No	Small quantities	No	No	No

Method	Infectious	Patho-logical	Sharps	Pharma-cutical	Genotoxic	Chemical	Radio-active
Discharge to sewer	No	No	No	Small quantities	No	No	Low-level infectious waste
Inertization	No	No	No	Yes	Yes	No	No
Other methods	-	-	-	Return expired drugs to supplier	Return expired drugs to supplier	Return expired chemicals to supplier	Decay by storage

Source: Pruss, et. Al. 1999

In the present circumstances of HCIs in the Kathmandu Valley, safe burial, autoclave and incinerator are the three possible options. They can be used in combination or only one option can be selected. However, though the guidelines direct the proper handling of medical waste, only a limited number of HCIs carry out appropriate segregation and treatment of waste. Autoclave has come into relatively wide use among HCIs but incineration systems are installed in only few large hospitals due to the high investment and operating costs and social concerns. In many cases, infectious waste and sharps are mixed with general waste without any segregation or treatment, and disposed of into municipal containers.

2) Incineration of medical waste in the Kathmandu Valley

In the field survey of the Study, several health care institutions that had installed the incinerators were interviewed and conditions of the existing incinerators were observed. A summary of the current condition of the incinerators surveyed by the Study is shown in Table 4.2-11.

Table 4.2-11 Condition of Incinerators of Hospitals in the Kathmandu Valley

Hospital	No.	Capacity	Amount of waste incinerated	Remarks
TU Teaching Hospital	3	50 kg/hour (x 3)	100 kg/day	- Installed by Japanese ODA - Two incinerators operating and infectious and non infectious wastes are incinerated separately
National TB Centre	1	50 kg/hour (estimate)	15 kg/day	- Installed by Japanese ODA
National Heart Center	1	500 kg/1.5 hour	80-100 kg/month	- Capacity of incinerator is adequate for greater amount of waste
Patan Hospital	1	-	200 kg/day	-

Source: Interview survey by JICA Study Team

At each hospital, one or two technicians are in charge of operating the incinerator. In general, infectious wastes and contaminated sharps such as needles or syringes are incinerated for disinfection purposes. Moreover, general waste which is combustible and non infectious is also burnt at the incinerator in some hospitals. Residues of incineration are discharged into municipal containers or buried in the backyard of the hospitals. Although there are still many risks of handling of residues of sharps even after incineration, in some cases, these are mixed with other waste and disposed of in municipal containers without any considerations for the health and safety of waste collection staff.

At Teku T/S, an incinerator was constructed for treatment of medical wastes generated from small scale health care institutions. Nevertheless, this incinerator has never started operation due to a public movement against the dioxin which might be discharged by incineration process.

4.3 Short-term Landfill Plan

4.3.1 Short-term Landfill Site for KMC and LSMC

The technical discussion in this sub-section was made in the course of the Phase 2 of the Study (from February to May, 2004) in order to facilitate the decision of Nepalese side on how to cope with the Bagmati River dumping. The following is again depicted for tracing the process of discussion at that time although some lack of accuracy in the reporting of time frame may be found.

(1) Situations of Solid Waste Dumping at the Bagmati River

At the commencement of the Study (January 2004) solid waste dumping was proceeding along the Bagmati River banks around the Balkhu area. KMC and LSMC waste was being dumped on the east bank while KRM waste was dumped on the west bank of the river. Waste dumping gradually progressed downstream and at the start of 2005, all the dumping activities shifted to the west bank. However, the available area for dumping was gradually becoming smaller as the encroachment on the river width grows. The existing dumping is being conducted at the west bank inside KRM and opposite to the reserved open areas for sewage treatment ponds as shown in Figure 4.3-1.

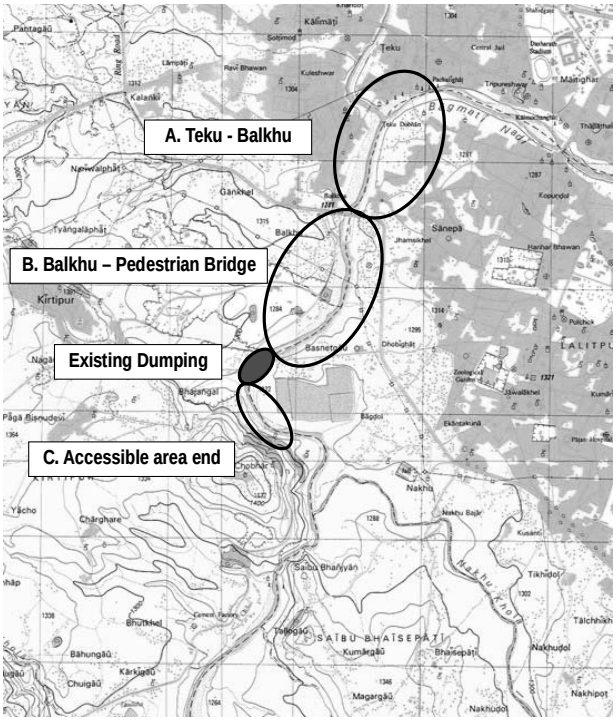


Figure 4.3-1 Solid Waste Dumping at the Bagmati River

Source: JICA Study Team

The remaining capacity along the sections depicted in the map (sections A-C) is estimated at about 30,000 m^3 if the dumping practice is not conducted in the river channel as discussed in Table 4.3-1. Assuming a daily waste volume of 900 m^3 and cover material application, approximately one and half to two months of dumping remained in these sections. If the dumping intrudes into the river channel, approximately one year may remain.

Table 4.3-1 Rough Estimation of Remaining Capacity of Bagmati River Dumping Site (as of April 2004)

Sections	Dumping condition	Remaining capacity estimated (m^3)	Remarks
A Teku-Balkhu	Dumping was completed. West bank is occupied by trucking station and farms. East bank has a strip of agricultural land adjacent to dumped waste. New waste will be dumped over previously dumped waste.	Total length = 1.1 km Usable length = 70% of East Bank Capacity = 4 m(w) x 2 m(d) x (1,100 x 0.7) = 6,160 m^3	Waste level will increase due to adding waste on bank, and excavated waste may be used as cover material. Bamboo pipes or HDPE vents may be installed to improve aeration.
B Balkhu-Pedestrian Bridge	Dumping was completed. 50 % of west bank is occupied. East bank has a strip of agricultural land adjacent to dump site. New waste will be dumped over previously dumped waste.	Total length = 1.5 km Usable length = 95% of East bank + 50% of West bank Capacity = 4 m(w) x 2 m(d) x (1,500 x 0.95 + 1,500 x 0.5) = 17,400 m^3	Waste level will increase, due to adding waste on banks, and excavated waste may be used as cover material. Bamboo pipes or HDPE vents may be installed to improve aeration.
C Accessible Area	Dumping will be continued in the present manner but proceed along the East bank only.	Total length = 0.40 km Usable length = 100% of East bank Capacity = 4 m(w) x 4 m(d) x 400 m = 6,400 m^3	-

Source: JICA Study Team

The extension of dumping to the south of the Nakhu Khola stream along the east bank may be done. However use of these areas as dumping sites may be hindered by lack of access roads for heavy waste trucks as well as social protest.

(2) Environmental/Social Problems on Bagmati River Dumping Site

The following environmental and social problems have been recognized regarding the waste dumping at the Bagmati River:

- Serious environmental impacts are being accumulated such as river water contamination and odor due to poor environmental consideration in operation of the site,
- Complaints from the local society are increasing which lead to bartering in order to soften these complaints,
- Difficulty to attain social acceptability is gradually becoming more and more obvious regarding dumping at the holy river of Bagmati, and
- In case dumping in the river intrudes on the cross-sectional area of the water course, it induces risk of disturbance of flood flow to the downstream meaning that a potential risk of flood disaster may be increased.

In addition, residents living near the dumping area put a stop to dumping the waste by force many times in April, 2004 against worsened odor conditions and insufficiency of the compensation.

It is necessary to discontinue the Bagmati River dumping in the very near future, considering the above problems as well as remaining available space. Accordingly, urgent launching of a new landfill site operated in an appropriate manner (i.e. short-term landfill site) is indispensable in line with immediate closure of the Bagmati River dumping site.

(3) Basic Strategy on Final Disposal Planning for KMC and LSMC

Based on the above discussion, the following are to be noted in order to establish the basic strategy on final disposal planning for KMC and LSMC:

- "Short-term" means LFS which are ready at present or will be ready before stopping Bagmati River dumping.
- Short-term LF provides time to prepare a Long-term LF and obtain consensus on site selection. Therefore, it is preferable that Short-term LFS has a life time of 2 or 3 years at least for operation, in order to smoothly come up to preparation of Long-term LF.
- Time gained by the Short-term LF can be used for preparing the Long-term LF such as a) identification of specific sites, b) engineering works including topography and soil surveys and detail designing, c) EIA procedure, d) gaining social acceptance, e) land acquisition, and f) site preparation works (civil works) including access road construction if necessary.

Accordingly, the basic strategy is proposed as follows for final disposal planning:

First: Short-term landfill commences operation at the time of closure of the Bagmati River dumping site.
Second: Within the serviceable life of the short-term landfill site, the long-term landfill site is to be prepared.
Third: At the time of exhaustion of the life of the short-term landfill site, the long-term landfill commences to provide disposal service.

(4) Alternative Analysis of Short-term Landfill Site

In order to ensure an appropriate landfill after closing the Bagmati River dumping site, the following three candidate sites were listed as conceivable Short-term alternatives, which are almost ready now or are could possibly be ready in the near future (within the remaining period of Bagmati River dumping site) for receiving the waste from KMC, LSMC and KRM:

- **Sisdol**: Site preparation including access road construction was on-going and only small outstanding works remain before operation of Valley 1 of the site could commence.
- **Chobhar quarry**: From the topographic view point, Chobhar quarry was assumed to be ready for receiving the wastes because a vast hole remained after the mining of limestone.
- **Gokarna re-opening**: Gokarna landfill site had been closed before exhausting its life time, meaning that some space for additional landfill remained according to the original design.

An alternative analysis was made based on the available information and data on the conditions of each conceivable candidate for Short-term LF. Among the various criteria for

evaluating the candidates, the first priority for identifying the better candidate was; "What was the status of readiness for receiving waste from the three municipalities?" since the most essential objective of Short-term LFS is to contribute to the immediate closure of Bagmati River dumping. The operational problems awaiting solution for the selected candidates were then examined in the next step. Thus, each candidate was evaluated from the following viewpoints as alternative analysis, and the result is summarized in Table 4.3-2.

- Technical aspects
- Environmental and social aspects
- Development progress

Table 4.3-2 Alternative Analysis of Conceivable Candidates for Short-term Landfill Site

Aspect	1. Sisdol	2. Chobhar quarry	3. Gokharna re-opening
Technical Aspects			
Geology	Clay liner will be required. The materials for liner can be procured from adjacent area	The site was developed as limestone quarry. Composite liner may be required at the base and along the steep walls of the quarry.	Settlement of old landfill is still on-going. Installation of liner and leachate collection network may be difficult and liner will be damaged, due to unstable base.
Maximum capacity	About 300,000 m^3	About 250,000 m^3	100,000 ~ 150,000 m^3
Estimated life time	About 2.5 – 3 years	About 2 years	Less than 1 year
Other technical issues to be noted	-	-	Space for facility installation of leachate treatment will encroach upon filling space.
Environmental and Social Aspects			
EIA process	EIA process was completed, and approval was issued by MOPE in June, 2004.	EIA will be needed.	EIA may not be needed.
Social environment	- Social aspects are examined and reflected in the EIA. - Land acquisition and resettlement were completed including provision of compensation. - Social acceptance by the local community is considered to be mostly achieved.	-The site has experienced social opposition which led to the closure of the former Himal Cement Plant. -It is considered that social acceptance can hardly be achieved for receiving waste from KMC and LSMC -Religious importance is pointed out such as the temple at the top of Chobhar hill and the nearby Chobhar gorge.	-Previous opposition of the local citizens lead to the closure of Gokarna twice before. -The local society will become very much demanding should there be a decision for re-opening, even if sanitary method is committed.
Natural conditions	- Impact on adjacent river is to be considered, such as water contamination. - Impacts on terrestrial and aquatic biota are considered to be slim in general.	-Impacts on hydrosphere may be brought about, especially on the ground water due to limestone base. -Impacts on terrestrial and aquatic biota are unknown.	-Stability of the existing northern slope of garbage seems fragilely balanced. Instability may be induced by additional landfill. -Water contamination will be accelerated due to insufficient leachate treatment.

Aspect	1. Sisdol	2. Chobhar quarry	3. Gokharna re-opening
Development Progress			
Situation	- The site was being developed as landfill. The site preparation was on-going. - Access road was almost completed notwithstanding improvement requirement.	-Abandoned quarry is considered to be reclaimed. Thus, the site has been considered as landfill by many studies. -Improvement of access to the site is necessary, but not difficult. -Presently there is a plan to develop a housing complex on the site.	-The site was originally developed as landfill. -Existing access road is available. -Development as recreational area is under consideration.
Expected minimum time toward launching	- Field survey and design: 4 months - EIA process: 1 month - Site preparation: 3 months (The above activities were completed by March 2005 for Phase 1.)	-Field survey and design: 4 months -EIA process: 6~12 months -Site preparation: 4 months*	-Field survey and design: 3 months -EIA process: unknown -Site preparation: 3 months

Note*: Slopes will be lined as operation proceeds.
Source: JICA Study Team

Based on the above alternative analysis, each candidate sites for short-term landfill site was evaluated as follows:

- **Sisdol**: Sisdol was advantageous regarding the length of serviceable life which would allow time for preparation of a new LFS (Long-term LFS). Moreover, among the alternatives, the it had the shortest time for commencement of providing service since; i) site preparation including access to the site was almost complete; ii) procedure for EIA approval was in the final stage; and iii) social acceptance of the local population was considered to be almost attained.
- **Chobhar quarry**: It was expected that social acceptance could be hardly attained considering the past experiences of the site as well as the religious and political aspects. It was also considered to be disadvantageous in that; i) limestone was unreliable for the base of landfill, and ii) the whole EIA process would required and it would take more than a year. Consequently, this site could not be used as the Short-term LF.
- **Gokarna re-opening**: It might be possible to skip over the EIA process based on the consultations with related agencies such as MOPE (now MOEST) to shorten the time for launching, since the site was already developed and used for landfill. However, crucial technical problems were recognized regarding the settlement of old landfill, leachate treatment, etc. Also, the expected life time seemed insufficient to allow for preparation of long-term LFS(s). Moreover, social acceptance would no doubt be difficult to achieve for re-opening of the site. These constraints posed large disadvantages.

As a result of the overall evaluation of the three alternatives, Sisdol was selected by the Nepalese side as an optimum short-term landfill site (S/T-LFS) for KMC and LSMC.

4.3.2 Facilities of Sisdol Short-term Landfill and Future Development Plan

At the commencement of the Study it was found that the development of the Sisdol S/T-LF had been in progress for around eight years. The land had been acquired, the EIA study was under way, the detailed design completed and some construction works were in progress. However it became clear that there were differences between the facilities required under the EIA, those proposed in the detailed design and the facilities actually under construction.

Under these conditions, Valley 1 of the site has been improved incorporating semi-aerobic system as part of the Pilot Projects of the Study.

The facilities planned and implemented at the site are outlined in Table 4.3-3.

Table 4.3-3 Facilities of the Sisdol S/T-LF

Facility	Content	Remark
Landfill site	Valleys 1 and 2	Valley 1 covered within the Pilot Project
	West waste dam	Downstream Valley 1 (developed by SWMRMC)
	East waste dam	To be developed for Valley 2
	Main leachate collection pipes	RC perforated pipes (**F**600mm) in Valley 1 (implemented as part of the Pilot Projects)
	Branch leachate collection pipes	HDPE perforated pipes (**F**250mm) in Valley 1 (implemented as part of the Pilot Projects)
	Gas removal pipes	HDPE perforated pipes (**F**100mm) in Valley 1 (implemented as part of the Pilot Projects)
	Site internal road	Road for access to the disposal site (implemented as part of the Pilot Projects and SWMRMC)
Liner system	Clay liner	Imported clay liner of 50 cm thickness in Valley 1 (implemented as part of the Pilot Projects)
Leachate pond	Regulation pond	RC lined pond provided downstream of the west waste dam for Valley 1 (implemented as part of the Pilot Projects)
	Aerator	Installed within the pond to provide aerobic treatment of the leachate (implemented as part of the Pilot Projects)
	Re-circulation system	Perforated hoses mounted on the vertical gas vents and pump to re-circulate the leachate back into the waste disposal areas (implemented as part of the Pilot Projects)
Drainage	Perimeter cut-off drain	U shaped masonry walls with concrete bed along the site perimeter road to collect the rain water flowing from the northern hills and discharge to a pipe downstream of the site (SWMRMC)
Control facilities	Weighbridge	40 ton capacity to serve the whole site (implemented as part of the Pilot Projects)
	Administration building	For the whole site (SWMRMC)
	Heavy equipment parking area	For the whole site (SWMRMC)
	Gate and fence	For the whole site (SWMRMC)
	Water tanks	For the whole site (SWMRMC)
	Electricity supply	For the whole site (SWMRMC)
	Generator	Provided as standby power supply (implemented as part of the Pilot Projects)

Source: JICA Study Team

Using these facilities the Valley 1 of the Sisdol S/T-LF is being operated as a semi-aerobic landfill. SWMRMC is now proceeding with the design for the Valley 2. The facilities to be provided there will be similar to those of the Valley 1, but at a smaller scale due to the smaller area of that Valley.

4.3.3 Collection and Transportation

(1) Examination of Secondary Transportation Plan to Short-term Landfill

Prior to considering the secondary transportation plan from KMC and LSMC, KMC, SWMRMC and the JICA Study Team conducted an experimental trip driving a KMC's multi packer compactor truck (14 m^3) from the Teku T/S to Sisdol S/T-LF. The result is as follows:

Table 4.3-4 Result of Trip Survey of Multi Packer to Sisdol

Survey Date: March 10 ,2004, Survey Time: 9:35 a.m. to 11:35 a.m. (one way), Climate: Fine				
Route: Teku-(Tripureswor Rd.)-Balkhu-(Ring Rd.)-Balaju Jct.-(Rd. to Trisuli)- Tinpiple -(Access Rd.)-Sisdol				
Sections	Teku – Balaju Jct.	Balaju Jct. – Tinpiple	Tinpiple - Sisdol	Total
Distance (km)	11.3	8.3	8.4	28
Time (min)	41	32	23	96
Speed (km/hr)	16.5	15.6	21.9	17.5
	-	18.2		

Source: JICA Study Team

Based on the above result, preliminary conditions for the examination of secondary transportation were tentatively assumed as follows:

Table 4.3-5 Preliminary Conditions for Examination of Secondary Transportation

One way	Teku – (Balkh)- Sisdol	Balaju: KMC-Sisdol*	Afadole: LSMC- Sisdol**
Distance (km)	28	19	28
Time (min)	90	55	90

Note: *Distance from Balaju to Sisdol is from the candidate site in Balaju along Bishnumati River to Sisdol
**Afadole in LSMC is located near the existing waste dumping site along the Bagmati River
Source: JICA Study Team

In addition, considering other conditions assumed from the experience of KMC's vehicle operation such as fuel consumption rate, labor cost, maintenance cost, the annual operation and maintenance costs of the secondary transportation by using only the existing equipment of KMC and LSMC were estimated as shown in Table 4.3-6 and 4.3-7. The amounts of waste collected by KMC and LSMC were assumed to be 250 ton/day and 60 ton/day respectively. These estimations show the existing transportation capacities of both municipalities are insufficient for waste transportation to Sisdol S/T-LF.

Table 4.3-6 Estimated Transportation Cost by Using Existing Equipment Only (KMC)

SN	Vehicle Type	No of vehicle	Waste Transferred (ton/day/veh.)	Total Transferred (ton/day)	Operational Cost (Rs/yr)	Trips/day
1	Multi-pack	7	10.9	77	12,868,708	3
2	Dumping Placer 4	8	4.4	36	7,365,087	3
3	Dumping Placer 4.5	2	5.0	10	3,165,558	3
4	Dumping Placer 6	4	7.9	31	5,668,939	3
5	Tipper 3.5	16	3.1	50	12,071,186	2
6	Tipper 4.5	10	4.2	42	7,723,195	2
7	Compactor 4	1	2.6	3	638,904	1
8	Compactor 6	2	3.8	8	1,555,410	1
Total		-	-	256	51,056,987	-

Note: All the collected waste is assumed to be transported to Sisdol through Teku T/S
Fuel cost is Rs 31.5/Liter
Source: JICA Study Team

Table 4.3-7 Transportation Cost Estimated by Using Existing Equipment Only (LSMC)

SN	Vehicle Type	No of vehicle	Waste Transferred (ton/day/veh.)	Total Transferred (ton/day)	Operational Cost (Rs/yr)	Trips/day
1	Dumping Placer 4.5	3	5.0	15	2,866,009	3
2	Dumping Placer 6	2	7.9	16	2,973,271	3
3	Tipper Truck 3.5	16	2.0	31	9,850,360	2 (4veh.)
Total		-	-	62	15,689,640	-

Note: Fuel cost is Rs 31.5/Liter
Source: JICA Study Team

Based on this estimation, it was concluded that transportation by the existing equipment of both municipalities was almost impossible for the following reasons:

- Three round trips will take more than nine hours for transportation only not including collection time. Actual operation hours of the transportation vehicles are more than double transportation time when adding in time for lunch or tea breaks, refueling, and loading time at the transfer station. For this longer operation, KMC and LSMC would have to establish at least another shift schedule with new employees.
- If two shifts are run, municipalities worry about the drivers losing their sense of ownership or responsibility for the vehicles.
- KMC is spending about Rs 6,000,000 annually for secondary transportation from Teku to Bagmati River dumping side at present. This transportation cost is 8.5 times the present cost.
- Since LSMC does not currently have a transfer station for the secondary transportation, all estimated cost will be just an additional expenditure for the municipality.

In order to solve above mentioned crucial problems, an alternative case using new secondary transportation vehicles (STVs) with a loading capacity of 15 m^3 (about 6 tons) was examined and at least 19 STVs, 16 for KMC and 3 for LSMC, were concluded necessary. Based on this estimation, HMG/N and MOLD applied to GOJ to procure these STVs under the Japan Non-Project Grant Aid. As the result of the tendering process, a total 21 STVs (17 for KMC and 4 for LSMC) which have hook lift equipment including spare parts, together with 18 extra containers will be delivered to Kathmandu by the end of September 2005.

The following measures were considered to manage secondary transportation to Sisdol S/T-LF by using 21 STVs.

- Full use of KMC's multi-pack compactor trucks and some direct transportation by the primary collection vehicles, by 6m^3 and 4.5m^3 dumper placers or tipper trucks.
- It is likely that the maximum possible number of trips per day to Sisdol is 2, but an attempt should be made to make 3 trips as circumstances permit.
- Tentatively, a transfer station for LSMC, which will use wheel loaders will be established at Afadole.

The transportation coverage plan is shown in Figure 4.3-2 based on the above mentioned conditions related to the fluctuations of future transportation requirements.

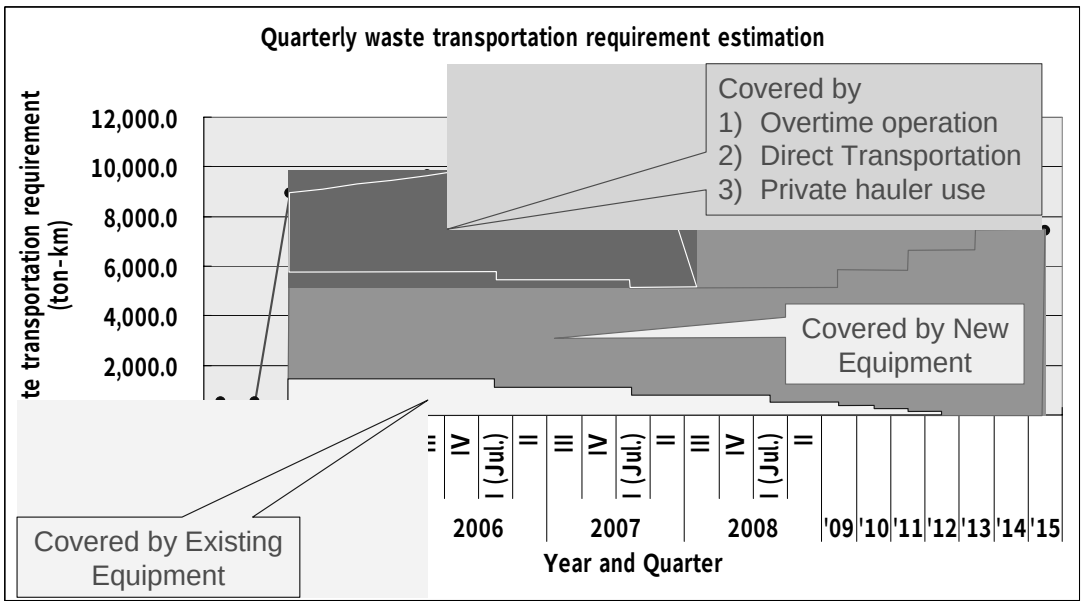


Figure 4.3-2 Transportation Coverage Plan

Source: JICA Study Team

Since Sisdol S/T-LF commenced its operation in June 2005 before delivery of new STVs, KMC and LSMC are transporting some of the collected waste from the morning collecting shift, about 30 to 50 tons per day, to Sisdol S/T-LF by using the existing equipment and a few rental trucks. The following figure shows the waste flow when the Sisdol S/T-LF will commence full-scale operating. Necessary measures for tentative transportation to Sisdol S/T-LF are as follows.

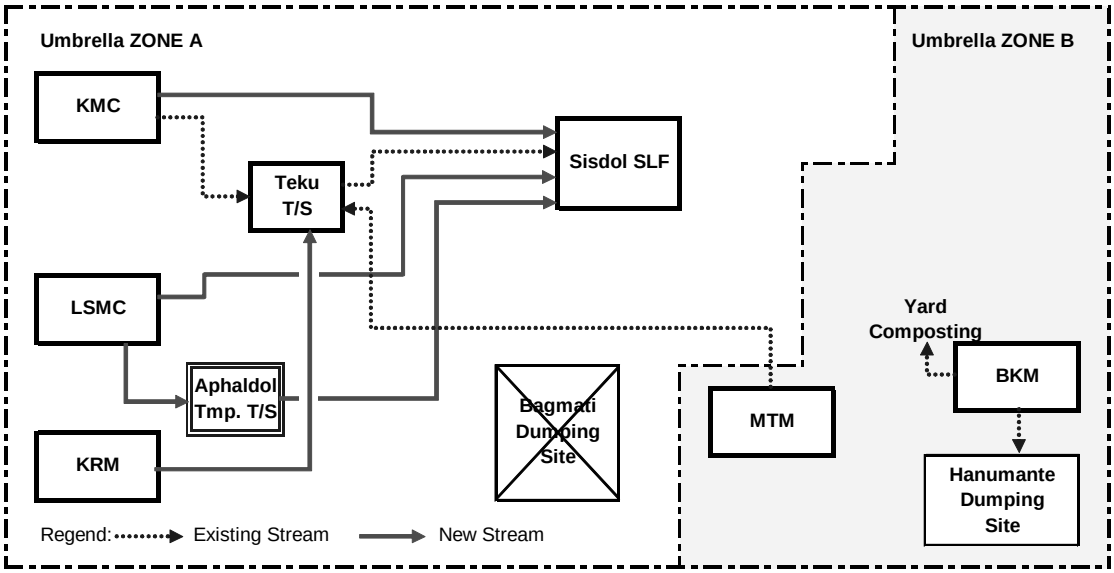


Figure 4.3-3 Waste Stream at the Commencement of Operation of Sisdol S/T-LF

Source: JICA Study Team

(2) Cost for Secondary Transportation to Short-term Landfill Site

After receiving new STVs, the solid waste balance and operation cost are estimated as follows;

Table 4.3-8 Transportation Cost from Teku T/S to Sisdol S/T-LF by KMC's STV

SN	Vehicle Type	No.	Waste Collection by KMC (ton/Day)	Waste Transferred (ton/d/veh.)	Total Transferred (ton/day)	Waste Balance (ton/day)	Operational Cost Rs (annual)
1	Multi Pack	7	276.8	8	54	223	11,259,894
2	Container Carrier	17	-	9	147	76	33,191,581
Total		24	276.8	-	201	76	44,451,475

Note: Operational cost includes fuel, maintenance, administration, salary, depreciation and interest
Fuel cost is Rs 41/Liter
Source: JICA Study Team

Table 4.3-9 Transportation Cost from Teku T/S or City Area to Sisdol S/T-LF by KMC's Existing Equipment

SN	Vehicle Type	No.	Waste Collection by KMC (ton/Day)	Waste Transferred (ton/d/veh.)	Total Transferred (ton/day)	Waste Balance (ton/day)	Operational Cost Rs (annual)
1	Dumper Placer 4	4	76	1.6	6	70	995,441
2	Dumper Placer 4.5	1	-	1.8	2	68	489,023
3	Dumper Placer 6	2	-	2.8	6	62	922,864
4	Tipper 3.5	16	-	1.6	25	37	4,484,736
5	Tipper 4.5	10	-	2.1	21	16	2,434,536
6	Compactor 4	1	-	2.6	3	14	291,883
7	Compactor 6	1	-	3.8	4	10	472,546
Total		35	76	-	66	10	10,091,029

Note: Operational cost includes only incremental cost for fuel, maintenance and administration, it dose not include salary, depreciation or interest.
Fuel cost is Rs 41/Liter
Source: JICA Study Team

Table 4.3-10 Transportation Cost from Afadole Temporary T/S by LSMC's STV

SN	Vehicle Type	No.	Waste Collection by LSMC (ton/Day)	Waste Transferred (ton/d/veh.)	Total Transferred (ton/day)	Waste Balance (ton/day)	Operational Cost Rs (annual)
1	Container Carrier	4	56.8	9	35	22	8,738,936
	Total	4	56.8	-	35	22	8,738,936

Note: Operational cost includes fuel, maintenance, administration, salary, depreciation and interest
Fuel cost is Rs 41/Liter
Source: JICA Study Team

Table 4.3-11 Transportation Cost from Afadole Temporary T/S or City Area to Sisdol S/T-LF by LSMC's Existing Equipment

SN	Vehicle Type	No.	Waste Collection by LSMC (ton/Day)	Waste Transferred (ton/d/veh.)	Total Transferred (ton/day)	Waste Balance (ton/day)	Operational Cost Rs (annual)
1	Dumper Placer 4.5	0	22	1.6	0	22	0
2	Dumper Placer 6	2	-	2.4	5	18	1,038,266
3	Tipper 3.5	12	-	1.6	19	-1	3,570,023
Total		14	22	-	24	-1	4,608,289

Note: Operational cost includes only incremental cost for fuel, maintenance and administration, it dose not include salary, depreciation or interest.
Fuel cost is Rs 41/Liter
Source: JICA Study Team

Fuel cost has been seriously raising to about 1.3 times more as expensive as a year ago. Due to this escalation, operational cost is estimated to become quite high. For KMC, incremental transportation cost of fuel, maintenance and administration for transportation by the existing collection equipment is about Rs 10 million per year in addition to the total transportation cost including salary, fuel, maintenance, depreciation and interest by the existing Multi Compactor trucks and new STVs, which is estimated to be approximately Rs 44.5 million per year. However, as shown in Table 4.3-9, 10 tons of waste per day should still be transported by another alternative way. In the LSMC case, total transportation cost for new STV is estimated to be about Rs 8.7 million and incremental cost for the existing collection equipment is to be Rs 4.6 million.

In terms of primary collection, the operation of Sisdol S/T-LF does not seriously affect the existing system except for re-arrangement of the collection route to the transfer stations from the Bagmati River dumping site.

4.3.4 Operation and Maintenance

(1) Demarcation of Responsibilities for O&M of Sisdol S/T-LF

There are three main stakeholders involved in the Sisdol S/T-LFS, namely the beneficiary municipalities of KMC and LSMC, the central government as the developer and land owner, represented by SWMRMC; and the surrounding communities, represented by the formed and duly registered OSLSMCC. The three parties have entered into two agreements which detail the roles of each concerning the operation and maintenance of the site. These are outlined in Table 4.3-12.

Table 4.3-12 Demarcation of Responsibilities for O&M of Sisdol S/T-LF

No	Activities	Responsible Stakeholder
1	Operation and maintenance (daily landfill site management such as inspection of incoming waste, storm water drainage system, leachate collection, retaining structures, leachate treatment and re-circulation, gas venting, liner, operation roads, and other land filling activities)	KMC & LSMC
2	Negotiations with surrounding people (explanation, compensation, handling complaints, etc.)	KMC & LSMC in cooperation with SWMRMC, OSLSMCC and VDC and DDC

No	Activities	Responsible Stakeholder
3	Environmental monitoring (water quality of surface and ground waters, odor, gas, settlement, etc.)	SWMRMC
4	Development of Valley 2 (including remaining development works for Valley 1)	SWMRMC
5	Management of local development budget	OSLSMCC and SWMRMC
6	Post closure re-development of the site	SWMRMC
7	Post closure management (leachate, gas treatment, soil cap and cover maintenance, etc.)	KMC & LSMC

Source: JICA Study Team

The Thumki – Sisdol access road has been specifically developed for the Sisdol S/T-LF and will be maintained by SWMRMC in constant working order to ensure continuous access to the landfill. Table 4.3-13 shows the demarcation of responsibilities for the operation and maintenance of this access road. The ownership of the access road is planned to be handed over to the Department of Road in future.

Table 4.3-13 Demarcation of Responsibilities for O&M of Accesses Road (Thumki-Sisdol)

No	Activities	Central Government (SWMRMC)	Local Bodies (KMC, LSMC)
1	Daily operation and maintenance (pavement repairs, small landslide, etc.)	SWMRMC, but to be placed under the control of DOR in future	-
2	Emergency maintenance (large scale landslides, etc.)	Ditto	-
3	Negotiations with surrounding people (explanation, compensation, handling complaints, etc.)	-	KMC and LSMC in cooperation with SWMRMC
4	Environmental monitoring (littering, etc.)	-	SWMRMC in cooperation with KMC and LSMC

Source: JICA Study Team

(2) Necessary Staff and Equipment for O&M of Sisdol S/T-LF

In order to operate the Sisdol S/T-LF in a sustainable manner, enough staff and equipment need to be allocated. The staff designations, numbers and responsibilities and the heavy equipment allocations, units and functions are described in Table 4.3-14.

Table 4.3-14 Staff and Equipment Requirements for O&M of Sisdol S/T-LF

Staff/ Equipment	No.	Responsibility/Function
A. STAFF		
1. Manager	1	Overall site management
2. Engineer	2	Daily landfilling operation management
3. Clerk/Secretary	3	Accounting, store keeping and personnel affairs
4. Weigh bridge operator	1	Incoming waste recording, checking and directing to disposal areas
5. Equipment operators	4	Operation of equipment for waste placing and compaction, cover soil transport and application, water transport, etc.
6. Mechanics	2	Maintenance of heavy equipment, pumps, aerator, weighbridge, and collection trucks
7. Workers	4	Assistance in all the above
8. Guard	2	Site access control

Staff/ Equipment	No.	Responsibility/Function
B. EQUIPMENT		
1. Compactor	1	Spreading and compaction of landfilled waste at the disposal cell
2. Bulldozer	1	Spreading, excavation and compaction of wastes and other materials at the site
3. Wheel loader	1	Packing and transporting of waste and cover materials
4. Excavator	1	Excavation of materials, making trenches and preparation of waste cells
5. Dump truck	1	Transport of cover materials and other requirements to/from the site
6. Water tanker	1	Water transport

Source: JICA Study Team

4.3.5 Environmental Aspects

(1) Technical Review of EIA

The EIA study on the Sisdol S/T-LFS was commenced in early 2001 by SWMRMC and the EIA report was drafted and submitted in October 2001 to then MOPE through MOLD. The JICA Study Team has completed a technical review of the EIA report, and the following issues are considered to require specific discussion:

- Physical environment: river water quality contamination due to leachate, odor, gas generation, and hydrological condition of the Kolpu Khola River
- Biological environment: protected area and endangered species
- Social environment: land acquisition and resettlement

In the course of the technical review, measures for recovering or mitigating the environmental impacts were also suggested if required, of which some have been included into the Pilot Project activities.

1) Water Quality Contamination

According to the water quality survey conducted in the course of the EIA study, the Kolpu Khola (the river flowing near the toe of LFS) does not seem to be contaminated by organic or chemical pollutants, whereas the river water is reported to be turbid very often due to sediment discharge by excessive earthwork for agricultural terrace construction upstream. The river water is only used for irrigation by the local people at present. Roughly one-third of the base of Sisdol S/T-LFS, downstream of Valley 1 comprises loose gravel deposits covered by sandy to silty loam of 1-2 m thick. As impermeability of this soil base cannot be secured from the geological viewpoint, a semi-aerobic method was applied to provide earlier decomposition of the waste and less contaminated leachate.

A simplified horizontal natural liner system on the landfill base was designed and installed in order to reduce the risk of leachate intrusion into Kolpu Khola, considering the geological condition as well as river water utilization. A preliminary leachate treatment system using a biological method was also planned, which was considered to be manageable under the current local technical and financial capabilities. The leachate treatment consisting of retaining ponds and re-circulation systems was designed taking into account the rainfall analysis and flood probability within the LF area and was reviewed to provide sufficient treatment capacity.

During operation, environmental monitoring of the water quality of the river and groundwater as well as leachate from LFS is necessary in order to confirm the effectiveness of the adopted semi-aerobic system, liner and leachate treatment systems.

2) Odor and Gas Generation

When a waste processing plant becomes serviceable, much of the compostable portion of the waste will be diverted from landfilling, thereby reducing the odor generation. However, for the near future landfilling without segregating organic waste is expected.

In the land use plan for the landfill site, approximately 50% of the total area is allocated as a buffer zone which contributes to reducing the impact of offensive odor from the site. Soil covering on a daily base is being conducted not only for odor prevention but also for sanitary control. If offensive odor problems arise causing frequent complaints by surrounding villages, site operational works such as soil covering are to be reviewed and reexamined.

Regarding the gas generation from the site, landfill gas is planned to be monitored once or twice a year in order to i) confirm whether or not (semi) aerobic decomposition is predominant, and ii) determine steps for the safe closure and redevelopment of the site.

3) Hydrological Condition of Kolpu Khola

Sisdol S/T-LF is located at the right bank of Kolpu Khola which has a catchment area of approximately 28 km^2 upstream of the site. There are no available data on the hydrological condition of the river, and valuable information could not be obtained through disclosure with the local people with the exception that the highest flood level observed in the most recent 3 or 4 years did not exceed the paddy field on the left bank whose level lies 1 or 2 m below the toe of storage dam structure.

In order to understand the probable effect of a flood on the landfill site, the flood discharge volume and flood water level of Kolpu Khola were preliminarily estimated. Major outcomes are summarized as follows:

- The paddy field on the left bank can be considered to provide a retarding function when flood comes. Therefore, the even flood level even of a return period of a 100 years will not exceed the crest of the storage dam.
- The flood level of a 10 years return period may reach up to about 1.5 m below the toe of storage dam, and the difference of elevation between flood level and toe of the dam may be less than 1 m in a return period even of 25 or 50 years.

Based on the above analysis, LFS facilities will not be directly damaged by the probable flood of Kolpu Khola. However, the leachate treatment system was installed on the river terrace at the same elevation as the toe of the storage dam. Therefore, river training work along the section of the leachate treatment system was suggested as river bank protection, since bank collapse may bring about destructive damage to the treatment facilities.

4) Biological Environment

Sisdol S/T-LF is not designated as a protected area. The Nagarjune Forest Conservation Area located about two km aerial distance away from the site is a nearby protected area. The forest and vegetation condition in and around the site can be considered to be

ecologically unimportant. The leopard is the only endangered species reported so far which is listed as a protected wildlife in the National Parks and Wildlife Conservation Act, 1973. It is thought that the area in and around the site is not the permanent habitat of leopards, and that it only occasionally appeared from the forest area nearby. The aquatic biota in Kolpu Khola is very poor and fish can only rarely be observed according to the local people.

Based on the above findings, impacts on the biological environment including the protected area and endangered species are considered to be slim.

5) Land Acquisition and Resettlement

Land acquisition procedure for Sisdol S/T-LF was completed and the necessary amount of the compensation determined under a legal process was already disbursed to the affected households. The land acquired by the project including Aletar waste processing facility (WPF) was estimated according to the EIA:

Table 4.3-15 Land Acquisition for Sisdol S/T-LF

Area	Total area (ha)	Of which	
		Area for facilities (ha)	Area for buffer/ utility (ha)
Sisdol S/T-LFS	10.3	4.8	5.5
Aletar WPF site	10.0	4.0	6.0
Total	20.3	8.8	11.5

Source: EIA for Development of Sanitary Landfill Site at Sisdol-ko-gairo, Okharpauwa VDC, Nuwakot, SWMRMC/MOLD, October 2001

Out of approximately 20.3 ha, about 70% (14 ha) was under private ownership with 41 probable affected households including 17 tenant-farming households, whose agricultural activities would be damaged partially or wholly. All private-owned land was cultivated, of which 7.6 ha and 6.4 ha were irrigated land (Khet) and rain fed land (Bari) respectively. The rest was under governmental ownership was bush or grass land.

A total of 13 buildings belongings to 7 households were identified as ones to be removed by Sisdol and Aletar projects. Although most of these structures were cowsheds, two structures were considered to be used for residential purposes. Based on the outcomes and conclusions of the EIA, two households would be seriously affected by Sisdol and Aletar projects. It was expected that not only should these households be resettled but also that they would loose all their land. It was considered that other affected households could restore their livelihood since they had extra lands for cultivating and reconstructing huts in different areas.

Looking over Sisdol project only, there were 10-12 affected households whose damages were mainly land acquisition. According to interview with the local people, most of these households have already moved out and into new areas after receiving compensation from the government, since they had extra lands. However, one household remained inside the site due to non-availability of extra land when the site operation started. This household used two residential dwellings inside the site and one cowshed located just downstream of the west waste dam.

From the viewpoint that one of the essential issues to be considered regarding social impacts was to have every effort to at least restore the former livelihood of the project-affected

households, a special consideration was paid to this household, such as employment for the constriction works of the site. A continuous care of this household is expected, such as supplemental allowance for assisting their livelihood restoration.

6) Environmental Mitigation Measures Proposed in the EIA

The various mitigation measures were proposed in the EIA as summarized in Table 4.3-16. Some of the proposed measures were considered to be technically inapplicable and impracticable under the current capability and resources of the Nepalese side. Therefore, reexamination and adjustment were made in the course of the Study as discussed above.

Table 4.3-16 Mitigation Measures Proposed in EIA

Items	Outline of Mitigation Measures
Physical Environment	i Afforestation of buffer zone ii Erosion control and land stability of the new access road, LF area, and river bank iii Installation of peripheral drainage system to divert the storm water from running into LF area iv Installation of geo-membrane to isolate the leachate from percolating into the groundwater v Installation of leachate treatment plant to treat up the leachate before discharging to the water bodies vi Installation of gas ventilation system for appropriate release of LF gas vii Compliance of Nepalese emission standards on heavy vehicles to be used in LF site viii Regular maintenance of heavy equipment and vehicles to be used in LF area in order to reduce air pollution as well as noise and vibration ix Control of littering the wastes x Application of cover soil with compacting the waste in LF area xi Prohibition of against the entry of outside persons including installation of fence
Biological Environment	i Prevention of over clearance of the site in the preparatory works ii Afforestation of buffer zone iii Fencing to restrict the encroachment on afforested area iv Cover soil to reduce the scavenging by the animals/birds v Installation of leachate treatment plant to treat up the leachate before discharging to the water bodies
Socio-economic Environment	i Compensation for relocation and loss of land, crops, trees, etc. in compliance with Nepalese legislation when resettlement and land acquisition are inevitable ii Guidance and instruction to workers for avoiding or reducing the locally social and cultural conflicts iii Enhancement of local community development such as infrastructure improvement, and water supply iv Reduction of risks on accidents or occupational health through such measures as fencing, installation of gas ventilation system, awareness campaign

Source: EIA for Development of Sanitary Landfill Site at Sisdol-ko-gairo, Okharpauwa VDC, Nuwakot, SWMRMC/MOLD, October 2001

(2) Procedural Review of EIA

1) EIA Process and Public Involvement Performed by the Nepalese Side

It can be thought that SWMRMC offered fair opportunities to the local people for public consultation in the EIA process for Sisdol. Based on the EIA legal requirement of Nepal, SWMRMC offered the 15 day public notice in January, 2001 for the purpose to obtain the public concerns on the EIA study at the scoping stage, as well as the public hearing in October, 2001 for the purpose to discuss the draft results of the EIA study. In addition, direct interviews and discussions with the local were made for social survey in the EIA study as unofficial opportunities. The major concerns raised from the local people in this legal process were reported as follows:

- Ensuring adequate compensation for land acquisition and other losses
- Effective and sure implementation of environmental management activities recommended in the EIA
- Various local developments in exchange for the LFS development

SWMRMC has been putting forth an effort to integrate the above concerns into the development activities. Compensation for land and other losses due to the Sisdol LFS development proceeded in line with the legislative framework of Nepal including the delineation of property to be compensated and determination of compensation amount. A local committee, OSLSMCC, has been organized with assistance of SWMRMC and MOLD to realize the well-balanced development between Sisdol S/T-LFS and the local communities considering the local demands. In the course of design and operation of the Sisdol S/T-LFS, the environmental control measures and monitoring were discussed and implemented to fulfill the suggestions provided in the EIA.

In the EIA evaluation process by the Nepalese authorities, MOPE requested SWMRMC to obtain the recommendation letter from Okharpauwa VDC, which showed the achievement of general consensus in the local communities for the Sisdol S/T-LFS development. The VDC submitted the letter on May, 2004 to SWMRMC based on the request from then MOPE, in addition that the same kind of VDC's letter had been already submitted in 2001. The EIA approval was issued from then MOPE on June 2004.

2) Social Concerns Reviewed by the JICA Study Team

According to the interviews with the local people and VDC chief by the JICA Study Team, social acceptance for Sisdol S/T-LFS development seems to be attained in general. The topics obtained through the interviews are noted below:

- At the initial stage of the LFS plan in late 1990s (Banchare Danda plan), some of the local people had expressed their objections. However, as local infrastructure was steadily developed and consultations accumulated, local feelings toward the project (Sisdol and Banchare Danda) got milder.
- The local people/community has additional development demands such as irrigation, a school, branch roads as bartering for the LFS development.
- The Aletar project was considered to play an important role for the local community from the viewpoints of a) big potential for creation of employment opportunity, and b) reduction of organic waste to be disposed of into Sisdol which would be a major source of environmental pollution. In case that the Aletar project would not be launched in parallel with Sisdol project, alternative measures/options may be required.
- Proper operation of the LFS is important in order not to contaminate the surrounding environment, and feasible and effective technology is to be adopted.

The above findings were notified to SWMRMC as well as KMC and LSMC, and the following actions especially against the latter three issues have been taken with assistance from the JICA Study Team:

- The additional development demands of local people/communities are now one of major topics being discussed. SWMRMC has established a system for allocating a fund annually from the central budget to OSLSMCC, which can be used for local development projects under the committee's initiative with being supervised by SWMRMC. Trading off of the Aleter project is also covered by this system.

- Environmental control measures were examined and applied to Sisdol LFS, which were the technically feasible and applicable considering the Nepalese capability and resource such as clay liner and leachate treatment and circulation system.

(3) Local Committee

OSLSMCC is a corporate organization under the Organization Registration Act. OSLSMCC consists of about 30 representatives from the local communities with the function of not only coordinating the environmental and social issues among the local people but also arranging and consulting the issues with SWMRMC and LFS operators (KMC/LSMC).

Agreement for operation of the LFS was signed on May 15, 2005 by the representatives from SWMRMC, KMC, LSMC, and OSLSMCC with the presence of the Minister and acting/joint secretaries of MOLD as well as concerned VDCs' secretaries. The contents of the agreement included LFS operational issues, cooperation for solution of problems/complaints, local development, coordination of monitoring of LFS operation and the environment, and so on.

OSLSMCC is considered to be the first comprehensive mechanism for such local coordination in the SWM sector in Nepal, and this mechanism has the potential to present a good practice for the nation regarding development of SWM-related facilities by sharing the information, understanding and benefits among the key stakeholders. The mechanism led by OSLSMCC should be kept and cared for continuously by the central and local authorities to be workable and functioning properly in line with the Sisdol S/T-LF operation.

(4) Comparison with JICA Guidelines Requirements

The JICA Guidelines for Environmental and Social Considerations (April 2004) delineate the principles to be required to the recipient government. Although the JICA Guidelines are not fully applied to the Sisdol S/T-LFS project, verification of the EIA-related activities performed by Nepalese side was made from the viewpoint of consistency with the JICA Guidelines.

1) Technical Aspect

The EIA study for Sisdol S/T-LF prepared by the Nepalese side has covered various components of the physical, biological and socio-economic environment. The mitigation measures and monitoring plan have also been developed in line with the likely impacts predicted in the EIA study. It can be said that the scope discussed in the EIA study is, in general, sufficient. However, technical examination and adjustment on the above mismatch were made during the Study. Some of the important issues were not examined such as the possibility of damage to the LFS facilities due to the hydrological fluctuation of Kolpu Khola. In addition, there were several mitigation measures that were hardly practical considering the current technical capability of the Nepalese side, such as the geo-membrane installation, leachate treatment plant associated with chemical treatment process.

2) Procedural Aspect

One of the most essential requirements of the JICA Guidelines is stakeholder involvement to the EIA process from the procedural viewpoint.

It can be considered that sufficient opportunities have been provided for stakeholder involvement so far. This is because that public notice and hearing were provided twice by SWMRMC in the course of the EIA study in accordance with the Nepalese legislation. Ad hoc communications with local communities/people were also made not only for obtaining the environmental/social information but also for confirming the perception and acceptability toward the Sisdol S/T-LFS development. OSLSMCC has been established for ensuring the continuous involvement of the key local stakeholders for operation of the site.

3) Monitoring

The JICA Guidelines point out the importance of monitoring in order to confirm the effectiveness of mitigation measures provided as well as to perceive the unpredicted impacts if they would occur.

A basic framework for environmental monitoring for Sisdol S/T-LF operation is proposed as shown in Table 4.3-17 taking into consideration the EIA study, characteristics of the project activities, site conditions, and the agreement of Sisdol operation. The environmental monitoring will be conducted by SWMRMC and the results of the monitoring will be shared among the stakeholders.

Table 4.3-17 Basic Framework of Environmental Monitoring for Sisdol Operation

Group	Environmental component/parameters	
Measurement/analysis monitoring	Precedent indicator monitoring	- pH, DO, EC, Cl^- (ad hoc basis)
	Groundwater, surface water, leachate	- pH, BOD, COD, SS, Nitrogen compounds, etc. (semi-annual or annual)
	Landfill gas	- Gas volume, gas composition (every three months)
Observation monitoring	Odor, littering, settlement, others if required (ad hoc)	

Source: The Operational Manual of Sisdol Landfill Site, June 2005

Social concerns to possibly be raised during the Sisdol S/T-LF operation will be managed by SWMRMC, KMC and LSMC in cooperation with OSLSMCC. It is proposed to record the concerns raised, process of discussion and solution, and measures taken. In addition, the one household remaining inside the site is to be watched from the viewpoint of their livelihood restoration after they move outside of the site. If necessary, it is suggested that support to be provided, such as giving an opportunity of employment at the site.

(5) Waste Picking

No prospect of launching segregation or resource-recovery facilities such as the Aletar project or other large-scale project for the time being means that recyclable and valuable materials are expected to be transported to Sisdol S/T-LFS. The landfill at the site may

attract waste pickers despite the increased distance from the city area after closure of the Bagmati River dumping site which is currently one of the major places for scavenging.

It is preferable to prohibit the waste picking activities in principle from the viewpoints of effective and safe operation of landfill site as well as avoidance of likely health hazards on waste pickers. OSLSMCC has also insisted that waste picking activity not be allowed at the site. It is therefore suggested that the waste picking activity in the Bagmati dumping site be registered and incorporated in the future plan to develop the waste processing facility.

CHAPTER 5 CONDITIONS OF MUNICIPAL SOLID WASTE MANAGEMENT OF EACH MUNICIPALITY

5.1 Kathmandu Metropolitan City (KMC)

5.1.1 Outline of KMC

Kathmandu Metropolitan City (KMC) is the capital city of the Kingdom of Nepal and is also the only city designated a metropolitan city in Nepal so far, which has 13 departments and 33 sections. The city is spread over an area of about 50 km^2 and it is divided into 35 wards administratively (see Appendix 5.1). KMC is listed in the world heritage list for its cultural, archeological and historical significances.

It is estimated that nearly 700,000 inhabitants lived inside the city in 2004 based on the national census data showing 672,846 population in 2001. Because of present conflict in the nation, people from all over the country are believed to be migrating into the capital at a greater extent, which has increased its population drastically. Rapid population growth and haphazard urbanization are causing SWM to become excessively challenging and difficult to accomplish successfully at this moment.

Its major industries are tourism, handicrafts, garments and cottage factories whereas big industries do not exist within the metropolitan boundary. It is believed that per capita income of the capital city is considerably higher than the national per capita income, which amounts to US$360. Besides that, most educational institutes like colleges and universities with health institutions such as 10 hospitals and 16 nursing homes are situated inside the city.

5.1.2 Waste Generation and Stream

(1) Waste Quantity

TWG members of KMC summarized the current situations of waste quantity as follows.

Estimated Population:	701,962
Waste Generation:	700,000 liter/day
Per capita Generation:	1 liter/day-capita
Commercial Waste:	70 liter/day
Street Waste:	70 liter/day
Waste from VDCs:	70 liter/day
Total Waste Collected:	800,000 liter/day (800 m^3/day)

In the course of the Kathmandu Valley Mapping Program (KVMP), a few studies were carried out and as per that waste sampling, it has been found that waste density is around 0.225 ton/m^3.

The JICA Study Team conducted the waste quantity survey at the various generation sources in KMC sampling 40 households, 15 commercial establishments like hotels, restaurants or offices and 5 points in the streets in April 2004 during the dry season. The result of the waste quantity survey of households in KMC is shown in Table 5.1-1. About one litter of waste per person per day with 230 to 250 g/litter of bulk density are generated on average.

Table 5.1-1 Result of Daily Waste Generation Quantity Survey of Households (KMC: Dry Season)

Income Level	Weekdays			Weekend		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
High	318	1.1	289	241	1.0	241
Middle	208	0.8	260	229	1.0	229
Low	159	0.8	199	222	1.0	222
Average	223	0.9	248	231	1.0	231

Source: JICA Study Team

From commercial areas, it was observed in the dry season survey that 139 kg/day of waste was generated at the Grand Hotel with 286 g/litter of bulk density, and 2.5 to 7.4 kg/day was generated from each surveyed restaurant with 400 to 610 g/litter of bulk density. From each selected office, 0.3 to 5.1 kg/day of waste were generated with 60 to 1,020 g/litter of bulk density. In the street, about 22.3 kg of waste are collected per day per each 100 m and bulk density was 380 g/litter.

In September 2004, a second large scale waste quantity survey was conducted during the wet season in KMC sampling 400 households, 120 commercial establishments and 15 points in the street. The result of this detail waste quantity survey is shown in Table 5.1-2

Table 5.1-2 Result of Daily Waste Generation Quantity Survey of Households (KMC: Wet Season)

Income Level	Weekdays			Weekend		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
High	332	1.53	217	287	1.35	213
Middle	240	1.51	159	261	1.12	234
Low	180	1.15	156	153	0.93	164
Average*	248	1.43	174	241	1.13	213

N/A: Not available at the moment
Note: * This is the average for only the surveyed household, it does not reflect the actual dispersion of income levels
Source: JICA Study Team

Figure 5.1-1 shows the frequency distribution of the unit generation rate (UGR) at different income levels of surveyed households. A large peak UGR for total surveyed households is shown around 100 to 150 g/day-capita and small peaks on 450 g/day-capita and 600 to 850 g/day-capita. The peak for low income households tends to appear around 100 g/day-capita, which is smaller than that for mid and high income households. It is also shown that high income households have a wide range of peaks from 100 to 850 g/day-capita.

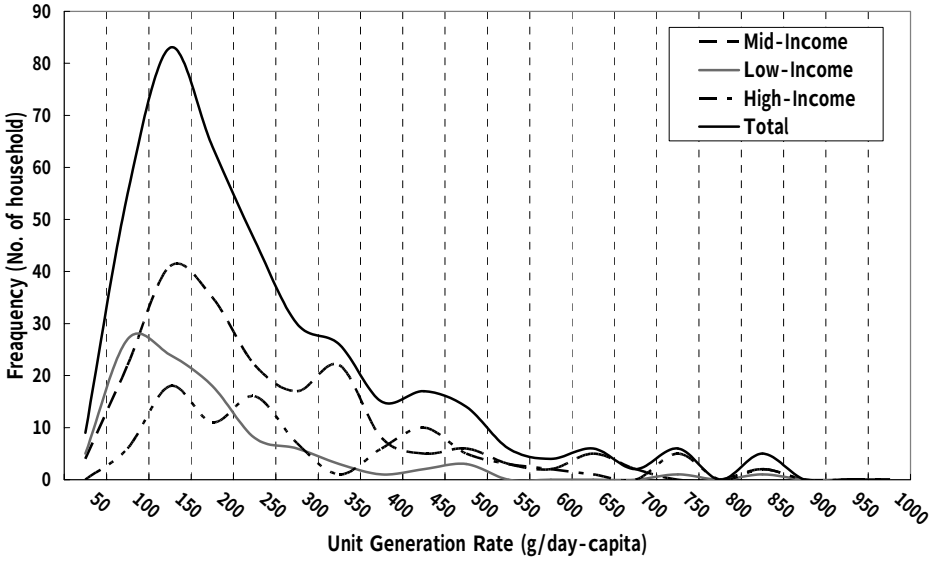


Figure 5.1-1 Frequency Distribution of UGR of Households in KMC

Source: JICA Study Team

(2) Waste Quality

Waste qualities given by TWG members of KMC and surveyed by the JICA Study Team in the dry season are shown in the following table. From households, about 70% is kitchen waste and plastic and paper items represent around 10%. The organic portion at hotels and restaurants fluctuated greatly. Almost 90% of waste generated from markets is organic. Offices are large generators of paper waste.

Table 5.1-3 Waste Quality (KMC: Dry Season)

Items	Households		Hotels and Restaurants	Markets	Offices	Streets**
	TWG data	Study				
Kitchen waste	68%	72.4% (70.9%)	30.8% (75.2%)	90.1% (91.0%)	50.0% (22.4%)	- (51.3%)
Paper	8%	11.5% (8.1%)	29.1% (10.5%)	0.0% (0.0%)	20.6% (47.8%)	- (7.7%)
Textile	-	2.8% (1.5%)	0.0% (0.0%)	0.0% (0.0%)	0.0% (0.0%)	- (2.1%)
Wood/leaves	-	3.1% (1.8%)	0.0% (0.0%)	0.0% (0.0%)	0.0% (0.0%)	- (8.1%)
Plastic	11%	7.6% (14.2%)	19.8% (4.5%)	2.0% (2.4%)	4.4% (17.9%)	- (9.0%)
Rubber/leather	-	2.2% (0.0%)	0.0% (0.0%)	0.0% (0.0%)	1.0% (0.0%)	- (0.8%)
Metal	-	0.4% (0.0%)	5.2% (6.8%)	0.0% (0.0%)	0.6% (0.0%)	- (1.7%)
Glass	2%	0.0% (2.5%)	14.0% (3.0%)	0.0% (0.0%)	23.5% (0.0%)	- (0.6%)
Ceramics	-	0.0% (1.2%)	1.2% (0.0%)	0.0% (0.0%)	0.0% (0.0%)	- (0.4%)
Others	11%*	0.0% (0.0%)	0.0% (0.0%)	7.9% (7.3%)	0.0% (11.9%)	- (18.3%)

Items	Households		Hotels and Restaurants	Markets	Offices	Streets**
	TWG data	Study				
Bulk density	225 g/L	248 g/L (231 g/L)	440 g/L (477 g/L)	312 g/L (476 g/L)	396 g/L (265 g/L)	- (380 g/L)
Water content	-	55.0% (59.0%)	58.0% (72.0%)	75.0% (69.0%)	51.0% (40.0%)	- (62.0%)

Note: Lower numerical value in parenthesis is data on weekends and upper on weekdays
Total value of each composition is not always 100% because each one was rounded off.
* KMC shows 6% for "inorganic" and 5% for "others"
** Street waste on weekdays was not analyzed.
Source: JICA Study Team

Table 5.1-4 shows the result of the wet season survey. There is not much change from the dry season except the contents of kitchen waste from markets. Paper and plastic quantities generated by markets and offices are also greater than the other season.

Table 5.1-4 Waste Quality (KMC: Wet Season)

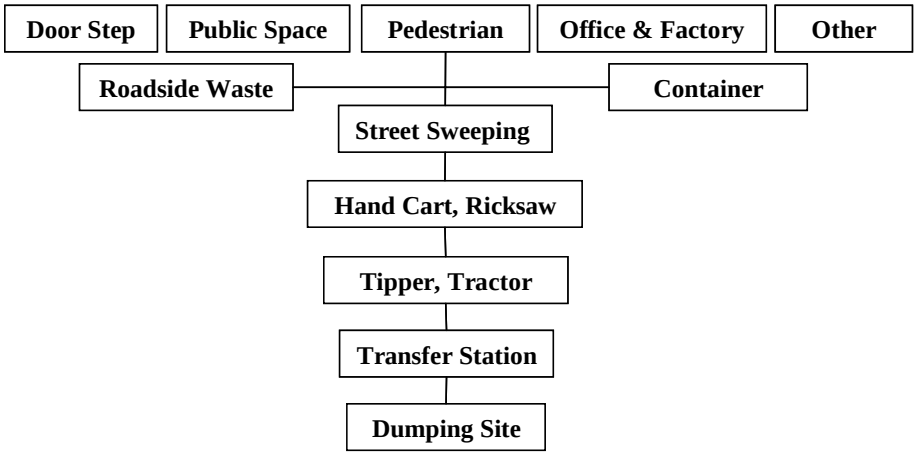
Items	Households	Hotels and Restaurants	Markets	Offices	Streets
Kitchen waste	71.1% (65.1%)	67.9% (60.7%)	7.9% (8.4%)	49.6% (27.3%)	58.5% (61.3%)
Paper	9.2% (10.6%)	10.0% (19.4%)	40.9% (70.5%)	32.8% (46.6%)	16.5% (19.3%)
Textile	2.4% (1.7%)	0.0% (1.0%)	4.7% (1.3%)	1.6% (1.5%)	0.0% (0.0%)
Wood/leaves	3.1% (6.0%)	0.2% (0.8%)	0.0% (0.0%)	0.4% (10.4%)	5.1% (4.3%)
Plastic	6.5% (8.0%)	12.0% (11.0%)	14.5% (7.3%)	14.7% (12.8%)	13.2% (4.8%)
Rubber/leather	0.0% (0.0%)	0.0% (0.0%)	0.0% (0.2%)	0.0% (0.0%)	0.0% (0.0%)
Metal	0.6% (0.6%)	1.1% (0.8%)	2.6% (1.1%)	0.8% (0.8%)	1.0% (0.4%)
Glass	5.1% (6.5%)	4.5% (0.9%)	29.1% (5.4%)	0.2% (0.0%)	1.7% (1.1%)
Ceramics	0.0% (0.4%)	4.4% (5.1%)	0.0% (1.4%)	0.0% (0.0%)	0.0% (0.0%)
Others	2.0% (1.1%)	0.0% (0.3%)	0.2% (4.5%)	0.0% (0.6%)	4.1% (8.9%)
Bulk density	174 g/L (213 g/L)	440 g/L (477 g/L)	312 g/L (476 g/L)	396 g/L (265 g/L)	292 g/L (400 g/L)
Water content	64.7% (65.5%)	57.7% (59.3%)	12.9% (11.7%)	40.1% (38.72%)	52.8% (54.1%)

Note: Lower numerical value in parenthesis is data on weekends and upper on weekdays
Total value of each composition is not always 100% because each one was rounded off.
Source: JICA Study Team

5.1.3 Collection and Transportation

TWG members of KMC summarized the current situation of waste collection and transportation as follows:

Collection work takes place from streets, land, including household's yards, and shops in all 35 Wards of KMC using dump trucks (containers), tipper, tractors, and rickshaws aiming to store at a transfer station



KMC has around 950 street sweepers and most of them are allocated to ward offices and conduct a single daily sweeping except Wards 1, 13 and 24, which are done in two shifts, a 5:00 a.m. to 7:00 a.m. morning sift and 7:00 p.m. to 10:00 p.m. night shift. Only in the city area is there another shift from 1:00 p.m. to 4:00 p.m. In Wards 1, 13 and 24, street sweepings are fully managed by authorized private sectors.

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 sectors and transported to Teku Transfer Station (T/S) or Bagmati River dumping site. Recently, private sectors have started conducting door-to-door collection of waste in many wards, collecting the waste from the generation sources directly and transport it to the designated waste collection points including Teku T/S. The door-to-door collection services usually use tricycles or rickshaws for collection of waste. The private sector collectors charges about Rs 75 per month to the households, but some unauthorized organizations cause irregular collection, illegal dumping or other problems by making money the quick way. On the other hand, some people still discharge their waste in vacant plots or other public areas such as nearby river banks.

Teku T/S is located in Ward 12 in the southern part of the city next to the confluence of Bagmati and Bishnumati Rivers. According to the KMC records, Teku T/S currently receives approximately 400 m^3 or 100 tons of waste per day. This waste is unloaded on to a concrete ground where waste pickers go through it to collect recyclables.

At the final disposal site, approximately 1,000 m^3 or 250 tons of waste per day are disposed of from both KMC (200 tons) and LSMC (50 tons) according to the KMC records for three months in 2003 (in the Nepalese Calendar from Kartik to Poushr, 2060). In this period, disposed waste quantity fluctuated, there was less on weekends and more after holidays, and the maximum daily quantity was estimated to be 365 tons and the minimum was 98 tons.

In the two-day waste quality survey under the Study at the facilities in April 2004, about 275 to 300 tons of waste were disposed of at Bagmati River dumping site, of which 125 to 140 tons were handled through Teku T/S.

The table below shows the existing waste collection and transportation equipment available to KMC.

Table 5.1-5 Vehicles Available to KMC for SWM Works

S.No.	Equipment	Pay Load in m^3	Total Units	Year of Operation	Remarks
1 For Primary Collection					
1.1	Hydraulic Tipper (Mitsubishi Canter)	3.0	15	1993	
1.2	Dumper Placer (DCM Toyota)	4.0	8	1994	Donated by Govt. of India
1.3	Dumper Placer (Ashok Leyland)	6.0	4	1994	Donated by Govt. of India
1.4	Dumper Placer (Tata)	4.5	2	1988	One unit not working
1.5	Multi Compactor	6.0	1	1997	Japanese
1.6	Tractor	1.7	37	1988	Chinese
1.7	Multi Compactor	4.0	2	-	One unit not working
1.8	Hydraulic Tipper (Swaraj Mazda)	4.5	10	2002	
2 For Secondary Transportation					
2.1	Multi Compactor (Ashok Leyland)	14.0	7	1994	Donated by Govt. of India
2.2	Roll-off Tipper (M. Benz)	20.0	2	1988	One unit not working

Source: KMC,2004

Table 5.1-6 shows the summary of the results of the Time and Motion survey conducted by the JICA Study Team on April 12, 14 and 15, 2005 on 12selected routes. This indicates that the average speed of a tractor and rickshaw, which is a tri-cycle and mini truck is lower than the others. Considering the returning speed, tri-cycle and tractor is also not lower than others.

Table 5.1-6 Result of Time and Motion Survey in KMC

Equipment	Average Collection/ Dumping Time in min	Total Distance Travel in km	Average Speed of Vehicle in moving km/hr	Average Speed of vehicle*	Return Distance in km	Average Speed on Return km/hr	Total Time for One Trip in min
Compactor	3.8	8.6	13.6	5.0	5.4	20.3	57.7
Tipper	7.5	12.0	16.4	9.9	5.8	17.8	71.0
Tractor	5.5	5.9	9.3	4.1	5.7	13.0	70.0
Rickshaw	8.4	1.7	5.2	1.4	1.3	5.9	41.2
Mini Truck	20.8	10.8	14.6	4.2	5.2	19.3	81.3

Note: *this includes collection and dumping time
Source: JICA Study Team

Since February 2005, KMC has shifted the waste collection system to the night/early morning shift from the former daytime collection in order to complete collecting the waste by 7:00 a.m. every day. Automatically, waste transferring at Teku T/S and waste disposal at Bagmati River dumping site are also conducted at night or early morning. Despite the fact that some bewilderment or difficulties occurred at the beginning days of this new collection shift, KMC has been contriving various measures to improve the collection efficiency such as introduction of bell/siren collection and setting up lighting on the truck.

5.1.4 Solid Waste Minimization Activities

(1) Composting

The Community Mobilization Unit (CMU) with five staff has taken a great role in community based waste minimization activities in KMC, and has promoted household level

composting activities mainly by distributing 100-liter compost bins. The home composting activity of KMC is summarized in Table 5.1-7. Almost 1,400 households have been provided home compost bins with technical training by CMU so far. The fruits of the promotional activities have been getting steadily more manifested.

Table 5.1-7 KMC/CMU Home Composting Activity

No.	Items	Contents
1.	Composting method	100 liters compost bin 
2.	Starting time	Year 2002
3.	No. of implementing households	About 1,400 households
4.	Composting duration	40 to 60 days
5.	Price of compost bin	Selling price Rs 700 (Total cost is Rs 1,000 and Rs 300 is subsided by KMC)
6.	Installation location of compost bin	Rooftop or garden
7.	Purchasing price of compost	5-6 Rs/kg

Source: JICA Study Team

CMU has also promoted vermi-composting activities by providing a set of vermi-composting kit including 300 worms, worm bed, a bucket and three-hour training by CMU for Rs 500. So far 100 households have already taken the kit and started the vermi-composting at their house. In addition, several NGOs/CBOs have promoted the home composting activities including vermi-composting. They have also provided their own compost bins and/or kits for composting activities. Most of the compost produced by each household is consumed for of their own garden. The rest of the products are purchased by municipalities or NGOs/CBOs in the market or at NGO/CBO offices in sacks.

At the community level, only one community composting facility has been operating and compost has been produced and on sale favorably since September 2003, as shown in Table 5.1-8. The reasons why this community composting is well managed are as follows:

- The O&M cost for the composting facility can be managed because the implementing NGO is collecting a tariff for door-to-door waste collection service from residents.
- The operation worker (waste collector) is motivated to continue daily works because they can obtain cash income by separating and selling recyclable materials at the site.

Table 5.1-8 Community Composting Activity by NGO in KMC

№o	Items	Contents
1.	Composting method	3,000 liter compost vessel
2.	Starting time	September 2003
3.	No. of implementing households	About 100 households
4.	Waste collection	Door-to-door collection by NGO (mixed waste)
5.	Waste separation	Site separation by waste collector (recyclable materials shall be sold)
6.	Operation & Maintenance of the composting facility	NGO manage all O&M works through waste collection to harvest of compost (Sagarmatha Environmental Development)
7.	Composting duration	Two and a half to three months
8.	Selling price for compost	8 Rs/kg

Source: JICA Study Team

Under the support of GTZ, a composting facility had been operating in the yard of Teku T/S since 1986 as mentioned in Table 5.1-9. However, it was closed in 1990 due to the public objection to offensive odors. Currently, only facilities for the screening process remain. In Teku T/S, the former fermentation field is used as a storage yard for recovered materials. During its operation, although a few impurities such as broken pieces of glass got included, the produced compost was purchased and used by surrounding farms.

Table 5.1-9 Operational Record of Teku Composting Facility 1986-1990

No.	Items	Contents
1.	Composting method	Semi-mechanical field heaping method
2.	Operating period	Year 1986 to 1990
3.	Waste disposal amount	about 15 to 30 tons/day
4.	Waste collection	Collected by municipality
6.	Waste separation	Collected by waste pickers at the site
7.	Operation & maintenance of the composting	Operated by municipality
8.	Composting duration	Two and a half to three months
9.	Selling price for compost	250 Rs/m^3（Cost 600 Rs/m^3）

Source: JICA Study Team

(2) Recycling

1) Recycling by Independent Recyclers and Kabadi Shops

Most of the recyclable materials are collected by independent recyclers from waste generation points, i.e. mainly households, industrial enterprises, commercial enterprises and institutions. Independent recyclers are registered with Nepal Recycle Producer Association (NEREPA), an association of buyers of recyclable materials. Recyclable materials collected by independent recyclers are carried to kabadi shops, of which 250 shops are in operation in KMC, then the kabadi shops resell the collected recyclable materials to larger-scale wholesalers called “kabadi centers”, of which more than three dozen centers are recorded within KMC as presented in the following Table 5.1-10.

Table 5.1-10 List of Major Scrap Dealers in KMC (kabadi centers)

No.	Name of Shop Owner	Location (Ward)	
1.	Chun Chun	Balkhu	- 14
2.	Nand Kishor	Kuleshwor	- 14
3.	Ram Bilas	Tahachal	- 13
4.	Sanjaya Saha	Bhurungkhel	- 15
5.	Uma Shankar	Dallu	- 15
6.	Shameshwor	Chetrapati	- 17
7.	Mahesh	Samakhusi	- 29
8.	Bindeshwor	Samakhusi	- 29
9.	Ganesh Dinesh	Kalanki	- 14
10.	Jyodhda Bhagat	Balaju	- 16
11.	Sunil Prasad	Balaju	- 16
12.	Kadel Ji	Balaju	- 16
13.	Sanjaya Rambalak Yadav	Balaju	- 16
14.	Nirmal Lama	Samakhusi	- 29
15.	Laxman	Maharajgunj	
16.	Ramanand P.	Dhumbarahi	
17.	Amar	Naxal	- 1
18.	Krishna Prasad	Bishal Bazaar	- 5
19.	Bhushan	Bhatbhateni	- 5
20.	Bijaya Pramod	Chabhil	- 7
21.	Nand Lal	Mitrapark	- 7
22.	Nawal Pramod	Chuchepati	- 6
23.	Umesh Chaudhari	Jorpati	- 6
24.	Min Bahadur	Baudha	- 6
25.	Abodh Kishor	Dillibazaar	- 32
26.	Shameshwor	Maitidevi	- 32
27.	Budhan	Baneshwor	- 10
28.	Jeebacha	Baneshwor	- 10
29.	Ram Kumar Khadka	Baneshwor	- 10
30.	Ram Yekpal Raya	Anam Nagar	- 32
31.	Newa Ji	Baneshwor	- 10
32.	Suresh	Baneshwor	- 10
33.	Ram Aayodhya	Baneshwor	- 10
34.	Raj Kumar	Milanchowk	- 12
35.	Ram Babu	Baneshwor	- 10
36.	Sattya Dev	Baneshwor	- 10
37.	Lal Bihari	Tinkune	- 35
38.	Shambhu Singh	Koteshwor	- 35
39.	Jiyalal Mahesh	Gangabu	-

Source: KMC

2) Recycling by Waste Pickers

It is reported that there are altogether 30 to 35 groups of waste pickers operating in the KMC. They mainly operate at Teku T/S and Bagmati River dumping site. There are more waste pickers who are not recorded and operate individually in streets-side waste. Most of the waste pickers at Teku T/S and Bagmati River dumping site are working full-time. At each site, there are about 150 waste pickers as listed by KMC.

3) Recycling Promotion Activities by Municipalities, NGOs/CBOs and Private Sectors

CMU has assisted and encouraged citizens to recycle their waste. One of the CMU' activities to promote peoples' recycling is to establish Community Recycling Centers (CRC). By learning from the past experience in Wards 15, 18, 24, CMU has tried to operate a CRC in cooperation with private sector at Ward 21.

Several NGOs/CBOs have been promoting recycling activities by themselves or by collaboration with CMU. Nhu Pucha, one of the CBOs, has been collecting plastic from 20 target households in Ward 20 for sale to kabadi shops. They have also promoted home composting activities there.

A private sector, JAMARKO, has become involved in paper recycling activities with 10 staff and 3 volunteers since 2001. Because recycling paper is still much more costly and its quality is lower than normal paper, it has been difficult to find regular customers or a big market inside the Valley.

Recycling Paper Products

5.1.5 Final Disposal

At present KMC is disposing of their waste (total around 1,000 m^3/day) mainly along and in the Bagmati River in LSMC and/or KRM. From February to May 2004 dumping proceeded along the eastern Bagmati River bank from Balkhu southwards reaching past Afadole area in LSMC. At that time, trenches of about 2-3 m height and widths of 5-10 m were excavated and the waste was dropped from the top into the trench. The waste was compacted by a "Sheep's foot" compaction roller. Soil that had been excavated from the trench was placed on top of the disposed of waste after the waste had reached the height of the trench. Disinfectants were sprayed to ward off disease vectors. After the eastern bank was filled up, the dumping was shifted to the western bank in KRM in the latter part of 2004, including the earthen dyke construction to prepare a landfill space intruding into the river section. The western bank dumping continued as of June, 2005.

The site, although located within LSMC and/or KRM, is operated by KMC. A contractor was hired by KMC for site preparation work and procurement of cover soil materials. KMC and LSMC have stationed staff at the site to record the incoming vehicle numbers, waste volume, arrival and departure times. KMC has spent about Rs 2 million monthly (Rs 1 million in operation and Rs 1 million for site development, local funds, etc.) to "operate" the Bagmati River dumping site.

The problems associated with this disposal site are as follows:

- The site is in a floodplain with the danger of waste washout.
- Many sections of the river have been altered by the waste dumping.
- In the absence of proper operation the immediately surrounding residents are affected by odors, scattering wastes and disease vectors.
- Access is uncontrolled permitting the disposal of any waste types, grazing of animals on the wastes and waste pickers working without control.
- There are no countermeasures to prevent leachate from flowing outside the constructed trenches/dykes and into the river and surroundings.
- There are no countermeasures to control landfill gas and prevent it from migrating into the surrounding houses (landfill gas is being tapped by neighboring households along the western bank which raises fears of explosions and property damages).
- A little construction can be observed on completed sections raising the fear of land misuse and dangers to human lives.

Since June 5, 2005, KMC has started transportation of their waste of 60-70 ton/day to Sisdol Short-term landfill (S/T-LF) through Teku T/S. After secondary transportation vehicles arrive at Kathmandu, full-scale operation of Sisdol S/T-LF will be put into practice. Then the Bagmati River dumping site is going into the post-closure maintenance stage.

5.1.6 Social Aspects

(1) Major Findings of Household Behavior and Attitude Survey on SWM[1]

1) Priorities of Public Services

With regard to service priorities, the respondents were asked to choose three priorities among the following public services and utilities; a) water supply, b) drainage/sewerage, c) solid waste collection, d) air pollution, e) electricity supply, f) public transportation, g) access road to house, and h) noise pollution. 19% of sample households (HHs) determined solid waste collection as the second priority followed by drainage/sewerage (12%). Water supply was ranked as the top priority (48%).

2) Waste Disposal and Management

As indicated by 65% of the sample HHs, pick up of solid waste by door-to-door collection service was the most prevalent practice in KMC. This method of disposal was the highest proportion in all five municipalities in this Survey. A total of 18 HHs or 5% of the sample HHs have practiced open dumping on vacant land (10 HHs), on roads (7 HHs) or on the bank of a stream/river (1 HH). It was reported that unavailability of door-to-door collection services (8 HHs) and long practice (6 HHs) were the major two factors for following the open space dumping practice. Most of females (66%) were exclusively responsible for handling waste and taking it out for disposal (54%). A total of 23% of sample HHs responded that children were also responsible for handling waste. About 30% of HHs noted that any of the family members took it out for disposal. Most of HHs surveyed noted that

[1] Household Behavior and Attitude Survey on SWM was conducted from the end of March to the beginning of May 2004 by assigning 3 quality controllers and 15 social surveyors from local communities. Five municipalities were categorized into two groups i.e. Group A (KMC and LSMC) and Group B (BKM, MTM, and KRM). These groups were categorized into subgroups based on the population density, economy, settlement pattern as well as land use patterns. In KMC, 12 out of 35 wards were selected based on the core area, sub-core are and fringe area. 330 sample HHs were selected.

they disposed of waste once a day. The majority of sample HHs used the backyard for storing the waste. Plastic bags were the most popular containers used for carrying waste to collection points.

Table 5.1-11 Waste Disposal Practice among HHs Surveyed (KMC)

Sample HH nos.	331#	128%
Dispose of waste by door-to-door collection service	214	65%
Dispose of waste by putting into Municipal or Communal Container	65	20%
Dispose of waste at Municipality's designated disposal site	25	8%
Dispose of waste by open dumping out side the house	18	5%
Dispose of waste by open combustion	37	11%
Dispose of waste by burying in the ground	3	1%
Dispose of waste by Composting	30	9%
Dispose of waste by giving it for recycling	20	6%
Dispose of waste by using as animal feed	11	3%

Note: Considering that often more than one method was given by the respondent, the summation of responses exceeds 100%.

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Household, Establishment and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

3) Existing Waste Collection Services

As indicated in Table 5.1-12, 89% of sample HHs responded waste collection services were available in their areas, and they have used these services. It might be assumed that the majority of HHs in KMC had access to waste collection services. Actually, the collection ration in KMC was said to be around 80 - 90%, which supported this assumption. With regard to the mode of waste collection, the door-to-door collection was the most prevailing service (77% of sample HHs used this service), which was provided by the Municipality, NGO/CBO or private sector. A total of 65% of sample HHs using this service said that their waste was collected on a daily basis. The involvement of various service providers in SWM might contribute to such high frequency of waste collection services in the result of the Survey. A total of 66% of sample HHs have already made payment for waste collection services, which was the largest category in the five municipalities. This might imply that the payment system has become popular in KMC in accordance with the increasing involvement of private sectors in SWM. A high proportion of these HHs (93%) responded that they were very or somewhat satisfied with these services. Neither proper waste collection nor sweeping services were the major reasons for less satisfaction or dissatisfaction with services.

Table 5.1-12 Availability and Use of Waste Collection Service in KMC

Sample HH nos.	331#	100%
Service available and used	295	89%
Service available and not used	13	4%
Service not available but required	7	2%
Service neither available nor required	16	5%

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Household, Establishment and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

4) Waste Minimization and Recycling

The majority of HHs reported having knowledge about separation and actually separating waste (76% of sample HHs), which was the highest proportion in the five municipalities. It could imply that the residents in KMC had more opportunities in exposing themselves to information on SWM. Most of them responded that they were sorting their waste into two categories namely organic and inorganic waste. Regarding the willingness to cooperate for source separation, more than 90% of sample HHs including those who have been already doing showed positive attitudes. The reasons for unwillingness to cooperate were addressed by a few HHs as follows; a) no space inside the house to keep the separated waste, and b) inconvenient or hard to separate waste. Close to 60% of sample HHs responded that they are selling their recyclable material to a buyer. The major items collected for sale were glass and papers, followed by plastic. Only 17% of sample HHs have had experience in making compost. The majority of these HHs were composting their waste in open spaces or organic fields (71%) rather than in containers or composting bins (24%). Almost 60% of sample HHs noted they knew what compost was. Few of them reported that they have been taught about making compost by the municipality, private company or NGOs/CBOs. The majority of HHs learned how to make compost by themselves. More than half of HHs (53%) who responded that they have no experience in making compost have shown no interest in compost. In this regard, the following reasons were pointed out; a) no space available and b) takes too much time. On the other hand, 41% of respondent sample HHs have shown a positive attitude towards making compost.

5) Public and Community Involvement

A total of 44% of sample HHs showed that they were responsible for SWM (See Table 5.1-13). However, it was reported that only 20% of sample HHs actually took initiative towards proper SWM by adopting various methods such as 3R activities, cleaning, or proper disposal practice. Regarding the willingness to pay for SWM services, a significant percent of sample HHs (95%) including those who have been already paying showed positive attitudes. Most of them could afford to pay Rs 11-30 or Rs 31-50 per month. The majority of those who were not willing to pay responded that SWM was the duty of the municipality or government. Regarding CBOs' activities related to SWM, only one forth of sample HHs have ever participated in this. On the other hand, the majority of sample HHs considered that CBOs' activities regarding SWM were very necessary or somewhat necessary. Further, almost 90% of HHs surveyed noted that they were willing to participate in CBOs' activities such as campaign for raising awareness (35% of sample HHs); any activities related to SWM (17%), clean up program (16%). As a whole, it seemed to imply that the level of knowledge and awareness as well as attitude towards public involvement in SWM was relatively high. However, the level of actual involvement in community-based SWM activities, except for payment for services, still remained low.

Table 5.1-13 Perception of Responsibility for SWM in KMC

Sample HH nos.	331#	100%
Government/Ministry of Local Dev.	37	11%
Municipality	105	32%
Sweepers	7	2%
Yourselves	146	44%
Our Communities/CBOs	0	0%
Private Company	28	8%
NGO	0	0%
Do not know	7	2%
Others	1	0%

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Household, Establishment and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

(2) Municipality's Programs regarding Community Mobilization on SWM

It has been gradually realized by KMC that community participation is the key to improvement of the urban environment. It has brought about the epoch establishment of CMU within its Environment Department in 1999. Since then, CMU has taken initiatives in various activities which help to mobilize the community and to increase the level of awareness regarding the urban environment among the general population. There are five main activities promoted by CMU. They include a) Children and environment by focusing on establishment of Nature Clubs in schools (known as Balbalika ra Batabaran- "BABA" in Nepali), b) Community participation and training program, c) Demonstration of environmental technology such as promotion of community- and household-level composting, d) Community recycling center, and e) Mass education program by running radio program called "ANKUR" and producing IEC (Information, Education and Communication) materials such as calendars, posters and brochures. Exhibition on Earth Day is one of CMU's unique activities. For effective implementation of these activities, CMU has had close collaboration and partnership with a number of organizations/stakeholders such as relevant NGOs, CBOs, schools, press agencies and donor agencies. In addition, CMU has made efforts to mobilize youth by introducing the city volunteer program, which recruits city volunteers from students who are studying the environment at colleges/universities and are willing to participate in CMU's activities. This program has been successful in terms of youth development in the environmental sector and obtaining appreciation and cooperation towards a variety of activities being implemented by CMU/ KMC.

(3) NGOs/CBOs' Programs regarding Community Mobilization on SWM

A number of NBOs/CBOs have been involved in various SWM activities including collection services, awareness, and 3R activities. Most of the NGOs/CBOs have carried out small-scale SWM activities at the community- or tole- levels, which can contribute to community mobilization to some extent. However, the majority of them faces financial problems and cannot expand their activities nor ensure sustainability. Some of them have collaborated with CMU at the program or activity levels. The major NGOs/CBOs which the Study interviewed are summarized below.

Table 5.1-14 Major NGOs/CBOs Working in the Field of SWM in KMC

Name of NGOs/CBOs	Year of foundation	Number of staff	Working Areas
Ward Environment Committee -28*	2001	11 volunteers/ members	Public Awareness of SWM (promotion of proper waste disposal practices)
Ward Women Environment Committee- 32*	2001	13 volunteers/ members	Cleaning and home composting (32 HHs)
Bhotu Indira*	1998	19 volunteers	Public Awareness in women's issues and weekly cleaning
Center for Integrated Urban Development (CIUD)*	2002	4 paid staff, 6 volunteers	Promotion of compost bins & training in Ward 30 (50 HHs)
Youth Initiative*	2001	5 paid staff and 760 volunteers	Public awareness and youth mobilization
Jana Jagruk Safa Sughar Abhiya*	1997	70	Door-to-door collection in Wards 9,10,13,14,15,16,34 (4200 HHs)
Jamarko*	2001	10 paid and 3 volunteers	Waste paper recycling
Women Entrepreneurship*	2000	NA	Public awareness of women's issues & sweeping in Ward 14
Prayas	2002	9	Door-to-door collection in Wards 10, 11, 32 (500 HHs)
Ce Pro In*	1995	4	Public awareness of SWM, training of compost
Environment & Public Health Organization (ENPHO)*	1990	40	Medical waste management, water quality management
Nhu Pucha*	1979	15 paid, 71 volunteers	Composting & recyclable collection (20 HHs) in Ward 20
16 Ward Women's Environment Improvement Committee*	1999	2 paid, 50 volunteers	Home composting, Training
We Team / Jai Kisahan*	2001	5 paid staff and 760 volunteers	Vermi-& community-compost in Wards 20, Home composting Wards 12, 15,19, 20
Society for Urban Poor (Soup)*	1992	2 paid and 33 volunteers	Community-based SWM including home composting (25 HHs) in Ward 21 targeting 225 HHs
Youth Corner Club*	1976	5 paid staff and 760 volunteers	
CLEAN- World Vision*	2000	150	SWM & Environment-public awareness and small local level projects along Bishnumati Corridor
15 Ward Community Committee	2001	4 paid staff, 40 volunteers	Community development including Ward 19 Community Committee compost training with the support of World Vision in Wards 15 &19
Nepal Pollution Control and Environment Management Center	2001	137	Door-to-door collection, home- & community-composting, sweeping in Wards 2, 3, 4, 5, 15, 16
Kathmandu 2020*	1995	1 paid and 1,500 volunteers	Vermi-compost & campaign, awareness in Ward 12
Environmental Camps for Conservation Awareness (ECCA)*	1987	8 paid and 50 volunteers	Environmental education by formation of nature clubs
Sagarmatha Environmental Development Center (SEDC)*	2000	11	Community compost bin in Ward 9 Door-to-door collection in Wards 7, 9, 13 (1,000 HHs)

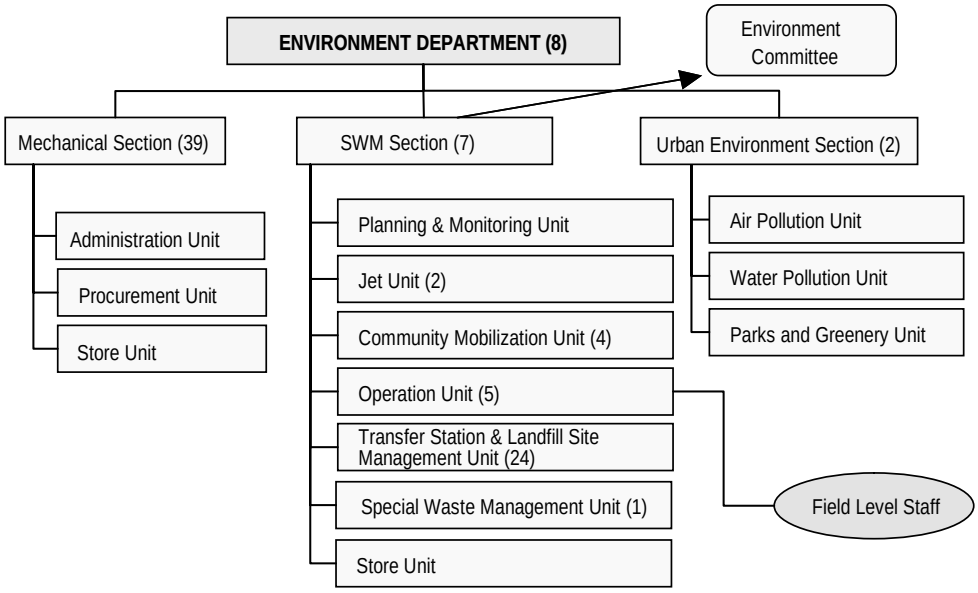
Note: *According to CMU, there is coordination with KMC or CMU at program/activity levels.
Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

5.1.7 Managerial Condition

(1) Organizational Structure and Management Practices

1) Organizational Structure

The KMC office currently has 13 departments and 33 sections. The Environment Department is responsible for managing solid waste that is generated within the city. Three sections comprise the Environment Department: the Solid Waste Management (SWM) Section, Mechanical Section and Urban Environmental Section. KMC is the only municipality in Nepal that has a section with a mandate to comprehensively address various aspects of SWM.



Note: ( ) shows number of staff

Figure 5.1-2 Organizational Structure of KMC Environment Department

Source: KMC, 2005

Under the SWM Section Chief, seven units exist specializing in various areas of SWM. These units are not official components as per the formal organization structure that was approved by the KMC Municipal Board, but were created to facilitate operations within the Section. It should be noted that arrangement with SWM-related private sector operators is also handled by this Section due to the absence of a centralized system/section for public private partnerships within the municipality. The major responsibilities carried out by the various units of the SWM Section are summarized in Table 5.1-15.

Table 5.1-15 Main Responsibilities of Various Units under KMC SWM Section

Unit Name	Main responsibilities
Planning and Monitoring	Overall management supervision of SWM section. Responsible for SWM program and resource planning (annual budgets) Maintains SWM data Oversees privatization schemes
Transfer Station and Landfill Site Management	Operation and maintenance of the current dumping site along the Bagmati Riverbank Operation and maintenance of Teku Transfer Station
Operations	Primary Waste collection and transportation Street sweeping and cleaning or drainage Management of field level staff
Community Mobilization	Public education programs on SWM and environment using media Mobilizing communities in Wards 18, 28 and 32 for waste reduction: e.g. promotion of home/community composting Recycling Center operations
Special Waste Management	Develop materials for public education concerning Medical Waste Management Provide training programs on Special Waste Management
Jet	Provision of cleaning services with jet machines on major drainage areas.

Source: KMC, 2005

During the Study, a restructuring plan of the Environment Department with new staffing arrangements and job descriptions were prepared to streamline operations. KMC committed to implement this plan in a phased approach. It should be noted that in late 2004 the function of landfill site management was agreed to be upgraded to a section directly under the Environment Department. This arrangement has not been formalized to date. However this unit, without the responsibilities regarding Teku T/S that is currently under the management of the SWM Section Chief, is managed independently directly under the Environment Department Head.

2) Management Practices

The SWM Section is by far the largest section within the KMC municipality office due to its sizable field staff. Among the various units, usually headed by a gazetted officer[2], decisions are taken based on discussions with the SWM Section Chief, or directly with the Head of the Environment Department. However, operation wise, most of the units are managed independently with relative autonomy, with a direct reporting line to the Head of the Environment Department.

In cases where there are specific issues that require more formal discussion processes, the Environment Committee is convened, of which the members consist of the Environment Department Head and three Ward Chairpersons with usually the SWM Section Chief participating. Based on their deliberations, the Environment Committee makes recommendations on various issues to be raised to the Municipality Board for discussion. As of June 2005, this Committee was not active since the Ward Chairpersons, who are political appointees, were not in office.

[2] Nepalese civil servants in local bodies are classified into officer level staff (level 6 and level 7), and assistant level staff (level 1 through level 5) as per section 212 of the Local Self Governance Regulation 2055. Within the report, Senior Level staff refers to the officer level staff, and mid-level staff refers to higher class assistant level staff (levels 4 and 5).

(2) Human Resources

Total number of staff under the Environment Department involved in SWM is 1,262 persons, which is about 60% of all municipal staff. The breakdown of human resources is as follows:

Table 5.1-16 KMC Environment Department Staff

Staff Category	Number of persons
Sweepers	950
Drivers	100
Mechanics	50
Administrative	50
Community Motivators	6
Engineers/Officers	9
Total	1,165

Source: KMC, 2005

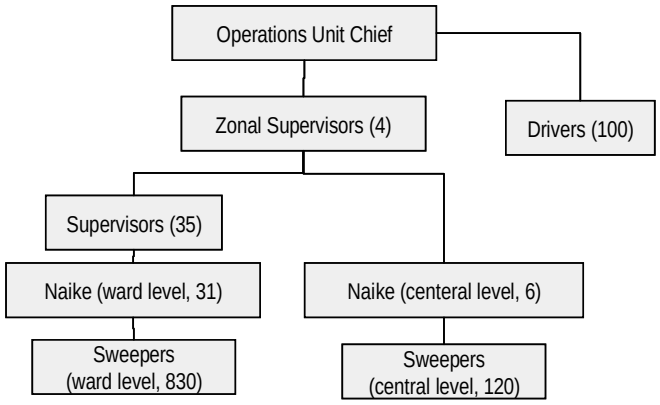
1) Senior Officers and Mid Level Staff

KMC's senior officers of the Environment Department have the highest technical capacities among all other municipalities in the Kathmandu Valley. Many of the officers hold educational degrees attained overseas and have specialized backgrounds in various aspects of SWM responsibilities. Some of the officers are often invited as resource persons for external SWM training courses.

As for mid-level staff, most have undergone some kind of introductory training in SWM related technical topics. A sufficient number have computer literacy and operational experience. Some mid-level staff have not been designated to a unit, and provide general support to the Environment Department.

2) Field Level Staff

As shown in Figure 5.1-3, KMC's field level staff are managed based on a four-layered hierarchy under the supervision of Operation Unit Chief. Field level supervisors called *Naikes*, directly supervise and monitor the sweepers, who then report to supervisors based in ward offices. Zonal supervisors are stationed in the central KMC office, and on a daily basis report to the Operation Unit Chief and SWM Section Chief on the conditions of the streets and sweepers' performance.



Note: ( ) shows number of staff

Figure 5.1-3 Structure of KMC Field Level Staff

Source: KMC, 2005

The troop of 950 sweepers are divided into two groups; one directly assigned to the 35 ward offices and the other assigned to the central KMC office. The sweepers usually work in three shifts per day (5:00 a.m. to 7:00 a.m., 1:00 p.m. to 4:00 p.m. only in the city area, and 7:00 p.m. to 10:00 p.m.). Centrally assigned sweepers are responsible for cleaning major highways and streets and bringing waste to collection stations to be picked up by trucks. Ward level assigned sweepers usually conduct street sweeping daily during their first shift of the day, but in the afternoon are assigned to a range of manual jobs from drainage cleaning to grass cutting, as the need arises within the designated wards. Over 80% of the sweepers are permanent staff of the municipality, and the majority belongs to the sweeper caste.

5.1.8 Financial Condition

KMC estimates direct expenditures for SWM services in FY2001/02 (2058/59[3]) as shown in Table 5.1-17.

Table 5.1-17 Expenditure for SWM in KMC (FY2001/02)

Items	Expenditure (Rs)	% in total of SWM
1. Street Sweeping	80,000,000	53.7%
2. Street Sweeping (Central)	10,000,000	6.7%
3. Collection	35,000,000	23.5%
4. Transfer Station	3,000,000	2.0%
5. Transportation	10,000,000	6.7%
6. Landfill	11,000,000	7.4%
Total of SWM	149,000,000	100.0%

Source: KMC, FY2001/2002 (2058/59)

KMC spends 30-35% of its total municipal expenditure on SWM. The SWM cost can be broken down by services and by account items as shown in Table 5.1-18. SWM cost of KMC is characterized by a high percentage for street sweeping cost and personnel cost.

[3] Nepalese Year

Table 5.1-18 Breakdown of SWM Cost by Service and by Items

Account Items	Street Sweeping		Collection	T/S	Transportation	LF	Total
	Ward	Central					
1. Personnel	55%	5%	11%	1%	1%	1%	74%
2. Maintenance	-	-	4%	-	1%	2%	7%
3. Fuel	-	-	3%	1%	2%	2%	8%
4. Material	6%	4%	-	-	-	-	10%
5. Administration	1%	-	-	-	-	-	1%
Total	62%	9%	18%	2%	4%	5%	100%

Note: Depreciation and interest are excluded from calculation.
Source: JICA Study Team based on the data from KMC, FY2001/2002 (2058/59)

5.2 Lalitpur Sub-Metropolitan City (LSMC)

5.2.1 Outline of LSMC

Lalitpur Sub-Metropolitan City (LSMC) was originally established in 1918 and finally upgraded to sub-metropolitan city in 1995. The municipality has a long history with its foundation in the third century, and is famous for "Patan" as old name even in these days with abundant fine historical art and culture.

The population of LSMC was less than 120,000 according to the census of 1991, whereas the 2001 census shows more than 160,000. The population growth rate of the city is higher than the national figure. The city, which covers an area of about 15 km^2, is administratively divided into 22 wards (see Appendix 5.1). Out of these 22 wards, 11 are located inside the historical area and the remaining 11 wards are located in new areas.

Other social features of LSMC are noted below:

- The bustling economic activities generate a lot of employment opportunities, but at the same time access to higher education results in the late entry of the population in employment. The proportion of economically active population in the city decreased from 62% of the total population to 42% in 1991. The decline has not been the result of a decline in participation rate of the population in the economic activities, but as a result of the change in the definition of economically active population.
- Household survey in 1993 for the town profile revealed that the largest proportion of households have an annual income ranging between Rs 50,000 to 100,000. Households with less than Rs 25,000 income constitute about 12% and those in the highest income group with more than Rs 200,000 account for 4%.
- The household survey in 1993 showed about 70% of the households own their own house; whereas the other households are living in rented houses.
- Agricultural land use is predominant, which account for about 45% of the total city area. Residential use, including for commercial and service use, follows with about 35% of the city area.

5.2.2 Waste Generation and Stream

(1) Waste Quantity

TWG members of LSMC summarized the current situation of waste quantity as follows.

The quantity of household waste produced per day is estimated as 90-100 tones. The waste production rate is estimated as 0.4 kg/day-capita.

The first waste quantity survey in the dry season at the generation sources in LSMC took samples from 20 households, six commercials and two points from the street. The result is shown in Table 5.2-1. More than 1 liter of waste with 160 to 210 g/L of bulk density is generated per capita day on average.

Table 5.2-1 Result of Daily Waste Generation Quantity Survey of Households (LSMC: Dry Season)

Income Level	Weekdays			Weekend		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
High	276	1.3	212	284	1.7	167
Middle	247	1.2	206	249	1.3	192
Low	117	0.7	167	190	1.1	172
Average	222	1.1	202	243	1.3	187

Source: JICA Study Team

From commercial areas, it was observed that 3.5 to 10 kg/day was generated from surveyed restaurants with 210 to 580 g/L of bulk density. On the other hand from selected markets, about 1 kg/day of waste were generated with 140 to 190 g/L of bulk density. In the street, about 21.0 kg of waste are collected per day per each 100m and bulk density was 217 g/L.

In September 2004, the second waste quantity survey in the wet season was conducted on a large scale in LSMC, sampling at 140 households, 40 commercials and 5 points from the street. The result of this detail waste quantity survey at households in LSMC is shown in Table 5.2-2.

Table 5.2-2 Result of Daily Waste Generation Quantity Survey of Households (LSMC: Wet Season)

Income Level	Weekdays			Weekend		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
High	204	1.2	165	262	1.5	173
Middle	398	1.0	391	151	1.0	148
Low	216	1.9	115	146	2.5	57
Average*	304	1.3	236	178	1.5	116

Note: * This is the average for only the surveyed households, it does not reflect the actual dispersion of income level
Source: JICA Study Team

Figure 5.2-1 shows the frequency distribution of the unit generation rate (UGR) at different income levels of surveyed households. A large peak of unit generation rate for total surveyed households is shown on around 50 to 250 g/day-capita and mid/small peaks on 300 to 450 g/day-capita and 500 to 650 g/day-capita. At LSMC, the peak for low income household tends to appear on around 100 g/day-capita that is smaller than that at mid and

high income households. It is also shown that high/mid income households have a wide range of peaks from 100 to 650 g/day-capita.

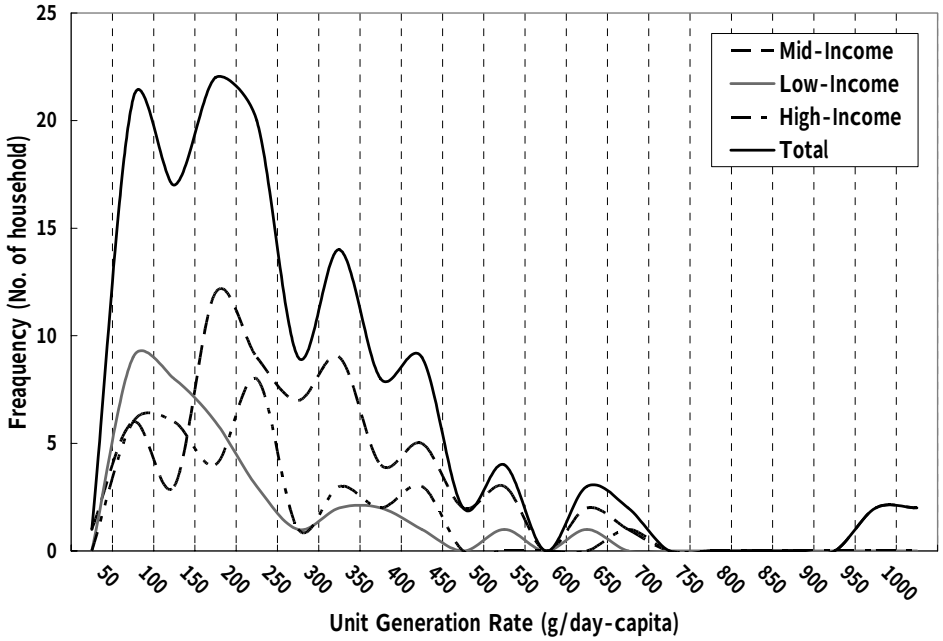


Figure 5.2-1 Frequency Distribution of UGR of Households in LSMC

Source: JICA Study Team

(2) Waste Quality

Waste quality data given by TWG members of LSMC and surveyed by the JICA Study Team in the dry season are shown in the following table. From households, about 70% is kitchen waste and plastic, paper and wood/leaves make up around 10% each. The organic portion at hotels, restaurants or offices fluctuated greatly. Offices can be large generators of paper waste as in LSMC.

Table 5.2-3 Waste Quality (LSMC: Dry Season)

Items	Households		Hotels and Restaurants	Markets	Offices	Streets**
	LSMC data	Study				
Kitchen waste	67.5%	68.9% (64.0%)	76.9% (41.6%)	NS	0% (69.4%)	51.5%
Paper	8.8%	6.5% (8.8%)	10.3% (20.8%)	NS	72.7% (4.6%)	8.2%
Textile	3.6%	2.3% (0.6%)	0% (3.6%)	NS	0% (13.9%)	6.4%
Wood/leaves	0.6%	8.1% (6.5%)	0% (0%)	NS	0% (2.8%)	4.1%
Plastic	11.4%	12.2% (16.2%)	12.8% (11.2%)	NS	18.2% (9.3%)	8.8%
Rubber/leather	0.3%	0% (0%)	0% (0%)	NS	9.1% (0%)	4.7%
Metal	0.9%	1.0% (0.7%)	0% (1.0%)	NS	0% (0%)	2.3%

Items	Households		Hotels and Restaurants	Markets	Offices	Streets**
	LSMC data	Study				
Glass	1.6%	1.0% (2.8%)	0% (20.3%)	NS	0% (0%)	4.7%
Ceramics	-	0.0% (0.4%)	0% (1.5%)	NS	0% (0%)	2.3%
Others	5.3%*	0.0% (0.0%)	0% (0%)	NS	0% (12%)	7.0%
Bulk density	400 g/L	202 g/L (187 g/L)	189 g/L (252 g/L)	NS	138 g/L (244 g/L)	216 g/L
Water content	-	55% (54%)	76% (43%)	NS	27% (43%)	43%

Note: Lower numerical value in parenthesis is data on weekends and upper on weekdays
Total value of each composition is not always 100% because each one was rounded off.
NS: Not Sampled in this Survey
* Construction Debris was categorized as others
** Street waste on weekends was not collected or analyzed.
Source: JICA Study Team

Table 5.2-4 shows the result of the wet season survey. There is no significant change from the dry season and much paper and plastic waste is generated from markets and offices.

Table 5.2-4 Waste Quality (LSMC: Wet Season)

Items	Households	Hotels and Restaurants	Markets	Offices	Streets
Kitchen waste	78.2% (79.6%)	68.8% (74.2%)	60.8% (14.2%)	28.5% (4.4%)	41.8% (38.1%)
Paper	9.1% (7.0%)	20.4% (11.2%)	21.6% (69.8%)	63.7% (77.7%)	31.2% (35.4%)
Textile	0.9% (1.3%)	0.1% (0.0%)	1.8% (1.4%)	0.0% (0.0%)	5.5% (11.1%)
Wood/leaves	3.0% (1.1%)	0.0% (1.2%)	0.0% (0.0%)	0.0% (0.0%)	2.6% (1.6%)
Plastic	6.2% (8.6%)	7.2% (10.3%)	10.8% (14.6%)	4.5% (11.2%)	11.3% (9.3%)
Rubber/leather	0.2% (0.0%)	0.0% (0.0%)	0.0% (0.0%)	0.0% (0.0%)	1.8% (0.0%)
Metal	0.3% (0.4%)	0.3% (1.5%)	0.2% (0.0%)	0.5% (1.1%)	0.5% (0.4%)
Glass	0.8% (1.3%)	3.2% (1.7%)	4.1% (0.0%)	0.0% (0.6%)	0.9% (0.0%)
Ceramics	0.3% (0.4%)	0.0% (0.0%)	0.0% (0.0%)	2.9% (0.0%)	0.0% (3.8%)
Others	0.9% (0.3%)	0.0% (0.0%)	0.6% (0.0%)	0.0% (4.9%)	4.4% (0.4%)
Bulk density	236 g/L (116 g/L)	160 g/L (150 g/L)	48 g/L (39 g/L)	96 g/L (56 g/L)	179 g/L (200 g/L)
Water content	67.7% (69.9%)	64.4% (69.9%)	48.0% (17.8%)	21.1% (13.5%)	60.5% (65.4%)

Note: Lower numerical value in parenthesis is data on weekends and upper on weekdays
Total value of each composition is not always 100% because each one was rounded off
Source: JICA Study Team

5.2.3 Collection and Transportation

TWG members of LSMC summarized the current situation of waste collection and transportation as follows:

The method being practiced is to throw mixed waste in packs covered with plastic bags. When the municipal vehicle arrives near the community route it signals the people with a siren, and the people throw the waste in the open type collection vehicles. The waste is being collected almost free of cost for the city dwellers. The following points hint the present scenario.

1) Waste Management process- (Collection-transportation) no special waste processing (3R) is done. (No recycle centers and only very limited composting facilities, incinerators (only Patan Hospital has their own) and processing facilities.)
2) Plastic bags are being widely used. This ultimately produces a great deal of waste.
3) Very little sorting of waste at the source has been practiced.
4) People are not directly charged for waste management service by the municipality.

People think they should not have to pay; the Municipality is responsible for solid waste management (lack of awareness).

Based on the above facts, LSMC office board and council had already approved the policy to involve the private sector to make them responsible to collect fees from polluters. The collection tariff had also been approved at the same time.

Table 5.2-5 List of Collection Vehicles (LSMC)

Types of Services	Vehicle Type	Total	Operating	Maintenance required	Not used by LSMC
Container Service	Dumper Pressure (ISUZU)	2	1	1	0
	Dumper Pressure (EICHER with Indian Hydraulics for 1 x 4.5 m^3 skips)	3	1	2	0
Pick up Service	3.5 m^3 Tripper (EICHER)	21	11	5	5
	Tractor Small	4	0	4	0
	Tractor Big	4	2	2	0
Sanitary Service	Water Jet Machine with high Suction (KAMBI)	2	1	1	0
	Small Jet Machine	5	1	0	4

Source: LSMC, 2004

Table shows the currently used vehicles are –

- Tippers -11
- Dumpers-2
- Tractors -2
- Loaders -2
- Jet machine -1

Collection area - basically there are three types of zonal requirements. They are

- Tourism area - Durbar square and connecting routes
- City core area - 11 wards
- Out side city core area - 11 wards

Current waste collection and transportation flow of LSMC is shown in Appendix 5.

In LSMC, there are many private sectors which have provided collection services in addition to LSMC as follows.

- WEG: Ward No. 10
- WID: Ward No. 2
- WEPCO: Wards No. 1 & 2 (Kumari pati to Jawalakhel)
- NEPCEMAC: Wards No. 2 (Jawalakhel to Pulchowk), 3, 4, 5 & 13
- NEPCO: Ward No. 15
- LSMC: All Wards (1 to 22)

Before February 2005, the waste collection in LSMC was carried out in a single shift from 6:00 a.m. to 2:00 p.m. There are altogether 170 sweepers in LSMC, out of which 100 sweepers work in street sweeping, and the remaining 70 sweepers are deployed to different wards for waste collection and they are directly managed by the respective wards. About 70% of sweepers are female. There are also about 10 small private organizations carrying out door-to-door waste collection services and they collect service fees of about Rs 100 per household for the service rendered. Street sweeping is carried out in two shifts of 6:00 a.m.-10:00 a.m. and 10:00 a.m.-5:00 p.m. only at Mangal Bazar.

The municipal containers are placed in the following locations:

- Ward No. 1: Bagmati Bridge (used by NEPCEMAC)
- Ward No. 2: Sanepa
- Ward No. 3: Naya Basti (used by WEPCO)
- Ward No. 10 : Pulchowk behind Institute of Engineering
- Ward No. 10: Jwagal
- Ward No. 14: Tasikhel
- Ward No. 15: Dhalaut Factory

In addition, there are also some private containers, where service is provided by LSMC for waste collection. These include:

- Patan Hospital
- SATA Office, Jawalakhel
- B&B Hospital
- Wai Wai Noodles Factory

Table 5.2-6 shows the result of the Time and Motion survey conducted by the JICA Study Team in April 2004 on 6 selected routes. This shows that the average collection time of the placer less than the tripper but the average traveling speed of the placer when loaded with waste is lower than the tripper.

Table 5.2-6 Result of Time and Motion Survey in LSMC

Vehicle	Average Collection/ Dumping Time in min	Total Distance Travel in km	Average Speed of Vehicle in moving km/hr	Average Speed of vehicle*	Return Distance in km	Average Speed on Return km/hr	Total Time for One Trip in min
Tipper	6.3	7.1	11.2	5.0	6.6	18.4	65.9
Placer	3.3	3.1	8.0	7.0	5.1	24.3	39.1

Note: *this includes collection and dumping time
Source: JICA Study Team

The JICA Study Team followed selected trippers during the survey and observed the bell collection system in LSMC. In some areas, especially observed in Chandi Binayak Tole near Pim Bahal or in Durbar Square, the bell collection was conducted quite well without waste littering around the collection point. In Chandi Binayak Tole, the truck stopped for 15 minutes and a total of 137 people came out from their houses to discharge the waste directly into the truck, in which 19 males and 61 females discharged with plastic bags, 8 males and 36 females discharged with buckets, and 2 males and 11 females brought the garbage with other containers like cardboard. During this bell collection, two loaders and the driver of the truck were just waiting except for helping some people to discharge into the truck. However in other places, regardless of having a bell collection point or not, there were waste piles on the ground and loaders had to load them into the truck by shovel with great effort. Piled waste was also scattered around the collection point.

LSMC has also shifted the waste collection system from the former daytime collection to the night/early morning shift, with the work being done mostly in the night shift, in order to complete the collection by 7:00 a.m. every day since February 2005. As well as other municipalities, some bewilderment or difficulties have been occurred, especially at the beginning days of this new collection sift. LSMC staff and the JICA Study Team carried out a Time & Motion Survey on one tipper truck on April 19, 2005 after changed to the night/early morning shift. The truck departed from the municipal garage at 6:49 p.m. and made four trips to Bagmati River dumping site before the truck returned to the garage at 11:40 p.m. The truck collected the waste at two to four collection points by staying 5 to 10 minutes at each per each trip and bell/siren collection was mostly made before 10:00 p.m., which means at the first to third trip because residents rarely came out for waste discharge after 10:00 p.m. at night.

Compared with the result of former Time & Motion Survey for daytime bell collection, more males were observed to bring their garbage to the collection truck. For example at the collection point at Mangal Bazar, 31 males came with plastic bags or garbage bins in addition to 15 females and 7 children. However, at some collection points, residents complained to LSMC about frequently irregular collection times.

5.2.4 Solid Waste Minimization Activities

(1) Composting

Composting activities using the compost bin and vermi-composting have been promoted by LSMC as well as several NGOs in LSMC, though less popular than in KMC. On the other hand, community composting activities have been conducted by some NGOs. Table 5.2-7 shows one of the activities which has been implemented actively and successfully since 1996.

Table 5.2-7 Community Composting Activity at LSMC

No.	Items	Contents
1.	Composting method	Compost pit method
2.	Starting time	Year 1996
3.	No. of targeted households	About 100 households
4.	Waste collection	Door-to-door collection by NGO (separate collection)
5.	Operation & maintenance of facility	All works throughout waste collection to compost harvest are controlled by NGO (Women's Environmental Preservation Committee)
6.	Composting duration	Two to three months
7.	Selling price	10 Rs/kg

Source: JICA Study Team

(2) Recycling

Although LSMC does not have a list of kabadi shops, there should be more than a dozen there and some independent recyclers who collect the recycle materials and sell to kabadi shops. On the other hand, about 150 waste pickers are working at Bagmati River dumping site full time and there are more waste pickers who are not recorded and operate individually in streets-side wastes.

Community Development Section (CDS) of LSMC is promoting awareness of recycling to women's groups, especially housewives, through training, in which CDS sometimes invites specialists on recycling from academics or NGOs/CBOs, or through awareness campaigns in collaboration with NGOs/CBOs.

As in KMC, some NGOs/CBOs have been trying to promote recycling activities to the local people. For example, the Women Environment Preservation Committee (WEPCO) stresses source segregation and recycling as well as composting. They have been producing recycled paper (5,000 sheet/month) from used paper (300 kg/month) by collecting from government offices, business offices, schools, NGOs and embassies since 1997. The paper recycling machine was provided by the Japanese Embassy as the Grass-roots grant assistance. Plastics, metals and bottles have also been collected at around 2 ton/month since 1995 so as to be sold to kabadi shops. WEPCO has also been emphasizing public awareness programs on segregation, recycling and composting at household and school levels.

5.2.5 Final Disposal

LSMC reports that about 200 m^3/d of waste is disposed of at the Bagmati River dumping site. While KMC is reported to be overseeing the overall operation of the site near the Bagmati River, LSMC has 2-3 staff members stationed there to record the incoming waste trucks hauling LSMC waste and also to operate the one bulldozer they have at the site. Again many open dumping areas and wide waste burning is noticed in LSMC.

Since June 5, 2005, a part of the waste collected in LSMC together with some from KMC is being transported to Sisdol S/T-LF.

5.2.6 Social Aspects

(1) Major Findings of Household Behavior and Attitude Survey on SWM[4]

1) Priorities of Public Services

According to the results of the Household Behavior and Attitude Survey on SWM, waste collection was ranked as the third priority (13% of sample HHs) and below water supply (47%) and drainage/sewerage (20%) among eight options of public services and utilities for improvement.

2) Waste Disposal and Management

As Table 5.2-8 indicates, 56% of the sample HHs have noted that they disposed of waste by using a door-to-door collection service. A total of 33% of HHs disposed of waste by putting it into municipal or communal containers. Only 3 HHs responded that they practiced open dumping on vacant land, or the bank of a stream or river. Regarding the responsibility of handling waste, close to 70% of sample HHs noted that a female adult took this role. Children were also responsible for this (23% of sample HHs). Female members were less involved if other members of the family took out waste for disposal. The majority of HHs (52%) disposed of waste once a day and around 41% of sample HHs did it once every 2 or 3 days. Almost 60% of sample HHs used the backyard for storing the waste. A total of 31% of HHs responded that they had no space. Plastic bags were the most common containers

Table 5.2-8 Waste Disposal Practice among HHs Surveyed (LSMC)

Sample HH nos.	162#	109%
Dispose of waste by door-to-door collection service	91	56%
Dispose of waste by putting into Municipal or Communal Container	54	33%
Dispose of waste at Municipality's designated disposal site	11	7%
Dispose of waste by open dumping out side the house	3	2%
Dispose of waste by open combustion	4	2%
Dispose of waste by burying in the ground	1	1%
Dispose of waste by Composting	9	6%
Dispose of waste by giving it for recycling	1	1%
Dispose of waste by using as animal feed	2	1%

Note: Because more than one method was given by the respondents, the summation of responses exceeds 100%.
Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Household, Establishment and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

3) Existing Waste Collection Services

As shown in Table 5.2-9, the majority of HHs surveyed (96%) noted that waste collection services were available in their areas and they used these services. This group was the highest proportion in the five municipalities. The door-to-door collection was the most prevailing service (61% of respondent sample HHs), and was followed by carrying to container/truck (33%). NGOs/CBOs (73% of respondent sample HHs) and municipality (19% of respondent sample HHs) were main service providers for door-to-door collection in LSMC. It was assumed that the existence of these different service providers could

[4] In LSMC, 5 out of 22 wards were selected based on the core area, sub-core are and fringe area. A total of 162 sample HHs were selected.

contribute to high availability of collection services in LSMC. A total of 6% of respondent sample HHs have received daily collection services while 32% of HHs have services 2 or 3 times per week. A total of 54% of sample HHs have already made payment for waste collection services, and out of which 95% of HHs were very or somewhat satisfied with these services. Except those who were very satisfied, the rest of the respondent 27 HHs described the main reasons for less satisfaction or dissatisfaction with services as follows; a) waste collection and sweeping services were irregular (9 respondent sample HHs), b) waste collection time was too early or too late (6 HHs), c) behavior of workers for waste collection and sweeping was bad (3HHs), and, d) fees were too expensive (3HHs).

Table 5.2-9 Availability and Use of Waste Collection Service in LSMC

Sample HH nos.	162#	100%
Service available and used	155	96%
Service available and not used	6	4%
Service not available but required	1	1%
service neither available nor required	0	0%

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Household, Establishment and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

4) Waste Reduction and Recycling

A total of 55% of sample HHs responded that they have knowledge about separation and actually separating waste while 25% of HHs noted that they have knowledge but are not doing so. It was also noted that 17% of sample HHs neither had knowledge nor practiced source separation of waste. However, a significant number of sample HHs who did not practice were "very much" willing to cooperate for recycling (46%) or "somewhat" (41%). The following reasons for unwillingness to cooperate for separation were; a) takes too much time and b) no space inside the house to keep the separated waste. A total of 51% of sample HHs did not sell their recycling items although buyers visited the house. A total of 48% of sample HHs responded that they were selling their recycling material to the buyer. The major items collected for sale were glass and papers. The level of knowledge about composting was relatively high indicating that 77% of sample HHs knew what compost was. A total of 71% of those who knew about compost noted that they learned about making compost by themselves. A total of 13% of respondent sample HHs reported that NGOs/CBOs taught them. One fourth of sample HHs reported having experience in making composts, and out of which 60% of HHs composted their waste in an open space or organic field. A total of 38% of HHs made compost in containers or composting bins. Close to 70% of those having no experience in making compost responded they were willing to do. The rest of HHs did not show interest in such activity. The major reasons for unwillingness to compost were as follows; a) no space available (34% of respondent sample HHs) and b) unclear regarding needs for composting (16%).

5) Public and Community Involvement

A relatively high proportion of sample HHs considered that they themselves should be responsible for SWM (Table 5.2-10). This proportion was the highest among the five municipalities. The fact that a wide range of community mobilization and participation activities have taken place actively in LSMC might make the public have a sense of self-responsibility for SWM. Nevertheless, only 7% of sample HHs actually have taken

initiatives in 3R activities, clean up and proper disposal practice. A total of 95% of sample HHs, including those who have already been paying had willingness to pay for SWM services. Most of them could afford to pay Rs 31-50 or Rs 11-30 per month. Among the 5% of sample HHs who were not willing to pay, the following reasons were noted; a) we could manage solid waste ourselves and b) we had no problems with SWM. Although few HHs have taken initiatives towards SWM by adopting various methods, almost half of sample HHs have participated in CBOs' activities related to SWM. According to the comparison result among the five municipalities, it was clearly noted that the level of participation in such community-based SWM activities was highest in LSMC. All respondents considered that these CBOs' activities related to SWM were necessary or somewhat necessary. Almost 70% of HHs surveyed also reported being willing to participate in relevant SWM activities in addition to the awareness campaign. To sum it up, it could be said that the level of knowledge and attitude towards public involvement in SWM was relatively high. Although the extent of actual practice or involvement of community-based SWM has been limited, LSMC has high potential for promotion of community-based SWM in existing community-based groups and organizations.

Table 5.2-10 Perception of Responsibility for SWM in LSMC

Sample HH nos.	162#	100%
Government/Ministry of Local Dev.	11	7%
Municipality	31	19%
Sweepers	0	0%
Yourselves	107	66%
Our Communities/CBOs	0	0%
Private Company	7	4%
NGO	1	1%
Do not know	5	3%
Others	0	0%

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey of Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

(2) Municipality's Programs regarding Community Mobilization on SWM

CDS is responsible for promoting community participation in development activities. CDS has implemented integrated community development activities including awareness, education/literacy, skill development, sanitation and conservation by group formation and mobilization at the tole levels with the technical and financial support from UDLE/GTZ (1992-2000). Up to date, approximately 40 women's groups have been established at the tole levels, covering all 22 wards. Further, 50 children's clubs were also formed at the initial stage of the UDLE project and of which 25 are likely to be active. Regarding SWM activities, CDS has carried out an awareness program, clean-up activities at the tole levels and 3 or 4-day training sessions. The training which focuses on a variety of SWM issues like the effects of solid waste on health and society and the 3Rs was given to the groups in the second year of its establishment by the CDS in collaboration with resource persons from external organizations. A total of 20 groups have received this training. LSMC has just taken initiatives in a pilot project in collaboration with two NGOs i.e. WEPCO and Nepal Pollution Control Environment Management. These contracted NGOs are responsible for door-to-door collection services targeting 200 HHs in Jawalakhel areas covering part of

Wards 4, 5, 13 and 20 whereas LSMC have distributed 2 disposal bins each for all 200 HHs in order to introduce a source separation system.

(3) NGOs/CBOs' Programs regarding Community Mobilization on SWM

In the field of SWM, the partnership program with NGOs/CBOs is not being carried out as planned due to internal problems. Although there is no formal agreement with LSMC, several NGOs have provided collection services in relatively large areas. There is little coordination among NGOs/CBOs, which may sometimes make the public be confused since they are adopting and introducing different approaches with different messages on SWM.

Table 5.2-11 Major NGOs/CBOs Working in the Field of SWM in LSMC

Name of NGOs/CBOs	Year of foundation	Number of staff	Working Areas
Women Environment Prevention Committee (WEPCO)*	1996	28 paid staff 7 volunteers	Door-to-door collection, Recycling of paper, Awareness campaign, Sweeping, Composting, Training in Wards 1 and 10
Women Environmental Group (WEG)*	1997	12 paid staff 6 volunteers	Door-to-door collection in Wards 3, 10, and 22 (600 HHs), Awareness campaign, Composting in Ward 10, Recycling in Ward 10
National Environment Pollution Control (NEPCO)	1998	28 paid staff 7 volunteers	Door-to-door collection, Awareness campaign, Sweeping, Composting in Wards 6, 8, 14, 15 &17 (1,050 HHs)
Nepal Pollution Control Environmental Management*	2001	137	Door-to-door collection in Wards 2, 3, 4, 5, 13, 14, and 19 (2,500-2,800 HHs) and pilot project with support of LSMC in Wards 4, 5, and 13 (150 HHs)
Society for Urban Poor (SOUP)	1992	2 paid and 33 volunteers	Community development including clean up in Wards 7&17 and 18&22, Composting (560 HHs)
Environmental Camps for Conservation Awareness (ECCA)	1987	8 paid and 50 volunteers	Public awareness on environmental education
Zero Waste Nepal	2001	20 volunteers	Public awareness and campaign on SWM
Women's Initiative for Environment and Development (WEID)	2000	3 paid and 25 volunteers	Door-to-door collection in Ward 2 (300 HHs + 2 schools)
Kathmandu 2020	1995	1 paid and 1,500 volunteers	Composting (20 HHs), Awareness campaign

Note: * According to LSMC, there is coordination with LSMC at program/activity levels.
Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Household, Establishment and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

5.2.7 Managerial Condition

(1) Organizational Structure and Managerial Practices

1) Organizational Structure

In 2004, LSMC approved a new organizational structure where it designated the Environment Section to be responsible for SWM activities. The Environment Section is comprised of two sub-sections, the Sanitation Sub-section and Mechanical Sub-section. It is located at Balkumari separately from the central LSMC office with its own garage and workshop building.

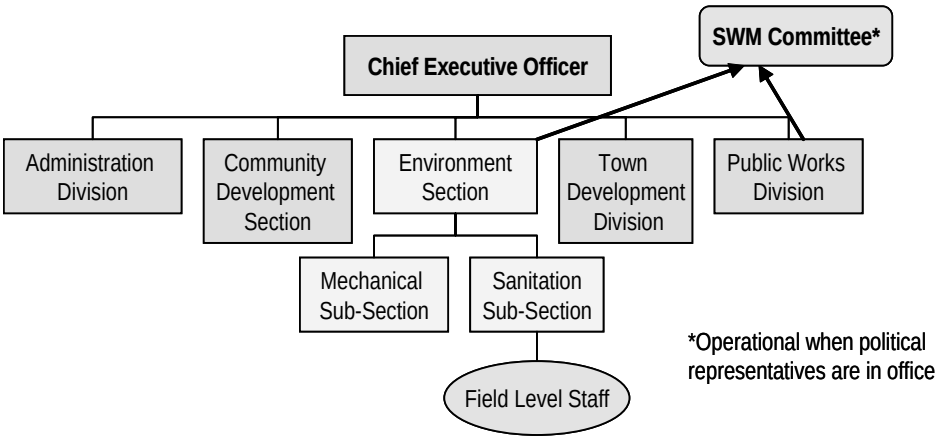


Figure 5.2-2 Organizational Structure of LSMC SMW Related Sections and Sub-Sections

Source: LSMC, 2005

The physical distance from other relevant sections has made coordination with other SWM relevant sections a challenge. The Public Works Division is responsible for identification, planning, development, and monitoring of municipal infrastructure projects. In matters of SWM facilities planning, this Section should be closely involved. Also, CDS has been implementing waste minimization training as a component of their community mobilization program for the last ten years. LSMC should tap into the experience of this section, and jointly formulate and implement effective community level SWM programs.

2) Managerial Practices

The post of the Environment Engineer heading the Environment Section was recently established, and an officer has been working as the Section Chief. In terms of reporting, the Environment Section Chief reports directly to the CEO of the municipality. Close coordination with the Public Works Division is maintained on various SWM issues.

LSMC established the Solid Waste Management Committee, composed of four Ward Chairpersons with relevant municipality staff as observers, which is usually convened on a monthly basis. This platform is used to settle daily waste management problems and make recommendations of some principles about SWM. As of June 2005, this Committee was not active since the members comprised of political appointees are not in office.

(2) Human Resources

Total number of staff under the Environment Section is 206 persons or about 40% of all LSMC staff. Over 80% of 206 persons are field level staff. The breakdown of human resources of the Environment Section is as follows:

Table 5.2-12 LSMC Environment Section Staff

Staff Category	Number of persons
Sweepers	165
Drivers	19
Mechanics	9
Supervisors	5
Administrative	7
Engineers/Officers	1
Total	206

Source: LSMC, 2005

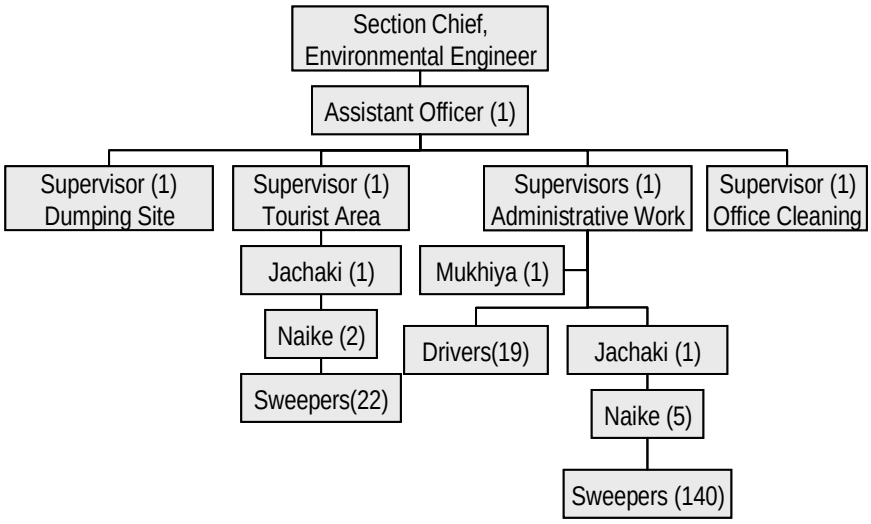
1) Senior Officers and Mid-Level Staff

LSMC senior officers all have solid educational and technical backgrounds in their respective fields, but not close relating to SWM. Some technical reorientation training would be useful so that they could build on their previous knowledge and expand capacities in the field of SWM. The Environment Section would need more strengthening of management capacities, especially in view of their responsibility to manage a sizable field staff.

Mid-Level staff also needs support in office management and communication skills. Furthermore, most of the staff at this level, aside from the assistant officer (Naya Subba), have not received any training on SWM and are only familiar with certain aspects such as street sweeping, waste collection, and transportation.

2) Field Level Staff

In LSMC, an assistant officer (Naya Subba), with the support of four supervisors and field level supervisors called Jachakis and Naikes, are managing all field level staff. Among the sweepers, 76 are assigned at the ward level and conduct various cleaning jobs in addition to regular street sweeping. The rest of the sweepers is assigned under the central LSMC office and separated into the following groups: sweepers concentrating on tourist areas, sweepers cleaning the major streets and highways, waste loaders going around with the collection trucks, and drainage cleaners. The sweepers usually work in two shifts, (6:00 a.m. to 10:00 a.m., 10:00 a.m. to 5:00 p.m. only at Mangal Bazar) but some like the drainage cleaners work only in one eight-hour shift. Figure 5.2-3 shows the organizational structure of the LSMC field staff.



Note: ( ) shows number of staff

Figure 5.2-3 Structure of LSMC Field Level Staff

Source: LSMC, 2005

5.2.8 Financial Condition

LSMC estimates direct annual expenditures for SWM services at Rs 25 million which corresponds to 25% of the total municipal expenditure (FY2002/2003). Fuel cost of Rs 4 million regarding transportation is included among the direct expenditures. All financial sources necessary for SWM are covered by the municipal budget.

5.3 Bhaktapur Municipality (BKM)

5.3.1 Outline of BKM

Bhaktapur Municipality (BKM) is well known as the city with an old history. The core area of the municipality has been designated as World Heritage since 1979, and it attracts a large number of tourists.

The municipality is spread over an area of nearly 7 km^2 and it is divided into 17 wards administratively (see Appendix 5.1). The predominant land use in the municipal area is agricultural accounting for 75% in the 2001 census. The residential area, including the historic core zone and commercial zone, is about 17%. The monumental protected zone is about 8 ha within the historic core zone.

It is estimated that nearly 73,000 people live inside the municipality as from 2001 national census, and population growth from 1991 was 1.7% annually. The number of households and average size of households are about 12,000 and 6 persons/HH, respectively. The predominant ethnic group is Newari which is 95% of the total municipal population.

5.3.2 Waste Generation and Stream

(1) Waste Quantity

The TWG members of BKM summarized the current situations of waste quantity as follows:

Waste Unit Generation Rate: 0.303 kg/day-capita
Total Waste Generation: 22 tons/day

The result of this first waste quantity survey in the dry season by the JICA Study Team in BKM with samples from 12 households, three commercials and one point in the street is shown below. About 0.7 to 1.0 L of waste per person with 200 to 230 g/L of bulk density is generated on average.

Table 5.3-1 Result of Daily Waste Generation Quantity Survey of Households (BKM: Dry Season)

Income Level	Weekdays			Weekends		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
High	184	1.0	184	198	1.0	198
Middle	160	0.7	229	149	0.7	213
Low	133	0.8	166	177	0.8	221
Average	159	0.8	199	166	0.8	208

Source: JICA Study Team

From commercial areas, it was observed that 0.3 to 1.4 kg/day was generated from each surveyed restaurant with 240 to 340 g/L of bulk density. From municipality offices, 1.5 to 1.6 kg/day of waste were generated with 160 to 270 g/L of bulk density. In the street, about 3.1 kg of waste are collected per day per each 100 m and bulk density was 186 g/L.

The second waste quantity survey in dry season was conducted in BKM in September 2004, sampled at 120 households, 21 commercials and four points in the street. The result of this detail waste quantity survey of households in BKM is shown in Table 5.3-2, but analysis for volume and bulk density will be finalized by the end of June 2005.

Table 5.3-2 Result of Daily Waste Generation Quantity Survey at Household (BKM: Wet Season)

Income Level	Weekdays			Weekend		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
High	134	0.9	145	124	1.0	119
Middle	116	0.9	137	135	0.9	145
Low	92	0.6	146	109	0.7	156
Average*	115	0.8	141	126	0.9	140

Note: * This is the average for only the surveyed households, it does not reflect the actual dispersion of income level
Source: JICA Study Team

Figure 5.3-1 shows the frequency distribution of UGR at different income levels of surveyed households. A peak of unit generation rate for surveyed households for each income level is shown around 50 to 100 g/day-capita. There is no household who generates the waste more than 500 g/day-capita.

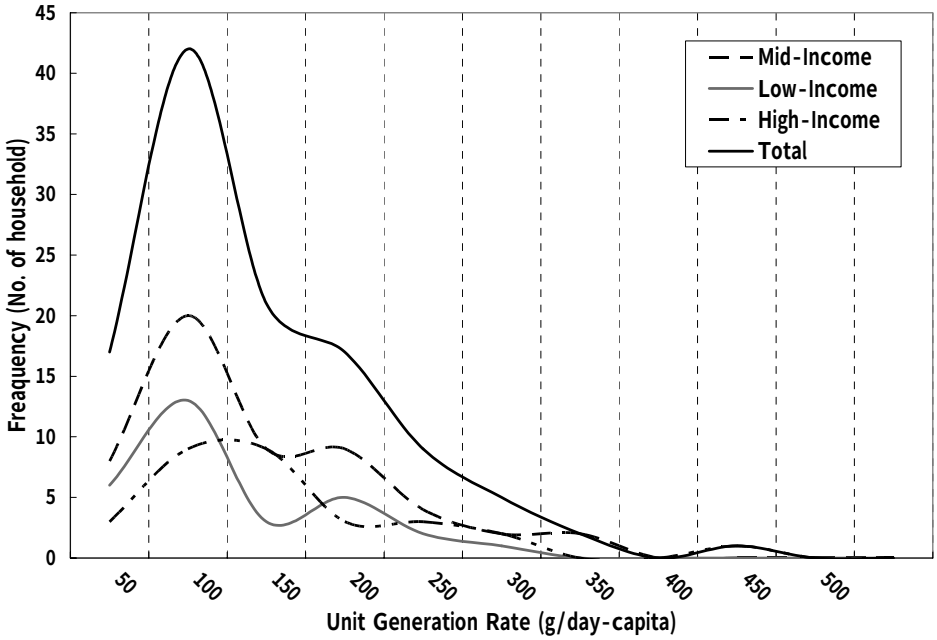


Figure 5.3-1 Frequency Distribution of UGR of Households in BKM

Source: JICA Study Team

(2) Waste Quality

Waste quality data given by TWG members of BKM and surveyed by the JICA Study Team are shown in the following table. From households, more than 80% is kitchen waste and plastic and paper items represents around 3 to 7% each.

Table 5.3-3 Waste Quality (BKM)

Items	Households			Commercial	
	BKM data	Study			
		Dry Season	Wet Season	Dry Season	Wet Season
Kitchen waste	75%	83.6% (90.3%)	87.4% (85.1%)	41.2% (28.3%)	74.6% (68.3%)
Paper	3.25%	6.0% (2.8%)	3.2% (3.5%)	19.1% (28.3%)	14.7% (26.4%)
Textile	3%	1.5% (0%)	0.7% (1.3%)	1.5% (0%)	1.5% (0.1%)
Wood/leaves	-	1.5% (2.8%)	1.1% (1.3%)	8.8% (8.7%)	0.4% (0.0%)
Plastic	3.4%	7.5% (4.2%)	3.2% (3.9%)	2.9% (32.6%)	4.4% (2.8%)
Rubber/leather	-	0% (0%)	0.0% (0.0%)	10.3% (0%)	0.0% (0.0%)
Metal	0.3%	0% (0%)	0.1% (0.8%)	10.3% (2.2%)	1.5% (0.5%)

Items	Households			Commercial	
	BKM data	Study			
		Dry Season	Wet Season	Dry Season	Wet Season
Glass	1.5%	0% (0%)	1.6% (1.9%)	5.9% (0%)	2.6% (1.6%)
Ceramics	-	0% (0%)	0.0% (0.0%)	0% (0%)	0.0% (0.0%)
Others	11.4%*	0% (0%)	2.6% (2.1%)	0% (0%)	0.1% (0.3%)
Bulk density	225 g/L	199 g/L (208 g/L)	141 g/L (140 g/L)	284 g/L (192 g/L)	182 g/L (207 g/L)
Water content	-	45% (44%)	65% (62%)	39% (28%)	54% (62%)

Note: Lower numerical value in parenthesis is data on weekends and upper on weekdays
Total value of each composition is not always 100% because each one was rounded off.
* In which, construction debris was 11.1%
Source: JICA Study Team, May 2004 for Dry Season, June 2005 for Wet Season

5.3.3 Collection and Transportation

TWG members of BKM summarized the current situation of waste collection and transportation as follows.

Spot collection :

-- Within the core areas : 72 (Approx.)
--*Along the surrounding areas : 28 (Approx.)
Total: 100 (Approx.)

*(Araniko Highway-Jagati-Kamalbinayak- Sallaghari Treatment pond- Araniko Highway)

Time and Motion of Collection:

-- 6 hr to 9 hr / 9 hr to 12 hr / 12 hr to 16 hr/& 16 hr to 19 hr
-- Total No. of trips = 30.00 Trips/day

Street Sweeping & Cleansing:	3 times per day in main roads
(-January, 2005)	(6:00 a.m., 12:00 noon, 4:00 p.m.)
	2 times per day in other roads
	(6:00 a.m., 12:00 noon)
(February, 2005-)	2 times per day
	(4:30 a.m. to 7:30 a.m., 4:30 p.m. to 8:30 p.m.)
Tipan Tapan (Waste Collectors)	9:00 a.m. to 4:00 p.m.

Vehicles & Tools for Collection

Pick up van:	8	(capacity : 1.30 Cum. - 1 Ton)
Power Tailor Tractor:	2	(capacity : 1.68 Cum.)
Hand Cart:	88	(capacity : 0.16 Cum.)
Kharpan (basket):	30 sets	(capacity : 0.06 Cum.)
Plastic Buckets:	50	(capacity : 0.01 Cum.)

Heavy Equipments

Backhoe Loader:	1	(6 ton, KOMATSU, JAPAN Procured in 1998)
Mini Chain Dozer:	1	(6 ton, KOMATSU, JAPAN Procured in 1998)

Present Problems

Sorting of organic & non organic wastes at the source (household level) is not effective.

Conventional waste collection system – being not able to collect organic & non organic wastes separately.

In addition to the above, 26 permanent sweepers work in two shifts in Ward Nos. 2, 9, 10, 12, 16 and 57 sweepers in contract works in three shifts in Ward Nos. 1, 3, 4, 5, 6, 7, 8, 11, 13, 14, 15 and 17. Since February 2005, as other municipalities in the Valley, BKM has shifted its collection system to night/early-morning collection.

The pick up truck that is currently used in BKM for waste collection is small enough that it can pass through the narrow streets in the historic area, but the mechanism of van's bed does not have a hydraulic dumping device. Therefore, the municipal worker unloads the waste from the van with great effort.

Table 5.3-4 shows the result of the Time and Motion survey conducted by the JICA Study Team on April 15 and 16 2004 on 4 selected routes.

Table 5.3-4 Result of Time and Motion Survey in BKM

Vehicle	Average Collection/ Dumping Time in min	Total Distance Travel in km	Average Speed of Vehicle in moving km/hr	Average Speed of vehicle*	Return Distance in km	Average Speed on Return km/hr	Total Time for One Trip in min
Pick Up Truck	5.6	8.1	13.0	5.7	0.9	2.9	61.6

Source: JICA Study Team

5.3.4 Solid Waste Minimization Activities

(1) Composting

In addition to a few composting activities at the household and community level, the Bhaktapur composting facility has been operating for 20 years as described in Table 5.3-5. Composting activity started as a part of recycling and reduction of waste with support from GTZ in 1984. The process of composting is a simple manual field heaping method and the municipality has been bearing the expenses and selling the produced compost at a low price. This is the reason why the composting facility is still operating. However, recently houses have been constructed close to the composting facility and residents are complaining against offensive odors from the composting facility. Though a belt conveyor for collecting recyclable materials has been broken and not used for long time, recyclable materials are collected directly from unloaded waste by staff in the yard.

Table 5.3-5 Operating Condition of Bhaktapur Composting Facility

No.	Items	Contents
1.	Composting method	Manual field heaping method 
2.	Starting time	Year 1984
3.	Waste disposal amount	About 3 to 3.5 tons/day
4.	Waste collection	Collected by municipality (mixed waste) (Rainy season is high volume, while dry season is low).
6.	Waste separation	Collected by municipality at facility site
7.	Composting duration	47 days
8.	Operation & maintenance of the facility	Operation by municipality
9.	Workers	16
10	Operation time	6:00-9:00, 12:00-16:00, Total 7 hours
11.	Site area	About 30 x 85 2,500 m^2
12	Selling price/ amount	100 Rs/m^3 (700 kg) (Cost 200 Rs/m^3, 207 tons for (FY2004/05)
13	Expenditure	Rs 715,000 (FY2004/05)

Source: JICA Study Team

(2) Recycling

1) Recycling by Independent recyclers and Kabadi Shops

In BKM, there are six kabadi shops dealing in iron (tin/steel), paper, plastic and glass. Independent recyclers collect recyclable materials door-to-door by bicycle or rickshaw and take them into kabadi shops. Table 5.3-6 shows market price of recyclable materials dealt with by buyers in BKM.

Table 5.3-6 Market Price of Recyclable Materials in BKM

	Buyer 1			Buyer 2		
Since establishment	8 months			2 years		
No. of employees	4			7		
Collection of materials	Amount (monthly)	Transaction prices		Amount (monthly)	Transaction prices	
		Buying	Selling		Buying	Selling
Paper	100kg	6-10 Rs/kg	6.5-10.5 Rs/kg	200 kg	10 Rs/kg	11 Rs/kg
Plastic	80kg	20 Rs/kg	22 Rs/kg	100 kg	22 Rs/kg	24 Rs/kg
Metal	2 tons	10-15 Rs/kg	10.5-15.5 Rs/kg	3 tons	15 Rs/kg	16 Rs/kg
Glass 1 (beer bottles)	4,000 nos.	2.5-3.5 Rs/kg	3.6 Rs/kg	6,000 nos.	3.5 Rs/kg	3.75 Rs/kg
Glass 2 (whiskey bottles)	2,000 nos.	1 Rs/no.	1.15 Rs/no.	3,000 nos.	1 Rs/no.	1.15 Rs/no.

Source: Hearing Survey by JICA Study Team, 2004 (March 28, 2004)

2) Recycling by Waste Pickers

The number of waste pickers at the Hanumante River is less by far than that at the Bagmati River dumping site and only ten or less waste pickers can be identified in a day. BKM does not manage waste pickers who are conducting their waste picking activities individually.

Out of recycling buyers in BKM, only one kabadi shop receives materials from waste pickers. Other kabadi shops tend to refuse to buy materials from waste pickers because the quality of materials picked up from the street or landfill site is inferior to that of materials from the generation source.

3) Recycling Activities Promoted by the Municipality, NGOs/CBOs and Private Sectors

At the Bhaktapur Composting Facility, during the composting process, plastic materials separated from incoming waste, most of which are plastic bags are collected together and sold to a recycle buyer. The income from recycling of plastic materials is about 7,000 to 8,000 Rs/months.

In addition, BKM has operated a paper recycling facility where a total of seven female staff members consisting of one responsible municipal officer and six workers have been working since 1999. They have been collecting used paper, mainly from the municipal or private offices. The recycling process is as follows:

- Collected used paper is dissolved in water
- Dissolved paper is skimmed off
- Skimmed paper is dried
- Dried paper is processed into envelopes or paper bags and sold to consumers.

Recycled paper from the facility is now being used mainly by BKM office, Khwopa College, Khwopa Engineering College and Khwopa Polytechnic College. Average net income from sales of recycled paper is Rs 1,500/month after expenditures of around Rs 46,000/month.

On the other hand, a NGO, Prayatna-Nepal located in BKM has conducted unique activities for promoting reuse and recycling. They have conducted some training for children and teachers to teach them how to make some products from reusable material. They sometimes conduct several exhibitions to display the products from reusable material for promotion.

Training for Children

Products from Reusable material

At Exhibition

5.3.5 Final Disposal

In BKM some of the collected waste is sent to the composting facility (about 10% daily) while the majority is directly dumped in the Hanumante River and along its banks. There

are two main dumping points, the first west of the city at the city's main entrance and the second east of the city in the vicinity of the closed dump site. No cover soil is applied. BKM does not have any staff assigned at the disposal site. Waste pickers have free access to the dumped waste. Pigs and cattle graze on the disposed waste. Open burning is observed at the site.

5.3.6 Social Aspects

(1) Major Findings of Household Behavior and Attitude Survey on SWM[5]

1) Priorities of Public Services

Waste collection was ranked as the third priority (13% of sample HHs) while water supply (46%) and drainage/sewerage (14%) were considered as more important needs regarding public services and utilities for improvement.

2) Waste Disposal and Management

Table 5.3-7 illustrated that the majority (50%) of HHs in BKM disposed of their waste at municipality's designated disposal sites. A total of 40% of sample HHs disposed of waste by door-to-door collection services. Composting was relatively a popular disposal practice and 12% of sample HHs adopted it. A total of 6% of HHs reported they practiced open dumping on roads or vacant land. Close to 80% of sample HHs said that a female adult was responsible for both handling waste and taking out waste for disposal. Children were also considerably involved in handling waste (almost 20% of sample HHs responded). 17% of HHs surveyed disposed of waste as soon as it arose and 13% HHs once every 2 or 3 days, but 69% did it daily. The nature of the place for waste storage was completely different from other municipalities. A total of 63% of sample HHs stored waste in the kitchen while 25% of HHs stored it in the backyard. Baskets were used by 60% of sample HHs, which was considered as the most popular container.

Table 5.3-7 Waste Disposal Practice among HHs Surveyed (BKM)

Sample HH nos.	126#	115%
Dispose of waste by door-to-door collection service	50	40%
Dispose of waste by putting into Municipal or Communal Container	5	4%
Dispose of waste at Municipality's designated disposal site	63	50%
Dispose of waste by open dumping out side the house	7	6%
Dispose of waste by open combustion	2	2%
Dispose of waste by burying in the ground	2	2%
Dispose of waste by Composting	15	12%
Dispose of waste by giving it for recycling	0	0%
Dispose of waste by using as animal feed	1	1%

Note: Considering more than one method was reported by the respondents, the summation of responses exceeds 100%.
Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Household, Establishment and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

[5] In the case of BKM, 6 out of 17 wards were selected based on the core area, sub core are and fringe area. A total of 126 sample HHs were selected.

3) Existing Waste Collection Services

As illustrated in Table 5.3-8, the majority of HHs surveyed (94%) responded that waste collection services were available in their areas and they used these services. A total of 53% of sample HHs carried their waste to a specific site while 44% of HHs used door-to-door collection services. Since BKM was fully responsible for such door-to-door collection services, neither private companies nor NGOs/CBOs were involved in them. A total of 94% of HHs out of those who used any collection services noted that these services were available on a daily basis. A total of 57% of HHs surveyed said that they paid for services. Most of them reported that they were very or somewhat satisfied with these services. Except those who were very satisfied, 18 HHs addressed the main reasons for less satisfaction as follows; a) waste collection and sweeping were not properly done (39%) and b) waste collection and sweeping were irregular (28%).

Table 5.3-8 Availability and Use of Waste Collection Service in BKM

Sample HH nos.	126#	100%
Service available and used	119	94%
Service available and not used	2	2%
Service not available but required	5	4%
Service neither available nor required	0	0%

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey of Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

4) Waste Reduction and Recycling

A total of 56% of sample HHs responded saying that they have knowledge about separation and actually separating waste, mostly into two categories. On the other hand, 20% of HHs noted they neither had knowledge nor practiced source separation of waste in spite of implementation of source separation by BKM. It was assumed that an effective information dissemination and awareness program had not been carried out by BKM to promote source separation. The level of attitudes towards cooperation for source separation varied from one to another. The proportion of HHs who were very willing to cooperate with recycling (61%) was the largest group in the five municipalities. On the contrary, the proportion (20%) of HHs who were less willing or not willing (7%) to do was also the highest among the five municipalities. The reasons for less willingness or unwillingness to cooperate for separation included; a) inconvenient and difficult to separate, b) not clear on necessity of recycling system, and c) not clear on benefits from recycling system. Regarding disposal of recyclable materials, 57% of sample HHs that responded are selling their recyclable materials to the buyer. Almost 40% of sample HHs did not sell their recyclable items although buyers visited the house. The major items collected for sale were glass and papers, followed by tin. The level of knowledge about composting was relatively high indicating that 81% of sample HHs know what compost is. This figure was the highest among the five municipalities. The majority of these respondents noted that they themselves learned how to make composting. However, less than 30% of sample HHs reported having actual experience in making composts, and most of them composted their waste in an open space or organic field (91% of respondent sample HHs). A total of 75% of those having no experience have shown no interest in making compost. The major reasons for unwillingness to compost include; a) unclear regarding needs for composting (29% of respondent sample HH) and b) inconvenient and difficult to compost (22%).

5) Public and Community Involvement

The perception that SWM was the duty of the municipality was still prevailing among sample HHs in BKM. This might result from the fact that BKM has executed various activities without collaboration with other organizations. Waste is actually being collected by BKM alone. Close to 30% of HHs noted that they themselves should be responsible for SWM. As a result, a negligible 2% of HHs took initiatives towards SWM. However, the large majority of HHs, including those who have already paid, had positive attitudes for paying a service charge for SWM. Most of them reported that an affordable monthly payment would be Rs 11-30 or less than Rs 30. The main reasons for unwillingness to pay were described as follows; a) could not afford to pay, and b) it is the duty of the Municipality. Almost 63% of sample HHs have not participated in CBOs' activities for SWM. However, close to 95% of HHs interviewed considered that these CBOs' activities related to SWM were necessary or somewhat necessary. The major activities in which those who were willing to participate included; a) campaign for raising awareness, b) any activities related to SWM, c) clean up program, and d) education program on SWM.

Table 5.3-9 Perception of Responsibility for SWM in BKM

Sample HH nos.	126#	100%
Government/Ministry of Local Dev.	4	3%
Municipality	60	48%
Sweepers	15	12%
Yourselves	35	28%
Our Communities/CBOs	0	0%
Private Company	11	9%
NGO	0	0%
Do not know	0	0%
Others	1	1%

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

(2) Municipality's Programs regarding Community Mobilization on SWM

BKM introduced a fee for cleaning of Rs 12 per year per house in all wards in 1999 and Rs 15 per shutter in market areas in 2004. BKM also distributed 2 buckets per house in all wards to promote source separation in 2002. Since BKM has not promoted specific community mobilization or awareness programs along with these initiatives, they have been far from satisfactory. Based on this experience, the BKM selected the implementation of source separation in target wards as part of the Pilot Projects under the Study (see Section 8.5.1 A-1).

(3) NGOs/CBOs' Programs regarding Community Mobilization on SWM

Although there are Guthis[6] and youth clubs in BKM, it is said that few of them have been working in SWM. The following two organizations were interviewed under the Study.

[6] Guthis are social and religious organizations that form the backbone of Newar social or religious order. In Bhaktapur where Newar culture is strongly prevailing, many Guthis exist in the community.

Table 5.3-10 Major NGOs/CBOs Working in the Field of SWM in BKM

Name of NGOs/CBOs	Year of foundation	Number of staff	Working Areas
Prayatna-Nepal	2000	18 volunteers	Recycling training/education for children, teachers
Kathmandu 2020	1995	1 paid and 1,500 volunteers	3R program for SWM

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

5.3.7 Managerial Condition

(1) Organizational Structure and Managerial Practices

1) Organizational Structure

BKM office's existing structure consists of four sections and 13 sub-sections. There is a sub-section responsible for sanitation activities under the Social Welfare and Sanitation Section.

In December 2004, the BKM Board and Council approved a new organogram based on the restructuring exercise of the municipality office. The existing four sections would be replaced by six sections introduced by the newly approved organogram. It is envisaged that the current Sanitation Sub-section is going to be placed under a newly established Environment Section with four newly established units as shown in Figure 5.3-2. In addition, a new Community Mobilization Unit will be set up under the Social Welfare Section.

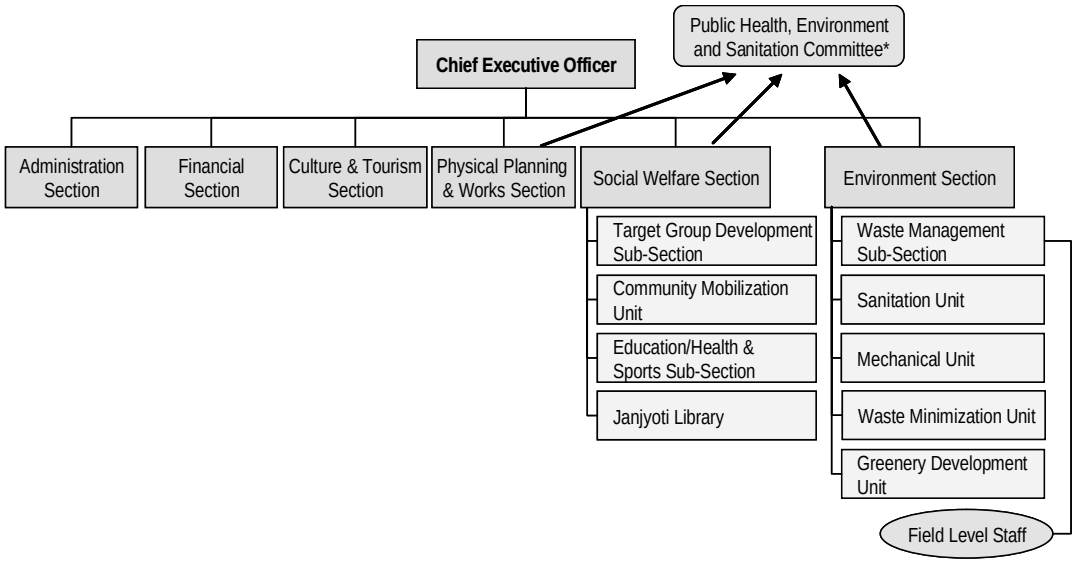


Figure 5.3-2 Newly Approved Organizational Structure of BKM SWM Related Sections and Sub-Sections

Source: BKM, 2005

2) Managerial Practices

SWM activities in BKM have for long been compartmentalized under the responsibility of the Sanitation Sub-Section. SWM tasks concentrate on waste collection, street cleaning,

and operation of the Bhaktapur Composting Facility and the Paper Recycling Factory. Since BKM does not operate any large-scale SWM facilities, such as landfill site, nor have any community mobilization program, not many other sections of the municipalities are involved in SWM. However, within the last few years, BKM has become more active in promoting the development of a sanitary landfill site in Taikabu and more recently in the expansion of the Bhaktapur Composting Facility. Under the leadership of the CEO, the Planning and Technical Section Staff (now Environment Section) are playing key roles together with the Social Welfare and Sanitation Section (now Social Welfare Section). For the expansion of the Bhaktapur Composting Facility, two committees were formed: one for land acquisition for the new facilities and the other for technical assessment. Both committees report directly to the Municipal Board.

BKM had a very active Public Health, Environmental and Sanitation Committee operating under the Municipality Board. This committee, consisting of Municipal Board Members, performed as a forum to deliberate policy and operational matters related to public health, the environment and sanitation issues. In addition, during the fiscal year 2003 to 2004, the Committee received its own budget to introduce SWM public education activities in support of school programs and nighttime literacy classes. This Committee, as in other municipalities, stopped activities when the politically appointed Ward Chairpersons stepped down in May 2004.

(2) Human Resources

The total number of SWM related staff under the Social Welfare and Sanitation Section is 219 persons, or about 50% of all municipal staff. The breakdown of human resources is as follows:

Table 5.3-11 SWM Related Staff of the Social Welfare and Environment Sections

Staff Category	Number of persons
Sweepers (permanent staff) including toilet cleaners, drainage cleaners, vendor control, cemetery	48
Sweepers (contract base staff)	57
Waste Collectors (Tipan Tapan)	47
Employees for Composting Facility	16
Waste Loaders	20
Drivers	11
Senior Inspectors	17
Registration	1
City Inspector (Sub-Section Chief)	1
Officer (Social Welfare Section Chief)	1
Total	219

Source: BKM, 2005

1) Senior Officers and Mid-Level staff

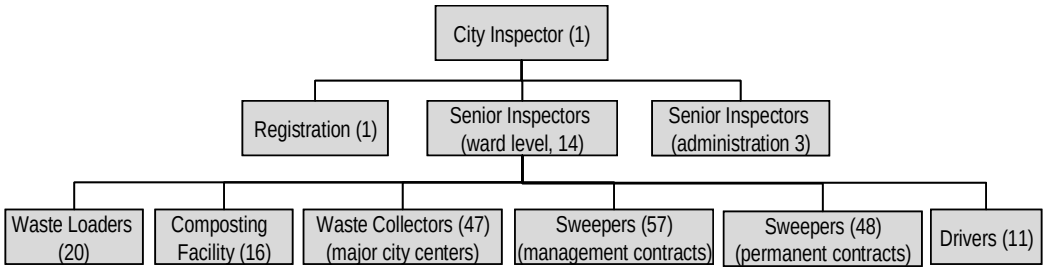
The Chief of the Social Welfare and Sanitation Section has been well trained in management skills but does not have a SWM technical background. BKM's Planning and Technical Section is well staffed with three engineers, of which one is a sanitation engineer. With the organizational restructuring and the recent municipal prioritization of SWM facilities development, closer cooperation is expected between the two sections.

The head of the Sanitation Sub-Section is a graduate of the six-month UDLE SWM Training Program, and has been trained in various cleaning and public health programs. On the other hand, the Ward Inspectors, although many are well educated and some hold university degrees, do not have adequate comprehensive knowledge about SWM issues.

2) Field Level Staff

BKM has several unique features in its field level SWM staff. First of all, out of the 105 sweepers, 57 sweepers are employed on contract basis covering 12 out of 17 wards. The sweepers assigned at the ward level mainly conduct street cleaning and transportation of waste to the collection stations. Some sweepers have other specific duties such as cleaning of public toilets or sewerage/rain drainage cleaning. Both permanent status sweepers and contract-based sweepers usually are working in two shifts (4:30 to 7:30, 16:30 to 20:30).

In addition, BKM has hired a troop of waste collectors, namely *tipan tapan* who go around the major streets and tourist areas to pick up littered waste with their carts and brooms. Waste collectors are organized into two groups with different shifts, and ensure that the main streets are cleaned at all times of the day. Figure 5.3-3 summarizes the structure of BKM field staff.



Note: ( ) shows number of staff

Figure 5.3-3 Structure of BKM Field Level Staff

Source: BKM, 2005

5.3.8 Financial Condition

BKM estimates direct expenditure for SWM services as shown in Table 5.3-12.

Table 5.3-12 Expenditures for SWM in BKM

Fiscal Year (Nepalese Year)	Budget for SWM	Actual Expenditures for SWM	
	(Rs)	(Rs)	% of Total Actual Municipal Expenditures
2000/01 (2057/58)	16,115,000	13,315,325	14 %
2001/02 (2058/59)	17,400,000	14,854,949	12 %
2002/03 (2059/60)	15,600,000	14,867,440	13 %
2003/04 (2060/61)	16,180,000	14,851,000	12 %

Source: BKM TWG members, 2004

BKM spent 12-13% of the total municipal expenditure on SWM services. This percentage is not very high compared with that of KMC (30-35%) and LSMC (25%) at this moment.

5.4 Madhyapur Thimi Municipality (MTM)

5.4.1 Outline of MTM

Madhyapur Thimi Municipality (MTM) was established in 1998 forming together with five contemporary VDCs. The municipality is spread over an area of about 11 km^2 and it is divided into 17 wards administratively (see Appendix 5.1). Due to very few chances of job opportunities within the municipal area, many of the indigenous people migrated out from MTM to mega cities nearby during the 1980s and early 1990s. But after declaration of MTM as a Municipality, employment opportunity increased within the municipality with the urbanization, and as in KMC and LSMC, more and more people migrated to MTM.

The municipal population was estimated at near 50,000 in the 2001 census with a 2.6% annual growth rate calculated from the 1991 census. But the current population growth rate of the municipality can be considered to be very high as with the rest of the Kathmandu Valley due to the national political situation in the last five years, and this trend will continue at least for the next ten years. Based on the discussions in different talk programs and seminars in Nepal, the scenario of MTM is expected to produce high pressure toward rapid urbanization due to both the proposed new Banepa-Sindhuli corridor and limitation of housing plots remaining in KMC and LSMC. Especially, Wards 15, 16 and 17 recorded remarkable population growth with an increase in the range of 150-370% over ten years.

Most of the lands within the municipality are virgin and are used for farming purposes which accounted for about 80% of the total municipal area as per the 1991 census. But due to rapid urbanization the land use pattern is changing drastically from agricultural to residential. In the last two years, the municipality has declared about 0.15 km^2 of agricultural land for land pooling to be converted into organized dwelling units.

5.4.2 Waste Generation and Stream

(1) Waste Quantity

TWG members of MTM summarized the current situation of waste quantity as follows.

Population:	47,751 (2001 census)
Total Waste Generated:	14.36 tons/day (0.3 kg/day-capita)
Monthly Production:	429.7 million tons
Annual Production:	5,157,108 tons

The JICA Study Team conducted a waste quantity survey in MTM, with five samples from households and three samples from commercials and offices. The sampling dates were April 16 and 17, 2004, Friday and Saturday. The result of the survey for households is shown below. About 0.9 L of waste with 170 to 221 g/L of bulk density is generated per capita day on weekdays and weekend respectively.

Table 5.4-1 Result of Daily Waste Generation Quantity Survey of Households (MTM: Dry Season)

Income Level	Weekdays			Weekends		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
Average	153	0.9	170	199	0.9	221

Source: JICA Study Team

It was observed that a 0.4 to 2.5 kg/day of waste was generated with 270 to 360 g/L of bulk density from a ward office.

The second waste quantity survey in the wet season was conducted in MTM in September 2004. 50 households and 15 commercials were sampled. The result of this detail waste quantity survey of households in MTM is shown in Table 5.4-2.

Table 5.4-2 Result of Daily Waste Generation Quantity Survey of Households (MTM: Wet Season)

Income Level	Weekdays			Weekend		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
High	178	0.8	219	193	0.8	235
Middle	151	0.8	200	150	0.8	193
Low	176	1.0	178	180	1.1	161
Average*	161	0.8	198	165	0.9	192

Note: * This is the average for only the surveyed households, it does not reflect the actual dispersion of income level
Source: JICA Study Team

Figure 5.4-1 shows the frequency distribution of the unit generation rate (UGR) of surveyed households at different income levels. A large peak of unit generation rate for surveyed households for each income level is shown on around 50 to 100 g/day-capita and a small peak on around 250 to 350 g/day-capita. There is no household who generates waste of more than 600 g/day-capita.

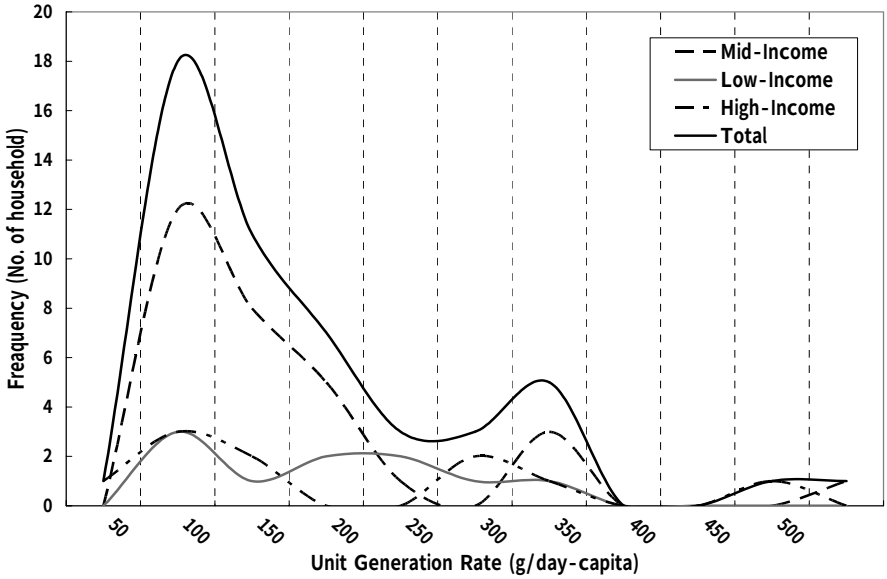


Figure 5.4-1 Frequency Distribution of UGR of Households in MTM

Source: JICA Study Team

(2) Waste Quality

Waste quality given by TWG members of MTM and as surveyed by the Study Team is shown in the following table.

Table 5.4-3 Waste Quality (MTM)

Items	Households			Commercial
	MTM data	Study		
		Dry Season	Wet Season	Wet Season
Kitchen waste	74%	74.0% (94.4%)	85.6% (82.6%)	70.5% (73.7%)
Paper	6%	11.7% (0.7%)	5.9% (8.6%)	13.9% (13.1%)
Textile	1%	0.5% (0.3%)	0.8% (0.6%)	5.8% (6.5%)
Wood/leaves	-	2.0% (0%)	1.9% (0.3%)	0.0% (0.8%)
Plastic	5%	6.1% (4.0%)	5.2% (6.2%)	9.2% (5.5%)
Rubber/leather	-	0% (0%)	0.0% (0.0%)	0.0% (0.1%)
Metal	3%	0.5% (0%)	0.2% (0.8%)	0.4% (0.0%)
Glass	2%	5.1% (0.7%)	0.1% (0.6%)	0.0% (0.0%)
Ceramics	-	0% (0%)	0.0% (0.0%)	0.0% (0.0%)
Others	9%	0% (0%)	0.4% (0.2%)	0.2% (0.4%)
Bulk density	-	176 g/L (221 g/L)	198 g/L (192 g/L)	162 g/L (295 g/L)
Water content	-	41% (57%)	60% (65%)	52% (64%)

Note: Lower numerical value in parenthesis is data on weekends and upper on weekdays
Source: JICA Study Team, May 2004 for Dry Season, June 2005 for Wet Season

5.4.3 Collection and Transportation

MTM does not have any motorized vehicles for solid waste management except four rickshaws and 17 handcarts. A total of 20 municipal sweepers collect waste, about 5 tons per day according to TWG members, from 6:00 a.m. and complete work by 10:00 a.m. everyday from the main streets in the municipality. Due to shifting to night/early-morning collection, municipal sweepers and private sectors collect the waste within the designated collection time since February 2005.

Two private sectors are conducting door-to-door collection without any consultation with MTM in Wards 15, 16 and 17. They charge about Rs 100 per household per month and collect the waste once a day. In addition to these private sectors, since June 2005, two more private sectors have started waste collection services in the municipal area. For this, MTM has recently prepared a draft guideline for the agreement with these private sectors to try to manage their activities appropriately.

5.4.4 Solid Waste Minimization Activities

(1) Composting

MTM has promoted home and community-based composting activities in which a total of 84 compost bins/drums have been distributed as shown in Table 5.4-4. MTM, with support from NGOs and GTZ/UDLE, has also provided people with training sessions on how to make compost.

Table 5.4-4 Distribution of Home/Community-based Composting Activities supported by MTM

Target	Compost bin/drum	Number	Cost
Women's Group in Ward 1	200 liter drum	10	1,500 Rs/drum
Ward Office	200 liter drum	1	-
Private School	50 liter pottery bin	20	600 Rs/bin
Government School	200 liter drum	11	-
Ward 8	100 liter plastic bin	42	350 Rs/bin (subsidized rate)

Source: MTM Task Force

At the community level, a NGO proposed a compost chamber, which is similar to one installed in Jorpati VDC in KMC. To that end, in March 2003, MTM constructed two compost chambers as briefly described in Table 5.4-5. However, one chamber at Ward 13 operated for only three months and has stopped because of structural defects such as weak beams damaged by load of the waste in the chamber. Another compost chamber between Wards 10 and 11 has been lying idle because of failure to collect separated organic waste due to lack of awareness and understanding of the residents for payment for waste collection service fee to the NGO.

Table 5.4-5 Composting Chambers in MTM

No.	Items	Contents
1.	Composting method	Compost chamber 
2.	Starting time	March 2003
3.	No. of constructed chambers	Two
4.	Dimensions and structure of the chamber	2.5 (width) x 2.5 (depth) x 4 (height), brick structure
5.	Effective capacity	2.5 (width) x 2.5 (depth) x 2.5 (height), About 15 m^3 (volume)
7.	Composting duration	Expected two to three months
8	Capacity per chamber	For 1,000 persons, About 0.5 t/day
9.	Operation & maintenance	NGO（Plan International）
10	Selling price	Members of community: free Others: 6 Rs/kg

Source: JICA Study Team

(2) Recycling

It is reported by MTM that there are no kabadi shops within the Municipality. Independent recyclers take away recyclable materials to kabadi shops located outside of MTM.

A NGO, Samyukta Mahila Uthan Samitee (Integrated Women's Upliftment Committee) has been implementing cleaning and improving sanitary activities including sweeping, composting, and segregation and recycling of waste.

5.4.5 Final Disposal

The waste collected is disposed of by open dumping in open spaces, and along the rivers flowing through the municipality such as the Manahara River bank. Before start of the Pilot Project of collection and transportation, there was no mechanized collection and transport system of the waste (2 tricycles are used) and the collected wastes have been dumped in the vicinity of the living area by the inhabitants and the sweepers. There are about 5-6 main locations where dumping is observed.

5.4.6 Social Aspects

(1) Major Findings of Household Behavior and Attitude Survey on SWM[7]

1) Priorities of Public Services

Waste collection was ranked as the top priority (35% of sample HHs) regarding public services and utilities for improvement in MTM, followed by water supply (30%) and drainage/sewerage (10%). It could be assumed that insufficient collection services or no fixed final disposal site within MTM made the respondents feel seriously concerned about SWM.

2) Waste Disposal and Management

As indicated by almost 60% of sample HHs, open dumping on roads or vacant land, or on the banks of streams and rivers was the most prevalent practice adopted in MTM. Composting (23%) and open combustion (22%) were also popular disposal practices (See Table 5.4-6). About half of those who were dumping waste outside the house responded that they followed this practice because it had been a long practice among their family. Neither door-to-door service nor collection containers were available and this was another reason for open dumping. Female adult members were mostly responsible for handling waste as well as taking out waste for disposal. As 18% of sample HHs reported, children were also involved in handling waste. Regarding taking waste out the house, other members than the female adult also took this role. The majority of HHs disposed of waste once a day or every 2-3 days. A total of 84% of sample HHs stored waste in the backyard and 14% of HHs put it in the kitchen. The nature of the place for waste storage in MTM was very similar to that of KRM. Plastic bags were the most popular containers (almost 60% of sample HHs), followed by baskets (26%).

Table 5.4-6 Waste Disposal Practice among HHs Surveyed (MTM)

Sample HH nos.	74#	147%
Dispose of waste by door-to-door collection service	8	11%
Dispose of waste by putting into Municipal or Communal Container	5	7%
Dispose of waste at Municipality's designated disposal site	13	18%
Dispose of waste by open dumping out side the house	44	59%
Dispose of waste by open combustion	16	22%
Dispose of waste by burying in the ground	5	7%
Dispose of waste by Composting	17	23%
Dispose of waste by giving it for recycling	1	2%
Dispose of waste by using as animal feed	-	0%

Note: Considering more than one method was given by the respondents, the summation of responses exceeds 100%.

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey of Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

[7] In MTM, 5 out of 17wards were selected based on the core area, sub-core are and fringe area. A total of 75 sample HHs were selected.

3) Existing Waste Collection Services

The proportion of those who received service and used it remained at a low of 35% of sample HHs. A total of 64% of HHs have expressed their need to have such services. Regarding the mode of waste collection, carrying to a specific site (54% of respondent sample HHs) and door-to-door collection services (31%) were prevailing. All of those who received door-to-door collection services responded that such services were provided by the municipality. Waste collection services were mostly available more than 4 times per week (35% of respondent sample HHs) and daily (42%). A negligible 3% of HHs surveyed responded that they paid for services. It was noted that this proportion was the lowest among the five municipalities. That is because MTM has not introduced a payment system. In addition, there seemed to be a limited number of NGOs which provide collection services with payment.

Table 5.4-7 Availability and Use of Waste Collection Service in MTM

Sample HH nos.	74#	100%
Service available and used	26	35%
Service available and not used	0	0%
Service not available but required	47	64%
Service neither available nor required	1	1%

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey of Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

4) Waste Reduction and Recycling

About 30% of sample HHs responded that they have knowledge about separation and actually separate waste, mostly into two categories. Close to 40% of HHs responded that they have knowledge but are not practicing separation. Further, the remaining 30% of HHs neither had knowledge nor practiced source separation of waste. This proportion was the second highest, behind that of KRM. However, there was a relatively positive attitude towards source separation. Around 16% of HHs were willing to cooperate for source separation. Furthermore, 64% of sample HHs responded that they were somewhat willing to do so. Regarding the unwillingness to cooperate, the following reasons were included; a) inconvenient and difficult to separate, b) taking too much time to separate and c) not clear on benefits of recycling system. The disposal practice for recyclable materials in MTM was very similar to that of KRM. More than half of sample HHs responded that they did not sell recyclable materials. Similarly they noted that buyers rarely visited their houses for collecting these materials. Only 16% of sample HHs noted that they sold their recyclable materials to the buyer. A total of 24% of HHs did not sell these materials although buyers visited the house. The major items collected for sale were glass and papers. The kitchen waste was also sold to the buyer who visited the house.

A total of 66% of sampled HHs responded that they have knowledge about making compost. The source of knowledge on compost making was as follows; a) NGOs/CBOs (35%), b) residents themselves (29%), c) the municipality (20%), d) private (10%), and e) others (6%). However, only one fourth of the sampled HHs responded having actual experience in making compost. With regard to the methods for making compost, both using containers/compost bins (47% of respondent sample HHs) and composting in open spaces/organic fields (53%) were reported. It could imply that composting has become popular in MTM through different initiatives taken by various stakeholders. The majority of those who had no

experience have shown a positive attitude towards making compost. In other words, the proportion of those who were not willing to make compost was 22%, which was the lowest among the five municipalities. There seemed to be high interest in compost making among residents in MTM. A total of 12 HHs have illustrated the major reasons for unwillingness to compost as follows; a) inconvenient and difficult to compost (25% of respondent sample HHs), b) taking too much time as we have no time (25%) and c) not clear on necessity of composting (25%).

5) Public and Community Involvement

Close to 50% of sample HHs responded that they themselves should be responsible for SWM. A total of 32% of HHs considered that SWM was the duty of the Municipality. Almost 20% of HHs had the perception that private companies should take responsibility for SWM (See Table 5.4-8). A negligible 1% of HHs actually took initiatives towards SWM. On the other hand, 93% of HHs showed willingness to pay if services are available. It implied that the majority of sample HHs have felt a desperate need for effective collection services. A total of 4% of HHs reported that they have been already paying. A negligible 3% of HHs reported that they were not willing to pay. The majority of HHs could afford to pay Rs 11-30 per month (64% of sample HHs), followed by less than Rs 11 (19% of HHs). Only 16% of sample HHs have participated in CBOs' activities in SWM. However, the majority of HHs surveyed considered that these CBOs' activities related to SWM were necessary or somewhat necessary. Those who showed a positive attitude would like to participate in the following activities; a) any activities related to SWM, b) waste collection in the community, and c) awareness campaign.

Table 5.4-8 Perception of Responsibility for SWM in MTM

Sample HH nos.	74#	100%
Government/Ministry of Local Dev.	2	3%
Municipality	24	32%
Sweepers	1	1%
Yourselves	34	46%
Our Communities/CBOs	0	0%
Private Company	13	18%
NGO	0	0%
Do not know	0	0%
Others	0	0%

Note: Considering more than one answer given by the respondents, the summation of responses exceeds 100%.
Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

(2) Municipality's programs regarding community mobilization on SWM

Since MTM is one of the newly-established municipalities with a small number of staff, the Community Development and Sanitation Section (CDSS) is partially in charge of the community mobilization for SWM. To date, CDSS has promoted a few small-scale SWM activities with the support of GTZ/UDLE. They include clean up programs, training on composting, and environmental education for school teachers. In 2002, MTM allowed one NGO to construct two community composting chambers and to form two user groups named Community-Based SWM Committees covering Wards 13 and 14, as well as Wards 8 and 10.

Unfortunately, these two chambers did not function four months after construction due to technical problems. There were other reasons as follows; a) lack of technical support for these Committees from this NGO or MTM, b) insufficient social mobilization process including awareness program before constructing chambers, and c) poor communication and coordination among stakeholders.

(3) NGOs/CBOs' Programs regarding Community Mobilization in SWM

Several NGOs/CBOs' activities focusing on awareness, clean up programs and composting have been observed in MTM. The summary of such activities is indicated below.

Table 5.4-9 Major NGOs/CBOs Working in the Field of SWM in MTM

Name of NGOs/CBOs	Year of foundation	Number of staff	Working Areas
Samyukta Mahila Uthan Samittee*	1993	30-35 volunteers	Awareness, composting (210 HHs), Bucket distribution (120 HHs) with support of World Vision, Clean up program in Ward 1
Innovative Idea	2000	10	Paper recycling in collaboration with ECCA
JESIS	NA	NA	Bucket distribution in Ward 7 (135 HHs)
World Vision	2000	150	Bucket distribution through Samyukta Mahila Uthan Samittee in Ward 1 (120HHs), Community-based sanitation activities including distribution of buckets in Wards 1, 2, 3, 4, 6, 8, 10, 13, 14
Self-help group of chapacho	NA	NA	Clean up in Ward 10
Child club of pobu & woman's group of pobu	NA	NA	Clean up program, plantation after cleaning open disposal site in Ward 9
Nave chatrodaya pustkalaya	NA	NA	Small scale training in SWM
Community-based SWM Committee in Wards 13&14	2003	2	Collection of separated waste, management of community chambers in Wards 13 &14 (Since March 2004, their activities have been halted.)
Community-based SWM Committee in Wards 8&10	2003	2	Collection of separated waste, Management of community chambers in Wards 8&10 (Since March 2004, their activities have been halted.)

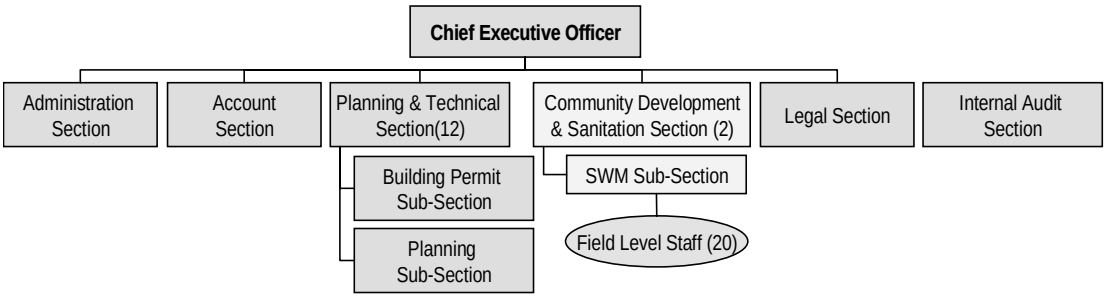
Note: * According to MTM, there is a coordination with MTM at a program/activity level.
NA means not available.
Source: JICA Study Team, 2004 "Interview and Questionnaire Survey of Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

5.4.7 Managerial Condition

(1) Organizational Structure and Managerial Practices

1) Organizational Structure

MTM has only a short history as a municipality. In 1997, MTM was formed combining five surrounding VDCs. MTM's municipal organizational structure is still in its nascent stages.



Note: ( ) shows number of staff

Figure 5.4-2 New Organizational Structure of MTM SWM Related Sections

Source: MTM, 2005

In principle, the Community Development and Sanitation Section (CDSS) has a responsibility in regards to sanitation activities within the municipality and manages 20 sweepers. This organizational arrangement may be a reflection of MTM's vision that SWM should be resolved through community level initiatives. Among other activities, CDSS provides community-level training and awareness raising sessions on SWM, with a special focus on composting. It also supports the activities of community level compost chamber committees. Sometimes resource persons from UDLE are invited as community motivators. More and more, the Planning and Technical Section is being involved in SWM issues, especially on formulation of long-term strategies and facilities planning.

More recently, with the support of the Pilot Projects under the Study, a new organogram was introduced where a SWM Sub-Section was established under the CDSS. The new structure is operationally in practice, but awaits official approval from the Municipal Council in July 2005.

2) Managerial Practices

MTM has experienced various community level initiatives to address SWM issues. Aside from the community compost chamber scheme, which was attempted in two communities, CBOs in Wards 1, 10 and 13 promoted composting and recycling. Although the results of these community level activities have been uneven, there appears to be a common appreciation within the municipality for a community-based approach to SWM. Such tendency could be observed at all levels of the municipal hierarchy starting with the former Mayor and other high level officials to field level staff.

Despite this common vision for SWM, the municipality is not equipped to sufficiently support the various community-level activities. CDSS as well as the Planning and Technical Section are grossly understaffed and staff are spread thin over a multitude of responsibilities. Close linkages with the political appointees, and their immediate involvement in operational issues have resulted in taking away authority regarding program planning and operations from operational level staff. This aspect appears to be alleviated under the recent leadership of the CEO.

(2) Human Resources

MTM is suffering from a shortage of human resources. It has only three officers among 85 staff of whom only one is a technical officer.

No specific post exists for SWM technicians; nevertheless, the CDSS Chief and Planning and Technical Section Chief have accepted SWM responsibilities as part of their portfolios. Neither has any specific background in SWM. Within CDSS, a graduate of a UDLE SWM training course has returned from a one-year deputation to a ward level office. With the establishment of the new SWM Sub-Section under CDSS, it is expected that new staff would be recruited, however to date; the same two staff from CDSS are functioning as staff of the SWM Sub-Section.

At the field level, MTM manages 20 sweepers who are responsible for sweeping the main roads. These sweepers provide services to the major roads within MTM and transport waste to dumping sites within the municipality's premises.

5.4.8 Financial Condition

MTM prepared budget for direct expenditure incurred by SWM services as shown in Table 5.4-10. MTM spent only 2-3 % of total expenditure on SWM.

Table 5.4-10 Budget on SWM in MTM

Fiscal Year	SWM Budget (R)	% in Total Municipal Budget
2001/02 (2058/59)	650.000	3.1%
2002/03 (2059/60)	300,000	2.0%
2003/04 (2060/61)	550,000	2.6%

Source: MTM Task force

5.5 Kirtipur Metropolitan City (KRM)

5.5.1 Outline of KRM

Kirtipur Municipality (KRM) whose altitude is ranging from 1,284 m to 1,524 m above mean sea level is situated in the south-western part of Kathmandu District. The municipality was established in 1997, combining eight contemporary VDCs. Total area of the municipality is 14.76 km^2 divided into 19 wards administratively (see Appendix 5.1).

According to the 2001 census, 40,835 people lived in 9,487 households within the municipal area in 2001. It is estimated that population growth rate of the municipality would be annually 2.07% in coming ten years of 2001-2011, which is the lowest within the five municipalities.

"Kirtipur" means "City of Honor", and a row of old houses built by adobe brick and old Newal temples are still creating the quiet town, where the people are living with traditional Newal culture life. Surrounding of the town area, there are agriculture lands spreading in the Southern part of the municipality. At the entrance of the municipality from KMC, Tribhuvan University is located, which was founded in 1959 and is the first university and the pioneer institute of higher education in Nepal. In Chobhar, located in Southern part of KRM, there was a Himal cement factory with quarry.

5.5.2 Waste Generation and Stream

(1) Waste Quantity

TWG members of KRM summarized the current situation of waste quantity as follows.

Waste Unit Generation Rate:	0.3 kg/day-capita
Total Waste Generation:	12.25 tons/day

The JICA Study Team conducted a waste quantity survey in KRM with very small sample numbers, which were five households and three commercials. The result of the waste quantity survey of households in KRM is shown below. Less than 0.5 liter of waste with 205 to 215 g/L of bulk density is generated per capita day on average.

Table 5.5-1 Result of Daily Waste Generation Quantity Survey of Households (KRM: Dry Season)

Income Level	Weekdays			Weekends		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
Average	86.0	0.4	215	61.6	0.3	205

Source: JICA Study Team

From commercial areas, it was observed that 3.5 to 8.2 kg/day was generated from each surveyed restaurant with 190 to 410 g/L of bulk density. From a selected office which was the bank, 0.7 to 2.0 kg/day of waste were generated with 180 to 220 g/L of bulk density. From a store, 0.8 kg of waste with 380 g/L of bulk density was generated on both weekdays and weekends.

The second waste quantity survey in wet season conducted in KRM in September 2004, sampled 50 households, and 15 commercials as well as MTM. The result of this detail waste quantity survey of households in MTM is shown in Table 5.5-2.

Table 5.5-2 Result of Daily Waste Generation Quantity Survey of Households (KRM: Wet Season)

Income Level	Weekdays			Weekend		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
High	119	0.7	165	133	0.8	165
Middle	161	0.9	186	169	0.8	212
Low	150	0.8	187	131	0.8	160
Average*	150	0.8	182	154	0.8	187

Note: * This is the average for only the surveyed households, it does not reflect the actual dispersion of income level
Source: JICA Study Team

Figure 5.5-1 shows the frequency distribution of the unit generation rate (UGR) at different income levels of surveyed households. A large peak of UGR for surveyed households for

each income level is shown around 50 to 200 g/day-capita and a small peak around 350 to 400 g/day-capita. There is no household that generates waste more than 500 g/day-capita.

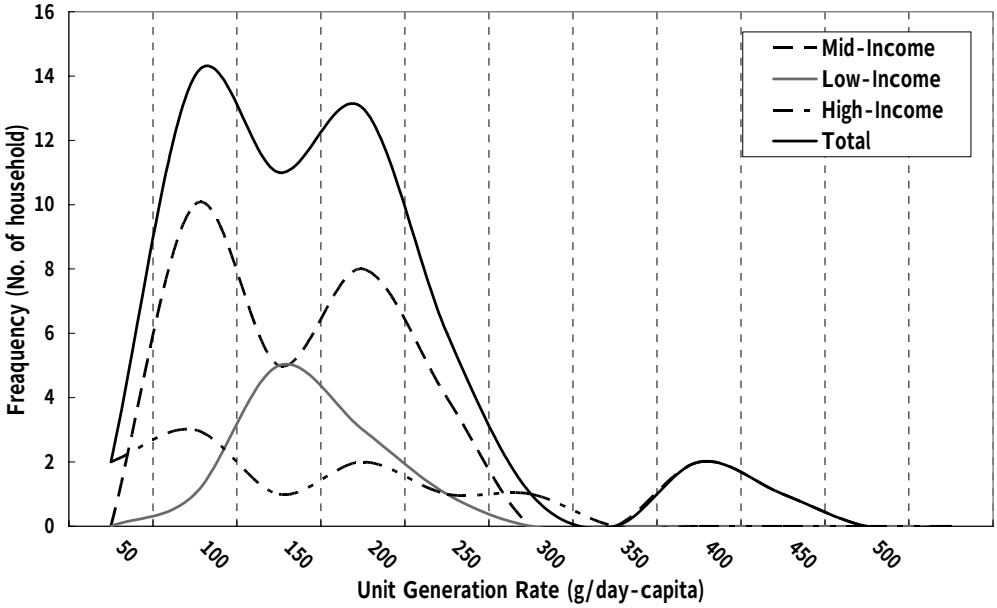


Figure 5.5-1 Frequency Distribution of UGR of Household in KRM

Source: JICA Study Team

(2) Waste Quality

Waste quality given by TWG members and as surveyed by the JICA Study Team is shown in the following table. From households, more than 70% is kitchen waste and plastic is around 10%. The organic portion from commercial establishments is high, almost the same as households.

Table 5.5-3 Waste Quality (KRM)

Items	Households			Commercial**	
	KRM data	Study			
		Dry Season	Wet Season	Dry Season	Wet Season
Kitchen waste	74.24%	86.7% (77.4%)	79.2% (82.7%)	74.2% (86.5%)	73.1% (79.4%)
Paper	5.72%	3.3% (3.2%)	5.2% (6.9%)	6.5% (9.0%)	15.4% (11.0%)
Textile	1.92%	3.3% (6.5%)	1.6% (1.3%)	0.8% (0%)	0.8% (3.0%)
Wood/leaves	0.09%	0% (3.2%)	2.8% (0.6%)	7.3% (0%)	0.4% (0.0%)
Plastic	8.83%	6.7% (9.7%)	6.6% (5.3%)	8.9% (3.7%)	9.6% (4.7%)
Rubber/leather	0.96%	0% (0%)	0.0% (0.0%)	0% (0%)	0.1% (0.0%)
Metal	1.94%	0% (0%)	0.4% (0.5%)	0.8% (0.2%)	0.5% (0.3%)
Glass	2.91%	0% (0%)	3.8% (2.7%)	1.6% (0.5%)	0.0% (0.0%)
Ceramics	-	0% (0%)	0.0% (0.0%)	0% (0%)	0.0% (0.0%)

Items	Households			Commercial**	
	KRM data	Study			
		Dry Season	Wet Season	Dry Season	Wet Season
Others	3.39%*	0% (0%)	1.2% (0.0%)	0% (0%)	0.0% (1.6%)
Bulk density	225 g/L	215 g/L (205 g/L)	182 g/L (187 g/L)	143 g/L (269 g/L)	116g/L (243g/L)
Water content	-	57% (65%)	65% (65%)	59% (71%)	52 % (64%)

Note: Lower numerical value in parenthesis is data on weekends and upper on weekdays
Total value of each composition is not always 100% because each one was rounded off.
* Includes batteries
** Commercial data in dry season is only from hotels and restaurants
Source: JICA Study Team, May 2004 for Dry Season, June 2005 for Wet Season

5.5.3 Collection and Transportation

KRM is not directly involved in solid waste collection, transportation and dumping. It had entered into a contract agreement under a Public Private Partnership arrangement with a CBO, UNIQUE, for managing solid waste in Wards 3 and 17 (Naya Bazar) in the municipality since 1998, but the contract expired in 2003. Under the contract, necessary equipment had also been lent to UNIQUE for management. UNIQUE purchased their own tractor. In addition to Naya Bazar, solid waste is also collected from Ward 16 (Na Gaon), Wards 9, 10, 11, 12 (Panga) and Ward 5 (Khasi Bazar), serving about 2,000 households. Other than UNIQUE, an NGO, National Environment Pollution Control (NEPCO), also provided door-to-door collection service in KRM using a tractor and two rickshaws. NEPCO provided services for about 1,000 households in Wards 1, 2, and 3. Together the organizations have been collecting only 30 to 40% of the total wastes generated in KRM and are transporting them to the right bank of the Bagmati River with a collection charge to residents, which is Rs 30 to 110 depending on the generation volume. However, recently, NEPCO has withdrawn from the waste collection service in KRM and UNIQUE is covering some areas which used to be covered by NEPCO. UNIQUE has also shifted its collection services to night/early-morning collection due to the government policy change regarding solid waste management in February 2005.

Table 5.5-4 shows the result of the Time and Motion survey conducted by the JICA Study Team on April 21, 2004 on one selected route. At the moment, three or four trips from generation sources to the final disposal site are implemented per day.

Table 5.5-4 Result of Time and Motion Survey in KRM

Vehicle	Average Collection/ Dumping Time in min	Total Distance Travel in km	Average Speed of Vehicle in moving km/hr	Average Speed of vehicle*	Return Distance in km	Average Speed on Return km/hr	Total Time for One Trip in min
Tractor	6.3	5.4	6.9	2.9	2.8	11.1	68.4

Note: *This includes collection and dumping time
Source: JICA Study Team

5.5.4 Solid Waste Minimization Activities

In KRM, conventional home composting activities known as “Noga” or “Saga” are still common in some areas. A few NGOs have promoted home composting activities by using

compost bins in Wards 3, 12 and 13. In addition, home composting activities by using 100 liter compost bin have also recently started to be promoted in Wards 1, 5, 14 by KRM through the Pilot Project.

In the year 2001, in the Ward 3, UNIQUE temporarily operated a community composting facility using a field heaping method. Nevertheless it ceased after only one year mainly due to odor problem. Making good use of their experience, a new composting facility with door-to-door collection service has been proposed by NGOs and is under review of the municipality. KRM reported that there are no kabadi shops within the Municipality. Independent recyclers take recyclable materials to kabadi shops located outside of the Municipality.

5.5.5 Final Disposal

Waste collected in KRM is open dumped on the western bank of the Bagmati River near the site being operated by KMC as of June 2005. KRM does not have any staff assigned at the disposal site. Some waste pickers are observed at the dumping site. Once or twice a month, the municipality covers the waste at the site. Some open dumping areas are observed within the municipality. However, KRM has a plan to transport their waste to Sisdol S/T-LF through Teku T/S in collaboration with KMC, when Valley 1 of Sisdol goes to full-scale operation.

5.5.6 Social Aspects

(1) Major Findings of the Household Behavior and Attitude Survey on SWM[8]

1) Priorities of Public Services

A total of 20% of sample HHs gave the third priority to waste collection regarding public services and utilities for improvement. Water supply was ranked as the first priority (35%), followed by drainage/sewerage (25%).

2) Waste Disposal and Management

A total of 56% of sample HHs in KRM responded that they disposed of their waste by door-to-door collection services. Further, combustion (35%) and open dumping outside the house (23%) were still popular disposal practices. These practices were observed in MTM as well. Most of the 17 HHs were dumping their waste on the banks of streams and rivers, on vacant land or on farmland. The major reason for open dumping was that no door-to-door services were available. Female adults (67% of sample HHs responded) and children (29%) were more responsible for handling waste. Further, female adults (65% of sample HHs) and other members of family (31%) were in charge of taking out waste for disposal. Almost 60% of HHs were disposing waste once every 2 or 3 days while 33% of HHs were doing it once a day. The majority of HHs used the backyard for waste storage (almost 84%) and the remaining HHs used the kitchen. This was very similar to MTM. Compared to the other three municipalities i.e. KMC, LSMC and BKM, there was more

[8] In KRM, 3 out of 19 wards were selected based on the core area, sub-core are and fringe area. A total of 75 sample HHs were selected.

space available within and near the houses. Plastic bags were one of the most popular containers (64% of sample HHs), followed by metal/plastic/wood bins (20% of HHs).

Table 5.5-5 Waste Disposal Practice among HHs Surveyed (KRM)

Sample HH nos.	75#	133%
Dispose of waste by door-to-door collection service	42	56%
Dispose of waste by putting into Municipal or Communal Container	2	3%
Dispose of waste at Municipality's designated disposal site	1	1%
Dispose of waste by open dumping out side the house	17	23%
Dispose of waste by open combustion	26	35%
Dispose of waste by burying in the ground	4	5%
Dispose of waste by Composting	8	11%
Dispose of waste by giving it for recycling	0	0%
Dispose of waste by using as animal feed	0	0%

Note: Considering more than one method given by the respondent, the summation of responses exceeds 100%
Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

3) Existing Waste Collection Services

The ratio of those who could receive service and used it remains at 56% of sample HHs. This proportion was the second lowest among the five municipalities. Almost 30% of HHs expressed their need to have such services. Regarding the mode of waste collection, door-to-door collection services were prevailing among HHs surveyed. A total of 73% of respondent sample HHs noted that they received door-to-door collection services from NGOs/CBOs. Although KRM has not directly provided such services, and contracted out them to NGOs/CBOs, some of HHs mentioned the municipality and private companies as service providers. Door-to-door collection services were likely to be provided irregularly, as 40% of respondent sample of HHs noted. Close to 30% of those who received such services noted that they were available 2-3 times per week. There seemed to be some room for improvement in terms of collection services provided by CBO and NGO. A total of 57% of HHs surveyed said that they paid for services. Almost 80% of them reported that they were somewhat satisfied with these services. Only 9% of those who paid for services were very much satisfied. Except those who were very satisfied, 39 HHs described the main reasons for less satisfaction as follows; a) services were not properly done (31%), b) services were irregular (23%), and c)frequency of services was too low (21%).

Table 5.5-6 Availability and Use of Waste Collection Service in KRM

Sample HH nos.	75#	100%
Service available and used	42	56%
Service available and not used	6	8%
Service not available but required	23	31%
Service neither available nor required	4	5%

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

4) Waste Reduction and Recycling

Almost 27% of sample HHs responded that they have knowledge about separation and actually separate waste, mostly into two categories while about 19% of HHs responded that

they have knowledge but are not practicing separation. It was noted that 32% of sample HHs neither had knowledge nor practiced source separation of waste. This proportion was the highest among the five municipalities. There seemed to be a limited program related to awareness and education programs in KRM. Almost half of sample HHs were willing to cooperate for recycling. On the other hand, 13% of sample HHs had no willingness to do so, which was the highest proportion among the five municipalities. The main reasons for unwillingness to cooperate were as follows; a) inconvenient and difficult to separate and b) taking too much time to separate. Only 16% of sample HHs noted that they sold their recycling materials to a buyer. A total of 60% of HHs did not sell these materials although buyers visit the house. Approximately 20% of HHs responded that they did not sell recyclable materials, and that buyers rarely visited to collect recyclables. Major items collected for sale were glass and papers. In addition, kitchen waste was reported as the major item for recycling. Close to 60% of sample HHs said that they had knowledge about composting, and all of them learned how to make composting by themselves. Only 17% of sample HHs noted having experience in making compost. Most of these respondents composted their waste in an open space or organic field. The majority of those having no experience have shown no interest in making compost (82% of respondent sample HHs). The major reasons for unwillingness to compost included; a) taking too much money and we cannot afford (24% of respondent sample HHs) and b) taking much time and we have no time (20%).

5) Public and Community Involvement

The majority of sample HHs considered that SWM was the duty of the Municipality (71%). This figure was the highest among the five municipalities. The fact that KRM has not provided SWM services might influence such response. Only 7% of HHs responded that they themselves should be responsible for SWM (See Table 5.5-7). There has been limited community mobilization in KRM, which might also lead to the low level of sense of responsibility for SWM among the public. In this regard, only 8% of HHs took initiatives towards SWM activities. However, 93% of HHs, including those who have been already paying, were positive about paying a service charge for SWM. Most of them reported that they could afford to pay Rs 31-50 or Rs 11-30 per month. Regarding the reasons for unwillingness to pay, 3 HHs of the respondent sample noted that they did not have any problems from waste. A total of 2 HHs were also not willing to pay because they considered SWM as the duty of municipality. Only 16% of sample HHs have participated in CBOs' activities in SWM. Nevertheless, all of HHs surveyed noted that these CBOs' activities related to SWM were necessary or somewhat necessary. Those who showed a positive attitude would like to participate in the following activities; a) waste collection in the community, b) any activities related to SWM, and c) clean-up program.

Table 5.5-7 Perception of Responsibility for SWM in KRM

Sample HH nos.	75#	100%
Government/Ministry of Local Dev.	10	13%
Municipality	53	71%
Sweepers	0	0%
Yourselves	5	7%
Our Communities/CBOs	0	0%
Private Company	7	9%
NGO	0	0%
Do not know	0	0%
Others	0	0%

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey of Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

(2) Municipality's Programs regarding Community Mobilization for SWM

Since KRM, being newly established and having very limited staffs, has contracted out SWM services to two organizations i.e. UNIQUE and NEPCO, it has not taken initiatives in community mobilization programs on SWM by its own effort. It is apparent that these organizations have provided collection services in certain areas, but have yet to provide sufficient awareness and education programs.

(3) NGOs/CBOs' Programs regarding Community Mobilization for SWM

UNIQUE and NEPCO have had partnerships with KRM in terms of collection services. However, there are few organizations working in the field of community mobilization and public education. The major organizations' activities are indicated below.

Table 5.5-8 Major NGOs/CBOs Working in the Field of SWM in KRM

Name of NGOs/CBOs	Year of foundation	Number of staff	Working Areas
UNIQUE*	1994	14 staff	Door-to-door collection in Wards 1,3, 4, 5, 6, 9, 10, 11, 12, 16, and 17 (2,000 HHs) compost, Training
NEPCO*	1998	28 paid staff 7 volunteers	Door-to-door collection (1,000 HHs) Partially in Wards 1, 2, and 3
We Team / Jai Kisahan	2001	5 paid staff and 760 volunteers	Home composting in Wards 3 and 12 (4 HHs)
SOUP	1992	2 paid and 33 volunteers	Community development including composting in Ward 13 (15 HHs)

Note: * According to KRM, there is coordination with KRM at program/activity levels.
Source: JICA Study Team "Interview and Questionnaire Survey of Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

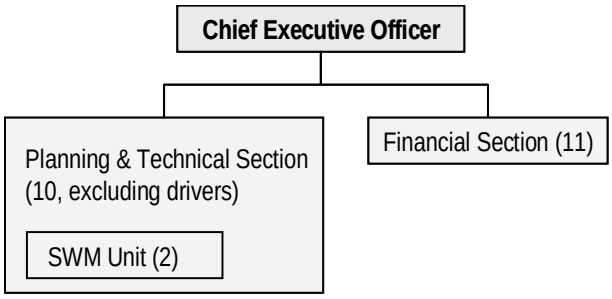
5.5.7 Managerial Condition

(1) Organizational Structure and Managerial Practices

1) Organizational Structure

Although KRM is the site for one of the oldest settlements in the Kathmandu Valley, as a municipality, it has relatively a short history. Reflecting its short history, KRM

organizational structure is still underdeveloped with many of the sections within the organogram either not functioning or operating in a limited capacity.



Note: ( ) shows number of staff

Figure 5.5-2 New Organizational Structure of KRM SMW Related Sections

Source: KRM, 2005

For SWM, the Planning and Technical Section (PTS) has the overall responsibility within KRM. However with the privatization of SWM services since 1999 to two operators, UNIQUE and NEPCO, the day-to-day responsibilities of this Section decreased to providing logistical support to private operators. Within the past year, with the increased capacity of the private operators, such logistical support has been minimized, and the only task held by the municipality is to periodically conduct monitoring of the activities.

More recently, with the support of the Study, a new organogram was introduced where a SWM Unit was established within the Planning and Technical Section. The new structure is operationally in practice, but awaits official approval from the Municipal Council in July 2005.

2) Managerial Practices

The advantage of a small municipality is the limited hierarchical layers in the management structure. Staff in the PTS, as well as the Account Section claim that they had very good access to the Mayor when he was in office and more recently the CEO. They also appear to have very good coordination among themselves. The downside of such flat management structure is that due to such proximity, influences from the high level officials on implementing day-to-day operations is significant, and their blessing is necessary in conducting any kind of activities.

The PPP strategy for SWM adopted by KRM was a prudent strategy, especially with due consideration of the severe staff shortage of the municipality. KRM and the private operators in general have forged good partnerships; however more recently, with the expiration of the original agreement, some conflict over operational issues has put such partnership under strain. KRM should not take it for the services provided by the two private operators. PPP is not a panacea to all SWM issues, and as a municipality, KRM will not be relieved from SWM responsibilities. As the needs and expectations for better SWM services expand in KRM, the municipality's contribution to development of various SWM facilities and improved monitoring of the Private Operators' activities would become vital.

(2) Human Resources

KRM has only 3 officers among 87 staff, and in 2002 became the municipality with the least number of staff per capita among all 58 municipalities. Under such constraints, no specific post existed for SWM related staff, and the PTS staff had accepted SWM responsibilities. Under the new organogram where a SWM Unit, two staff were designated on a part time basis, one from PTS, and one from the Account Section. The latter staff is a graduate of a UDLE SWM training course.

5.5.8 Financial Condition

KRM spent Rs 150,000 on SWM in FY2002/03 (2059/60) and 2003/04 (2060/61), which accounted for only 1% of total municipal expenditure because private sectors provide all SWM services in the core areas of the municipality.