



SMC Disposal Site before Pilot Project (September 2003)



SMC Disposal Site after Pilot Project (March 2004)

Plate 1: Improvement of the Stung Mean Chey Disposal Site



Discharge of Waste
in a Commercial Area



Discharge of Waste
in a Residential Area



Collection
Collection Work by Self Help Group



Collection
Collection Work by Private Contractor



Recycling
Waste Buyer (Et Chhay)



Recycling
Storage of Recyclables at Home

Plate 2: Current Conditions of SWM in Phnom Penh



Recycling
Recycling Shop



Recycling
Construction Materials



Final Disposal
SMC Disposal Site



Final Disposal
SMC Disposal Site



Final Disposal
SMC Disposal Site



Sorting of Waste
SMC Disposal Site

Plate 3: Current Conditions of SWM in Phnom Penh



NGO Activities: PSE
Informal Education Program for Waste Picker
Children



NGO Activities: VCAO
Vocational School



NGO Activities: World Vision Cambodia
Informal Education Program for Waste Picker
Children



NGO Activities: CSARO
Compost Production



Illegal Dumping



Illegal Dumping

Plate 4: Current Conditions of SWM in Phnom Penh



WACS:
Collecting waste from target households



WACS:
Weighing waste collected from households



WACS:
Sorting waste to investigate the composition



WACS:
Sorting waste to investigate the composition



POS
Interview Survey



POS
Interview Survey

Plate 5: Field Survey



SES
Focus Group Meeting (Waste Pickers)



SES
Additional Meeting (Waste Pickers)



Factory Survey



Medical Institution Survey



Factory Survey



Medical Institution Survey

Plate 6: Field Survey



Recycling Survey
Recycling Company of Paper



Recycling Survey
Recycling Company of Iron-Steel



Recycling Survey
Steel waste for recycling at steel recycling
handicraft workshop



Recycling Survey
Recycling Company of Plastics



Topographic Survey
SMC disposal site



Water Quality Survey

Plate 7: Field Survey



Leachate Treatment Pond
(Under Construction)



Construction of Main Road



Construction of Model Block



Enclosing Bank



Model Block and Gas Removal Pipes



Use of Landfill Gas (Charcoal Production)
CDM Project by Japan's MOE

Plate 8: Pilot Project
Improvement of the SMC Disposal Site (1)



Community Meeting
Explanation of Waste Picking Rules



Registration of Waste Pickers
at SMC Disposal Site



Construction of Working Face



Working Area Separation
(Waste Picking Area)



Working Area Separation
(Waste Unloading Area)



Working Group Meeting
(JICA team, PPWM, VCAO, Police, Waste
Picker Assistants)

Plate 9: Pilot Project
Improvement of the SMC Disposal Site (2)



Community Meeting



Street Improvement by public participation



Demonstration of Skip loader



Container on the street



Collection Work by SHG



Public Education and Campaign in Chroy Changva

Plate 10: Pilot Project
Improvement of the Waste Collection System



Sangkat Monorom before PP



Baseline survey in Monorom



Community Meeting in BTB



Cleansing Event

Pilot Project: Public Education



Construction of Weighbridge



Training in Computer Operation

Plate 11: Pilot Project
Development of the Data Management System for SWM



Compost Market Survey



Compost Market Survey



Field Trip
PR Field Trial Farmland



Field Trip
PR Field Trial Farmland



Field Trip
PR Field Trial Farmland



Compost Plant at the SMCDS

Plate 12: Pilot Project
Development and Promotion of the Urban Waste Compost Market



EIA Survey



EIA Survey



First Public Hearing



First Public Hearing



Second Public Hearing



Second Public Hearing

Plate 13: Environment Impact Assessment Survey on the Dang Kor Disposal Development Project



C/P Training in Laos



C/P Training in Laos
Field Trip



Group Training in MPP



Group Training in MPP
Field Trip to DMCDs



Seminar on Technology Transfer



3R Workshop
Field Trip to Recycling Shop in SMC

Plate 14: Institutional Capacity Building

CONTENTS

	Page:
Preface	
Letter of Transmittal	
Outline of the Master Plan	
Map of Study Area	i
Photos	ii
Contents	xvii
Abbreviation	xxiii
1 Outline of the Study	1-1
1.1 Background.....	1-1
1.2 Outline of the Study.....	1-2
1.3 Objectives and Study Area	1-3
1.3.1 Objectives	1-3
1.3.2 Study Area	1-3
1.3.3 Wastes covered in the Study.....	1-3
1.4 Basic Policies of the Study	1-4
1.5 Study Schedule	1-4
1.6 Organization of the Study.....	1-5
1.6.1 Members of the study team.....	1-5
1.6.2 Members of the counterpart personnel	1-5
1.7 Transfer of Technology	1-5
1.8 Reports.....	1-5
1.9 JICA Guideline for Environmental and Social Consideration	1-7
2 Current Situation of Solid Waste Management	2-1
2.1 Current Situation of the Study Area	2-1
2.1.1 Natural Environment.....	2-1
2.1.2 Population	2-2
2.1.3 Urban Structure.....	2-2
2.1.4 Economic Conditions.....	2-3
2.2 Field Investigations.....	2-3
2.2.1 Waste Generation and Discharge Amount.....	2-3
2.2.2 Waste Composition.....	2-4
2.2.3 Medical and Industrial Waste	2-5
2.2.4 Waste Flow	2-6
2.3 Assessment of the Current SWM System.....	2-7
2.3.1 Summary of the Current SWM System	2-7

2.3.2	Assessment of the Current SWM system	2-9
2.3.3	Current Issues concerning SWM	2-17
3	SWM Master Plan	3-1
3.1	Master Plan	3-1
3.1.1	Goal.....	3-1
3.1.2	Target year	3-1
3.2	Planning Framework for the Master Plan.....	3-2
3.2.1	Population Forecast.....	3-2
3.2.2	Economic Framework.....	3-2
3.2.3	Forecast of Future Waste Amount and Composition.....	3-3
3.2.4	Medical and Industrial Waste Forecast.....	3-4
3.3	Selection of the Optimum Technical System	3-5
3.4	Institutional Issues	3-6
3.4.1	Legal System.....	3-6
3.4.2	Administration and Organization.....	3-7
3.4.3	Public-Private Partnership	3-8
3.4.4	Capacity Building	3-10
3.5	Numerical Targets and Strategies of the Master Plan	3-10
3.5.1	Numerical Target	3-10
3.5.2	Strategies to Achieve the Target.....	3-11
3.5.3	Future Waste Flow.....	3-18
3.5.4	SWM Master Plan.....	3-21
3.5.5	Priority Projects	3-24
3.5.6	Site Plan for Future Facilities	3-24
3.5.7	Implementation Schedule	3-27
3.5.8	Project Cost.....	3-27
3.5.9	Financial Appraisal of the M/P	3-28
4	Pilot Projects	4-1
4.1	Selection of Pilot Projects.....	4-1
4.2	Improvement of SMC disposal site	4-1
4.2.1	Outline of Improvement Plan	4-1
4.2.2	Finding.....	4-5
4.2.3	Poor Access and its Problems.....	4-9
4.2.4	Actions to be taken by MPP/PPWM.....	4-10
4.3	Improvement of Collection System.....	4-12
4.3.1	Introduction of Container Collection System.....	4-12
4.3.2	Collection Service Expansion.....	4-16
4.4	Public Education Campaign	4-21
4.4.1	Outline of the project	4-21
4.4.2	Findings	4-22
4.5	Development and Promotion of Urban Waste Compost Market.....	4-24
4.5.1	Outline of the Study	4-24
4.5.2	Findings	4-24

4.6	Development of a Data Management System for SWM	4-25
4.6.1	Outline of development	4-25
4.6.2	Findings	4-25
5	Institutional Capacity Building (ICB).....	5-1
5.1	Objective and Method	5-1
5.1.1	Objective.....	5-1
5.1.2	Method.....	5-1
5.2	ICB through the Implementation of PP	5-1
5.2.1	Improvement of the SMC Disposal Site.....	5-1
5.2.2	Improvement of the Waste Collection System.....	5-3
5.2.3	Public Education Campaign.....	5-4
5.2.4	Establishment of Regular Monitoring System (under PP for the improvement of SMC disposal site)	5-6
5.3	ICB through seminars, workshops, etc.....	5-6
6	Feasibility Study	6-1
6.1	Selection of Priority Project	6-1
6.2	Dang Kor Disposal Site Development Project	6-1
6.2.1	Design Concept.....	6-1
6.2.2	Natural Environment of the Project Site in Dang Kor.....	6-1
6.2.3	Outline of Design.....	6-2
6.2.4	Project Evaluation.....	6-6
6.3	Waste Collection Service Expansion Project	6-15
6.3.1	Design Concept.....	6-15
6.3.2	Preliminary Design	6-15
6.3.3	Project Evaluation.....	6-20
6.4	SMCDS Closure Project.....	6-25
6.4.1	Design Concept.....	6-25
6.4.2	Outline of Design.....	6-25
6.4.3	Project Evaluation.....	6-28
7	Conclusion and Recommendations	7-1
7.1	Conclusion	7-1
7.1.1	Problems concerning the Current Municipal Solid Waste Management.....	7-1
7.1.2	Master Plan	7-2
7.1.3	Priority Projects	7-4
7.1.4	Other SWM Problems and Recommended Countermeasures	7-7
7.2	Recommendation	7-8
7.2.1	Recommendation for improvement of the Master Plan.....	7-8

List of Tables

	Page:
Table 2-1: Population, Population Density and No. of Households in 2003	2-2
Table 2-2: Waste Generation Rate and Discharge Amount in 2003	2-4
Table 2-3: Comparison of Discharged Household Waste Composition	2-4
Table 2-4: Generation Amount of Medical Waste in 2003	2-5
Table 2-5: Generation Amount of the Industrial Waste in 2003	2-5
Table 2-6: Current Technical system in 2003	2-7
Table 2-7: Current Institutional System	2-9
Table 2-8: Assessment of Current SWM Conditions in Phnom Penh.....	2-9
Table 3-1: Population Forecast.....	3-2
Table 3-2: Economic Indicator in the Study Area.....	3-3
Table 3-3: Forecasted Waste Generation Ratio.....	3-3
Table 3-4: Forecasted Number of Waste Discharge Sources.....	3-3
Table 3-5: Forecasted Waste Generation Amount	3-4
Table 3-6: Forecasted Waste Composition.....	3-4
Table 3-7: Forecasted Medical Waste Generation	3-4
Table 3-8: Forecasted Industrial Waste Generation	3-4
Table 3-9: Selected Optimum Technical System	3-5
Table 3-10: Solid Waste Classification	3-6
Table 3-11: Proposed Area Wise Responsibilities and Roles of PPWM and CINTRI	3-8
Table 3-12: Numerical Targets of the Master Plan for SWM in Phnom Penh.....	3-10
Table 3-13: Strategies to Achieve the Targets of the SWM M/P	3-11
Table 3-14: Implementation Schedule.....	3-27
Table 3-15: Project Cost for M/P	3-27
Table 3-16: The Cost of MSW Collection/Haulage and Operation of SMC Disposal Site by PPWM	3-28
Table 3-17: Preconditions of the Project.....	3-28
Table 3-18: Estimated Fee Rate of MSW Collection for Household.....	3-30
Table 3-19: Estimated Fee Rate of MSW Collection for Household.....	3-30
Table 3-20: Comparison of MSW collection fee rate between the cases with and without grant assistance.....	3-30
Table 3-21: Estimated Amount of MSW Disposal by PPWM and CINTRI.....	3-31
Table 3-22: Household Fee Rate for MSW Collection by PPWM	3-32
Table 3-23: Tipping Fee Rate to be Covered by Household.....	3-33
Table 3-24: Total Cost of MSW Service for Household.....	3-33
Table 3-25: Household's Willingness and Affordability to Pay in 2003	3-33
Table 3-26: Prediction of the Affordability to Pay of Household.....	3-33
Table 4-1: SMC Disposal Site Improvement Plan and Responsible Bodies.....	4-2
Table 4-2: Analysis Method for Each Parameter	4-8
Table 4-3: Outline of Target Areas of Trials.....	4-13
Table 4-4: Road improvement in the PP area.....	4-14
Table 4-5: Results of Fee Collection (January 2004)	4-15
Table 4-6: Area and Population of the Project area (in 2003).....	4-17
Table 4-7: Number of Customers informed by Sangkats.....	4-17
Table 4-8: Targeted Collection Amount in the Service Area.....	4-18
Table 4-9: Collection Capacity of PPWM.....	4-19
Table 4-10: Implementation Schedule.....	4-19
Table 4-11: Waste Amount Collected in 4 Sangkats (Weighbridge data)	4-20

Table 4-12: Number of Customers, Contract Amount and Collected Amount (End of Nov. 2004).....	4-21
Table 5-1: ICB through PP for the Improvement of SMC Disposal Site.....	5-2
Table 5-2: ICB through PP for the Improvement of Waste Collection System.....	5-3
Table 5-3: ICB through PP for Public Education Campaigning.....	5-5
Table 5-4: ICB through seminars, workshops, etc.....	5-7
Table 6-1: Expected Disposal Amount.....	6-2
Table 6-2: Area of Facilities.....	6-3
Table 6-3: List of Landfill Equipment.....	6-4
Table 6-4: Organization Structure of Landfill Operation section.....	6-4
Table 6-5: Organizational Structure of Compost Plant.....	6-4
Table 6-6: Monitoring Plan of Dang Kor Disposal Site.....	6-5
Table 6-7: Project Cost of Dang Kor Disposal Site Plan (1,000US\$).....	6-6
Table 6-8: Preconditions of the Project for Financial Appraisal.....	6-11
Table 6-9: Financial Viability and Tipping Fee Rates.....	6-12
Table 6-10: Preconditions of Compost Plant Project.....	6-13
Table 6-11: EIRR of Compost Plant Project by Cases.....	6-14
Table 6-12: Planned Collection Amount (unit: ton/day).....	6-16
Table 6-13: Combination of Equipment.....	6-16
Table 6-14: Necessary Collection Equipment.....	6-17
Table 6-15: Personnel required for collection service.....	6-17
Table 6-16: Personnel Required for O&M of Equipment.....	6-18
Table 6-17: Required Investment to Expand Collection Service (US\$1,000).....	6-19
Table 6-18: Operation and Maintenance Cost (US\$1,000).....	6-20
Table 6-19: Waste Collection Cost (US\$1,000).....	6-20
Table 6-20: Unit Cost.....	6-20
Table 6-21: Preconditions of the Project for Financial Appraisal.....	6-22
Table 6-22: Financial Viability and Fee rates.....	6-23
Table 6-23: Estimated Fee Rate of MSW Collection for Household.....	6-23
Table 6-24: Estimated Fee Rate of MSW Collection for Household.....	6-24
Table 6-25: Project Cost of the SMCDS Closure Plan (US\$1,000).....	6-28
Table 6-26: Number of Waste Pickers at SMCDS (the observation survey).....	6-29
Table 7-1: Priority Projects and Investments.....	7-4

List of Figures

	Page:
Figure 1-1: Planning Hierarchy.....	1-4
Figure 1-2: Reporting Schedule.....	1-6
Figure 2-1: Waste Flow in 2003.....	2-6
Figure 3-1: Waste Flow in 2007.....	3-18
Figure 3-2: Waste Flow in 2012.....	3-19
Figure 3-3: Waste Flow in 2015.....	3-20
Figure 3-4: Candidate Sites.....	3-24
Figure 3-5: Candidate Sites in the Geographical Feature.....	3-25
Figure 3-6: Change of the Land for the New Disposal Site.....	3-26
Figure 4-1: SMCDS Facility Improvement Plan.....	4-3
Figure 4-2: Expansion Area of SMC Disposal Site.....	4-6
Figure 4-5: Propose Excavation Area of Aged Waste and Access Road.....	4-12
Figure 4-6: Location Map of target Area for Collection Trial.....	4-13

Figure 4-7: Fee collection rate.....	4-16
Figure 4-9: Collection Vehicles owned by PPWM	4-18
Figure 4-10: Project Site in Sangkat Monorom.....	4-22
Figure 4-11: Project Site in Sangkat Boeung Trabek.....	4-22
Figure 6-1: Layout Plan of Dang Kor Disposal Site (Phase1)	6-3
Figure 6-2: Monitoring Points	6-5
Figure 6-3: Layout Plan of Maintenance Workshop	6-18
Figure 6-4: Fee Collection System.....	6-19
Figure 6-5: Final Shape of the SMCDS	6-26

Abbreviations

A/P	Action plan
BTB	Sangkat Boeung Trabek
C/P	Counterpart
CDRI	Cambodia Resource Development Institute
DF/R	Draft final report
DKDS	Dang Kor Disposa Site
DOE	Department of Environment, Municipality of Phnom Penh
DPWT	Department of Public Works and Transportation
EIA	Environment Impact Assessment
FAO	Food and Agriculture Organization
F/S	Feasibility Study
F/R	Final report
HIW	Hazardous industrial waste
ICB	Institutional Capacity Building
IC/R	Inception report
IT/R	Interim report
IEE	Initial Environment Examination
IW	Industrial waste
IWM	Industrial waste management
JICA	Japan International Cooperation Agency
M/M	Minutes of meetings
MOE	Ministry of Environment
MOEYS	Ministry of Education, Youth and Sport
MOH	Ministry of Health
M/P	Master plan
MPP	Municipality of Phnom Penh
MW	Municipal waste
NHIW	Non-hazardous industrial waste
NIP	Neighbourhood Improvement Program
O&M	Operation and Management
P/P	Pilot project
PPWM	Phnom Penh Waste Management
P/R	Progress report
POS	Public opinion survey
SES	Social Environment Survey
SHG	Self-Help Group
SMC	Stung Mean Chey
SMCDS	Stung Mean Chey Disposal Site
S/W	Scope of work
T&M	Time and Motion
VDC	Village Development Committee
WACS	Waste Amount and Composition Survey
WHO	World Health Organization

1 Outline of the Study

1.1 Background

The Municipality of Phnom Penh (MPP) is the capital of Cambodia having a population of 1.2 million in 2003 (estimated) and an area of 374 km². Municipal solid waste management (MSWM) in the MPP has been under the jurisdiction of the Department of Public Works and Transport (DPWT). The MSWM services had been provided by the municipal cleansing section under DPWT until June 1994. Since then, due to the extremely limited capability for MSWM, the MPP entrusted its MSWM service to mainly private contractors with franchise agreements, which allows the monopoly service. However, the service provider has been changed six times mainly due to financial difficulty.

Under such circumstances, the Institutional Capacity Building and Neighborhood Improvement Program (ICB & NIP by NORAD) was conducted from May 1997 to March 2002, which is part of the ADB supported drainage component under the Phnom Penh Water Supply and Drainage Project and co-financed by Norwegian Agency for Development Cooperation (NORAD).

According to the proposal given in the ICB & NIP by NORAD, the MPP established the Phnom Penh Waste Management Authority (PPWM) by merging the Cleansing Authority of Phnom Penh (CAP) and the Wastewater Authority of Phnom Penh (WAP) in 2001. The monopoly situation was weakened when PPWM commenced waste collection services in the NIP area and also took over operation of the Stung Mean Chey disposal site (SMCDS). The contract made between MPP and the private company (CINTRI), however, limits the PPWM collection service area to only the NIP area, which is less than 2% of the MPP population.

Waste collection has generally improved in Phnom Penh by the current private company. However, many areas of the city are still without an adequate waste collection service and many tons of wastes are dumped into rivers and ponds, burned or left uncollected to be scattered by animals, block drains and create unsanitary conditions. Waste collection is especially weak in outlying areas and in many of the cities unplanned settlements that are home for thousands of the cities poorest families.

The SMCDS is the only disposal site in the MPP where unregulated landfill operation has continued for 38 years, since 1965. Because the municipality land plot is very limited (only 6.8 ha) and waste is piled up to a height of more than 5 m on average, operation of the landfill is getting more and more difficult. The remaining service life of the landfill is very little within the municipal land (less than two years) and the residential area is approaching less than 100 m away from the site due to rapid urbanization. The construction of a new disposal site is urgently needed. The site is a typical open dump, where more than 500 waste pickers (WPs) are working regularly without any rules or control. This poses a seriously negative impact on the surrounding environment, such as air pollution by smoke caused by fire, waste scattering, offensive odor, surface and underground water contamination, etc.

In order to overcome the aforementioned difficulties with MSWM in the MPP, a comprehensive plan of countermeasures including both soft and hard components is required.

GOC requested the Government of Japan to carry out a development study in 2000. In response to this request, JICA's preliminary study team was sent to Cambodia and the Scope of Work (S/W) was signed by both governments on 24 October 2002. Subsequently, JICA selected Kokusai Kogyo Co., Ltd. as the consultant to conduct this study.

1.2 Outline of the Study

The Study commenced in February 2003, scheduled to be carried out over a 16-month period according to the S/W. The study period was divided into two phases. The study team prepared the master plan (hereinafter referred to as “M/P”) in Phase 1 based on the understanding of present SWM and the forecast of future waste generation, etc. In Phase 2, the study team conducted a feasibility study (hereinafter referred to as “F/S”) on the priority projects selected in the master plan, which were the Dang Kor disposal site development project, the waste collection service expansion project and SMC disposal site closure project. In addition to these studies, the study team conducted several pilot projects, including the improvement of SMC disposal site, improvement of the collection system, development and promotion of the urban waste compost market, and development of a data management system for SWM.

Regarding the new disposal site development project, MPP held a public hearing twice in the second phase based on the results of the preliminary design and EIA study prepared by the study team, considering the limited remaining capacity of the SMCDS and promoting the project. Although MPP started to acquire the land according to the development plan prepared by the study team, the proposed area was not secured because of a sudden soaring of land prices along national route 303. This might have been due to the fact that the proposed area was identified through the public hearing, and the cost for land acquisition exceeded the budget authorized by the central government. Therefore, MPP changed the plan and acquired 20 ha of land about 800m to the west of national route 303, adjacent to the 11 ha of land MPP had already acquired, securing 31.4 ha of land in all. Consequently, the development plan should be amended according to the land acquired.

Although CINTRI, which was a private service provider, had the right to provide collection services to the whole city according to the contract agreement signed between MPP and CINTRI, the master plan prepared in the first phase of the study proposed that the MPP/PPWM would provide the waste collection service to the three semi-urbanized Khans and CINTRI to the four urban Khans. However, the proposed area demarcation was not agreed to by CINTRI. Therefore, the master plan and the F/S on waste collection should be modified based on a mutual agreement between MPP and CINTRI.

Furthermore, the lack of experience and weak organization of the Phnom Penh Waste Management Authority (herein after referred to as PPWM) and the Department of Environment (hereinafter referred to as “DOE”) of MPP were recognized through the study. It was reconfirmed that the capacity development of PPWM and DOE as the executing agencies of SWM would be necessary.

Accordingly, on February 4, 2004 MPP requested JICA to expand the study period, aiming to revise the plan of new disposal site development and expansion of the waste collection service, strengthen the capacity of PPWM and disseminate the results of the study. JICA approved this request and decided to expand the study period until March 2005. Therefore, the third phase of the study was conducted to revise the M/S and F/S and develop the capacity of PPWM through continuation of the pilot projects.

The study team reviewed the preliminary design of the new disposal site development project based on the assumption that the soil condition was almost the same as the results of the geological survey conducted in the second phase of the study. This is because the project site is adjacent to the former site and they had the same geographical features. An additional geological survey was to be done in the detailed design stage. MPP held the third public

hearing and built a public consensus of the implementation of the new disposal site development project explaining the revised plan. MPP also obtained the EIA approval from the Ministry of Environment of Cambodia on July 15 2004.

Regarding the waste collection service expansion project, the MPP and CINTRI agreed to eliminate the unserved and insufficiently serviced areas in cooperation with each other on May 12, 2004 and both parties have continued to identify the unserved areas. However, both parties did not reach an agreement by the end of February, 2005. Consequently, MPP has requested the study team to finalize the M/P and feasibility study based on the assumption that PPWM would provide the waste collection service to the areas considered to be unserved areas by the study team on March 3, 2005. Therefore, the study team prepared this final report according to the request mentioned above.

The study team conducted the pilot projects, which included a continuation of the improvement of SMC disposal site, expansion of the waste collection service to the four Sangkats and an education campaign, to strengthen the capacity of PPWM and DOE. In addition to these pilot projects, the study team conducted a group training workshop for the staff of SWM of the provincial cities so that the provincial cities in Cambodia would be able to formulate their own M/P respectively based on the understanding of the results of the study.

1.3 Objectives and Study Area

1.3.1 Objectives

1. To formulate a master plan (hereinafter referred to as “M/P”) for solid waste management in Phnom Penh with a target year of 2015.
2. To conduct a feasibility study (hereinafter referred to as “F/S”) for the selected priority projects.
3. To transfer technology to the counterpart (hereinafter referred to as the C/P”) in the course of the study.

1.3.2 Study Area

The study area includes the entire municipality of Phnom Penh (population: approx, 1.2 million, area: 373.73 km²).

1.3.3 Wastes covered in the Study

The wastes covered in the study are municipal solid waste, septage (sludge collected from septic tanks), industrial and medical waste. Municipal solid waste means combustible waste, incombustible waste and bulky waste generated in the MPP, and can be divided into five categories by generation source, namely household waste, commercial waste, institutional waste, market waste and street sweeping waste.

The team conducted studies on the composition and amount of septage, and industrial and medical wastes that are disposed of at the final disposal site. However, the team did not fully consider these three categories of waste in the M/P but clarified current conditions, identified issues that need to be resolved and proposed possible solutions.

1.4 Basic Policies of the Study

In ICB/NIP by NORAD, the “Strategic Solid Waste Management Plan and Action Plan” (SSWMPAP), which is the baseline plan of this Study, was formulated. According to the SSWMPAP, it is necessary to prepare an operational plan, which deals with the management and operation of service institutions and the actual work, as the next step in establishing a waste management system in Phnom Penh.

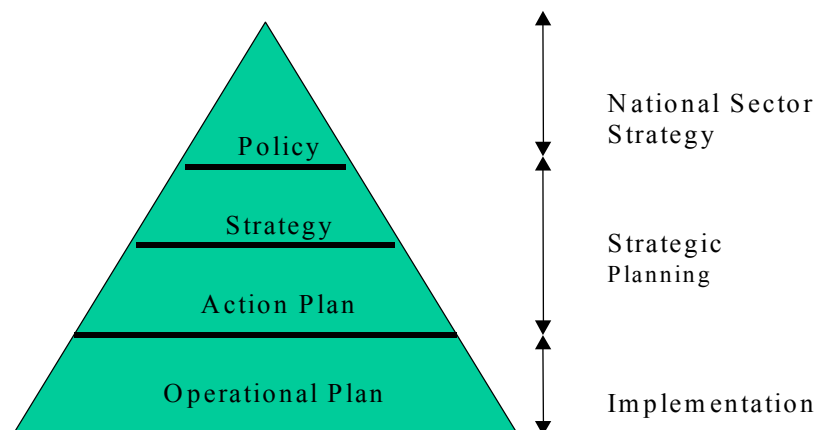


Figure 1-1: Planning Hierarchy

On the basis of the SSWMPAP formulated in the ICB/NIP by NORAD mentioned above, this study was implemented placing particular emphasis on establishing an actual operational plan for solid waste management.

The basic policies of the study were as follows:

- Formulation of a practical SWM plan (Practicability)
- Promotion of capacity development for main SWM activities (Capacity Building)
- Development and application of appropriate technology (Appropriate Technology)
- Promotion of public participation (Public participation)
- Promotion of consensus building among stakeholders (Consensus)

1.5 Study Schedule

Based on the S/W agreed upon by the Cambodian Government and JICA, the study commenced in February 2003 and the field study was completed in January 2005.

The study was implemented in the following three phases:

Phase 1 : February 2003 — August 2003

Implementation of a study on current conditions of solid waste management and formulation of a master plan

Phase 2 : September 2003 — March 2004

Implementation of a feasibility study for the priority projects

Phase 3 : May 2004 — March 2005

Review of the M/P and the feasibility study and capacity development through continuation of the pilot projects

1.6 Organization of the Study

The study shall be implemented as a joint work by the JICA study team and the C/P.

1.6.1 Members of the study team

Name	Assignment
Mr. Junji Anai	Leader/solid waste management planning
Mr. Susumu Shimura	Deputy leader/institutional management
Mr. Robert Deutch	Collection and transportation planning
Mr. Tamotsu Suzuki	Final disposal/recycling /medical waste/industrial waste
Ms. Keiko Kani	Social consideration/public participation/environmental education
Mr. Takeshi Higo	Waste amount and composition/environmental consideration
Mr. Satoshi Sugimoto	Economic/financial analysis
Mr. Masahiro Ido	Facility planning/cost estimation
Mr. Kunito Ishibashi	Data management system/Web site development
Mr. Masanori Takeishi	Vehicle maintenance planning
Mr. Masahiko Takahashi	Training/administrative coordinator
Mr. Tep Makathy	Chief local assistant (institutional management/collection)
Mr. Saing Hay	Local assistant (Final disposal)
Ms. Kheang Lyhun	Local assistant (Social consideration/public participation/education)

1.6.2 Members of the counterpart personnel

Name	Position
Mr. Moeung Sophan	Head of Public Works Office of DPWT, MPP
Mr. Pumarith	Staff of DPWT
Mr. Samdap	Staff of DPWT
Mr. Heng Lay Orn	Governor of PPWM (2, 2003 - 4, 2004)
Mr. Sao Kunchhune	Governor of PPWM (5, 2004 -)
Mr. Leng Simen	Deputy Governor of PPWM
Mr. Ouch Vann	Deputy Governor of PPWM (2, 2003 - 10, 2004)
Mr. Sam Vicheka	Deputy Governor of PPWM (10, 2004 -)
Mr. Soung Phally	Deputy Governor of PPWM (5, 2004 -)
Mr. Tep Sambath	Staff of Accounting, PPWM
Mr. Khat Orstha	Staff of Accounting, PPWM
Ms. Ly Thavy	Staff of Accounting, PPWM
Ms. Nay Ratha	Staff of Planning, PPWM
Ms. Hem Visal	Staff of Administration, PPWM

1.7 Transfer of Technology

The study team transferred technology to the C/P by implementing all studies in cooperation with the C/P, and through OJT during implementation of the pilot projects. Moreover, training for the C/P was held in Laos as well as workshops in Cambodia. The details of the technology transfer are discussed in Chapter 5.

1.8 Reports

The study team submitted several reports according to the progress of the study, as shown in the figure below.

Figure 1-2: Reporting Schedule

	2003				2004				2005
	1	2	3	4	1	2	3	4	1
Study Phase	Phase 1		Phase 2		Phase 3				
Submission of Reports	▲ IC/R		▲ ▲ PR/R(1) IT/R		▲ PR/R(2)	▲ DR/R(1)	▲ PR/R(3)		▲ ▲ DR/R(2) F/R

Symbol	Report	Contents
IC/R	Inception Report	Study contents and schedule
PR/R(1)	Progress Report (1)	Confirmation of the preconditions for M/P, proposal of the pilot projects
IT/R	Interim Report	M/P (Draft), selection of the priority projects
PR/R(3)	Progress Report (2)	Progress of the pilot projects, interim results of the study on the priority projects
DF/R(1)	Draft Final Report (1)	M/P, F/S on the priority project
PR/R(3)	Progress Report (3)	Progress of the pilot projects, confirmation of the precondition for the study on M/P and F/S
DF/R(2)	Draft Final Report (2)	Draft final M/P and F/S
F/R	Final Report	Final version of M/P and F/S

The Final Report consists of the reports listed below. This report is the English copy of the Summary of Final Report.

- Summary (Japanese, English and Khmer)
- Main Report (English)
- Supporting Report (English)
- Data Book (English)

The study team compiled the report as follows.

- Part 1 : Current situation of SWM
- Part 2 : SWM Master Plan
- Part 3 : Pilot Projects and Capacity Development
- Part 4 : Feasibility Study on the Priority Projects
- Part 5 : Conclusion and Recommendations

For the convenience of compilation, some detailed data are not shown in the summary report and/or main report. For such data, the reader is requested to refer to the supporting report and/or data book.

1.9 JICA Guideline for Environmental and Social Consideration

JICA decided to apply the “JICA Guideline for Environmental and Social Consideration” to projects and studies adopted in FY 2004.

As this study commenced in FY 2002, the guideline is not applied. However, JICA requested the advisory council of environmental and social consideration to review this study for its completion, and obtained a report from the council.

Although this report reflects the comments given by the council, the study team recommends conducting some matters that cannot be done within the study period in the implementation stage.

2 Current Situation of Solid Waste Management

2.1 Current Situation of the Study Area

2.1.1 Natural Environment

Being a tropical country, Cambodia has dry and rainy seasons, the former from December to April and the latter from May to November. The annual rainfall amount in the Study area exceeds 1,800 mm in the western and eastern mountains, and from 1,400 to 1,700 mm in the plains. In Phnom Penh, rain from May to August produces a monthly rainfall amount of about 150 mm. The maximum rainfall amount of 300 mm, however, falls from September to October. Temperature is at its maximum in April at 35 °C, dropping to around 30 °C from November to January.

The topographic and geological features of Cambodia may be largely classified into: the northern mountain region, eastern plateau, southwestern mountains, and central plains. The northern mountain region connects with the Korat Plateau of Thailand, with the upper strata geologically made up of Indosinian consolidated sandstone rich in iron. The eastern plateau mainly consists of sandstone from the Mesozoic era overlain by basalt in some areas. The Elephant and Cardamon mountains, which range from 500 to 1,700 m in elevation, can be found in the southwestern mountain zone and are mainly made up of sedimentary rocks (i.e., sandstone, schist, limestone) from the Mesozoic era. The central plain is surrounded by these mountains and highlands, and form the low-lying area of Cambodia, which is divided into the Mekong River basin and the basin of Tonle Sap River - Tonle Sap River joins Mekong River at the southern section of Phnom Penh. The low-lying area developed from a collapse resulting from tectonic movement, and consists of thick deposits of sand, clay, and gravel of the Pleistocene and Holocene epochs. This area forms the Study area and the vast Mekong Delta in Vietnam.

The city of Phnom Penh covered by this Study, is largely situated in the Mekong Delta at an elevation of less than 10 m. Bedrock monadnocks can also be seen in several places, while a newly formed cone shaped volcanic hill can be seen on one side of the plain.

The central plain where Phnom Penh is located is divided into the Tonle Sap River basin north of Phnom Penh and the Mekong River basin south of Phnom Penh. The Mekong River converges with Tonle Sap at the outskirts of Phnom Penh, after which it further goes downstream to diverge into: the Mekong headstream that flows eastward along the Prey Veng and Svay Rieng border and the Bassac River that flows westward along the border of Ta Keo Province. When the Mekong headstream overflows, floodwater flows backward all the way into Tonle Sap Lake which is the natural reservoir. The Mekong River has a monthly maximum flow of 38,719 m³/sec as recorded at the Kompong Cham station in September. The monthly flow observed in Neak Luong downstream, however, was only 24,780 m³/sec due to backflow influences.

2.1.2 Population

The population, density and households by Khan in Phnom Penh in 2003 have been calculated based on a regression model using data from the Population Census in 1998¹ and population data supplied by the Department of Planning in MPP.

Table 2-1: Population, Population Density and No. of Households in 2003

Khans (Districts)	Total Area* (km ²)	Land Area** (km ²)	Population (persons)	Density on Land (Persons/ha)	No. of households*** (Households/ha)
Chamkar Mon	9.59	9.26	208,750	217.7	36.9
Daun Penh	7.34	5.39	137,186	186.9	31.7
Prampir Makkara	2.2	2.14	104,013	472.8	80.1
Tuol Kork	7.95	7.82	178,373	224.4	38.0
Total of Urban Area	27.08	24.61	628,322	230.2	39.0
Dang Kor	187.91	181.69	114,333	6.1	1.1
Mean Chey	50.86	40.18	210,027	41.3	7.4
Ruessey Kaev	107.88	88.33	246,732	22.9	4.1
Total of Rural Area	346.65	310.2	571,092	16.5	2.9
Grand Total	373.73	334.81	1,199,414	32.1	5.5

*: Whole area

** : Water surface is not included

***: Number per household, 5.9 is urban area, 5.6 is rural area and 5.8 is average in the whole city based on the 1998 census

2.1.3 Urban Structure

Administratively, the city is divided into seven Khans. Of these, four Khans are mainly urban (Daum Penh, Chamkar Mon, Toul Kork, and Prampir Makara) in nature with a total area of 27.08² km² and a population of 623,322³. The majority of government and administrative buildings are located here, especially in Khan Daun Penh and Chamkar Mon. The remaining three Khans are mainly rural in nature with a total area of 346.65 km² and population of 571,092. The housing stock in high-density downtown areas mainly consists of older, 3-6 story buildings constructed in the colonial period, typically with a “Chinese shop house” configuration at the street level and walk-up flats on the upper floors. These are accessed by stairways in the rear of the buildings that commonly connect to small alleyways. Housing in medium density areas consists mainly of 2-3 story shop houses and detached or semi-detached buildings from the postcolonial periods. A number of unplanned settlements (squatter areas) also located in the medium density areas. Low density, rural areas contain the widest range of housing types with rural style wooden houses, shop houses, detached and semi-detached all represented.

¹ National Institute of Statistics, Ministry of Planning, General Population Census of Cambodia 1998

² According to BUA July 2003, the area of urban area is estimated as 27.19km² and rural is 348.30km² considering a spherical surface.

³ Population forecasted in the study on Transport Master Plan of the Phnom Penh Metropolitan Area” conducted by JICA in 2001

2.1.4 Economic Conditions

a. National and Regional Economy

The GDP in Cambodia had grown by an annual average of 10.6% during 1994 – 2000. The per capita GDP of Cambodia was about 920 thousand riels or 238 US dollars in 2000.

According to the socio-economic survey in 1993-94, the average income in Phnom Penh is more than three-fold on the national average income of about 169 thousand riels or 66 US dollars per month. It should be noted that there is a big difference in income between urban and rural households.

b. National and MPP Budgets

The government revenue accounted for only 9% of GDP in 1998. The Government of Cambodia is currently restructuring the taxation and revenue collection systems to broaden its revenue bases. The latest Public Investment Plan 2002-2004 set the revenue target at 13.5% of GDP in 2005.

On the other hand, the total revenue of MPP in 2002 reached 26,572 million riels (6.6 million US dollars). Per capita revenue in MPP was estimated to be around 5.5 US dollars. Meanwhile, the total expenditure of MPP is about 27,822 million riels (6.9 million UD dollars).

2.2 Field Investigations

The Study team conducted the following surveys to fully understand the current situation of the SWM in the study area.

1. Waste amount and composition survey (WACS)
2. Time and motion survey
3. Public opinion survey (POS)
4. Social environmental survey in and around the final disposal site
5. Cleansing workers survey
6. Medical institutions survey
7. Factories survey
8. Recycling market survey
9. Water Quality Survey
10. Septage sludge survey
11. Others

2.2.1 Waste Generation and Discharge Amount

Based on the WACS conducted on 560 samples in the dry and rainy seasons respectively, the following generation rates were obtained. The number of generation sources was obtained from the interview survey of 76 Sangkats.

Table 2-2: Waste Generation Rate and Discharge Amount in 2003

Discharge Source	Number of Discharge Source	Unit	Discharge Ratio			Daily Discharge Amount (ton/day)		
			Dry season	Rainy season	Average	Dry season	Rainy season	Average
Household Waste	1,199,414	g/person/day	498	476	487	597.3	570.9	584.1
Commercial Waste (Restaurant)	27,808	g/table/day	1,940	1,387	1,664	54.0	38.6	46.3
Commercial Waste (Other Shop)	33,524	g/shop/day	4,566	4,437	4,502	153.1	148.8	151.0
Market Waste	51,766	g/stall/day	1,700	1,945	1,823	88.0	100.7	94.4
School Waste	385,013	g/student/day	18	21	20	6.9	8.1	7.5
Street Sweeping Waste	56	g/km/day	47,235	59,510	53,373	2.6	3.3	3.0
Hotel Waste	13,385	g/room/day	199	263	231	2.7	3.5	3.1
Office Waste	368	g/office/day	2,946	4,174	3,560	1.1	1.5	1.3
Total								890.6

* : The waste amount of which the discharge source such as parks and slaughter houses could not be identified was estimated by waste flow.

2.2.2 Waste Composition

The present discharged household waste composition in Phnom Penh and those obtained from other JICA SWM studies are as shown in the following table. A prominent feature of the waste composition is the high content of kitchen waste and plastic, which are 63.3 % and 15.50 % respectively.

Table 2-3: Comparison of Discharged Household Waste Composition

Country	Unit	Cambodia	Malaysia	Lao	Philippines	Paraguay	Tanzania	Honduras
		Phnom Penh*	Penang	Vientiane	Manila	Asuncion	Dar es Salaam	Tegucigalpa
Kitchen waste	%	63.30	32.80	16.90	45.82	36.60	42.00	47.20
Paper	%	6.40	25.50	2.80	15.39	6.40	3.10	11.50
Textile	%	2.50	3.40	1.60	4.33	1.30	1.20	2.80
Plastic	%	15.50	11.20	6.10	15.60	3.90	2.20	7.10
Grass & Wood	%	6.80	14.40	38.20	7.45	22.20	25.30	11.60
Leather & Rubber	%	0.10	0.80	1.10	0.80	0.70	0.90	2.20
Metal	%	0.60	2.60	3.70	5.47	1.30	2.00	1.90
Bottle & Glass	%	1.20	1.40	9.30	2.69	3.10	3.50	3.50
Ceramic & Stone	%	1.50	0.20	(Included in glass)	1.26	2.50	0.40	12.10
Miscellaneous	%	2.10	7.80	20.30	1.19	22.00	19.40	0.10
Total	%	100.00	100.00	100.00	100.00	100.00	100.00	100.00
ASG	kg/l	0.25	0.19	0.168	0.19	0.22	0.39	0.20

*: Average of the dry and rainy seasons in 2003

2.2.3 Medical and Industrial Waste

a. Medical Waste

In the survey on medical waste, interview surveys were conducted at 41 medical institutions. Based on the survey results, the Study Team estimated the amount of medical waste generated in Phnom Penh to be as shown in the table below.

Table 2-4: Generation Amount of Medical Waste in 2003

Generation Source	Generation rate	No. of Sources	No. of Beds/Patient + Staff	Occupancy rate of beds	Generation amount (kg/day)	
General waste						
1. Hospital	kg/bed/day	5.174	15	3,241	39.8 %	6,674
2. Poly-clinic		1.060	33	776	19.5 %	160
3. Clinic		1.313	816	9,067	23.0 %	2,738
4. Health centre		5.069	6	92	31.5 %	147
Total		---	870	13176	---	9,719
1. Hospital	kg/person/day	0.3854	15	17,318	---	6,674
2. Polu-clinic		0.093	33	1,730	---	160
3. Clinic		0.111	816	24,661	---	2,738
4. Health centre		0.327	6	449	---	147
Total		---	870	44,158	---	9,719
Medical waste						
1. Hospital	kg/bed/day	0.262	15	3,241	39.8 %	338.0
2. Polu-clinic		0.312	33	776	19.5 %	47.2
3. Clinic		0.263	816	9,067	23.0 %	548.5
4. Health centre		0.952	6	92	31.5 %	27.6
Total		---	870	13,176	---	961.3

b. Industrial Waste

In order to gain an understanding of the current situation regarding industrial waste in Phnom Penh, interview surveys were conducted at 32 factories. Based on the survey results, the Study Team estimated the industrial waste generation amount to be as shown in the table below.

Table 2-5: Generation Amount of the Industrial Waste in 2003

Generation Sources	Code	Generation Rate (kg/employee)	No. of Sources	No. of Employees	Generation Amount (kg/day)
Food	G01	3.893	21	2,440	9,499
Textile	G02	0.409	23	30,687	12,551
Wearing apparel	G03	0.254	179	137,595	34,949
Chemical	G04	0.293	10	1,354	397
Non-metal	G05	0.293	4	344	101
Fabricated metal	G06	0.293	9	761	223
Wood	G07	0.293	3	145	42
Paper	G08	0.339	2	112	38
Others	G09	0.851	1	504	429
Total			252	173,942	58,229

Of the industrial waste generated, 51% (29,697kg/day) is collected by CINTRI and discharged at the SMCDS. The remaining 49% (28,532kg/day) is collected by Salam

Trading Company and treated at a hazardous waste disposal facility approved by the Ministry of Environment.

2.2.4 Waste Flow

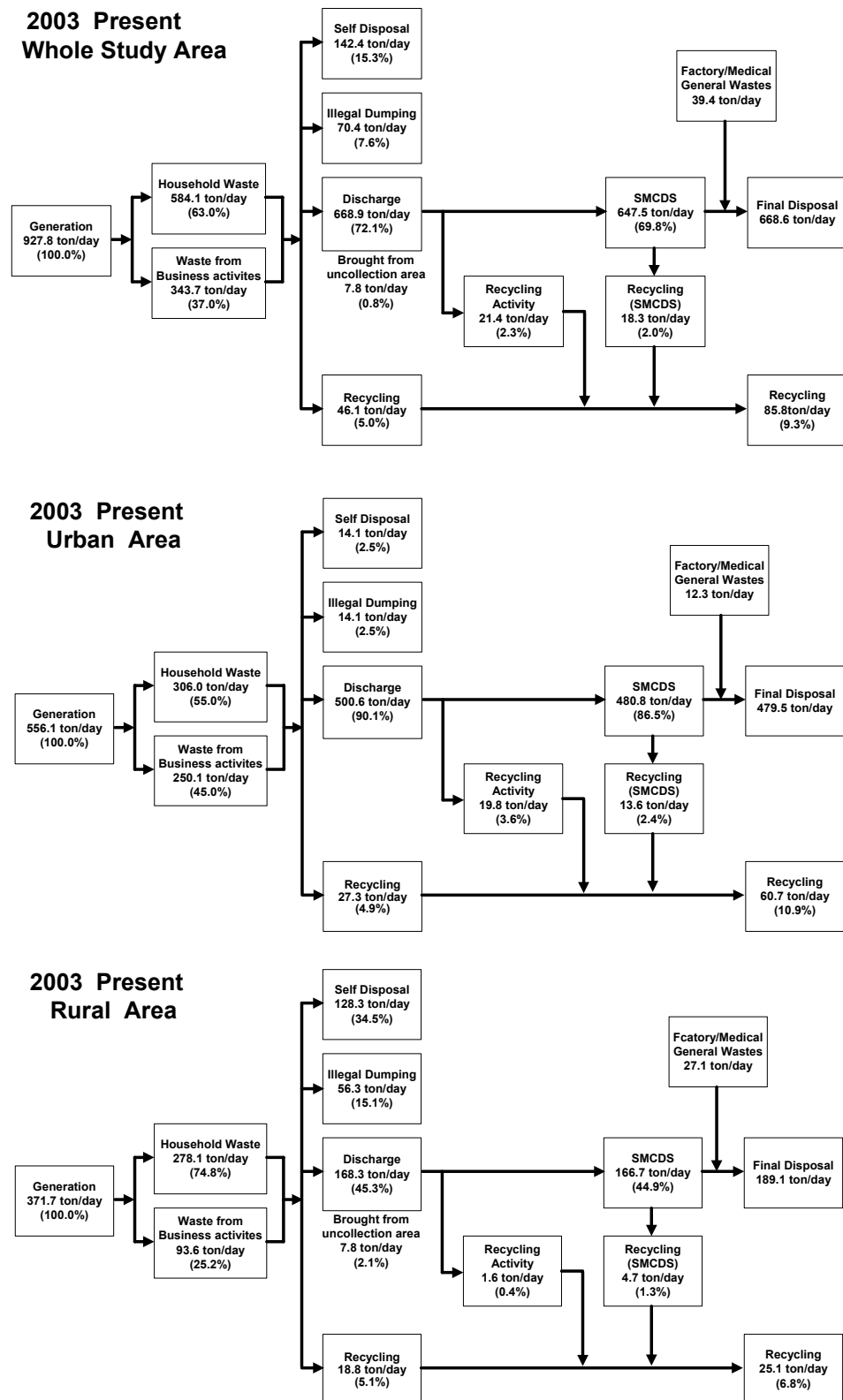


Figure 2-1: Waste Flow in 2003

2.3 Assessment of the Current SWM System

2.3.1 Summary of the Current SWM System

The current technical and institutional systems for solid waste management in Phnom Penh are summarized in Table 2-6 and Table 2-7.

Table 2-6: Current Technical system in 2003

Items	Current situation
1. Waste generation (ton/day) * Generation sources, such as parks and slaughter houses, estimated from the waste flow are not specified	Household waste 584.1 ton/day Commercial waste (Restaurant) 46.2 ton/day Commercial waste (Other Shop) 150.9 ton/day Market waste 94.3 ton/day School waste 7.7 ton/day Street sweeping waste 3.0 ton/day Hotel waste 3.1 ton/day Office waste 1.3 ton/day Other waste* 37.2 ton/day Total 927.8 ton/day
2. Discharge and storage	<ul style="list-style-type: none"> No system for storing (in plastic bags) Place waste in heaps or drum containers on the sidewalks Some large restaurants, hotels etc. use bins or containers Many households burn their excess waste in the streets There are no discharge rules.
3. Collection and haulage 3.1 Collection service area 3.2 Population (in 2003) Whole area Urban area Rural area	373.73 Km ² 1,199,414 628,322 571,092
3.3 Collection coverage rate in terms of population (The value in () is the rate excluding recycling at discharge point) Whole area Urban area Rural area 3.4 Collection system In NIP Area by PPWM CINTRI's Area 3.5 Collection frequency 3.6 Collection equipment PPWM CINTRI 3.7 Department in charge Number of staff	77.1% (72.1%) 95.0% (90.1%) 50.4% (45.3%) Primary collection (curbside and door-to-door collection by Self Help Group: SHG) and secondary collection in NIP area Waste collection for the Sen Sok relocation site by small compactor truck by PPWM twice a week Curbside collection, bell collection, primary/secondary collection Daily in NIP area Every day along the main streets and 1 to 3 times a week for another area by CINTRI Compactor truck (11 tons) 1 Compactor truck (4.5 tons) 1 Containers (2.5 m ³) 6 Containers (0.75 m ³) 5 Compactor truck (KAMAZ) 4 Compactor truck (11 tons) 14 Compactor truck (9 tons) 1 Compactor truck (4.5 tons) 11 Compactor truck (3.5 tons) 9 Compactor truck (2.5 tons) 8 Dump truck (6 tons) 2 Solid Waste Operation Section, PPWM Administration 1

Items	Current situation																																
3.8 Private contractor Number of staff 3.9 Unit cost for collection service by PPWM (US\$/ton)	<table border="0"> <tr><td>Waste collection</td><td>2</td></tr> <tr><td>Fee collection</td><td>7</td></tr> <tr><td>Total</td><td>10</td></tr> <tr><td>CINTRI</td><td></td></tr> <tr><td>Office worker</td><td>30</td></tr> <tr><td>Customer relations</td><td>78</td></tr> <tr><td>Quality controllers</td><td>10</td></tr> <tr><td>Truck drivers</td><td>60</td></tr> <tr><td>Garbage collectors</td><td>260</td></tr> <tr><td>Mechanics</td><td>35</td></tr> <tr><td>Supervisors and group leaders</td><td>40</td></tr> <tr><td>Workers in a special cleansing activities</td><td>20</td></tr> <tr><td>Total</td><td>533</td></tr> <tr><td>Primary collection</td><td>1.89 US\$/ton</td></tr> <tr><td>Secondary collection</td><td>1.62 US\$/ton</td></tr> <tr><td>Total</td><td>6.73 US\$/ton</td></tr> </table>	Waste collection	2	Fee collection	7	Total	10	CINTRI		Office worker	30	Customer relations	78	Quality controllers	10	Truck drivers	60	Garbage collectors	260	Mechanics	35	Supervisors and group leaders	40	Workers in a special cleansing activities	20	Total	533	Primary collection	1.89 US\$/ton	Secondary collection	1.62 US\$/ton	Total	6.73 US\$/ton
Waste collection	2																																
Fee collection	7																																
Total	10																																
CINTRI																																	
Office worker	30																																
Customer relations	78																																
Quality controllers	10																																
Truck drivers	60																																
Garbage collectors	260																																
Mechanics	35																																
Supervisors and group leaders	40																																
Workers in a special cleansing activities	20																																
Total	533																																
Primary collection	1.89 US\$/ton																																
Secondary collection	1.62 US\$/ton																																
Total	6.73 US\$/ton																																
4. Street sweeping and park cleansing 4.1 Cleansing system of PPWM 4.2 Cleansing system of CINTRI Method Number of sweepers	<p>No service provided by PPWM but DPWT carries out cleansing in a few large parks. Park cleansing is carried out by the Public Garden Div. of DPWT</p> <p>Mechanical and manual cleansing/1 mechanical sweeping vehicle 350 sweepers</p>																																
5. Intermediate treatment 5.1 Composting by NGOs	<p>CSARO is producing 2.0 tons of compost per month (product base) at Waste Recycle Development Center (WRDC). COMPED is producing 6.0 tons of compost per month (product base) at the SMC disposal site.</p>																																
6. Recycling 6.1 Private recyclers 6.2 Sorting by NGO	<p>Waste recycling by private recyclers is very active. Recycled material amounts to about 46 tons/day. CSARO is sorting 1.5 – 2.0 tons/month recyclable materials at WRDC.</p>																																
7. Final disposal 7.1 Disposal site 7.2 Disposal method 7.3 Land use in the surrounding area 7.4 Haulage distance from center of the city 7.5 Department in charge Number of staff 7.6 Landfill equipment 7.7 Unit cost for landfill operation (US\$/ton)	<p>Stung Mean Chey disposal site (SMCDS) Open dumping Wetland, borrow pit, residential 5.3km form the Central market Department of Dump Site Management and Mechanical Workshop, PPWM</p> <table border="0"> <tr><td>Landfill manager</td><td>1</td></tr> <tr><td>Weighbridge operator</td><td>2</td></tr> <tr><td>Worker</td><td>1</td></tr> <tr><td>Total</td><td>4</td></tr> <tr><td>Bulldozers (rented inc. operator)</td><td>2</td></tr> </table> <p>0.43 US\$/ton</p>	Landfill manager	1	Weighbridge operator	2	Worker	1	Total	4	Bulldozers (rented inc. operator)	2																						
Landfill manager	1																																
Weighbridge operator	2																																
Worker	1																																
Total	4																																
Bulldozers (rented inc. operator)	2																																
8. Maintenance of equipment	<p>PPWM maintains all the equipment by out-sourcing CINTRI maintains by its own shop.</p>																																
9. Septage management 9.1 Department in charge 9.2 Number of staff 9.3 Collection equipment	<p>Department of Sludge Waste Operation, PPWM</p> <table border="0"> <tr><td>Chief of Sludge operation</td><td>1</td></tr> <tr><td>Chief of Private business</td><td>1</td></tr> <tr><td>Driver</td><td>4</td></tr> <tr><td>Worker</td><td>8</td></tr> <tr><td>Total</td><td>14</td></tr> <tr><td>Tank truck of 5.0 m³</td><td>3</td></tr> </table>	Chief of Sludge operation	1	Chief of Private business	1	Driver	4	Worker	8	Total	14	Tank truck of 5.0 m ³	3																				
Chief of Sludge operation	1																																
Chief of Private business	1																																
Driver	4																																
Worker	8																																
Total	14																																
Tank truck of 5.0 m ³	3																																

Table 2-7: Current Institutional System

Items	Current situation
1. Organization	
1.1 Department concerned	PPWM
1.2 Number of Staff	Administration 12 Solid waste operation 10 Sludge waste operation 14 Dump site operation and mechanic workshop 4 Total 40
1.3 Management system	MPP contracted out the collection service excluding the NIP area to the private company "CINTRI". PPWM has a right of supervision of collection services provided by CINTRI.
2. Financial situation	
2.1 Municipality of Phnom Penh in 2002 (Unit: 1, 000 Riels)	Revenue (actual) 26,572,474 (6.6 million US\$) Expenditure (actual) 27,821,974 (6.9 million US\$)
2.2 Budget for cleansing services in 2002	MPP does not compensate for cleansing service
2.3 Income and Expenditure of PPWM in 2002	Income US\$ 159,139.50 Expenses US\$ 156,407.89
2.4 Fee collection system	
a. Public (PPWM)	Direct collection in NIP area
b. Private	Tack the waste fee on the electric bill
2.5 Fee collection rate	
a. Public (PPWM)	In 2002 approx. 60% (household)
b. Private	Private approx. 60% (household) approx. 15% (commercial)
2.6 Tariff	Tariff is settled by MPP New tariff was applied from the end of October, 2003..
2.7 Income from fee collection	
a. Public (PPWM)	From NIP area in 2002 US\$ 30,717.08
b. Private	No data
3. Legal Basis	PPWM statute was approved by the MPP on September, 2003 but not legally authorized by the central government yet.
3. Public Cooperation	There are very little public education programs and co-operation

(Note) *1: The information is released by CINTRI.

2.3.2 Assessment of the Current SWM system

The current SWM system in Phnom Penh has been assessed, and the results are shown in the table below.

Table 2-8: Assessment of Current SWM Conditions in Phnom Penh

Items	Urban Area (4 Khans)	Rural Area (3 Khans)
Technical System	1. Waste generation	<ul style="list-style-type: none"> The generation unit of household waste is 487 g/person/day The proportion of kitchen waste is as high as 63.3%. The proportion of recyclable matters such as metals, paper and bottles is 23.7% all together. Of that, the proportion of plastic is 15.5%, which is strikingly high. Plastic bottles have become popularized and the use of plastic bags has drastically increased; their consumption rate is equal to that of developed countries.
	2. Waste disposal at	<ul style="list-style-type: none"> 2.5% of waste generated is self disposed and 2.5% is illegally dumped by the As much as 34.5% of waste generated is disposed of by the generators. Illegal

Items	Urban Area (4 Khans)	Rural Area (3 Khans)
source	<p>generators. These figures are relatively low.</p> <ul style="list-style-type: none"> The reason for these low figures is that about 90% of waste generated in areas without collection services is carried to waste collection areas by people. The other reason is that the area is overpopulated (population density: 230.2 persons/ha) and there are only a few vacant lands or gardens, thus self-disposal or illegal dumping is not practically possible based on the study of waste flow. 	<p>dumping is 15.1%, 6 times as much as in the urban area.</p> <ul style="list-style-type: none"> The primary reason for the high self-disposal and illegal dumping rates is the low coverage of waste collection services. Secondly, the area is not highly populated (population density: 16.5 persons/ha) and there is vacant land and houses with gardens, making self-disposal and illegal dumping possible.
3. Storage and Discharge	<ul style="list-style-type: none"> Plastic bags are widely used to store waste before discharge. Since there are no discharge rules, the waste piles do not disappear from the city because people discharge waste after the collection trucks have passed. Street vendors and cars parked on the sidewalk obstruct cleansing works and litter the sidewalks with waste. There are waste piles on the sidewalk and carriageway making a mess even in the city center, degrading city beauty and public health. Sangkats reported there are 57 waste heaps in the 4 urban Khans. Some large restaurants, hotels and shops use bins or containers for on-site storage of waste. 	<ul style="list-style-type: none"> The method of waste storage and discharge varies from place to place. There are waste piles making a mess in the urbanized or populated areas, degrading city beauty and public health. Sangkats reported there are 6 waste heaps in the 3 rural Khans. The problem of scattered waste is not serious in the unpopulated areas. The sanitary and aesthetic problem of waste scattering in vacant land is particularly severe in the areas where people were relocated.
4. Collection and Transport	<ul style="list-style-type: none"> The waste collection rate in terms of population is estimated at 95.0% by adding the waste recycling rate at the source (4.9%) and the waste discharge rate to collection services (90.1%). Because the collection vehicles are old (in use for 8-25 years) and frequently break down, the collection service is not able to keep to the schedule. As a result, some of the discharged is left uncollected. The loading of waste piled on sidewalks and streets requires manpower, which reduces the collection efficiency. Waste piled in empty lots that cannot be accessed by collection vehicle is neglected, which is causing considerable deterioration of the surrounding environment. 	<ul style="list-style-type: none"> The waste collection rate in terms of population is estimated at 50.4% by adding the waste recycling rate at the source (5.1%) and the waste discharge rate to collection services (45.3%). Because the collection vehicles are old (8-25 years) and frequently break down, the collection service is not provided at fixed intervals. As a result, the waste discharged by residents is left uncollected. Self-disposal and illegal dumping are comparatively high in unpopulated area. However, the most serious problem is that most parts of the populated areas are out of the service area. Therefore, the top priority should be given to the provision of collection services to populated areas.

Items	Urban Area (4 Khans)	Rural Area (3 Khans)
	<ul style="list-style-type: none"> • Most of the population in the four Khans in the urban area enjoys waste collection services. The collection service covers almost everywhere. The primary target of SWM in cities, i.e. the removal of waste from the living environment, has thus been generally achieved. • In part of the area, for example the NIP area, former waste pickers were organized to make self help groups (SHGs) and the SHGs provide primary collection services. This is a very effective way to expand waste collection services to the areas that collection vehicles cannot easily enter. • The NIP area is the only area where PPWM renders waste collection services. Although PPWM has 2 compactor trucks and 1 skip loader truck, it collects only 19 tons of waste a day. • A resource recovery system by an informal sector at the source and waste discharge points is efficiently working. Resource recovery at waste discharge points, however, causes problems such as the scattering of waste. In view of waste reduction, recycling and city cleansing, source separation will be preferable. • Except for the NIP area, there is no waste transfer system. Collection vehicles directly go to the SMCDS. The site is within 10 km from anywhere in the city, it seems no transfer station is considered. 	<ul style="list-style-type: none"> • In some areas, primary collection has been attempted as in the NIP area, but collection services in the areas where collection vehicles cannot enter are inadequate. Because most parts of the area with no or poor collection services are areas with low accessibility, the method used in the NIP area should be employed to expand collection services. • There is no area served by PPWM. The collection service is provided only by a private company which follows economic principle. Because of the character of the area, the efficiency of the waste collection service cannot be high, and the provision of collection services by the public sector needs to be considered. • There is active resource recovery by the informal sector at the generation source and waste discharge points. • There is no waste transfer system. Waste collected by collection vehicles goes directly to the SMC final disposal site. Since the transport distance from some areas exceeds 20 km, the establishment of a waste transfer system is needed.
5. Road and park cleansing	<ul style="list-style-type: none"> • Street sweeping services are provided by CINTRI with waste collection fees as the financial source. • Cleansing services are provided to major roads and parks in the city, which heavily contribute to city beauty. • Machinery is used for cleansing services in a limited area. Manual cleansing is the main practice creating jobs. 	<ul style="list-style-type: none"> • Street sweeping services are provided only to the road to the airport by CINTRI with waste collection fees as the financial source. • Manual cleansing is the main practice creating jobs.
6. Intermediate treatment	<ul style="list-style-type: none"> • One composting facility (compost production capacity is about 2.0 tons/day) is operated by a NGO, CSARO. The product quality of compost is high because selected material is used, but its market is unstable. 	<ul style="list-style-type: none"> • There is one composting facility run by the NGO, COMPED, at the SMC disposal site (compost production capacity is reported to be about 6.0 tons/day by the NGO, which seems to be overestimated). It receives waste from markets, thus the quality of compost is high, but its market is not stable. According to POS, on-site composting is practiced at some households.

Items	Urban Area (4 Khans)	Rural Area (3 Khans)
	<ul style="list-style-type: none"> • The promotion of compost is one of the effective ways to raise the waste recycling rate. The evaluation of project feasibility, however, requires market research such as a study on prices of competitive products such as organic fertilizers. It is also necessary to diffuse knowledge to farmers on the effect of soil improvement by using compost and to stimulate demand. • Major hospitals have small incinerators for treating infectious waste, but they are not fully operated due to financial and technical problems. 	
7. Recycling	<ul style="list-style-type: none"> • The recycling rate of the city is 9.3% (85.8 tons/day) of total waste generation, which is comparable to that in Japan (13.1% in 1999). Recycling systems in the two countries are, however, largely different. In Japan, recycling is done by community groups (5.1%), recycling facilities and machinery, while in Cambodia recycling is an informal activity using cheap labor. • NGOs such as CSARO carried out recycling although on a limited scale. The recycling system of individual recyclers is well developed. • Informal recycling by street waste pickers at the source and waste discharge points is especially active. Their recycling is estimated to reach 67.5 tons/day, or 7.3 % of the total waste generated in the city. • Final users of recycled material are various but their business scale is small. The majority of recovered material is therefore exported to Vietnam and Thailand. • At the SMC disposal site, there are more than 500 waste pickers engaged in resource recovery. 	
8. Final disposal	<ul style="list-style-type: none"> • The SMC disposal site is the only disposal site in MPP. Unregulated landfill operation has continued for 38 years, since 1965. The municipality possesses a land plot of only 6.8 ha, which is too small for a city with a population of million, and waste spreads out of the municipal area to the surrounding private land. Since waste is piled up to a height of more than 5 m on average, it is getting difficult for the collection vehicles to access to the working face. Accessibility to the site is particularly poor in the rainy season, when waste disposal must occasionally cease. Improving accessibility and securing a landfill area are urgent issues. • The site is a typical open dump, posing serious negative impacts on the surrounding environment. Air pollution by smoke caused by fire is particularly serious not only for the surrounding area but also a wide area in the city. The prevention of fire is therefore also an urgent matter. • Incoming vehicles are not controlled. It is not known what kind of waste is disposed of in which part of the landfill. Infectious hazardous waste is disposed of without being distinguished from municipal waste. • The most problematic matter is that the remaining service life of the site is nearly nil and a residential area is approaching less than 100 m away from the site due to rapid urbanization. Therefore, a new disposal site must be constructed as soon as possible and the existing site must be closed. • More than 500 waste pickers are working without any rules. Their resource recovery activities interfere with landfill operations and put their lives at risk. It is urgently required to segregate the working area of waste pickers and the working area of heavy machinery and waste collection vehicles so as to realize efficient landfill operation and safe material recovery. • All landfill equipment being used in SMCDS are leased. Since the number of landfill equipment and fuel are shorted, the landfill operation is not operated sufficiently because of financial problems. 	

Items		Urban Area (4 Khans)	Rural Area (3 Khans)
Institutional System	9. Operation and Maintenance (O&M) of Machinery	<ul style="list-style-type: none"> • CINTRI's machinery for waste collection, transport, and road cleansing, which have been in use for 8 to 25 years, break down frequently. Although CINTRI's maintenance shops in Beng Kak 1 and Toul Kork are not adequate facilities, CINTRI is somehow able to keep the machinery in working condition. However, CINTRI is not able to keep to the collection schedule. • PPWM does not have the human resources, equipment or facilities to operate and maintain its machinery. When machinery breaks down, the repair work is entrusted to a private service shop. • The landfilling machinery at the disposal site is all rental, and the rental company carries out the repair work at a small shop set up on-site. 	
	10. Management of Septage	<ul style="list-style-type: none"> • Septage generated in the city is collected by three vehicles of PPWM and 11 vehicles of the private sector. • According to records in the year 2003, 5.8 m³/day of septage was disposed of at the SMC disposal site on the average. • Examining these figures, it is highly anticipated that septage collected by the private sector is disposed of out of the SMC disposal site. Appropriate disposal must be strongly instructed. The establishment of a septage disposal system requires a correct understanding of the real situation by studying the number of septic tanks, the frequency of emptying the tanks, and other aspects. • Septage is disposed of in the sludge pond constructed on top of the waste layers at the SMC disposal site. This method is simple but effective, and should be continued in the absence of an alternative system. 	
	11. Legal system	<p>There is a Sub-Decree on SWM, established in April, 1999, which is the fundamental law on SWM. Since it only sets an overall framework, the following issues should be solved.</p> <ul style="list-style-type: none"> • Although MOE has issued a ministerial declaration to supplement the Sub-Decree, detailed regulations, standards and guidelines that should have been established based on it have not been well prepared yet. • The Sub-Decree on SWM states that waste is divided into hazardous waste (HW) and non-hazardous waste (non-HW), but does not define or categorize waste. It is hence not practically possible to separate non-HW and HW. Though the classification of non-HW and HW is reasonable as a broad one, a more detailed classification is necessary for proper SWM, especially for identification of the body (producer) responsible for the disposal of the SW. • The Sub-Decree on SWM states that the local authorities are responsible for the disposal of HW from domestic sources. However, the domestic sources in the Sub-decree included clinics and hospitals. This might need to be examined. • The collection, transport or storage of hazardous waste from factories requires the approval of MOE, but the responsibility of supervision is not clearly placed. • The Sub-Decree on SWM stipulates that the municipalities responsible for non-hazardous waste management (non-HW) have to prepare waste management plans. However, no municipalities in the country have developed the plan. The SWM plan for the MPP to be formulated in this study is the first one and the methodology of SWM planning is expected to diffuse to other cities throughout the country. • By-laws on SWM and guidelines on waste discharge and others to ask people for cooperation are necessary for the municipalities to properly carry out SWM. There are, however, no such by-laws or guidelines. • MOE stated that it detected nine cases of breach of the Sub-Decree on SWM and its 	

Items	Urban Area (4 Khans)	Rural Area (3 Khans)
11. Legal system	<ul style="list-style-type: none"> • ministerial declarations and collected 44.23 million Riels in fines in 2002 following the Law on Environmental Protection and Natural Resources Management issued in January 1997. The team considers these cases are only part of the illegal activities. An example is the problem of septage. There is a septage disposal facility on the SMC disposal site. The private septage collection companies, which possess 11 septage collection vehicles (PPWM owns only three), do not deliver septage there. Most septage collected by the private sector is presumed to be illegally dumped. 	
12. Administration and Organization	<ul style="list-style-type: none"> • At the national level, it is clear that SWM is within the jurisdiction of MOE. On the other hand in MPP, DPWT, DOE and PPWM are involved in SWM and the relationship among the three is not clear. Management of waste disposal and cleansing services in a practical sense are carried out by PPWM under the DPWT. The PPWM Statute was made based on such a situation, but has not been approved as of July 2003 either by the Ministry of Interior, the Ministry of Finance of Economics, or the MOE. On the other hand, Prakas No. 80, which was issued jointly by the Ministry of Interior and the MOE on February 25, 2003, stipulates that a SWM plan should be formulated mainly by the DOE of each municipality. The jurisdiction of SWM in the city should be unified without delay. The immediate approval of the PPWM Statute is expected in view of the clarification of the jurisdiction. • Waste collection and cleansing work was contracted out to CINTRI, which took over the franchise contract from PSBK in 2002. The contract is valid for 50 years from 1997, and allows CINTRI to do business as a monopoly and to collect fees. If any problems occur such as CINTRI's breach of contract, there is no other organization that can provide waste services in place of CINTRI. It is critical that a monopoly of waste collection and cleansing work be avoided. • Since the PPWM Statute has not yet been approved, its presence is very unstable. Moreover PPWM is weak in terms of property (machinery and facility), human resources (quality and quantity of personnel) and finance. MPP amended the contract between MPP and CINTRI and currently executes waste collection in the NIP area and landfill operations in the SCMDS. • The waste collection and cleansing service being provided by CINTRI and PPWM as a whole are hardly monitored. A monitoring and control system for SWM should be established. 	
13. Public-Private Partnership	<p>SSWMPAP⁴ strongly pointed out, the 46-year franchise contract on SWM work with the private company has the following problems.</p> <ul style="list-style-type: none"> • Open and transparent competitive bidding and pricing of the contracted services are not practiced. • Service performance and costs of the private contractor's work is not contested or monitored by the responsible organization of MPP. • The contractor is not accountable to the client and customers for the standards and manner in which his service is provided. <p>In addition to the aforementioned problems with the contract, MPP's monitoring and control system for SWM is weak as described in the following.</p> <ul style="list-style-type: none"> • There are no baseline data necessary for SWM, such as data on the rate of population without waste collection services and data on the waste disposal quantity from each generation source, district, or collection company. Moreover the data collection system is not developed. • Due to a lack of baseline data, the unit cost of each sub-component of SWM (i.e. waste collection, septage collection, final disposal) is not known. • MPP does not control or monitor the private company operating SWM work, and does not even have a unit to do so. It also lacks a mechanism to receive complaints from people. <p>As shown above, the compilation of basic data on SWM and the development of a database are urgently needed.</p>	

⁴ "Strategic Solid Waste Management Plan and Action Plan" by NORAD March, 2003

Items	Urban Area (4 Khans)	Rural Area (3 Khans)
14. Capacity Building	<ul style="list-style-type: none"> • Following the SSWMPAP, several programs were carried out by ADB and NORAD for five years in order to strengthen DPWT and PPWM. Although they are still weak, the development of their present structure owes much to the assistance. • Although the structure of PPWM was developed, its collection service covers only 2.1 % of the population in MPP and the SMC final disposal site they operate is nothing but an open dump. Although the PPWM statute stipulates that monitoring the private business company on solid and liquid waste is one of the PPWM's tasks, PPWM does not supervise or control the SWM work in the city carried out by the private company. • In conclusion, further development of PPWM's human resources is necessary so that PPWM can operate and control an appropriate and sustainable SWM system for MPP. The acquisition of the know-how on the provision of waste collection and cleansing services and the operation of a sanitary landfill is especially urgent for the existence of the organization. The acquisition of such know-how would provide PPWM or any other organization in MPP responsible for SWM of the know-how on the monitoring and control of proper SWM works, which are main responsibility of the public sector. Therefore, in regard to the human resources development of PPWM, priority should be placed on the acquisition of the know-how of SWM operation. • On the other hand, the monitoring and control of the collection service and disposal site operation should be the responsibility of a separate organization from the implementing body, i.e. PPWM. It is necessary for MPP to establish this as quickly as possible. 	
15. Financial Condition	<ul style="list-style-type: none"> • The financial base of PPWM is weak as shown by the fact that as much as 70% of revenues depend on the waste disposal fee paid by CINTRI. The total revenue in 2002 was 159,000 dollars and there is no financial support from MPP to PPWM. The repayment of loans and interest amounted to about 22,000 dollars in 2002. The yearly balance of income and expenditure does not have a problem, but no funds are retained to purchase new machinery and vehicles or to improve the final disposal site. Even the budget for the operation and maintenance of existing property is very tight. • The financial condition of MPP is also severe. The total revenue of the year 2002 was 26.6 billion riels (approximately 6.65 million dollars), which is too tight to subsidize the SWM work of PPWM. • The area where PPWM provides waste collection service is very limited. As of 2003, CINTRI's collection service covers 130,000 households and institutions, while PPWM's service covers only 3,400 (2.1%). Moreover, PPWM's area is mostly residential and the collection fee of more than 3,200 households is less than 1 dollar/month. Even if PPWM collects fees from all the beneficiaries in the area, the income will only amount to 4,300 dollars/month. The average monthly fee collected in 2002 was about 2,560 dollars; thus the fee collection rate is about 60% in the NIP area. Accordingly, not only the purchase of new vehicles but also their maintenance is difficult. • The current tariff structure for municipal waste management was determined by an agreement among PPWM, CINTRI and MPP. It should be reviewed in order to prepare for additional expenditure if the development of the new final disposal site and the enforcement of PPWM's SWM service system are to be put into effect. • The tariff structure needs adjustment also from the viewpoint of equality. The households and institutions are broadly categorized depending on the size and/or type, and the waste fee is set for each category. In order to more strictly follow the "beneficiary pays" principle, careful categorization should be considered. • At present, CINTRI is charging fees by tacking it onto the electric bill. However, CINTRI has set the fee based on it own studies and sends bills to customers without their agreement, which has resulted in many complaints and unpaid bills. In order to improve the fee collection rate, the fee should be charged based on an agreement made between the CINTRI and the customer. 	

Items	Urban Area (4 Khans)	Rural Area (3 Khans)
15. Financial Condition	<ul style="list-style-type: none"> • The city is divided into seven Khans, which are further divided into 76 Sangkats, the smallest administrative division. It is believed that it would be effective to incorporate the Sangkat into the fee collection system. • The disposal fee currently being paid by CINTRI is approximately 0.5 dollars per ton and when the new disposal site is constructed, it will pay 0.75 dollars per ton. However, as a sanitary landfill cannot be properly operated at that cost, it is necessary to reexamine the disposal fee. • Considering the severe financial situation of MPP and PPWM, it is apparent that self-financing for the development of a new final disposal site is far beyond their affordability. In light of the provision of public services, the country or the city should be responsible for allocating as much funding as possible, but grant assistance from donor countries or international organizations is inevitable for an appropriate SWM system because of the financial shortage of the country and the city. 	
16. Public education and cooperation	<ul style="list-style-type: none"> • Sustainable SWM cannot be realized without the sufficient understanding and cooperation of residents. SWM authorities in developed countries try to raise people's awareness and ask for cooperation in many ways. Such public relations activities are hardly seen in MPP. • It is reported that CINTRI, a monopoly rendering waste collection and cleansing service in MPP, uses 100,000 US dollars for PR activities. It does not, however, receive enough cooperation from residents for appropriate waste discharge. • In order to reduce waste scattering and increase the collection efficiency, it is necessary to establish waste discharge rules and promote a public education campaign to disseminate the rules by the joint effort of the MPP and the public. • According to the result of POS, people's awareness of SWM is not high. Many people are concerned with the problem of scattered waste that degrades city beauty, but they are not well aware of the important roles that they should play in waste reduction or recycling. • In order to keep the city clean and to conserve the sanitary environment, people's cooperation is inevitable. The authority has to actively carry out PR activities. 	
17. Hazardous waste management	<ul style="list-style-type: none"> • The Sub-Decree on SWM sets basic rules for hazardous waste management including infectious waste, but standards or guidelines have not been developed, although they are necessary to practically control and regulate the management of these wastes. • A private disposal site for hazardous waste was approved by MOE and constructed in the Khan Ang Snoul by Sarom Trading Company, but its control is insufficient. Main hospitals have incinerators for medical waste but most are not working well because of financial and technical problems. • MOI issued a monitorial order (Prakas), which requires factories to report on their management of hazardous waste and instructs them to properly treat and dispose of it, but the enforcement of this Prakas is weak. • The team studied SWM at 41 medical institutions. It was found that all of them had known that the management system for medical waste was regulated by a law. • Personnel working for the medical institutions are aware of a medical waste management system and the risks of infectious or hazardous waste. Most medical institutions take prevention measures against infection and separately collect and store such waste within the premises. • The number of separation categories of infectious or hazardous waste is small. • Many medical institutions do not report hazardous waste. This shows a lack of consciousness about the definition, character and identity of hazardous waste. 	

Items	Urban Area (4 Khans)	Rural Area (3 Khans)
17. Hazardous waste management	<ul style="list-style-type: none"> • Many medical institutions replied that the disposal manner of collected infectious or hazardous waste is not satisfactory. A part of infectious or hazardous waste is separated from municipal waste when collected, and is incinerated or entrusted to contractors for disposal. Some stated that the contractors mix infectious or hazardous waste with municipal waste during collection, and they end up being disposed of together at the landfill. Since no treatment measure is taken at the landfill for infectious or hazardous waste, human health and the environment are threatened. • The medical institutions stated that they are ready to cooperate with the national or local government for the realization of the appropriate medical waste management system. Most of them, however, also answered that they need governmental support financially and technically in order to put the appropriate waste management system into action. 	

2.3.3 Current Issues concerning SWM

The following problems have been summarized based on the current situation of SWM in Phnom Penh.

a. Expansion of waste collection service

MPP contracts out its MSWM service to a private company based on a franchise agreement. However, because the collection service by the private contractor is limited to areas that are profitable, there are many unserved areas. Many of those areas are unplanned settlements that are home to the cities poor, and access is difficult because the roads are narrow. Otherwise, they are located in rural areas where the population density is low and waste collection cannot be carried out efficiently.

From the standpoint of conserving the urban environment, the unserved areas and areas where the collection service is not adequate have to be eliminated. All Phnom Penh residents have the equal right to public services and MPP is obligated to ensure they are covered.

b. Avoiding a private sector dependent system

As with electricity and water, waste collection is a public service vital to urban life. Hence, the suspension of that service would have such a great impact as to cause urban function to shut down. As waste collection in Phnom Penh is currently monopolized by the private sector, the city is in a crisis situation where it will not be able to cope with an unexpected event, such as the private company going bankrupt. MPP needs to take measures to avoid this kind of dependency on the private sector.

c. Securing of a new final disposal site

The Study Team estimates that SMC disposal site, the only disposal site in Phnom Penh, has a remaining capacity of less than two years. Therefore, the development of a new disposal site is a necessary and urgent issue.

d. Extending the life of the existing disposal site

As the planning, design and construction of the new disposal site will require about three years, the remaining service life of the existing SMC disposal site is inadequate (less than 2 years). Therefore, measures must be taken as soon as possible to extend the life of the

existing site. As SMC disposal site is basically an open dump, the environment at the site is poor; foul odor, smoke from fires and the scattering of waste is an every day problem. In order to gain the understanding of residents with regard to the development of the new disposal site, it is urgent that the environment be improved.

e. Promotion of the 3Rs

Reduce, reuse, and recycle (3Rs) are basic SWM policies that are promoted throughout the world. As mentioned above, the capacity of the final disposal site in Phnom Penh is not adequate, and the securing of a new disposal site is a serious problem. Reducing the generation amount even by a small amount in order to extend the life of the existing site is important under the tight financial conditions. Furthermore, studies found that 70% of the waste in the city is compostable waste, such as household and yard waste, and 24% is recyclable waste, such as paper, plastic, metals, and glass. Therefore, it is necessary to reduce the volume of waste by actively promoting recycling activities.