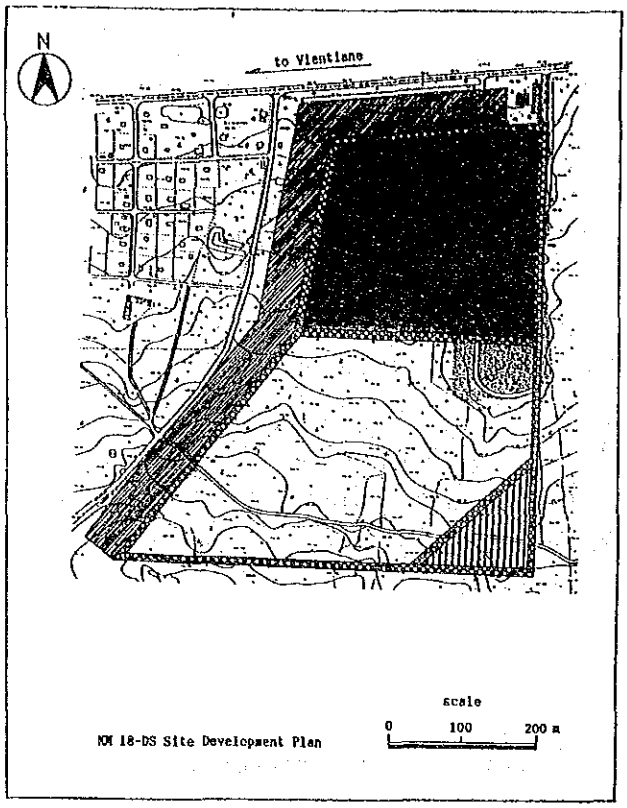
b. Outline of facilities

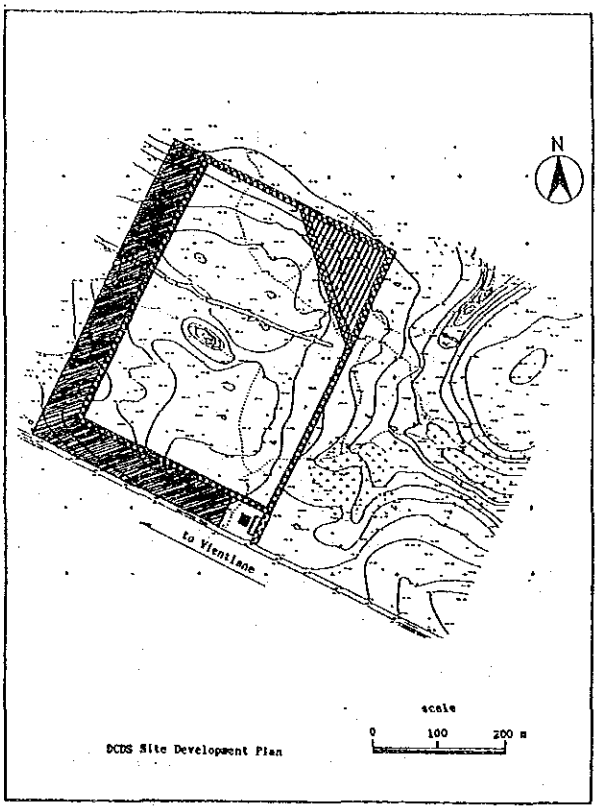
The outlines of facilities which are in need of a preliminary design at this stage are as follows:

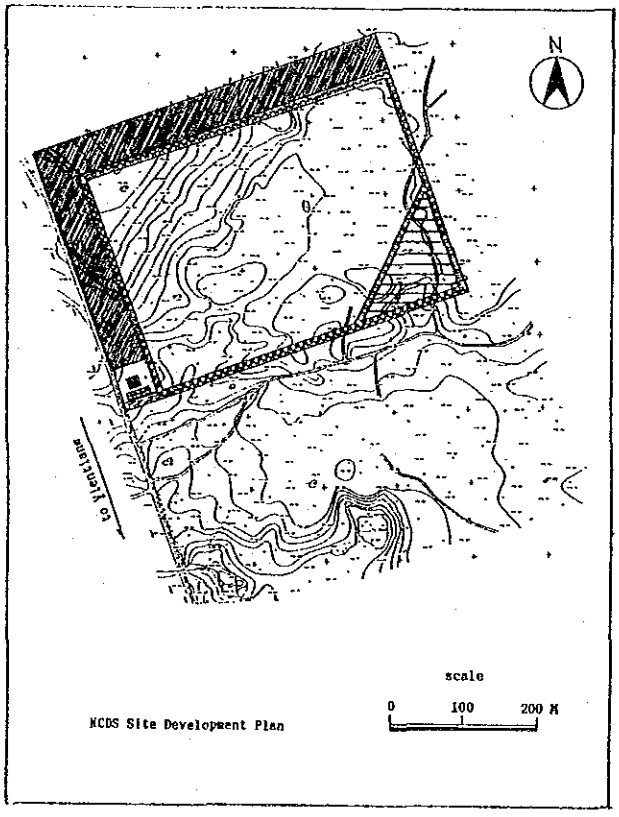
- site preparation works
- access
- enclosing structures
- environmental prevention measures
- leachate collection and treatment
- drainage and groundwater protection
- gas removal
- administration and inspection
- basic utilities

The development plan for each candidate site was made and is shown in Fig. 7.2-2. As shown in the figures, an area for the following facilities is required.

. buffer zone
. bund and others
. regulation and retention pond
. landfill area







LEGEND

Symbol	Contents
	Buffer Zone
	Landfill Area until 1995
	Landfill Area from 1995 to 2000
	Bund
	Approach Road
	Inspection Building
	Weighbridge
	Regulation and Retention Pond

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JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.2-2 Site Development Plans for Three Candidate Disposal Sites

7.2.3 Outline of Facility and Equipment

1) Collection and Haulage, Road Sweeping, Drain Cleansing and Grass Cutting Systems

Outline of equipment for collection and haulage, road sweeping, drain cleansing and grass cutting systems in 2000 is summarized in Table 7.2-3. This system is applied to three alternatives for comparison, and the operation and maintenance cost of the equipment for each alternative is calculated in consideration of the distance of each collection and haulage route of the alternative.

2) Outline of Each Disposal Sites

Based on the preliminary design, the outline of each disposal site is summarized and tabulated in Table 7.2-4.

Table 7.2-3 Outline of Equipment for Collection and Other Cleansing System in 2000

Type of Cleansing Service	Type of Vehicle and Equipment		Number of Vehicle and Equipment	Number of Staff	Remarks
Waste Collection and haulage				Manager : 1 Engineer : 1 Supervisor: 3 Driver : 34 Worker : 130 Total : 169	
	Residential, Commercial Area	Dump Truck ($10m^3$)	35 vehicles	Driver : 32 Worker : 128	Door to door and bell collection system
	Institutional (Market, Hospital & Office)	Detachable Container Truck ($5m^3$)	3 vehicles 40 containers	Driver : 2 Worker : 2	Communal container collection system
Road Sweeping, Grass Cutting, Drain Cleansing & Clean-up of Illegal Dumps				Manager : 1 Supervisor: 3 Operator : 1 Driver : 5 Worker : 41 Total : 51	
	Road Sweeping	Water Truck	2 vehicles	Driver : 2 Worker : 22	
	Grass Cutting	Grass Cutter	10 units	Worker : 10	
	Drain Cleansing & Clean-up of Illegal Dumps	Small Dump Truck Wheel Loader	3 vehicles 1 unit	Driver : 3 Worker : 9 Operator : 1	

Table 7.2-4 Outline of Each Disposal Site

ITEMS	Unit	Name of Disposal Site			Remarks
		KM 18-DS	DCDS	NCDS	
1. Civil & Mechanical Work					
Clearing	ha	20.6	19.0	19.0	
Buffer Zone	m	940	770	770	
Bund (Inland)	m	2,650	1,780	1,780	
Drainage	m	3,180	2,140	2,140	
Approach Road (New)	m	70	50	50	W=4m Asphalt Pavement
Access Road (Pavement Only)	m	-	7,000	-	W=6m Asphalt Pavement
On-site Road	m	2,650	1,780	1,780	W=3m Gravel Pavement (t=0.3 m)
Water Supply	m	7,000	7,000	7,000	
Leachate Collection Pipe	m	500	500	500	
Others	LS	1	1	1	Gas Removal, Fence, Gate and Car Wash etc.
Electric Supply	LS	-	1	1	
Weighbridge & Inspection Building	No.	-	1	1	
Building (50 m²)	No.	1	1	1	
Regulation and Retention Pond	No.	1	1	1	With circulation pump
2. Equipment					
Bulldozer	No.	1	1	1	
Hydraulic Excavator	No.	1	1	1	
Dump Truck	No.	1	1	1	
Water Truck	No.	1	1	1	
3. Operation & Maintenance					
i. Personnel	No.	10	10	10	
Manager	No.	1	1	1	
Engineer	No.	1	1	1	
Supervisor	No.	1	1	1	
Operator	No.	2	2	2	
Clerk	No.	1	1	1	
Driver	No.	2	2	2	
Worker	No.	2	2	2	
ii. Utility					
Water	1000m3	1	1	1	
Electricity	Mwh	5	5	5	
Fuel	1000 l	165	165	165	
iii. Cover	1000m3	(198)	(198)	(198)	On site
iv. Maintenance					
Bulldozer	No.	1	1	1	
Hydraulic Excavator	No.	1	1	1	
Dump Truck	No.	1	1	1	
Water Truck	No.	1	1	1	

7.2.4 Cost Estimation

1) Conditions for Cost Estimation

The cost of each alternative plan includes the investment cost and the annual expenses of facilities and equipment required to meet the generated solid waste volume in 2000 based on the 1991 prices.

In principle, a 5% tax will be added to the CIF Vientiane price of equipment whose import is deemed necessary.

Contingency costs, including costs for land acquisition and survey/design, are excluded in the investment cost.

The following shows the average annual salary scale in DCTC;

- Manager ; 276,000 kips/year
- Engineer ; 240,000 kips/year
- Supervisor ; 216,000 kips/year
- Technician or Operator ; 192,000 kips/year
- Clerk ; 180,000 kips/year
- Driver ; 156,000 kips/year
- Worker ; 144,000 kips/year

The above annual salaries include various social insurance payments, special benefits and over-time payment. Basic working hours are 7 hours/day with 306 working days/year. Table 7.2-5 shows the unit cost of utilities and fuels, etc.. Table 7.2-6 shows the unit cost of equipment.

Table 7.2-5 Unit Cost of Utilities and Fuel

- Fuel (light oil x 120%*)	162 kips/lit.
- Electricity (for office use, 6,600 V or less)	18 kips/Kwh
- Water for trade use, less than 100,000 l/month)	110 kips/m^3

Note: Cost of lubricant, which is more expensive than light oil, is included in the fuel cost.

Table 7.2-6 Unit Cost of Equipment

Equipment	Capacity	Unit Price (1,000 kips)
- Dump Truck for Collection	10 m^3	28,917
- Detachable Container Truck	5 m^3	39,690
- Container	5 m^3	3,969
- Water Truck	6 m^3	36,855
- Small Dump Truck	2 ton	14,742
- Wheel Loader	80 PS	53,015
- Bulldozer	160 PS	130,977
- Hydraulic Excavator	80 PS	88,565
- Dump Truck for Landfill	8 ton	38,556

As for the annual maintenance costs of facility and equipment, heavy machinery/vehicle and building service equipment/building structure covers 4% of the purchase cost and 1% of the construction cost respectively.

By employing the straight line depreciation method, the annual depreciation cost was calculated based on the life and residual value of the equipment given in Table 7.2-7.

Table 7.2-7 Life and Residual Value of Equipment

	Duration	Salvage Value
- Container Grass Cutter and Maintenance Equipment	5 years	0 %
- Vehicle & Heavy Equipment	7 years	10 %
- Machinery	18 years	0 %
- Building and Civil Works	30 years	0 %

Table 7.2-8 shows the details of manpower and equipment requirements, as well as waste amount to be treated.

2) Estimated Cost

The initial investment cost for all facilities and equipment to be introduced by 2000, and annual expenses for dealing with the volume of estimated solid waste in 2000, were estimated for each alternative based on the cost estimate conditions given in 1). Estimated results are given in Table 7.2-9 and 7.2-10.

Table 7.2-8 Details of Alternatives in 2000

	Alt. 1	Alt. 2	Alt. 3	Existing
Collection				
Amount of Waste (t/d)	116	116	116	15
Distance (km/day)	3944	2908	3944	196
Manpower (Nos.)				
Manager	1	1	1	0
Engineer	1	1	1	0
Supervisor	3	3	3	0
Driver	34	34	34	5
Worker	130	130	130	21
Vehicle (Nos.)	38	38	38	2
Cleansing Work				
Length of Road (km)	15	15	15	15
Manpower (Nos.)				
Manager	1	1	1	0
Supervisor	3	3	3	1
Driver	5	5	5	0
Operator	1	1	1	0
Worker	41	41	41	20
Operation & Maintenance				
Manpower (Nos.)				
Manager	1	1	1	0
Engineer	1	1	1	0
Supervisor	1	1	1	0
Mechanic	11	11	11	0
Clerk	4	4	4	0
Administration				
Manpower (Nos.)				
Manager	3	3	3	1
Clerk	11	11	11	5
Collection for Fee	30	30	30	0
Disposal Site				
Amount of Waste (t/d)	139	139	139	18
Manpower (Nos.)				
Manager	1	1	1	0
Engineer	1	1	1	0
Supervisor	1	1	1	0
Operator	2	2	2	2
Clerk	1	1	1	0
Driver	2	2	2	0
Worker	2	2	2	1
Heavy Equipment & Vehicles (Nos.)	4	4	4	0

Table 7.2-9 Investment Cost

(Unit: million Kips)

	Alt. 1	Alt. 2	Alt.3
1) Construction			
(1) Maintenance Shop	157.5	157.5	157.5
(2) Disposal Site	1,188.1	1,465.4	1,196.6
Sub-Total	1,345.6	1,622.9	1,354.1
2) Purchase of Vehicles & Equipment			
(1) Collection	1,290.0	1,290.0	1,290.0
(2) Cleansing Work	176.7	176.7	176.7
(3) Maintenance Shop	11.3	11.3	11.3
(4) Disposal Site	295.0	295.0	295.0
Sub-Total	1,773.0	1,773.0	1,773.0
Total	3,118.6	3,395.9	3,127.1

* Purchase cost of vehicles and equipment is counted only one time because of its useful term (5 or 7 years) and planning term (1995-2000).

Table 7.2-10 Annual Expenses in 2000

(Unit: million Kips)

	Alt. 1	Alt. 2	Alt. 3
Collection			
Depreciation	177.2	177.2	177.2
Personnel Cost	25.2	25.2	25.2
Maintenance	45.2	45.2	45.2
Fuel & etc.	103.4	76.3	103.4
Sub-Total	351.0	323.9	351.0
Cleansing Work			
Depreciation	31.5	31.5	31.5
Personnel Cost	7.8	7.8	7.8
Maintenance	7.1	7.1	7.1
Fuel & etc.	64.8	64.8	64.8
Sub-Total	111.2	111.2	111.2
Final Disposal			
Depreciation	230.3	272.1	227.3
Personnel Cost	1.9	1.9	1.9
Maintenance	11.2	11.2	11.2
Fuel & etc.	26.9	26.9	26.9
Sub-Total	270.3	312.1	267.3
Management & Administration			
Personnel Cost	10.3	10.3	10.3
Fuel & etc.	1.4	1.4	1.4
Sub-Total	11.7	11.7	11.7
Maintenance			
Depreciation	7.5	7.5	7.5
Personnel Cost	3.6	3.6	3.6
Sub-Total	11.1	11.1	11.1
Total Cost	755.3	770.0	752.3
Depreciation	446.5	488.3	443.5
Personnel Cost	48.8	48.8	48.8
Maintenance	63.5	63.5	63.5
Fuel & etc.	196.5	169.4	196.5

** Personnel cost does not include that for night soil service and dead body treatment.

7.3 Evaluation

7.3.1 Methodology

1) Planning Objectives

The procedure adopted for evaluating the proposed alternatives is shown in Fig. 7.3-1. It consists of the following three steps:

- formulation of alternative plans which meet the prescribed objectives;
- evaluation of individual alternatives based on four evaluation criteria; and
- synthesis of individual evaluation results.

The objective of the Basic Plan is the improvement of the environment and standard of living. This can be achieved through the following.

- improvement of collection and cleansing services; and
- improvement of environmental amenities.

2) Evaluation Criteria

The four evaluation criteria used for highlighting the distinguished features of the alternatives are:

- technical desirability;
- economic/financial viability;
- transactional facilitation requirements; and
- environmental acceptability.

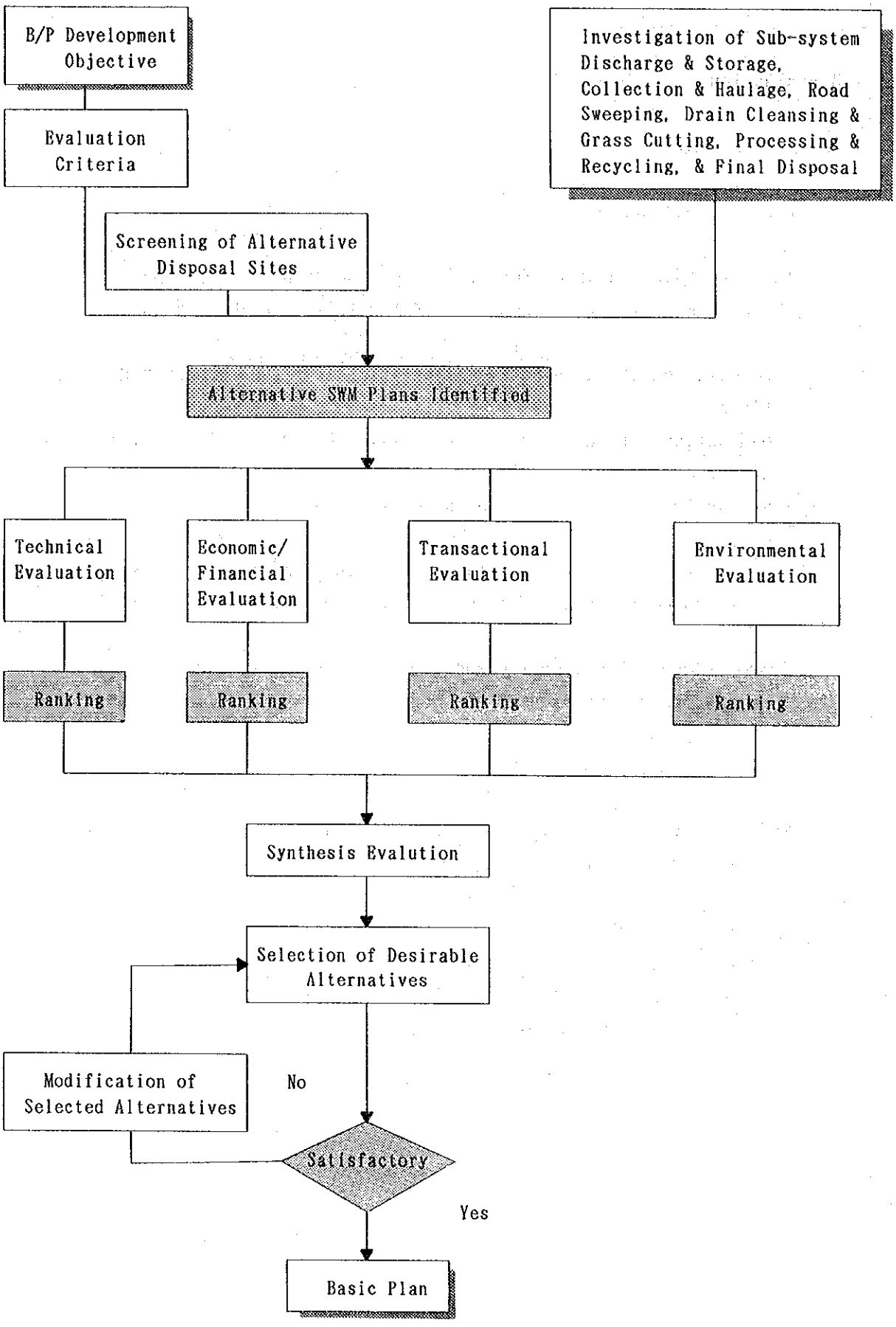


Fig. 7.3-1 Procedure for Evaluating Alternatives

The alternatives identified are ranked quantitatively and qualitatively based on the above-mentioned evaluation criteria. The methodology used for environmental evaluation, individual rankings (for four criteria above) and obtaining the overall ranking is a simplified version of the multiple criteria evaluation method called "Electre". Without assigning any subjective weight, the predominant characteristics of certain alternatives over others became apparent.

7.3.2 Technical Evaluation

1) Evaluation Factors

The technical evaluation of each alternative plan was conducted on the basis of the following four factors, and the plans were ranked accordingly as shown in Table 7.3-1.

a. Working conditions

- safety and hygiene; and
- equal work load and work suitability.

b. Operation and maintenance

- reliability and maintainability of facility; and
- preparedness for emergency.

c. Construction

- physical landfill site condition; and
- equipment availability and technical know-how.

d. Indirect advantages

- prospect of future technical development; and
- contribution to fostering or upgrading engineers.

2) Evaluation

a. Working conditions

Workers involved in solid waste management are engaged in different types of work determined by such processes as collection, transportation and final disposal, and these works differ from those of cleansing workers. The following four types of work in particular require improved working conditions to ensure both safety and hygiene.

- loading of solid waste into collection vehicles;
- landfill work at disposal sites;
- road sweeping and drain cleansing; and
- grass cutting along roadsides and parks.

Since the same technical systems will be applied to the discharge/storage, collection/haulage and road sweeping/drain cleansing/grass cutting, there is no specific difference between the three alternatives. Although the site conditions are different, there is also no specific difference in terms of final disposal, because the same landfill method (level 3 sanitary landfill) will be applied.

b. Operation and maintenance

Similar to the reason described above, there is no clear difference among the three alternatives except for Alternative 2. Since the DCDS is in close proximity to an elementary school, special care will be required to guarantee the safety of the pupils of the school.

c. Construction

Similar to the reason described in a. Working conditions, there is no clear difference among the alternatives.

d. Indirect advantage

Similar to the reason described in a. Working conditions, the same indirect advantages will be expected from the alternatives.

Table 7.3-1 Technical Evaluation

Criteria	Alternatives		
	1	2	3
(1) Working Conditions	A	A	A
(2) Operation and Maintenance	A	B	A
(3) Construction	A	A	A
(4) Indirect Advantages	A	A	A
Overall Assessment	A	B	A

A: Good

B: Fair

C: Poor

7.3.3 Economic and Financial Evaluation

1) Economic Evaluation

Table 7.3-2 shows the costs of construction, purchase of vehicles and annual expenditures, excluding depreciation as well as direct benefits expected from the re-use of land after disposal of solid waste.

The costs shown in the table were estimated based on the following assumptions;

a. Import duties, turnover tax and other related taxes were excluded to calculate economic costs.

b. With regard to personnel cost, some adjustment of wage (shadow price) was made considering the potential unemployment of un-skilled workers such as collection workers and fee collectors.

c. With regard to vehicle procurement, the number of vehicles procured in 1994 is counted as the 1995 equivalent number, and shortage for the next year will be fulfilled every year. With regard to disposal site, the disposal facility to be constructed in 1994 is at level 2. This will be improved to level 3 in 1997. The maintenance shop is assumed to be constructed in the proposed figure in 1994.

d. The annual expenditure includes personnel costs, maintenance costs, fuel cost and others. That of each year is calculated in proportion to the treatment volume of collection waste and disposed waste.

Given the above assumptions, the total project cost is the least for Alternative 1 whenever a discount rate of 0%, 5% and 10% are adopted.

Table 7.3-2 Economic Evaluation

(Unit: million Kips)

	Alt. 1	Alt. 2	Alt. 3
Economic Price in 1991			
Investment Cost	2,955.7	3,219.2	2,963.8
Construction Cost	1,286.1	1,549.6	1,294.2
Purchasing Cost	1,669.6	1,669.6	1,669.6
Annual Expenditure in 2000 (excluding depreciation)	211.2	188.1	211.2
Land Value after Disposal	2.9	0.5	0.5
Discount 0%			
Total Project Cost	3,756.6	4,073.8	3,917.2
Total Benefit	2.9	0.5	0.5
Net Cost	3,753.7	4,073.3	3,916.7
Rank	1	3	2
Discount 5%			
Total Project Cost	3,473.8	3,774.3	3,613.2
Total Benefit	2.1	0.3	0.3
Net Cost	3,471.7	3,774.0	3,612.9
Rank	1	3	2
Discount 10%			
Total Project Cost	3,251.3	3,537.0	3,373.2
Total Benefit	1.5	0.2	0.2
Net Cost	3,249.8	3,536.8	3,373.0
Rank	1	3	2

2) Financial Evaluation

Table 7.3-3 shows the cost comparison of the alternatives based on the 1991 market prices. Alternative 1 requires the least investment. This is explained by the alternatives settled based on the conditions of the disposal site.

In terms of annual expenditure in 2000, with the exclusion of the depreciation cost, Alternative 2 shows the least because its transportation cost for collection vehicle is least in the alternatives.

If the depreciation cost is included, Alternative 3 shows the lowest amount. However, the difference between Alternative 1 and Alternative 3 is not so big.

3) Combined Evaluation

The combined evaluation with respect to economic and financial aspects indicates that Alternative 1 is the most preferable as shown in Table 7.3-4.

Table 7.3-3 Financial Evaluation

(Unit: million Kips)

	Alt. 1	Alt. 2	Alt. 3
Investment Cost Rank	3,118.6 1	3,395.9 3	3,127.1 2
Annual Expenses (excluding depreciation) Rank	308.8 2	281.7 1	303.8 2
Annual Expenses (including depreciation) (C) Rank	755.3 2	770.7 3	752.3 1
Revenue (R)** Surplus (C-R) Rank	2.9 752.4 2	0.5 769.5 3	0.5 751.8 1
Net Cost in case of Increment Personnel Cost (5% per annum.) Rank	783.1 2	800.2 3	782.3 1

** Revenue from sale of land after the completion of landfill operation under the assumption that the land price is as same as that of surrounding area.

Table 7.3-4 Combined Economic and Financial Evaluation

	Alt. 1	Alt. 2	Alt. 3
Economic Evaluation Financial Evaluation	A B	C C	B A
Combined Evaluation	A	C	B

7.3.4 Evaluation of Transactional Facilitation

1) Evaluation Factor

The distinguished features of the three alternatives are characterized in terms of the following planning considerations:

- location of disposal sites; and
- collection and hauling distances.

While these alternatives may have a diverse social impact on the public, estimating the extent of such impact will not be easy due to difficulties in obtaining pertinent data at this stage of the study. Efforts are made, therefore, to examine transactional facilitation necessary for resolving the following sensitive and/or demanding issues associated with the planning considerations cited above.

a. Possibility of land acquisition;

- land use restrictions
- land ownership
- necessity of compensation

b. Possibility of acquiring neighborhood consensus;

- necessity of neighborhood consensus
- necessity for "out of sight" measures
- relative difficulty

c. Compatibility with regional development plans

- competitive development plan
- conformity with the land use plan
- direction of urbanization towards sites

2) Evaluation

The estimation of the order and magnitude of difficulties to overcome in (or of efforts needed for) facilitating these transactions depends largely on the degree of political as well as administrative interaction. For the current analysis, however, the ranking of the alternatives is based simply on the number of criteria with a X-mark under each alternative or column heading of the matrix as shown in Table 7.3-5.

a. Possibility of land acquisition

It is identified in the field survey that the acquisition of DCDS and NCDS might be difficult while that of KM 18-DS is not. The reasons are as follows:

i. Both lands are presently national reserved forests, while KM 18-DS is the Municipal land for final disposal.

ii. As for the DCDS, the Office of the Cabinet Council, the owner of the land, has already approved the Green Peace Lanxang Plan for the promotion of tourism.

iii. The ongoing foreset reservation project aided by the Swedish Government, which is in close proximity to the NCDS would make the change in land use difficult.

b. Possibility of acquiring neighborhood consensus;

There seems to be no difficulty in getting a neighborhood consensus on three sites, because they are less populated areas and "out of sight" measures such as the construction of a buffer zone could be easily achieved. It is, however, necessary to pave the present access road leading to the DCDS to get a neighborhood consensus for Alternative 2.

Table 7.3-5 Transactional Evaluation

Criteria \ Alternatives	1	2	3
(1) Possibility of Land Acquisition		x	x
- Land use restrictions	Nil	National Reserved Forest	National Reserved Forest
- Land ownership	Vientiane Municipa-lity	Office of Cabinet Council	Ministry of Agriculture & Forestry
- Necessity of Compensation	Nil	Much	Little
(2) Possibility of Acquiring Neighbourhood Consensus			
- Necessity of neighbourhood consensus	A little	A little	A little
- Necessity for "out of sight" measures	Necessary	Necessary	Necessary
- Relative difficulty	Easy	Easy	Easy
(3) Compatibility with Regional Development Plans		x	
- Competitive development plan	Nil	Green Peace Lanxang Plan	Nil
- Comformity with the land use plan	Good	Poor	Fair
- Direction of urbanization towards sites	Less	Fair	Less
Overall Assessment	A	C	B

Note: "X" indicates that there might be measurable difficulties in transactional facilitation.

c. Compatibility with regional development plans

As for the KM 18-DS and the NCDS, a competitive development plan is not evident and the use of the lands as final disposal sites seems to be in agreement with the regional development plan unlike the DCDS in which the implementation of the Green Peace Lanxang plan has been approved upon by the Office of the Cabinet Council.

7.3.5 Environmental Evaluation

1) Evaluation Factor

Since the three alternatives may have a diverse environmental impact on the surrounding area, estimating the extent of such impact will not be easy. This is due to difficulties in obtaining pertinent data at this stage of the study. Efforts are made, therefore, to examine environmental acceptability regarding the following sensitive and/or demanding issues associated with the planning considerations.

a. Possibility of drinking water contamination

b. Impact of surface water contamination

c. Impact of flooding

d. Impact of groundwater contamination

e. Distance from airport and other public facilities

f. Distance from densely populated area

g. Possibility of dust, noise and odor hazards

h. Compatibility with land use of adjacent areas

i. Slope Stability

j. Impact on inshore or river fishery

k. Impact on terrestrial vegetation and wildlife

l. Impact on aquatic/marine flora and fauna

m. Impact on natural landscape

n. Impact on historic places or structures

o. Impact on religious places or structures

2) Evaluation

For the current analysis, the ranking of the alternatives is based simply on the number of criteria with a x-mark under each alternative as shown in Table 7.3-6. The reasons of the evaluation are described as follows,

a. Although most of the subsoils of the three candidate sites are clayey silt or clayey soil and their permeabilities range from 10^{-5} cm/sec. to 10^{-6} cm/sec., impact on groundwater pollution will be fair. It is not recommended to use groundwater for drinking if the site would be used as a disposal site. It is, therefore, necessary to provide potable water to the surrounding area.

b. As for the DCDS, a primary school is located within 100 meters from the site. It seems to be rather inadequate to have a disposal site near the primary school.

c. The DCDS and NCDS are presently used as natural forest reserved areas. It is, therefore, concluded that impact on natural landscape is fair.

Table 7.3-6 Environmental Evaluation

Evaluation Items	Alternative 1		Alternative 2		Alternative 3	
a. Possibility of drinking water pollution	Fair	x	Fair	x	Fair	x
b. Impact by surface water pollution	Low		Low		Low	
c. Impact of flooding	Nil		Nil		Nil	
d. Impact by groundwater pollution	Fair	x	Fair	x	Fair	x
e. Distance from airport and other public facilities	Adequate		Rather Inadequate	x	Adequate	
f. Distance from densely populated area	Adequate		Adequate		Adequate	
g. Possibility of dust, noise and odour hazards	Low		Low		Low	
h. Compatibility with land use of adjacent area	Good		Good		Good	
i. Land stability	Good		Good		Good	
j. Impact on inshore or river fishery	Nil		Nil		Nil	
k. Impact on terrestrial vegetation and wildlife	Nil		Nil		Nil	
l. Impact on Aquatic/Marine flora and fauna	Nil		Nil		Nil	
m. Impact on natural landscape	Nil		Fair	x	Fair	x
n. Impact on historic places or structures	Nil		Nil		Nil	
o. Impact on religious places or structures	Nil		Nil		Nil	
Overall Evaluation	A		C		B	

Note: The following ranking is used in the Table.
For Items a, b, c, d, g, j, k, l, m, n & o; Very high, High, Fair, Low and Nil.
For Items h & i; Good, Fair and Poor.
For Items e & f; Adequate and Inadequate.

"x" indicates that there might be measurable problems in environmental acceptability.

Based on the evaluation results, the alternatives have been ranked as follows:

a. First Rank: Alternative 1

b. Second Rank: Alternative 3

c. Third Rank: Alternative 2

7.3.6 Selection of an Optimum Alternative

The summary of the evaluation results based on each of the four evaluation criteria are presented in a matrix form in Table 7.3-7.

Table 7.3-7 Overall Evaluation

	Alternative 1	Alternative 2	Alternative 3
Technical Aspect	A	B	A
Economic Aspect	A	C	B
Transactional Aspect	A	C	B
Environmental Aspect	A	C	B
Overall Ranking	1	3	2

The matrix implies the following overall ranking of alternatives.

i. Alternative 2 is dominated by Alternative 1, and 3 regardless of any set of weights to be associated with the evaluation criteria.

ii. Alternative 3 is dominated by Alternative 1, regardless of any set of weights to be associated with the evaluation criteria except for the technical aspect.

iii. Alternative 1 is not dominated by any other alternative. Therefore, it may be considered to be the best alternative.

In view of the foregoing evaluation results, the solid waste management system to be established in the Vientiane urban area by 2000 should be Alternative Plan 1.

CHAPTER 8

OUTLINE OF THE BASIC PLAN

CHAPTER 8 OUTLINE OF THE BASIC PLAN

8.1 Technical System

The proposed technical system for the Basic Plan is summarized and tabulated in Table 8.1-1.

The outline of each system is tabulated in their Tables respectively:

a. Discharge and storage	; Table 8.1-2
b. Collection and haulage	; Table 8.1-3
c. Road sweeping, drain cleansing and grass cutting	; Table 8.1-4
d. Final disposal	; Table 8.1-5
e. Maintenance shop	; Table 8.1-6

Table 8.1-1 Outline of Technical System in 2000

Technical Sub-Systems	Contents and Proposed Systems
1. Discharge and Storage	
a. Amount of Generation	186.7 ton/day
b. Amount of Discharge	155.0 ton/day *
c. Type of Refuse Bins	Bamboo baskets for the residential and commercial area, and communal containers for the institutions.
2. Collection and Haulage	
a. Amount of Collection	148.2 ton/day * **
b. Collection Service Ratio	100% for whole Vientiane urban area
c. Collection Frequency	Once a week for residential and commercial area, and everyday for the institutional waste in principle.
d. Collection System	Curb collection and bell collection for the residential and commercial area, and station collection for the institutions.
e. Equipment	Dump trucks for the residential and commercial area, and detachable container trucks for the institutional waste.
3. Road Sweeping, Drain Cleansing and Grass Cutting	
a. Service Area	Road Sweeping; 15 km of road same as the present road length for sweeping Drain Cleansing; The drains of the 15 km and any drains requested by the residents Grass Cutting; 15 km of road same as the present
b. Main Equipment	Road Sweeping; Detachable container trucks and containers, and water trucks Drain Cleansing; Small dump trucks and a wheel loader Grass Cutting; Grass cutters
4. Processing and Recycling	
a. Processing	No specific facility
b. Recycling Amount	31.7 ton/day
c. Recycling Facility	No specific facility
5. Final Disposal	
a. Disposal Amount	152.9 ton/day **
b. Final Disposal Site	KM 18-DS
c. Area	Available land area; more than 60 ha Landfill area; 12.4 ha
d. Final Disposal Method	Sanitary landfill level 3
e. Equipment	A bulldozer, a hydraulic excavator, a dump truck and a water truck
6. Operation & Maintenance of Equipment	
a. Vehicle Depot	KM 7 Vehicle Depot
b. Maintenance	Preventive maintenance & light repair; KM 7 maintenance shop Heavy repair; Outside order

Notes;

* The diffrence of waste amount(6.8ton/day) between discharge amount and collection amount is derived from self-disposal amount(5.2ton/day) and direct hauled amount from one market(1.6ton/day).

** The difference of waste amount(4.7ton/day) between collection amount and disposal amount is derived from direct hauled amount.

Table 8.1-2 Outline of Proposed Discharge and Storage System in 2000

Generation Source	Source Separation	Type of Refuse Bins	Storage & Discharge Points	Discharge Frequency
Residential Area	Continuance of present system Partly separate discharge (Food waste is separated as food for animals.)	Continuance of present system Bamboo basket	Bring out waste and discharge at collection point	Once a week
Commercial Area	Continuance of present system Partly separate discharge (Food waste is separated as food for animals.)	Continuance of present system Bamboo basket	Bring out waste and discharge at collection point	Once a week (partly more than twice a week)
Market	Continuance of present system Mixed discharge	Communal container	Container put in a premise	Everyday
Office	Continuance of present system Mixed discharge	Communal container	Container put in a premise	Everyday
Hospital	Separate discharge (Infectious waste should be segregated from other wastes.)	Communal container	Container put in a premise	Everyday

Table 8.1-3 Outline of Proposed Collection and Haulage System in 2000

Generation Source	Service Coverage(%)	Collection Frequency	Mixed or Separate Collection	Collection System	Collection Time	Collection Tools	Haulage Method	Transfer System
Residential Area	100 %	Once a week	Mixed collection	Curb collection and bell collection	Day time	Not necessary	Dump truck (10m3)	Without transfer
Commercial Area	100 %	Once a week (partly more than twice a week.)	Mixed collection	Curb collection and bell collection	Day time	Not necessary	Dump truck (10m3)	Without transfer
Market	100 %	Everyday	Mixed collection	Station collection	Day time	Not necessary	Detachable container truck(5m3)	Transfer from the station
Office	100 %	Everyday	Mixed collection	Station collection	Day time	Not necessary	Detachable container truck(5m3)	Transfer from the station
Hospital	100 %	Everyday	Separate collection	Station collection	Day time	Not necessary	Detachable container truck(5m3)	Transfer from the station

Table 8.1-4 Outline of Proposed Road Sweeping, Drain Cleansing and Grass Cutting System in 2000

Type of Cleansing Service	Cleansing System	Cleansing Area and Length	Cleansing Equipment	Cleansing Frequency
Road Sweeping	・Manual sweeping by labourers ・Station collection system using container(5m3) ・Haulage method by detachable container trucks	Present road covered by the sweeping services (15km*)	Detachable container trucks and containers water trucks	Everyday except sundays and holidays
Drain Cleansing	・Manual cleaning by labourers ・Loading method by wheel loader ・Haulage method by small dump trucks	Drain of the road covered by the sweeping services (15km*)	Small dump trucks & a wheel loader	Once every three months
Grass Cutting	・Grass cutting by cutting machines ・Station collection system using container(5m3) ・Haulage method by detachable container trucks	Road side of the road covered by the sweeping services (15km*)	Grass cutters	Every two months
Cleansing Activity through Public Cooperation	・Cleaning by residents, and collection and haulage by the Municipality	Entire Vientiane urban area	Small dump trucks & a wheel loader	Once every three months

Note; * means the road length which recieves sweeping services

Table 8.1-5 Outline of Final Disposal System in 2000

Items	Contents	Remarks
a. Proposed Site	KM 18-DS	
b. Waste to be Disposed	Domestic waste, commercial waste, road sweeping waste and institutional waste	
c. Daily Disposal Amount	152.9 ton/day	
d. Cumulative Disposal Amount	178,400 tons	From Jan. 1995 to Dec. 2000
e. Landfill Method	Sanitary landfill level 3	
f. Available Land Area	More than 60 ha	
g. Landfill Area	12.4 ha	From Jan. 1995 to Dec. 2000
h. Facilities Outline		
- Main Facilities	Enclosing structure, drain system and access	
- Environmental Protection Facilities	Buffer zone, litter control, gas removal, leachate collection, leachate circulation, and monitoring facilities	
- Building and Accessories	Site office and weighbridge	
i. Equipment	Bulldozer, hydraulic excavator, water truck and dump truck	
j. Personnel	10 persons	

Table 8.1-6 Outline of Vehicle Depot and Maintenance Shop at KM 7

Items	Contents	Remarks
1. Vehicle Depot	Available Area; 2,500 m² Location; KM 7 Present Depot	
2. Maintenance Shop		
a. Facility	Office, various shops and inspection pits	
b. Function	- Administration and accounting section	- for general works
	- Service shop	- for minor repair
	- Tire shop	- for inspection and repair of tire
	- Tools and store shop	- for supply and control of spare parts
	- Field storage for disposal site	- for preventive maintenance of landfill equipment
c. Equipment	High pressure car washer, battery quick charger, air compressor, electric welder, gas cutting equipment, nozzle tester, etc.	
3. Personnel	18 persons	

8.2 Institutional System

8.2.1 Methodology

In order to realize the proposed technical system, the improvement measures of institutional systems, such as organization, financial system, laws and enforcement, public education and staff training, were studied and a suitable institutional system was planned and recommended in this section.

With respect to the institutional system, the following two are the main objectives of the Basic Plan:

a. Establishment of a specific organization responsible for SWM by setting up a new department;

b. Establishment of a stable financial system.

8.2.2 Organization

1) Present Problems

As for the present organization, virtually all aspects need to be improved. The major problems are identified as follows:

- lack of a specifically responsible organization;
- lack of a planning section;
- poor working conditions;
- unclear roles of the Vientiane Municipality and the private companies;
- lack of regulatory system of private companies; and
- lack of staff training system

2) Responsible Organization

In order to solve the above-mentioned problems, it is necessary to examine the kind of organization which should be responsible for SWM in Vientiane. The following are the candidate organizations:

- DCTC, VM;
- DPH, VM;
- State Sanitary Company;
- Private Companies; and
- Establishment of a new organization in Vientiane Municipality like the Urban Service Department, VM

As a result of the examination and discussions with the relevant authorities in Lao P.D.R., it is proposed that a new department, Urban Service Department, shall be established in Vientiane Municipality as the organization responsible for SWM in Vientiane. The reasons are described as follows:

i. The main objective of the Basic Plan is to extend its collection services to the whole population of the Vientiane urban area. The present population covered by the collection services is only 4.8%. At present DCTC and DPH are both in charge of SWM, but as it is only one among the many tasks they are responsible for, SWM is qualitatively and quantitatively defective.

ii. In order to attain the goal of the Basic Plan, the number of personnel of the organization responsible for SWM in Vientiane should be increased from 67 in 1991 to 366 in 2000. With 366 staffs, an independent department in Vientiane Municipality should be established.

iii. The Beneficiary-Pay-Principle was proposed in the Basic Plan. However, road sweeping, drain cleansing and grass cutting fees are excluded from their coverage. It is, therefore, necessary for Vientiane Municipality to subsidize these works for continuance.

iv. As for final disposal, sanitary landfill costs including construction, operation and maintenance, could not be covered by the tipping fees if strict enforcement on illegal dumping is not established. In order to completely avoid illegal dumping, it is indispensable not only to strictly enforce the anti-littering law but also to ask public cooperation through public education programs. These tasks, however, could not be done by the private sector.

v. The privatization of the state companies is the basic policy of the Government of Lao and many state companies were privatized recently. However, problems such as lack of capability, poor financial management, unclear roles, lack of O&M cost, etc., exist in privatized companies. Since sound SWM is indispensable in maintaining the city and the lives of the people, a sound and self-sustainable solid waste management system should be established in the Municipality first. Thus, the privatization of SWM shall be done after the establishment of a regulatory system of private companies in the Municipality.

3) Proposed Scheme for Urban Service Department (USD)

a. Necessity of establishment

Establishment of an independent department (herein referred to as Urban Service Department - USD) responsible for SWM is recommended in view of the following:

i. Although the present collection service ratio in residential and commercial areas is 4.8% and 22.3%, respectively, they should be increased to 100% by 2000. In accordance with the increase, the number of personnel required for the service will also increase.

ii. Although the present budget for SWM is extremely low (it shares only 0.2% of the entire budget of Vientiane Municipality), the budget or cost of SWM will increase

rapidly due to urbanization and the change in life style. In other developing countries, the cost of SWM falls under the major expenditures of local governments.

iii. The demand for solid waste management service will further increase in the future, both in terms of quantity and quality. The demand for higher technological standards will also increase.

b. Organizational framework

i. organization scheme

An organization scheme as shown in Fig. 8.2-1 (Organization Chart) is proposed for the new Urban Service Department of Vientiane Municipality. The organizational scheme of the USD proposed below is to be achieved by the additional hiring of personnel and transfering staffs from another department in Vientiane Municipality.

ii. manpower scheme

The number of personnel required for the proposed department is shown in Table 8.2-1, according to section and the position.

c. Features of the organization

The organization proposed has the following features:

i. In order to fulfil the expansion of the collection service up to the whole population of the Study area, the new department shall recruit about 300 new employees in accordance with the expansion. However, some of the personnel required can be deployed from the existing departments.

Table 8.2-1 Proposed Number of Personnel for the USD in 2000

Position / Name of Section	Manager	Engineer	Supervisor	Technician (Mechanic)or Operator	Clerk or Fee Collector	Driver	Worker	Total
1. Research & Development Unit	1	1	-	2	-	-	-	4
2. Administration Section	*6	-	-	-	42	-	-	48
3. Cleansing Service Section I	1	1	4	-	-	38	143	187
4. Cleansing Service Section II	1	-	3	1	-	8	32	45
5. Night-Soil Management Section	1	1	1	2	5	15	25	50
6. Disposal Site Operation & Management Section	1	1	1	2	1	2	2	10
7. Campaign & Enforcement Section	1	-	1	-	4	-	-	6
8. Operation & Maintenance of Equipment Section	1	1	2	8	4	-	-	16
Total	13	5	12	15	56	63	202	366

Note; * Managers of the Administration Section include a director and two deputy director of the department.

ii. The new department will have a unit and seven sections as shown in Fig. 8.2-1. Research and Development Unit, Disposal Site Operation and Management Section and Campaign and Enforcement Section will perform new functions which have not been performed under the existing Cleansing Section.

iii. The heads of the sections are directly answerable to the Deputy Director. This is to eliminate unnecessary time-consuming formalities.

d. Function of each section

i. research and development unit

- monitoring the performance of cleansing services
- development or research for improvement

Monitoring the performance of the services and measuring efficiency levels are important steps toward the identification of problems and improvement of services. Monitoring will also enable the Municipality to assess its progress towards the Basic Plan Targets. The person in charge of this unit should develop performance indicators.

The effectiveness of the cleansing services depends much on the appropriateness of the equipment used. An engineer in charge of this unit must be keen in finding appropriate technology through studying equipment catalogues and observing other municipalities in other countries or making research of his own. Two technicians for the drafting and documentation work would be necessary.

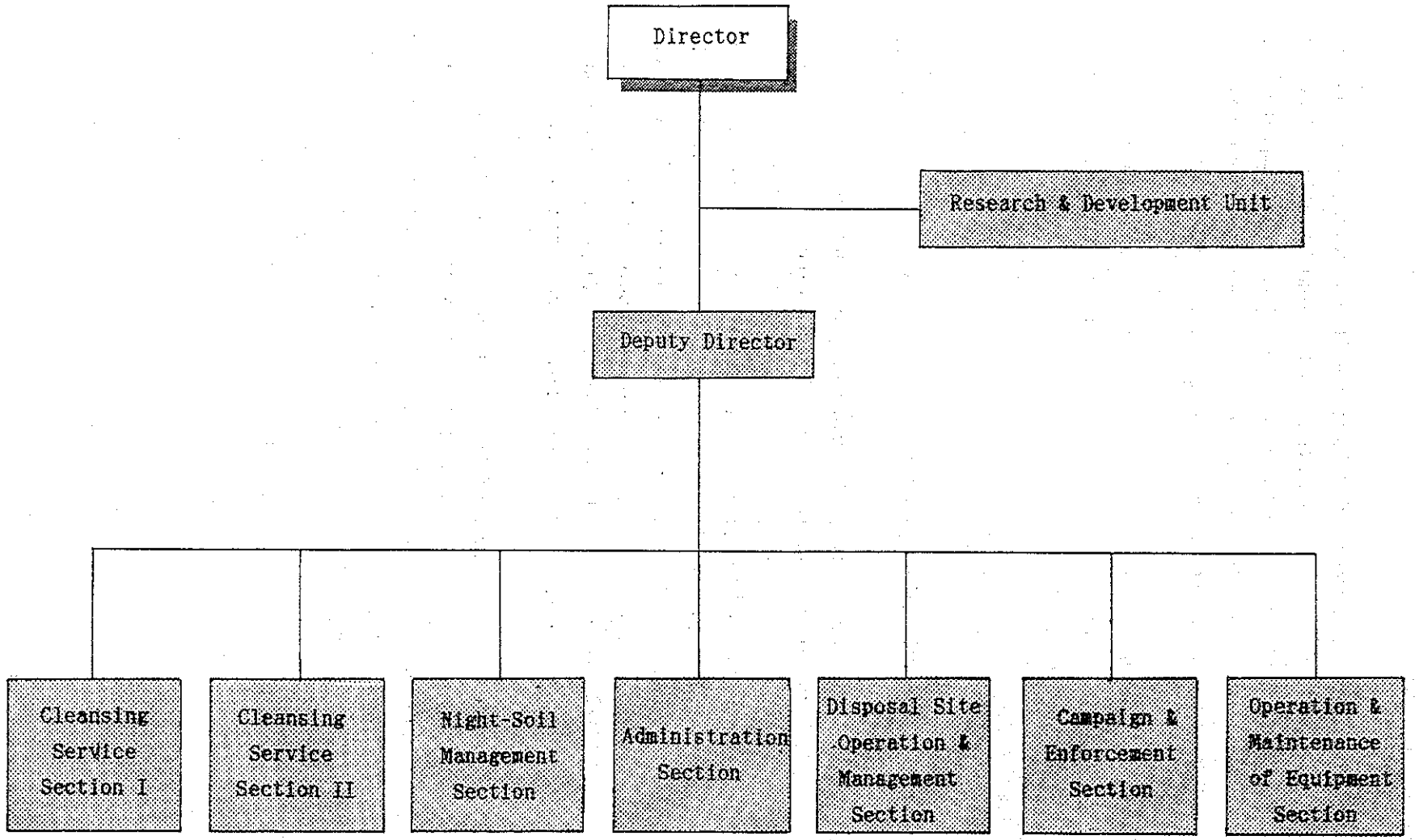


Fig. 8.2-1 Proposed Organization of the USD

ii. administration section

Under the proposed scheme, judging from the personnel size of the department and areas for fee collection, one manager, 18 clerks (including two sub-managers, typists and others) and 34 fee collectors would be sufficient to the new department.

iii. cleansing services section I

This section will be responsible for the execution of solid waste collection and haulage. A crew of a dump truck will consist of a driver and four workers, while that of a detachable container truck will consist of a driver and an assistant. A supervisor will oversee 24 villages. As such, 4 supervisors will be required and three units will be set up under the control of each supervisor.

iv. cleansing services section II

This section will be responsible for the execution of road sweeping, grass cutting, drain cleansing and clean-up of illegal dumps. The section will have the following three units, each headed by a supervisor.

- Road Sweeping Unit;
- Grass Cutting Unit; and
- Drain Cleansing and Clean-up of Illegal Dumps Unit.

v. night-soil management section

At present, the Night-Soil Management Unit of the Cleansing Section has the following sub-units, and totally 10 staffs are engaged in the work:

- Treatment of Dead Body Sub-unit;
- Night-Soil Management Sub-unit; and
- Watering Flowers Sub-unit.

In the plan proposed, those sub-units will become main units with similar functions.

vi. disposal site operation and management section

In view of the increasing importance of the sanitary disposal of waste, a personnel should specialize in site planning and management.

Ideally speaking, mechanical engineers or sanitary engineers with a university degree should be employed. This could be difficult, however, since no budget is allocated in the Urban Service Department for such personnel. In the present set-up, it would be more feasible for the Municipality to place a civil engineer in the Research & Development Section, a mechanical engineer in Cleansing Services Section I and a sanitary engineer in this section. This is an acceptable arrangement provided that there is good inter-sectional collaboration between the three sections. In any case, it is advisable to have at least one manager or some other technical personnel in this Section.

vii. campaign and enforcement section

Campaign and enforcement are necessary if Vientiane Municipality wishes to expand its collection services, to stop illegal dumpings and littering of waste, and to improve its SWM.

This Section will have one manager, one supervisor and four overseers who will be mobilized for campaign and enforcement. Both manager and supervisor are expected to come up with the detailed implementation plan for campaign and enforcement.

viii. Operation & Maintenance of Equipment Section

Operation and maintenance of equipment for collection, haulage, disposal and cleansing services is the key factor in a self-sustainable solid waste management. Therefore, an Operation and Maintenance Section shall be established in the USD. The Section will be responsible for operation and maintenance of SWM vehicles and equipment. Consequently 8 mechanics and 4 clerks will be assigned.

e. Role of personnel

In order to strengthen solid waste management, the personnels in the respective levels (Departmental head, engineers, supervisors, etc.) are expected to perform more positive roles than currently practiced.

Supervisors are expected to concentrate on non-routine matters such as:

- identification of fundamental problems;
- working out implementation plans for system-improvement and expansion of collection area;
- training of operators, drivers and workers;
- data-base management; and
- monitoring the services performance of the Departmental workers.

Managers and engineers are expected to perform the following duties:

- measurement of productivity and cost-control;
- introduction of sanitary landfilling;
- inter-communication to exchange experience and know-how; and
- overall supervision.

Directors and deputy directors are expected to perform the following responsibilities:

- disciplinary control to improve work-morale;
- sound personnel management;
- provision of training opportunity for staff;
- inter-departmental communication; and
- overall management.

Municipal administrators are expected to:

- understand the importance of the application of systematic thinking and planning in solid waste management;
- support service executing departments, and give them certain authorities (controlling power);
- maintain quick and effective disciplinary control, and strengthen employees' work-morale; and
- minimize political involvement in the execution of cleansing services.

2) Improvement of the Labour Management

a. Necessity for effective disciplinary control and work-morale support

The Municipality's labour management is generally weak and lax in terms of disciplinary control and work-morale support. Lax management is the important factor behind inefficiency of the Municipality, as compared with private contractors, in terms of waste collection.

It is important to note that general improvements in facilities and technologies alone would not bring about the desired effects unless the managerial aspect (labour management) is improved.

Good labour management requires fair and quick evaluation of employees job performance and behavior. Results of such evaluation should then be expressed in terms of disciplinary actions and rewards.

b. Solution to the problem

The root of this problem is so deep that it requires not only the proposed organizational reform but more importantly requires serious attention of the Municipal administrators. What is also equally required is the reduction of political interference in the Municipality's administrative and managerial affairs.

8.2.3 Finance

1) Targets

As long as SWM is indispensable to urban life and aims to keep an environmental condition befitting to a capital city, it is necessary to find a source for the expenses required. As city services have a tendency to expand easily, beneficiaries must clearly understand their responsibilities in paying for their share of the services. Further, rational and low-cost waste collection and disposal system should be established. Therefore, it must be made clear that SWM costs are to be financed by all households and enterprises (regardless of whether they are public or private) who discharge waste.

The SWM system in Vientiane Municipality has the following characteristics:

a. Collection service area is very limited and the service is not punctual.

b. Crude open dumping is adopted at the present disposal site, causing environmental problems.

c. Residents in non-collection areas conduct recycling and self-disposal to maintain sanitary conditions in area.

d. The consciousness and willingness to pay for SWM is very high.

These situations described in a and b will cause the deterioration of the capital city's environment. On the other hand, the above-mentioned characteristics of c and d indicate a clue of the resolution of the problems.

Therefore, punctual collection services and sanitary disposal is urgently necessary for the expansion of the collection area. The cost to maintain these activities is estimated as 755 million Kips in 2000. It is about thirty times the cost of SWM in 1990. But it is necessary to self-finance these cost mainly by fee collection. Therefore, the study basically aims to achieve 100% financial support from the beneficiaries in 2000.

The following secondary targets must be established in order to attain the basic target mentioned above,

a. Formulation of rational and low-cost solid waste collection and disposal plan.

b. Clear money flow for SWM, especially disclosure and termination of informal money flow.

c. Establishment of a fair fee system, which shall include a tariff schedule commensurate to the services provided and improvement of fee collection system.

2) Composition of Financial Resources

Financial resource in 2000 should be composed in proportion to the waste amount collected and disposed by the Beneficiary-Pay-Principle.

a. Households' share

The expenses incurred in the collection and disposal of waste discharged from households should be covered by the fees collected from the residents.

b. Enterprises' share

The expenses incurred in the collection and disposal of waste discharged from shops, factories and hospitals should be covered by the fees collected from owners of these enterprises.

c. Public's share

The expenses incurred in the collection and disposal of waste discharged from public establishments, as well as waste collected from roads, rivers, canals and parks, should be paid by the respective administrative body. In other words, the expenses shall be appropriated from the budget of Vientiane Municipality.

In Vientiane Municipality, the public organization often reduce or ignore their payment for the cleansing services due to the shortage of their budget, thus becoming an obstacle in the establishment of financial resources of SWM. The resolution of this obstacle is indispensable matter for the establishment of the financial system.

The respective amount to be shouldered by each of the above is as shown in Table 8.2-2.

If collection service is executed 313 days a year, the cost share per collected waste volume is calculated as follows:

	Share million Kips	Collected Volume ton/year	Cost Share 1,000 Kips/ ton
a. Share of households	572.8	40,346	14.2
b. Share of enterprises	37.3	2,629	14.2
c. Public's share	119.0	282	422.0

Table 8.2-2 Estimated Burden in 2000

Waste volume to be treated by the USD (ton/day)

	To be Collected	To be Disposed	To be Cleaned
Households	128.9	128.9	
Enterprises	8.4	8.4	
Public	0.9	0.9	0.9
Collected by			
Private Company	(10.0)	10.0	
Direct Hauled		4.7	
Total	138.2	152.9	0.9

	Collection	Final Disposal	Cleansing	Total
Cost Required (million Kips/Year) by the Work	351.0	270.3	111.2	732.5
Management Cost*	8.5	0.6	2.6	11.7
Maintenance Shop Cost**	7.9	2.0	1.2	11.1
Total	367.4	272.9	115.0	755.3

Burden (million Kips/Year)	Collection	Final Disposal	Cleansing	Total
Households	342.7	230.1		572.8
Enterprises	22.3	15.0		37.3
Public	2.4	1.6	115.0	119.0
Private Company		17.8		17.8
Direct Hauled		8.4		8.4
Total	367.4	272.9	115.0	755.3

Note; * Management cost is calculated based on the ratio of personnel expense of each work category.

** Maintenance shop cost is calculated based on the ratio of maintenance expense of equipment and vehicles for each work category.

According to the results of the CCS, households presently share about 0.5% of their income, which is 80,000 kips/month/household for SWM. In 1991, the monthly collection fee per household is about 400 kips, indicating a cost share of 3,580 kips per ton (400 kips/month/household/(0.62 x 30 days x 6 persons) x 0.001). This figure shows that fee tariffs should be increased if self-finance is to be implemented. The process and feasibility will be examined in the pilot project.

3) Fee Collection System

The method of collecting fees may be roughly divided into direct collection and indirect collection. Direct collection means the system where the fees for SWM are collected by fee collectors or the officers in SWM office. The existing system in Vientiane Municipality employs one of the direct collection methods. Indirect collection means the collection of fees through taxes or other charges for other public services.

Since the flow of the fees collected is unclear and causes distrust in SWM, the fee collection system should be examined. The clearness and effectiveness of the system, therefore, should be examined. From the principle of Beneficiary-Pay-Principle, a fair system is also expected.

A suitable system for Vientiane Municipality was proposed and examined through the feasibility study and discussion with the Vientiane Municipality.

(1) Types of Fee by Service

According to the quality of the services, there are three types of fees:

a. Basic collection service ; Basic Fee
b. Additional collection service ; Special Fee
c. Disposal service ; Tipping Fee

Basic services are those of collection from collection points, transfer to disposal site, and disposal. Door-to-door service is more convenient for the beneficiaries, but is more labour intensive than the curb collection, thus requiring additional fees. On the other hand, private contractors or private companies with vehicles and employees who can transfer solid waste to the disposal site can save the cost involved in transferring activities. Therefore, a tipping fee system which covers only the final disposal expense of the waste hauled by each hauler is recommended.

Basic fee should cover both the transferring and disposal costs in minimum. Special fee should cover door-to-door collection cost, transferring cost and disposal cost. Tipping fee should cover disposal cost.

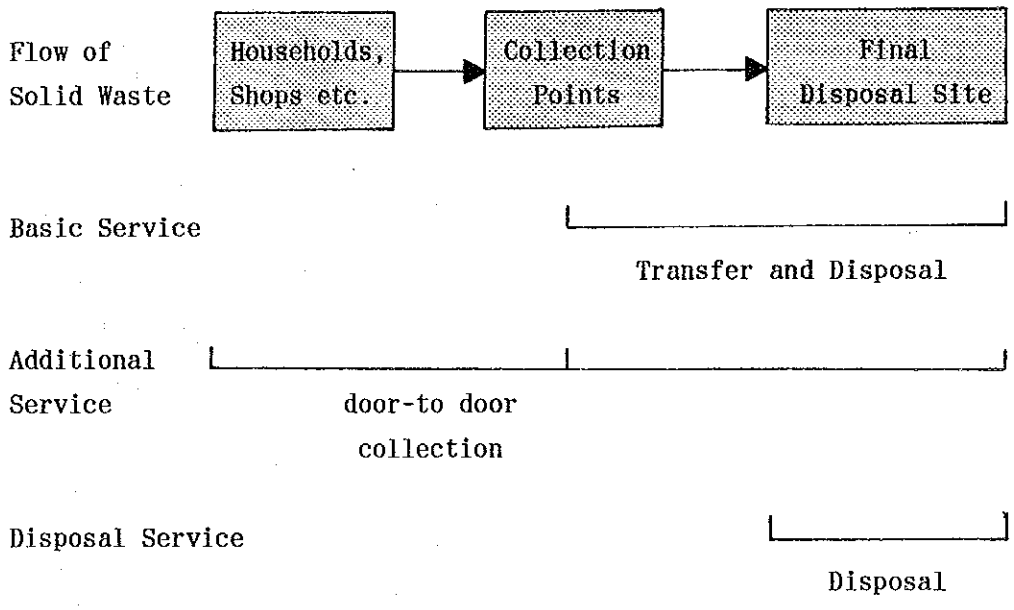


Fig. 8.2-2 Principle of Solid Waste Services and Fees

(2) Fee Collection System

The first improvement step for the fee collection system is the reduction of the portion of money collected by the fee collectors, to eliminate doubts that some part of the money collected are not received by the officers in the Cleansing Section and to eliminate the collection of additional fees for tips. One of the methods to guarantee a sound fee collection system is to introduce the indirect collection system. Another method is to expand the offices where customers can pay their fees without anxiety.

The second proposal for the fee collection system is to make a data base of customers to check whether they paid or not and to facilitate the sending of bills. This will also stop the fee collectors from pocketing the fees.

8.2.4 Laws and Enforcement

1) Laws and Regulations

(1) Aspects on Legal Control

Some legal control is necessary in the following aspects of solid waste management.

a. Waste storage and discharge method to be applied in households and business establishments.
b. Waste collection fee and tipping fee
c. Control of toxic waste
d. Control of illegal dumping
e. Control of littering

(2) Laws and Regulations Required

a. Regulations regarding waste storage and discharge

The formulation of regulations on the following stipulating in detail the methods the residents should abide by was recommended to the Vientiane Municipality.

i. discharge days (to keep waste in each house until the collection day);
ii. discharge time;
iii. discharge method and location; and
iv. use of standard bamboo baskets.

The above items are closely related to the collection system the Municipality wishes to employ. Instructions should be clearly given to the residents regarding the above through the distribution of campaign leaflets.

b. Waste collection fee and tipping fee

This Basic Plan recommends that financial resources for SWM in 2000 shall be established by the Beneficiary-Pay-Principle. From this view point, it is recommended that the existing regulations be revised accordingly.

c. Control of toxic waste

In accordance with industrialization, control of toxic waste may be increasingly important in the future. Laws and regulations regarding toxic waste control should be formulated in both national and municipal levels. In the municipal level, the regulations should include the following:

i. definition of waste type prohibited at municipal disposal sites;
ii. registration of factories which generate toxic waste;
iii. registration of contractors which transport or dispose toxic waste; and
iv. Imposition of penalties to offenders of the toxic waste regulations.

d. Control of illegal dumping

The necessity to control illegal dumping will increase as the Municipality wishes to impose higher tipping fees. It is recommended that the existing regulation serial No. 633/VMAC should impose penalties to violators.

2) Law Enforcement

The laws of Vientiane Municipality are weakly and poorly enforced. Whether or not the Municipality can effectively enforce the law depends entirely on the influence of the Municipality's Administrators. Their firm determination, therefore, is much desired. It should be noted that the effective enforcement of the law would serve the interest of the majority of the citizens.

8.2.5 Public Education

1) Objective of Public Education

The objective of public education is to strengthen the citizens' cooperation with respect to the following aspects.

a. Proper storage and discharge manner;
b. Reducing litter in public places;
c. Eliminating illegal dumping of waste; and
d. Resource recycling

Both National and Municipal Governments should be responsible for educating the public concerning the above.

2) Public Education by the National Government

There may be two major forms of public education on SWM which can be given by the National Government: through schools and the other through the mass-media.

Basic education with respect to cleanliness and health is given in primary schools in Lao P.D.R.. The provision of waste education programs is, therefore, recommended for primary or secondary school levels. This waste education program should include the following:

a. Waste and public health;
b. Necessity of proper discharge and storage;
c. Importance of keeping public places clean;
d. Waste flow from generation to final disposal;
e. Waste amount and cost;
f. Waste disposal and environment; and
g. Importance of resource recovery (recycling).

3) Public Instructions and Education by Municipal Government

The public instructions and education to be conducted by the municipal government should enable them to achieve their specific improvement targets with respect to waste collection and disposal. If the municipal government wishes to introduce a new collection system, such as bell collection, public instructions should be given on the following:

- days of waste discharge (to keep waste inside the house until the collection day);
- discharge time;
- discharge method and place;
- use of standard bins if required; and
- separation of waste if required.

Public instruction and education can be most effective in the form of organized campaigns and the following points are important to make the campaign successful.

a. To obtain support from residents' representatives, political parties, and other community leaders.

b. To concentrate on one campaign zone at a time. The Municipality should move to the next campaign zone only after gaining reasonable success in the previous zone.

c. The campaign should be followed by enforcement, without which the campaign would not be successful.

8.2.6 Training of SWM Personnel

1) Personnel Who Should Receive Training and Education on SWM

Personnel who should receive training and education can be categorized as follows:

a. Top administrators or decision makers in both national and municipal levels;

b. SWM staff such as departmental head, engineers, supervisors and clerks;

c. Drivers, operators and workshop personnel; and

d. Workers.

Types and contents of training differ according to level (category) of personnel involved in SWM.

2) Education (in broader sense) for Top Administrators and Decision Makers in Both National and Municipal Level.

Many administrators and decision makers still think that solid waste management is only a matter of scavenging and dumping of waste, and therefore, would not require systematic and scientific methods. They also think that spending much money on waste disposal is a useless effort.

It is, therefore, necessary to change their views to:

- SWM can be improved considerably through the application of a more systematic approach.

- Collection and haulage costs can be obtained by the establishment of a fee collection system.

- Sanitary disposal will be increasingly important for improving environmental conditions and public health.

- A considerable amount of capital investment is required to develop a sanitary disposal system.

It can be fairly said that most SWM problems can be solved quickly, if the above views are clearly understood by the top administrators and decision makers in both national and municipal levels. To convince these people, educational programs on the subject should be formulated.

3) Training and Education for SWM Staff inclusive of Departmental Heads, Engineers, Supervisors and Clerks

(1) Types of Knowledge and Experience Required for Solid Waste Management

The knowledge and experience on the following aspects are required for the staff involved in solid waste management.

a. Collection/Haulage and Road/Drain Cleansing

i. operation systems (kinds, characteristics, advantages and disadvantages of respective systems);
ii. measurement and evaluation of SWM service efficiency (productivity);
iii. labor management;
iv. legal and law enforcement aspects;
v. the organization of campaigns for extension of collection services, etc.
vi. vehicle and equipment control and maintenance of both daily and long term nature.

b. Final disposal and processing

i. Engineering knowledge regarding various types of disposal and processing systems;
ii. knowledge regarding operation of disposal and processing systems; and
iii. handling of toxic waste.

It is urged that both national and municipal governments should take more positive roles in SWM training.

(2) Training and Education to be Provided at National Level

It is recommended that the National Government should establish the following education/training programs.

a. A formal post-diploma course on SWM for relevant personnels

In view of an increasing demand for personnel specializing in SWM, it is recommended that the National Government should establish a formal post-diploma course on SWM for relevant personnels. The duration of the course may be from 6 to 12 months and should be given recognition and accorded with an appropriate status by the National Government to encourage relevant personnels to take up such course.

b. Sanitary engineering course in university

There are no such courses at present. In view of an increasing demand for sanitary disposal system in Lao P.D.R., establishment of this course will contribute much to the improvement of the environmental sanitation standard of Lao P.D.R..

c. Seminar/workshop on SWM

Ministry of Health has held a workshop on some topics on SWM in August 1990 under the auspices of the WHO. Workshop or seminars of similar nature should be implemented in future, too. It is recommended that participants in seminars/workshops should be given more opportunities to exchange their views and discuss problems.

(3) Training and Education to be Provided at Municipal Level

It is recommended that Local Authorities should provide SWM training in the following forms:

- To promote discussions horizontally among personnel of the same level and vertically among different level of positions in order to identify and solve problems.

- To give engineers and supervisors opportunities to visit other Local Authorities, as well as abroad, to observe on SWM systems and to exchange opinions.

- On-the-job-training.

For example, the Municipality's SWM staff can be assigned to suitable agencies or some other Local Authorities to gain experience by working with experienced staff of such establishments for a period of time. On their return, these personnels can then provide on-the-job training for other staff of the Municipality.

The above program should be carried out in such a manner as to strengthen trainees' sense of self-motivation for improvement and pride in individual jobs.

It is also recommended that the Municipality should provide an incentive system to reward personnel showing interest and dedication. Such incentive system, though lacking in most public sector establishments, is vital for revitalization.

A trainee should be self-motivated to produce effective training. Rewards or incentives could help motivate trainees, too.

4) Training of Drivers, Operators and Workshop Personnel

Actual economic life and operation efficiency of waste collection vehicles and other equipment depend much on the degree of maintenance.

From this view point, the Municipality should provide workshop personnel, operators and drivers with training on the maintenance of vehicles, particularly preventive maintenance.

5) Training of Workers

The training of workers is required with respect to the following:

i. scope and manner of their job;
ii. waste storage and discharge methods the citizens have to abide by;
iii. work safety;
iv. maintenance of equipment used by workers; and
v. polite manner needed in communicating with citizens.

In addition to the above-mentioned training of workers, disciplinary control and work-morale support are also very important to increase the efficiency of the waste collection and road/drain cleansing services.

8.3 Phased Implementation Plan

8.3.1 Stage Plan

1) Basic Policy of Stage Plan

A stepwise approach is considered necessary to achieve the targets of the Basic Plan due to financial limitations and difficulty in obtaining public cooperation.

Phased improvement plan is proposed as follows.

a. Phase I 1995 - 1997
b. Phase II 1998 - 2000

Prior to the Phase I project, immediate improvement projects were proposed to contribute to the successful implementation of the Phase I project.

Table 8.3-1 shows the proposed stage plan. The stage plan is prepared based on the following considerations.

a. Curb collection and bell collection systems which will be examined in the collection experiment shall be established by 1995.

b. Collection service ratios of residential and commercial areas shall be expanded up to 50% and 60% by 1995, respectively, and up to 100% by 2000.

c. Public cooperation for cleaning up roads and drains shall be established by 1995, and cleaned-up wastes shall be collected and disposed by the USD.

d. Level 2 sanitary landfill site should be constructed at the KM 18-DS in 1994. It is proposed that level 3 sanitary landfill system should be realized in Phase II.

Table 8.3-1 Phased Improvement Plan

Items / Phase / Year	Immediate Improvement 1992	Phase I 1995 1997	Phase II 1998 2000
1. Collection & Other Cleansing Works	- Preparation of weekly and monthly working schedule - Collection of data regarding amount of waste collected. - Stimulation of the community cooperation for cleaning up its surroundings.	- Extension of collection service area. - Establishment of appropriate transfer system for the institutional waste. - Establishment of public cooperation for cleaning up road and drain. - Establishment of proper operation and maintenance system.	- Extension of collection service to whole Vientiane urban area
2. Final Disposal	- Securing land for the KM 18-DS. - Provision of a record of incoming vehicles. - Improvement of tipping fee collection system	- Construction and execution of a sanitary landfill level 2 at the KM 18-DS; Area = 8 ha. - Establishment of an organization for final disposal.	- Construction and execution of the sanitary landfill level 3 at the KM 18-DS; Area = 13 ha
3. Organization & Manpower		- Establishment of USD	
- Cleansing Services	- 48 persons	- 126 persons	- 242 persons
- Disposal Site and O & M of Equipment	- 4 persons	- 16 persons	- 26 persons
- Administration	- 7 persons	- 28 persons	- 48 persons
-(Night-Soil Management)	-(8 persons)	-(27 persons)	-(50 persons)
4. Financial Plan			
- Fee collection amount	- 11.9 million kips in 1991	- 322 million kips in 1995	- 903 million kips in 2000
- Annual budget	- 10.5 million kips in 1991	- 129 million kips in 1995	- 132 million kips in 2000
- Investment	- 0.6 million kips in 1991	- 2,139 million kips	- 2,300 million kips

e. The establishment of an independent organization for solid waste management called Urban Service Department for specialization in Phase I was also proposed.

2) Discharge and Collection

It is important to get the cooperation of the residents to enable the expansion of the collection area and to be able to employ the curb and bell collection which requires the following discharge manners:

a. Use of bamboo basket;

b. To discharge waste once a week as designated by the Municipality; and

c. To bring out waste and discharge at collection point (waste station) designated by the Municipality.

It was recommended that the proposed collection system as well as expansion of collection area should be introduced as a pilot project in a model area and then implemented in other areas. Experience gained through the pilot project was useful in expanding the same system to other areas.

Considering the above conditions, the stage plan for discharge and collection is summarized as follows:

a. Expansion of collection area

- Expansion of collection area to 50% of the residential area and 60% of the commercial area of Vientiane urban area by 1995.

- Expansion of collection area by covering the entire Vientiane urban area by 2000.

b. Establishment of the curb and bell collection systems both in the residential and commercial areas.

c. Introduction of detachable container trucks

- Introduction of communal containers for institutional wastes collection by 1995.

- Expansion of container collection system to the institution and other large generation sources by 2000.

3) Road Sweeping and Drain Cleansing

Citizen's cooperation is required to reduce littering of waste.

Littering can be reduced by providing reliable and regular waste collection services, while illegal dumping can be reduced by the strong enforcement of the law. Therefore, the improvement of cleansing services is planned as follows:

a. Introduction of drain cleansing waste collection through the citizen's cooperation and clean-up services of illegal dumps by 1995.

b. Expansion of drain cleansing waste collection services to the entire Vientiane urban area by 2000.

c. Introduction of the following mechanization by 1995.

- mechanization of grass cutting methods;
- mechanization of road sweeping, drain cleansing and grass cutting wastes collection methods.

4) Final Disposal

It is financially impractical to construct in Phase I all facilities which would meet the whole disposal demand up to 2000, therefore, the Basic Plan for the KM 18-DS will be implemented as follows:

a. Phase I

The northern section of the disposal site (8 ha) will be used for landfill operation to be completed by the end of 1997.

- Commencement of construction : beginning of 1994
- Period of landfill operation : 1995 - 1997
- Design disposal amount : 72.3 ton/day (1997)
- Design landfill volume : 183 thousand m^3 (total volume between 1995 and 1997 including soil covering)
- Landfill Site Area : 8 ha

b. Phase II

The southern section of the disposal site (13 ha) will be used for landfill operations to be completed by the end of 2000.

- Commencement of construction : beginning of 1997
- Period of landfill operation : 1998 - 2000
- Design disposal amount : 152.9 ton/day (2000)
- Design landfill volume : 286 thousand m^3 (total volume between 1998 and 2000 including soil covering)
- Landfill Site Area : 13 ha

In view of the facts that the promotion of the project which requires substantial investment may destroy the financial basis of the Municipality and that the balanced development of the infrastructure (including drainage system) in addition to the solid waste management system is essential for the cost-effective preservation of a healthy environment for urban life, it has been decided that the KM 18-DS to be constructed in Phase I will be within Level 2 where the enclosing bund and daily soil covering will be introduced, and that this will be improved to Level 3 in Phase II onwards.

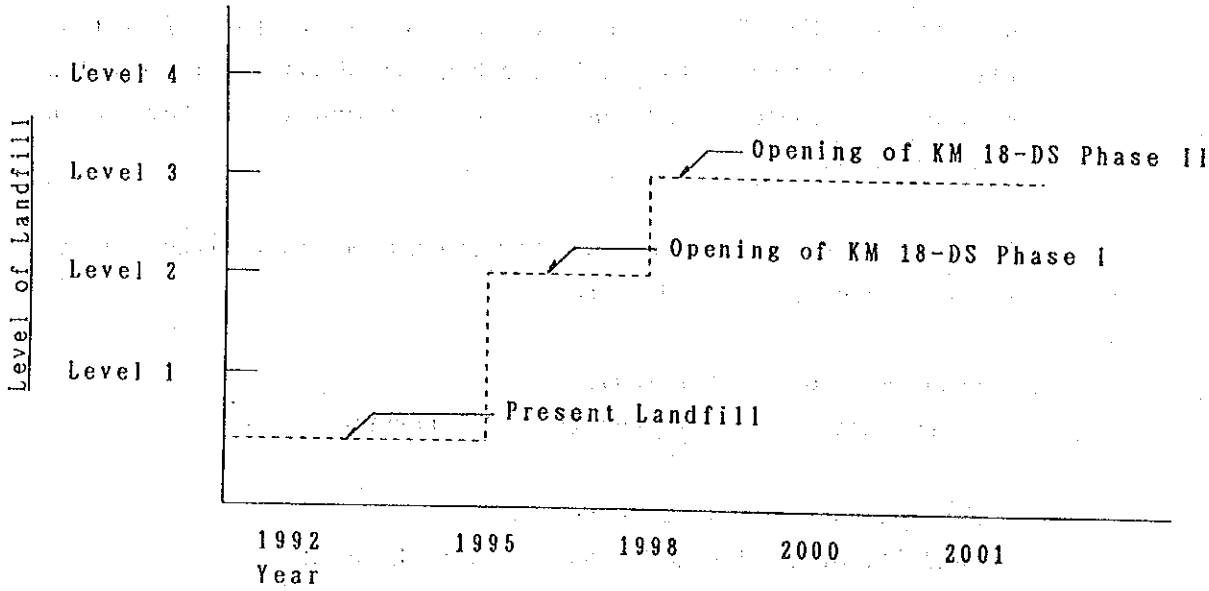
Upon consideration of the above-mentioned aspects, a stage plan is proposed and illustrated as follows:

- From 1992 to December 1994;
  Improvement of the present landfill operation

- From January 1995 to December 1997;
  Landfill at the KM 18-DS Phase I site (Level 2)

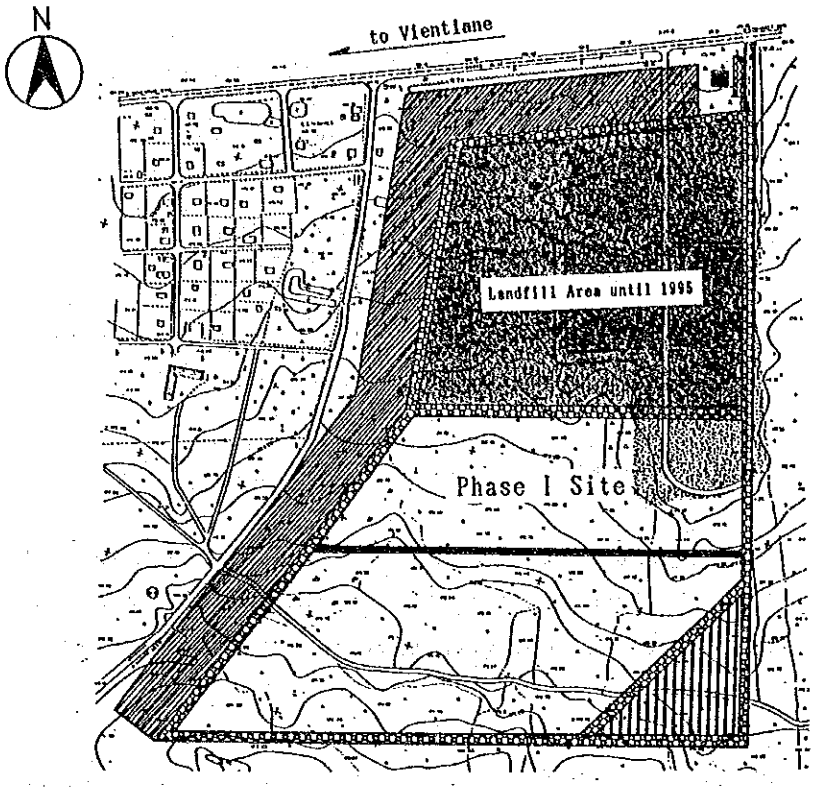
- From January 1998 to 2000;
  Landfill at the KM 18-DS Phase II sites (Level 3)

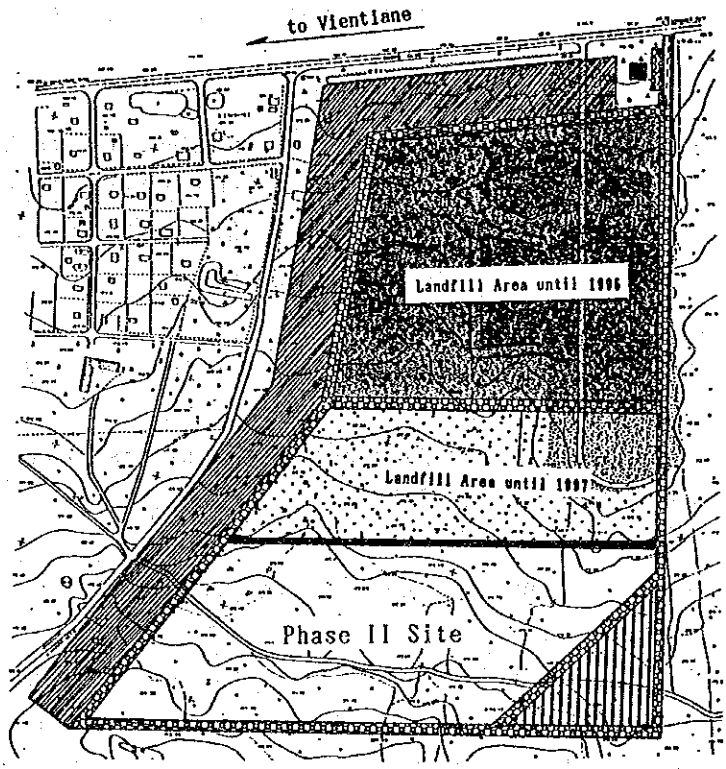
Based on the above stage plan, the actual site preparation and construction of the KM 18-DS is as shown in Fig. 8.3-1 and 8.3-2.



Landfill Level and Target Year

Fig.8.3-1 Stage Plan of Final Disposal





scale

0 100 200 m

THE STUDY ON THE SOLID WASTE MANAGEMENT SYSTEM IMPROVEMENT PROJECT IN VIENTIANE, LAO P. D. R.

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 8. 3-2 Staged Development Plan for KM 18-DS

8.3.2 Financial Plan

1) Major Assumptions

To investigate financial affordability of the Basic Plan, a cash flow is prepared on the following assumptions:

a. Financial requirement

Total investment cost of the Basic Plan is shown in Section 7.2.4, Table 7.2-19. Investment plan as shown in Table 8.3-2 was prepared according to the same economic evaluation shown below.

i. With regard to vehicle procurement, the number of vehicles procured in 1994 is in accordance with the required number in 1995. The number of vehicles for other years is for additional requirement due to the increase of the waste collected.

ii. With regard to disposal site, the facility to be constructed in 1994 is set for the level 2 and will be improved to level 3 in 1997. The capacity of the disposal site proposed is set only for 6 years in this calculation.

iii. The construction of maintenance shop is assumed for 1994.

The life span of containers, grass cutters and equipment for maintenance is estimated to be only 5 years, therefore, additional investment for their renewal is considered in 1999. As for the disposal site, the same idea is used as shown in Table 8.3-2.

Operation and maintenance cost in 2000 is shown in Table 7.2-10. The cost in other years is calculated based on the waste volume treated in 1995 and 2000, as shown in Table 8.3-3 and Table 8.3-4.

Table 8.3-2 Investment Plan

(Unit: million Kips)

Year	1994	1995	1996	1997	1998	1999	2000	Total
Collection								
Vehicle	495	127	127	127	127	127		1,131
Container	159							159
(Renual)						159		159
Final Disposal								
Construction	757			431				1,188
(Renual)							1,188	1,188
Heavy Equipment	258							258
Cleansing Work								
Vehicle etc	171							171
Grass Cutter	6							6
(Renual)						6		6
Maintenance								
Shop	158							158
Equipment etc	8							8
(Renual)						8		8
Total	2,012	127	127	558	127	300	1,188	4,440

Table 8.3-3 Annual Cost for Operation and Maintenance

(Unit: million Kips)

Year	1994	1995	1996	1997	1998	1999	2000
Personnel Cost		28	32	36	40	45	49
Maintenance Cost		37	42	47	53	58	64
Fuels & Others		124	138	153	167	182	197
Depreciation		271	292	312	405	426	447

Table 8.3-4 Solid Waste to be Treated by USD

(ton/day)

Year	1994	1995	1996	1997	1998	1999	2000
Collection		58.3	72.4	87.4	103.4	120.3	138.2
Disposal		72.3	86.5	101.7	117.8	134.9	152.9

b. Financial source

Financial source proposed for the investment is shown in Table 8.3-5. The first investment to set up the SWM in Vientiane Municipality for 1994 is assumed from a long term loan entailing a 10 years repayment with 3 years grace period and 4 percent interest rate. The additional investment for vehicles and equipment is assumed to be financed by the Vientiane Municipality. The investment for the improvement of the disposal site is assumed by the long term loan above mentioned.

Financial source for annual expenses is covered by the fees and the budget of Vientiane Municipality, as shown in Table 8.3-6. The budget of Vientiane Municipality is considered as public share. Solid waste covered by each category of shares and type of services is shown in Table 8.3-7.

The budget from Vientiane Municipality is summarized in Table 8.3-9. The share of Vientiane Municipality is about 25 times of the present budget, about 10 million kips.

Table 8.3-5 Financial Source for Investment

(Unit: million Kips)

Year	1994	1995	1996	1997	1998	1999	2000	Total
Budget VM		127	127	127	127	300	0	809
Long Term Loan	2,012			431			1,188	3,631
Total	2,012	127	127	558	127	300	1,188	4,440

Table 8.3-6 Financial Source for Annual Expenses

(Unit: million Kips)

Year	1994	1995	1996	1997	1998	1999	2000
Fee Collection							
Basic Fee		90	133	176	219	262	305
Special Fee		143	160	177	194	211	228
Tipping Fee		25	25	25	26	26	26
Budget from VM		119	119	119	119	119	119
Total		377	437	497	558	619	679

Table 8.3-7 Amount of Waste according the Burdens and Fee

(ton/day)

Year	1994	1995	1996	1997	1998	1999	2000
Burden of Households							
Basic Service		25.2	37.3	49.4	61.7	73.8	85.9
Special Service		25.1	28.7	32.3	35.8	39.4	43.0
Burden of Establishment							
Special Service		7.1	7.4	7.6	7.9	8.1	8.4
Disposal Service		14.0	14.1	14.3	14.4	14.6	14.7
Public Burden		0.9	0.9	0.9	0.9	0.9	0.9
Total		72.3	88.4	104.5	120.7	136.8	152.9

Table 8.3-8 Tariff Table

(Kips/ton)

Year	1995 ~ 2000
Basic Fee	11,360 (= 1,270 Kips/month/household)
Special fee	14,200 (= 1,580 Kips/month/household)
Tipping Fee	5,700

Table 8.3-9 Budget of Vientiane Municipality for Solid Waste

(Unit: million Kips)

Year	1994	1995	1996	1997	1998	1999	2000
For Investment		127	127	127	127	300	0
For Public Burden		119	119	119	119	119	119
Total		246	246	246	246	419	119

2) Result of Calculation

The balance sheet shows good indications if the fee is collected successfully. But the total of debt, which includes long term and short term loans, will reach over 2 billion kips in 2000, an amount which is thought to be enormous for Vientiane Municipality. If the first investment in 1994 is to be subsidized by foreign aids, the balance will be improved as shown in Fig. 8.3-3. The sensitivity analysis on important points was done and a feasible plan was prepared to establish a suitable financial system in the Feasibility Study. The long term calculation, as shown in Fig. 8.3-3, shows that the loan can be repaid if the revenue and annual expenses are maintained on the same level and if the financial source will be acquired similarly.

Table 8.3-10 Balance Sheet and Cash Flow of SWM in Vientiane

Balance Sheet

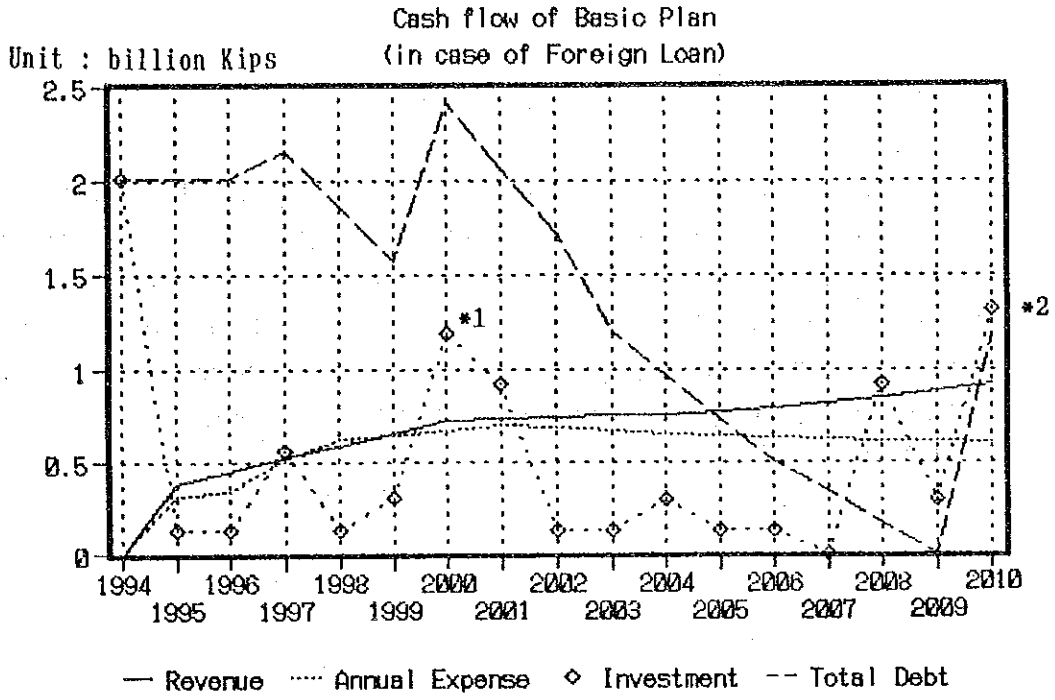
Unit: million Kips

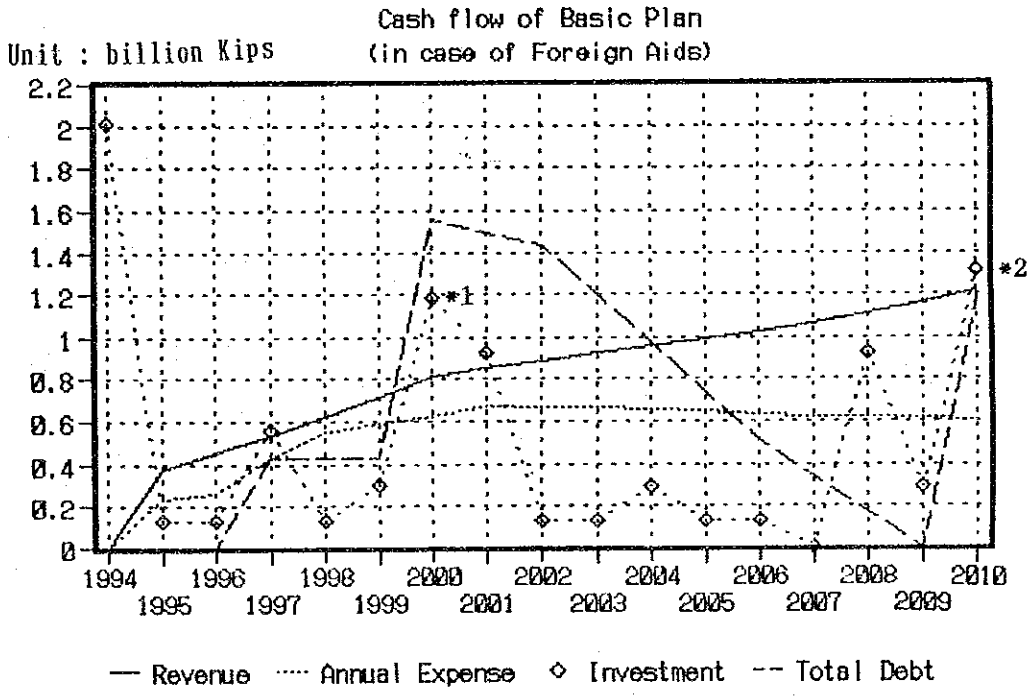
Year	1994	1995	1996	1997	1998	1999	2000
Revenue							
Fee Collection							
Basic Fee		90	133	176	219	262	305
Special Fee		143	160	177	194	211	228
Tipping Fee		25	25	25	26	26	26
Budget from VM		119	119	119	119	119	119
Others		0	13	29	32	37	47
Sub-total (A)	0	377	450	527	590	656	725
Expense							
Personnel							
Expenditure	0	28	32	36	40	45	49
Maintenance		37	42	36	40	45	49
Fuel & Others		37	42	47	53	58	64
Fee Collect							
Depreciation		136	146	312	405	426	447
Interest		80	80	80	86	75	63
Sub-total (B)	0	317	342	513	625	648	671
Balance	0	59	107	14	-35	8	55

Cash Flow

Unit: million Kips

Year	1994	1995	1996	1997	1998	1999	2000
Balance	0	59	107	14	-35	8	55
Depreciation	0	136	146	312	405	426	447
Sub-total	0	195	253	326	370	434	501
Money Demand							
Investment	2012	127	127	558	127	300	1188
Loan							
Long Term	0	0	0	287	287	287	349
Short Term	0	0	0	0	0	0	0
Sub-total	2012	127	127	846	415	587	1537
Money Supply							
Budget from VM	0	127	127	127	127	300	0
Foreign Aids	0	0	0	0	0	0	0
Long Term	2012	0	0	431	0	0	1188
Short Loan	0	0	0	0	0	0	0
Sub-total	2012	127	127	558	127	300	1188
Shortage of Money	0	195	253	39	83	146	152
Reserved Fund	0	195	448	487	570	716	868
Total of Debt	2012	2012	2012	2155	1868	1580	2420





Note : Investment (*1) in 2000 is for the development and construction cost of the disposal site for 10 years from 2001 to 2010 and investment (*2) in 2010 is for 10 years after 2011.

Fig. 8.3-3 Cash Flow of Basic Plan

8.3.3 Selection of the First Priority Project

The Basic Plan consists of the various projects described in this chapter. Among these, the first priority project regarding the technical system in 1995 is proposed and the outline is shown in Table 8.3-11. The feasibility of the proposed technical system as well as institutional system was studied in Phase 2 from February 1992 to June 1992, and the result of the study is described in Chapter 11.

Table 8.3-11 Outline of Proposed Technical System in 1995

Technical Sub-Systems	Contents and Proposed Systems
1. Discharge and Storage	
a. Amount of Generation	158.0 ton/day
b. Amount of Discharge	131.1 ton/day
c. Type of Refuse Bins	Bamboo baskets for the residential and commercial area, and communal containers for the institutions.
2. Collection and Haulage	
a. Amount of Collection	68.3 ton/day
b. Collection Service Ratio	50% for residential area, 60% for commercial area and 100% for the institutions
c. Collection Frequency	Once a week for residential and commercial area, and everyday for the institutional waste in principle.
d. Collection System	Curb collection and bell collection for the residential and commercial area, and station collection for the institutions.
e. Equipment	Dump trucks for the residential and commercial area, and detachable container trucks for the institutional waste.
3. Road Sweeping, Drain Cleansing and Grass Cutting	
a. Service Area	Road Sweeping; 15 km of road same as the present road length for sweeping Drain Cleansing; The drains of the 15 km and any drains requested by the residents Grass Cutting; 15 km of road same as the present
b. Main Equipment	Road Sweeping; Detachable container trucks and containers, and water trucks Drain Cleansing; Small dump trucks and a wheel loader Grass Cutting; Grass cutters
4. Processing and Recycling	
a. Processing	No specific facility
b. Recycling Amount	26.9 ton/day
c. Recycling Facility	No specific facility
5. Final Disposal	
a. Disposal Amount	72.3 ton/day
b. Final Disposal Site	KM 18-DS
c. Area	Available land area; more than 60 ha Landfill area; 8.0 ha
d. Final Disposal Method	Sanitary landfill level 2
e. Equipment	A bulldozer, a hydraulic excavator and a dump truck
6. Operation & Maintenance of Equipment	
a. Vehicle Depot	KM 7 Vehicle Depot
b. Maintenance	Preventive maintenance & light repair; KM 7 maintenance shop Heavy repair; Outside order

Notes;* The difference of waste amount(64.6ton/day) between discharge amount and collection amount is acquired from the self-disposal amount(63.7ton/day) and directly hauled amount from one market(0.9ton/day).

** The difference of waste amount(3.6ton/day) between collection amount and disposal amount is acquired from the directly hauled amount.

PART III

FEASIBILITY STUDY

CHAPTER 9

IMPLEMENTATION OF IMMEDIATE IMPROVEMENT PLAN

PART III FEASIBILITY STUDY

CHAPTER 9 IMPLEMENTATION OF IMMEDIATE IMPROVEMENT PLAN

9.1 Immediate Improvement Needs

Immediate improvement needs have been identified based on the following criteria and described in the section 9.1. Based on the needs identified, the immediate improvement plans were prepared, as described in 9.2. Then, most of the plans prepared were implemented in the Study period and the results of them were described in 9.3.

a. Possibility of immediate improvement;

b. Efficient use of existing resources without requiring large investments;

c. Achievement of tangible improvement effects in a short time;

d. Possibility of becoming a model for future improvement.

There are two types of immediate improvement needs as shown below:

a. Improvement needs in crucial areas with specific problems.

b. Improvement needs to demonstrate the feasibility of introducing a future system (e.g. Pilot project for collection experiment and experiment on sanitary landfill operation).

The implementation of these immediate improvement projects is very important as the Basic Plan targets can be achieved only through a step-wise improvement method. The former is described in this Chapter, while the latter is mentioned in Chapter 10.

Immediate improvement needs in Vientiane urban area have been identified as follows:

9.1.1 Technical System

1) Discharge and Storage

The immediate improvement need on the discharge system in the Study area is:

-execution of a separate discharge for infectious waste in hospitals.

2) Collection and Haulage

The needs identifed regarding the collection and haulage system are:

- preparation of weekly and monthly working schedule; and
- collection of data on amount of waste collected.

3) Road Sweeping, Drain Cleansing and Grass Cutting

The need required for the road sweeping, drain cleansing and grass cutting system is:

- stimulation of community cooperation for cleaning up the surroundings.

4) Final Disposal

The immediate improvement needs on the final disposal system are;

- securing land for the KM 18-DS;
- authorization of the KM 18-DS as a disposal site;
- control of scavenging activities;
- provision of the record of incoming vehicles; and
- improvement of tipping fee collection system.

5) Equipment Operation and Maintenance

The needs for the equipment operation and maintenance system are:

- improvement of the basic knowledge of the DCTC operators and mechanics on equipment operation and maintenance; and
- execution of regular maintenance.

9.1.2 Institutional System

1) Organization and Management

The needs identified regarding organization and management are:

- clarification of the roles of each organization; and
- assignment of the person (s) in charge of planning and management.

2) Legislation and Enforcement

The immediate improvement need for the present legislation and enforcement is:

- strengthening of enforcement capability.

3) Finance

The immediate improvement needs on the present financial system are:

- improvement of accounting system;
- improvement of fee collection system; and
- collection of data for operational expenditure.

4) Public Cooperation and Education

The needs for the present public cooperation and education are:

- strengthening present public cooperation for the Cleansing Day designated on Saturdays; and
- preparation of an education program for primary schools.

9.2 Immediate Improvement Plan

Based on the immediate improvement needs mentioned in 9.1, immediate improvement plans were prepared and described in this section. Most of the plans were executed in the Study period.

9.2.1 Technical System

1) Discharge and Storage

a. Execution of a separate discharge for infectious waste in hospitals

Even though infectious waste was segregated at the generation source, it was discharged into open heaps, a trailer or a container together with non-infectious waste. The Study Team and DCTC executed WACS both in the rainy and dry season. During this period, the hospitals were requested to segregate the discharge of infectious waste by using plastic bags to guarantee the safety of the workers. After the WACS, the Study Team and DCTC asked the hospitals to continuously segregate and discharge infectious waste.

2) Collection and Haulage

a. Preparation of weekly and monthly working schedule

i. working schedule for collection workers

Working Day Table was prepared to manage collection workers and drivers. Every morning before work, the workers were gathered and briefed by the supervisor on the day's collection

areas, routes and on matters to be attended at the court of DCTC. This table was used both as a check sheet of the work days and the receipt for the daily allowances in addition to the monthly salary.

ii. weekly schedule for collection vehicles

A weekly schedule was made to manage collection vehicles and to give regular services to the residences, shops, offices and institutions under contract with DCTC. Each collection vehicle got their own collection routes beforehand. The supervisor checked which of the vehicles needed repair and the collection routes not covered last week. He also made the weekly schedule of the collection vehicles.

b. Collection of data regarding amount of waste collected

The actual amount of waste collected, amount of waste hauled to KM18-DS and hauling ratio of DCTC, private companies, and waste directly hauled were not clearly understood until the waste hauled to KM 18-DS was measured using a weighbridge. The measured data was compiled daily by the operators in the site. The daily record was processed in the computer twice a week in the DCTC office.

These data constructed the monthly records. The daily fluctuation of amount of waste hauled to KM18-DS and hauling ratio by DCTC, private and directly were graphed and referred as the basic data of the collection and haulage plan.

The daily fluctuation of amount of waste hauled to KM 18-DS is shown in Fig. 9.2-1.

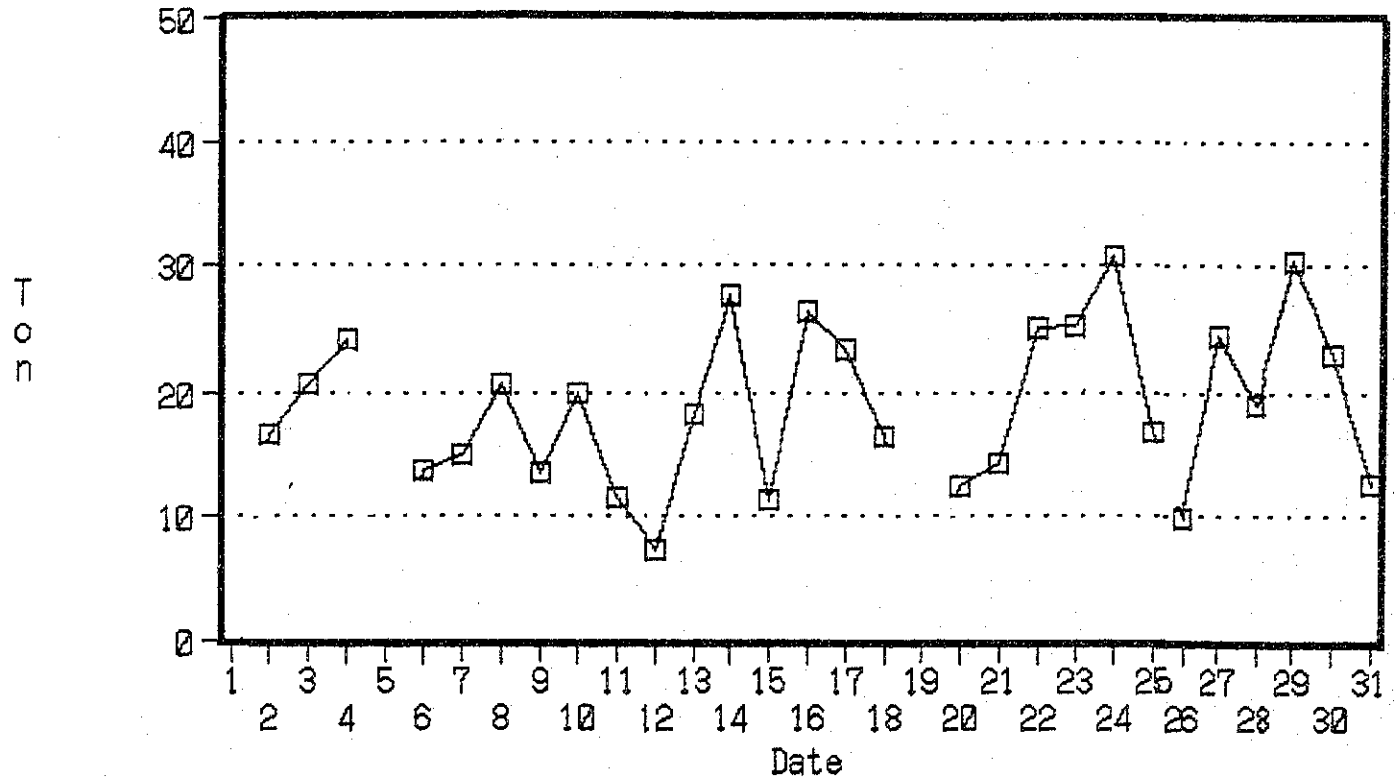


Fig. 9.2-1 Amount of Waste Hauled to KM18-DS
January, 1992

3) Road Sweeping, Drain Cleansing and Grass Cutting

a. Stimulation of community cooperation for cleaning-up its surrounding

Cleaning-up of public areas was done by the residents and collection and haulage is carried out by DCTC in the collection experiment.

The schedule for the cleaning-up of roads, drains and public areas through public cooperation was prepared below and the routes for public waste collection is shown in Fig. 9.2-2.

Date of cleaning-up		Cleaning-up Areas
Residents	DCTC	
22 Feb.	24 ~ 29 Feb.	Ban Sisavath Tay
29 Feb.	2 ~ 7 Mar.	Ban Sisavath Kang
7 Mar.	9 ~ 14 Mar.	Ban Dong Mieng

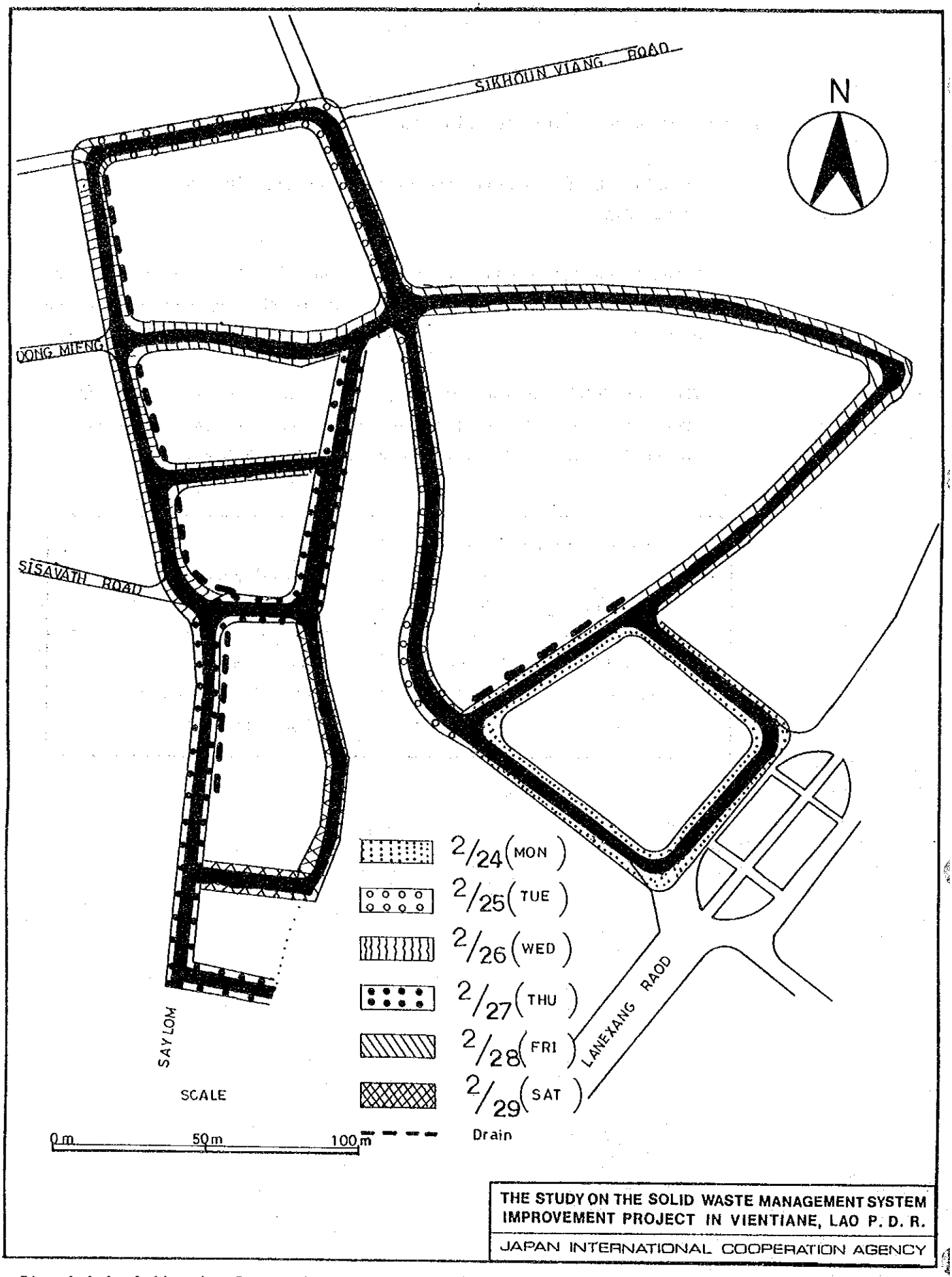


Fig. 9.2-2 Collection Routes for Cleaning-up of Roads, Drains and Public Areas (Ban Sisavath Tay)

4) Final Disposal

The immediate improvement plan for the final disposal system, has been discussed with the related organizations. In addition, the experiment on sanitary landfill operation was conducted by the DCTC and the Study Team from February 13 to March 21, 1992. The details of the immediate improvement plan proposed for the final disposal system are as follows:

a. Securing land for the KM 18-DS

The boundary of the present KM 18-DS was not clearly secured. The part of the land which should belong to the Vientiane Municipality has been used not only for cultivation but also as residences of private farmers. It was, therefore, urgent to secure the land of the Vientiane Municipality for the KM 18-DS by the installation of boundary fences or pegs in order to avoid further invasion which would only make the future operation of the KM 18-DS more difficult.

b. Authorization of the KM 18-DS as a disposal site

A final disposal site is absolutely necessary for solid waste management. It was, therefore, necessary that Vientiane Municipality should authorize the KM 18-DS as the final disposal site of the Vientiane urban area and restrict not only cultivation in the site but also the use of the surrounding area to avoid future problems.

c. Control of scavenging activities

Scavenging activities contributed to the recycling and recovery of reusable materials in the Study area. Scavenging by children, however, should be prohibited and scavengers should be sufficiently cautioned against infectious hospital waste. In order to avoid the spread of communicable diseases, animal scavenging at the site should also be restricted.

d. Provision of the record of incoming vehicles

For a sound SWM, the provision of the record of incoming vehicles is indispensable. When recording incoming vehicles, the inspection of incoming waste, especially dangerous wastes such as industrial and hospital wastes, was also required. When an inspector identifies the existence of hazardous wastes, he must caution the scavengers and instruct the vehicles to dump their waste at a designated area.

e. Improvement of tipping fee collection system

The present tipping fee collection system should be improved as follows:

i. The temporary overseer should be employed by DCTC and his assignment should be clearly outlined to him.
ii. The receipt of the tipping fee should be issued at the time of inspection.
iii. The tipping fee was proposed to be increased in the following manner:

- a small vehicle ; 600 kips/unit
- a medium vehicle ; 900 kips/unit
- a large vehicle ; 1,200 kips/unit

5) Equipment Operation and Maintenance

a. Improvement of basic knowledge of the DCTC operators and mechanics

In order to improve the basic knowledge of the DCTC operators and mechanics regarding equipment operation and maintenance, the Study Team has arranged a 2-week training course from the 2nd to the 14th of March. Totally 8 operators and mechanics were selected by DCTC to be trained in the course.

Content of training programs were as follows:

i. basic information on vehicles and construction equipment;
ii. outline of main parts of engine and power train;
iii. instruction on operation of a truck and a bulldozer;
iv. instruction of " HOW TO MAINTAIN EQUIPMENT ";
   - inspection record,
   - daily report to workshop,
   - daily, three months, six months and one year check list,
   - how to make a check list.
v. outline of hydraulics for power steering;
vi. safety regulations; and
vii. tire and under carriage.

b. Execution of regular maintenance

The Study Team also provided the operators and mechanics a training course on "Regular Maintenance System".

The training included the following:

i. regular maintenance which consists of daily, weekly, monthly and one yearly check-up; and

ii. how to use and make a weekly, monthly check sheet.

9.2.2 Institutional System

1) Organization and Management

The immediate improvement plan on organization and management was as proposed below.

a. Clarification of organizational roles

There were various organizations concerned in the solid waste management. However, the responsibilities and roles of these agencies were not clearly defined. This situation was the same even in the various organizations of the Vientiane Municipality. The Study Team, therefore, proposed the major importance of clearly defining the role of the Cleansing Section of the DCTC, VM, especially in respect to the successful conduct of the collection experiment.

b. Assignment of the person (s) in charge of planning and management

Good planning is one of the key factors behind the conduct of smooth and effective works. Unfortunately, neither a long term nor a short term plan regarding solid waste management have been set lup by the responsible agencies. Moreover, nobody was directly assigned to take charge of the planning and management in the Cleansing Section of DCTC. The Study Team recommended to DCTC the assignment of person(s) to take charge of planning and management in the Cleansing Section.

2) Legislation and Enforcement

a. Strengthening enforcement capability

Vientiane Municipality has few regulations related to solid waste management, and they seem to be insufficient and out of date. A basic law and an enforcement system on solid waste management is also non-existent in Lao P.D.R.. All of the existing regulations issued by Vientiane Municipality should be revised, therefore, in accordance to the present situation and to strengthen effective enforcement.

3) Finance

The immediate improvement plan of the financial system was as proposed below:

a. Improvement of accounting system

The major point to improve was the introduction of a separate accounting system for SWM, to clarify cash flow.

An accounting sheet shown in Table 9.2-1 was proposed and has been used in the collection experiment.

At the end of the working day, the cash and the balance recorded in the sheet were to be checked.

b. Improvement of fee collection system

A ledger for the management of collection fee was prepared as shown in Table 9.2-2. The major improvement to be made in this system was the formulation of the ledger and the development of a method which should allow easy access to the ledger whenever a contract was made or fee was collected.

Table 9.2-1 Accounting Sheet

No. 1

Month	Date	Receipt No.	Code	Item	Revenue	Expenditure	Balance
Feb.	17		R-1	Collection Fee	21,000		21,000
Feb.	17	1	E-7	Stationary		1,200	19,800
Feb.	18		R-1	Collection Fee	52,000		71,800
Feb.	18		R-1	Collection Fee	63,000		134,800
Feb.	20	2	E-7	Opening Bank Account		1,000	133,800
Feb.	22		R-1	Collection Fee	1,000		134,800
Feb.	22		R-1	Collection Fee	177,000		311,800
Feb.	24		R-3	Unclear	100		305,600
Feb.	24	4	E-2	Labour Fee		6,200	306,000
Feb.	24		R-2	Tipping Fee	1,810		306,600
Feb.	24	001	R-2	Tipping Fee	400		308,410
Feb.	24	002	R-2	Tipping Fee	600		308,510
Feb.	24	003	R-2	Tipping Fee	800		309,310
Feb.	24	004	R-2	Tipping Fee	800		310,110
Feb.	25	3	E-7	Stationary		2,350	310,610
Feb.	25	4	E-2	Labour Fee		6,200	304,410
Feb.	25	005	R-2	Tipping Fee	500		304,910
Feb.	25	006	R-2	Tipping Fee	500		305,510
Feb.	25	007	R-2	Tipping Fee	600		306,010
Feb.	25	008	R-2	Tipping Fee	500		306,810
Feb.	25	009	R-2	Tipping Fee	800		307,610
Feb.	25	010	R-2	Tipping Fee	800		308,410
Feb.	25	011	R-2	Tipping Fee	800		309,210
Feb.	25	012	R-2	Tipping Fee	800		306,860
Feb.	26	013	R-2	Tipping Fee	800		307,660
Feb.	26	014	R-2	Tipping Fee	500		308,160
Feb.	26	015	R-2	Tipping Fee	800		308,960
Feb.	26	016	R-2	Tipping Fee	400		309,360
Feb.	26	018	R-2	Tipping Fee	800		310,160
Feb.	26	019	R-2	Tipping Fee	800		310,960
Feb.	26	4	E-2	Labour Fee		5,600	305,360
Feb.	27	020	R-2	Tipping Fee	500		305,860
Feb.	27	021	R-2	Tipping Fee	800		306,660
Feb.	27	022	R-2	Tipping Fee	800		307,460
Feb.	28	023	R-2	Tipping Fee	500		307,960
Feb.	28	024	R-2	Tipping Fee	800		308,760
Feb.	28	025	R-2	Tipping Fee	800		309,560
Feb.	28	026	R-2	Tipping Fee	400		309,960
Feb.	28	027	R-2	Tipping Fee	500		310,460
Feb.	28	028	R-2	Tipping Fee	400		310,860
Feb.	28	029	R-2	Tipping Fee	500		311,360
Feb.	28	030	R-2	Tipping Fee	800		312,160
Feb.	28	031	R-2	Tipping Fee	500		312,660
Feb.	29	032	R-2	Tipping Fee	500		313,160
Feb.	29	033	R-2	Tipping Fee	800		313,960
Feb.	29	035	R-2	Tipping Fee	500		314,460
Feb.	29	036	R-2	Tipping Fee	800		315,260

Table 9.2-2 Ledger for Management of Collection Fee

No.	Code No.	Family Name	House No.	Nouai	Ban	District	Contract Date	Contract Month & No. of Baskets												Reception Month											
								Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱	⑲	⑳	21	22	23	24	25	26	27	28	29	30	31	32
134	SK-1-01	Mrs. Phoy	N.A.	14	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
135	SK-1-02	Mr. Bounmy	N.A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
136	SK-1-03	Mrs. Keo	N.A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
137	SK-1-04	Mr. Nouphat	N.A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
138	SK-1-05	Mr. Nouphanh	N.A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
139	SK-1-06	Mr. Khamfong	N.A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
140	SK-1-07	Mr. Khammanh	N.A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
141	SK-1-08	Mr. Phansamay	N.A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
142	SK-1-09	Mr. Yen	N.A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
143	SK-1-10	Mr. Vichit	N.A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
144	SK-1-11	Mrs. Khonkham	N.A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
145	SK-1-12	Mr. Viengxay	N.A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
146	SK-1-13	Mr. Khamsene	N.A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
147	SK-1-14	Mr. Bounhome	N.A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
148	SK-1-15	Mrs. Fong	N.A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
149	SK-1-16	Mrs. Xiou	N.A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
150	SK-1-17	Mr. Khampane	N.A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
151	SK-1-18	Mr. Viangkham	N.A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
152	SK-1-19	Mrs. Naly	N.A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
153	SK-1-20	Mr. Khamphay	N.A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
154	SK-1-21	Mrs. Khamtanh	N.A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
155	SK-1-22	Mrs. Somphane	N.A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
156	SK-2-01	Mrs. Vongdeuane	N.A.	12	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
157	SK-2-02	Mr. Somphavanh	N.A.	12	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
158	SK-2-03	Mr. Boutdy	N.A.	12	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

The second one was the numbering of every page of the receipt book before it was used. A rule of not tearing any page regardless of errors made was established in order to avoid trouble or doubt.

c. Collection of data for operational expenditure

From the account sheet, the sum by each item-code was arranged in the cost analysis sheet every month. The same went with the volume of solid waste transferred based on the data of weighbridge.

From the above data, the balance and unit cost of each work on SWM could be attained. Careful analysis of the change of unit cost would point out the problem or possible ways to improve SWM.

4) Public Cooperation and Education

The immediate improvement plan for public cooperation and education were:

a. Strengthening present public cooperation on the Cleansing Day designated on Saturdays

It can be surely said that most solid waste management problems would be solved quickly and efficiently, if the public cooperation is strengthened. Residents' cooperation does not only refer to the number of people participating in the Cleansing Day activities, but also refers to how they keep the city clean by proper storage and discharge manner, non-littering at public places, etc.

The Study Team proposed the strengthening of public cooperation by means of public education and public campaign to DCTC.

b. Preparation of an education program for the primary school

The objective of public education is to strengthen residents' cooperation. It was recommended that waste education should be established in primary schools. Solid waste education should include the following:

i. waste and public health
ii. necessity for proper discharge and storage
iii. importance of keeping public places clean
iv. waste flow from generation to final disposal
v. waste amount and cost
vi. waste disposal and environment
vii. importance of recovery (recycling)

9.3 Implementation

Most of the immediate improvement plans proposed were implemented by DCTC in cooperation with the Study Team and the results of the implementation are described below.

9.3.1 Technical System

1) Discharge and Storage

During the WACS, the hospitals were requested to segregate and discharge infectious waste. However, a lot of the infectious waste was found to be included in the non-infectious waste in the rainy season (the first WACS), in spite of the request made by the Study Team to the hospitals on segregation.

During the second WACS conducted in the dry season, infectious wastes were segregated, thus making waste composition analysis possible.

As infectious waste was segregated at the generation source, it is concluded that segregation and discharge of infectious waste will easily become a habit if the equipment necessary for segregation, i.e., plastic bags or containers for infectious waste, is provided.

2) Collection and Haulage

a. Preparation of weekly and monthly working schedule

i. working schedule for collection workers

Through the Working Day Table prepared, the following effects were achieved:

- Collection service was done at a regular time due to the daily check-ups conducted before the start of daily collection work.

- The daily allowances of the labourers were managed systematically and clearly.

- Collection crew became conscious of the importance of the collection work, and behaviour became efficient due to regular working time.

The Weekly Schedule of the collection vehicles produced the following effects:

- The collection areas allotted to each vehicle became known to every staff;
- A regular collection service was conducted;
- Administration system of collection vehicles was established;
- Planning of repair, maintenance and back up service for the vehicles was established.

b. Collection of data regarding amount of waste collected

The actual amount of waste hauled to KM18-DS was maximum of 39.36 tons and an average of 17.4 tons per day. The average number of incoming vehicles was about 8.5 units per day.

The average amount of waste hauled by DCTC and those privately and directly hauled were 6.1 tons, 7.8 tons and 3.5 tons, sharing a ratio of 35.3 %, 44.7 % and 20 % respectively.

3) Road Sweeping, Drain Cleansing and Grass Cutting

As for the cleaning-up of roads, drains and public areas through public cooperation, a cleansing day was proposed and implemented in each Ban of the collection experiment.

The Study Team informed the chiefs of the 3 Bans the designated day, method and type of waste for the cleansing day and asked them to explain the details and solicit the participation of their residents. In addition, announcements were conducted on the loudspeaker during previous and designated days. However, the result of the cleansing work by the residents was not satisfactory.

The Study Team requested, therefore, that DCTC as well as the chiefs of the Bans should further conduct public and educational campaigns in order to achieve public cooperation regarding cleansing services.

4) Final Disposal

Considering the present situation of final disposal in the Study area, the proposed immediate improvement plan has been modified and executed by the Vientiane Municipality as follows:

a. Securing land for the KM 18-DS

The DCTC received the approval for the staking of the site and the construction of fences. The boundary stakes were installed and the fence will be constructed after budget allocation.

b. Authorization of the KM 18-DS as a disposal site.

After the approval of the Governor, the Vientiane Municipality took the necessary measures for acquire authorization. Finally, the Department of Land, Ministry of Economy Planning and Finance has issued a title deed for the use of the site to the Municipality.

c. Control of scavenging activities

The DCTC has assigned an inspector for the control of scavenging activities. The inspector is responsible for restricting children from scavenging and caution the scavengers on hazardous wastes found in incoming vehicles.

d. Provision of the record of incoming vehicles

The record of incoming vehicles to the KM 18-DS was provided after the installation of the weighbridge in November 15, 1991. Incoming vehicles were then classified into the following three categories;

- DCTC vehicles;
- Private companie vehicles; and
- Others (directly hauled).

The inspector assigned at the KM 18-DS inspects the wastes of other vehicles as they may contain some industrial wastes, and also carefully checks the infectious hospital wastes hauled by DCTC.

e. Improvement of tipping fee collection system

In response to the improvement plans, DCTC employed an overseer and gave him a clear assignment at the disposal site.

The receipt of the tipping fee was prepared by the Study Team in February 1992. Subsequently, DCTC issued the receipt and the overseer inspected the incoming vehicles upon the issuance of the receipt.

However, the increment of the tipping fee is being discussed in the Administrative Committee of Vientiane Municipality.

5) Equipment Operation and Maintenance

The operators and mechanics trained have improved in their vehicular and heavy equipment operation and maintenance capabilities, and techniques which might contribute in the improvement of the DCTC present equipment operation and maintenance system.

9.3.2 Institutional System

1) Organization and Management

a. Clarification of organizational roles

In response to the proposal made by the Study Team, DCTC has assigned the persons required for execution of the collection experiment. The assigned staffs, totally 18 persons, consisted of a project manager, a supervisor, an accountant, fee collectors, weighbridge operators, a mechanic, drivers and labourers. Each person was clearly assigned his duty and responsibility. The result of the collection experiment shows that the personnel of the Cleansing Section is being well organized. The clarification of duties and responsibilities resulted in efficient work.

b. Assignment of the person (s) in charge of planning and management

DCTC has assigned a person in charge of the planning and finance division of the Cleansing Section upon the recommendation of the Study Team. This person also joined the collection experiment as a fee collector. Moreover, during the collection experiment, some of the immediate improvement plans regarding planning and management have been executed.

They were;

i. daily and weekly working plan of workers;
ii. daily and weekly working plan of vehicles; and
iii. planning of fee collection and waste collection.

After the collection experiment, DCTC has set a plan to extend the collection service contract with the residents up to the end of 1992 and also plans to extend the service coverage to other areas in Vientiane Municipality.

2) Legislation and Enforcement

a. Strengthening enforcement capability

In order to strengthen enforcement capability as proposed by the Study Team, DCTC has requested the Study Team to provide laws and regulations regarding solid waste management in the neighbouring countries of Lao P.D.R.. These laws and regulations will be used as examples for revising existing regulations and for issuing new ones. After careful consideration, the Study Team got the existing laws and regulations of Thailand and gave them to DCTC to refer them for the revision work, because of the similarities in language and way of living, social conditions, traditions and customs, between Thai and Lao.

3) Finance

a. Improvement of accounting system

In the collection experiment, the personal computer of the JICA Study Team was used to make the above-mentioned accounting and ledger sheets. This is expected to contribute to the improvement of the SWM accounting system, because the accountant who was the counterpart of the project mastered its operation.

b. Improvement of fee collection system

With regard to fee collection, the potential possibilities for the establishment of self-finance was proven when punctual services were given. Moreover, a new extra charge concept was induced from the experiment. Residents sometimes want to discharge more waste than what was agreed in the contract, and this prompted the introduction of the ticket system for extra charge.

c. Collection of data for operational expenditure

Cost analysis is also expected to improve SWM through the checking of the operational cost according to the monthly data. Data for operational expenditure of the experiment was collected and analyzed. The cost analysis sheet of the experiment is tabulated in Table 9.3-1.

4) Public Cooperation and Education

a. Strengthening present public cooperation for the Cleansing Day designated on Saturdays

In the collection experiment, the Study Team has strengthened public cooperation for the Cleansing Day designated on Saturdays by recommending the conduct of public education and campaign to DCTC. For public education, the Study Team conducted an education program on solid waste management to the Lao Women's Union.

As for public campaign, the Study Team, with the cooperation of the village committees, encouraged the residents in the 3 selected villages for the collection experiment to carry out drain cleansing on Saturday. Since the number of people joining in the cleansing day was not satisfactory, DCTC and the village committees should continuously conduct public campaigns.

Furthermore, the Study Team and DCTC also campaigned in Vientiane Municipality through the mass-media (television and newspaper) to promote the collection experiment using the slogan "Clean Vientiane".

The Study Team also prepared a uniform (see Plate 5) for all persons concerned in the collection experiment and stickers of "Clean Vientiane" as shown in Fig. 9.3-1, to promote the project and encourage greater public awareness regarding the importance of proper solid waste management.

Table 9.3-1 Cost Analysis Sheet

Total		Collection		Disposal		Others	
Revenue	328,200	R-1	314,000	R-2	14,100	R-3	100
Expenditure							
Personnel	275,384	E-2,E-2-1	145,500	E-3,E-3-1	26,800	E-1,E-1-1	103,084
Fuel & Lubrica	54,550	E-4	50,000	E-6	0	E-7	4,550
Maintenance	0	E-5	0				
Rental	840,000		0	E-8	840,000		
Depreciation	360,429	E-9	360,429				
Sub-total	1,530,363		555,929		866,800		107,634
Administration			42,058		65,576		
Disposal fee			39,663				
Total	1,530,363		637,650		932,376		
Balance	**********		-323,650		-918,276		
excluding Depr	-841,734		36,779		-918,276		
Volume treated			19.38		455.57		
Unit cost(kips)			32,902		2,047		

Code for Revenue

R-1: Collection Fee for Collection Service
R-2: Tipping Fee at KM18-DS
R-3: Others

Code for Expenditure

E-1: Personnel Expenditure for Administration
E-1-1: Personnel Expenditure for Administration (Over Time)
E-2: Personnel Expenditure for Cleansing Service

E-2-1: Personnel Expenditure for Cleansing Service (Over Time)
E-3: Personnel Expenditure for KM18-DS
E-3-1: Personnel Expenditure for KM18-DS (Over Time)
E-4: Fuel & Lubricant for Vehicle
E-5: Maintenance for Vehicle
E-6: Utility for Inspection Building
E-7: Others (Administrative Expenditure etc.)c
E-8: Rental for Buldozer
E-9: Depreciation of Collection Vehicles

Fig. 9.3-1 Symbol of "Clean Vientiane Project" used as Sticker and Uniform for Collection Experiment