### 9.2.2 Summary of Alternative Plans

In this Study, eight alternative plans are studied for the formulation of the master plan for MPPP and MPSP. The concept of each alternative is shown in Fig. 9.2-2 and Fig. 9.2-3 summarized in the following.

(1) Alternative 1

Alternative 1 is presented as an independent disposal system providing sanitary landfill operations for MPPP and MPSP. It has 3 disposal sites; Pantai Acheh for MPPP, Kuala Muda and Pulau Burong for MPSP.

All wastes would be hauled directly to these disposal sites without using transfer stations nor incineration plants.

(2) Alternative 2

Alternative 2 is presented as an independent disposal system for MPPP and MPSP. In addition to the three disposal sites as in Alternative 1, this alternative has two transfer stations.

Waste from the east side of MPPP would be hauled to Jelutong transfer station and then hauled by transfer vehicles to Pantai Acheh disposal site. Waste from the west side would be hauled to the Pantai Acheh disposal site directly.

In MPSP, waste from the south part of North District and whole area of Central District would be hauled to Mak Mandin transfer station and then transfered to Pulau Burong disposal site.

(3) Alternative 3

Alternative 3 is presented as an independent disposal system for MPPP and MPSP also. It has three disposal sites and two incineration plants.

All the combustible wastes, which include domestic, commercial and some factory waste, would be hauled to incineration plants; then the remaining residue would be hauled to disposal sites. Incombustible waste, mostly generated from factories, would be hauled directly to disposal sites.

In MPPP, waste from the entire area would be hauled to Free Trade Zone (FTZ) incineration plant and the burnt ashes would be disposed of at Pantai Acheh disposal site.

In MPSP, waste from all the areas would be hauled to the Perai Incineration Plant and the burnt ashes would be disposed of at Pulau Burong disposal site.

(4) Alternative 4

Alternative 4 is an inter-municipal disposal system for MPPP and MPSP. It has two disposal sites; Kuala Muda and Pulau Burong, and all the waste of MPPP and MPSP would be hauled directly to disposal sites.

Waste of MPPP would be hauled through the Penang Bridge and disposed of at Pulau Burong disposal site.

Waste from the North and Central Districts of MPSP would be disposed of at Kuala Muda disposal site, while the waste from the South District of MPSP would be hauled to and disposed of at Pulau Burong that would be used as an inter-municipal disposal site.

(5) Alternative 5

Alternative 5 is also an inter-municipal disposal system for MPPP and MPSP. It has two disposal sites and two transfer stations.

Almost all the waste in MPPP would be hauled to Jelutong transfer station, and then transfered to Pulau Burong disposal site. Waste collected at surrounding area of Balik Pulau would be hauled to Pulau Burong disposal site via Balik Pulau transfer station.

In MPSP, waste would be hauled without a transfer station as in Alternative 4, because a transfer station of MPSP would not be cost-effective in comparison with direct haulage.

(6) Alternative 6

Alternative 6 is an inter-municipal disposal system like Alternatives 4 and 5. It has two disposal sites and a barge system to haul waste from MPPP to Pulau Burong disposal site.

All waste collected in MPPP area would be hauled to FTZ transfer station, and then shipped to Pulau Burong disposal site by barge.

Waste collected in the MPSP area would be hauled in the same manner as in Alternative 2.

(7) Alternative 7

Alternative 7 is also an inter-municipal disposal system, but has incineration plants both in MPPP and in MPSP. All waste would be hauled to incineration plants in the same way as in Alternative 3. Ashes from both incineration plants would be hauled to Pulau Burong disposal site only.

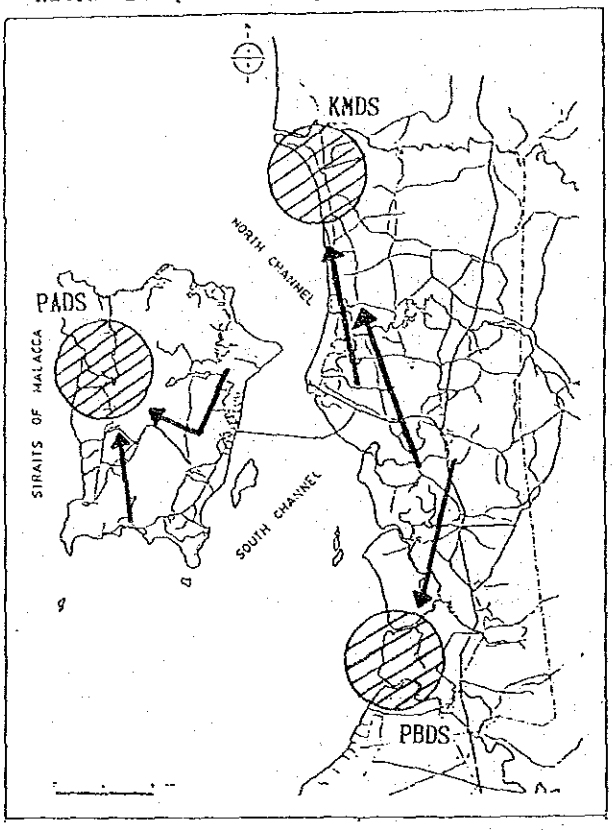
(8) Alternative 8

Alternative 8 has one incineration plant at Perai Industrial area to treat all the waste hauled from both MPPP and MPSP. The burnt ashes would be hauled to Pulau Burong disposal site.

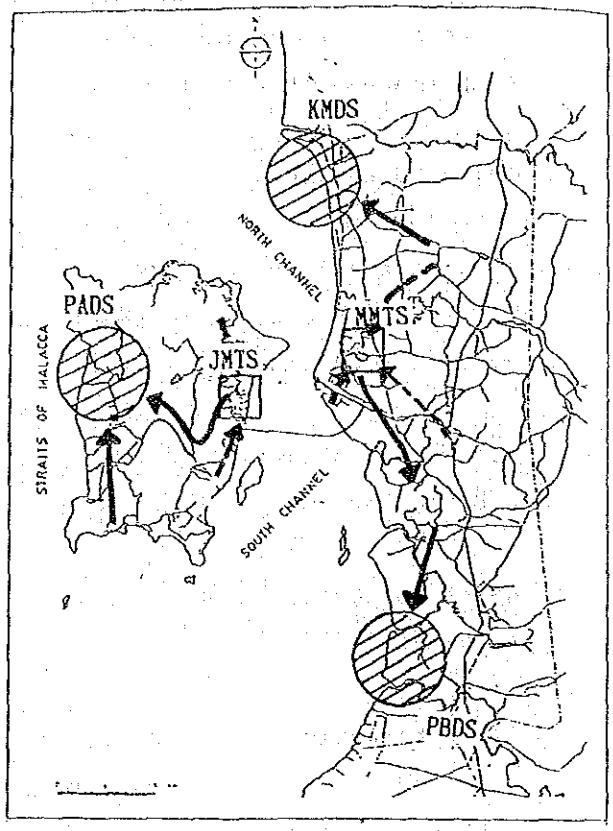
9.2.3 Outline of Facility

Outline of main facilities for each alternative is summarized in Table 9.2-1.

Alt.1 Independent Disposal-Direct Haulage




Alt.2 Independent Disposal-Introduction of Transfer Station




Alt.3 Independent Disposal-Introduction of Incineration Plant

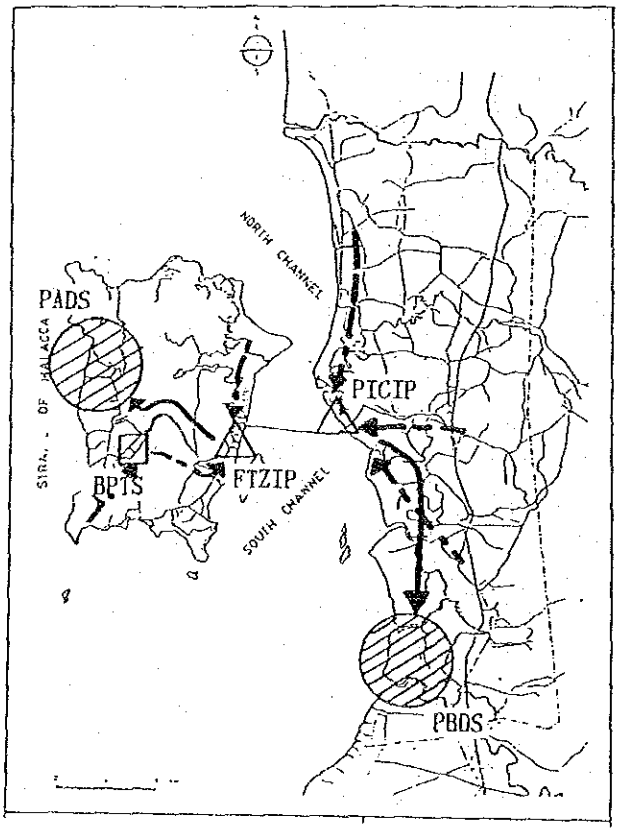
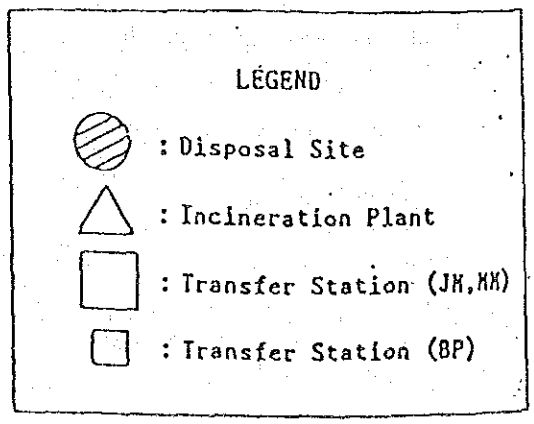
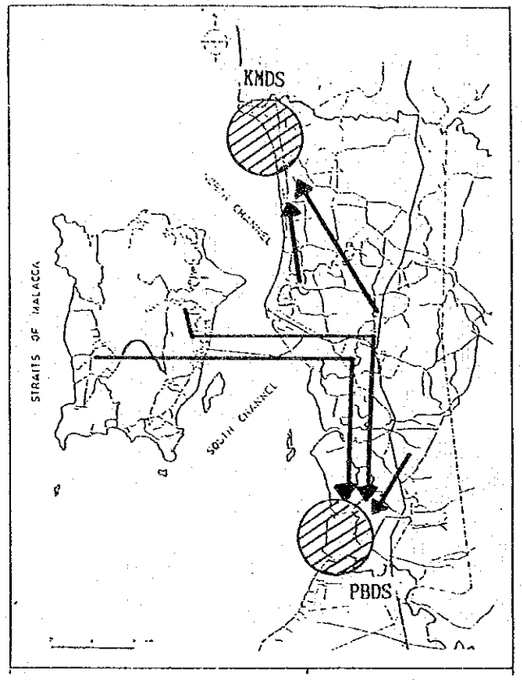


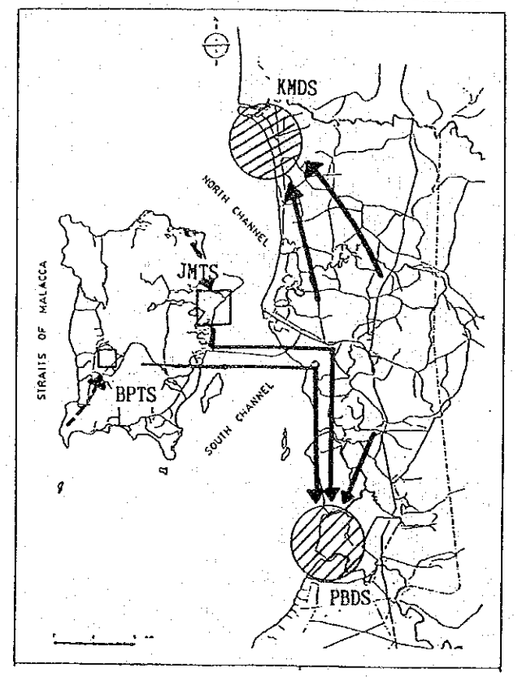

Fig. 9.2-2 Alternatives for Master Plan (1)



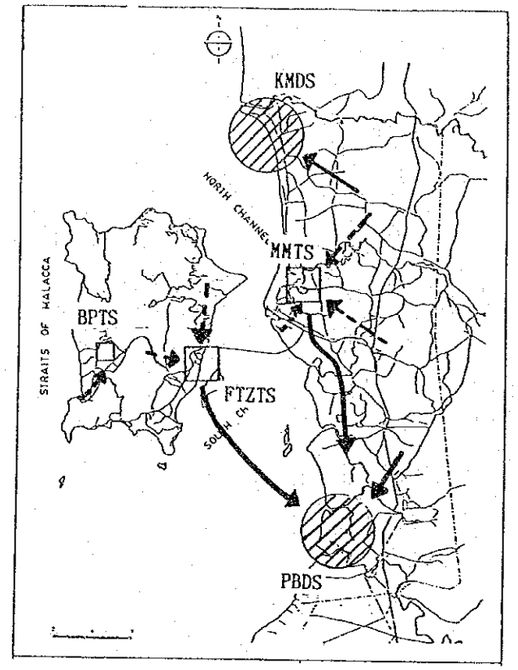
Alt.4 Intermunicipal Disposal-Direct Haulage



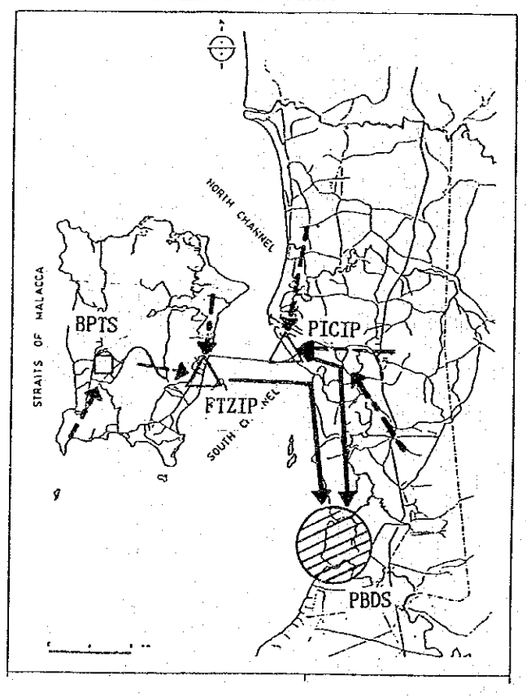

Alt.5 Intermunicipal Disposal-Introduction of Transfer Station for Motor Vehicles




Alt.6 Intermunicipal Disposal-Introduction of Transfer Station for Ocean-going Vessels




Alt.7 Intermunicipal Disposal-Introduction of Incineration Plant




Alt.8 Intermunicipal Treatment and Disposal -Introduction of Incineration Plant

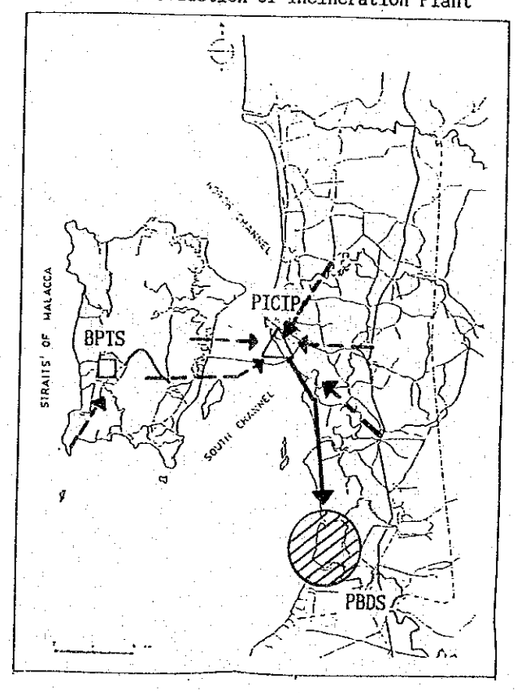



Fig. 9.2-3 Alternatives for Master Plan (2)

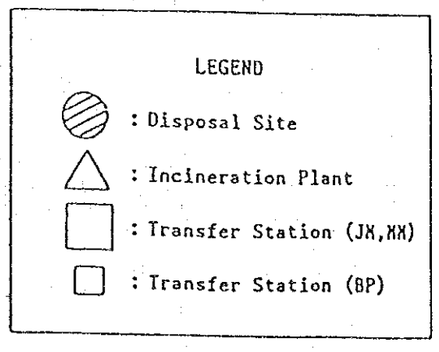


Table 9.2-1 Main Facilities of Each Alternatives

(t/day)

| Alter-natives | Main Facility | Collection amount | Transfer station | | | Incineration plant | | | | Final disposal site | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hauled in | Transfer amount | Capacity | Hauled in | Treatment amount | Capacity | Ash amount | Hauled in | Ash amount | Disposal amount | Area to be used (ha) |
| Alt-1 | MPPP | 670 | - | - | - | - | - | - | - | - | - | - | - |
| | Pantai Acheh d.s | 670 | - | - | - | - | - | - | - | 100 | - | 770 | 85 |
| | MPSP | 540 | - | - | - | - | - | - | - | - | - | - | - |
| | Kuala Muda d.s | 248 | - | - | - | - | - | - | - | 64 | - | 312 | 53.5 |
| | Pulau Burong d.s | 292 | - | - | - | - | - | - | - | 76 | - | 368 | 35 |
| Alt-2 | MPPP | 670 | - | - | - | - | - | - | - | - | - | - | - |
| | Jelutong t.s | 600 | 86 | 686 | 920 | - | - | - | - | | - | - | - |
| | Pantai Acheh d.s | 70 | - | - | - | - | - | - | - | 14 | - | 770 | 85 |
| | MPSP | 540 | - | - | - | - | - | - | - | - | - | - | - |
| | Mak Mading t.s | 387 | 75 | 462 | 620 | - | - | - | - | - | - | - | - |
| | Kuala Muda d.s | 80 | - | - | - | - | - | - | - | 47 | - | 127 | 18 |
| | Pulau Burong d.s | 73 | - | - | - | - | - | - | - | 17 | - | 552 | 35 |
| Alt-3 | MPPP | 670 | - | - | - | - | - | - | - | - | - | - | - |
| | FTZ i.p | 639 | - | - | - | 30 | 700 | 810 | 84 | - | - | - | - |
| | Balik Pulau t.s | 31 | 13 | 44 | 60 | - | - | - | - | - | - | - | - |
| | Pantai Acheh d.s | - | - | - | - | - | - | - | - | 70 | 84 | 154 | 31 |
| | MPSP | 540 | - | - | - | - | - | - | - | - | - | - | - |
| | Perai i.p | 540 | - | - | - | 45 | 585 | 675 | 70 | - | - | - | - |
| | Pulau Burong d.s | - | - | - | - | - | - | - | - | 95 | 70 | 165 | 35 |
| Alt-4 | MPPP | 670 | - | - | - | - | - | - | - | - | - | - | - |
| | Pulau Burong d.s | 670 | - | - | - | - | - | - | - | 100 | - | 770 | - |
| | MPSP | 540 | - | - | - | - | - | - | - | - | - | - | - |
| | Kuala Muda d.s | 467 | - | - | - | - | - | - | - | 122 | - | 589 | 53.5 |
| | Pulau Burong d.s | 73 | - | - | - | - | - | - | - | 18 | - | 91 | 35 |
| Alt-5 | MPPP | 670 | - | - | - | - | - | - | - | - | - | - | - |
| | Jelutong t.s | 639 | 86 | 726 | 970 | - | - | - | - | - | - | - | - |
| | Balik Pulau t.s | 31 | 13 | 44 | 60 | - | - | - | - | - | - | - | - |
| | Pulau Burong d.s | - | - | - | - | - | - | - | - | - | - | 770 | - |
| | MPSP | 540 | - | - | - | - | - | - | - | - | - | - | - |
| | Kuala Muda d.s | 467 | - | - | - | - | - | - | - | 47 | - | 589 | 53.5 |
| | Pulau Burong d.s | 73 | - | - | - | - | - | - | - | 17 | - | 91 | 35 |
| Alt-6 | MPPP | 670 | - | - | - | - | - | - | - | - | - | - | - |
| | FTZ i.p | 639 | 86 | 770 | 1,050 | - | - | - | - | - | - | - | - |
| | Balik Pulau t.s | 31 | 13 | 44 | 60 | - | - | - | - | - | - | - | - |
| | Pulau Burong d.s | - | - | - | - | - | - | - | - | - | - | 770 | - |
| | MPSP | 540 | - | - | - | - | - | - | - | - | - | - | - |
| | Mak Mading t.s | 387 | 75 | 462 | 620 | - | - | - | - | - | - | - | - |
| | Kuala Muda d.s | 80 | - | - | - | - | - | - | - | 47 | - | 589 | 53.5 |
| | Pulau Burong d.s | 73 | - | - | - | - | - | - | - | 17 | - | 91 | 35 |
| Alt-7 | MPPP | 670 | - | - | - | - | - | - | - | - | - | - | - |
| | FTZ i.p | 639 | - | - | - | 30 | 700 | 810 | 84 | - | - | - | - |
| | Balik Pulau t.s | 31 | 13 | 44 | 60 | - | - | - | - | - | - | - | - |
| | Pulau Burong d.s | - | - | - | - | - | - | - | - | 70 | 84 | 154 | - |
| | MPSP | 540 | - | - | - | - | - | - | - | - | - | - | - |
| | Perai i.p | 540 | - | - | - | 45 | 585 | 675 | 70 | - | - | - | - |
| | Pulau Burong d.s | - | - | - | - | - | - | - | - | 95 | 70 | 165 | 35 |
| Alt-8 | MPPP | 670 | - | - | - | - | - | - | - | - | - | - | - |
| | Perai i.p | 639 | - | - | - | 30 | 700 | - | 84 | - | - | - | - |
| | Balik Pulau t.s | 31 | 13 | 44 | 60 | - | - | - | - | - | - | - | - |
| | Pulau Burong d.s | - | - | - | - | - | - | - | - | 70 | 84 | 154 | - |
| | MPSP | 540 | - | - | - | - | - | - | - | - | - | - | - |
| | Perai i.p | 540 | - | - | - | 45 | 585 | 1,500 | 70 | - | - | - | - |
| | Pulau Burong d.s | - | - | - | - | - | - | - | - | 95 | 70 | 165 | 35 |

9.2.4 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 2005 based on 1987 prices.

In principle, the equipment and machinery required for the facilities will be produced locally and 20% duty will be added to the CIF price of equipment whose import is deemed necessary.

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

Table 9.2-2 shows annual salary scale.

Table 9.2-2 Annual Salary Scales

| POST | SCALE | RATE(M$) |
|---|---|---|
| - PHIs and other supervising personnel | B | 21,700 |
| - Technicians & Clerks | C | 15,400 |
| - Overseers, Junior Technicians & Junior Clerks | Upper D | 11,300 |
| - Drivers & Machine Operators | Middle D | 8,300 |
| - Mandor & Laborers | Lower D | 6,500 |

The above annual salaries include various social insurance payments, special benefits and over-time payment. Basic working hours are 8 hours/day with 265 working days/year. The assumed over-time is 30% of basic working hours. Table 9.2-3 shows unit cost of utilities and fuels, etc. Table 9.2-4 shows unit costs of equipment.

Table 9.2-3 Unit Cost of Utilities and Fuel, etc.

| | |
|---|---|
| - Fuel (light oil x 120%*) | M$ 0.468/ℓ |
| - Electricity (for industrial use, 6,600 V or less) | M$ 0.21/Kwh |
| - Water (for business use, less than 60,000 ℓ/month) | M$ 0.52/$m^3$ |
| - Tools at Penang Bridge (for large vehicle) | M$15.00/trip |

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

Table 9.2-4 Unit Cost of Equipment

| EQUIPMENT | CAPACITY ($m^3$) | UNIT PRICE (M$) |
|---|---|---|
| Side loader | 10.0 | 80,000 |
| Tipper truck | 10.0 | 80,000 |
| Compactor | 10.0 | 150,000 |
| Roll-on Roll-off vehicle | 10.0 | 100,000 |
| Hauled container | 10.0 | 5,000 |

With regard to facility and equipment maintenance costs per year, heavy machinery/vehicle and building service equipment/building structure account for 8% of the purchase cost and 1.5% of the construction cost respectively.

Employing straight line depreciation method, the annual depreciation cost was calculated based on the life and residual value of the equipment given in Table 9.2-5.

Table 9.2-5 Life and Residual Value of Equipment

| | Duration | Salvage Value |
|---|---|---|
| - Container | 3 years | 0% |
| - Vehicle & Heavy Equipment | 7 years | 10% |
| - Machinery inclusive of Barge | 18 years | 0% |
| - Building and Foundation | 30 years | 0% |

Tables 9.2-6 shows 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 2005, and annual expenses for dealing with the volume of estimated solid waste in 2005, were estimated for each alternative based on the cost estimate conditions given in (1). Estimated results are given in Tables 9.2-7 and 9.2-8.

Table 9.2-6 Details of Alternatives in 2005

| | Alt1 | Alt2 | Alt3 | Alt4 | Alt5 | Alt6 | Alt7 | Alt8 | Existing |
|---|---|---|---|---|---|---|---|---|---|
| Collection | | | | | | | | | |
| Amount of Waste (t/d) | 1209 | 1209 | 1209 | 1209 | 1209 | 1209 | 1209 | 1209 | 1209 |
| Distance *** 1,000 km/year | 7793 | 3492 | 4575 | 12240 | 3444 | 3822 | 4516 | 5539 | 7793 |
| Manpower (Nos.) | | | | | | | | | |
| Driver | 372 | 279 | 305 | 445 | 278 | 288 | 303 | 327 | 480 |
| Worker | 1488 | 1117 | 1218 | 1782 | 1112 | 1151 | 1212 | 1207 | 1919 |
| Vehicle (Nos.) | 295 | 236 | 258 | 377 | 235 | 244 | 257 | 277 | 406 |
| Transfer Station | | | | | | | | | |
| Amount of Waste (t/d) | | 1149 | 44 | | 770 | 1276 | 44 | 44 | |
| Manpower (Nos.) | | | | | | | | | |
| Manager | | 4 | | | 2 | 8* | | | |
| Engineer | | 3 | | | 2 | 8 | | | |
| Supervisor | | 4 | | | 2 | 33** | | | |
| Driver or Operator | | | | | | 53 | | | |
| Worker | | | | | | 65 | | | |
| Heavy Equipment (Nos.) | | 2 | | | 1 | 1 | | | |
| Haulage Vehicle (Nos.) | | 95 | | | 67 | 44 | | | |
| Barge (Nos.) | | | | | | 10 | | | |
| Incinerator | | | | | | | | | |
| Amount of Waste (t/d) | | | 1207 | | | | 1207 | 1259 | |
| Manpower (Nos.) | | | | | | | | | |
| Manager | | | 12 | | | | 12 | 9 | |
| Supervisor | | | 8 | | | | 8 | 7 | |
| Engineer | | | 10 | | | | 10 | 7 | |
| Operator | | | 66 | | | | 66 | 47 | |
| Worker | | | 18 | | | | 18 | 13 | |
| Haulage Vehicle (Nos.) | | | 15 | | | | 17 | 15 | |

Table 9.2-6 Details of Alternatives in 2005 (con't)

| | Alt1 | Alt2 | Alt3 | Alt4 | Alt5 | Alt6 | Alt7 | Alt8 | Existing |
|---|---|---|---|---|---|---|---|---|---|
| Disposal Site | | | | | | | | | |
| Amount of Waste (t/d) | 1449 | 1449 | 387 | 1449 | 1449 | 1449 | 387 | 342 | 1449 |
| Manpower (Nos.) | | | | | | | | | |
| Manager | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 3 |
| Engineer | 7 | 5 | 2 | 6 | 4 | 4 | 2 | 2 | 7 |
| Supervisor | 14 | 6 | 4 | 8 | 4 | 4 | 2 | 2 | 14 |
| Operator | 16 | 16 | 6 | 15 | 15 | 15 | 4 | 4 | 16 |
| Worker | 12 | 9 | 4 | 10 | 8 | 8 | 3 | 3 | 12 |
| Heavy Equipment (Nos.) | 19 | 19 | 8 | 17 | 17 | 17 | 5 | 5 | 19 |
| Cleansing Work | | | | | | | | | |
| Length of Road (km) | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |
| Manpower (Nos.) | | | | | | | | | |
| Worker | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 |
| Supervisor & Staff | | | | | | | | | |
| Manpower (Nos.) | | | | | | | | | |
| Manager | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| Engineer | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| Supervisor | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| Worker | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |

* including 4 highclass sailors
** including 18 sailors
*** 1000 km/year

Table 9.2-7 Investment Cost

(Unit : M$ million)

| | Alt1 | Alt2 | Alt3 | Alt4 | Alt5 | Alt6 | Alt7 | Alt8 | Existing |
|---|---|---|---|---|---|---|---|---|---|
| 1) Construction | | | | | | | | | |
| (1) Transfer Station | | | | | | | | | |
| Civil Work | | 16.3 | 0.3 | | 9.9 | 7.3 | 0.3 | 0.3 | |
| Machinery & Equipment | | 24.8 | | | 13.1 | 11.5 | | | |
| Subtotal | | 41.1 | 0.3 | | 23.0 | 18.8 | 0.3 | 0.3 | |
| (2) Inconerator | | | | | | | | | |
| Civil Work | | | 62.9 | | | | 62.9 | 51.3 | |
| Machinery & Equipment | | | 229.6 | | | | 229.6 | 187.4 | |
| Subtotal | | | 292.5 | | | | 292.5 | 238.7 | |
| (3) Disposal Site | | | | | | | | | |
| Civil Work | 59.8 | 52.7 | 21.1 | 41.0 | 41.0 | 36.4 | 13.9 | 13.3 | 59.8 |
| Machinery & Equipment | 15.1 | 15.1 | 10.1 | 10.1 | 10.1 | 10.1 | 5.0 | 5.0 | 15.1 |
| Subtotal | 74.9 | 67.8 | 31.2 | 51.1 | 51.1 | 46.5 | 18.9 | 18.3 | 74.9 |
| (4) L/on & L/off | | | | | | | | | |
| Civil Work | | | | | | 31.9 | | | |
| Machinery & Equipment | | | | | | 7.0 | | | |
| Subtotal | | | | | | 37.7 | | | |
| 2) Purchase of Vehicles & etc | | | | | | | | | |
| (1) Collection Vehicle | 46.2 | 34.7 | 37.9 | 55.4 | 38.8 | 35.8 | 37.7 | 40.6 | 42.0 |
| (2) Haulage | | | | | | | | | |
| Vehicle | | 13.7 | 2.7 | | 10.2 | 10.0 | 3.0 | 2.9 | |
| T/S | | (13.7) | (1.0) | | (10.2) | (10.0) | (1.0) | (1.5) | |
| I/R | | | (1.7) | | | | (2.0) | (1.4) | |
| (3) Heavy Equipment | 4.8 | 5.0 | 1.7 | 4.4 | 4.5 | 4.5 | 1.2 | 1.2 | 4.8 |
| T/S | | (0.2) | | | (0.1) | (0.1) | | | |
| F/D | (4.8) | (4.8) | (1.7) | (4.4) | (4.4) | (4.4) | (1.2) | (1.2) | (4.8) |
| (4) Barge | | | | | | 24.6 | | | |
| 1+2x2* Total | 176.9 | 215.7 | 408.6 | 170.7 | 181.1 | 228.2 | 395.4 | 346.7 | 168.5 |

* Purchase cost of barge was counted only one time because of its useful term.

Table 9.2-8 Annual Expenses in 2005

(Unit : M$ million)

| | Alt1 | Alt2 | Alt3 | Alt4 | Alt5 | Alt6 | Alt7 | Alt8 | Exist |
|---|---|---|---|---|---|---|---|---|---|
| Collection | | | | | | | | | |
| Depreciation | 5.9 | 4.5 | 4.9 | 7.1 | 5.0 | 4.6 | 4.8 | 5.2 | 5.4 |
| Personnel Cost | 12.5 | 9.4 | 10/3 | 15.0 | 10.5 | 9.7 | 10.2 | 11.0 | 20.4 |
| Maintenance | 3.7 | 2.8 | 3.0 | 4.4 | 3.1 | 2.9 | 3.0 | 3.3 | 3.3 |
| Fuel & etc. | 0.9 | 0.4 | 0.5 | 2.3 | 0.6 | 0.4 | 0.5 | 1.6 | 1.4 |
| Subtotal | 23.1 | 17.1 | 18.7 | 28.9 | 19.2 | 17.6 | 18.6 | 21.0 | 30.4 |
| Transfer Station | | | | | | | | | |
| Depreciation | | 4.8 | 0.1 | | 3.1 | 2.2 | 0.1 | 0.2 | |
| Personnel Cost | | 1.3 | 0.1 | | 0.9 | 0.6 | 0.1 | 0.1 | |
| Maintenance | | 1.7 | 0.1 | | 1.2 | 0.8 | 0.1 | 0.1 | |
| Fual & etc. | | 1.4 | 0.0 | | 1.4 | 0.7 | 0.0 | 0.1 | |
| Subtotal | | 9.2 | 0.3 | | 6.5 | 4.3 | 0.3 | 0.5 | |
| L/on & L/off | | | | | | | | | |
| Depreciation | | | | | | 3.2 | | | |
| Personnel Cost | | | | | | 1.3 | | | |
| Maintenance | | | | | | 7.4 | | | |
| Fuel & etc. | | | | | | 2.2 | | | |
| Subtotal | | | | | | 14.2 | | | |
| Incinerator | | | | | | | | | |
| Depreciation | | | 14.9 | | | | 14.9 | 12.2 | |
| Personnel Cost | | | 1.3 | | | | 1.3 | 0.9 | |
| Maintenance | | | 8.9 | | | | 8.9 | 7.3 | |
| Fuel & etc. | | | 2.0 | | | | 2.2 | 2.1 | |
| Subtotal | | | 27.1 | | | | 27.4 | 22.5 | |
| Final Disposal | | | | | | | | | |
| Depreciation | 6.0 | 5.5 | 2.5 | 4.2 | 4.2 | 3.9 | 1.5 | 1.5 | 6.0 |
| Personnel Cost | 0.5 | 0.4 | 0.2 | 0.4 | 0.4 | 0.3 | 0.1 | 0.1 | 0.5 |
| Maintenance | 0.6 | 0.6 | 0.3 | 0.5 | 0.5 | 0.5 | 0.2 | 0.2 | 0.6 |
| Fuel & etc. | 2.5 | 2.7 | 1.4 | 2.0 | 2.0 | 2.2 | 0.8 | 0.8 | 2.5 |
| Subtotal | 9.6 | 9.2 | 4.3 | 7.1 | 7.1 | 6.9 | 2.6 | 2.5 | 9.6 |
| Cleansing Work | | | | | | | | | |
| Personnel Cost | 10.1 | 10.1 | 10.1 | 10.1 | 10.1 | 10.1 | 10.1 | 10.1 | 10.1 |
| Fuel & etc. | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Subtotal | 11.1 | 11.1 | 11.1 | 11.1 | 11.1 | 11.1 | 11.1 | 11.1 | 11.1 |
| Supervisor & Staff | | | | | | | | | |
| Personnel Cost | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Total Cost | 45.8 | 48.6 | 63.6 | 49.2 | 45.9 | 56.1 | 62.0 | 59.7 | 53.2 |
| Depreciation | 11.9 | 14.7 | 22.4 | 11.4 | 12.3 | 14.0 | 21.4 | 19.1 | 11.4 |
| Personnel Cost | 25.2 | 23.2 | 23.9 | 27.5 | 23.9 | 24.1 | 23.7 | 24.2 | 33.0 |
| Maintenance | 4.3 | 5.1 | 12.3 | 4.9 | 4.8 | 11.6 | 12.2 | 10.8 | 3.9 |
| Fuel & etc. | 4.4 | 5.6 | 4.9 | 5.3 | 4.9 | 6.5 | 4.6 | 5.6 | 4.9 |

Note: "Exist" refers to an alternative which employs existing collection/haulage system and the disposal system same as in Alt.1.

## 9.3 Evaluation

### 9.3.1 Methodology

(1) Planning Objectives

The procedure adopted for evaluating the proposed alternatives is shown in Fig. 9.3-1. 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;
- Synthesis of individual evaluation results.

The overall objective of the master plan is the improvement of environment and quality of life, which consists of the following components:

- Improvement of collection and cleansing services;
- Reduction of service cost;
- 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;
- Environmental acceptability.

The alternatives identified are ranked on the basis of quantitative as well as qualitative examinations of each of 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 domination of certain alternatives over others became apparent.

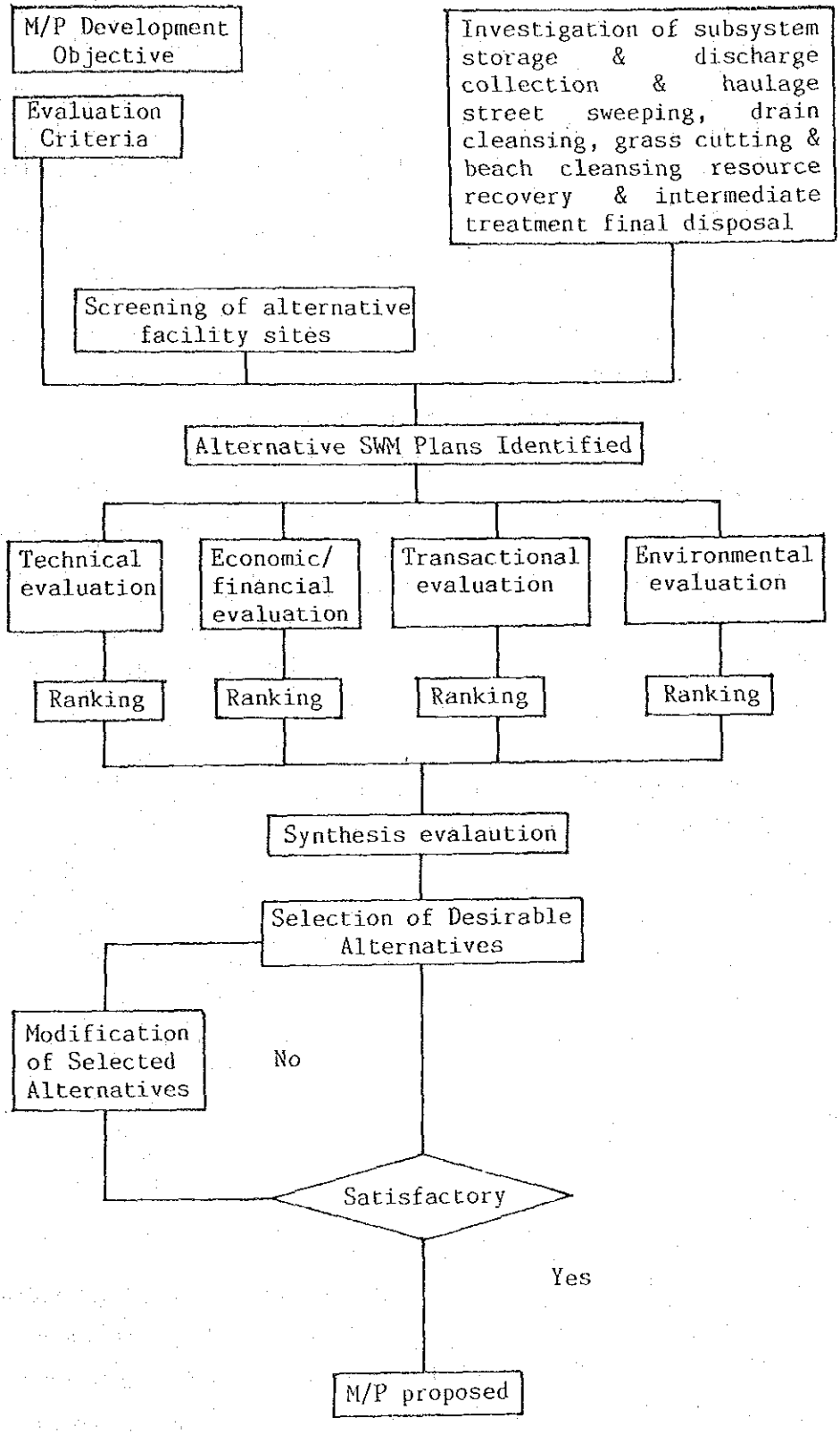



Fig 9.3-1 Procedure for Evaluating Alternatives

9.3.2 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 9.3-1.

a. Working Conditions

- safety and hygiene
- equal work load and work suitability

b. Operation and Maintenance

- reliability and maintainability of facility
- preparedness for emergency

c. Construction

- land acquisition and landfill method
- equipment availability and technical know-how

d. Indirect Advantages

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

(2) Detailed Evaluation

a. Working Conditions

Workers involved in solid waste management are engaged in different types of work determined by such processes as collection, transportation, intermediate treatment and final disposal, while the work of cleansing workers is also different from that of the workers engaged in these processes. 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
- street sweeping and drain cleaning
- grass cutting along roadsides and median strips

Of the above, the loading of solid waste into collection vehicles tends to create problems because of the fluctuating workload, in turn caused by daily and seasonal changes in the volume of waste generated.

Improvement measures for collection work, cleansing work and grass cutting work, etc. have already been discussed in 9.1-2 and 9.1-3. As these measures are adopted in the alternatives, there is no qualitative difference between the plans in this regard, except where the existing system is continued.

In the case of landfill work at disposal sites, Alternatives 3, 7 and 8 are considered superior, since the incineration plants would largely reduce the landfill volume and improve the hygiene level of the landfill work, which would mainly deal with ashes instead of the original solid waste.

Table 9.3-1 Technical Evaluation

| Criteria \ Alternatives | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| (1) Working Conditions | B | B | A | B | B | B | A | A |
| (2) Operation and Maintenance | | | | | | | | |
| a. Stability & in good | B | B | B | B | B | B | B | B |
| Maintenance order | A | B | C | A | B | B | C | C |
| b. Emergency preparedness | B | A | A | C | A | B | A | B |
| (3) Construction | | | | | | | | |
| Land acquisition | B | B | A | B | B | B | A | A |
| Constructin of disposal facility | B | C | B | C | C | C | B | B |
| (4) Indirect merits | C | B | A | C | B | B | A | A |
| Overall Assessment | B | B | A | C | B | C | A | A |

A: Good

B: Fair

C: Poor

9.3.3 Economic and Financial Evaluation

(1) Economic Evaluation

Table 9.3-2 shows economic costs of construction, purchase and annual expenditures excluding allowance for depreciation as well as direct benefit arising from sales of power to be generated by incinerators.

The economic costs shown in the table have been estimated based upon the following conditions.

a. Import duties, sales tax and other related taxes were omitted in calculating econoMic costs.

b. Some adjustment was made regarding the labor costs considering rates of unemployment of unskilled workers.

c. Facility construction will take place in 1991

d. With regard to vehicle procurement, the number of vehicles procurred in 1991 is counted as the 1997 equivalent number, and the ones in 1997 counted as the 2005 equivalent number. Since barges can be operated throughout the project period, the number of barges to be procurred in 1997 will be the difference between the number procurred in 1991 and the number required in 2005.

e. The annual expenses will include personnel costs, maintenance and repair costs, fuel cost and others, and annual expenditure will be determined in proportion to the treatment volume at each facility.

Given the above preconditions, the total project cost is the lowest for Alternative 5 if a discount rate of 0% is adopted, while Alternative 1 will incur the lowest cost if the discount rate is either 5%, 10% or 15%. The Alternatives 3, 7 and 8 with incinerators are more expensive than the other alternatives without incinerators, even if income from power sales is considered.

Table 9.3-2 Economic Evaluation

(M$ million)

| | Alt1 | Alt2 | Alt3 | Alt4 | Alt5 | Alt6 | Alt7 | Alt8 | No Change |
|---|---|---|---|---|---|---|---|---|---|
| Economic Price in 1988 | | | | | | | | | |
| Discount 0% | | | | | | | | | |
| Construction Cost | 69.4 | 66.3 | 273.9 | 47.4 | 68.0 | 68.0 | 275.7 | 219.2 | 69.4 |
| Purchasing Cost | 43.1 | 45.1 | 36.8 | 50.5 | 41.2 | 42.8 | 37.4 | 40.0 | 43.3 |
| Annual Expenditure in 2005 | 19.7 | 19.7 | 40.9 | 23.3 | 19.4 | 27.6 | 24.5 | 36.0 | 27.0 |
| Total Project Cost 1991-2005 | 493.6 | 527.2 | 805.8 | 524.6 | 486.5 | 574.2 | 743.8 | 703.8 | 574.6 |
| Total Benefit 1992-2005 | | | 98.7 | | | | 98.7 | 103.2 | |
| Net Cost | 493.6 | 527.2 | 707.1 | 524.6 | 486.5 | 574.2 | 644.9 | 600.6 | 574.6 |
| Rank | 2 | 4 | 8 | 3 | 1 | 5 | 7 | 6 | |
| Discount 5% | | | | | | | | | |
| Cost | 329.2 | 357.6 | 568.2 | 343.2 | 331.0 | 376.4 | 529.2 | 493.7 | 377.1 |
| Benefit | | | 58.3 | | | | 58.3 | 61.0 | |
| Net Cost | 329.2 | 357.6 | 509.9 | 343.2 | 331.0 | 376.4 | 470.8 | 432.7 | 377.1 |
| Rank | 1 | 4 | 8 | 3 | 2 | 5 | 7 | 6 | |
| Discount 10% | | | | | | | | | |
| Cost | 229.5 | 253.8 | 421.3 | 234.8 | 232.9 | 258.7 | 395.1 | 363.6 | 259.6 |
| Benefit | | | 36.6 | | | | 36.6 | 38.3 | |
| Net Cost | 167.7 | 188.8 | 303.5 | 168.5 | 171.9 | 186.9 | 284.9 | 255.8 | 187.6 |
| Rank | 1 | 5 | 8 | 2 | 3 | 4 | 7 | 6 | |

Note: "No Change" refers to an alternative which employs the existing collection/haulage system and the sanitary landfill disposal system of Alternative 1.

(2) Financial Evaluation

Table 9.3-3 shows a cost comparison of the alternatives based on the present market prices. Alternative 4 requires the least investment. This is explained by the fact that the investment cost for the disposal site is relatively higher than the solid waste haulage cost from MPPP to MPSP.

In terms of annual expenditure in 2005 excluding the depreciation cost, Alternative 5 shows the lowest because annual expenditure of transfer station is less than annual expenditure of Pantai Acheh disposal site.

When the depreciation cost is included, however, Alternative 1 has the lowest followed by Alternative 5. None of the alternatives involving the construction of at least one incinerator is cheaper than any of the plans without an incinerator.

The superior ranking of Alternatives 1 and 5 is not affected even if income from power sales is taken into consideration. The advantage of introducing the transfer station but not the incinerator will become noticeable when personnel costs increase relative to other costs in the future.

(3) Combined Evaluation

The combined evaluation with respect to economic and financial aspects is shown in Table 9.3-4. The overall assessment, therefore, indicates that Alternatives 1 and 5 are most preferable.

Table 9.3-3 Financial Evaluation

(M$ million)

| | Alt1 | Alt2 | Alt3 | Alt4 | Alt5 | Alt6 | Alt7 | Alt8 | No Change |
|---|---|---|---|---|---|---|---|---|---|
| Investment Cost | 176.9 | 215.7 | 408.6 | 170.7 | 181.1 | 228.2 | 395.4 | 346.7 | 168.5 |
| Rank | 2 | 4 | 8 | 1 | 3 | 5 | 7 | 6 | |
| Annual Expenses (excluding depreciation) | 33.9 | 33.9 | 41.1 | 37.7 | 33.6 | 42.2 | 40.5 | 40.6 | 41.8 |
| Rank | 2 | 2 | 7 | 4 | 1 | 8 | 5 | 6 | |
| Annual Expenses (including depreciation) (C) | 45.8 | 48.6 | 63.6 | 49.2 | 45.9 | 56.1 | 62.0 | 59.7 | 53.2 |
| Rank | 1 | 3 | 8 | 4 | 2 | 5 | 7 | 6 | |
| Sale of Electricity (R) | | | 9.0 | | | | 9.0 | 9.4 | |
| (C) - (R) | 45.8 | 48.6 | 54.6 | 49.2 | 45.9 | 56.1 | 53.0 | 50.3 | 53.2 |
| Rank | 1 | 3 | 7 | 4 | 2 | 8 | 6 | 5 | |
| Annual Expenses (including depreciation and Interest for Loan) (E) | 50.5 | 54.2 | 79.4 | 53.9 | 50.7 | 63.7 | 77.7 | 73.2 | 57.6 |
| Rank | 1 | 4 | 8 | 3 | 2 | 5 | 7 | 6 | |
| Net Cost (E) - (R) | 50.5 | 54.2 | 70.4 | 53.9 | 50.7 | 63.7 | 68.7 | 63.8 | 57.6 |
| Rank | 1 | 4 | 8 | 3 | 2 | 5 | 7 | 6 | |
| Net Cost in case of Increment Personnel Cost (5% per year) | 81.2 | 81.5 | 97.2 | 88.0 | 79.5 | 90.1 | 95.6 | 94.0 | 99.6 |
| Rank | 2 | 3 | 8 | 4 | 1 | 5 | 7 | 6 | |

Note: "No Change" refers to an alternative which employs the existing collection/haulage system and the sanitary landfill disposal system of Alternative 1.

Table 9.3-4 Combined Economic and Financial Evaluation

| | Alt1 | Alt2 | Alt3 | Alt4 | Alt5 | Alt6 | Alt7 | Alt8 |
|---|---|---|---|---|---|---|---|---|
| Overall Assessment | A | B | C | B | A | B | C | C |

9.3.4 Evaluation of Transactional Facilitation

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

- Number and location of disposal sites;
- Number and location of incinerator(s);
- Number and location of transfer station(s);
- Whether or not MPPP has its disposal site on Penang Island;
- Collection and hauling distances.

While these alternatives may have a diverse social impact on the affected public, 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 will be made, therefore, to examine transactional facilitation necessary for resolving the following sensitive and/or demanding issues associated with the planning considerations cited above.

(1) Avoidance of the disruption of fishing village located at or near the proposed disposal sites (Alternatives 1, 2, 4, 5 and 6)

(2) Legal and/or coordination difficulties associated with transshipment of waste via Penang Bridge or by barge from MPPP to MPSP for disposal (Alternatives 4, 5, 6, 7 and 8)

(3) Difficulties associated with realizing incineration options in terms of meeting the necessary financial, technical, managerial as well as public acceptance requirements (Alternatives 3, 7 and 8)

The above discussion is summarized in the matrix below.

Table 9.3-5 Transactional Evaluation

| | Alt1 | Alt2 | Alt3 | Alt4 | Alt5 | Alt6 | Alt7 | Alt8 |
|---|---|---|---|---|---|---|---|---|
| 1. Avoidance of Fishing Village Disruption | X | X | | X | X | X | | |
| 2. Difficulties in arranging trans-municipal Shipment of Wastes | | | | X | X | X | X | X |
| 3. Difficulties in meeting various requirements for incineration | | | X | | | | X | X |
| Overall assessment | B | B | B | C | C | C | C | C |

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

The above matrix indicates that none of the alternatives is free from transactional difficulties. Social evaluation would be more significant if applied to such aspects as:

- Contracting-out policy
- Reduction in service level or service quality
- Political settlement through compensation

All the eight alternatives, however, are identical with respect to the above points. Lastly, the most serious social problem (citizens' complaints) will arise when the Councils spend money (taxes) for solid waste management that could have been saved by selecting more cost effective alternatives.

An estimation of the order and magnitude of difficulties to overcome in (or of efforts needed for) facilitating these transactions depends very much on the degree of political as well as administrative interaction. For the purpose of the current analysis, however, the ranking of the alternatives was based simply on the number of criteria with an X-mark under each alternative or column heading of the matrix.

### 9.3.5 Environmental Evaluation

The results of the environmental evaluation of the alternatives are given in Table 9.3-6 and are summarized as follows.

a. Impact on Surface Water Quality

Although each disposal site has its own leachate treatment facility, the alternatives without incineration plants may have an adverse effect on surface water quality.

b. Impact on Ground Water Quality

Although each disposal site is to be lined with sealants, the alternatives without incineration plants may have an adverse effect on ground water quality.

c. Impact of Noise, Odour and Dust

Since the disposal site of Kuala Muda and the transfer stations are in close proximity to residential areas, the alternatives encompassing these facilities may cause nuisances. The decrease in traffic volume in terms of haulage vehicle by means of transfer haulage can mitigate traffic noise.

d. Impact on River Fishing

The introduction of an incineration plant mitigates the effect on surface water quality and reduce the amount of waste to be disposed of. Therefore, the alternatives including at least one incineration plant are more preferable with respect to river fisheries.

e. Impact on Aquatic/Marine Flora and Fauna

The introduction of a transfer station for ocean-going vessels requires construction of a jetty in the present mangrove forest of Pulau Burong. It will definitely have adverse effects on aquatic/marine flora and fauna.

f. Impact on Natural Landscape

The mangrove forest in Pulau Burong will be cleared once it is decided as a disposal site.

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

a. First Rank: Alternatives 3, 7 and 8

b. Second Rank: Alternatives 1, 2, 4 and 5

c. Third Rank: Alternative 6

Table 9.3-6 Environmental Evaluation Results

| ITEMS FOR EVALUATION | ALTERNATIVES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Impact on Surface Water Quality | B | B | A | B | B | B | A | A |
| Impact on Ground Water Quality | B | B | A | B | B | B | A | A |
| Noise, Odours and Dust Problems | B | B | A | B | B | B | A | A |
| Compatibility with Land Use of Adjacent Area | A | A | A | A | A | A | A | A |
| Impact on River Fisheries | B | B | A | B | B | B | A | A |
| Impact on Terrestrial Vegetation and Wildlife | - | - | - | - | - | - | - | - |
| Impact on Aquatic/Marine Flora and Fauna | - | - | - | - | - | C | - | - |
| Impact on Natural Landscape | A | A | A | A | A | A | A | A |
| Impact on Historical Places or Structures | A | A | A | A | A | A | A | A |
| Impact on Religious Places or Structures | A | A | A | A | A | A | A | A |
| Overall Assessment | B | B | A | B | B | C | A | A |

A: No Damage

B: Slight Damage or Adverse Effect

C: Damage

-: Further Survey Required

## 9.4 Selection of the Most Favorable Alternative

### 9.4.1 Overall Evaluation

The evaluation results based on each of the four evaluation criteria are summarily presented in a matrix form in Table 9.4-1.

Table 9.4-1 Overall Evaluation

| | Alt1 | Alt2 | Alt3 | Alt4 | Alt5 | Alt6 | Alt7 | Alt8 | NO CHANGE |
|---|---|---|---|---|---|---|---|---|---|
| Technical Aspect | B | B | A | C | B | C | A | A | C |
| Economic Aspect | A | B | C | B | A | B | C | C | C |
| Transactional Aspect | B | B | B | C | C | C | C | C | B |
| Environmental Aspect | B | B | A | B | B | C | A | A | C |
| Overall Ranking | 1 | 2 | 1 | 3 | 2 | 4 | 2 | 2 | 4 |

Note: "No Change" refers to an alternative which employs the existing collection/haulage system and the sanitary landfill disposal system as in Alt.1.

The matrix implies the following overall ranking of alternatives.

i) Alternatives 2, 4, 5, 6 and "No Change" are dominated by Alternative 1, regardless of any set of weights to be associated with the evaluation criteria.

ii) Alternatives 7 and 8 are dominated by Alternative 3, regardless of any set of weights to be associated with the evaluation criteria.

iii) Alternatives 1 and 3 are not dominated by any other alternative, and therefore they may be considered to be good alternatives.

iv) Alternative 3 may not be economically feasible.

v) Alternative 5 is inferior to Alternative 1 only with respect to the transactional aspect.

vi) Alternatives 7 and 8 are inferior to Alternative 3 only with respect to the transactional aspect.

In view of the foregoing evaluation results, the solid waste management system to be established in Penang State by 2005 should be selected from several alternatives based on Alternative Plans 1 or 3, both of which have independent disposal systems for MPPP and MPSP respectively.

Given the financial capability of MPPP and MPSP and the local conditions for possible disposal sites, two further alternatives are presented here for both MPPP and MPSP for examination of their feasibility, particularly from the financial point of view.

i) MPPP

Alternative 1 : Direct sanitary landfill of all solid waste at Pantai Acheh Disposal Site.

Alternative 1-A : Incineration of all solid waste and sanitary landfill of residual waste (ash) at Pantai Acheh Disposal Site.

ii) MPSP

Alternative 1 : Direct sanitary landfill at Kuala Muda and Pulau Burong Disposal Sites, generated solid waste is divided and hauled to these two sites on the basis of optimal haulage efficiency.

Alternative 1-B : Only Pulau Burong Disposal Site; cases for having a transfer station are studied.

9.4.2 Examination of Further Alternatives for MPPP

The feasibility of the further alternative for MPPP suggested in 9.4-1 as well as the following three sub-alternatives have been examined.

1. Reduction of the construction costs by 20% or 40% from the original level by lowering the specification of the incineration plant.

2. Gradual consolidation of the incineration plant in response to generated solid waste volume

3. Construction and operation of the incineration plant by contracting with a private company

Through this examination, it was reconfirmed that Alternative 1, which does not include the construction of an incineration plant, would incur the minimum cost. Consequently, Alternative 1 was selected as the best choice for the master plan and the feasibility study.

To be more precise, assuming the present level of budgetary appropriation (annual increase of 0.1%), it would be impossible to repay any debt incurred by the incineration system by 2005, even if the construction cost of an incineration plant were reduced to 60% of the level suggested in Alternative 3. In addition, serious environmental problems may result.

In cases where the construction cost is reduced to 80% to avoid serious effects on the environment, the debt would still amount to M$200 million by 2005 assuming the above budgetary appropriation. An annual budgetary increase of 3.5% for solid waste management would be required if the completion of debt repayment were projected for 2005.

With regard to the construction of an incineration plant in two phases, while the total debt in 2005 would be slightly reduced, the overall tendency would be the same as if the incineration plant to meet the requirement of solid waste management in 2005 were constructed in Phase 1.

The expenditure of MPPP would naturally decrease if a subsidy were provided for the construction of the incineration plant and/or disposal site by the Federal or State Governments. Nevertheless, MPPP would still be required to increase its solid waste management budget by more than 2.5% annually even with a 25% subsidy for both facilities.

If a private company were contracted to build and operate the incineration plant and if this company intended to repay all debts by 2005, it would have to impose a tipping fee of M$100/ton to supplement the income from power sale. The total debt would exceed M$400 million in 2005 assuming that MPPP increases its budget by only 0.1% annually. To clear the entire debt by 2005 while paying the tipping fee, MPPP would have to increase its budget by 5.5% annually.

Based on the above argument, it is clear that MPPP would face a heavy financial burden if the construction of an incineration plant were included in the plans.

In view of the fact that Pantai Acheh Disposal Site has a large enough capacity to meet the entire volume of solid waste expected till 2005, Alternative 1 is proposed as the most appropriate alternative and it is not recommended to construct an incineration plant.

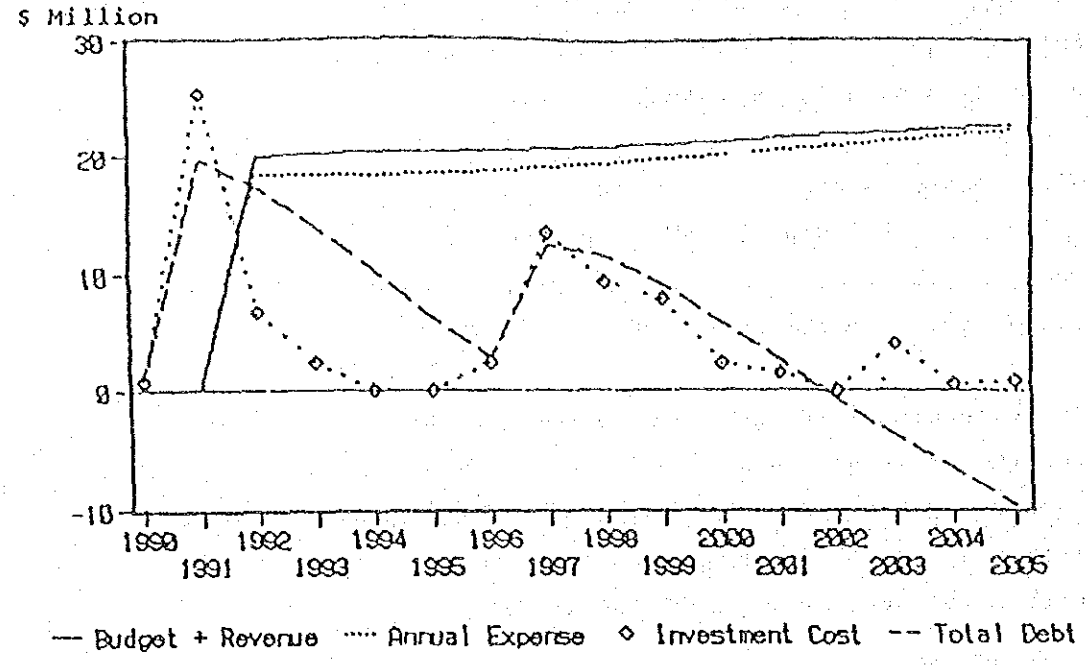



Fig. 9.4-1 Alternative 1: Debt, Investment, Expenses and Allocation

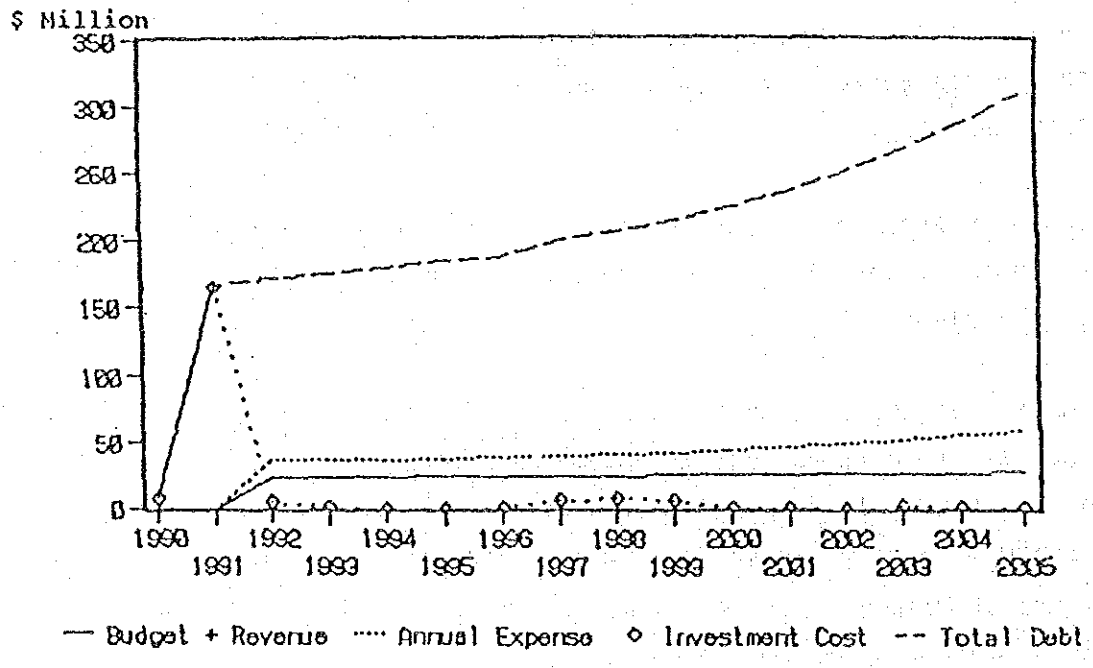



Fig. 9.4-2 Alternative 1-A: Debt Investment, Expenses and Allocation

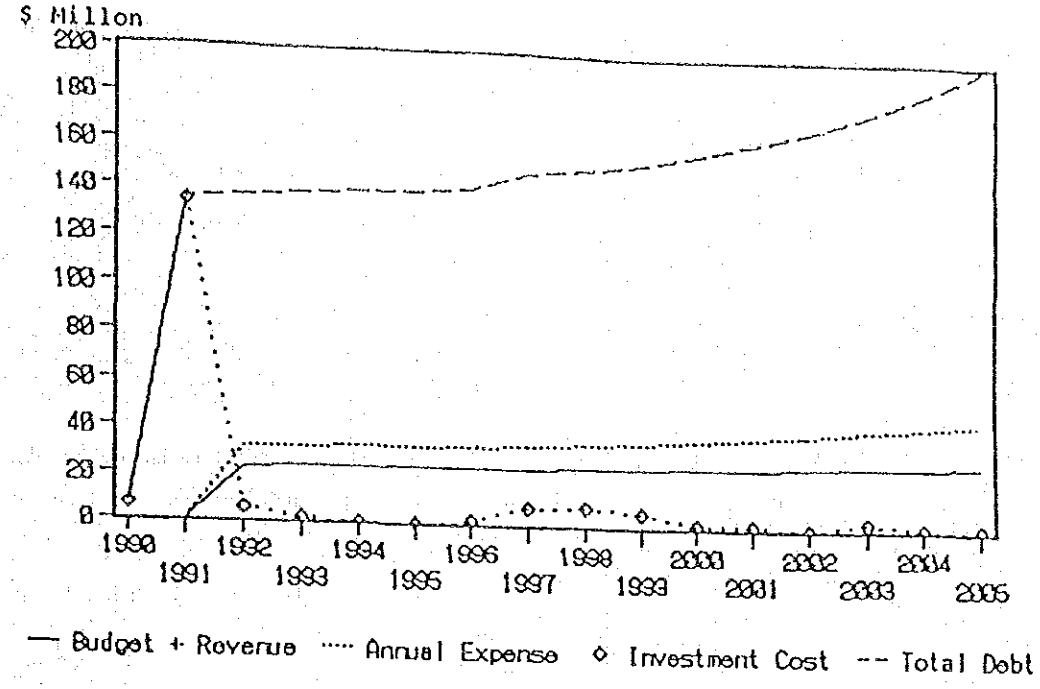



Fig. 9.4-3 Cash Flow of Alternative 1-A

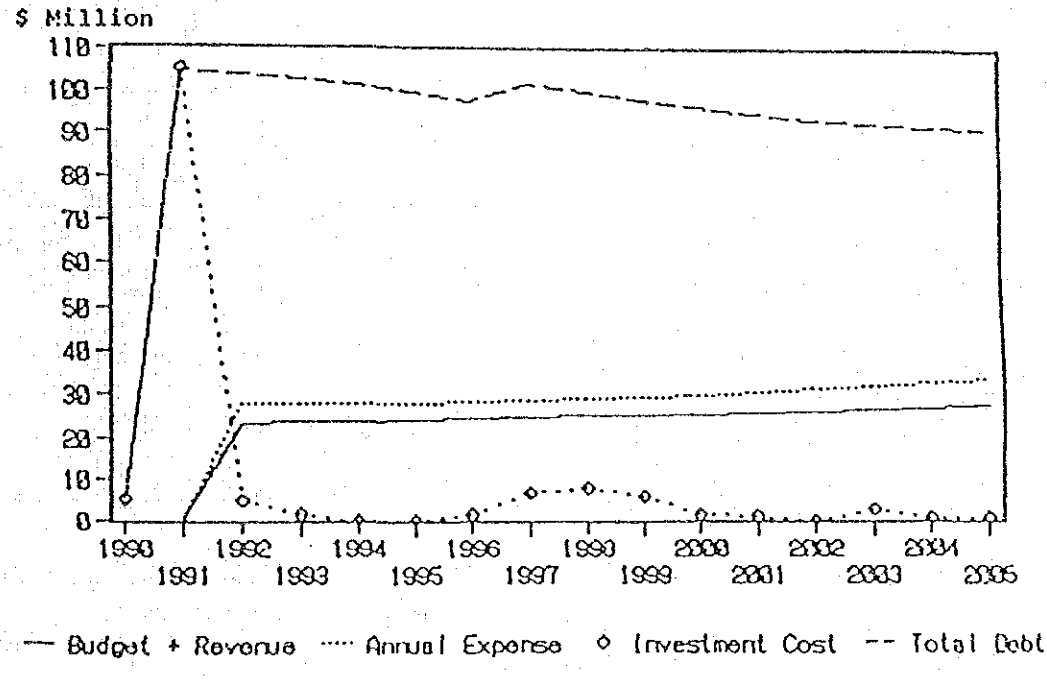
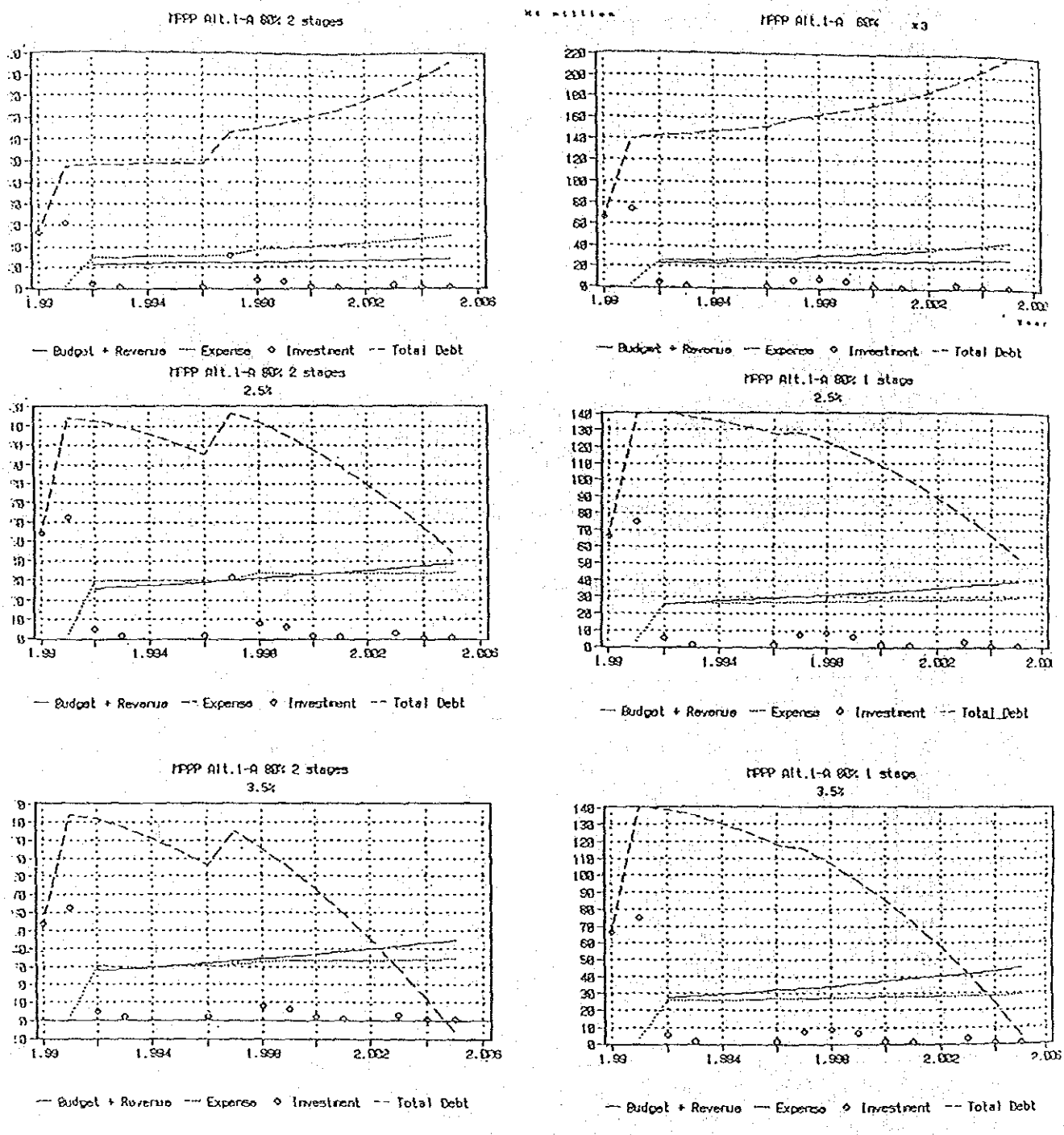



Fig. 9.4-4 Alternative 1-A with 40% Cost Reduction of Incinerator: Debt, Investment, Expenses and Allocation




(Unit: $1,000)

Fig. 9.4-5 Cash Flow of Alternative 1-A

9.4.3 Examination of Further Alternatives for MPSP

The following three sub-alternatives have been added to Alternative 1 in the financial analysis.

- One disposal site with no transfer station (Alt. 1-B1);
- One disposal site with one small transfer station (170 t/day) (Alt. 1-B2);
- One disposal site with one large transfer station (420 t/day) (Alt. 1-B3).

If there would be only one disposal site, either expansion of the landfill area of Pulau Burong or an increase in the landfill height would be necessary to deal with the designed disposal volume, affecting the disposal site construction cost.

Since an increase in the landfill height over the original site area will result in an excessive landfill height, the disposal site area should be extended in comparison with the other alternatives. The land acquisition cost of the extended site is not accounted for.

Based on the premises that (i) the solid waste management budget will increase in proportion to the economic growth rate, (ii) a large cost reduction will be achieved in solid waste collection and cleansing work, and (iii) fees will be imposed on commercial waste and waste taken directly to the disposal site(s), the financial analysis of the alternatives for MPSP resulted in the following conclusions.

1. The total cost is lower with two disposal sites than with one disposal site.

2. The introduction of transfer stations has no advantage when only one disposal site is selected.

3. While the gradual repayment of the debt is possible in the case of Alternative 1, it would be extremely difficult in the case of the other alternatives.

Alternative 1 with two disposal sites was found to be the most flexible alternative for MPSP and, therefore, was selected as the best choice for the master plan and the feasibility study.

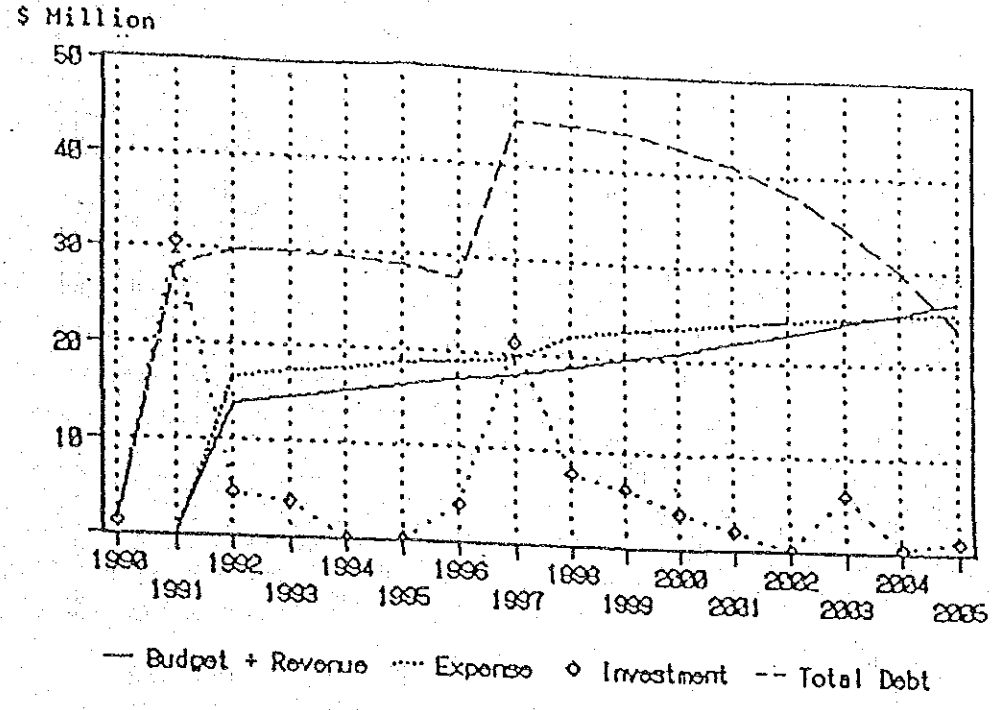



Fig. 9.4-6 Alternative 1: Debt, Investment, Expenses and Allocation

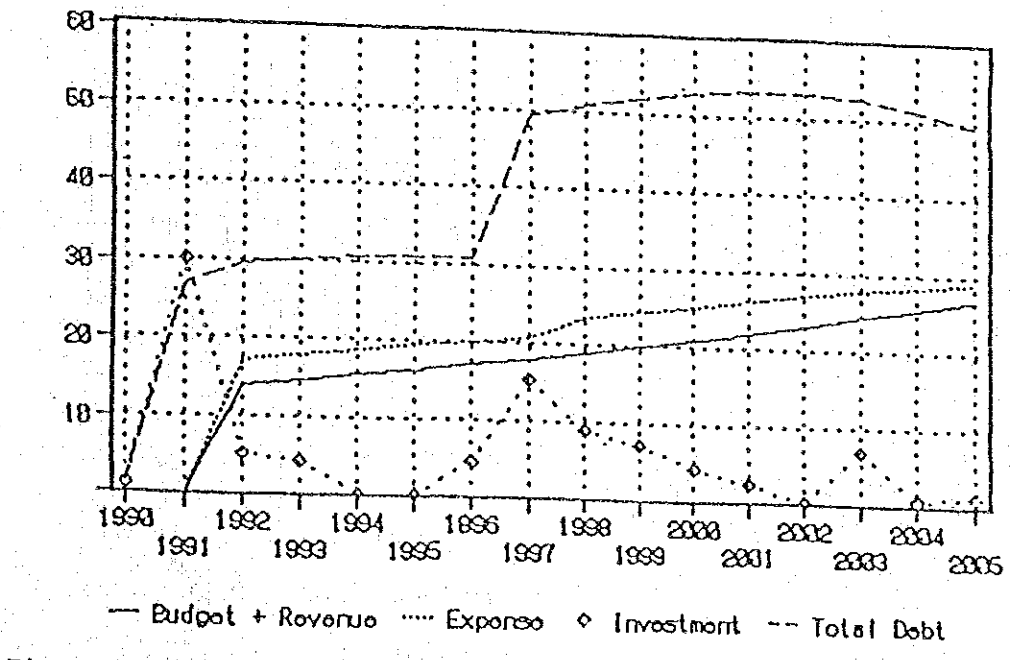



Fig. 9.4-7 Alternative 1-B1: Debt, Investment, Expenses and Allocation

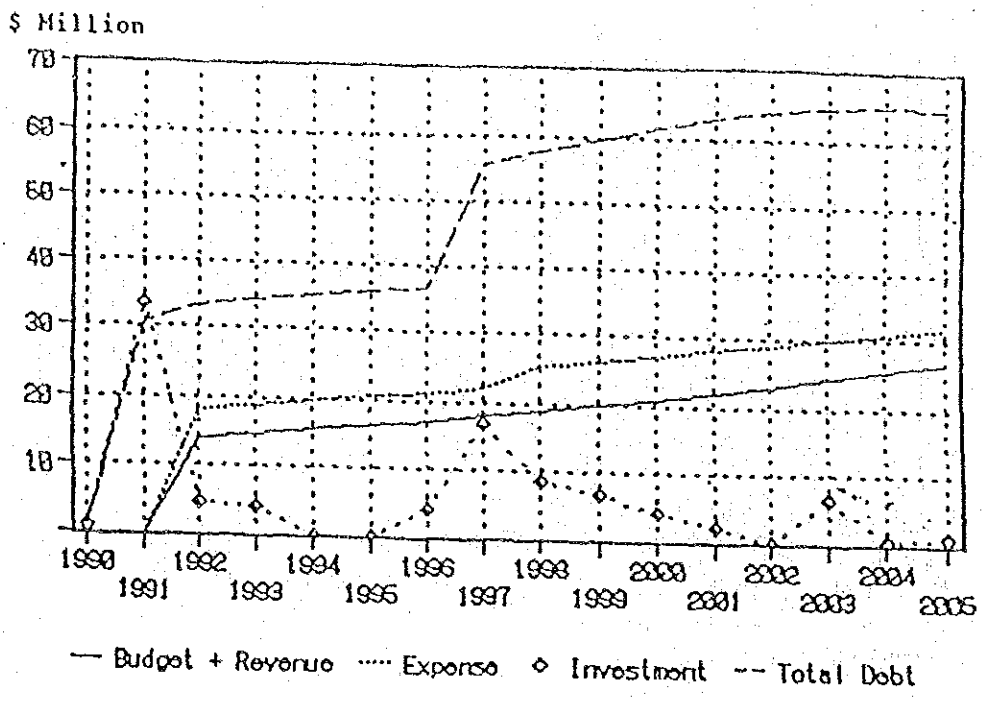



Fig. 9.4-8 Alternative 1-B2: Debt, Investment, Expenses and Allocation

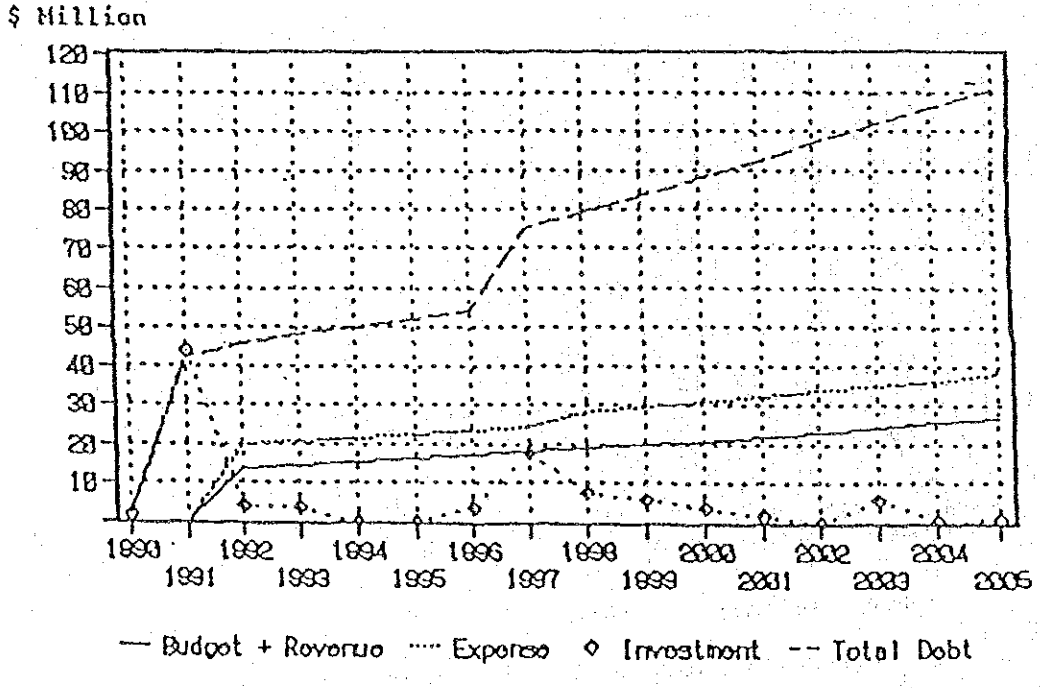



Fig. 9.4-9 Alternative 1-B3: Debt, Investment, Expenses and Allocation

# Chapter 10. Proposed Arrangements for Reorganization, Finance and Privatization

This chapter has the following two sections:

10.1 Arrangements Proposed for MPPP
10.2 Arrangements Proposed for MPSP

## 10.1 Arrangements Proposed for MPPP

### 10.1.1 Organization and Labor Management

Section 10.1.1 presents the following four proposals:

1) Functional Specialization in SWM by Public Health Inspectors
2) Establishment of an Independent Department Responsible for Solid Waste Management (SWM)
3) Review of the Role of the Ad Hoc Committee on SWM
4) Improvement on the Labor Management

#### (1) Functional Specialization in SWM by Public Health Inspectors

a. Necessity for Functional Specialization

The realization of functional specialization through the establishment of an independent department responsible for SWM is one of the most important recommendations related to the institutional building.

In both MPPP and MPSP each Public Health Inspector (PHI) has an area where he is responsible for all matters related to licences to food handlers, public health and environmental matters including solid waste management. This follows that a PHI has area-wise specialization instead of functional specialization. Each type of specialization has both advantages and disadvantages.

Advantages of the area-wise specialization include the following:

1) A PHI can acquire deep knowledge about particular conditions of an area assigned to him.
2) A PHI may effectively coordinate public health matters and environmental matters which are related each other.
3) The departmental head may find it easier to evaluate a PHI's work performance.
4) Much coordination among PHI's may not be necessary. This may be an advantage if the uncooperative attitude prevails among PHIs.
5) The past experience of MPPP shows that it is less likely to form cliques and cause clique problems under the area-wise specialization than under the functional specialization in the Health Department. In this sense, the area-wise specialization gives an advantage to the top management if they are not strong enough to handle the clique problems.

On the other hand, advantages of the functional specialization include the following:

1) Through the concentration on a specialized function, a PHI can acquire deeper understanding and develop more professional skill, which are necessary for the problem identification and work improvement.

Having considered all the above points, it is considered that the functional specialization still provides greater prospect for the improvement on SWM than the area-wise specialization. Its major reasons include the following:

1) SWM requires increasingly more professional knowledge and skill in the future than in the past.

2) Operational nature of SWM is very different from that of licensing for food handlers and other health related matter, although both the former and the latter have a common goal; i.e., the promotion of public health and environmental sanitation. (It is a historical fact that productivity of goods and services has increased through the functional specialization.)

b. Degree of Specialization

A PHI, in both MPPP and MPSP, is charged with a general responsibility for public health and environmental control. It is also possible to say that a PHI is "specialized" in the public health and environmental control. Generalization v.s. specialization are relative concepts which indicate only the directions with respect to scope of role to be played. What really matters is the degree of specialization. The following three different degrees of specialization are considered.

Degree 1: Specialization in public health and environmental control inclusive of SWM (Degree 1 specialization is currently practiced by both MPPP and MPSP.)

Degree 2: Specialization in SWM

Degree 3: Specialization in one of the aspects of SWM such as control of contractors, campaign and enforcement, disposal site operation, research and development, etc.

Degree 3 specialization is recommended for both MPPP and MPSP in view of types, nature, and amount of SWM services as well as size of manpower available.

c. Necessity for Establishing an Independent Department Responsible for SWM

Establishment of an independent department (herein referred to as Urban Service Department - USD) responsible for SWM will result from the specialization in SWM by a department and its head. Such departmental specialization in SWM is strongly recommended in view of the following:

1) Solid waste management (SWM) of MPPP is important and large enough to deserve receiving an USD. SWM shares 38% of the Council's total manpower and 26% of its expenditure.

2) 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 standard will also increase.

3) Establishment of an USD can naturally lead to the specialization in SWM at the level of both PHIs and departmental head, through which their managerial capacity can be strengthened.

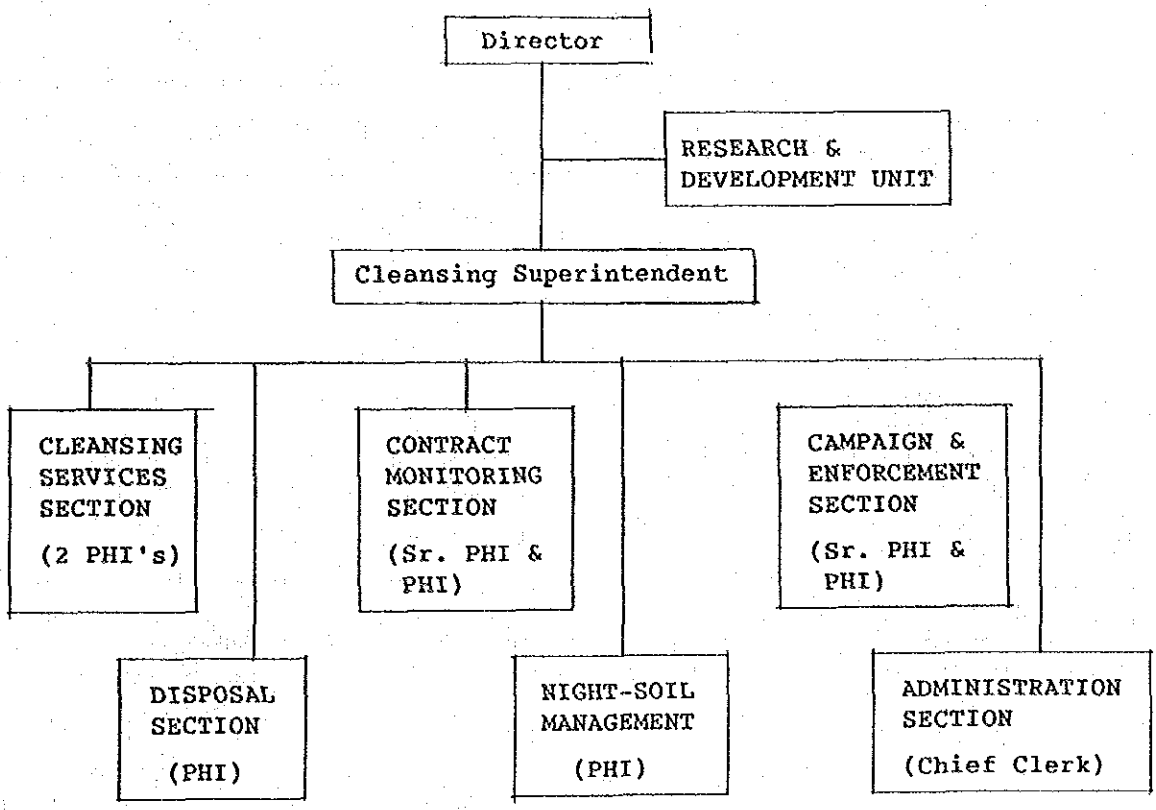
To establish an USD does not basically require money. Whether or not to establish it depends on the decision of the Council's top administrators. It seems there is no major reasons to delay its establishment.

(2) Proposed Scheme for the New Department (USD) Responsible for SWM

a. Organizational Framework Proposed

i. Organization Scheme

An organization scheme as shown in the chart below is proposed for the new Urban Service Department of MPPP. The organizational scheme of the USD proposed below is the one that can be implemented immediately by deploying the existing cleansing personnel.




Note:

1) The responsibility of Cleansing Services Section will include street and drain cleansing as well as collection and haulage.

2) Positions shown below the names of sections indicate the heads of these sections. Actual appointments, however, should be made based upon the merits of individual persons.

Fig. 10.1-1 Proposed Organization of the Urban Services Department for MPPP

ii. Manpower Scheme

The number of personnel required for the proposed department is shown in the following table according to the sections and the positions.

Table 10.1-1 Proposed Number of Personnel for MPPP's USD According to Section and Position

| NAME OF SECTION | DIRECTOR | SPHI B2 | SPHI B3 | SPHI B4 | PHI | SOVERSEER | OVERSEER | DRIVER | MANDOR | LABORER | CCLE (C3) | CLE & OTH | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Cleansing services | | | | | 2 | 1 | 35 | 15 | 73 | 1387 | | | 1515 |
| 2. Contract Monitoring | | | | 1 | 1 | 3 | | | | | | | 5 |
| 3. Campaign Enforcement | | | | 1 | 1 | | 8 | | | | | | 10 |
| 4. Disposal Site Planning & Management | 1 | 1 | | | 1 | 1 | | | | | | | 4 |
| 5. Night-Soil Management | | | | | 1 | 1 | 5 | | 5 | 84 | | | 96 |
| 6. Research & Development | | | 1 | | 1 | | | | | | | | 2 |
| 7. Adminis-tration | | | | | | | | | | | 1 | 10 | 11 |
| Total | 1 | 1 | 1 | 2 | 7 | 6 | 48 | 15 | 78 | 1471 | 1 | 10 | 1641 |

Abbreviations:

SPHI: Senior PHI

CCLE: Chief Clerk

SOVERSEER: Senior Overseer

CLE & OTH: Clerks and Others such as typist and handymen

b. Features of the Organization Proposed

The organization proposed has the following features:-

i. In line with the government's policy of reducing the size of personnel in civil service, the new department is proposed in such a way that it does not require the Council to recruit new employees except for the head of the department. All other personnel required can be deployed from the existing Health Department.

ii. The new department will have seven sections as shown below.

1) Cleansing Service Section
2) Contract Monitoring Section *
3) Campaign & Enforcement Section *
4) Disposal Site Planning & Management Section *
5) Night-soil Management Section
6) Research & Development Section*
7) Administrative Section

Note: Sections marked with asterisks will perform new functions which have not been performed under the existing Health Department.

iii. All the sections except the Administrative Section are headed by either Sr. PHI's or PHI's. The heads of the sections are directly answerable to the Cleansing Superintendent. This is to eliminate unnecessary time-consuming formalities.

iv. The new department will absorb collection vehicle drivers who are currently placed under the Engineering Department.

c. Function of Each Section

i. Cleansing Service Section

This section is responsible for the execution of all the Cleansing Services which are provided by the workers of the existing Health Department. The cleansing services include street and drain cleansing, collection and haulage of solid wastes.

One of the two PHIs will be responsible for a part of Penang Island, while the other is responsible for the remaining part of the Island. A boundary should be drawn in such a way as to equalize the work-load of one PHI to that of the other.

From specialization point of view, it would be better to assign the management task of collection and haulage to one PHI, and the management task of street/drain cleansing to the other. There are however two problems arising from this assignment system. One is that the work-load of the management of street/drain cleansing is far greater than that of waste collection and haulage because the Council's street/drain cleansing service uses resources about 6 times more as compared to the Council's collection and haulage service in terms of both manpower and expenditure. The other problem with such an assignment system is that a PHI will have only partial control of an overseer who is responsible for the supervision of both street/drain cleansing, and collection and haulage.

ii. Contract Monitoring Section

The duty of this Section is to make sure that contractors provide required service in a satisfactory manner. MPPP currently receives service from six contractors.

Sr. Overseers will be responsible for the daily close monitoring of the contract service. Each overseer will be responsible for the supervision of two contractors.

There is one Sr. PHI and one PHI assigned to this Section. It is advisable that both of them equally share the responsibility for monitoring contractors. They should have monthly meetings with the contractors.

iii. Campaign and Enforcement Section

Campaign and enforcement are necessary if MPPP wishes to improve its collection efficiency through the introduction of a new system such as usage of plastic bags and standardized bins on the part of residents and introduction of alternate-day collection system in selected areas.

From the experience gained in Kuantan, Petaling Jaya and some other municipalities, it was found that campaign was never successful without enforcement. Urban Service Department in Petaling Jaya, at present, has eight overseers acting as enforcement officers.

This Section will have one Sr. PHI, one PHI and eight overseers who will be mobilized for campaign and enforcement. Both Sr. PHI and PHI are expected to come up with detailed implementation plan for campaign and enforcement.

iv. Disposal Site Planning and Management Section

In view of the increasing difficulty in securing disposal sites and also increasing importance of sanitary disposal of waste, systematic acquisition of disposal sites as well as the site-planning and management have already become important enough to have some personnel specialized in this field.

Ideally speaking, there should be some environmentalists or public health engineers with a university degree qualification. It may, however, be difficult for MPPP to find such personnel and place them in the Urban Service Department in view of the lack of promotional opportunity for such personnel within the department. In the present set-up, it would be more feasible for MPPP to place such personnel in

the Engineering Department. This is an acceptable arrangement provided that there is a good inter-departmental collaboration between the two departments. In any case, it is advisable to have at least one PHI or some other technical personnel in this Section.

v. Night-Soil Management Section

At present, Health Department has ten overseers responsible for the supervision of night-soil collection and haulage. In view of the decreasing demand for this service, it would be realistic to replace five Overseers with five mandors. (Overseers who will be made redundant are transferred to Campaign and Enforcement Section in the proposed scheme.)

One PHI will be made responsible for the overall night-soil management including monitoring night-soil contractors in the rural area.

vi. Research and Development Unit

The functions of this unit include the following:

1) Monitoring the performance of cleansing services
2) Development or research for improvement

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

The effectiveness of the cleansing services depends much on the appropriateness of the equipment used. The person in charge of this unit must be keen in finding appropriate technology through studying equipment catalogues and observing other councils or making research of his own.

vii. Administration Section

Under the proposed scheme, judging from the personnel size of the department, one Chief Clerk and ten other personnels including clerks, typists and office boys would be sufficient to the new Department. (Kuantan USD and Petalling Jaya USD have six and seven personnel respectively in their Administrative Sections.)

d. Role of Personnel Expected

In order to strengthen the solid waste management, personnel in respective level (Departmental head, PHI, and overseers, etc.) are expected to perform more positive roles than currently practised.

Overseers are expected to handle most of day-to-day problems and routine (roll-calling and reporting, etc.). Overseers should be encouraged to make suggestions which may lead to the improvement on the operational efficiency.

PHIs on the other hand, are expected to concentrate on non-routine matters such as:-

- Identification of fundamental problems
- Working out implementation plans for system-improvement and introduction of new collection systems such as usage of plastic bags with different frequency
- Training of overseers
- Data-base management
- Monitoring the services performance of contractors and the Council workers

Cleansing Superintendent is expected to perform the following duties:-

- Measurement of productivity and cost-control
- Inter-council communication to exchange experience and know-how
- Overall supervision

Departmental Head is expected to perform the following responsibilities:-

- Disciplinary control for improving work-morale
- Sound personnel management
- Provision of training opportunity for staff
- Inter-departmental communication
- Introduction of sanitary landfilling
- Overall management

Council Administrators are expected to:

- Understand the importance of the application of systematic thinking and planning to the solid waste management
- Support the service executing departments, and give as much authority (controlling power) as possible to them
- Maintain quick and effective disciplinary control, and strengthen employees' work-morale
- Minimize Councillors' political involvement in the execution of the council's services

Roles of personnel expected are summarized in Table 10.1-2.

Table 10.1-2 Roles of Personnel Expected

| PERSONNEL RESPONSIBLE | ROLES TO BE PLAYED |
|---|---|
| Council Administrators | - Support of work-morale<br>- Disciplinary control<br>- Provision of training<br>- Target, Strategy & Policy |
| Departmental Head | - Over-all management<br>- Fair evaluation of employees' work performance |
| Cleansing Superintendent | - Measurement of Productivity and cost-control<br>- Over-all supervision |
| PHI's and Sr. PHI's | - Monitoring the service performance<br>- Identification of fundamental problems<br>- Working out implementation plans for system-improvement<br>- Training of overseers<br>- Management of data-base |
| Overseers | - Discipline of laborers<br>- Attending to day-to-day routine, solving problems and reporting<br>- Preparation of weekly work-schedule |
| Mandors | - Supervision and control of laborers |
| Labourers | - Execution of cleansing work |

(3) Review of the Role of the Ad Hoc Committee on SWM

The following is the view presented by the Study Team.

a. Introduction

The Ad Hoc Committee was formed in 1981 to correct the ills of the Health Department at a time of contracting out its cleansing services. The same Committee, has performed very well, and achieved its aim in overcoming almost all the problems that overshadowed the Health Department's progress. But even after achieving this target, the Committee still continued to control the department's activities, and this might have lessened the enthusiasm and efforts of the department. The purpose of this Section is to present some views on the necessity for reviewing the role of the Ad Hoc Committee so as to create an ideal and independent SWM system.

b. Historical Background

Towards the National policy on privatisation, MPPP first awarded a Contract to a private company in 1979 to remove refuse for disposal. This private company was performing satisfactorily for about 3 years when problems (disruption in the service due to frequent vehicle troubles) began to surface. When these problems worsened, the collection service suffered greatly, and the public became very upset, and the complaints to the Council mounted up very high. It was at this stage, that the Council felt that the Health Department could not properly handle the Solid Waste Management, and so the Council decided to set up an AD Hoc Committee to assist the Health Department to manage the solid waste management system, on a yearly basis. Over the years in the past since its establishment, this Ad Hoc Comittee has made an impact on SWM, introduced many changes in the policy matters, and has really established a system which is practical and stable.

c. Problems with the Ad Hoc Committee

It should be noted that this Committee was established purely on an Ad Hoc basis. That means the functions of the Committee were of a specific nature with limit duration of office. Once it has reached its goal of achieving smooth and regular SWM, its functions should have ceased and the Health Department be given the opportunity to start afresh from where the Committee left off.

The Ad Hoc Committee, at present, holds a monthly meeting with contractors to evaluate their monthly performance, and to discuss and solve problems related to their services. The Committee checks such matters as:

- Daily waste collection tonnages in comparison to the tonnage expected
- Daily work-finishing-time to check lateness of the service
- Appropriateness of locations of some communal-bins

These are rather routine and operational matters, and can be and should be handled by the officers of the service executing department.

It seems that such deep involvement of the Committee in the day-to-day affairs has lead to a situation where the functional powers of the department have eroded to a great extent that it has affected the general morale of the personnel in the department. The officers in the department seem to be less-interested in their motivation and initiation. They feel that they function only on directives which are formulated by this Ad Hoc Committee. They feel that their initiative is no longer respected, and this is a very dangerous trend and is a hindrance to progress and improvement.

The power of the Ad Hoc Committee can be best utilized for attending to more important matters such as the strengthening of the law enforcement and receiving citizens' cooperation with respect to waste discharge manner.

In view of the political climate in Penang where citizens are politically active, Councillors, who are representatives of the citizens, can exert great influence on them in respect of the above matters.

d. Recommendations

The Ad Hoc Committee has superbly conducted its mission, and has achieved the purpose for which it was established years ago. It is hightime now to pass this responsibility back to the department.

As a responsible Committee, it should recommend to the Council the abolition of the Committee and passing over the responsibility back to the Health Department. Or alternatively, the President of MPPP should ask the Ad Hoc Committee to review the managerial capability of the Health Department to take over the responsibility of SWM by itself, and submit a report to him. At the same time, he can also ask the Department itself to submit a report reassuring of its readiness to take over the functions of the Ad Hoc Committee and run the SWM by itself.

If the President, after receiving the reports, feels that the Health Department still cannot stand on its own feet, then the role of the Committee should be reviewed. It should function in a different manner more like a policy-maker and consultant on SWM. Implementation of these policies should be left to the Health Department. The Committee should not have any dealings directly or indirectly with the contractors, which is essentially an administrative matter of the department.

The above recommendations have been presented assuming the case where the Heath Department would continue to execute SWM for some more time in the future. Establishing an independent department for SWM still remains to be the prime recommendation.

(4) Improvement on Labor Management

a. Necessity for Effective Disciplinary Control and Work-Morale Support

The Council's labor management is generally weak and loose in terms of its disciplinary control and work-morale support. The loose management, in fact, is an important element which explain why the Council is lower than the contractors in terms of waste collection efficiency.

It is important to note that facility improvement and technological improvements, in general, alone would not bring about desired effects unless such improvements are accompanied with the improvement on the managerial capacity inclusive of the labor management capacity.

The good labor management requires fair and quick evaluation of employees' job performance and behavior. Results of such evaluation then should be expressed in terms of disciplinary actions and rewards.

The Council has serious problems in taking appropriate and speedy disciplinary actions. The degree of severity of disciplinary actions, in some cases, has been reduced substantially as compared to what was originally proposed by the departmental heads. Another drawback of the Council's disciplinary system is that it takes such a long time for the Council to reach to a final decision. It often took one and a half years before the final decision is made.

b. Solution to the Problem

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

The power of making decision on the disciplinary matters, in the present set-up, is entirely in the hands of the disciplinary action commitee members comprising of the Council's Administrators and Councillors. This implies that the problem, though serious, may possibly be solved quickly and simply upon the change in the attitude of those decision makers.

### 10.1.2 Finance

#### (1) Financial Sources for the Operation and Maintenance

The target SWM cost in 2005 is estimated to be 130% of the cost in 1987 in real term provided that all the improvement measures would be successfully implemented as proposed in the Master Plan. Most fund for SWM, at present, comes from the Council's general budget of which major source is the assessment tax collected from citizens.

In the view of the necessity for securing the sufficient fund for SWM and other services of the Council, the following recommendations are presented.

1) Increase of the assessment revenue through:
   - Review (increase) of the assessment rates
   - Reduction of arrear through better information system and stronger collection activity

2) Establishment of "Beneficiary-Pay-Principle" under which the following two types of fee should be collected:
   - Fees for Commercial Waste Collection Service
   - Tipping fees for disposal service

The following table shows types of SWM services and persons who should bear the costs of the services.

Table 10.1-3 Proposed Sources of Fund for SWM Service

| TYPE OF SWM SERVICES | PROPOSED SOURCES OF FUND |
|---|---|
| 1. Domestic Waste Collection | Assessment (Local Property Tax) |
| 2. Commercial Waste Collection | Fees to be collected from service recipients. |
| 3. Disposal of Waste Privately Brought into Municipal Disposal Sites | Tipping fees to be collected from the service recipients. |
| 4. Waste Collection/Haulage and Cleansing for Public Premises (Roads, Parks, Facilities, etc.) | Owners of premises |

Both the tipping fees and the fees for commercial waste collection should be gradually raised so that those fees would be sufficient enough to fully (100%) cover the costs of those services in 2005.

The Council can keep the same amount of the appropriation to SWM from its general budget over the long period provided that those fee revenue would increase as proposed above.

The Council, at present, provides street/drain cleansing and grass cutting services for some of the state and federal roads without receiving sufficient fund for those services.

It is proposed that the State and the Federal Governments should provide the Council with sufficient funds for those services or alternatively, they should execute those services by themselves because the state and Federal Governments are responsible for the maintenance and cleansing of their roads according to the Malaysian Laws.

The sources of the fund for SWM services in 2005 are estimated as shown below provided that the two kinds of fees are collected as proposed above.

- The Assessment will cover 84% of the SWM expense in 2005.
- Commercial waste collection fees will cover 14% of the SWM expense in 2005.
- Tipping Fees will cover 2 % of the SWM expenses in 2005.

(2) Financial Sources for Investment

a. Construction Cost of Final Disposal Facilities

It is recommended that both the Federal Government and the State Government provide financial assistance (grants or low-interest-rate-loans) to cover the major portion of investment costs. This recommendation is presented in view of the following.

i. Under the existing tax system in Malaysia where the Local Authorities receive a very small portion of the aggregate tax paid by all Malaysians, the Local Authorities including MPPP and MPSP are financially not capable of undertaking large investment projects such as the construction of disposal facilities.

ii. On the other hand, the Federal Government (DOE) has recently set high standards regarding environmental quality, and requires the Local Authorities to meet such standards. With respect to waste disposal, a sanitary landfill system would be the only choice that would meet the standards. The construction of sanitary landfills, however, requires a large investment.

In view of the above situation, it is simply impossible for the Council to meet the disposal standards without having financial support from the Federal or State Government.

It is strongly hoped that the Sixth Malaysia Plan of the Federal Government will include sufficient budget for the development of sanitary disposal system and for the improvement on some other aspects of SWM in Malaysia.

b. Replacement of Collection Vehicles

The existing collection vehicles (mainly side-loaders) should be replaced with large-sized compactor vehicles in the near future in view of the long distance from collection points to the future disposal site.

It is advised that the Council will prepare sufficient budget for the timely replacement of the vehicles.

(3) Establishment of an Independent Accounting System for SWM

It is strongly recommended that the Council should establish an independent accounting system for SWM in view of the necessity to accurately identify SWM costs. An accurate identification of SWM costs is a first step for the evaluation of the efficiency and progress of SWM performance.

10.1.3 Privatization

(1) Waste Collection and Haulage

MPPP currently uses five contractors for the solid waste collection and haulage. Those contractors collect 87 % of the waste in MPPP area. Though MPPP had many problems in managing the contractors in its initial stage of the privatization, it had overcome most problems. Most contractors are satisfactory in their performance. The contract prices are competitively low.

In view of the situation mentioned above, it is advised that MPPP would maintain the same policy regarding the use of contractors for the collection service, except for the the system of monitoring and control of the contractors.

Currently, an Ad Hoc Committee for SWM comprising of some Councillors takes an initiative in the monitoring and control of the contractors' performance. The Committee holds monthly meetings with the contracotrs to discuss matters related to the contract services. It is advised that the Health Department, instead of the Ad Hoc Committee, will take more initiative in the control of the contractors as proposed in Section 10.1.1 (3). Review of the Role of Ad Hoc Committee.

(2) Street and Drain Cleansing

Althogh it is expected that the street/drain cleansing service may be provided at lower prices by contractors than by the Council, the privatization of this service is not recommended in view of the following situation.

1) MPPP has abount 1,100 laborers for the street/drain cleansing service which represents abount 80 % of the total laborers in the Health Department, and a quarter of the Council's total employees. Such number of laborers is considered excessive relative to the amount of the service actually performed.

2) It is estimated that about 300 laborers will be made redundent if the frequency of the street/drain service is reduced from daily to weekly basis in residential area as proposed in the Master Plan.

3) Judging from the age structure of the cleansing laborers, it would take until the year 2000 for MPPP to reduce 300 laborers through the natural retirement of the laborers provided that MPPP would not recruit any new laborers in the future.

4) It is also anticipated that some more laborers will be made redundent through the introduction of the 3 times/week waste collection.

The above-descrived situation indicates that the privatization of the street/drain service would not be feasible before the year 2000 at earliest if MPPP would not find ways to deploy redundent laborers for some other services.

(3) Privatization of MPPP's Clinics

MPPP has clinics for child and welfare, and clinics for the Council's employees. There are about 70 staff working for the clinics. Those clinics have been giving financial burden to the Council. The operation and maintenance of those clinics requires large expenditures as MPPP basically provides free medical services to patients except for costs of medicines charged at the child and welfare clinics.

Besides, MPPP's financial situation is not favorable. Its deficit is estimated to be 17.8 million Malaysia dollar which corresponds 32 % of the estimated revenue in 1989.

According to the Malaysian Laws, the provision of medical services is not the responsibility of the Local Governments, it is the responsibility of the Federal Government.

Considering all the above points, it is recommended that all the Council's clinics should be privitized by transferring its ownership and management responsibility. This will allow MPPP to save considerable amount of money every year, which in turn would help the Council to improve the standard of the other services including waste disposal service.

## 10.2 Arrangements Proposed for MPSP

### 10.2.1 Organization and Labor Management

Section 10.2 presents the following three proposals:

1) Functional Specialization in SWM by Public Health Inspectors
2) Establishment of an Independent Department Responsible for Solid Waste Management (SWM)
3) Improvement on the Labor Management

#### (1) Functional Specialization in SWM by Public Health Inspectors

a. Necessity for Functional Specialization

The realization of functional specialization through the establishment of an independent department responsible for SWM is one of the most important recommendations related to the institutional building.

In both MPPP and MPSP each Public Health Inspector (PHI) has an area where he is responsible for all matters related to licences to food handlers, public health and environmental matters including solid waste management. This follows that a PHI has area-wise specialization instead of functional specialization. Each type of specialization has both advantages and disadvantages.

Advantages of the area-wise specialization include the following:

1) A PHI can acquire deep knowledge about particular conditions of an area assigned to him.

2) A PHI may effectively coordinate public health matters and environmental matters which are related each other.

3) The departmental head may find it easier to evaluate a PHI's work performance.

4) Much coordination among PHI's may not be necessary. This may be an advantage if the uncooperative attitude prevails among PHIs.

On the other hand, advantages of the functional specialization include the following:

1) Through the concentration on a specialized function, a PHI can acquire deeper understanding and develop more professional skill, which are necessary for the problem identification and work improvement.

Having considered all the above points, it is considered that the functional specialization still provides greater prospect for the improvement on SWM than the area-wise specialization. Its major reasons include the following:

1) SWM requires increasingly more professional knowledge and skill in the future than in the past.

2) Operational nature of SWM is very different from that of licensing for food handlers and other health related matter, although both the former and the latter have a common goal: i.e., the promotion of public health and environmental sanitation. (It is a historical fact that productivity of goods and services has increased through the functional specialization.)

b. Degree of Specialization

A PHI, in both MPPP and MPSP, is charged with a general responsibility for public health and environmental control. It is also possible to say that a PHI is "specialized" in the public health and environmental control. Generalization v.s. specialization are relative concept which indicate only the directions with respect to scope of role to be played. What really matters is the degree of specialization. The following three different degrees of specialization are considered.

Degree 1: Specialization in public health and environmental control inclusive of SWM (Degree 1 specialization is currently practiced by both MPPP and MPSP.)

Degree 2: Specialization in SWM

Degree 3: Specialization in one of the aspects of SWM such as control of contractors, campaign and enforcement, disposal site operation, research and development, etc.

Degree 3 specialization is recommended for both MPPP and MPSP in view of types, nature, and amount of SWM services as well as size of manpower available.

c. Necessity for Establishing an Independent Department Responsible for SWM

Establishment of an independent department (herein referred to as Urban Service Department - USD) responsible for SWM will result from the specialization in SWM by a department and its head. Such departmental specialization in SWM is strongly recommended in view of the following:

1) Solid waste management (SWM) of MPSP is important and large enough to deserve receiving an USD. SWM shares 56% of the council's total manpower and 31% of its expenditure.

2) 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 standard will also increase.

3) Establishment of an USD can naturally lead to the specialization in SWM at the level of both PHIs and departmental head, through which their managerial capacity can be strengthened.

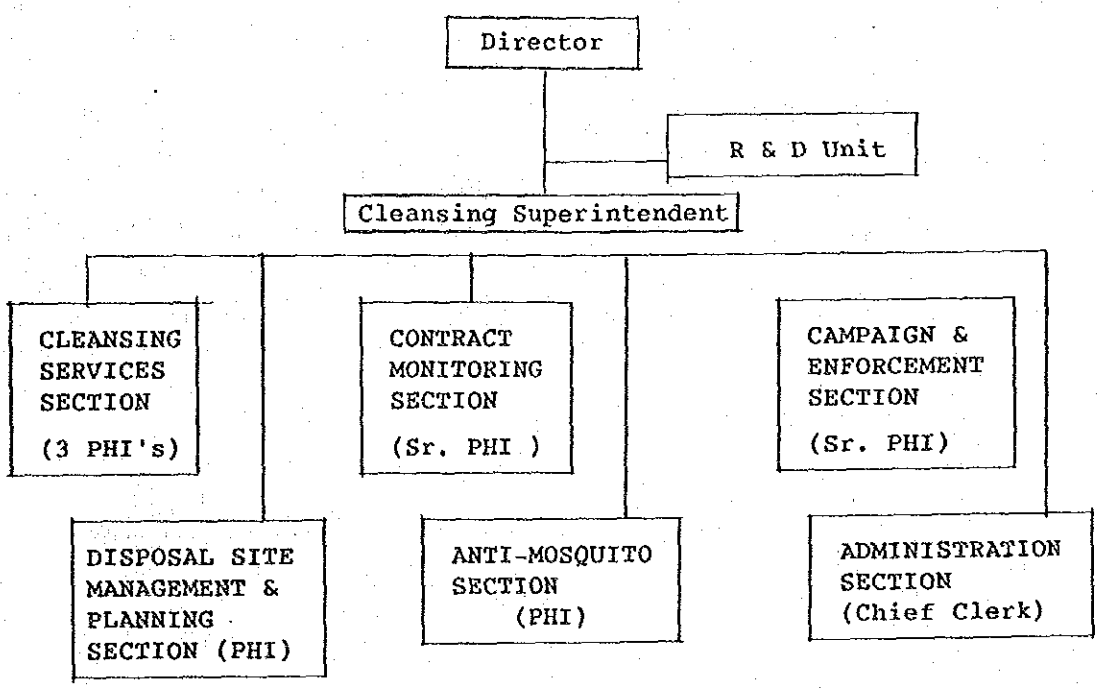
To establish an USD does not basically require money. Whether or not to establish it depends on the decision of the Council's top administrators. It seems there is no major reasons to delay its establishment.

(2) Proposed Scheme for the New Department (USD) Responsible for SWM

a. Organizational Framework Proposed

i. Organization Scheme

An organization scheme as shown in the chart below is proposed for the new Urban Service Department of MPSP. The organizational scheme of the USD proposed below is the one that can be implemented immediately by deploying the existing cleansing personnel.




Notes:

1) Position shown below the names of sections indicate the heads of these sections proposed. Actual appointment, however should be made based upon the merits of individual persons.
2) The responsibility of Cleansing Services Section will include collection/haulage and street/drain cleansing.

Fig. 10.2-1 Proposed Organization of the Urban Services Department for MPSP

ii. Manpower Scheme

The number of personnel required for the proposed department according to the sections and the positions is shown in the table below.

Table 10.2-1 Proposed Number of Personnel for MPSP's USD According to Sections and Position

| | NAME OF SECTION | DIRECTOR | SUPERINT (B3) | SPHI (B4) | PHI (B9) | OVERSEER | DRIVER | MANDOR | LARVAECO | LABORER | CCLE (C3) | CCE&OTH | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Cleansing services | | | | 3 | 24 | 38 | 48 | | 831 | | | 946 |
| 2. | Contract Monitoring | | | 1 | | 5 | | | | | | | 6 |
| 3. | Campaign Enforcement | | | 1 | | 4 | | | | | | | 5 |
| 4. | Disposal Site Management & Planning | 1 | 1 | | | | | | | | | | 2 |
| 5. | Research & Development | | | | 1 | | | | | | | | 1 |
| 6. | Anti-mosquito | | | | 1 | 4 | | 6 | 5 | 65 | | | 81 |
| 7. | Adminis-tration | | | | | | | | | | 1 | 21 | 22 |
| | Total | 1 | 1 | 2 | 6 | 38 | 38 | 54 | 5 | 904 | 1 | 21 | 1071 |

Abbreviations:

SUPERINT: Cleansing Superintendent

SPHI: Senior Public Health Inspector

CCLE: Chief Clerk

CLE & OTH: Clerks and Others such as typists and office boys

LARVAECO: Larvae Collector

b. Features of the Organization Proposed

The organization proposed has the following features:-

i. In line with the government's policy of reducing the size of personnel in civil service, the new organization is proposed in such a way that it does not require MPSP to recruit new employees except for the head of the department.

ii. It has seven sections as shown below.

1) Cleansing Service Section
2) Contract Monitoring Section *
3) Campaign & Enforcement Section *
4) Disposal Site Management & Planning Section *
5) Research & Development*
6) Anti-Mosquito Section
7) Administration Section

The four sections marked with asterisk will perform new functions.

iii. The remaining functions of the Health Department include the following.

- Licensing for food handlers and other traders including petty traders
- Clinics for preventive innoculation of food handling licence holders

iv. The allocation of PHIs and departmental heads for the USD and the Health Department is proposed as follows:

Table 10.2-2 Proposed Allocation of Personnel for MPSP's USD & Heath Dept.

| | PHI's (B9) | Sr. PHI's (B4) | Sr. PHI's (B3) | Chief PHI (B1) | Director |
|---|---|---|---|---|---|
| 1) USD (SWM & NSW) | 6 | 2 | 1 | 0 | 1 |
| 2) Health Department | | | | | |
| - Licensing | 6 | 1 | 0 | 1 | 1 |
| - Clinics | 0 | 0 | 0 | | |
| Total | 12(12) | 3(4) | 1(0) | 1(1) | 2(1) |

Note: Figures in the parentheses indicate the existing number of personnel.

In the proposed scheme, one Sr. PHI of B3-scale will act as a cleansing superintendent. (One B3 post has been created in MPSP some time ago. This post however has not been filled since then.)

Personnel such as overseers, drivers, mandors and laborers who have been involved in the cleansing services will be transferred to the new department.

v. The recruitment of a director will require immediate increase in the emolument amounting approximately $3,600/month, which be equivalent to the emolument for 5-7 laborers.

There may however be a strong case where such increase will soon be offset by the reduction of emolument related to workers without lowering the cleansing service level as the council's cleansing manpower size shrinks as a result of natural retirement under the council's existing policies for non-recruitment of new personnel as well as expansion of the contracting-out of the cleansing services. It can be expected that overall cost-effectiveness of the cleansing services will be improved as a result of expansion of the contracting-out in view of the relatively higher cost-effectiveness of the contractors over the council's own service.

c. Function of Each Section

Functions to be assigned to each section are explained as follows:-

i. Cleansing Service Section

This section will be responsible for street/drain cleansing and collection/haulage. In the proposed scheme, this section will be managed by three PHIs. In view of the wide-spreadness of respective district in Seberang Perai, it is proposed that each PHI will be responsible for one of the three districts: North, Central and South.

Roles of Overseers and PHIs should be such that Overseers handle most of the day-to-day problems, and PHIs use their time to generate more managerial and planning inputs for the improvement of the existing systems with less expenditure. Among others, the PHIs should be responsible for making sure that conditions of communal bins and collection vehicles are checked by overseers and reported to the PHIs.

ii. Contract Monitoring Section

The duty of this Section is to make sure that contractors provide required service in a satisfactory manner. MPSP currently receives service from seven contractors.

This section will be managed by one Sr. PHI. He should have monthly meetings with the contractors.

Five Overseers will be responsible for the daily close monitoring of the contract service. Each of them will be responsible for the supervision of one or two contractors.

iii. Campaign and Enforcement Section

Campaign and enforcement are essential if MPSP wished to introduce a new system such as alternate-day collection and usage of plastic bags and standardised bins on the part of residents.

From the experience gained in Kuantan, Petaling Jaya, and some other municipalities, it was found that campaign was never successful without enforcement. This fact cannot be overemphasized. Sr. PHI of this section is expected to come up with a detailed implementation plan for campaign and enforcement.

iv. Disposal Site Management and Planning

In view of the increasing importance of sanitary disposal of waste, the site management and planning have already become important enough to have some personnel specialized in this field.

It is recommended that MPSP will recruit some environmentalists or public health engineers with a university degree qualifications in the future.

v. Research and Development Unit

In the proposed scheme, one PHI is assigned to Research and Development Unit. A person to be assigned to this Section should be creative and keen to identify problems. This unit is expected to perform the new functions including the following:

1) Analysis of information obtained at the weigh-bridge
2) Developing or searching for new tools and equipment
3) Analysis of current practice

1) Analysis of information obtained at the weigh-bridge

Whether or not the weigh-bridge will prove to be useful depends greatly on how effectively the users will utilize the information to be obtained at the weigh-bridge. The weigh-bridge will enable the users not only to keep the daily operation record but also to measure the efficiency of waste collection and haulage in various ways. In other words, users of the weigh-bridge should extensively use it as a planning tool.

To measure the efficiency of the cleansing services is the first step toward the identification of problems and improvement on the services. The weigh-bridge data should also be used to monitor the progress in the achievement of the Master Plan targets.

After the introduction of weigh-bridge to some other municipal councils in Malaysia, it would be useful and advisable for those municipal councils to make cross-municipal comparisons to know the relative efficiency of respective councils.

2) Developing or searching for new tools and equipment

The effectiveness of the cleansing services depends much on the appropriateness of the equipment used. The person in charge of this unit must be keen in finding appropriate technology through studying equipment catalogues and observing other councils or making research of his own.

3) Analysis of current practice

The PHI of R & D section is expected also to review the current practice analytically, and come up with improvement plans in collaboration with PHIs of Cleansing Section.

vi. Anti-Mosquito Section

This section will execute anti-mosquito activity that has been carried out by the existing Health Department. In the proposed scheme, this section will be placed under the Urban Service Department in view of the operational nature of this service; major anti-mosquito operation is the cleansing of some drains. Currently this service is provided only in Butterworth.

A PHI will be responsible for the management of this section.

vii. Administration Section

In the proposed scheme, all the existing personnel (One Chief Clerk and 21 other personnel including clerks, typists, etc.) in the Administrative Unit of the Administrative Section of the Health Department will be transferred to the new department. The existing Licencing Unit and Computer Unit of the Administrative Section will remain in the Health Department.

d. Role of Personnel

In order to strengthen the solid waste management, personnel in respective level (Departmental head, PHI, and overseers, etc.) are expected to perform more positive roles than currently practised.

Overseers are expected to handle most of day-to-day problems and routine (roll-calling and reporting, etc.). Overseers should be encouraged to make suggestions which may lead to the improvement on the operational efficiency.

PHIs on the other hand, are expected to concentrate on non-routine matters such as:-

- Identification of fundamental problems
- Working out implementation plans for system-improvement and introduction of new collection systems such as usage of plastic bags with less frequency
- Training of overseers
- Data-base management
- Monitoring contractors' performance

Cleansing Superintendent is expected to perform the following duties:-

- Measurement of productivity and cost-control
- Inter-council communication to exchange experience and know-how
- Overall supervision

Departmental Head is expected to perform the following responsibilities:-

- Disciplinary control and work-morale support
- Sound personnel management
- Provision of training opportunity for staff
- Inter-departmental communication
- Introduction of sanitary landfilling
- Overall management

Council Administrators are expected to:

- Understand the importance of the application of systematic thinking and planning to the solid waste management
- Support and give as much authority (controlling power) as possible to the service executing departments
- Maintain quick and effective disciplinary control, and strengthen employees' work-morale
- Minimize Councillors' political involvement in the execution of the council's services

Roles of personnel are summarized in Table 10.2-3.

Table 10.2-3 Roles of Personnel Expected

| PERSONNEL RESPONSIBLE | ROLES TO BE PLAYED |
|---|---|
| Council Administrators | - Support of work-morale<br>- Disciplinary control<br>- Provision of training<br>- Target, Strategy & Policy |
| Departmental Head | - Over-all management<br>- Fair evaluation of employees' work performance |
| Cleansing Superintendent | - Measurement of Productivity and cost-control<br>- Over-all supervision |
| PHI's and Sr. PHI's | - Monitoring the service performance<br>- Identification of fundamental problems<br>- Working out implementation plans for system-improvement<br>- Training of overseers<br>- Management of data-base |
| Overseers | - Discipline of laborers<br>- Attending to day-to-day routine, solving problems and reporting<br>- Preparation of weekly work-schedule |
| Mandors | - Supervision and control of laborers |
| Labourers | - Execution of cleansing work |

(3) Improvement on Labor Management

a. Necessity for Effective Disciplinary Control and Work-Morale Support

The Council's labor management is generally weak and loose in terms of its disciplinary control and work-morale support. The loose management, in fact, is an important element which explain why the Council is lower than the contractors in terms of waste collection efficiency.

It is important to note that facility improvement and technological improvements, in general, alone would not bring about desired effects unless such improvements are accompanied with the improvement on the managerial capacity inclusive of the labor management capacity.

The good labor management requires fair and quick evaluation of employees' job performance and behavior. Results of such evaluation then should be expressed in terms of disciplinary actions and rewards.

The Council has serious problems in taking appropriate and speedy disciplinary actions. The degree of severity of disciplinary actions, in some cases, has been reduced substantially as compared to what was originally proposed by the departmental heads. Another drawback of the Council's disciplinary system is that it takes such a long time for the Council to reach to a final decision. It often took one and a half years before the final decision is made.

b. Solution to the Problem

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

The power of making decision on the disciplinary matters, in the present set-up, is entirely in the hands of the disciplinary action commitee members comprising of the Council's Administrators and Councillors. This implies that the problem, though serious, may possibly be solved quickly and simply upon the change in the attitude of those decision makers.

### 10.2.2 Finance

#### (1) Financial Sources for the Operation and Maintenance

The target SWM cost in 2005 is estimated to increase to 270% of the cost in 1987 in real term provided that all the improvement measures would be successfully implemented as proposed in the Master Plan. Most fund for SWM, at present, comes from the Council's general budget of which major source is the assessment tax collected from citizens.

In the view of the necessity for securing the sufficient fund for SWM and other services of the Council, the following recommendations are presented.

1) Increase of the assessment revenue through:
   - Review (increase) of the assessment rates
   - Reduction of arrear through better information system and stronger collection activity

2) Establishment of "Beneficiary-Pay-Principle" under which the following two type of fee should be collected:
   - Fee for Commercial Waste Collection Service
   - Tipping fee for disposal service

The following table shows types of SWM services and persons who should bear the costs of the services.

Table 10.2-4 Proposed Sources of Fund for SWM Service

| TYPE OF SWM SERVICES | PROPOSED SOURCES OF FUND |
|---|---|
| 1. Domestic Waste Collection | Assessment (Local Property Tax) |
| 2. Commercial Waste Collection | Fees to be collected from service recipients. |
| 3. Disposal of Waste Privately Brought into Municipal Disposal Sites | Tipping fees to be collected from the service recipients. |
| 4. Waste Collection/Haulage and Cleansing for Public Premises (Roads, Parks, Facilities, etc.) | Owners of premises |

In order to match revenue to the expected future SWM expenditures, the following has to be realized.

1) MPSP should increase the appropriation to SWM from the general budget at a rate same as the average annual growth rate of the Council's future revenue which is estimated at 4.8% in real term (6.4% in nominal term) in the Structure Plan.

2) In addition, the revenues frm both commercial waste collection fees and disposal tipping fees must increase to the extent that those revenue would cover 90% and 70% of actual costs of those services respectively in the year 2005.

The Council, at present, provides street/drain cleansing and grass cutting services for some of the state and federal roads without receiving sufficient fund for those services.

It is proposed that the State and the Federal Governments should provide the Council with sufficient funds for those services or alternatively, they should execute those services by themselves because the state and Federal Governments are responsible for the maintenance and cleansing of thir roads according to the Malaysian Laws.

The sources of the fund for SWM services in 2005 are estimated as shown below provided that the two kinds of fees are collected as proposed above.

- The Assessment will cover 87% of the SWM expense in 2005.
- Commercial waste collection fees will cover 10% of the SWM expense in 2005.
- Tipping fees will cover 3 % of the SWM expenses in 2005.

(2) Financial Sources for Investment

a. Construction Cost of Final Disposal Facilities

It is recommended that both the Federal Government and the State Government provide financial assistance (grants or low-interest-rate-loans) to cover the major portion of investment costs. This recommendation is presented in view of the following.

i. Under the existing tax system in Malaysia where the Local Authorities receive a very small portion of the aggregate tax paid by all Malaysians, the Local Authorities including MPPP and MPSP are financially not capable of undertaking large investment projects such as the construction of sanitary disposal facilities.

ii. On the other hand, the Federal Government (DOE) has recently set high standards regarding environmental quality, and requires the Local Authorities to meet such standards. With respect to waste disposal, a sanitary landfill system would be the only choice that would meet the standards. The construction of sanitary landfills, however, requires a large investment.

In view of the above situation, it is simply impossible for the Council to meet the disposal standards without having financial support from the Federal or State Government.

It is strongly hoped that the Sixth Malaysia Plan of the Federal Government will include sufficient budget for the development of sanitary disposal system and for the improvement on some other aspects of SWM in Malaysia.

b. Replacement of Collection Vehicles

The existing collection vehicles (mainly side-loaders) should be replaced with large-sized compactor vehicles in the near future in view of the long distance from collection points to the future disposal site.

It is advised that the Council will prepare sufficient budget for the timely replacement of the vehicles.

(3) Establishment of an Independent Accounting System for SWM

It is strongly recommended that the Council should establish an independent accounting system for SWM in view of the necessity to accurately identify SWM costs. An accurate identification of SWM costs is a first step for the evaluation of the efficiency and progress of SWM performance.

10.2.3 Privatization

(1) Degree of Privatization

MPSP, currently, contracts out 25 % of the collection/haulage service in terms of waste amount. The privatization ratio of the street/drain cleansing is estimated also at 25 % in view of the fact that all the contractors employed by MPSP provide street/drain cleansing service as well in their respective contract areas.

There is a great prospect for MPSP that costs of waste collection and street/drain cleansing services will be much reduced by increasing the degree of privatization in view of the large difference in the waste collection costs between the contractors and the Council itself. The Council, in 1987, spent $3.9 million for the Council's own collection and haulage of 47,300 tons of waste, that leads to the unit cost of $ 82 per ton, which is more than 200 % of the contractors's unit price (less than $ 40).

The necessity for the privatization of these services will grow in view of the future demand for the services which would definitely grow due to the following factors.

1) Increase in population

2) Increase in service coverage
   (The service coverage, at present, is about 60 % of the population. The coverage is proposed to increase to 85 % in 2005.)

3) Increase in per-capita waste generation rate

Considering the future demand for the services as well as the number of laborers who would retire, the degrees of the future privatization is proposed as follows:

Table. 10.2-5 Degree of Privatization of Waste Collection and Street/Drain Cleansing Services

| | DEGREE OF PRIVATIZATION | |
|---|---|---|
| YEAR | COLLECTION/HAULAGE (In terms of Collection Amount) | STREET/DRAIN CLEANSING (In terms of population served) |
| 1989 | 25% | 25% |
| 1995 | 56% | 50% |
| 2000 | 58% | 50% |
| 2005 | 60% | 50% |

(2) Needs for Careful Selection of Contractors and Establishment of a System for Monitoring Contractors' Performance

The current contractors' services are not satisfactory according to the MPSP's Health Department. Reasons for this may be partly attributable to a very low contract prices. In view of this situation, the following recommendations are presented.

1) MPSP should examine more carefully the experience and capability of tenderes in the selection of contractors, rather than resorting always to the lowest-tender selection principle.

2) MPSP should have a better system of monitoring contractors' performance. Such monitoring is important enough to necessitate the specialization of some public health inspectors in this job as discussed in Section 10.2.1 (1).

# Chapter 11. Proposed Arrangements for Laws, Public Education and Training

This Chapter is meant for both MPPP and MPSP.

## 11.1 Laws and Enforcement

### 11.1.1 Laws and Regulations

(1) Aspects of Solid Waste Management Which Need Legal Control

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

1) Waste storage and discharge method to be applied to households and business establishments.
2) Commercial waste collection fee and tipping fee
3) Control of toxic waste
4) Control of illegal dumping
5) Control of anti-littering

(2) Laws and Regulations Required

a. Regulations Regarding Waste Storage and Discharge

Both Public Cleansing and Safety By-Laws of MPPP, 1980 and Refuse Collection By-Laws of MPSP, 1975 stipulate general requirements to be followed by citizens regarding waste storage and discharge. It is recommended that both Councils will prepare some regulations which stipulate detailed methods to be followed by the citizens with respect to the following aspects:

1) Discharge days (to keep waste in each house until collection service day comes.)
2) Discharge time
3) Discharge location

4) Use of standard bins and plastic bags
5) Discontinuation or control of the use of dust-chute in high-rise buildings

The above items 1) to 4) are closely related to a collection system that the Councils wish to apply. Clear instructions should be given to citizens with respect to those items through delivery of campaign leaflet.

The discontinuation of the use of dust-chute (Item 5) is an important issue, which is studied by the Federal Government. This Master Plan recommends the discontinuation of dust-chute from the view point of its low collection efficiency (time-consuming), difficult maintenance and sanitation problem.

Once the discontinuation of the use of dust-chute is decided by the Councils, relevant laws and regulations should be changed accordingly.

b. Commercial Waste Collection Fee and Tipping Fee

This Master Plan recommends:
- Introduction of those fees for MPSP
- Gradual increase of those fees for MPPP

Those fees will be important source of revenue for the Councils in the future. From this view point, it is recommended that the existing regulations be revised accordingly.

c. Control of Toxic Waste

Control of toxic waste will be increasingly important in the future. Laws and regulations regarding toxic waste control should be prepared at both federal and local level. At local level, the regulations should include the following:

1) Definition of waste type not to be accepted at municipal disposal sites
2) Registration of factories which generate toxic waste
3) Registration of contractors which transport or dispose of toxic waste
4) Penalty to be applied to offenders of the toxic waste regulations

d. Control of Illegal Dumping

The necessity for control of illegal dumping will increase as the Councils wish to impose higher tipping fee. This is because the strong imposition of higher tipping fee would increase illegal dumping if the control of illegal dumping is not strongly enforced. It is recommended that the existing By-Laws should include some articles on the penalty to be applied specifically to those who committed an illegal dumping.

11.1.2 Law Enforcement

Both Councils are weak and poor in the law enforcement as has been discussed in Section 3.10. The weak enforcement is attributable to the weak attitude of the Councils' decision makers which include the Councils' Administrators and Councillors.

An important problem regarding the enforcement is that there exits some political interference by the Councillors in the administrative affairs. Such interference is very harmful to the Councils in the sense that it would not only weaken the law enforcement but also affect general morale of the Councils' executive officers.

Whether or not the Councils can strengthen the law enforcement depends entirely on the intention of the Councils' Administrators and Councillors. Their firm determination on the enforcement is much desired. It should be remembered that the strong law enforcement would serve for the interest of majority of the citizens.

## 11.2 Public Education

### 11.2.1 Objective of Public Education

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

1) Proper storage and discharge manner
2) Reducing litter in public places
3) Eliminating illegal dumping of waste
4) Resource recycling

Both Federal and Local Governments should be responsible for the public education.

### 11.2.2 Public Education by the Federal Government

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

Basic education with respect to cleanliness and health is given at primary schools in Malaysia. It is recommended that some education on waste should be given at primary or secondary school level. The solid waste education should include the following;

1) Waste and public health
2) Necessity for proper discharge and storage
3) Importance of keeping public places clean
4) Waste flow from generation to final disposal
5) Waste amount and cost
6) Waste disposal and environment
7) Importance of resource recovery (recycling)

The Municipal Council of Musashino in Tokyo Metropolitan Area has its own education programme and a text book on SWM for elementary school children. Such programme and text may be of reference to Malaysia.

### 11.2.3 Public Instructions and Education by Local Governments

Public instructions and education to be given by local governments should be the one that would help the local governments to achieve their specific improvement targets with respect to waste collection and disposal. If a local government wishes to introduce a new collection system such as a 3 times/week collection, public instructions should be given with respect to the following:

- Days of waste discharge (to keep waste inside the house until the collection day comes)
- Discharge time
- Discharge location
- Use of plastic bags and standard bins if required
- Separation of waste if required

The public instruction and education can be most effective if they are given in the form of an organized campaign. The following points are important in order to make the campaign successful.

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

2) To concentrate on one campaign zone at a time. The Councils should move to a next campaign zone only after having a reasonable success in the previous zone. (The experience of Kuantan and Petaling Jaya shows that the campaign period is at least two months for each zone.)

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

## 11.3 Training of SWM Personnel

### 11.3.1 Personnel Who Should Receive Training and Education on SWM

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

1) Top administrators or decision makers at both local and federal levels
2) SWM staff such as departmental head, public health inspectors (PHIs) and overseers
3) Drivers and workshop personnel
4) Mandors/laborers

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

### 11.3.2 Education (in broader sense) for Top Administrators and Decision Makers at Both Local and Federal Level

Many administrators and decision makers still share a view like... Solid waste management is only a matter of scavenging and dumping waste, so there are not so much systematic and scientific things needed for SWM and it is useless to spend much money on waste disposal ...

What is most needed for such top administrators and decision makers is to replace such view with a new view on SWM like:

- SWM can be improved considerably by applying more systematic approach.
- Collection and haulage costs can be reduced greatly by changing storage and collection systems.
- 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 would be solved quickly, if the above views are clearly understood by the top administrators and decision makers at both federal and local level. A kind of education to change their view is very much needed for the top administrators and decision makers.

### 11.3.3 Training and Education for SWM Staff inclusive of Departmental Heads, PHIs and Overseers

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

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

a. Collection/Haulage and Street/Drain Cleansing

1) Operation systems (kinds, characteristics, advantages and disadvantages of respective systems)
2) Measurement and evaluation of SWM service efficiency (productivity)
3) Labor management
4) Legal and law enforcement aspects
5) To organize campaign for introduction of new collection systems, etc.
6) Vehicle and equipment control and maintenance of both daily and long term nature.

b. Final Disposal and Treatment

1) Engineering knowledge regarding various types of disposal and treatment systems
2) Knowledge regarding operation of disposal and treatment systems
3) Evaluation of candidate disposal sites for selection
4) Handling of toxic waste

It is urged that both federal and local governments should take more positive role in SWM training.

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

It is recommended that the Federal Government should establish or continue, if already exist, the education/training programmes as shown below.

a. A Formal Post-Diploma Course on SWM for PHIs and Other Relevant Personnels

The Public Health Institute of Malaysia offers a 3-year diploma course for public health inspectors (PHIs). This course, however, provides very little training on solid waste management, i.e., only about 4% of the course programme in terms of lecture hours is used for the training on SWM. In view of an increasing demand for personnel specialized in SWM, it is recommended that the Federal Government should establish a formal post-diploma course on SWM for PHIs and other relevant personnels. The duration of the course may be from 6 to 12 months. Such post-diploma course should be given recognition and accorded with an appropriate status by the Federal Government to encourage PHIs and other relevant personnels to take up such course.

b. Sanitary Engineering Course at University

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

In view of the situation where graduates of the Environmental Studies of UPM have not been well received by the public sector, it is important to change the current employment and job structure in such a manner as to absorb the graduates of those courses.

c. Seminar/Workshop on SWM

Ministry of Housing and Local Government has held seminars/workshop on some topics of SWM from time to time. Such seminars/workshop should continue in the future. It is recommended that more opportunities should be provided in seminars/workshop to exchange views and discuss problems among the participants. It is also suggested that there should be some workshops for overseers.

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

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

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

- To give PHIs and overseers opportunities to visit other Local Authorities to observe their SWM systems and exchange opinions.

- On-the-job-training

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

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

It is also recommended that the Councils should provide some incentive system where persons who made good suggestions can be rewarded in some manner. Such incentive system, though lacking in most public sector establishments, is vital for revitalizing themselves.

It should be noted that effect of training would be greater if a trainee is self-motivated, and if he or she can be rewarded for active and successful use of what the trainee has acquired through the training.

### 11.3.4 Training of Drivers and Workshop Personnel

Actual economic life and operation efficiency of waste collection vehicles and other equipment depend much on the degree of maintenance of those vehicles and equipment. From this view point, the Councils should provide workshop personnel and drivers with a training on the maintenance of vehicles, preventive maintenance in particular.

### 11.3.5 Training of Laborers

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

1) Scope and manner of their job
2) Waste storage and discharge methods which citizens have to follow
3) Work safety
4) Maintenance of equipment used by laborers
5) Polite manner needed in communicating with citizens

In addition to the above-mentioned training of laborers, disciplinary control and work-morale support of laborers are very important in view of increasing the efficiency of the waste collection and street/drain services.

# Chapter 12. Phased Implementation Plan for MPPP

## 12.1 Stage Plan

### 12.1.1 Basic Policy of Stage Plan

Stepwise approach is necessary to achieve the targets of Master Plan considering the financial limitation and difficulty of obtaining public cooperation.

Phased development plan is proposed as follows in accordance with national Malaysia Plans which have a planning period of 5 years.

a. Phase I 1991 - 1995
b. Phase II 1996 - 2000
c. Phase III 2001 - 2005

Before commencement of Phase I project, immediate improvement projects, and interim measure are proposed in order to contribute to successful implementation of the Phase I project.

Table 12.1-1 shows the stage plan for MPPP reflecting the result of the feasibility study for Phase I projects described in Part II. The stage plan is prepared based on the following consideration.

a. 3 times a week/door to door collection system which has been accepted in Bayan Baru should be introduced in the whole residential area by 1995. 3 times a week/station collection should be introduced in Phase II and Phase III. Since Pantai Acheh disposal site is far from Georgetown, it is also proposed that collection vehicle should be changed to compactor vehicle.

b. Once a week street sweeping and drain cleansing in residential area with team work system will be established by 1995. These system should be continued in Phase II and Phase III periods.

c. Level 3 sanitary landfill site should be constructed at Pantai Acheh in 1991. It is proposed that level 4 sanitary landfill system should be realized in Phase II. Until 1992, solid waste will be disposed of at present and previous disposal site through mounting up method.

d. It is also proposed that an independent organization for solid waste management called as Urban Service Department which will contribute to specialization will be established in Phase I.

Table 12.1-1 Phased Plan for MPPP

| | Immediate Improvement Interim Measure | Phase I | Phase II | Phase III |
|---|---|---|---|---|
| | 1989 | 1991 | 1995 | 2001 2005 |
| 1) Collection | - Replacement of old collection vehicles<br>- Experimental operation of 3 times a weeks collection in the Bayan Baru | - To change the type of collection vehicles<br>- Introducing 3 times a week collection<br>- Plastic bag discharge<br>- Reduction of street/drain cleansing frequency | - Introduction Station collection | |
| 2) Final disposal | - Mounting-up of present and previous disposal sites<br>- Detail design of 1st phase landfill site at P.Acheh | - Construction of the third level sanitary landfill site at: <ha> <cu.m><br>P.Acheh 25.0 1,540,000 | - Forth level sanitary landfill<br><ha> <cu.m><br>58.0 3,590,000 | |
| 3) Organization<br>Manpower | | - Establishment of USD | | |
| - Collection | - 200 laborers | - 94 laborers in 1995 | | - 98 laborers in 2005 |
| - Street/drain | - 1,138 laborers | - 784 laborers in 1995 | | - 800 laborers in 2005 |
| 4) Financial plan | | | | |
| - Fee collection amount | - M$0.4 million | - M$1.4 million in 1995 | | - M$5.1 million in 2005 |
| - Annual budget | - M$18.7 million in 1987 | - M$24.0 million in 1995 | | - M$27.8 million in 2005 |
| - Investment | | - M$9.6 million | - M$24.6 million | - M$3.8 million |
| 5) Privatization | | | | |
| - Waste collection | - 310 t/d | - 410 t/d in 1995 | - 500 t/d | - 580 t/d |
| - Street/drain | - 0% | - 0% | - 0% | - 0% |

12.1.2 Storage and Collection

It is indispensable to get resident's cooperation to achieve 3 times a week/station collection which requires following discharge manner.

a. Use of Plastic bag
b. Discharge waste 3 days a week designated by the Council
c. Bring out waste and discharge at collection point (waste station) designated by the Council

Municipal Councils of Kuantan and Petaling Jaya have successfully introduced 3 times/week collection. Use of plastic bags and standard household bins are generalized in those cities.

Bringing out the waste by residents is practiced in Kampongs and some high rise buildings. Therefore, 3 times a week/station collection should be introduced based on these experience in a systematic manner.

It is also recommended that the new collection system should be introduced as a pilot project in a model area where the local conditions satisfy the criteria described in 7.2.2 and then expand to other areas. Experience gained through the pilot project will be useful in diffusing the same system to other area.

Under the condition of present service in MPPP where daily and door to door collection is provided, two pilot projects should be introduced; one for introduction of the door to door & 3 times a week collection and the other for station collection on daily basis. After that, 3 times a week/station collection will be introduced as shown in Fig. 12.1-1.

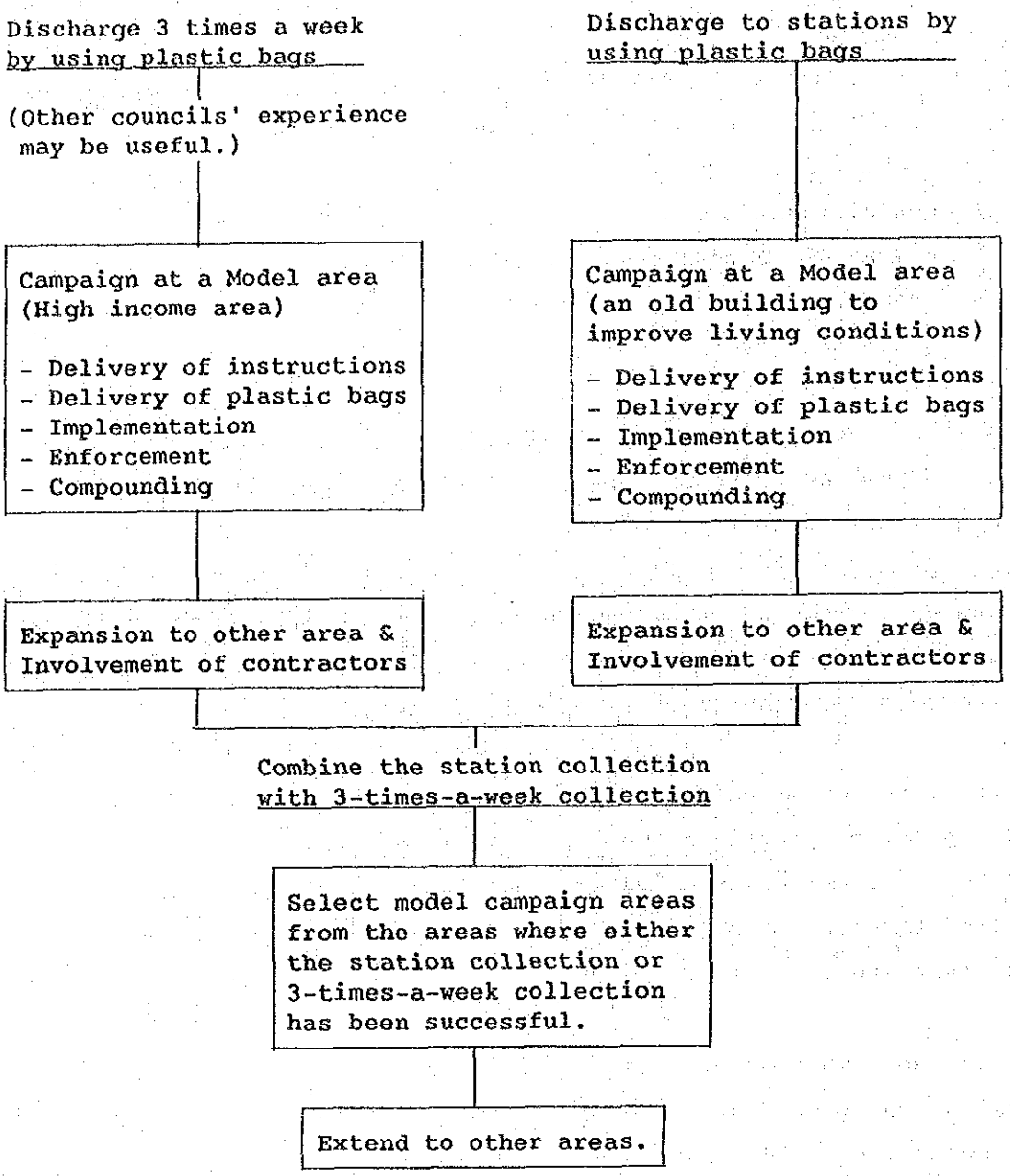



Fig. 12.1-1 Approach to the Introduction of a New Collection System

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

a. Introduction of New Collection System in Residential Area

- Introduction of 3 times/week and door-to-door collection in 50% of the residential area by 1992
- Introduction of 3 times/week and door-to-door collection in the entire residential area by 1995
- Introduction of station collection from 1995 till 2005
- Establishment of periodical bulky waste collection by 1995

b. Introduction of Compactor Vehicle

- Replacement of side loader vehicles with $10m^3$ compactors by 1992.
- Modification of collection zones for private contractors because of employment of 10 $m^3$ compactor.

c. Provision of the Services in New Developed Area

- Collection service should be provided in newly developed areas of 770 ha. by 1995 and 1,820 ha. by 2005.

12.1.3 Street Sweeping and Drain Cleansing

Citizens' cooperation is required to reduce littering of waste.

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

a. Introduction of once a week cleansing in residential area

- Introduction of once a week cleansing with team work system by 1995

b. Mechanization

- Mechanization of grass cutting
- Mechanization of street sweeping of main road

12.1.4 Final Disposal

It is unrealistic from a financial viewpoint to construct in Phase I all facilities which would meet whole disposal demand up to 2005, therefore, the master plan for the PADS will be implemented as follows:

a. Phase I

The northern section of the disposal site (25ha) will be used for landfill operation which will be completed at the end of 1996.

- Commencement of construction : beginning of 1991
- Period of landfill operation : 1992 - 1996
- Design disposal amount : 560 t/day (1996)
- Design landfill volume : 1.54 million $m^3$ (total volume between 1992 and 1996 including covering soil)

Landfill Site Area : 25 ha

b. Phase II and Phase III

The southern section of the disposal site (58ha) will be used for landfill operations which will be completed at the end of 2005.

- Commencement of construction : beginning of 1996
- Period of landfill operation : 1997 - 2005

- Design disposal amount : 770 t/day (2005)
- Design landfill volume : 3.59 million $m^3$ (total volume between 1997 and 2005 including covering soil)
- Landfill Site Area : 58 ha

Based on the above stage plan, the actual site preparation and construction of the PADS is proposed as shown in Fig. 12.1-2 and 12.1-3.

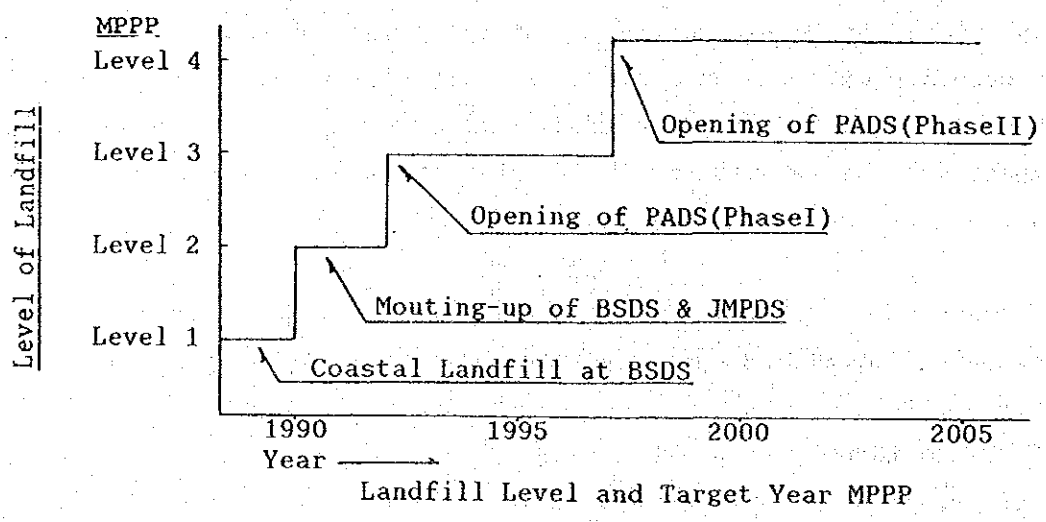
In view of the facts that the promotion of project which requires substantial investment against limited financial resources may destroy the financial basis of the Council and that the balanced development of the infrastructure (including sewage system) in addition to the solid waste management system is essential for the cost-effective preservation of a healthy environment for urban life, it has been decided that the PADS to be constructed in Phase I will be of Level 3 where the system of leachate circulation will be introduced, and that this will be improved to Level 4 in Phase II onwards. This decision is also supported by the environmental impact assessment results showing that the impact of Level 3 disposal site on the surrounding environment is minimal.

Proposed PADS is planned to be opened in year 1992. It is proposed that the following interim measures be taken until the opening of PADS.

i. Mounting up of present BSDS
ii. Mounting up of JMPDS (Jelutong Mole Previous Disposal Site)

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

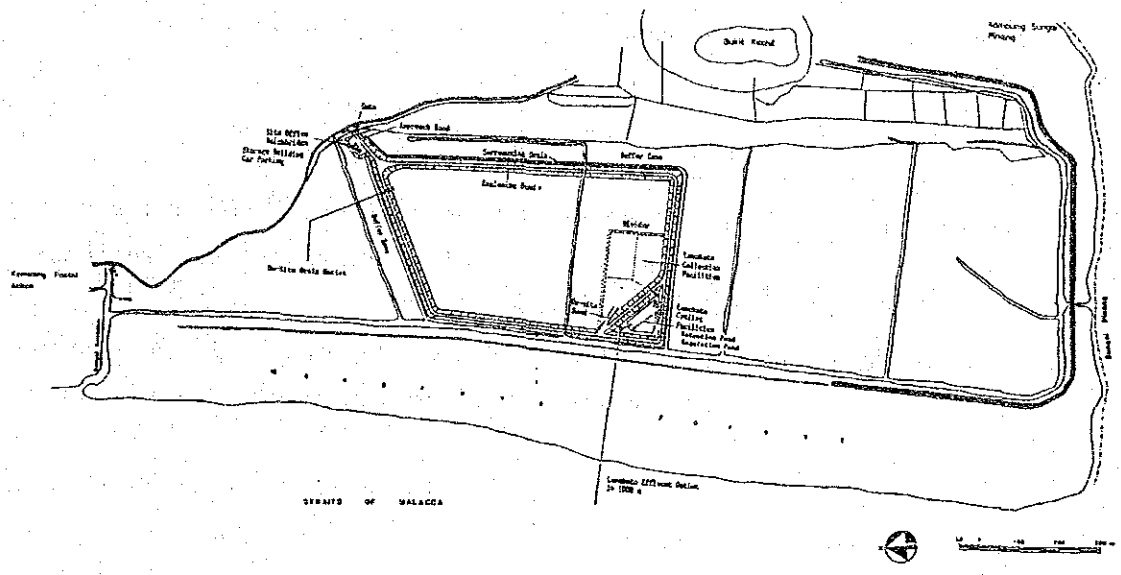
- From January 1988 to December 1991;
  Mounting-up landfill at the BSDS and the JMPDS (Level 2)
- From January 1992 to December 1996;
  Landfill at the PADS Phase I site (Level 3)
- From January 1997 to 2005;
  Landfill at the PADS Phase II and III sites (Level 4)




Landfill Level and Target Year MPPP

Fig. 12.1-2 Stage Plan of Final Disposal for MPPP

Phase I



Phase II

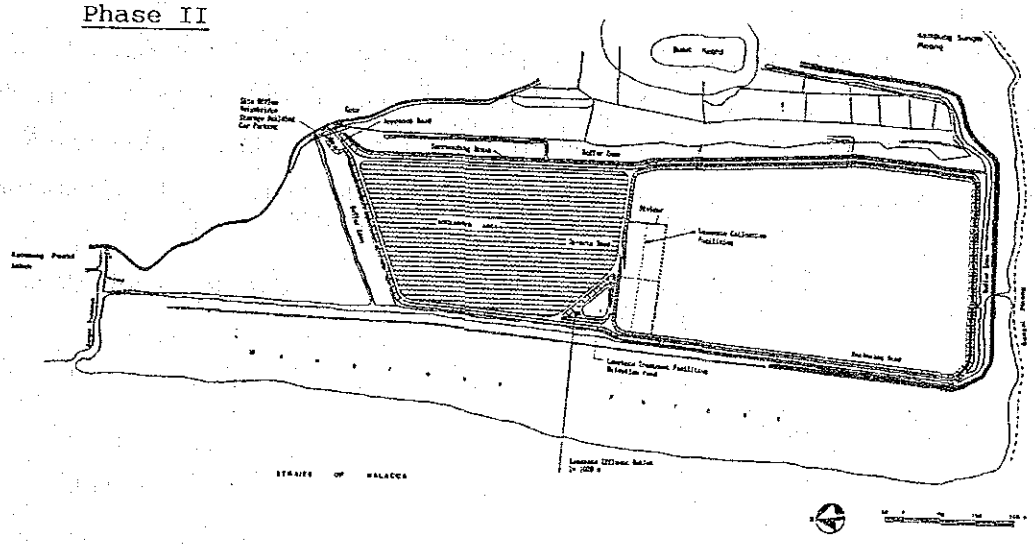


Fig. 12.1-3 Staged Development Plan for PADS

## 12.2 Financial Plan

Based on the results of the feasibility study, the financial plan for the implementation of the Master Plan is proposed in this section.

### 12.2.1 Required Fund

The investment cost and annual expenses have been estimated based upon Part II Tables 3.1-4 and 3.2-4 making the following additional assumptions:

a. An additional budget amounting to 15% of the original contruction cost may be required for engineering services and allowance for contingency.

b. Annual expenses except emolument will increase at the rate of 1.5% per year. Emolument will increase at the rate of 2.5% per year.

c. Rates of interest on long term, middle term and short term loans will be 7%, 9% and 13.5% respectively instead of 6%, 8% and 12%.

(1) Investment Cost Required

Implementation of the Master Plan requires MPPP to make a direct investment amounting to M$38.3 million during the period of 1990-2005. Another M$40 million approximately is assumed to be invested by the contractors, which will be eventually borne by MPPP through the payments to the contractors.

It is proposed that the investment will be made in three phases as shown below:

Phase I: 1991 - 1995
Phase II: 1996 - 2000
Phase III: 2001 - 2005

A phased investment schedule is proposed as shown in Table 12.2-1

Table 12.2-1 Phased Investment Schedule

(M$ million)

| | Interim Period | Phase 1 | Phase 2 | Phase 3 | Total |
|---|---|---|---|---|---|
| 1) Collection | - | 1.9 | 2.7 | 2.4 | 6.9 |
| 2) Cleansing | - | 1.5 | 1.6 | 0.8 | 3.9 |
| 3) Disposal | 0.3 | 6.2 | 20.3 | 0.7 | 27.5 |
| 4) Total | 0.3 | 9.6 | 24.6 | 3.8 | 38.3 |

Note: (1) The total investment cost excludes the amounts to be invested by contractors.
(2) Inflation is considered as shown in Item b of Section 12.2.1.
(3) It is expected that some expenditures for engineering services will be necessitated in 1990. Such expenditures are included in the above investment costs.

(2) Annual Expenses

Annual expenses comprise of annual operation/maintenance costs and annually allocated depreciation, as well as interest to be paid on loans as shown in Table 12.2-2.

Table 12.2-2 MPPP's Estimated Annual SWM Expenses

(M$ million)

| | 1987 | 1992 | 1995 | 2000 | 2005 |
|---|---|---|---|---|---|
| Management | 1.0 | 1.2 | 1.3 | 1.5 | 1.7 |
| Collection | 8.3 | 11.3 | 11.8 | 14.6 | 17.5 |
| Cleansing | 8.8 | 7.3 | 6.5 | 7.5 | 8.9 |
| Disposal | 0.6 | 1.9 | 2.1 | 4.2 | 4.8 |
| Interest on Loans | 0.0 | 0.7 | 0.5 | 0.3 | 0.2 |
| Total | 18.7 | 22.4 | 22.2 | 28.2 | 33.1 |

Note: Inflation is considered as shown in Item b of Section 12.2.1.

The SWM cost in 2005 will be 1.8 times as large as that in 1987, though the unit cost of waste collection will be reduced by the successful implementation of a 3 times/week collection system.

The reasons of increment of annual SWM expenses are as follows:

a. Introduction of sanitary landfill
b. Increase of solid waste volumes
c. Increase of personnel cost (2.5% per annum)
d. Effect of inflation (1.5% per annum)

12.2.2 Major Assumptions Used for the Financial Plan

Numerous assumptions have been made in estimating costs. This section shows some critical assumptions and other major assumptions used. MPPP would be forced to follow a different financial scenario than what is indicated in the preceding sections, if these assumptions should turn out to be inaccurate.

(1) Critical Assumptions

a. MPPP and its contractors could successfully achieve a significant reduction in the unit cost of waste collection and haulage by introducing 3 times/week collection system, even though haulage distances would be longer when a disposal site is provided at Pantai Acheh. Average unit cost of collection and haulage to Pantai Acheh could be assumed to decrease to M$50.9/ton in 1987 price under the 3 times/week collection system, while the present unit cost is M$65.7/ton under the daily collection system. (It is estimated that the unit cost will increase to about M$83/ton if MPPP continued the daily collection system, and waste were transported to Pantai Acheh.)

Note: The above future average unit costs have been estimated by dividing the projected total annual collection and haulage cost of both the Council and its contractors by the projected total annual amount of waste collected by both parties. It is assumed that the contractors' unit cost would be M$47.5/ton, while the Council's own unit cost would be M$75.4/ton, which leads to the above shown overall average cost of M$50.9/ton. This is based on the assumption that the contractors will collect and haul 90% of the total waste collected by both parties.

The above unit costs do not include emolument for overseers and personnel above overseers.

b. MPPP will also achieve a significant cost reduction in street/drain cleansing services by reducing the service frequency and reducing the number of laborers involved. MPPP's annual expenditure for this service in 1995, will decrease to M$5.4 million/year in 1987 price, which corresponds to about 61% of the 1987 expenditure of M$8.8 million. (The above expenditures do not include emolument for overseers and personnel above overseers.)

c. MPPP will increase its revenues from both commercial waste collection and tipping fees at disposal site in the future. In 1992, MPPP will recover, from the service recipients, a half of the annual expenses (a total of annual depreciation and operation/maintenance) incurred for provision of these services. Those fee revenue will gradually increase step by step in the future, and will cover 100% of the costs of services by 2005 as shown in Table 12.2-3.

Table 12.2-3 Estimation of Fee Collection (MPPP)

(in 1987 price)

| MPPP | | 1995 | 2000 | 2005 |
|---|---|---|---|---|
| Waste Amount (t/d) | - Total disposal | 539.0 | 644.3 | 770.0 |
| | : Direct haul | 69.9 | 83.5 | 100.5 |
| | : Council | 61.0 | 72.9 | 87.0 |
| | : Contractor | 408.1 | 487.9 | 582.5 |
| | - Commercial waste to be collected | 103.4 | 122.7 | 145.9 |
| Total Cost (M$1000/year) | - Disposal | 1,751 | 3,317 | 3,701 |
| | - Collection | 1,398 | 1,532 | 1,617 |
| Unit Cost (M$/ton) | - Disposal*1 | 8.9 | 14.1 | 13.2 |
| | - Collection*2 | 62.8 | 57.6 | 50.9 |
| | Total | 71.7 | 71.7 | 64.1 |
| Fee Tariff (M$/ton) | - Disposal | 6.6 | 9.9 | 13.2 |
| | - Commercial (B) | 32.1 | 48.1 | 64.1 |
| | (B/A) | (45%) | (78%) | (100%) |
| Efficiency of Fee Collection | - Tipping | 100% | 100% | 100% |
| | - Commercial waste | 100% | 100% | 100% |
| Fee Collection (M$1000/year) | - Tipping | 168 | 302 | 484 |
| | - Commercial waste | 1,211 | 2,154 | 3,414 |
| | Total | 1,379 | 2,456 | 3,898 |

*1 M$1,751,000/(539.0 t/d x 365 days) = M$ 8.9/t

*2 M$1,398,000/ (61.0 t/d x 365 days) = M$62.8/t

d. MPPP's Revenue and Budget Allocation to SWM

MPPP's revenue and budget allocation to SWM will be as shown in Table 12.2-4.

Table 12.2-4 MPPP's Revenue and Budget Allocation to SWM

(M$ 1000)

| | 1987 | 1992 | 1995 | 2000 | 2005 | Annual Increase Rate |
|---|---|---|---|---|---|---|
| MPPP's Revenue (a) | 68.9 | 94.3 | 113.5 | 154.7 | 210.4 | 6.4% |
| Allocation to SWM from the General Budget (b) | 18.7 | 22.9 | 24.0 | 25.9 | 27.8 | 1.5% |
| (b)/(a) x 100 (%) | 27.1 | 24.3 | 21.1 | 16.7 | 13.2 | |

Note: Inflation is considered.

(2) Major Assumptions Made with Respect to Loans and Other Financial Sources Available

a. Financial Sources

Different types of financial sources will be available for investments. Proportion of respective financial sources will be as shown in Table 12.2-5.

Table 12.2-5 Financial Resources for the Investment

(M$ million)

| | Interim Period | Phase 1 | Phase 2 | Phase 3 | Total |
|---|---|---|---|---|---|
| Long Term Loans | | 6.2 | - | - | 6.2 |
| Middle Term Loans | | 1.7 | - | - | 1.7 |
| MPPP Funds | 0.3 | 1.7 | 24.6 | 3.8 | 30.4 |
| Total | 0.3 | 9.6 | 24.6 | 3.8 | 38.2 |

Note: 1. MPPP Funds mean internal reserve plus short term loan.
2. Inflation is considered as shown in Item b of Section 12.2.1.

b. Conditions of the Loans

The following loan conditions are assumed.

Table 12.2-6 Loan Conditions

| | REPAYMENT SCHEDULE | INTEREST RATE REAL | NOMINAL |
|---|---|---|---|
| Long Term Loans | Repayment over 20 years with a 3 year grace period | 6% | 7.0% |
| Middle Term Loans | Repayment over 10 years with a 2 year grace period | 8% | 9.0% |
| Short Term Loans | Repayment in the following year | 12% | 13.5% |

12.2.3 Resources of Revenue

If all residents pay 1% of their annual income towards solid waste management, the annual total will amount to M$19.8 million in 2005. In addition, M$4.4 million can be expected from the commercial sector, provided that 0.3% of gross regional domestic product (GRDP) of the commercial sector is paid towards solid waste management. Similarly, M$4.5 million can also be recouped from the industrial sector on the basis of a 0.3% contribution from GRDP of the industrial sector. From the macroeconomic viewpoint, therefore, solid waste management costs can be entirely covered by the introduction of appropriate collection fees.

When the experiences of other municipalities imposing solid waste collection fees are referred to, however, many problems can be observed in the direct collection of fees from residents and, therefore, MPPP may find such fee collection difficult. It is preferable that MPPP will continue the existing indirect collection method under which the solid waste collection fee is included in the assessment rate.

In the commercial sector, the solid waste collection fee can be collected as a surcharge on the water bill, and then increased in a step by step manner in the future.

The rates of the fee should be assessed based upon the amount of waste of each waste generator.

Tipping fee should be assessed based upon the amount of waste brought into the Council's disposal site, and increased in a step by step manner.

As a method of collection of the tipping fee, a pre-paid ticket system may be suitable.

Management costs for the project considering inflation are to be born by a portion the assessment (property), fees for commercial waste collection and tipping fees for landfill, as shown in Table 12.2-7.

Table 12.2-7 Resources of SWM Budget

(M$ million)

| | 1992 | 1995 | 2000 | 2005 |
|---|---|---|---|---|
| Appropriation from Assessment revenue | 22.9 | 24.0 | 25.9 | 27.8 |
| Fee Collection | | | | |
| - Commercial Fee | 1.2 | 1.4 | 2.6 | 4.5 |
| - Tipping Fee | 0.2 | 0.2 | 0.4 | 0.6 |
| Total | 24.3 | 25.5 | 28.8 | 32.9 |

Note: Inflation is considered as shown in Item b of Section 12.2.1.

12.2.4 Cash Flow and Relevant Problems

Fig. 12.2-1 shows the cash flow for the Master Plan in current prices which clearly indicate the possibility of debt repayment completion in 2000. While the long-term loan will still remain, the internal reserve in 2005 will total M$18.7 million and the investment funds required for renewal of disposal site will be available with this internal reserve. As the balance

of payments will keep black basically, however, appropriation from ordinary revenues should be considered in 2005.

From a long-term perspective, it will be possible for MPPP to implement its solid waste management in accordance with the Master Plan. However, as MPPP has no source of investment funds for construction of disposal site under the present financial circumstances, it must secure financial assistance from the Federal and/or State Governments.

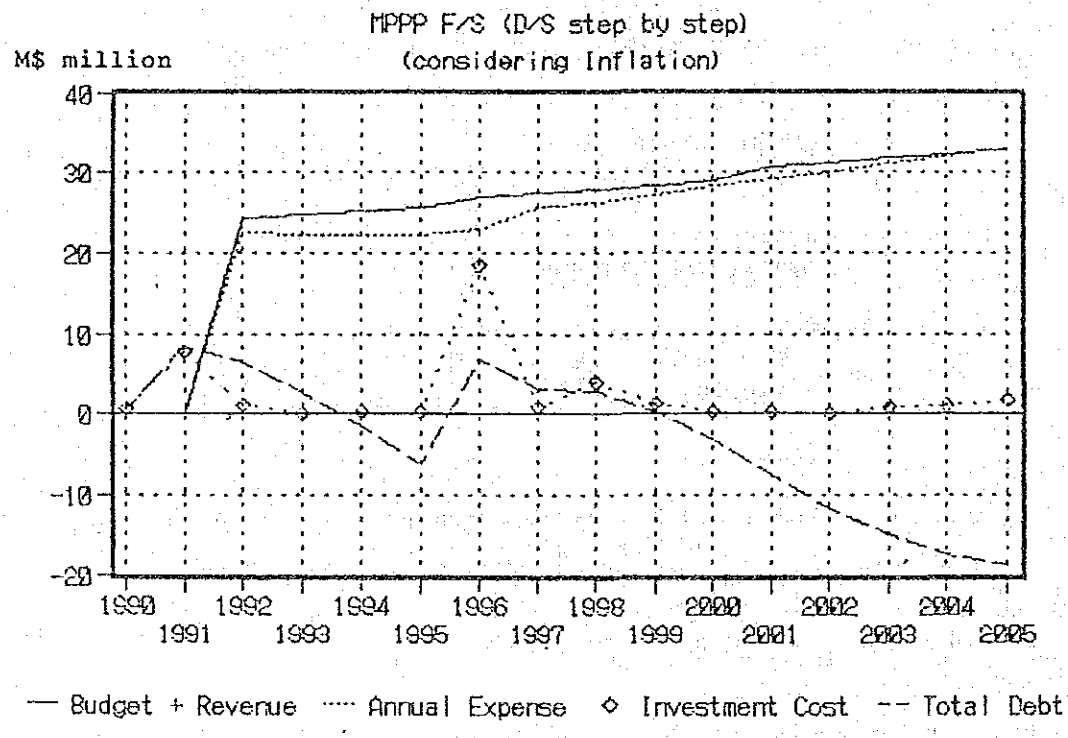



Fig. 12.2-1 Cash Flow for the MPPP Master Plan