SUMMARY

The Greater Amman, the capital city of the Hashemite Kingdom of Jordan, with a population of about 1,260 thousand people(1990) occupies an area of 520 sq. kms. In the city, the generation of the municipal solid waste (MSW) has remarkably increased, mainly with a rapid increase of the population after the wars in 1948 and 1967 followed by the Gulf Crisis. The present MSW collection trucks and equipment used in the MSW management system in the city can no longer cope with the increasing MSW, thus, resulting in leftover MSW which pollutes the environment and lowers the level of hygiene, especially in the Palestine refugees camps and other low income residential areas. In those conditions, the Government of the Hashemite Kingdom of Jordan has requested the Government of Japan Grant Aid, aiming to strengthen the insufficient vehicles and equipment used for the MSW management system.

In response to the request, the Government of Japan decided to conduct a basic design study on the "Project for Improvement of Solid Waste Management in the Greater Amman in the Hashemite Kingdom of Jordan" and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Jordan a study team from 23rd August to 21st September, 1993.

The study team held discussions with the officials concerned of the Government of Jordan and the Municipality of Greater Amman (MOGA), and conducted a field study in the study area. After that, further studies were made as for the contents of the Project, and the optimum program of the Grant Aid as well as basic design for necessary equipment were prepared as a draft report. Then, JICA sent a mission to Jordan in order to discuss the draft report, and as this result, the present report has been finalized.

MOGA consists of 20 districts. The Public Cleansing Department plays a main role in the MSW management system of the city with assistance from the Transportation Department, Heavy Duty Machine Department and Workshop Department. The District Offices conduct street sweeping and the MSW collection and supervise sanitation within the districts.

The City of Amman is located in a hilly region and has many steep sloping roads. The project areas are densely populated and have many cars and they are parked on narrow roads. In consideration of these conditions, two methods of the MSW collection are considered, that is by means of a small compaction truck system and a door-to-door handcart collecting system. The city generates about 1,065 tons of MSW per day. There are 109 collection and transportation trucks, 37 of these have been in operation for over 10 years. Repairing of these trucks is one of the major problems and the procurement of spare parts for repairing is difficult.

The final disposal site (FDS) is located 20km northeast of the central Amman, called Rusayfa. The FDS has 70ha. of land, 30ha. of which is in use as a first-term landfill. This site receives the MSW from Zarqa and other surrounding municipalities in addition to Amman. Currently, 1,500 tons of the MSW are disposed of at the site. The MSW volume is increasing annually and is expected to completely fill the site in about two years. It is necessary to begin the construction on a second-term landfill in the near future.

To finance the MSW management for MOGA, the MSW collection and disposal fees were established in 1978 and collected from each household and firms. The amount of fees collected is equivalent to about 7% of the entire income of MOGA (2.7 million JD) and covers about 60% of the total expenditures for the MSW collection and disposal.

In order to improve the MSW collection services and raise the standards of landfill operations and equipment maintenance, 61 units of equipment were requested together with the priority A to C ranked by MOGA.

As a result of this study, it was judged after reducing some requested units through the priority that the request is appropriate and the planned equipment is optimum and necessary for the following reasons:

(1) Due to the many steep and narrow roads, there is a need to improve the present door-to-door handcart collection system. This can be substituted by a sidewalk collection system using small compaction trucks. However, this kind of truck has a small loading capacity, making the MSW collection in these areas extremely efficient, but resulting in inefficient transportation on the other hand. Accordingly, there is a need to transfer the MSW into large capacity vehicles (tractors and trash trailers) at a location near the collection areas.

(2) The lack of equipment for landfilling the MSW at the FDS makes the operations unsanitary. In an effort to improve these conditions and in order to prevent environmental problems and extend the life of the FDS, there is a need to immediately increase the number of heavy duty machines.

(3) Some of the MSW collection trucks have been in operation for more than ten years and have a high rate of failure. Due to the concentration of houses, heavy traffic conditions in the project areas, road obstructions and vehicles' troubles on the roads lead to collection inefficiency and traffic jams. Therefore, it is necessary to strengthen the emergency repairing system for the troubled collection trucks on the roads.

(4) The organizations related to the MSW management have worked effectively so far. Accordingly, the introduction of new trucks and heavy duty machines will not require any immediate need for systematic or organizational changes in terms of operation, maintenance and supervision. Furthermore, the necessary technology for the operation, maintenance and supervision of the new equipment is already familiar to the relevant organizations of MOGA, and this project can be sufficiently implemented without any serious difficulty.

Based on the stated conditions relating to this project and the content of the requests, an implementation plan for the project is as follows:

(a) Implementation organization

This project is to be implemented by the Public Cleansing Department with the assistance of relevant organizations, including Workshop Department, Heavy Duty Machine Department, Transportation Department and related District Offices.

(b) Scope of the plan

1) Period of the plan : Five years from 1994 to 1998.

2) Target areas : Five districts include Nasr, Yarmouk and Abdali, which have Palestine refugees camps, and Basman, Ras Al Ain, which have many low-income residential areas. The areas and population of the target areas are shown in Table A. Rusayfa FDS is also included in this project.

Table A Target Areas for the Plan

District	Area (km^2)	Population	Note
BASMAN	15.042	168,799	
NASR	16.259	140,812	Al Hassan Camp
YARMOUK	5.989	135,003	Al Wihdat Camp
RAS AL AIN	9.875	94,789	
ABDALI	14.037	148,289	Al Hussain Camp
Total	61.202	687,692	

Note : Population figures are for 1990

3) The amount of MSW generated and disposed: The MSW volume dealt with this plan is chiefly the household waste. The estimated amount of MSW generated in a day is 779 tons. Two hundred forty tons/day of the MSW will be hauled by the small collection trucks, including 115 tons/day from the Palestine refugees camps' areas. The amount of the MSW from Amman (1,480 tons/day), Zarqa and other surrounding municipalities is about 2,000 tons/day in total and disposed at the Rusayfa FDS.

(c) Collection, transportation and landfill system

1) Collection and transportation: Priority will be put on the introduction of small compaction trucks (4 cubic meters) and the replacement of sidewalk collection system in the areas where the handcart collection system is in operation. The bulky wastes which cannot be loaded onto the small compaction trucks will be collected by the small dump trucks (2-ton). The MSW collected by these small collection trucks will be transferred to the trash trailers to haul it to the FDS.

A new transportation system will be introduced. The system consists of the transfer station, the trash trailers (30 cubic meters) and the tractors for pulling the trailers.

2) Support to the MSW cleansing operations: In the steel containers (1.1 cubic meter) placed at the MSW container station along the roads, corrosive organic waste sticks to the walls, and foul odors, harmful organisms and other environmental problems arise. As a measure to resolve those problems, a truck equipped with container cleansing system will be introduced to clean the dirty containers on the roads.

3) Landfill sanitation: A bulldozer, dozer shovel and wheel loader will be introduced as the heavy duty machines for improving the compaction of soil-covered waste, surface ground and access roads arranging as well as cover-soil gathering.

4) Support to landfill operations: A water tank lorry will be introduced as the equipment for supporting the improvement and management of the landfill operation and to wash the landfill equipment.

5) Maintenance of trucks: A mobile workshop with accessories and tools will be introduced to strengthen the function of urgent repairs needed on roads.

(d) Planned equipment

Table B shows the equipment of minimum in number and necessary for the urgent improvement based on the study results.

Table B List of Equipment

Machine	Q'ty	Specification
<Collection and transportation equipment>		
1. Small compaction truck	25	capacity: 4m³, with the trash compaction and automatic discharge mechanisms, overall width: under 2.1m, turning radius: under 5.3m
2. Tractor	4	for pulling trailer, engine output: 250 HP, with the hydraulic unit for driving the dumping function of trailer,
3. Trash trailer	8	capacity: 30m³, semi-trailer with the body without roof, with dumping mechanism
4. Small dump truck	5	loading capacity: 2 tons, loading volume: 3m³, overall width of body: under 2.1m, turning radius: under 5.3m, dumping mechanisms included.
<Cleansing supporting equipment>		
5. Container cleaning truck	1	tank capacity: 8m³ (cleaning water tank and waste water tank separated), cleaning water pressure: 70 kg/cm², with a tilting mechanism.
<Landfill disposal equipment>		
6. Bulldozer	1	flywheel output: 320 HP, angle dozer, total weight: 36 tons, blade length: 4.5m.
7. Dozer shovel	1	flywheel output: 200 HP, standard type for soil & gravel, bucket volume: 2.2m³, bucket lift: over 3.7m
8. Wheel loader	1	flywheel output: 150 HP, standard type for soil & gravel, bucket volume: 2.5m³, bucket lift: over 3.7m
<Landfill disposal supporting equipment>		
9. Water tank lorry	1	tank volume: 5m³, engine output: 160 HP, with sprinklers.
<Maintenance and control equipment>		
10. Mobile workshop car	1	engine output: 155 HP, 4 x 4 drive, equipped with a set of vehicle inspection repair tools.
11. Spare parts	1 lot	for the above equipment for 2 years

(e) Finance plan

In MOGA, presently, an accounting system of revenue and expenditure for the MSW management is not separately classified from other revenues and expenditures. Therefore, the above-mentioned deficit in the MSW management sector should probably be covered within the entire quantity of ordinary income. However, the following measures and efforts should be discussed and made in order to increase the revenue of the MSW management sector.

1) To increase the collection fees from the households by 20% in 1996 at the latest. (0.2JD monthly increase per household)

2) To increase the commercial waste collection fees and landfill fees by 5% annually beginning in 1995.

In consideration of these measures, the additional operation and maintenance costs due to the increase of equipment are not expected to greatly increase the city expenditures.

The procurement for this equipment will be executed in terms of untied bidding basis, that will take place in Japan, and the use of third-country products will be considered. The implementation schedule of the project is presented below.

After the Exchange of Notes (E/N), the schedule will be executed in the following order.

- Discussion and formulation of detailed design
- Preparation for tender documents
- Bidding

- Bid evaluation & contract
- Production schedule and quality control of equipment
- Shipping of equipment and its delivery at Amman

Japanese side shall cover the expenses related to the procurement of the equipment, as well as ocean and inland transport and insurance of the equipment, while Jordanian side shall cover the commissions to the Japanese foreign exchange bank, and the construction of transfer stations. For the operation and maintenance of the equipment, the budget for that purpose will probably need to be about 300 thousand JD (about 48 million yen) per year in the future.

The contribution by this project are as follows:

1) The MSW collection services and sanitary conditions of the environment in the densely populated areas will be improved. The population directly benefiting from this project will be about 770 thousand ordinary residents, primarily those at the low income level. This is a very significant contribution.

2) This new system of the MSW collection will serve as a model to other cities, bringing widespread results.

3) Sanitary landfill operation will be secured. The population directly benefiting from these measures will be about 1.9 million residents in Amman as well as the neighboring municipalities.

4) Securing sanitary landfill operation will alleviate the concerns of the surrounding residents with respect to the next FDS in

cooperation with stabilization by sanitation operations.

5) The strengthening of the maintenance structure will prevent a decrease in collection capacity. Furthermore, traffic jams caused by the mechanical troubles of collection trucks on the roads will be mitigated.

Accordingly, it has been judged that the equipment in the plan is appropriate in number and necessary for the urgent improvement of the MSW management in MOGA, therefore, the implementation of this project through the grant assistance cooperation of the Government of Japan is appropriate.

Meanwhile, in order to make this project and the MSW management for the whole Amman more effective, it is desirable to repair the truck scale immediately at the Rusayfa FDS, by which a system for the MSW management will increasingly be enforced, and the appropriate measures will promptly be taken for operation problems.

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CHAPTER 1 INTRODUCTION

The Greater Amman, the capital city of the Hashemite Kingdom of Jordan, with a population of about 1,260 thousand people (1990) occupies an area of 520 sq. kms. In the city the generation of the municipal solid waste (MSW) has remarkably increased, mainly with a rapid increase of the city population after the Gulf Crisis. Present vehicles and equipment used in the MSW management system in the city can no longer cope with the increasing MSW, thus, resulting in the leftover MSW pollutes the environment and lowers the level of hygiene, especially in the Palestine refugees camps and other low income residential areas. In those conditions, the Government of the Hashemite Kingdom of Jordan has made a request to the Government of Japan for grant assistance cooperation, aiming to strengthen the insufficient number of vehicles and equipment used for the MSW management system.

In response to the request, the Government of Japan decided to conduct a basic design study on the "Project for Improvement of Solid Waste Management in the Greater Amman in the Hashemite Kingdom of Jordan" and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Jordan a study team headed by Mr. Hisatoshi Okubo, First Basic Design Study Division, Grant Aid Study and Design Department, JICA and constituted by members of Environmental Technologic Consultant Co., Ltd., from 23rd August to 21st September, 1993.

The team held discussions with the officials concerned of the Government of Jordan and the Municipality of Greater Amman (MOGA), confirmed the background and contents of the request, examined the validity of the request, and prepared a suitable implementation plan and a basic design of the equipment necessary for the plan. In addition, the team compiled a draft report included informations on the background and aims of the project, suitable basic design for equipment, and the appropriateness to grant assistance cooperation.

Then, a mission headed by Mr. Naohiro Watari, Grant Aid Division, Bureau of Economic Cooperation, Ministry of Foreign Affairs, was sent to Jordan in order to discuss the draft report, and as this result, this report was finalized.

The compositions, the member list of study team, study schedule, the member list of draft report explanation mission, the member list of concerning party in Jordan, the minutes of discussions of the study team and draft report explanation mission are included in the part of appendix.

CHAPTER 2 BACKGROUND OF THE PROJECT

2.1 Background of the Project

The Greater Amman, with a population of about 1.26 million people (1990), has faced a boosted increase of the population in rapid urbanization from 1980s, particularly, as a result of considerable number of migration of refugees from Palestine in 1948 and 1967 wars, and Jordanian passport holders from Kuwait in the wake of the Gulf Crisis. The increasing rate of the population is estimated as 4.0% by MOGA.

In Amman, the increase of municipal solid waste (MSW) generation with the rapid growth of population has caused environmental and financial issues. At the present time, the MSW volume collected in the city is estimated about 1,065 tons a day, of which sources is mainly households, commercial and institutional. In 1998, the MSW volume to be collected will reach to about 1,430 tons a day.

As for the concerned agencies for the MSW management, the Public Cleansing Department which is under control of the Under Secretary Assistant for Health and Environmental Affairs in MOGA is substantially taking responsibility for the MSW management.

Other three concerned Departments, i.e., Transportation Department, Workshop Department and Heavy Duty Machine Department are in charge of the daily operation and maintenance of MSW collection and transportation trucks, and heavy duty machines for the final disposal (landfill).

The organization structure charts of MOGA and relevant departments are shown in Figures 2-1-1 - 2-1-5.

Figure 2-1-1 Organization Structure of the Greater Amman

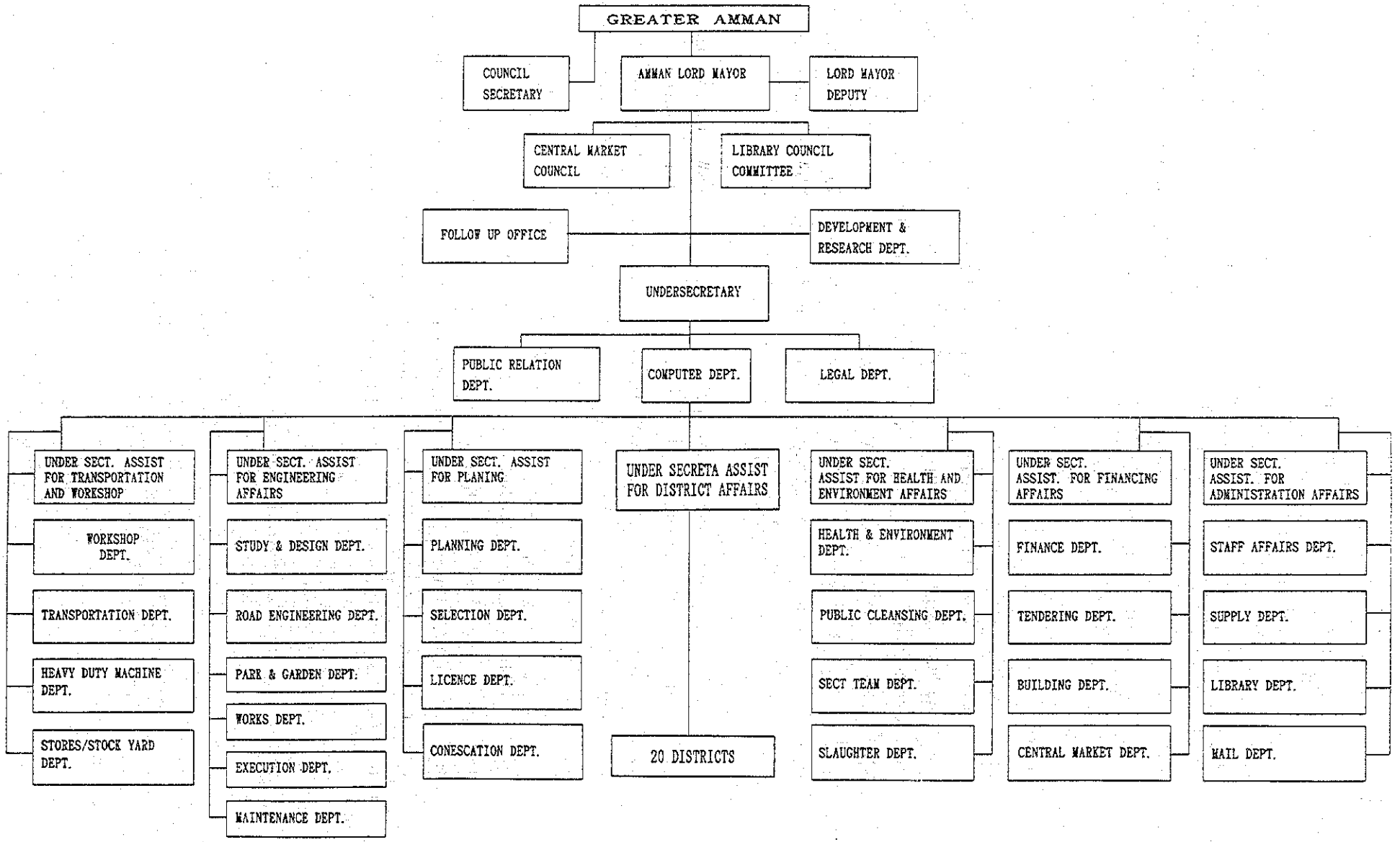


Figure 2-1-2 Organization Structure of Public Cleansing Department

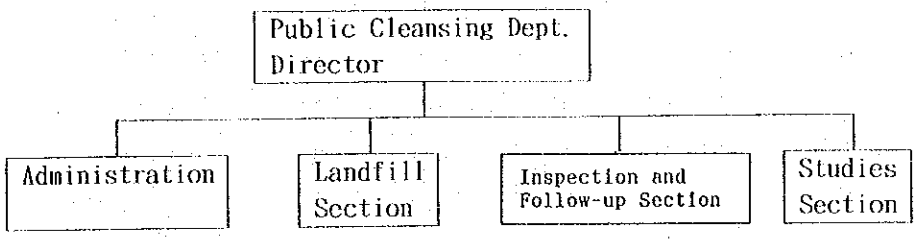


Figure 2-1-3 Organization Structure of Heavy Duty Machine Department

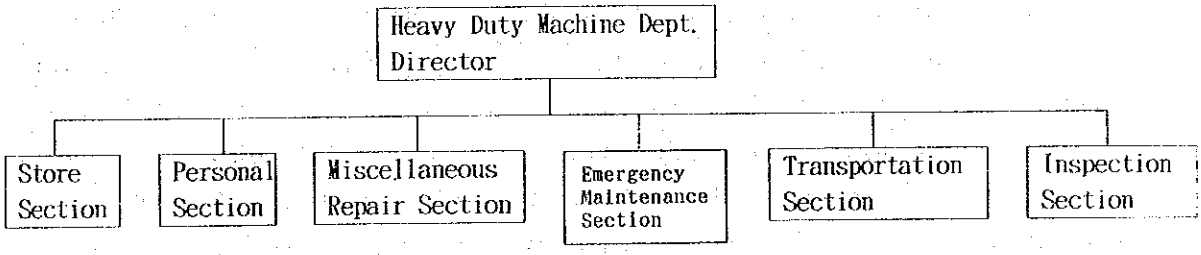


Figure 2-1-4 Organization Structure of Transportation Department

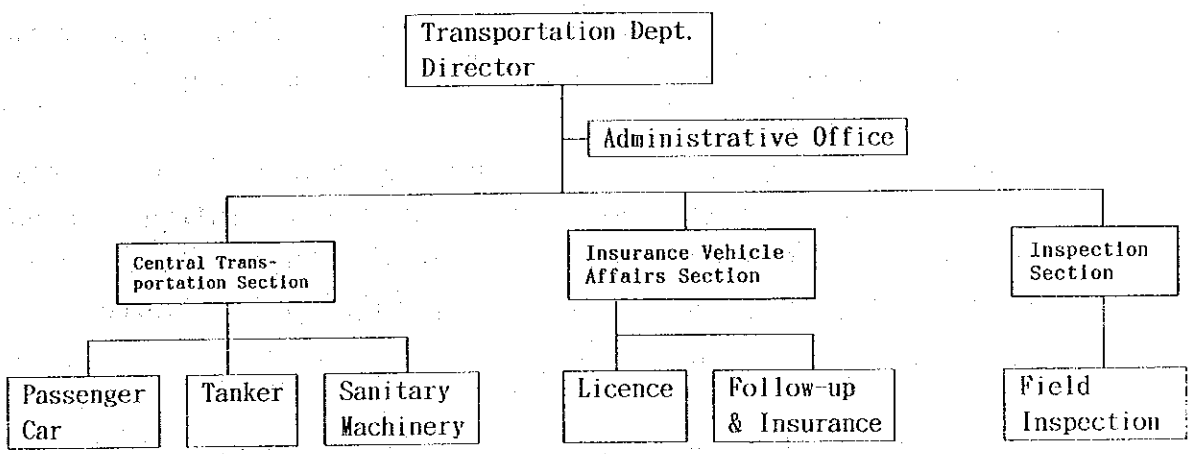
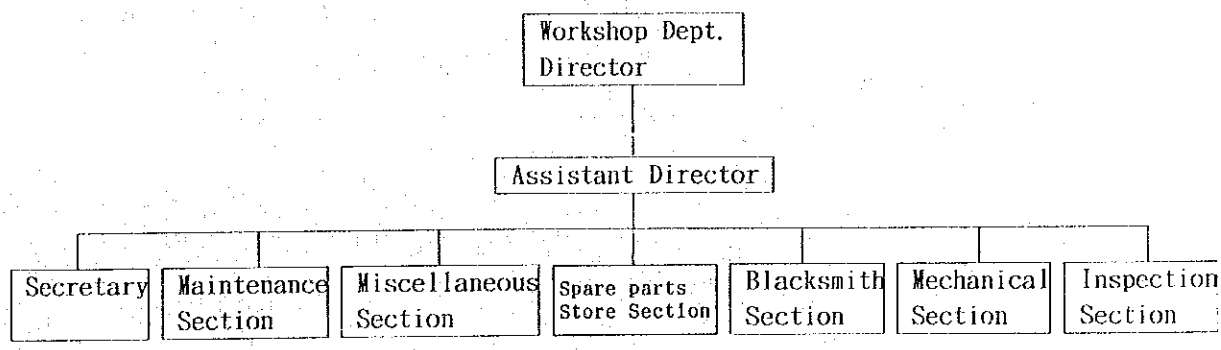


Figure 2-1-5 Organization Structure of Workshop Department



MOGA is administratively consisting of twenty districts which are executing the daily MSW management activities within their own district areas. Each district provides the laborers and performs the daily MSW collection, equipment operation and supervision for street sweeping. The Public Cleansing Department is also in charge of operating the final disposal site (FDS) in Rusayfa.

Since Amman has developed in hilly region, there are several densely populated districts, with many old houses closely built and steep narrow roads passing through. Three districts, Yarmouk, Abdali and Nasr, where Palestine refugees camps are situated. In some areas of those districts, for the MSW collection the handcarts are used. Consequently, It is very hard work, inefficiency in collection and heavy contamination with scattered waste at living regions. If the handcart collection system can be replaced with a small truck collection system, it will surely improve the above disagreeable circumstances.

The MSW collection trucks owned by MOGA are not only insufficient in quantity but also in quality. Thirty seven of total 109 collection trucks have been used for more than 10 years, exceeding its service life, as shown in Table 2-1-1.

Table 2-1-1 Number of Trucks Corresponding to Number of Years of Operation

Number of operated years (1993=0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Number of trucks	-	7	20	-	-	3	2	40	-	3	1	7	20	-	6	109

The collected MSW in Amman is transported to the FDS in Rusayfa, almost 20 kms from the city center, and disposed of at the site. Because of a lack of the heavy duty machines, disposal operation does not satisfy a sanitary landfilling method. Considering the increasing of the MSW generation additionally and in order to minimize potential environmental degradation problems, strong measures should be taken by strengthening the present number and quality of heavy duty machines used for landfill operation.

A Master Plan of the MSW management in Jordan was elaborated by the Higher Council for Science and Technology (HCST) as a part of "the Science and Technology Policies and Strategies in the Environment Sector" published in January 1993, However, any concrete Project has not been implemented yet for Amman. The draft of Jordan Environment Act was formulated in October 1992 and the Act is scheduled to be in force in the near future, and after that, many subjects should be studied for improving environmental issues.

2.2 Outline of the Request

In Amman, the rapid increase in population as mentioned in the chapter 2-1 and the increase in economic activity caused by this influx have resulted in a rapid and dramatic increase in the amount of the MSW generated. Population is densely concentrated in the low income areas including the Palestine refugees camps, where roads are narrow. The narrow roads make the MSW collection using handcarts necessary, that is an extremely inefficient system. Large amounts of the leftover MSW have had a negative effect in regards to the hygiene and environment of the areas. As these areas are located in the city center, a large attention has been paid on the social issues. The Government of the Hashemite Kingdom of Jordan has requested the grant assistance cooperation from the Government of Japan for the procurement of the equipment necessary for promoting the environmental hygiene improvement plan of

Amman.

The list of the requested equipment is the result of the discussion concerning the contents of the previous request of March 1993, and is shown in Table 2-2-1.

Table 2-2-1 Items Requested by the Jordanian Side

ITEM	QUANTITY	PRIORITY
1. Compaction truck (4 m^3)	25	A
2. Cleansing container truck (8 -10m^3)	2	A
3. Tractor (250 HP)	4	A
4. Trash trailer (30 m^3)	8	A
5. Bulldozer (320 HP)	1	A
6. Dozer shovel (200 HP)	2	A
7. Wheel loader (150 HP)	2	A
8. Mobile workshop with accessories and tools	2	A
9. Small dump truck (2 ton)	5	B
10. Mini-loader (30 HP)	2	B
11. Water tank (5 m^3)	1	B
12. Fuel tank (5 m^3)	1	B
13. Jet tank (8 -10m^3)	2	C
14. Sweeper (5 m^3)	1	C
15. Sweeper (2 - 3 m^3)	1	C
16. Motorgrader (150 HP)	1	C
17. Excavator (150 HP)	1	C
18. Spare parts for all equipment		A - C

2.3 Outline of the Project Area

MOGA consists of 20 districts as shown in Figure 2-3-1. The Public Cleansing Department plays a central role in the MSW management system of MOGA with management assistance from the Transportation Department, Heavy Duty machine Department and Workshop Department. The District Offices conduct street sweeping and the MSW collection and supervise sanitation within the district. The roles of the relevant organizations are shown in Table 2-3-1, and Table 2-3-2 shows the area, population, MSW collectors, containers and vehicles for each of the districts of the city.

Table 2-3-1 Roles of the MSW Management Organizations

a. Public Cleansing Department
   . Planning and supervision of street sweeping and the MSW collecting activities of each district.
   . Collection and analysis of data for the necessary equipment and operation plans.
   . Improvement and technical guidance related to equipment and final disposal site (FDS).
   . Efficiency improvement and standardization of cleansing operations.
   . Education on sanitation and the environment.
   . Planning and operation of FDS.

b. Workshop Department
   . Maintenance, repair and renewal of equipment for cleansing and transportation.

c. Transportation Department
   . Supervision and operation of vehicles (District Offices supervise the operation of MSW collection trucks).
   . A total of 518 units are owned (collection trucks, buses and others).

d. Heavy Duty Machine Department
   . Supervision, operation, maintenance, repair and renewal of bulldozers and other equipment.
   . A total of 497 units are owned (heavy duty machines for the landfill, excavation and other purposes)

e. District Offices
   . Operation and control of street sweeping, the MSW collection and collection trucks.
   . Inspections of sanitation and health hazard.

Fig. 2-3-1 The Greater Amman and the Project Area

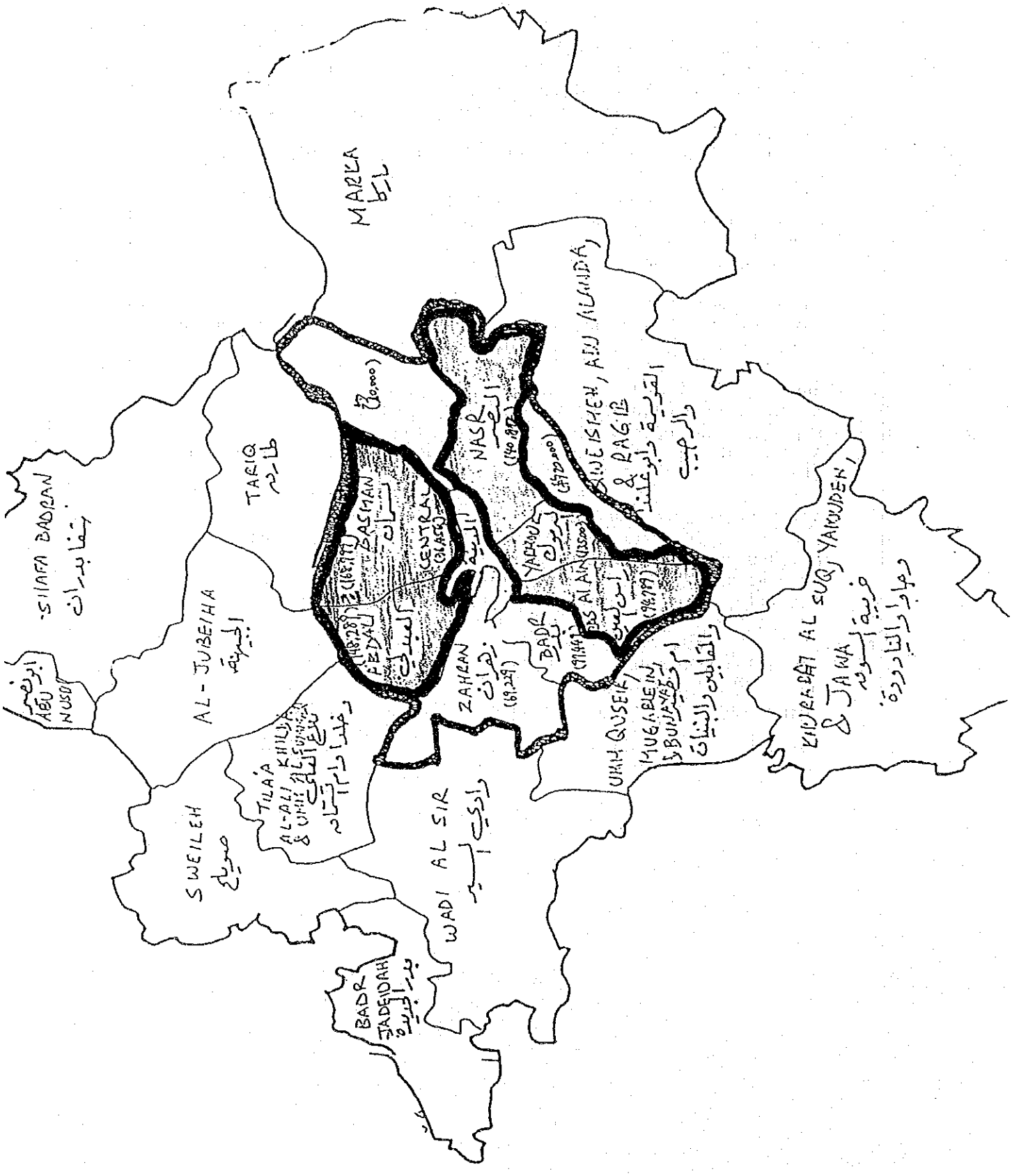


Table 2-3-2 Areas, Populations, Collect Workers and Collecting Equipment by District of the Greater Amman

District	Area km²	Population (1990)	Collect worker	Container	Vehicle	
1. CITY CENTER	2,716	36,456	334	236	5	
2. BASMAN *	15,042	168,799	247	474	5	
3. MARKA	100,315	70,519	146	440	3	
4. NASR *	16,259	140,812	222	374	5	Al Hassan Camp
5. YARMOUK	5,989	135,003	214	300	5	Al Wihdat Camp
6. RAS AL AIN *	9,875	94,789	168	252	4	
7. BADR	5,776	97,449	140	320	4	
8. ZAHRAN	13,749	69,229	175	444	5	
9. ABDALI *	14,037	148,289	267	400	6	Al Hussein Camp
10. TARIQ	22,617	14,160	54	209	1	
11. QWEISMEH	61,037	50,774	102	276	4	ABU ALANDA & RAGIB
12. KHURAYBAT AL SUQ	51,067	21,430	81	178	1	JAWA & YADOUDEH
13. UMM QUSEIR	24,061	9,738	45	143	2	MUQABLEIN & BUNAYAT
14. WADI AL SIR	39,793	62,822	126	479	5	
15. NEW BADR	16,399	5,721	14	56	1	
16. SWEILEH	23,977	47,066	112	277	3	
17. TILA'A AL ALI	17,316	28,365	97	269	4	UMM AL SUMMAQ & KHILDA
18. JUBEIHA	28,041	31,209	89	267	3	
19. SHAFA BADRAN	45,313	5,118	20	97	1	
20. ABU NUSEIR	6,573	24,238	46	109	1	
Total	520,442	1,261,986	2,699	5,600	68+Hoist, etc 13=81	

Note : [*] indicates the project area.

The Government of Jordan set the MSW collection and disposal fee system in 1978 and fees are collected from each household and trash generating firms. The fees is collected together with electric bills. The collected figure amounts to approximately 7% (2.7 million JD) of the total income of MOGA, covering 60% of the total expenses related to MSW collection disposal.

- MSW collection and disposal fee

  Household: A collection fee of 1 JD (160yen) per month per family.

  Stores and firms: A collection fee of 20% of the amount of the business permit (minimum of 12 JD per annum) and a disposal fee of 1 JD (for private sector and other municipalities) per ton of wastes transported to the FDS.

The amount of MSW is estimated on the basis of the data collected in surveys made in 1984 and 1986, because the truck scale installed at the FDS is out of order. The amount of MSW is estimated at 1,065 tons per day for the whole Amman including 580 tons per day in the five districts targeted in this project.

CHAPTER 3 OUTLINE OF THE PROJECT

3.1 Objective

This project is directed at the low income residential areas, including the Palestine refugees camps, in which narrow roads cause inefficient MSW collection and the leftover MSW leads to a worsening of the environment and hygiene of the region. Because the area is situated in the center of the city, this is likely to be a major social issue. This project forms the core of the MSW management plan of MOGA which has been set down to cope with the issues. In those conditions the Jordan has made a request to Japan for grant aid, aiming to strengthen the insufficient vehicles and equipment used for the MSW management system.

The objectives of this study are to confirm the background and content of the request, to examine the validity of the request, and to prepare a suitable implementation plan and a basic design of the equipment necessary for the plan.

3.2 Study and examination on the request

3.2.1 Appropriateness and necessity of the project

(1) Service improvement of the MSW collection and transportation

At the present, the MSW is put into plastic containers (120 lit or 240 lit) or steel containers ($1.1m^3$), from which the MSW is loaded on collection trucks and hauled to the FDS. Those trucks are large and the containers are located on the side of wide roads. In areas where roads are narrow, the collecting laborers carry the discharged MSW by handcarts (one or three-wheeled) from each house to the container station. At the place where a lot of the MSW is generated such as shopping centers, large containers

($10m^3$) are placed which are used by the container lift trucks. This system using large trucks is inefficient in the areas of narrow spaces with densely populated like the refugees camps and low income residentials, remaining a lot of uncollected waste. This causes adverse effects of the health and the environment. Hence, improvement of the MSW collection service is an eminent necessity.

In the areas of narrow spaces, the sidewalk collection system using small collection trucks should be introduced. Small trucks, however, will degrade efficiency in transportation to the FDS because of their small loading capacity. Hence, the MSW should be transferred onto large capacity vehicles at a place near the collection area.

(2) Upgrading of the MSW final disposal site operation

The Rusayfa FDS, presently operated by MOGA, is located in the place easy to access from a highway. Therefore, people sometimes come close to the site, and the site easily draws their attention to the environmental contamination with insufficient landfilling operation.

Aquifer is likely to be structured with lime stone lies at the level of 30 to 40 meters depth, but as the bottom base of the site is covered with impermeable clay-silt layer horizontally, there is few possibility of groundwater contamination by the leachate flow from the landfilled waste.

Foul odor emission comes from the exposed and insufficiently covered waste and from various industrial wastes disposed being mixed with the MSW. This is attracting public concerns more than groundwater contamination. Therefore, it will be more

important to prevent the foul odor emission.

The heavy duty machines available are very limited in numbers as shown below;

. Trash Compactor (310HP- 200HP)	Total 5	4 : Operable 1 : Non-Operable
. Bulldozer (200HP)	Total 2	1 : Operable 1 : Non-Operable
. Dozer Shovel (200HP)	Total 1	1 : under-repair
. Dump Truck ($12m^3$)	Total 5	: Operable

At present, all operable heavy duty machines at the FDS are almost fully working. For instance, 4 trash compactors are always too busy for spreading the heaps of the MSW unloaded from the collection trucks, and have no time to compact the waste spreaded out there effectively. Only one bulldozer is fully occupied for earth moving work at the cover-soil digging place which is several hundred meters away from the actual landfilling site.

Under those circumstances, due to the insufficient compaction effect of the landfilled waste and soil-covered layer, the limited landfill space has been consumed lavishly, and the effect of sanitary landfill has been considerably reduced.

Therefore, first of all, it is urgently requested to increase numbers of heavy duty machines, by which the sanitary landfilling and site space-saving will be realized.

Consequently, the increase of the heavy duty machines will be an appropriate plan. It will improve the deficiency of the current landfill operation and upgrade environmental conditions.

(3) Improvement of equipment maintenance and control

Workshop Department and Heavy Duty Machine Department undertake maintenance and control of the transportation equipment and the heavy duty machines respectively. With several shops other than the main workshop, Workshop Department maintains and repairs the MSW collection trucks as well as other vehicles, i.e. pick-ups, passenger cars owned by MOGA. Heavy Duty Machine Department maintains and repairs MOGA-owned heavy duty machines for civil works and the FDS. The system is provided for the heavy duty machines for the FDS to be urgently repaired on the site.

The maintenance system and the control of spare parts are also provided. No serious problem remains, supposedly, in repairing whereas some parts are hard to procure for the trucks operated more than 10 years. As shown in Table 2-1-1 (Chapter 2-1), trucks operated for many years are increasing and accordingly mechanical troubles on the road occur frequently.

Since the city is crowded with houses and traffics, truck failures on the road are causing traffic jams. Hence, the system for on-road repair should be improved.

3.2.2 Study and examination on the project implementation and operation

(1) Institutional aspect and personnel

When the project is implemented and, thereby, new collection trucks and heavy duty machines are supplied to MOGA, the operation and maintenance of which can be achieved without any major modification on the present institutional frame.

It is because that four Municipal Departments including the Public Cleansing Department and 20 District Offices concerned in the cleansing services of MOGA, have been satisfying their duties without any serious difficulty until now from the institutional view point. They will be able to manage to operate and maintain the newly procured equipment properly. Tasks corresponding to the new equipment will be allotted to all concerned municipal organizations just in the present same manner for job allotment, as shown in Table 3-2-1.

Table 3-2-1 Job Allotment for the New Equipment

	Planning	Control of distribution	Operation	Maintenance
Trucks (compact. dump, etc) Tractor & Trailer	PCD	TD	DO	WD
Heavy duty machine for Landfill	PCD	HMD	PCD	HMD/PCD
Fuel and water lorry	PCD	TD	PCD	WD

Abbreviation: PCD: Public Cleansing Dept., WD: Workshop Dept.
TD: Transportation Dept., DO: District Office
HMD: Heavy Duty Machine Dept.

However, it is necessary for the concerned Departments to increase the number of people to comply with the increased duties. As for the MSW collection trucks and transportation equipment, Transportation Department which has already 110 drivers, must recruit other 40 new drivers for the increased job.

For heavy duty machines for landfill operation other 5 operators including bulldozer drivers should be employed in addition to 8 operators working on the FDS

presently. Those incremental operators are considered well securable.

For the maintenance work required for the equipment to be increased, it is certain that present working people and facilities in the Workshop Department, with increasing 4 repair-workers, can take good care of the maintenance.

With the consideration described above, it will be quite feasible to accomplish this project successfully without any critical issues for operation and maintenance when this project is implemented.

(2) Technological aspect

The Technologies necessary to operate and maintain the collection trucks and heavy duty machines to be procured are already well known among MOGA people concerned. Thus, there is no doubt that equipment operation and maintenance required for the project will be satisfactorily carried out with existing technologies.

When a new transfer station system is introduced, it may cause some complications in the MSW system. To cope with the above possible situation, it is necessary for the management staff to gain integrated management technique to control the whole system efficiently.

Furthermore, at the FDS, people's work load may fluctuate more intensely with the controlling the large sized trash trailers joining in the transportation system to accomplish a better sanitary landfill. Consequently they have to improve the equipment control method at the field work so that they can cope with above issues.

Fortunately, there is a good practices to exchange information and technology with foreign countries among the technical staffs working for MSW management in MOGA. We believe, judging from it, that they have enough capabilities to overcome the issues in such ways as pointed out above.

(3) Budget

Revenue and expenditure of MOGA are shown in Table 3-3-2. Main revenues of MOGA are consisting of the subsidies from the government taxes (i.e., 35% of property tax, 20% of custom duty and etc.,), and the city's own license fees and cleansing service fees. The government grant was provided until 1990 but terminated in 1991.

On the other hand, expenditures consist of current expenditure and capital expenditure, the later is larger than the former. Although the revenue and expenditure were once roughly balanced in 1992, the expenditure is always in excess of the revenue in other years.

Table 3-2-2 Revenue and Expenditure

(unit : JD)

(Unit: JA)

	1989	1990	1991	1992	1993 (Budget)
Revenue					
a) Subsidy from Government	9,641,597	10,100,388	12,283,203	16,699,928	17,300,000
b) City's license fees	7,700,350	8,194,536	9,426,663	11,927,062	11,000,000
c) Toll and etc.	1,440,986	1,367,842	2,410,306	2,316,670	2,150,000
d) Cleansing service fees	2,105,223	2,071,082	2,443,789	2,590,346	2,670,000
e) Government grant	2,140,000	1,500,000	0	0	0
f) Other revenue (Entrance fees etc.)	1,225,271	1,653,350	2,431,476	3,926,113	3,900,000
Sub total	24,282,930	24,884,198	29,045,437	37,460,119	37,020,000
Expenditure					
a) Current expenditure	13,774,913	14,042,236	14,658,170	17,511,385	21,504,500
b) Capital expenditure	15,298,682	18,650,780	20,036,495	19,401,318	37,027,256
Sub total	29,073,595	32,693,016	34,694,665	36,912,703	58,531,756
Surplus/Deficit	-4,790,665	-7,808,818	-5,649,228	+547,416	-21,511,756

When the project is implemented, the necessary increment of the city's current expenditure to cover direct cost of equipment operation and maintenance is estimated as JD 300,000 to 400,000 a year, being equivalent to 1.4 to 1.9% of the current expenditure and 11% to 15% of cleansing service fees of 1993 budget.

The increment seems to be a considerable burden for the city's finance. However, this is not a high hurdle for the project implementation if the AM makes all possible efforts for increasing revenues and reducing expenditures as mentioned below;

(a) to rise the MSW collection fee for generators of the large quantity of MSW such as stores, business offices, and hotels,

(b) to rise the disposal fee of industrial solid wastes handled by the generators,

(c) to save labor cost by introduction of an enlarged mechanization in the MSW collection system.

As to the civil construction of the transfer stations, the expenses should be paid from a capital fund.

3.2.3 Relation to similar projects and assistance by international institutions

The master plan by HCST have been prepared, as mentioned in the Chapter 2-1, however, the implementation schedule is not established yet financially. Since there are no international assistance plans at the present, this project constitutes no duplication with any other projects.

3.2.4 Project components

This project aims at upgrading the MSW disposal capacity and improving the environment and the health conditions by supplementing the MSW collection and transportation equipment for densely populated areas and the landfill equipment used at the FDS. Improvement of the environment and the health conditions in the objective areas is effectuated by eliminating the problems in the relating aspects such as noxious insect and foul odor from the leftover MSW. The project also intends to reinforce the present work systems for sanitary landfill at the FDS.

This improvement project is consisted of the components shown in Table 3-2-3. Equipment procurement and the system for implementation and operation are important for each factor.

Table 3-2-3 Factors and Objective Equipment of this Project

Components	Objective equipment
<Service improvement of collection and transportation>	
1. Strengthening of the MSW collection and transportation	(a) Small compaction truck (4m³) (b) Tractor (250 HP) and trash trailer (30m³) (c) Small dump truck (2 tons)
2. Strengthening the support of cleansing operation	(a) Cleansing container truck (8-10m³) (b) Mini-loader (30 HP) (c) Jet tank lorry (Vacuum lorry) (8-10m³) (d) Road sweeper (5m³, 2-3m³)
<Upgrading of landfill disposal>	
3. Strengthening of landfill disposal	(a) Bulldozer (320 HP) (b) Dozer shovel (200 HP) (c) Wheel loader (150 HP) (d) Motor grader (150 HP) (e) Excavator (150 HP)
4. Strengthening the support for the FDS operations	(a) Water tank lorry (5m³) (b)Fuel tank lorry (5m³)
<Improvement of equipment maintenance>	
5. Strengthening of truck repairs	(a) Mobile workshop car

3.2.5 Study and examination of equipment

(1) Strengthening of the MSW collection and transportation

The equipment listed below is requested for the MSW collection and transportation;

(a) Small compaction truck : 4m³ (Priority A)
(b) Tractor (250 HP) and trash trailer : 30m³ (Priority A)
(c) Small dump truck : 2 ton (Priority B)

Each equipment is studied below.

(a) Small compaction truck ($4m^3$)

The roads in the Palestine refugees camps and low-income residential areas targeted by this project are narrow and many areas cannot be reached by the $15m^3$ compaction trucks presently used by MOGA. Much of the MSW collection is carried out by handcarts, which are inefficient due to the many hills in the area and cause problems related to hygiene. The small compaction truck introduced in this project is vital to improve sanitation and the collection process. A small $4m^3$ compaction truck with a small turning radius is ideally suited for efficient and hygienic collection on crowded and narrow streets and will markedly increase the efficiency of the collection and transportation system when used in conjunction with the tractor trailer outlined later in this report.

(b) Tractor (250 HP) and trash trailer ($30m^3$)

The trash trailers and tractors are necessary for effective haulage of the MSW that is collected by small trucks and then transferred onto large-scale trailers in the collection areas. For transfer works in the residential areas, it is important to adopt a system in which the MSW collected by small trucks are directly re-loaded on a large trailer without any stagnation of the MSW and save transferring space. Hence, the combination of the trash trailer which can store the MSW temporarily and the tractor which drives the trailer quickly to the FDS is considered most suitable.

At the transfer station, the difference in height of platforms is utilized in transferring the MSW from small trucks to the trailers. It is that the trash trailer is set at the lower platform for receiving the MSW and small trucks unload the collected MSW from the upper platform.

(c) Small dump truck (2 tons)

The small compaction truck cannot load bulky wastes such as garden trees and furniture because it receives the MSW through a small hopper and pushes them in. Hence, the small dump truck is necessary to carry those large wastes.

(2) Strengthening the support of cleansing operation

The equipment listed below is requested for supporting cleansing tasks:

(a) Cleansing container truck : 8-10m^3 (Priority A)
(b) Mini-loader : 30 HP (Priority B)
(c) Jet tank lorry (Vacuum lorry) : 8-10m^3 (Priority C)
(d) Road sweeper : 2-3m^3, 5m^3 (Priority C)

Each equipment is studied below.

(a) Cleansing container truck (8-10m^3)

The container cleansing truck washes away the residues, sticking on the 1.1m^3 steel containers that store the MSW temporarily until collection. The total 5,600 containers are installed all over the city and 1,800 out of them are in the project areas. The containers are necessary even after introducing the sidewalk collection system using small compaction trucks. Presently, only one container cleansing truck is owned for the whole

area of the city. This number reduces frequency of cleansing so as to cause health problems such as foul odor and noxious insect generation in densely populated areas. To solve these problems, cleansing structure should be strengthened.

(b) Mini-loader (30HP)

The mini-loader picks up and loads the MSW, which have been scattered on the ground during transfer works from the small trucks to the large trailer at the transfer stations.

Such scattered MSW are feared to generate foul odor and noxious insects when left as it is, since the transfer stations are located near the residential area. But, an introduction of the mini-loaders is not considered to be urgently necessary because the MSW scattering can be almost perfectly prevented by installation of the shooter, complete control of the transfer work, and picking it up with the small trucks at the starting and/or finishing of the working hour.

(c) Jet tank lorry (Vacuum lorry) (8-10m^3)

In the project areas, residential areas are located on slopes of hills with the street draining facilities. Dusts and soil clogging the drain discharge port are removed manually at the present. The vacuum lorry has been requested to remove soil and sludge, and to open the piping system. Therefore, it is recommendable to turn the manpower that has become excessive by introduction of the small collection trucks to maintain manholes, and to use a existing jet tank lorry for opening the piping system. Thus, the vacuum lorry is not considered to be urgently necessary for this

project.

(d) Road sweeper (2-3m³, 5m³)

The road sweepers are aimed at mechanizing road sweeping. The large sweeper has been requested to clean trunk roads and the small one to clean small town roads. But, in the project areas, cleaning efficiency with the road sweepers cannot be so high because houses are dense and a lot of cars park on roadsides in all the time. The road sweeping should recommendably be executed by using the excessive manpower mentioned in the previous paragraph. Hence, introduction of the road sweepers is not considered to be urgently necessary for this project.

(3) Strengthening of landfill disposal

The machines listed below are requested as the heavy duty machines:

(a) Bulldozer	: 320 HP	(Priority A)
(b) Dozer shovels	: 200 HP	(Priority A)
(c) Wheel loaders	: 150 HP	(Priority A)
(d) Motor grader	: 150 HP	(Priority C)
(e) Excavator	: 150 HP	(Priority C)

These machines improve the defects of works described in the section 3-2-1. The bulldozer and the dozer shovels are used to cover the MSW with soil and compact the soil-covered MSW, and the existing trash compactors are used exclusively for compaction works. The wheel loaders are used for loading the cover-soil onto trucks as well as arranging the landfilling areas making use of their mobility. The motor grader has been requested to use for arranging the surface of soil-covered landfill area and the access roads. But,

quantity of this sort of work is not so large and the bulldozer blade can be used for this purpose. These works should be included in the duty of the bulldozer. Thus, introduction of the motor grader is judged to be not urgently necessary. The excavator has been requested for digging ditches and loading soil onto dump trucks. But, this sort of work can be available with machines in MOGA. Hence, introduction of the excavator is judged to be not urgently necessary.

(4) Strengthening the support of the FDS operations

In order to support landfill operation, following vehicles are requested;

(a) Water tank lorry : 5m^3 (Priority B)
(b) Fuel tank lorry : 5m^3 (Priority B)

The water tank lorry with sprinkler is used for spraying water over the landfill work place and the access roads as well as carrying utility water in the FDS for washing the equipment. The request is considered appropriate.

The fuel tank lorry carries fuel from the central fuel tank of MOGA to the fuel tank in the FDS. The fuel can be procured from private fuel stations in urgent need and the fuel tank lorry is not considered to be immediately necessary.

(5) Strengthening of truck repairs

The following equipment cars is requested for truck repairs:

(a) Mobile workshop with accessories and tools (Priority A)

The mobile workshop is provided with the tools and jigs for inspection and repairs required to repair urgently trucks that have become out of order on roads. A considerable portion of the MSW collection and transportation trucks is becoming so aged, as shown in Table 3-1-1, as to cause troubles frequently on roads. Such a trouble evolves to traffic jams, and lowers the MSW collection efficiency. These trucks are necessary to eliminate such problems. Hence, this request is appropriate.

3.2.6 Necessity of technical assistance

The persons concerned of cleansing service in MOGA have sufficient knowledge and experiences on the operation and maintenance of the MSW collection and transportation equipment and the landfill disposal, requiring little external technical assistance. The relating people have believingly sufficient potential to elaborate their own control system gradually when the necessary equipment is arranged.

3.2.7 Basic policy for the project implementation

As described above, this project is clearly appropriate and necessary, and no significant issues are found in the execution and operation systems supporting the project and in the technical bases. It is judged appropriate for the Japanese Government to implement this grant aid assistance project. Under this presumption, the contents of the project are described and the basic designs are made hereunder.

3.3 Project Description

3.3.1 Execution agency and operational structure

(1) Execution agency

This project improves the MSW management system of general wastes, discharged mainly from households, in Amman. As described in the Chapter 2-1, the Public Cleansing Department plays a central role in the MSW management system with management assistances from Maintenance Department, Heavy Duty Machine Department and Transportation Department and District Offices. The present cleansing-related organizations are almost satisfactorily functioning.

Accordingly, the total execution agency of this project should be Public Cleansing Department, in cooperation with their Departments of Maintenance, Heavy Duty Machine and Transportation, and the relevant District Offices.

(2) Operational structure

This project can be implemented with the present organizations given with the necessary personnel increase described before. The operational structure with those organizations are shown in Table 3-3-1.

Table 3-3-1 Operational structure

	Collection, transportation & road sweeping	Landfill operation
Planning & control	PCD	PCD
Equipment control	TD	HMD
Operation	DO	PCD
Implementation Supervision	PCD	PCD
Equipment maintenance	WD	HMD

Abbreviation = PCD: Public Cleansing Dept., TD: Transportation Dept.
HMD: Heavy Duty Machine Dept.,
WD = Workshop Dept., DO: District Office

3.3.2 Plan of the project operation

(1) Period of the plan

This plan is provided for five years from 1994, in which the contents of the project and the basic design of the equipment are determined based on the data for 1998.

(2) Target area

This plan improves the collection service in the areas of adverse environment and health conditions caused by the leftover MSW due to the inefficient MSW collection, especially in the Palestine refugees camps and other low income residential areas.

Amman is consisted of 20 districts as described in the previous Chapter 2-3. Table 2-2-1 indicates that population and houses are dense in the Older Amman, the centre of the city. Particularly, in the five districts; Nasr, Yarmouk and Abdali Districts which

include the Palestine refugees camps, and Basman and Ras Al Ain Districts where low income people live; health environment is so bad as to require urgently upgrading the MSW collection service level. These districts should duly be the subject of this project. Table 3-3-2 shows the areas and the population of those districts. Ruseifa FDS is also included in the project.

Table 3-3-2 Target Areas for the Plan

District	Area (km^2)	Population	Note
BASMAN	15.042	168,799	
NASR	16.259	140,812	Al Hassan Camp
YARMOUK	5.989	135,003	Al Wihdat Camp
RAS AL AIN	9.875	94,789	
ABDALI	14.037	148,289	Al Hussain Camp
Total	61.202	687,692	

Note : Population figures are for 1990

(3) MSW generation quantity

The objective wastes are the MSW chiefly generated in household, excluding other types of waste such as industrial wastes and special wastes like medicals. The MSW generation quantity is estimated by the generation rate per capitation, calculated based on the data of the past censes (in 1984 and 1986) as the unit. Estimating based on the unit, the quantity in the project areas, five districts is 580 tons/day, approx. 55% of the total quantity of 1,065 tons/day in the whole Amman.

The quantity will be 1,430 tons/day in the city including 779 tons/day in the objective districts in 1998 assuming an annual growth rate of population of 4%. Future estimations of the population and the generation quantity are given in Tables 3-3-3 and 3-3-4

respectively.

Table 3-3-3 Population at Present and Future Estimation

(Population growth rate : 4% annually)

	1990	1993	1994	1995	1996	1997	1998
YARMOUK	135,003	151,860	157,934	164,252	170,822	177,655	184,761
ABDALI	148,289	166,805	173,477	180,416	187,633	195,138	202,944
NASR	140,812	158,394	164,730	171,319	178,172	185,299	192,711
BASMAN	168,799	189,876	197,471	205,370	213,585	222,128	213,013
RAS AL AIN	94,789	106,624	110,889	115,325	119,937	124,785	129,724
Total in the project areas	687,692	773,559	804,682	836,682	870,149	904,886	941,153
Total in the whole Amman	1,261,986	1,419,563	1,476,345	1,535,399	1,596,815	1,660,687	1,727,115

Table 3-3-4 MSW Generation Quantity at Present and Future Estimation

MSW generation rate (kg/cap/day)	1993 0.750	1994 0.765	1995 0.780	1996 0.796	1997 0.812	1998 0.828
YARMOUK	114	121	128	136	144	153
ABDALI	125	132	141	149	151	168
NASR	119	126	134	141	151	160
BASMAN	142	151	160	170	180	191
RAS AL AIN	80	85	90	96	101	107
Total in the project areas	580	615	653	693	735	779
Total in the whole Amman	1,065	1,129	1,198	1,271	1,348	1,430

The contents of the quantity in the project areas, 779 tons/day (1998), are as listed below:

Morning collection(80%) : 623 tons/day
- narrow road collected wastes : 225 tons/day
  (including 115 tons/day from the refugee camps)
- bulky wastes in narrow spaces : 15 tons/day

- collected by the present system : 383 tons/day

Evening collection (20%) : 156 tons/day

(4) Collection and transportation plan

With regard to the collection and transportation, this project basically reinforces the system presently operated by MOGA in the aspect of function. The sole factor added to the current system is the transfer stations.

At the present, the collection and transportation operation is being carried out in the areas (the five districts) using the two systems described below together:

- To haul the wastes collected with a 15m^3 compaction truck via containers(1.1m^3 steel containers and 120-240 l plastic containers) placed on wide roads (i.e. curb-side collection) to the FDS with the same truck
- As the system for the areas of dense population and narrow roads, to haul the wastes collected at each home by handcarts, to the FDS with container hoist trucks. The containers are 10m^3 steel containers and placed at the MSW container stations for temporary storing

The compaction trucks allocated to this system are 25, and the container hoist trucks are 9. More truck allocation is impossible unless curtailing services to other districts.

This project proposes as follows;

- To introduce the small compaction trucks mainly to the areas where wastes are collected at the homes with handcarts such as the Palestine refugees camps and low income areas, and to switch to sidewalk

collection system instead of door-to-door handcarts collection system

- To collect the bulky wastes, which cannot be loaded on the small compaction truck, with the small dump truck
- To newly install transfer stations, where the wastes collected by small compaction trucks and small dump trucks are transferred to large capacity trash trailer in order to carry the wastes to the FDS
- To collect wastes by the present system in the areas with wide roads allowing passage of the large vehicle ($15m^3$) and the living areas above stairs inhibiting passage of vehicles

(5) Transfer station plan

This plan introduces the transfer station where the MSW are gathered into large batches and the new transportation system consisted of the trash trailer ($30m^3$) and the tractor. The objective wastes of the tractor and trailer should be those collected by the small collection trucks with sidewalk collection system.

(6) Cleaning service supporting plan

The containers ($1.1m^3$) installed at the MSW container stations on the street side are dirty with corrosive, organic waste sticking thereon. Such waste causes problems of environmental pollution such as foul odor and noxious insect generations. As measures to solve this problem, this plan introduces a cleansing container truck to wash containers effectively on the road.

(7) Final disposal plan

The FDS of MOGA, Ruseifa FDS, receives wastes from other cities and factories besides MOGA wastes. The ratio of MOGA wastes to the whole is estimated approx. 70%.

At present 300 to 350 trucks as an average haul wastes daily, the number of trucks is nearing to 100 per hour in peak time (10:30 to 12:30 a.m.) on Saturday. The quantity of wastes landfilled everyday is approx. 2,200m^3 as an average, and the volume of cover-soil required is estimated 330m^3.

This project introduces the heavy duty machines listed below to reinforce soil digging, soil covering and compacting works, which are only imperfectly conducted at present.

- Bulldozer
- Dozer shovel
- Wheel loader

And, the following lorry is introduced to support operation of the FDS for improving the environment at the site.

- Water tank lorry with sprinkler

(8) Equipment maintenance plan

The equipment increased by this project should be maintained by the existing organizations and system. Additionally, a mobile workshop truck should be introduced to meet the need for reinforcing capacity of urgent repair on road since collection trucks operated for many years are increasing.

(9) Organization and personnel

Operation and maintenance of the increased equipment should be executed by the existing organization, and the operators and maintenance personnel for the increased trucks and heavy duty machines should be additionally employed by MOGA.

(10) Sharing of cost burdening

The procurement cost for the increased trucks and heavy duty machines included in the project described above, should be expected to be burdened by the Japanese grant aid, and the cost for the construction of transfer station and increased personal expense should be burdened by MOGA.

3.3.3 Outline of the planned equipment

The equipment included in the contents of the project, the previous section, are summarized in Table 3-3-5.

Table 3-3-5 List of the Planned Equipment

Planned work	Equipment
1. Strengthening of the MSW collection - Sidewalk collection - Bulky waste collection	 - Small compaction truck (4m³) - Small dump truck (2 tons)
2. Strengthening the support of cleansing operation - Washing containers on roadside	 - Cleansing container truck (8m³)
3. Strengthening of landfill disposal - Covering the MSW with soil - Landfilled ground compaction & arrangement - Access road arrangement - Soil digging and pilling up - Soil loading on truck - Site arrangement	 - Dozer shovel (200HP) - Bulldozer (320HP) - Bulldozer (320HP) - Dozer shovel (200HP) - Wheel loader (150HP) - Wheel loader (150HP)
4. Strengthening the support for the FDS operation - Water supply to the FDS - Water spraying for dust prevention and compaction	 - Water tank lorry (5m³) - Water tank lorry (5m³)
5. Strengthening of truck repairs - Urgent repair of failed trucks on road	- Mobile workshop car with accessories and tools

3.3.4 Financial plan for the project

(1) Revenue and expenditure for the MSW management of MOGA

In the present the accounting system of MOGA, revenue and expenditure for the MSW management are not separately classified from other revenues and expenditures. Therefore, a precise financial analysis on the revenue and expenditure for the MSW management was almost impossible in a short time study. The past revenue and expenditure, however, can be roughly guessed based on the limitted data obtained from the Financial Department as shown in Table 3-3-6. It

should be noticed that the Table 3-3-6 does not include the personnel expenses of street cleansing works and manual collection services due to the lack of data.

Table 3-3-6 Revenue and Expenditure for the MSW management (Unit:JD)

Year	1990	1991	1992	1993
1. Revenue MSW collection fees from household	1,600,413	1,725,597	1,782,487	1,800,000
(rate to previous year)	(-)	(+ 8%)	(+ 3%)	(+ 1%)
MSW fees from firms	459,805	586,498	653,589	700,000
(rate to previous year)	(-)	(+ 28%)	(+ 11%)	(+ 7%)
Landfill fees	0	147,944	116,409	150,000
(rate to previous year)	(-)	(-)	(- 21%)	(+ 29%)
Sales of trash container	10,864	33,750	37,861	20,000
(rate to previous year)	(-)	(+210%)	(+ 12%)	(- 47%)
Sub-total	2,071,082	2,493,789	2,590,346	2,670,000
(rate to previous year)	(-)	(+ 20%)	(+ 4%)	(+ 3%)
2. Expenditure				
Heavy Duty Machine Dept.	-	-	130,300	289,000
Workshop Dept.	-	-	806,500	806,800
Public Cleaning Dept.	-	-	67,700	65,400
Transportation Dept.	-	-	146,200	248,000
Sub-total			1,150,700	1,409,200
3. Surplus/Deficit			1,569,946	+1,549,800

Notes : The expenditures of each concerned Department is assumed to be
1)10% for Heavy Duty Machine Dept.
2)20% for Transportation Dept.
3)70% for Workshop Dept.
4)100% for Public Cleansing Dept.

According to Table 3-3-6 the balance of the account is, JD 1,569,946 surplus in 1992 and JD 1,549,800 surplus in 1993 (budget). However, as mentioned previously, this personnel expense of street cleansing works and manual collection services done by each district are omitted from the expenses. If above personnel expense were roughly guessed as JD2,268,000 a year for around 2,700 laborers, the balance would be deficit in revenue, of JD 698,060 in 1992 and of JD 718,200 in 1993.

MOGA has suffered from continuous deficit because the city had to manage to raise capital expenditure from the current revenue. It may be easily imagined that the past deficits have been a real burden on the city finance.

(2) Operation and maintenance costs for the increased equipment

Expected cost as an increment of the operation and maintenance expenditure, corresponding to the equipment of this plan, is shown in Table 3-3-7 (assuming operation of the equipment will start in 1995).

Table 3-3-7 Expenditures for the Operation and Maintenance Cost of the Planned Equipment

(unit : JD)

	Quantity	1995	1996	1997	1998
Personnel Cost					
Supervisor	3	6,500	7,200	7,900	8,700
Driver	49	85,000	93,300	102,500	113,000
Laborer	42	48,800	53,600	58,900	64,900
(Sub total	(-)	(140,300)	(154,100)	(169,300)	(186,600)
Fuel Cost	860 kl	108,900	119,800	131,500	145,000
Maintenance Cost	48 units	54,400	59,800	65,700	72,400
Total	-	303,600	333,700	366,500	404,500

Notes: 1) Assumed 10% of cost escalation a year based on the cost in 1993
2) Equipment maintenance cost is estimated from the records of Workshop Dept.

(3) Expected Revenue and Expenses

A provable revenue and expenditure for the MSW management from 1995 to 1998 are estimated on the basis of Table 3-3-7, as shown in Table 3-3-8.

Table 3-3-8 Estimated Revenues and Expenditures for the MSW management sector

(Unit:JD)

	1995	1996	1997	1998
1. Revenues				
MSW collection fees from household	1,948,000	2,016,000	2,106,000	2,196,000
Commercial waste collection fees	924,000	1,064,000	1,225,000	1,407,000
Landfill fees	198,000	228,000	262,500	301,500
Sale of container	20,000	20,000	20,000	20,000
(Sub-total)	(3,090,000)	(3,328,000)	(3,613,500)	(3,924,500)
2. Expenditures				
Present expenditures for MSW Management	1,705,100	1,874,200	2,057,400	2,268,800
Present expenditures for Laborer	2,744,000	3,016,000	3,311,000	3,651,000
Operation/ Maintenance	303,600	333,750	366,500	404,500
(Sub-total)	(4,752,700)	(5,223,950)	(5,734,900)	(6,324,300)
3. Surplus or Deficit	-1,662,700	-1,895,950	-2,121,400	-2,399,800
Ratio of shortage in revenues	54%	60%	59%	61%

Notes: 1) Assumed 4% a year of an increase of population
2) Assumed 15% a year of an increase of revenue from firms
3) Assumed the same as above for landfill fees

(4) Financial Consideration

As mentioned previously, every Department of MOGA who is engaged in public services, is not operated on an independent account system. Therefore, it may safely be assumed that the deficit originated in the cleansing services can be compensated from the total revenue of MOGA.

It is recommended that, however, the Departments concerned in cleansing service take following measures to increase the revenue from cleansing services and, as a result, to diminish dependence on other revenues which might be a precious source for capital investment.,

1) To increase the collection fees from the households by 20% in 1996 at the latest. (0.2 JD/month/household fee increase)
2) To increase the commercial waste collection fees and landfill fees by 5% annually beginning in 1995.

If those measures are duly taken, the increment costs to operate and maintain the new equipment supplied by the project would not be a financial burden for MOGA.

3.4 Technical Cooperation

Most of the systems of organization and scheme, and the technical bases relating to the MSW services are well arranged, suggesting little need for technical assistance. But, the site works and its control skills are not necessarily well settled. Such techniques and skills should be settled in the future for the purpose of more effective and efficient operation and control. The actions in this respect will be considered in the future since this does not require so much urgency.

CHAPTER 4 BASIC DESIGN

4.1 Design Policy

Setting down of specifications of the equipment in this project considers natural conditions, social conditions, technical bases and procurement conditions in Amman, particularly the following points:

(1) Collection and transportation trucks should be suitable for road conditions in the low income residential areas of MOGA.
(2) Equipment vender should have an agent at least in Amman, which is able to afford a good after-service.
(3) Equipment does not require special high level training for the operators and maintenance technicians.

4.2 Equipment for MSW Collection and Transportation

4.2.1 Design criteria

(1) Quantity and quality of the MSW

In the MSW quantity of 779 tons/day (refer to Table 3-3-4), the figures listed below will be hauled by each designated truck or trailer from the specific area.

- The MSW quantity of 225 t/day will be hauled by the 4m^3 compaction trucks from the areas with narrow roads.

- The bulky waste quantity of 15 t/day will be hauled by the 2-ton small dump trucks from the areas consist of narrow spaces.

- The MSW quantity of 240 t/day will be hauled by the 30m^3 capacity trailers.

The MSW quality is shown in Table 2-2-5, its specific weight is not constant, because it depends on the waste's physical characteristics. Hence the following are assumed:

- The bulk density of MSW compressed by the small compaction truck: 0.55t/m³
- The bulk density of bulky waste loaded on the truck: 0.26t/m³
- The bulk density of MSW loaded on the trailer after reloaded from the small compaction truck: 0.44 t/m³

The number of containers to be cleaned by the cleansing trucks are 1,800; and each container will be cleaned twice a month.

- The number of containers to be cleaned every day: 120/day

(2) Loading quantity

The design adopts a loading factor of 90% to the equipment's capacity.

(3) Work schedule

The MSW in the project areas is storaged in unspecified containers of the habitants and collected in scheduled time and along specified routes. The working time of one shift is eight(8) hours from 7:00 to 15:00 for the small compaction trucks. The collection trips are five(5) per shift for a compaction truck and six(6) for a dump truck. As for tractor and trailer, the eight(8) hours from 8:00 to 16:00 for one shift. The working time of the cleansing truck per shift is also the eight(8) hours from 8:00 to 16:00.

(4) Operation ratio of the equipment is 90%.

4.2.2 Specification

(1) Collection trucks (small compaction truck and small dump truck)

The project areas include the densely populated areas which refugees camps, where the roads are mostly narrow and sometimes blinded for which only small trucks are available to pass. The width of the truck for these areas should be less than 2.1m and of which turning radius should be less than 5.3m.

The roads are generally narrow and often not separated into the footpath and the car lane. Thus, the collection truck should be so designed that MSW are loaded from the rear side of the truck. In these areas, the curb-side collection that uses the standard container is hard to be executed because the roads are not often provided with sufficient space to put the container in and, consequently, people have to carry the MSW in bags and/or small receptacles at the time when the collection truck arrives at the spot and directly load them onto the truck. Hence, the loading port should be less than 1.0m above the ground, and a mechanism to feed the loaded MSW automatically to the inside is indispensable.

The collection truck should be provided with a compaction mechanism for raising a loading efficiency because there is a lot of compressible wastes and some MSW are packed loosely in corrugated boxes. The small compaction truck will prevent the health conditions of the areas from adverse effects because its bed is totally enclosed type.

The dump truck for the bulky waste is open without a cover and, hence, should be closed with a covering

sheet. Since the height of the bed with a volume of 33 should be less than 1.6m above the ground.

The fundamental specifications for the collection trucks should be as enumerated below considering the conditions mentioned hitherto.

<Small compaction truck>

- Overall width of the body: 2.1m or less
- Minimum turning radius: 5.3m or less
- Loading capacity: 4.0m³
- Compacting mechanism: press plate or rotary drum method
- Loading port: rear of the body, 1.0m or less above the ground
- Discharging method: automatic push out or tipping

<Small dump truck>

- Overall width of the body: 2.1m or less
- Minimum turning radius: 5.3m or less
- Loading capacity (weight and volume): 2.0 tons, 3m³
- Discharging method: tipping

(2) Transportation equipment(tractor and trash trailer)

Transportation is carried out with the trash trailer and the tractor which pulls the trailer to the FDS and returns to the next trailer so as to continue pulling operation.

The trailer plays the role of receiving the small lots of compacted MSW (4m³) at the transfer station, collected by the small collection trucks and carrying them to the FDS in a large lot. In this sense, the larger the trailer's capacity, the higher the efficiency, but the longer the waiting time at the

transfer station and the less flexible in operation. Considering these factors comprehensibly, a suitable trailer capacity is examined by 30m³, which is equivalent 7 to 8 collecting trucks.

The tractor should be provided with sufficient capability to pull the trash trailer.

The transfer station should be provided with such function that the collecting truck on the stepped platform drops the MSW and the trailer under the platform directly receives it, in this way the transfer method could be the simplest and minimum area required. For this purpose, the trash trailer should be open upward without a cover, the loaded MSW has to be covered with a covering sheet.

The trash trailer type should be a semi-trailer type with simple construction requiring no complicated operation. It should be provided with a dumping mechanism discharging the MSW automatically at the FDS, therefor the hydraulic unit to drive the mechanism should be mounted on the tractor.

(3) Cleansing container truck

The corrosive organic trash sticking on the containers on roads has to be cleaned on the road sanitarily and efficiently. The cleansing method should be washed out with pressurized water(approx. 70kg/m²). Hence, the cleansing truck should be provided with a tank containing the waste water after washing to keep the road clean.

And the truck should be provided with a lifting mechanism and water blowing equipment for cleaning the container at inclined state in the the hopper of truck.

Capacity of the cleansing water tank should be over $5m^3$, and the waste water tank over $3m^3$.

4.2.3 Number of equipment required

(1) Small compaction truck ($4m^3$)

The necessary number of the trucks is calculated for the MSW quantity collected on footpaths in the project area, 225 t/day. An operation ratio of 90% and a loading factor of 90% are assumed.

- Loading weight per truck:
  $4m^3 \times 0.9 \times 0.55$ t/m^3 = 2.0 t/truck
- Necessary number of trucks:
  225 t/day ÷ 2.0 t/truck ÷ 5 trips/day ÷ 0.9
  = 25

Hence, the necessary number of the small compaction trucks is 25.

(2) Small dump truck (2 tons)

The necessary number of the trucks is calculated for the quantity of the bulky waste in the objective areas. An operation ratio of 90% and a loading factor of 75% are assumed.

- Loading weight per truck:
  $3m^3 \times 0.75 \times 0.26$ t/m^3 = 0.6 t/truck
- Necessary number of trucks:
  15 t/day ÷ 0.6 t/truck ÷ 6 trips/day ÷ 0.9
  = 4.6

Hence, the necessary number of the small dump trucks is five(5).

(3) Tractor and trash trailer ($30m^3$)

The necessary number of the trailers is calculated for the total daily transportation quantity, 240 t. An operation ratio of 90% and a loading factor of 90% are assumed.

- Loading weight per trailer:
  $30m^3$ x 0.9 x 0.4 t/m^3 = 10.8 t/trailer
  Two(2) transfer stations are planned. For each,
- MSW to be dealt by a transfer:
  240 t/day ÷ 2 ÷ 7 hr = 17.1 t/hr
- Loading time per trailer:
  10.8 t/trailer ÷ 17.1 t/hr = 0.6 hr = 36 min
- Cycle time of the trailer:
  loading (36) + coupling (2) + running (30) + discharging(5) + returning (30) + waiting (30) = 133 min
- Number of trips per day:
  7 hr x 60 min ÷ 133 = 3
- Necessary number of the trailers:
  240 t/day ÷ 10.8 t/trailer ÷ 3 trips/day ÷ 0.9 = 8.2

Hence, the necessary number of the trailers ($30m^3$) is eight(8).

Next, number of the tractor with the assumption of 90% as an operation ratio is calculated.

- Cycle time of the tractor:
  coupling (2) + running (30) + discharging (5) + returning (30) = 67 min
- Number of trips per day:
  7 hr x 60 min ÷ 67 min = 6.3
- Necessary number of the tractors:
  8 trailers x 3 trips ÷ 6.3 trips ÷ 0.9 = 4.2

Hence, the necessary number of the tractors is four(4).

(4) Cleansing container truck

Necessary number of cleansing container trucks is calculated for the containers to be cleaned daily in the project areas, 120. Operating time is estimated from the present working record: three(3) hours for water charging/ discharging and running, and four(4) hours for cleansing. An operation ratio of 90% is assumed.

- Cleansing time per container: 2.5 min
- Daily cleansing capacity:
  4 hr x 60 min ÷ 2.5 min = 96 containers
- Necessary number of the trucks:
  120 containers/day ÷ 96 containers/day ÷ 0.9
  = 1.4

Hence, the necessary number of the cleansing container trucks is one(1).

4.2.4 Spare parts

In the project areas there are many slope roads and starting and stopping of the trucks are frequent in operation. Hence, repairs are frequently needed for the brakes and the clutches. Besides those parts, hydraulic hose is necessary as an item of the spare parts. The spare parts, those mentioned above and others, for 2 years operation should be provided.

4.3 Equipment for Landfill Disposal

4.3.1 Design criteria

(1) Works at the FDS

The MSW disposed of at the Rusayfa FDS includes wastes from business/factories and the MSW from the peripheral cities and towns(approx. 30%). Works at the site include receiving, spreading, compacting, soil-covering, ground compacting after soil-covering, surface arranging, digging and piling cover-soil, and arrangement of the access roads.

- Quantity of the wastes:
  2,000 t/day; assuming a bulk density of 0.9 t/m^3 after compaction, 2,200 m^3/day
- Quantity of cover-soil:
  assuming that 30m^3 cover-soil is laid every two(2) meter height of waste heap,
  2,200 m^3/day ÷ 2 m x 0.3 m = 330 m^3/day
- Quantity of compaction and surface arrangement after covering with soil:
  2,200 m^3/day ÷ 2 m = 1,100 m^2/day
- Quantity of cover-soil to be collected: 330 m^3/day
- Arrangement of the access roads and others in the site: 4 hr/day

(2) Working hour and operation ratio

Heavy duty machine works such as soil-covering, compaction and surface arrangement are executed between 8:00 and 16:00. Subtracting times for starting inspection, oiling and lunch, the net working time per day is 6.5 hours. A material operation ratio of 90% is assumed.

4.3.2 Specifications

(1) Bulldozer

Bulldozer works include spreading cover-soil and compacting ground after soil-covering, arranging ground surface using the blade, and arrangement of the access roads. The following specifications are set down for the bulldozer:

- Type: angle dozer
- Flywheel output: 320 HP
- Total weight: 36 tons
- Length of the equipped blade: 4.5m,
  soil spreading volume: 6.0m^3

(2) Dozer shovel

Dozer shovel works include digging cover-soil, piling it and loading it on trucks and spreading soil for covering the wastes. The following specifications are set down for the dozer shovel:

- Type: standard type for soil and gravel use
- Flywheel output: 200 HP
- Bucket capacity: 2.2m^3
- Bucket lift: 3.7m or more

(3) Wheel loader

Wheel loader works include loading cover-soil on trucks, short distance transportation of soil for ground arrangement and access roads, and site arrangement works such as that of waste reception area. The following specifications are set down for the wheel loader:

- Type: standard type for soil and gravel use

- Flywheel output: 150 HP
- Bucket capacity: 2.5m³
- Bucket lift: 3.7m or more

(4) Water tank lorry

Water tank lorry work include dustproof water spray at the FDS, pressurized, water spray for covering soil and water supply to the FDS. The following specifications are set down for the water tank lorry:

- Truck type: steering wheel on the left, two wheel drive
- Tank capacity: 5.0m³, with a sprinkler
- Engine output: 160 HP

4.3.3 Number of equipment required

(1) Bulldozer (320 HP)

The necessary number of bulldozer is calculated for the following works; spreading cover-soil: 330m³/day, compacting: 1,100m²/day, ground surface arrangement: 1,100m²/day and the access road arrangement: 4 hr. An operation ratio of 90% is assumed.

- Spreading cover-soil:
  [spreading quantity] plate capacity 6m³ x efficiency 0.6
  = 3.6m³/cycle
  [time] 330m³ ÷ 3.6 m³/cycle x 2 min/cycle
  = 183 min(3.1 hr)
- Compacting: the machine executing compaction for 100m in 3 min with 2 units of the 0.56 m wide shoe, and assuming five(5) cycles of compaction for the entire area,
  1,100m² x 5 cycles ÷ (0.56 x 2 x 100 m) x 3 min
  = 147 min (2.5 hr)

- Surface ground arranging:
  the machine executing arrangement for 100 min
  3 min with a 4.5 m wide blade and an efficiency of
  0.6, and assuming three(3) cycles of arrangement
  for the entire area,
  1,100m² x 3 cycles ÷ (4.5 m x 0.6 x 100 m) x 3 min
  = 37 min (0.6 hr)
- Access road arranging and others : 4 hr
- Necessary number of the bulldozer:
  (3.1 + 2.5 + 0.6 + 4) hr ÷ 6.5 hr/unit ÷ 0.9
  = 1.7 units
- Number of the units:
  one existing at the present, 0.7 units lacking
- Number of the bulldozer to be procured: 1

(2) Dozer shovel

The necessary number of dozer shovel is calculated for the following works; digging and pilling cover-soil: 330m³/day, spreading soil on the waste: 330m³/day. An operation ratio of 90% is assumed.

- Digging and pilling cover-soil:
  two (2) minutes per cycle required with capacity:
  2.2m³ and efficiency: 0.8
  330m³ ÷ (2.2 3 x 0.8) x 2 min = 375 min (6.3 hr)
- Spreading soil: 330m³ ÷ (2.2m³ x 0.8) x 2 min
  = 375 min (6.3hr)
- Necessary number of the dozer shovel:
  (6.3 + 6.3)hr ÷ 6.5 hr/unit ÷ 0.9 = 2.2 units
- Number of the units = one existing at the present,
  1.2 units lacking
- Number of the dozer shovel to be procured: 1

(3) Wheel loader

The necessary number of wheel loaders is calculated for the conditions; loading cover-soil onto

trucks: 330 m^3/day and arranging the site: 60 min. An operation ratio of 90% is assumed.

- Loading truck:
  two(2) minutes per cycle required with the bucket capacity:
  2.5m^3 and efficiency: 0.8
  330m^3 ÷ (2.5m^3 x 0.8) x 2 min
  = 330 min (5.5 hr)
- Site arrangement: 60 min (1.0 hr)
- Necessary number of the wheel loader:
  (5.5 + 1.0)hr ÷ 6.5 hr/unit ÷ 0.9 = 1.1 units
- Number of the wheel loader to be procured: 1

(4) Water tank lorry

The necessary number of water tank lorry is calculated for the conditions; compaction-water spray for cover-soil: 1,100m^2/day, site dustproof-water spray: 500m^2/day and water supply: 15m^3/day. An operation ratio of 90% is assumed.

- Compaction-water spray for cover-soil:
  from the water spraying capacity of 500m^2/hr,
  1,100m^2 ÷ 500m^2/hr = 2.2 hr
- Water spraying in the site:
  500m^2 ÷ 500m^2/hr = 1.0 hr
- Water supply:
  15m^3 ÷5 m^3/cycle ÷ 1.0 hr = 3.0 hr
- Necessary number of the water tank lorry:
  (2.2 + 1.0 + 3.0)hr ÷ 6.5 hr ÷ 0.9 = 1.1
- Number of the water tank lorry (5m^3) to be procured: 1

4.3.4 Spare parts

There are a lot of dusts flying in the air in the FDS, and machines suffer frequently from troubles such as overheats due to clogged radiators, damages of air filtres

and troubles in t he lower mechanisms due to catching foreign matters like wire pieces mixed in dusts in rotary portions. For coping with these conditions, the spare parts for 2 years are necessary.

4.4 Equipment for Maintenance

4.4.1 Type of equipment

Mobile workshop(with accessories and tools)

With the inspection and repair tools, the mobile workshop car is used for repairing failed vehicles on roads.

4.4.2 Specifications and number of equipment required

With many sloped roads, it is necessary to pull failed vehicles for a distance in order to repair them urgently in the objective areas. Hence, the mobile workshop should be designed with a four wheel drive system with the following specification:

- Truck portion: steering wheel on the left, 4 x 4 driving
  total weight : 11 tons
  engine output: 155 HP

- Workshop portion : equipped with the inspection tools for repairing diesel engines, a set of electric drills, an air compressor, the inspection tools for hydraulic and electric systems, the welding tools, the tools for maintaining lubrication systems, a set of type repairing tools, and a set of tools for handling heavy parts

Necessary number of the mobile workshop car is set on the basis of following conditions. Whereas the existing three units of the mobile workshop are in full operation, the immediate repair of failed vehicles is often impossible in the project areas at present. Since it is clear that vehicle failures increase in the future because of increase of aged cars, one(1) mobile workshop should be added.

Hence, the necessary number of the mobile workshop car is one (1).

4.4.3 Spare parts

Areas to be used are the same as the areas of the MSW collection trucks. Hence, spare parts for 2 years are necessary.

4.5 List of the Equipment Required

The list of the equipment required is shown below together with the specifications:

Table 4-5-1 List of Equipment Required

Machine	Q'ty	Specification
<Collection and transportation equipment>		
1. Small compaction trucks	25	capacity: 4m³, with the mechanisms for waste compaction and automatic discharge, total width of body: 2.1m or less, turning radius: 5.3m or less.
2. Tractors	4	for pulling trailers, engine output: 250 HP or more, with the hydraulic unit for dumping.
3. Trash trailers	8	capacity: 30m³, semi-trailer, loading floor upside open, with the dumping mechanism.
4. Small dump trucks	5	loading capacity: 2 tons, loading volume: 3m³, overall width of body: under 2.1m, turning radius: under 5.3m or less, with the dumping mechanism.
<Cleansing supporting equipment>		
5. Cleaning container trucks	1	tank capacity: 8m³ (cleaning water tank and waste water tank separated), cleaning water pressure: 70 kg/cm², with the container tilting mechanism.
<Landfill disposal equipment>		
6. Bulldozer	1	flywheel output: 320 HP, angle dozer, total weight: 36 tons, blade length: 4.5m.
7. Dozer shovel	1	flywheel output: 200 HP, standard type for soil use, bucket capacity: 2.2m³, bucket lift: 3.7m or more.
8. Wheel loader	1	flywheel output: 150 HP, standard type for soil use, bucket capacity: 2.5m³, bucket lift: 3.7m or more.
<Landfill disposal supporting equipment>		
9. Water tank lorry	1	tank capacity: 5m³, engine output: 160 HP, with sprinklers.
<Maintenance and control equipment>		
10. Mobile workshop car	1	engine output: 155 HP, 4 x 4 drive, equipped with a set of vehicle inspection and repair tools.
11. Spare parts	1 lot	for the above equipment for 2 years

4.6 Procurement Plan

4.6.1 Procurement Policy

The equipment is to be procured by the method of united bidding, that will take place in Japan. The machines are to be selected among products of not solely Japan but third countries. The selection should be based on not only the price but also consideration on future maintenance, easiness of parts procurement and repair in Jordan and the maker's aftercare system. Cautions should be posed on the procurement involving problems in quality and delivery period even if the price is cheap.

4.6.2 Matters to be considered on procurement and the project implementation

The fundamentals to be cared for in the equipment procurement include the followings:

(1) The manufacturer of the product must be sure in quality and delivery period.

(2) The manufacturer must have its dealer and a well arranged system for services in Jordan where this project is executed.

(3) The system for parts procurement must be well arranged so that no anxiety hangs on effective use of the equipment.

(4) A procurement not less than JD 150,000 in this project must be approved by the city council of MOGA. Hence, guidance should be made, on conclusion of the agreement with contractors, for an authorized person to come to Japan and sign the documents.

4.6.3 Procurement execution

Table 4-6-1 to 3 show the candidate manufacturers and their dealers. Tenders should be offered in Japan. Jordan side hopes procurements from not only Japan but also the third countries, the advanced countries in Europe. If the country is one of the third countries, the contractor should be stationed in that country for the sake of supervision on quality and delivery period.

4.6.4 Implementation schedule

Table 4-6-4 gives the implementation schedule(draft).

Implementation of a grant aid project must be completed in one year (12 months). It is supposed that approx. 7 to 8 months are required for delivery of a machine; approx. 5 to 6 months for production, 1.5 months for shipping, and 0.5 months for unloading, customs clearance and transportation in Jordan all together. Hence, the tasks in Japan after E/N conclusion such as review on effectiveness of documents should be processed as quickly as possible.

4.6.5 Project cost sharing

In terms of the division of expenses, Japanese side shall cover expenses related to the procurement, as well as ocean and inland transport and insurance of the equipment, while Jordanian side shall cover the commissions to the Japanese foreign exchange bank, and construction of transfer stations.

- Rough estimation of the construction cost of two(2) transfer stations: JD 295 thousands

For the maintenance of the equipment to be provided, the budget will probably need to be about 300 thousand JD per year in the future.

Table 4-6-1 Equipment Makers and their Dealers

	Procurement in Jordan (Europe, the U.S., etc.)	Procurement in 3rd country	Procurement in Japan
Maker's presence or absence	No vehicle or heavy machine maker in Jordan. The entire equipment to be imported.	German, Swedish and U.S. makers present, but some companies producing somewhere else.	Makers present in Japan, but heavy machines (bulldozers) limited to 2 companies, both Japan-the U.S. joint ventures.
Site dealer's presence or absence	Some dealers of vehicle or heavy machine makers present in Jordan. Procurement from the dealers possible if conditions can be arranged.	Vehicles: U.S., Swedish, German, French and other dealers present in Jordan. Heavy machines: U.S. and European dealers present.	The dealers of Japanese vehicle and heavy machine makers listed below present.
Names of the site dealers	The vehicle dealers listed on the right present.	T. Gargour & Fil Co. (Mercedez-Benz) Mithkal Shawkat & Sami Asfour (Volvo)	Vehicle makers: Ismail Bilbeishi & Co. (Toyota) Motor Vehicle Trading Co. Ltd. (Mitsubishi) United Machine Co. (Hino)
	The heavy machine dealers present as listed on the right.	Jordan Tractor & Equipment Co. Ltd. (Caterpillar USA) Mithkal Shawkat & Sami Asfour (Volvo)	Heavy Machine makers: The Near East Equipment Co. Ltd. (Komatsu) Jordan Tractor & Equipment Co. Ltd. (Caterpillar)

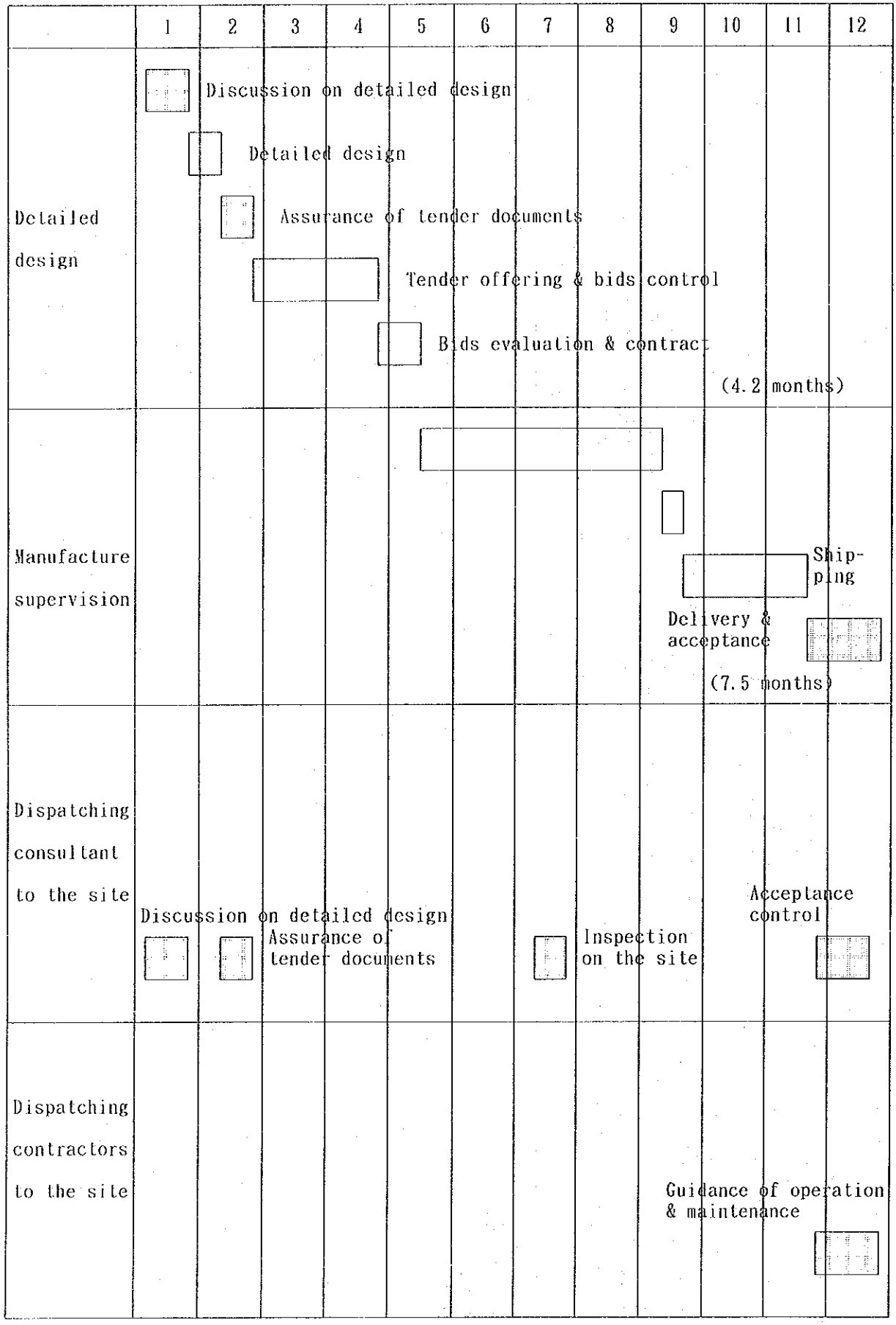
Table 4-6-2 Vehicle Dealers

	T. Gargour & Fils Co.	Mithkal Shawakat & Sami Asfour	Ismail Bilbeisi & Co.	Motor Vehicle Trading Co. Ltd.
State of equipment distribution	A dealer of Mercedez-Benz. Many delivery records of compactors in the City. Sharing 90% of the City-owned compactors.	A dealer of Volvo. A dealing experience of about 30 years with the City. Recently delivered road cleaning vehicles besides heavy machines.	A dealer of Toyota. A delivery record of 67 pickup double cabins to the City.	A dealer of Mitsubishi. Delivery records to Jordanian forces and the City Police.
Survey results	On the dealers' workshops 100 repair workers among the total 200 employees.	37 employees incl. technicians and repair workers.	50-60 technicians & repair workers among the total 250 employees.	39 engineers in the service section, incl. 14 experts.
Spare parts stock	Stock of approx. JD 3,000,000.	87% of necessary parts stocked anytime. 13% available in 2-3 weeks after order by air. Stock of approx. US$3,000,000.	Stock of US$ 5 - 6,000,000. A depot in Belgium, also one at a place between Zarqa and Amman.	Stock of US$5,000,000, incl. 20,000 types of parts. Stock space: 7,000 m^2 20 dealers in Amman City, which can also supply parts.
Service system and maintenance workshop	Splendid service factory, provided with a part control system. Reliable system. The total plot: 1,200 m^2	Very reliable service system	Periodical patrol team from Toyota H.O. Making efforts to establish a perfects service system.	Periodical patrol team from Mitsubishi.

Table 4-6-3 Heavy Machinery Dealers

	Jordan Tractor & Equipment Co. Ltd.	Mithkal Shawkat & Sami Asfour	The Medr East Equipment Co. Ltd.
State of equipment distribution	One of "Caterpillar's" dealers since 1929. Delivered 10 compactors to the City in 1992.	A Volvo's dealer, operating since 1956 and dealing with the City since 30 years. Delivered 6 wheel loaders recently.	A Komatsu's dealer. Delivered 2 excavators, 2 graders & 2 dozer/rollers.
Survey results Technicians and repair workers Spare parts	On dealers' maintenance workshops 30 repair workers including 4 engineers among the 110 employees. Stock of US$ 3-4,000,000. Space: approx. 700 m^2. The parts location gripped by a computer system. Stocked spare parts covering 90% of the parts demands. Necessary parts imported by air from Grimbergen Parts Depot.	37 skilled workers in the service workshop. Stock of US$3,000,000. Stocking 87% of any necessary parts at any time, and 13% available in 2-3 weeks by air.	35 staffers in the service section. 1,800,000, covering 92% of the parts supplied from Russel, Belgium. With Komatsu's parts depot, parts available in several days after order.
Service system and maintenance workshop	12 persons in several teams for field services. 4 workshops.	Very reliable service system.	6 mobile service teams. The Komatsu persons stationed in Cairo and teams direct from Japan patrolling. The plot: 81,000 m^2

Table 4-6-4 Implementation Schedule (Draft)



CHAPTER 5 PROJECT EVALUATION AND CONCLUSION

5.1 Results of the Project

(1) Aim of the project

This project is designed to improve the MSW collection service and in the low-income residential areas, including the Palestine refugees camps, in these areas leftover trash is exerting a negative influence on the living environment and hygiene conditions. It is needed to upgrade the landfill method by conducting sanitary operation and to strengthen the present situation of the equipment related to the MSW management on the other hand by taking into account of the grant assistance cooperation from Japan.

(2) Expected results

The expected results of the plan for this project are shown in Table 5-1-1.

5.2 Recommendation

Provisions have been made for the organization and system for the MSW management, but sufficient measures related to the daily supervision of the MSW disposal operation have not begun yet. However, in order to make the MSW management more effective, Japanese side recommended to repair the truck scale at the Rusayfa FDS, and establish a system for the supervision of operations using the data by the truck scale by which pinpoint problems and the appropriate measures will immediately identified.

5.3 Conclusions

It has been judged that the planned equipment is appropriate in number and urgently necessary for the improvement of MSW management in Amman, therefore, the implementation of this project through the grant assistance

cooperation of Japan can be justified as appropriate with the following reasons:

- The project improves the living conditions and state of hygiene in the Palestine refugees camps' areas and other densely populated areas. The direct beneficiaries to the number of 770,000 residents, create significant contributions.

- The new system of the MSW collection will serve as a model for other cities, yielding widespread results.

- Sanitary landfill operation will be secured. The population directly benefiting from these measures will include 1.9 million residents of Amman and neighboring municipalities.

- The operation, maintenance and supervision of the project will not require any special technology, consequently be executed by the current organizational structure.

Table 5-1-1 Improvement and Results of Current Conditions through Implementation of the Plan

Conditions and issues	Response by this plan	Plan results and improvements
(1) Collection and transportation .The Palestine refugees camps and surrounding low-income areas in Amman, the capital of Jordan, are densely populated with narrow streets. Therefore, MSW collection is conducted manually, in an extremely inefficient way. .As a result, the large quantity of leftover MSW exerts negative impacts on the living environment and state of hygiene.	.In response, a sidewalk collection method, which uses a small truck to collect the MSW in the regions with narrow streets, and a tractor trailer system will be introduced in order to transport the MSW in a large lot size after transferred from a small truck. .The following minimum necessary equipment will be provided immediately: Small compaction trucks (25), small dump trucks (5), tractors (4), trash trailers (8) and cleansing container trucks (1).	.MSW collection service in the densely populated regions will be enhanced, consequently the environment and state of hygiene will be improved. .The population directly benefited by the improvement of MSW collection service includes 770,000 (1993) ordinary residents, mainly those at the low-income level. .The new system of MSW collection service will serve as a model case, improving the sanitation technology standards in cities throughout the country.
(2) Landfill disposal .In one day, the average amount of MSW disposed of at the FDS totals about 2,200 m^3, including the MSW by approximately 100 trucks is disposed of in a single hour. There are many issues caused by a lack of equipment, resulting in the landfill operations unsatisfactory.	.In order to create sanitary landfill conditions and make landfill disposal capacity efficient, spreading cover-soil, compacting soil-covered MSW and soil digging will be increased. .In order to facilitate landfill operations, the water and fuel supply structure will be strengthened. .The following minimum necessary equipment will be provided immediately: bulldozer (1), dozer shovel (1), wheel loader (1), and water tank lorry (1).	.Sanitary landfill operations will be realized. .The population benefiting from the sanitary landfill operations totals about 1.9 million (1993) residents of Amman and the surrounding municipalities. .By facilitating sanitary landfill operations, the concerns of the surrounding residents will be alleviated in regard to the next landfill, and sanitary operations will be ensured.
(3) Equipment maintenance .The MSW collection and transportation equipment in operation for many years has been increasing, raising the breakdown on the roads, decreasing the collection capacity and causing traffic jams.	.The structure for making urgent repairs on the roads will be strengthened. .The following minimum necessary equipment will be provided immediately: 1 mobile workshop car with accessories and tools.	.Vehicle will be smoothly repaired on roads. .This will prevent a decrease in collection capacity and rapidly eliminate traffic jams. .Almost the entire population will benefit from these measures.

APPENDIX

Appendix 1.

Member List of Study Team and Study Schedule

1) Members of the Study Team

Leader	Hisatoshi OKUBO	First Basic Design Study Division Grant Aid Study & Design Department Japan International Cooperation Agency
Solid Waste Management Institution Planner	Tsuyoshi MIYABE	Chief of Section, Environmental Works Bureau, Nagoya City Government
Solid Waste Treatment Planner (chief)	Yasufumi SATO	Environmental Technologic Consultant Co. Ltd.
Solid Waste Treatment Equipment Planner	Hiroatsu NARITA	Ban Project Group Corporation
Operation & Maintenance Planner	Masanori ITOH	Environmental Technologic Consultant Co. Ltd.

2) The Study Schedule

Aug.	23rd (Mon.)	Left Japan
	24th (Tue.)	Arrived at Amman, JICA & Embassy of Japan
	25th (Wed.)	Ministry of Planning, Municipality of Greater Amman, Ambassador.
	26th (Thu.)	Public Cleansing Dept. Municipality of Greater Amman

27th (Fri.)	Site Survey (landfill site)
28th (Sat.)	Site Survey
29th (Sun.)	Discussion on Minutes with Municipality of Greater Amman
30th (Mon.)	National holiday (meeting among Survey Team)
31th (Tue.)	Signing the Minutes, Report to Embassy of Japan, JICA
Sept. 1st (Wed.)	Mr. Okubo, leader and Mr. Miyabe left for Japan Consultants remain to continue Survey, Discussion on schedule with Public Cleansing Dept.
2nd (Thu.)	Heavy Duty Machine Dept. and its Work Shop Separtment of Environment.
3rd (Fri.)	Holiday (meeting among Survey Team)
4th (Sat.)	District of Yarmouk and Abdali.. Central Work Shop of vehicles.
5th (Sun.)	Transportation Dept., Ministry of Trade & Industry.
6th (Mon.)	Following Survey of collection trucks.
7th (Tue.)	UNRWA, discussion with Public Cleansing Dept. Central Work Shop of vehicles.
8th (Wed.)	Dealers & service shops. Discussiobn with Public Cleansing Dept.
9th (Thu.)	Dealers & service shops. Surrounding cities survey
10th (Fri.)	Holiday (meeting among the Team)
11th (Sat.)	Department of Environment. Royal Scientific Society. The Higher Council for Science and Technology
12th (Sun.)	Landfill site survey. Central Bank of Jordan.
13th (Mon.)	Shipping agents. Finance Dept. Discussion with Public Cleansing Dept. Discussion with Dr. Zaki, WHO.

14th (Tue.)	Discussion with Dr. Zaki and Dept. of Planning Survey on expected Transfer Stations.
	Discussion with Public Cleansing Dept.
	Report to Embassy of Japan.
15th (Wed.)	Work shops in the city.
	Planning Dept.
	Discussion with Amman Municipality regarding Technical Note.
16th (Thu.)	Discussion with Public Cleansing Dept.
	Planning Dept. and Financial Dept.
	Signing Technical Note.
17th (Fri.)	Holiday (meeting among the Team)
18th (Sat.)	Discussion with Public Cleansing Dept.
	Planning Dept/
	Report to Embassy of Japan and JICA.
19th (Sun.)	Left for Japan.

Appendix 2.

Member List of Draft Report Mission and the Schedule

1. Members of Draft Report

Leader	Naohiro WATARI	Grant Aid Division, Bureau of Economic Cooperation, Ministry of Foreign Affairs
Solid Waste Treatment Planner	Yasufumi SATO	Environmental Technologic Consultant Co., Ltd.
Solid Waste Treatment Equipment Planner	Hiroatsu NARITA	Ban Project Group Corporation

2. The Schedule

Nov.	14th (Sun.)	Arrived at Amman, JICA
	15th (Mon.)	Ministry of Planning, Municipality of Greater Amman (MOGA), Ambassador
	16th (Tue.)	Explanation and consultation on draft report with MOGA, Site survey
	17th (Wed.)	Consultation on draft report and Minutes with MOGA
	18th (Thu.)	Signing the Minutes, report to Embassy of Japan, JICA
	19th (Fri.)	Holiday (meeting among team)
	21st (Sat.)	Consultation on the project with Ministry of Planning
	22nd (Sun.)	Left for Japan

Appendix 3. Member List of Concerning Party in Jordan

Embassy of Japan
- Yuji Ikeda, Japanese Ambassador
- Toshihiro Shinohara, First Secretary
- Hideo Shibuya, Second Secretary

JICA Jordan Office
- Yasuyuki Mori, Resident Representative
- Yuji Shirata, Assistant Resident Representative
- Hani H. Akurdi, Research Coordinator

Ministry of Planning
- Salem Ghawi, Assistant Secretary General
- Nael T.H. Alhajaj,Ph.D., Economic Researcher
- Kamal S. Saleh, Demographer, Dept. of Environment Department

Ministry of Municipal & Rural Affairs and the Environment
- Saleh Al Share,Dr.Eng., Director of Environment Department

Ministry of Industry & Trade
- Sami M. Saeed, Engineer,

Municipality of Greater Amman
- Sultan Khalifat,Eng., Under Secretary
- Hussein Zeki Said,Dr., Under Secretary Assistant for Health and Environment
- Mohammad Bani Hani, Director of Public Cleansing Department
- A.Qader Abu Hijgleh, Engineer, Public Cleansing Department
- Sami Al Najdawi, ditto
- Ibrahim Issa Zeiater, Director of Base Workshop
- El.Momanil Ali, Director of Heavy Duty Machine Department
- Abtaan Ali, Manager of Transportation Department
- Hahmmod Khlifat, Manager of Financial Department
- Moh'd N. Diab, Head of Planning Department
- Fairouz Masoud, Engineer, ditto
- Majid S. Nimri,Engr., Technical Assistant
- Mohammad Ali Oudah, Director of Civil Defence, Fire Protection and Safety

Ahmad Abdallat, Engineer, Ruseifa Sanitary Landfill Site
Hdeib Shhadeh, Director of Purchasing and Tenders Dept.
A. Qader Abu Hijgleh, Purchasing and Tenders Dept.

District Office of Amman Municipality
Khalad Matar, Director of Health Dept., Yarmouk District
Ali Alomari,Dr., Health Dept., Yarmouk District
Rezek Tunash, Civil Engineer, Yarmouk District
Abdal Wahab Al Falah, Director of Health Dept., Abdali District

UNRWA (United Nations Relief and Works Agency)
Paul I.David, Deputy Director of UNRWA Affairs
A.Salam Abu Awad,Dr., Field Health Officer, UNRWA
Nash't Ammari,Dr., Deputy Field Health Officer, Health Dept.
Hasan Salem,Engineer, Health Dept.

The Royal Scientific Society
Murad Jabay Bino,Dr., Director, Environmental Research Center

The Higher Council for Science and Technology
Talal S.Akasheh,Dr., Director of Environment Sector
Fawwaz Z.Elkarmi,Dr., Director of Energy Technology Sector
Mohammad Shahbaz, Researcher

WHO (World Health Organization)
Hassan M. El-Baroudi,Dr., Coordinator, Centre for Environmental Health Activities
Odyer Speraudio,Dr., WHO Consultant, Geneva,Switzerland
M.I.Sheikh,Dr., Director, Environmental Health Program, WHO-EMRO,

SHIPPING AGENT
Tawfiq Amin Kawar, Chairman/Managing Director, Amin Kawar & Co.(W.L.L.)
Chassoub F.Kawar,BSc., General Manager, Amin Kawar & Sons Co. (W.L.L.)
Jebril O.Abu Sneimeh, Marketing Depy. ditto

Jamil F.Said, Liner Manager ditto
Tawfiq Amin Kawar, Honorary Royal Danish, Consul General in Jordan
Fawaz Qandil, Deputy Managing Director, National Shipping Services Co.,Ltd.
Marwan Azmi Ghaith, Shipping Manager, ditto
Mona Zoumot, Asst.Shipping Manager, ditto

EQUIPMENT AGENT & SERVICE SHOP
Faik Daher,Eng., General Manager, Jordan Tractor CAT
M.Khaldoun Khyami,Eng., Asst.General Mgr., ditto
Husan Abu Hanna, Mechanical Engineer, Jordan Tractor & Equipment Co.,Ltd.
Fawzi I.Beiruti, Deputy General Manager, The Near East Equipment Co.,Ltd.
George E.Haddad, General Manager, Ismail Bilbeisi & Co
Nabil Abu Khader, General Manager, Motor Vehicle Trading Co.Ltd.
Ibrahim M.Musallam, Asst.General Manager, T.Gargour & Fils Co.
Shawki Abu Haidar, Marketing Manager, Mithkal Shawkat & Sami Asfour
Kazuhiko Sakishima, General Manager, Amman Branch, Mitsubishi Co.
George E. Saba, Assist. Manager, ditto
Moritomi Miura, Regional General Manager, Amman Office, Sumitomo Co.
Yutaka Ezaki, Regional Manager,

PRIVATE WORKSHOP
Kosta Terlikis, President, The M odern Technical Workshop
Hosni, President, Hosni Workshop

Appendix 4.

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY ON
THE PROJECT FOR
IMPROVEMENT OF SOLID WASTE MANAGEMENT
IN THE GREATER AMMAN
IN THE HASHEMITE KINGDOM OF JORDAN

In response to a request from the Government of the Hashemite Kingdom of Jordan, the Government of Japan decided to conduct a Basic Design Study on the Project for Improvement of Solid Waste Management in the Greater Amman (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Jordan the study team headed by Mr. Hisatoshi OKUBO, Official, First Basic Design Study Division, Grant Aid Study and Design Department, JICA from 24th August to 19th September, 1993.

The team held discussions with the officials concerned of the Government of Jordan and conducted a field survey.

In the course of discussions and the field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed to further study and prepare the Basic Design Study report.

Amman, 31st August, 1993

Mr. Hisatoshi Okubo
Leader
Basic Design Study Team
JICA

Dr. Hussein Zaki Said
Under Secretary Assistant For
Health and Environmental Affairs
Municipality of Greater Amman

Mr. Nael T.H. Alhajaj Ph.D.
Economic Researcher
Ministry of Planning

ATTACHMENT

1. Objective

The objective of the Project is to improve the solid waste collection, transportation and disposal systems in the Greater Amman by procurement of supplementing machinery and equipment.

2. Project Area

The Project area is Amman City as shown in the attached map (Annex I). Priority is given to densely populated areas, namely the following 5 districts, of which three have refugee camps.

DISTRICT	NAME OF REFUGEE CAMP OR DENSELY POPULATED PLACE	
Yarmouk	Al Wihdat Camp	Al Jawfa
Abdali	Al Hussein Camp	
Nasr	Al Amir Al Hassan Camp	
Basman		Al Nuzha
Ras Al-Ain		Al Marich

3. Executing and responsible agencies

(1) The Municipality of Greater Amman is responsible for administering and executing the Project and thus soley responsible for procurement, operation and maintenance of machinery and equipment to be purchased under the Grant.

(2) The Ministry of Planning will serve as the focal point for facilitating the Project implementation.

4. Items requested by the Government of Jordan

After discussions with the Basic Design Study Team, the items in Annex II were finally requested by the Jordanian side. The list also shows priority of the items according to the needs and urgency of the Jordanian side.

The final component of the items, both types and quantity, will be decided after a further study in Japan.

5. Other issues of discussions

The team has suggested and pointed out to the Jordanian side the following issues:

(1) Since UNRWA is also actively involved in garbage collection and sanitation improvement schemes in the refugee camps, contacts with them would be important and useful for the implementation of the Project. One of the agenda will be a possible unemployment problem of UNRWA garbage collectors when considerable portion of manual labor is mechnized after the Project implementation.

(2) Transfer stations are essential for introduction of small compaction trucks to the refugee camps. The Jordanian side will submit a detailed plan of transfer stations (location, design, cost and schedule, etc.,) to the team not later than 15th September.

6. Japan's Grant Aid System

(1) The Jordanian side has understood the system of Japanese Grant Aid explained by the Team.

(2) The Jordanian side will take necessary measures described in Annex III for smooth implementation of the Project on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

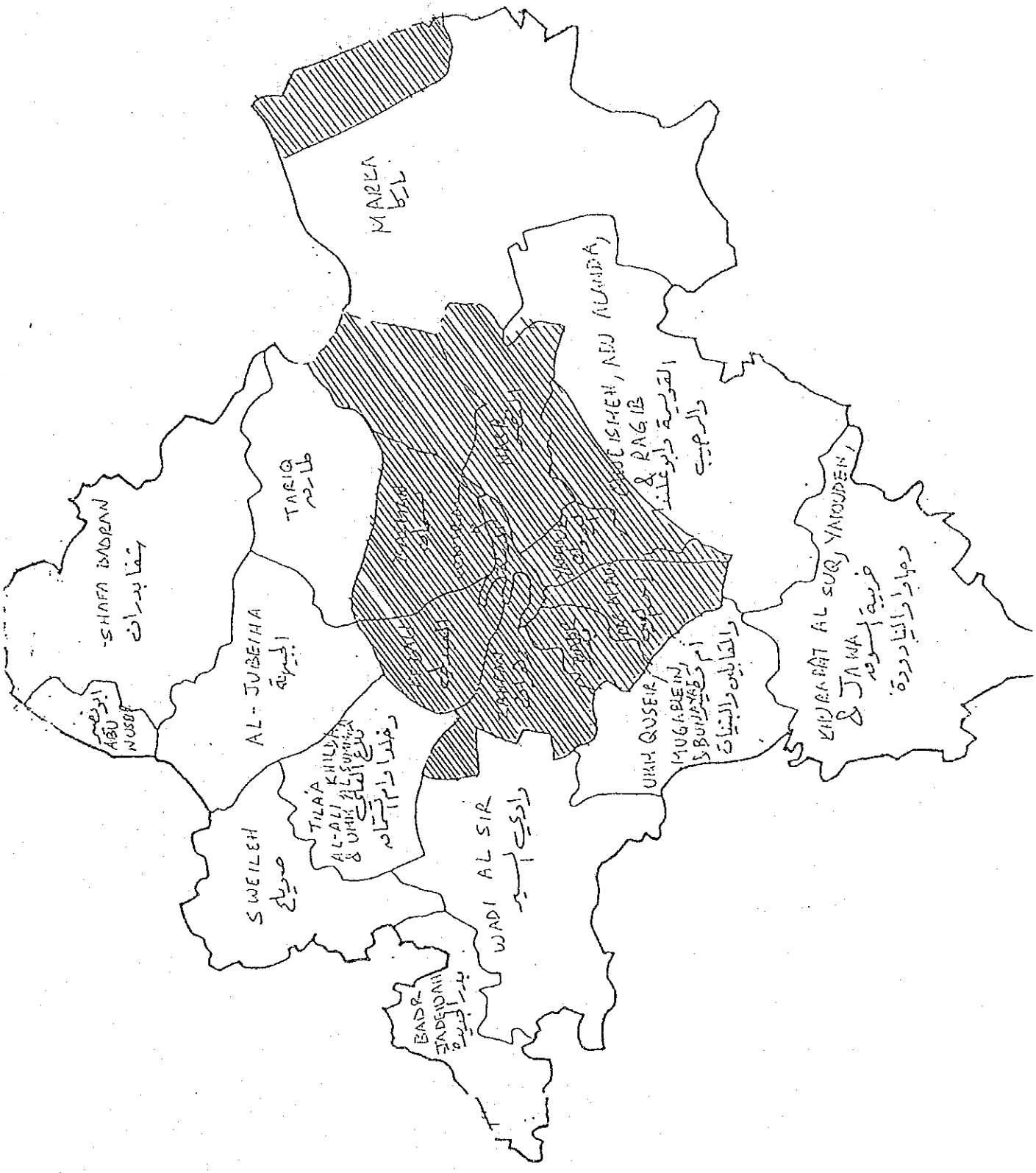
7. Schedule of the Study

(1) The consultants will proceed to further studies in Jordan until 18th September. Towards the end of their studies, technical details concerning the Project will be written up in a technical note to be signed by both parties.

(2) JICA will prepare a draft report and dispatch a mission to Jordan to explain its contents around the end of November, 1993.

(3) When the draft is accepted in principle, JICA will complete a final report and send it to the Government of Jordan in February, 1994.

Annex I Project Area



Annex I Project Area

Annex II Items requested by the Jordanian side

ITEM	QUANTITY	PRIORITY
1. compaction truck (4 m^3)	25	A
2. cleansing container truck (8 -10 m^3)	2	A
3. tractor (250 HP)	4	A
4. trush trailer (30 m^3)	8	A
5. bulldozer (320 HP)	1	A
6. dozer shovel (200 HP)	2	A
7. wheel loader (150 HP)	2	A
8. mobile workshop with accessories and tools	2	A
9. small dump trucks (2 ton)	5	B
10 mini-loader (30 HP)	2	B
11. water tank (5 m^3)	1	B
12. fuel tank (5 m^3)	1	B
13. jet tank (8 -10 m^3)	2	C
14. sweepers (5 m^3)	1	C
15. sweepers (2 - 3 m^3)	1	C
16. motorgrader (150 HP)	1	C
17. excavator (150 HP)	1	C
18. spare parts for all equipment		A～C

Annex III

Necessary measures to be taken by the Government of Jordan in case Japan's Grant Aid is extended

1. To bear commissions to the Japanese foreign exchange bank for the banking services based upon Banking Arrangement.

2. To exempt taxes and to take necessary measures for customs clearance of materials and equipment brought for the Project at the port of disembarkation.

3. To accord Japanese nationals whose services may be required in connection with the supply of products and the services under the verified contract such facilities as may be necessary for their entry into the Hashemite Kingdom of Jordan and stay therein for the performance of their work.

4. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Hashemite Kingdom of Jordan with respect to the supply of the products and services under the verified contracts.

5. To ensure that the equipment purchased under the Grant are used and maintained properly and exclusively for the Project.

6. To bear all the expenses other than those to be borne by the Grant necessary for the project implementation.

Appendix 5.

TECHNICAL NOTES
ON
THE PROJECT FOR
IMPROVEMENT OF SOLID WASTE MANAGEMENT IN THE GREATER AMMAN
IN THE HASHEMITE KINGDOM OF JORDAN

The Minutes of Discussions on the Basic Design Study on the Project for Improvement of Solid Waste Management in the Greater Amman in The Hashemite Kingdom of Jordan (hereinafter referred to as "the Project") was concluded between the JICA Basic Design Study Team (hereinafter referred to as "the JICA Team") and the Municipality of Greater Amman on 31st August 1993.

Following the conclusion of Minutes of Discussions of the Project, the JICA Technical Team continued technical discussions and field survey in the Greater Amman up to 16 September, 1993.

The JICA Technical Team and the Municipality of Greater Amman made several discussions as described hereinafter.

These discussion results will be studied and final components will be decided in Japan by the JICA Team. The results of the study will be concluded in the Draft Final Report of Basic Design Study which will be presented to Jordanian side around the end of November 1993.

I. Items requested by the Government of Jordan

Items requested by the Government of Jordan are basically understandable, though the final component of the items will be decided after a further study in Japan.

2. Transfer station

As mentioned on the Minutes of Discussion, transfer stations are essential for introduction of small compaction trucks to the refugee camps and densely populated areas where roads are narrow. The Jordanian side has decided the location and basic plan of the transfer stations, as shown on the attached drawings.

Jordanian side has also confirmed that necessary measures (e.g. land aquisition, detailed design and budgeting for civil construction) would be taken for the smooth construction of the transfer station before the arrival of the equipment at the site, in case the Project implementation is decided.

For JICA Basic Design Study Team

By :

Mr. Yasufumi SATO
Chief Engineer,
Basic Design Study Team, JICA

For Municipality of Greater Amman

By :

Dr. Hussein Zaki Said
Under Secretary Assistant For
Health and Environmental Affairs
Municipality of Greater Amman

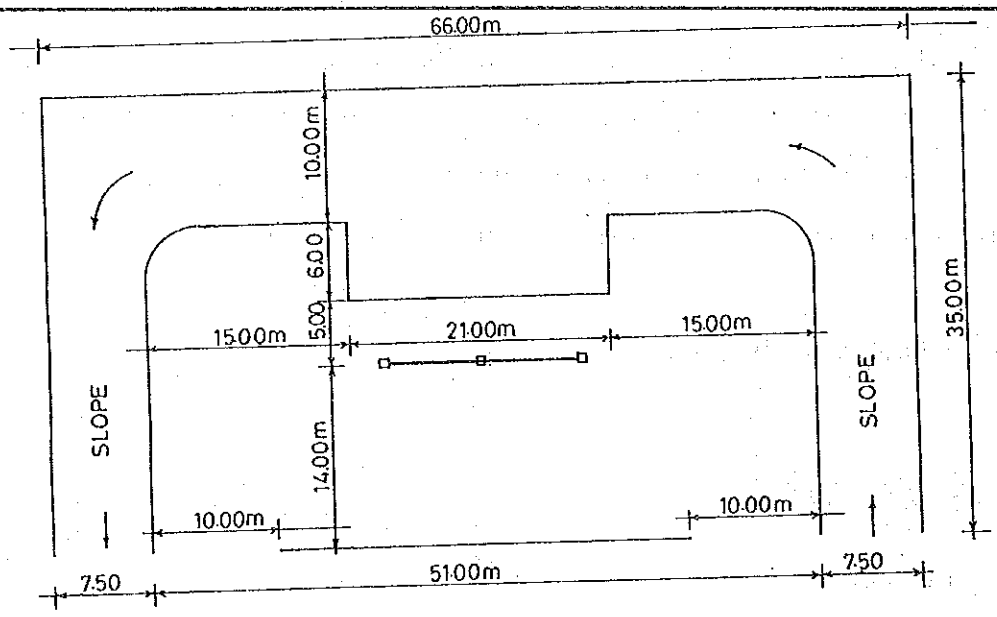
WITNESS :

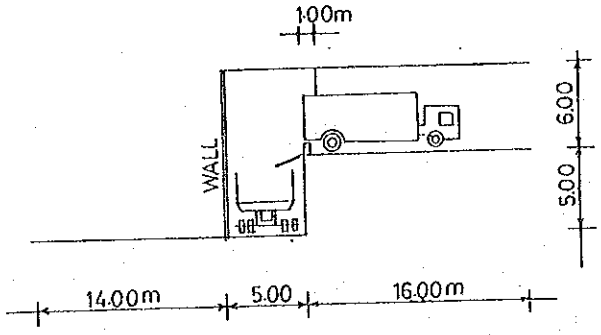
Mr. Hideo SHIBUYA
Second Secretary
Embassy of Japan

Mr. Yasuyuki MORI
Resident Representative
JICA Jordan Office

WITNESS :

Mr. Nael T.H. Alhajaj Ph.D.
Economic Researcher
Ministry of Planning





TRANSFERE STATION

SCALE 1:400

A - AL-HUSSEIN REFUGEE CAMP S.

B - AL-WAHDAT REFUGEE CAMP S.

أمانة عمان الكبرى


△322 BL
△326 BL
△325 BL
AL Housien Transfare Station
A-17

AL WAHDAT
TRANSFARE STATION
(2125 m²)

2125.00 م²

Appendix 6.

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY ON THE PROJECT FOR IMPROVEMENT OF SOLID WASTE MANAGEMENT IN THE GREATER AMMAN IN THE HASHEMITE KINGDOM OF JORDAN
(CONSULTATION ON DRAFT REPORT)

In August 1993, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study team on the Project for Improvement of Solid Waste Management in the Greater Amman in the Hashemite Kingdom of Jordan (hereinafter referred to as "the Project") to the Hashemite Kingdom of Jordan, and through discussions, field survey, and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult the Jordanian side on the components of the draft report, JICA sent to Jordan a Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr.Naohiro Watari, Grant Aid Division, Bureau of Economic Cooperation, Ministry of Foreign Affairs, and scheduled to stay in the country from 14th to 21st November, 1993.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Amman, 18th November, 1993

渡里 直広

Mr. Naohiro Watari
Leader
Draft Report Explanation Team
JICA

H. Zaki

Dr. Hussein Zaki Said
Under Secretary Assistant For
Health And Environmental Affairs
Municipality Of Greater Amman

Nael

Mr. Nael T.H. Alhajaj, Ph.D.
Economic Researcher
Ministry Of Planning

ATTACHMENT

1. Components of Draft Report

The Government of Jordan and the Municipality of Greater Amman have agreed and accepted in principle the components of the Draft Report including the list of equipment (Annex 1) proposed by the Team.

2. Japan's Grant Aid System

(1) The Government of Jordan and the Municipality of Greater Amman have understood the system of Japanese Grant Aid explained by the Team.

(2) The Municipality of Greater Amman will take the necessary measures, described in Annex 2, for smooth implementation of the Project on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

(3) The Ministry of Planning will serve as the focal point for facilitating the Project implementation.

3. Other Items Confirmed during the Discussions

(1) Since the existing first stage of final disposal site in Rusayfa will be fulfilled within few years, the Municipality of Greater Amman has responsibility to prepare the next stage of final disposal site and report it to the Government of Japan as soon as possible.

(2) Jordanian side, the Municipality of Greater Amman, agrees to take necessary measures (e.g. land acquisition, detailed design and budgeting for civil construction) for the smooth construction of the transfer stations before the arrival of the equipment at the site, in case the Project implementation is decided.

(3) In order to make the municipal solid waste management more effective, Japanese side recommends to repair the truck scale at the final disposal site in Rusayfa, and establish a system for the supervision of operations using the data by the truck scale.

4. Further Schedule

The Team will make the Final Report in accordance with the confirmed items, and send it to the Government of Jordan by the end of January 1994.

Annex 1

List of Equipment

Machine	Q'ty	Specification
<Collection and transportation equipment>		
1. Small compaction truck	25	capacity: 4m³, with the trash compaction and automatic discharge mechanisms, overall width: under 2.1m, turning radius: under 5.3m
2. Tractor	4	for pulling trailer, engine output: 250 HP, with the hydraulic unit for driving the dumping function of trailer
3. Trash trailer	8	capacity: 30m³, semi-trailer with the body without roof, with dumping mechanism
4. Small dump truck	5	loading capacity: 2 tons, loading volume: 3m³, overall width of body: under 2.1m, turning radius: under 5.3m, dumping mechanisms included.
<Cleansing supporting equipment>		
5. Cleansing container truck	1	tank capacity: 8m³ (cleaning water tank and waste water tank separated), cleaning water pressure: 70 kg/cm², with a tilting mechanism.
<Landfill disposal equipment>		
6. Bulldozer	1	flywheel output: 320 HP, angle dozer, total weight: 36 tons, blade length: 4.5m.
7. Dozer shovel	1	flywheel output: 200 HP, standard type for soil & gravel, bucket volume: 2.2m³, bucket lift: over 3.7m
8. Wheel loader	1	flywheel output: 150 HP, standard type for soil & gravel, bucket volume: 2.5m³, bucket lift: over 3.7m
<Landfill disposal supporting equipment>		
9. Water tank lorry	1	tank volume: 5m³, engine output: 160 HP, with sprinklers.
<Maintenance and control equipment>		
10. Mobile workshop car	1	engine output: 155 HP, 4 x 4 drive, equipped with a set of vehicle inspection repair tools.
11. Spare parts	1 lot	for the above equipment for 2 years operation

Annex 2

Necessary measures to be taken by the Government of Jordan in case Japan's Grant Aid is extended

1. To bear commissions to the Japanese foreign exchange bank for the banking services based upon Banking Arrangement.

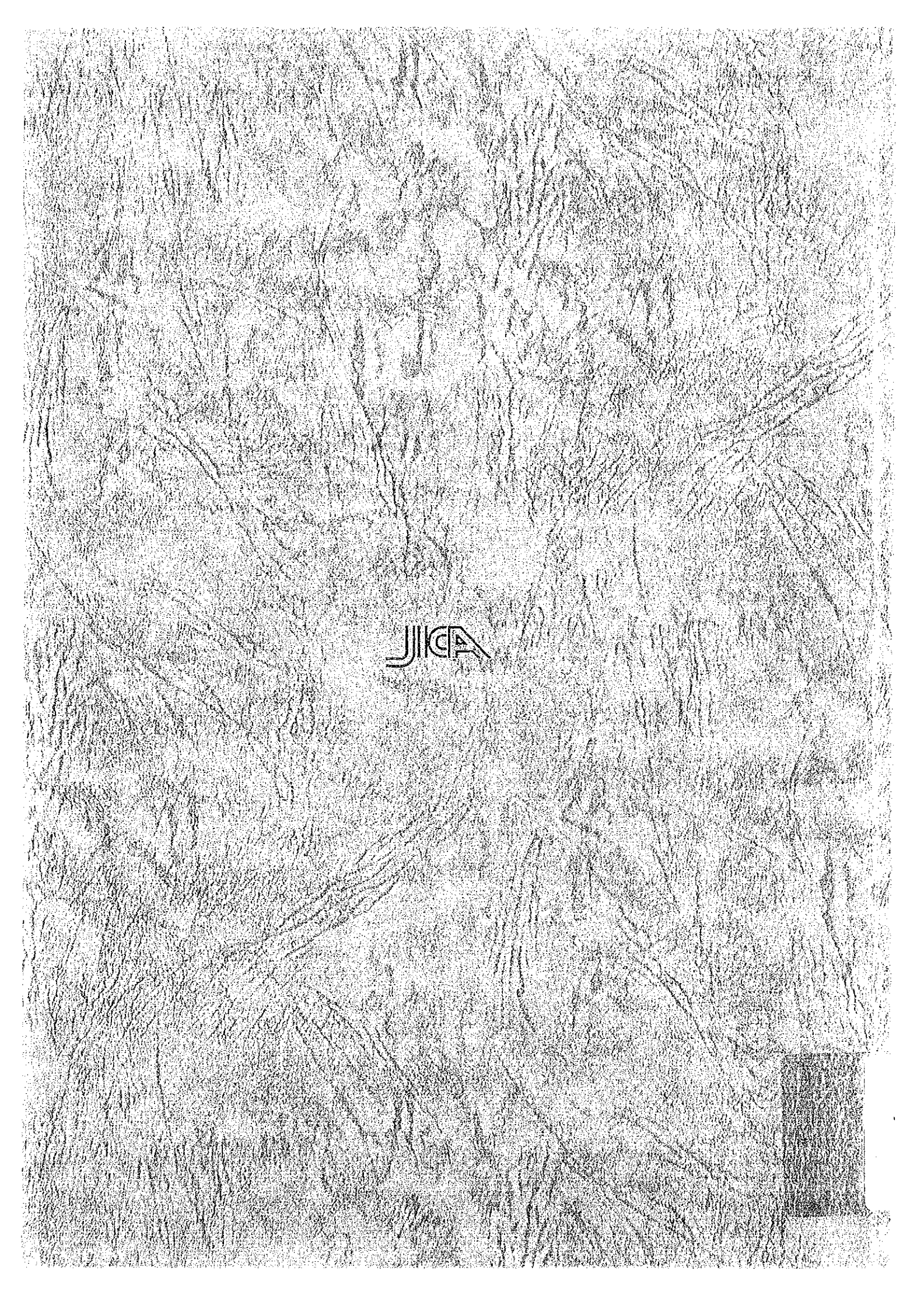
2. To exempt taxes and to take necessary measures for customs clearance of materials and equipment brought for the Project at the port of disembarkation.

3. To accord Japanese nationals whose services may be required in connection with the supply of products and the services under the verified contract such facilities as may be necessary for their entry into the Hashemite Kingdom of Jordan and stay therein for the performance of their work.

4. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Hashemite Kingdom of Jordan with respect to the supply of the products and services under the verified contracts.

5. To ensure that the equipment purchased under the Grant are used and maintained properly and exclusively for the Project.

6. To bear all the expenses other than those to be borne by the Grant necessary for the project implementation.


JICA