

5.2.4 Recycling

To the knowledge of the Study Team, there is no formal recycling implemented by the governmental agencies in Morocco. During the questionnaire survey, based on the information available to the urban communes an attempt was made to understand the extent of recycling by the residents, collection workers, private recycling centers and scavengers. Unfortunately the majority of the questionnaires provided no replies to the related recycling questions. This either indicates urban communes lack of knowledge concerning the residents' activity or their opinion that this activity does not exist. The results are shown in Table 5.2-8.

Where replies were available, residents appear to be very active in plastic and glass separation, followed by cardboard. Both methods of direct purchase by recyclers and direct sales by residents to the end users appear to be active for such items as plastic, cardboard and glass.

Collection crews separate mainly cardboard, plastic and glass bottles during the collection. The additional income they earn from this activity varied from 100 to 300 Dirhams monthly per crew member.

The low priority given to encouraging source separation and recycling by the authorities is disappointing. The Study Team is aware of one recycling pilot project that was conducted in Tangier recently, on the occasion of Environment Day in a small area. Plastic bins (@ 200 liter) of different colors were placed in several locations and residents were encouraged to separate glass, plastic and paper. Certain collection vehicles were operated by the cleansing authority to collect these separated items. Urban Community officials in Tangier explained that the residents response was positive but they gave no information on the future of such pilot projects.

Separation of the recyclable items during the collection work is done very efficiently by the workers, but generates the significant problem of time wasted on the route and at the sales points, and increase in number of collection workers to assist in this activity. It is however a significant practice in Morocco and represents an important additional income to the workers.

Table 5.2-8 Recycling Activity based on Questionnaire Survey Results

Unit: Number of questionnaires

Survey Item	very active	fairly active	not active	no reply
1. Extent of source separation by residents				
1) Printed material	2	1	7	8
2) Cardboard	3	3	4	8
3) Glass bottles	4	2	4	8
4) Steel cans		3	6	9
5) Aluminum cans	1	2	6	9
6) PET bottles	2	1	6	9
7) Plastic	5	2	3	8
8) Materials, old clothes	2	3	5	8
2. Recycling method of the residents	Collected by recycler from the houses	Taken by residents to recycler	Sold directly by residents to end users	no reply
1) Printed material	3		2	13
2) Cardboard	2	1	3	12
3) Glass bottles	2	1	4	11
4) Steel cans	1	1	3	13
5) Aluminum cans	1	1	3	13
6) PET bottles	3		3	12
7) Plastic	4		2	12
8) Materials, old clothes		1	5	11
3. Collection workers recycling activity	most important	second	third	fourth
1) Printed material	1	2		
2) Cardboard	5		1	
3) Glass bottles	2	5	1	1
4) Steel cans	1	1		
5) Aluminum cans		1		
6) Plastic, PET bottles	3	2	5	
7) Materials, old clothes	1			2

5.2.5 Intermediate Treatment

1) General

In recent years, securing of landfill sites has been getting rather difficult not only in advanced and semi-developed countries but also in developing countries. On the other hand, more than 85% of solid waste generated worldwide is hauled to disposal sites. Under these conditions, several kinds of intermediate treatment systems have been developed and adopted for the purpose of volume reduction and effective utilization/recycling of solid waste. Incineration, sorting/crushing and composting are internationally popular systems for intermediate treatment of solid waste.

In the Kingdom of Morocco, intermediate treatment system for the municipal solid waste is not so wide spread. Compost is the only system introduced here. Four (4) mechanized compost plants, windrow type, were constructed in major cities in the 1960's and 1970's, and recently one compost plant is under-construction in Agadir and several projects for composting in other cities are in various stages of study, design and fund allocations. However it is necessary to note that to date there are no standards issued by the government regulating the quality and composition of the compost.

2) Compost

a. General

Composting is the most commonly used biological process for the conversion of the organic waste to a stable humus-like material called compost. Purposes and significance of composting are the following;

- Volume reduction of organic waste
- Stabilization of organic waste
- Harmlessness of hazardous substance
- Effective utilization as soil improvement agent

b. Present Conditions and Issues

During 1960's and 1970's, four compost plants were constructed and commenced operation in Rabat, Meknes, Marrakech and Casablanca. However, three suspended their operation approx. 5-10 years ago and there are no plans for restarting operation. Although Rabat plant is the only plant operating today in Morocco, waste handling amount by the plant has decreased from 250 ton/day, its original capacity to 150 ton/day (actual treated waste amount), i.e. a reduction of 40%. Considering these conditions, present situation of composting in Morocco may be evaluated as unsuccessful.

Meanwhile, in 1989 a new compost plant was planned and designed by French consultants in Agadir as a French & Moroccan cooperation project. Plant construction is almost completed (visited by JICA Study Team in March 1996).

Table 5.2-9 shows a brief description of the existing and planned compost plants in Morocco. For the three closed plants of Meknes, Marrakech and Casablanca information available to the Study Team was very limited, even though the urban communities of both Casablanca and Marrakech were covered in the questionnaire survey.

The followings are case studies of three (3) compost plants, the operating Rabat plant, Meknes plant as one of the suspended plants and the newly planned Agadir plant.

(1) Case Study

Case-1: Rabat Compost Plant

The plant started operation in 1962 by the Ministry of Agriculture as a pilot project, with an initial capacity of 50 ton/day. In 1965, ownership of the plant was transferred to Municipality of Rabat (which is at present Wilayah Rabat/Sale), and the plant was enlarged by facilitating two additional chains with 8 ton/hour conveying capacity each, thereby increasing the capacity to 250 ton/day. The plant was managed/operated by the Bureau of potable water and electricity (RED) since 1981 in an arrangement with Wilayah Rabat/Sale which retained ownership of the plant.

Compost production process of Rabat plant is as follows; direct discharge of the waste into the pit (two units), size reduction by hammer mills (two units), metal recovery by magnetic separator (not functioning), waste separation by rotary drum (40-100mm mesh sieve: not functioning properly) and finally fermentation at stockpile yard.

The present 150 tons/day of solid waste treated at the plant come from one Urban Commune, Hassan Rabat. Recent annual plant production is approx. 22,000 tons of coarse and 200 tons of fine compost, however fine compost production has been gradually decreasing. During the high demand period, from October to March, approx. 100 tons of coarse compost are sold daily, and as a consequence of this excessive demand and supply, compost is sold before its fermentation is completed (sometimes with only 8 days fermentation period). Terrible odor, over-flow of leachate, and a large number of flies etc. were found at the site.

Price is set at DH 25/ton for coarse and DH 60/ton for fine compost. These low prices result in a deficit of approx. DH 900,000 per year in operation costs as reported by the RED officer at the plant. Only considering initial costs, about 100 dirhams/ton should be added to the selling price. Therefore cost recovery is assumed to be very difficult.

The following issues for Rabat compost plant have been identified;

- Sanitary condition of the site is very poor
- Mechanical equipment of the plant are not operating properly
- Existing mechanical equipment are not suitable for recent waste composition
- Quality of compost produced is inferior
- No quality control or analysis of produced compost
- The plant shows deficit regularly (non-profitable plant)
- Lack of budget for repairing the plant equipment and also for improving its facilities
- When accessibility to the Rabat Akreush dump site is blocked because of rains the waste from other urban communes is diverted to the plant resulting in very difficult work conditions
- Scavengers operate freely at the plant and animal grazing also occurs there

Case-2: Meknes Compost Plant

The plant was constructed in 1965, and was operated from 1971 to 1992. Mechanical equipment and compost production process of Meknes plant were the same as those for the Rabat plant.

A study on Meknes, «Preliminary Assessment of SWM Systems in Meknes, Azrou and Sefrou» (ICMA, July 1995) explains that in the 1970's and 1980's, waste composition in Meknes gradually changed and the non-organic content such as plastic, glass, etc. increased significantly. Meanwhile, as no pre-treatment system for waste separation was facilitated in the plant, incoming waste including non-organic matter was directly hauled into the hammer mill, and consequently crushed/shredded non-organic material was mixed with the compost products. Under these conditions, farmers gradually refrained from using the compost, and purchases declined, although price of compost dropped from DH 60 per ton in 1979 to DH 20 in 1992. Accordingly, Meknes compost plant was obliged to terminate its operation.

The following issues for Meknes compost plant have been identified;

- Plant system could not correspond with the change of waste composition and high water content waste
- Operation and maintenance system of the plant was not sufficient
- Quality of compost products was inferior
- Lack of budget for repairing the plant facilities and also for improving its facilities

Case-3: Agadir Compost Plant

Agadir compost plant was planned and designed with an improved system compared to the former plants such as Rabat, Meknes, etc. Major points which have been taken into consideration for this project were, first, applicability to recent municipal solid waste composition characterized with high moisture content and non-organic matters, second, existence of compost marketing demands in the region, and third, usefulness of co-operation with disposal site in mutual use of common facilities and operation coordination.

Compost production process of Agadir plant is as follows; from the beginning to end, accordingly, primary fermentation of five to eight weeks at stockpile yard (two hectares), size reduction by shredder, ridding of residual water, waste separation by rotary drum/sieve (two units) and complete fermentation at stockpile yard (one hectare).

However, as the plant is under-construction at present (March 1996) and the operation is not started yet, technical adequacy of Agadir compost project can not be evaluated at this stage.

The following issues for Agadir compost plant have been identified;

- The market demand study confirming the project feasibility can be evaluated in light of the actual sales and serve as a reference for future projects
- Operational condition of Agadir compost plant and suitability of equipment could be worth of note for future compost plants in Morocco
- Plant design and operation plan is closely associated with the existing disposal site (plant to be constructed next to the site) and life span of the disposal site should be confirmed

(2) Issues

In consideration of the above three (3) case studies and present conditions of other compost plants listed in Table 5.2-9, the following synthetic issues for composting in Morocco have been identified;

- Although most of compost plants in Morocco ended in failure, reasons for the failure have not been sufficiently verified at the municipal and/or national levels
- Action for the next step to avoid the same kind of failure are not sufficiently/properly considered both on the municipal and national levels

The followings are important points which should be carefully considered/examined for successful introduction and operation of composting;

- Verification of applicability of the waste for composting
- Delivery to the plant of suitable waste types such as domestic, market wastes
- Securing of compost market and sales route
- Support of agricultural authorities concerned
- Quality control of compost products
- Standardize the compost products
- Confirm the advantage of combined usage of compost and chemical fertilizer
- Unify/coordinate the studies and efforts made by various agencies in the government related to composting
- Financial and economical analysis/evaluation
- Subsidy system

Existing reports for future compost plants (Fez, Oujda, Tangier, ...) should be studied by one suitable national agency taking into consideration the above identified issues in order to coordinate these efforts and avoid repetition of mistakes and ensure their technical quality.

3) Recommendations

In order to avoid future failures, introduction of successful intermediate treatment facilities for SWM in Morocco requires careful consideration. Methodology for planning and evaluation regarding intermediate treatment facilities should be established. Classification of intermediate treatment systems from the view point of resource recovery is shown in Table 5.2-10.

5.2.6 Final Disposal

1) General

In most developing countries, wastes are disposed at final disposal site by «Open dumping». Final disposal site is merely stated as «dumping site» and aesthetic, environmental and sanitary issues are hardly taken into consideration. As the dumping site creates environmental pollution such as air pollution, water pollution, odor etc., the issue of open dumping of wastes has become a serious social problem in these countries.

«Sanitary landfill» is the method for disposal of solid waste that minimizes public health and environmental impacts. Wastes to be disposed of should be compacted and covered with a layer of soil at the end of each day's operation, and after all disposal operation have been completed, ultimate land use of the site should be utilized effectively (defined by American Society of Civil Engineering). Of course, in case there is a possibility of leachate production and contamination of surrounding area by it, leachate treatment should also be considered. Meanwhile, «Control landfill» is a basic controlled method of disposal, and can be defined as method between open dumping and sanitary landfill. Table 5.2-11 shows definition/classification of open dumping, control landfill and sanitary landfill.

In this section, present conditions of dumping sites in Morocco are discussed and evaluated, and recommendations for improvement of dumping sites are stated.

2) Present Conditions and Issues

a. General

Fifteen (15) disposal sites located in urban areas in Morocco have been visited and inspected by JICA Study Team and/or Counterpart Team during the last four months. Furthermore answers of questionnaires which have been delivered to five (5) Urban Communities; Rabat, Oujda, Marrakech, Casablanca and Safi, were collected recently, except for Rabat.

Results of these site visits and questionnaire answers are shown in Table 5.2-12 (1/3), (2/3) and (3/3), and summarized as follows :

- In fourteen (14) cities out of fifteen (15), disposal method is merely open dumping. Meanwhile, in Casablanca, control landfill is adopted but its operation is not sufficient
- In twelve (12) cities, dumping sites are located within ten kilometers from the city center. Further, seven (7) of them are within five kilometers
- In thirteen (13) cities, surmised remaining life time of dumping site is within ten years. Further, eight (8) of them are within five years

Meanwhile, in several cities, there are plans to construct a new disposal site to replace an existing one. In Rabat, Taza and Casablanca, selection of new disposal site has recently been completed, and it is presently under processing in Safi, Fes and Meknes. More explanation on Safi may be found in Book 4 of this report.

The following are case studies of three (3) disposal sites; Beni Mellal as an open dumping site, Casablanca as a controlled landfill site and Rabat/Sale as a newly selected disposal site.

b. Case Study

(1) Case-1: Beni Mellal

Beni Mellal city is located at approx. 180 km south-west-south from Rabat and at western foot of the Middle Atlas. The climate here is classified as inland type, same as Marrakech, and rainfall in 1993/94 was 335 mm/year. Population is 387,000 (in 1994).

Dumping site in Beni Mellal started its operation in 1986 on an area of 35 hectare. The site is located on flat ground and at approx. 5 km north-east of the city, on the border of Beni Mellal municipality and extends into the Rural Commune of Foum Al Anser. The Ministry of Interior has given permission to use this dumping site as an inter-municipal site. All waste types including municipal waste, industrial waste and hospital waste are hauled to the site.

Open dumping is practiced at the dumping site. The site is characterized by open burning, stinking odor, scattering of waste, many flies and scavenging activities; characteristics which can easily apply to most dumping sites in Morocco. Animals such as sheep and cattle are grazing there. No control/supervision is done by the municipality at all, and no facilities such as gate, fence, truck scale etc. are found. Recently, groundwater contamination by leachate was reported, but details are not available.

The following issues for Beni Mellal dumping site have been identified (these issues represent most of the dumping sites in Morocco):

- Dumping method is open dumping (no waste compacting, no covering soil and no leachate control)
- No control by the municipality for incoming waste/vehicles, site operation etc.
- Sanitary condition of the site is very poor (open burning, stinking odor, scattering of waste, many flies, etc.)
- No heavy equipment operated
- Site is not enclosed by fence, access is open
- All types of waste, including municipal, industrial and hospital waste (which may contain toxic/infectious waste), are hauled to the site in mixed form
- Scavengers are active and animals are grazing at the site
- Access road is not paved
- Condition of operational road is not sufficient for the operation
- As the site is located quite near from city center (5 km), in accordance with the rapid growth of central city area, the location of the site itself will be a serious problem in the near future
- Proper operation system of inter-municipal disposal site and defining of responsibilities for operation and resulting environmental pollution not clear

(2) Case-2: Casablanca

Casablanca city is located at approx. 80 km south-west from Rabat facing the Atlantic ocean. This is the country's largest city and its commercial capital. The climate here is classified as Mediterranean type and rainfall in 1993/94 was 423 mm/year. Population is 2,775,000 (in 1994).

Disposal site in Casablanca started operation in 1985 on an area of 30 hectares (remaining life time of the site is estimated to be 2 - 3 years). The site is located at a hill-side along the Casablanca - Marrakech road (Meduna Road), and at a distance of 15 km south of the city center. The land is owned by the Urban Community of Casablanca. The site is operated mutually by the Urban Community and a private company (contract amount is DH 6 million/year, reported by company's engineer). The Urban Community staff operate the truck scale and maintain the records, as well as other administrative duties. The private contractor operates the landfill operation. The private contractor reported a staff of 21 persons and six heavy equipment for operation, and the urban community employs 20 persons of its own.

All types of waste including municipal waste, industrial waste and hospital waste are disposed at the site.

The Casablanca disposal site is the sole site which adopted control landfill in Morocco. Namely, first, incoming vehicles are checked at the gate by using truck scale, second, specific area inside the site is designated for present dumping area, third, hauled wastes are spread and compacted by heavy equipment, and forth, soil covering is implemented by heavy equipment. However, its operational method is not sufficient for control landfill. The covering soil is applied only once a week or every two weeks after finishing one stage of waste layer, and also the site is not properly enclosed by a fence. Covering soil is excavated from a private neighboring site. Therefore, stinking odor, scattering of waste, and many flies dominate the site. Further, there is no separated area inside the site designated for hazardous/toxic waste. Uncontrolled scavenging activities and animal grazing are common.

The following issues for Casablanca disposal site have been identified:

- Operation of control landfill is not sufficient (frequency of cover soil application low, waste compaction inadequate due to sometimes lack of heavy equipment, etc.)
- Site is not properly enclosed by fence
- All types of waste, including toxic/infectious waste, are hauled to the site mixed together
- Scavengers are active and animals are grazing at the site
- Remaining life time of the site is not sufficient for long term disposal site (it is surmised at 2-3 years)
- Proper landfill operation system by contracting out needs to be strengthened

(3) Case-3 : Rabat/Sale

Topographical and meteorological conditions of Rabat/Sale are similar with that of Casablanca. Rainfall in 1993/94 was 359 mm/year. Population is 1,241,000 (in 1994).

i. Existing Dumping Site

Rabat/Sale dumping site commenced operation in 1987 on an area of only 2 hectare (remaining life time of the site is surmised at several months). The site is located at a former quarry area and wastes are piled up to heights of approx. 10-15 m from access road level. Land ownership is private and the owner benefits from the recycling activity ongoing there (Wilaya Rabat/Sale have used this site without any official procedure, say purchase or rent and only the oral agreement of the owner). Open dumping is practiced at the site and sanitary conditions of the site are very poor. Further, contamination to drinking water sources and the nearby Abou Regrag river by leachate generated at the site has been reported by National Office of Drinking Water (NODW) since 1988, but the detail is not clear.

Issues for Rabat/Sale existing dumping site are almost the same as that of Beni Mellal, therefore Case-1 shall be referred to. The followings are additional issues:

- Such a dumping site should not be located at Rabat, the capital city of Morocco and its seat of government
- Environmental affects for surrounding housings located near the dumping site
- Necessary measures when dumping site is closed and returned to private land owner
- Contamination to source of drinking water which is located at the coastal area of Rabat

Because of these critical conditions at the existing dumping site as mentioned above, Wilayah Rabat/Sale recently selected a new disposal site for long term disposal.

ii. Newly Selected Disposal Site

The selection procedure for the new disposal site implemented by Wilaya Rabat/Sale started in 1988. The first motivation was a complaint letter from NODW to Wilaya Rabat/Sale regarding the contamination of drinking water source by leachate generated from Rabat/Sale dumping site. In 1995, the location for a new disposal site, as an inter-municipal disposal site, was selected from among five (5) candidate sites by Wilaya Rabat/Sale and Prefecture of Temara, and mediated by Ministry of Interior.

The new disposal site is located at Aouda Commune, Prefecture of Temara, on an area of seventy hectares. Distances from city center of Rabat, Sale and Temara are approx. 20 km, 25 km and 30 km respectively. The site is located in a plain agricultural land and approx. 50 m above mean sea level. The site will serve Wilaya Rabat/Sale and Prefecture of Temara, and will be designed and operated as controlled landfill.

During the selection procedure, the following matters have been mainly considered; harmful odor affecting surrounding inhabitants, contamination by leachate to drinking

water source, groundwater, and water bodies and settlement of inhabitants who are living next to existing dumping site for scavenging activity (approx. 50-60 houses exist). Hydro-geological analysis for each of the five candidate sites was performed. However, detailed selection procedure is not clear.

In early 1997 a controversy arose over the selected site due to land ownership issues, and another of the original 5 candidate sites was selected.

The following issues for selection procedure of new disposal site have been identified:

- Evaluated items for selection of new disposal site are not sufficient (Table 5.2-13 shows recommended items/conditions to be considered, such as possibility of land acquisition, acceptability of neighboring consensus, social conditions, environmental conditions, disaster prevention conditions, technical conditions and economical conditions)
- Operational method of inter-municipal disposal site is not well discussed in terms of land ownership, operation responsibilities, operation budgeting, site closure responsibility after use, etc.

c. Issues

In consideration of the above three (3) case studies and present conditions of other dumping sites listed in Table 5.2-12 (1/3), (2/3) and (3/3), the overall issues for final disposal site in Morocco have been identified as follows;

(1) Site Location

- Sites are located too close to the city urban area and although this is beneficial for decreasing transport costs, it will have a bad effect on future urban development (e.g. Settat, Beni Mellal, Kenitra, Agadir, Mohammedia, Safi, El Jadida, Tetouan, Fes, Taza)
- Sites in close proximity to water bodies such as river, stream may be source of pollution for these waters or the groundwater (e.g., Taza, Tetouan, Kenitra, Rabat, Mohammedia (nearby surface water contamination already confirmed), Casablanca (warning already issued not to use nearby contaminated groundwater))
- Sites located adjacent to housing areas or their access roads passing through such areas (e.g. Settat, Fes, Taza)

(2) Sanitary Condition

- Lack of cover material application on all sites (excluding to a certain extent Casablanca) leads to open fires, waste scattering, generation of flies and odor, etc. which can harmfully effect nearby residential settlements
- Unlimited access to scavengers and animal grazing puts them in dangerous contact with potential hazardous wastes mixed with domestic waste and dumped at the sites (all the sites)
- Potential pollution of drinking and irrigation waters (for sites close to water bodies) as in Casablanca and Mohammedia

(3) Site Operation

- Open dumping in all the sites, except for Casablanca
- Operation plan is mostly non-existent and truck dumping points inside sites largely controlled by scavengers
- Lack of control of incoming waste amounts by truck scale (all sites excluding Casablanca and Oujda)
- No records of incoming waste trucks kept (e.g. Beni Mellal, Kenitra, Settlat, Mohammedia, Safi, Taza, Tangier and Tetouan)
- Operation roads in most of the sites in poor condition and inaccessible in case of heavy rains
- Heavy equipment not at all used in sites (e.g. Marrakech, Beni Mellal, Mohammedia, El Jadida, Settlat) or available in insufficient amount (e.g. 1 bulldozer at Safi, Tangier, Tetouan)
- Waste dumping from high to low land creates problems in site stabilization and difficulty in compaction (e.g. Mohammedia, Fes)
- All waste types accepted at the dump sites and no specified areas within the dump sites designated for certain types of hazardous or industrial waste (all the sites)
- Staff from Urban Community for recording incoming waste, site access control, etc. are not present (e.g. Beni Mellal, Settlat, Safi, Taza)

(4) Local Officials Responsible for Final Disposal

- Low importance attached to dump site operation within Urban Communities (e.g. no specific department, no allocated budgets, no improvement plans in most sites,..)
- Technical staff ability in the field of landfill operation, planning and monitoring inadequate
- No medium and long terms plans (in some cities search for new site is ongoing but procedure is not clear nor well documented)
- No effort to develop data base (e.g. waste amount and type arriving to the site, vehicle arrival frequencies, capacity calculation for remaining years of use, quality of leachate generated, number of scavengers and amount of recycled materials, heavy equipment operation indices, private contractors which may be used in operation, etc.)
- Responsibility for operation of sites located on more than one commune territory, or used by one commune but located entirely on another commune's territory is not clear (e.g. (for the former) Beni Mellal, (for the later) Marrakech, Mohammedia, Tetouan)
- Responsibility for environmental pollution clearing and site closure for sites located on mixed ownership land (public and private) (e.g. Safi, Tangier)

3) Recommendations

In order to minimize public health and environmental impacts of final disposal site, the following matters shall be established by national and municipal organizations;

- Upgrade of planning technique for final disposal site within the SWM
- Establishment of design and facility standards for final disposal site
- Establishment of operational standards for final disposal site
- Training of engineers and skilled workers
- Establishment of selection criteria for new final disposal site
- Enforcement of environmental impact assessment at site selection process
- Guidelines of rehabilitation technique of existing dumping site
- Enforcement of monitoring system for operation and environmental protection
- Secure of domestic/inland supply route of heavy equipment
- Consideration of proper methods for open dumping site closure

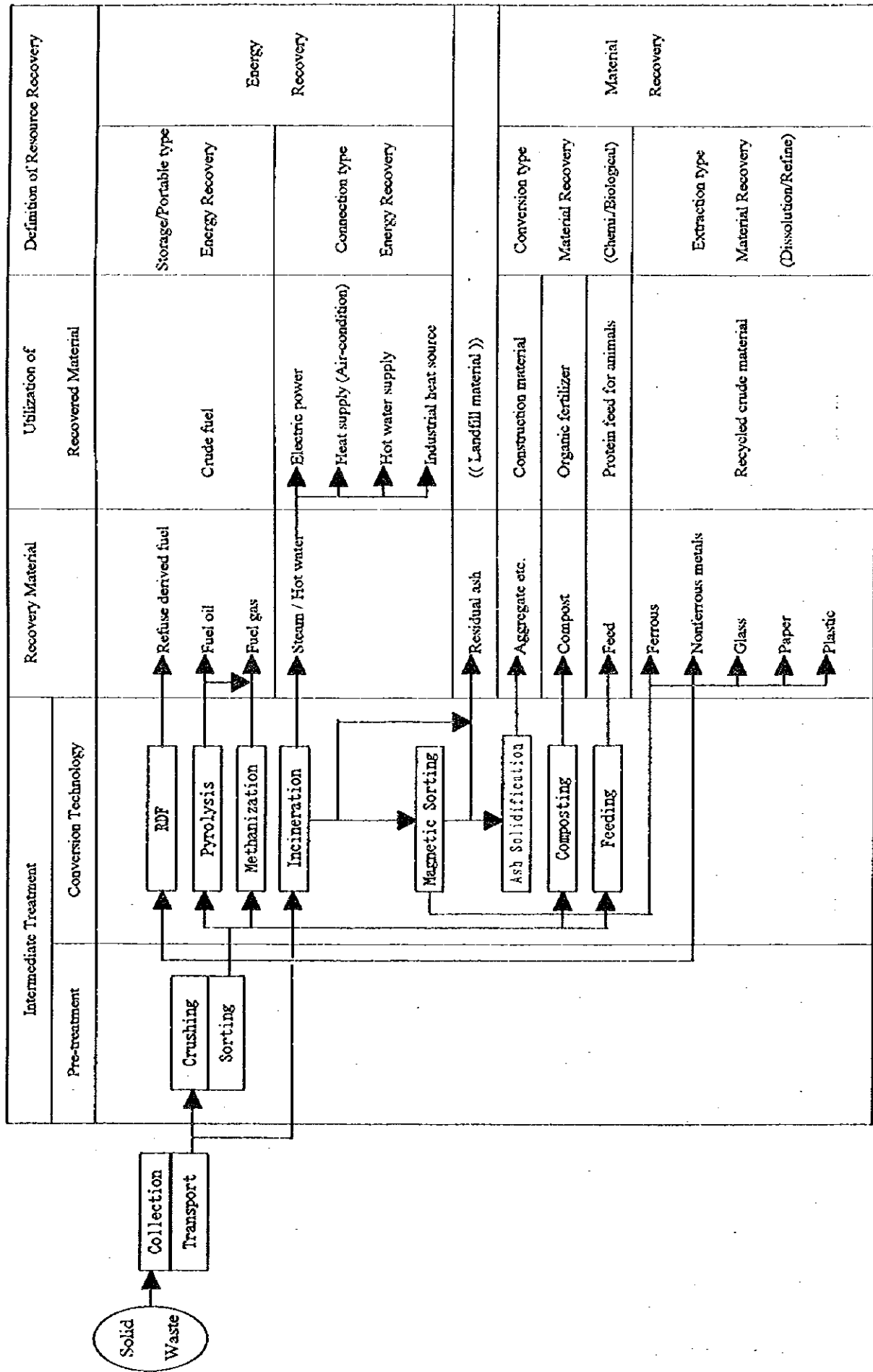
The stepwise improvement of disposal site incorporating the above stated planning technique, design & facility standard and operational standard is shown in Table 5.2-11. Meanwhile, selection criteria of new disposal site is shown in Table 5.2-13. As the first step, candidate sites for final disposal shall be chosen in consideration of two conditions, that is, possibility of land acquisition and required land area for disposal, and second step, new disposal site shall be selected from several candidate sites which have been chosen at the first step in consideration of seven (7) conditions listed in Table 5.2-13. Details of these tables will be stated in the next report (Interim Report -Guidelines).

Table 5.2-9 List of Existing/Planning Compost Plants in Morocco

No.	Location Condition	Descriptions / Remarks	
1	Rabat (operating)	a. Type : Piled compost	i. Major facilities/equipment etc. :
		b. Operation started in 1962	- Truck scale (30 ton capacity)
		c. Capacity : 250 ton/day (approx. 150 ton/day is treated recently)	- Three chain conveyor (8 ton hour chain)
		d. Compost production : 200 ton/year of fine and 22,300 ton/year of course compost	- Hammer mills (2 units)
		e. Plant owner : Wilaya Rabat Sale	- Magnetic separator (not functioned)
		f. Operation : by RED (Bureau of potable water and electricity)	- Rotary drum (40-100mm mesh sieve)
		g. Operation hours : from 07:00 to 18:00	- Stockpile yard
		h. Selling price : DH 60/ton for fine and DH 25/ton for course compost	- 2 wheel loaders, 1 tractor, 2 dump trucks, 1 vacuum car, etc.
2	Meknes (not operating)	a. Type : Piled compost	d. Compost production process (facilities) is same with Rabat plant
		b. Operation period : 1971 - 1992 (Plant is not operating and no plan to recover)	
		c. Capacity : surmised to 150 ton/day	
3	Marrakech (not operating)	a. Type : Piled compost	d. Compost production process (facilities) is same with Rabat plant
		b. Operation period : 1962 - 1985 (Plant is not operating and no plan to recover)	
		c. Capacity : surmised to 150 ton/day	
4	Casablanca (not operating)	a. The plant was constructed in 1978 by private company	b. Plant terminate its operation 7 - 8 years ago
		b. Detail of compost plant in Casablanca is not clear but compost production process surmised to be same with Rabat and Marrakech plant	c. Information has obtained by following reports : - "Waste Thematic Report" - "Dustbins Source of Life in the Region of Ain Asserdoune" (prepared by French consultant)
5	Agadir (under-construction)	a. Type : Piled compost	f. Major facilities/process etc. :
		b. Plant is under construction (on Mar. 1996)	- Stockpile yard of concrete based (2 ha) for primary fermentation (5-8 weeks)
		c. Capacity : 100 ton/day	- Shredder with feeding box (100 ton/day)
		d. Improved point compare with former type of compost plants such as Rabat, Marrakech	- Rotary drum/sieve (2 units) for rid of residual water and waste separation
		- Primary fermentation process has added	- Stockpile yard of concrete based and covered (1 ha) for complete fermentation
		- Waste separation process has improved	- Administration office and workshop
- Co-operation with controlled landfill site	- 40 permanent staffs are planned		
- Recycling system for non-organic selected waste by rotary drum is planned	- Others		
e. Study of Agadir compost plant was done in 1989 by French consultants as French & Moroccan cooperation			
6	Tanjir (planned)	a. Preliminary study for combined plant of bio-methanization and compost was done recently by Danish consultant as Denmark & Moroccan cooperation	b. This project supposed to be implemented financed by none interest loan from Denmark The cost is estimated at US \$ 7 million (hearing from Tangier U. Community official)
7	Oujda (planned)	a. Study for "The Development of the Composting Plant in the City of OUJDA" was done in 1992 by French companies as French & Moroccan cooperation	b. This project has not been realized yet
8	Fes (planned)	a. Compost plant has evaluated and concluded as feasible in "Draft Field Report, SWM in FES, Morocco" prepared by World Bank in June 1996	c. Evaluated items in the report : - Location of compost plant - Market demand/potential in FES region - Selling cost of compost products
		b. Recommended capacity of the plant in FES is not more than 50 ton/day (by the report)	- Affordability for farmers to buy compost
			d. This project has not been realized yet

Source: JICA Study Team, March 1996

Table 5.2-10 Classification of Intermediate Treatment Systems (Resource Recovery)



(Source : Japanese Reference Material)

5.2-11 Classification of Landfill Development and Operation

Description	Level of Landfill				Remarks
	Level -1 Open dumping	Level -2 Control landfill	Level -3 Sanitary landfill (level-I)	Level -4 Sanitary landfill (level-II)	
1 Site Facilities					
1-1 Main Facilities					
a. Access road	○	○	○	○	
b. Onsite road (Enclosing bound)		○	○	○	
c. Partition dike (Divider)		△	○	○	
d. Operational road	△	○	○	○	
e. Surrounding drain		△	○	○	
f. On-site drain (Surface water)		△	○	○	
g. On-site drain (Underground spring)			○	○	if necessary
h. Drain for reclaimed area		△	○	○	
1-2 Environmental Protection Facilities					
a. Buffer zone			○	○	
b. Litter control facilities		○	○	○	
c. Gas removal facilities			○	○	
d. Liner (penetration/seepage control)			○	○	
e. Leachate collection facilities			○	○	
f. Leachate circulation facilities			○		
g. Leachate treatment facilities				○	
1-3 Other Related Facilities					
a. Site office	△	○	○	○	
b. Truck scale (w/control room)		○	○	○	
c. Parking lot for car/equipment		○	○	○	
d. Washing station			○	○	
e. Safety facilities	△	○	○	○	fence, gate, lighting etc.
f. Fire prevention facilities			○	○	
g. Monitoring facilities			○	○	monitoring well etc.
2 Equipment					
a. Landfill equipment	△	○	○	○	
b. Soil covering equipment		○	○	○	
b. Others			○	○	sprinkler/inspection vehicle etc.
3 Operation and Maintenance					
3-1 Operation					
a. Personnel	△	○	○	○	
b. Covering soil		○	○	○	
3-2 Utilities					
a. Fuel		○	○	○	
b. Water		△	○	○	
c. Electricity		△	○	○	
3-3 Chemicals					
a. Insecticide			△	△	if necessary
b. Monitoring chemicals			△	△	if necessary

Legend ; ○ : should be facilitated/prepared
 △ : recommended to facilitate/prepare

5.2-12 Present Conditions of Dumping Sites of each City (1/3)

Description	Name of City					
	Agadir	Marrakech	Safi	Beni Mellal	Casablanca	Mohammedia
General information						
- Urban population in 1994 (x 10 ³)	561	746	376	387	2,771	170
- Area of dumping site (ha)	15	14	7	35	30	5
- Distance from city center (km)	4	20	5	6	15	5
- Surmised remaining life time of site (year)	5.1	3.6	3.6	17.3	2.1	5.6
1 Site Facilities						
1-1 Main Facilities						
a. Access road	△	○	△	△	○	○
b. Onsite road (Enclosing bound)	X	X	X	X	△	X
c. Partition dike (Divider)	X	X	X	X	△	X
d. Operational road	△	△	△	△	△	△
e. Surrounding drain	X	X	X	X	X	X
f. On-site drain (Surface water)	X	X	X	X	X	X
g. On-site drain (Underground spring)	X	X	X	X	X	X
h. Drain for reclaimed area	X	X	X	X	X	X
1-2 Environmental Protection Facilities						
a. Buffer zone	X	X	X	X	X	X
b. Litter control facilities	X	X	X	X	X	X
c. Gas removal facilities	X	X	X	X	X	X
d. Liner (penetration/seepage control)	X	X	X	X	X	X
e. Leachate collection facilities	X	X	X	X	X	X
f. Leachate circulation facilities	X	X	X	X	X	X
g. Leachate treatment facilities	X	X	X	X	X	X
1-3 Other Related Facilities						
a. Site office	(○)	△	X	X	○	△
b. Truck scale	(○)	X	X	X	○	X
c. Parking lot for car/equipment	(○)	X	X	X	△	X
d. Washing station	(○)	X	X	X	△	X
e. Safety facilities (fence, gate, lighting)	X	△	X	X	△	△
f. Fire prevention facilities	X	X	X	X	△	X
g. Monitoring facilities	X	X	X	X	X	X
2 Equipment						
a. Landfill equipment	△	X	△	X	○	X
b. Soil covering equipment	△	X	X	X	○	X
b. Others	X	X	X	X	○	X
3 Operation and Maintenance						
3-1 Operation						
a. Personnel	△	△	△	X	○	X
b. Covering soil	△	X	X	X	△	X
3-2 Utilities						
a. Fuel	X	X	X	X	X	X
b. Water	(○)	X	X	X	○	X
c. Electricity	(○)	X	X	X	○	X
3-3 Chemicals						
a. Insecticide	X	X	X	X	X	X
b. Monitoring chemicals	X	X	X	X	X	X

Legend ; ○ : exist / facilitated
 △ : exist / facilitated, but not sufficient
 X : not exist / not facilitated

Remarks ; (○) are the facilities which settled for compost plant located next to dumping site in Agadir

5.2-12 Present Conditions of Dumping Sites of each City (2/3)

Description	Name of City					
	El Jadida	Settat	Kenitra	Rabat	Tanger	Tetouan
General information						
- Population (x 10 ³)	240	236	449	1,241	526	400
- Area of dumping site (ha)	5	50	3	2	25	4
- Distance from city center (km)	2	10	7	21	4	5
- Surmised remaining life time of site (year)	4.0	40.6	1.3	0.3	9.1	1.9
1 Site Facilities						
1-1 Main Facilities						
a. Access road	△	○	○	△	○	○
b. Onsite road (Enclosing bound)	X	X	X	X	X	X
c. Partition dike (Divider)	X	X	X	X	X	X
d. Operational road	△	△	△	△	△	△
e. Surrounding drain	X	X	X	X	X	X
f. On-site drain (Surface water)	X	X	X	X	X	X
g. On-site drain (Underground spring)	X	X	X	X	X	X
h. Drain for reclaimed area	X	X	X	X	X	X
1-2 Environmental Protection Facilities						
a. Buffer zone	X	X	X	X	X	X
b. Litter control facilities	X	X	X	X	X	X
c. Gas removal facilities	X	X	X	X	X	X
d. Liner (penetration/seepage control)	X	X	X	X	X	X
e. Leachate collection facilities	X	X	X	X	X	X
f. Leachate circulation facilities	X	X	X	X	X	X
g. Leachate treatment facilities	X	X	X	X	X	X
1-3 Other Related Facilities						
a. Site office	X	X	X	X	△	△
b. Truck scale	X	X	X	X	X	X
c. Parking lot for car/equipment	X	X	X	△	X	X
d. Washing station	X	X	X	X	X	X
e. Safety facilities (fence, gate, lighting)	△	X	△	△	△	△
f. Fire prevention facilities	X	X	X	X	X	X
g. Monitoring facilities	X	X	X	X	X	X
2 Equipment						
a. Landfill equipment	X	X	△	○	△	△
b. Soil covering equipment	X	X	X	X	X	X
b. Others	X	X	X	X	X	X
3 Operation and Maintenance						
3-1 Operation						
a. Personnel	X	X	△	○	X	△
b. Covering soil	X	X	X	X	X	△
3-2 Utilities						
a. Fuel	X	X	X	X	X	X
b. Water	X	X	X	X	X	X
c. Electricity	X	X	X	X	X	X
3-3 Chemicals						
a. Insecticide	X	X	X	X	X	X
b. Monitoring chemicals	X	X	X	X	X	X

Legend ; ○ : exist / facilitated
 △ : exist / facilitated, but not sufficient
 X : not exist / not facilitated

5.2-12 Present Conditions of Dumping Sites of each City (3/3)

Description	Name of City			
	Fes	Taza	Oujda	
General information				
- Urban population in 1994 (x 10 ³)	877	206	679	
- Area of dumping site (ha)	10	6	35	
- Distance from city center (km)	6	2	9	
- Surmised remaining life time of site (year)	2.2	5.6	9.7	
1 Site Facilities				
1-1 Main Facilities				
a. Access road	○	△	○	
b. Onsite road (Enclosing bound)	X	X	X	
c. Partition dike (Divider)	X	X	X	
d. Operational road	△	△	△	
e. Surrounding drain	X	X	X	
f. On-site drain (Surface water)	X	X	X	
g. On-site drain (Underground spring)	X	X	X	
h. Drain for reclaimed area	X	X	X	
1-2 Environmental Protection Facilities				
a. Buffer zone	X	X	X	
b. Litter control facilities	X	X	X	
c. Gas removal facilities	X	X	X	
d. Liner (penetration/seepage control)	X	X	X	
e. Leachate collection facilities	X	X	X	
f. Leachate circulation facilities	X	X	X	
g. Leachate treatment facilities	X	X	X	
1-3 Other Related Facilities				
a. Site office	X	X	X	
b. Truck scale	X	X	○	
c. Parking lot for car/equipment	X	X	X	
d. Washing station	X	X	X	
e. Safety facilities (fence, gate, lighting)	△	X	X	
f. Fire prevention facilities	X	X	X	
g. Monitoring facilities	X	X	X	
2 Equipment				
a. Landfill equipment	△	△	△	
b. Soil covering equipment	X	X	△	
b. Others	X	X	X	
3 Operation and Maintenance				
3-1 Operation				
a. Personnel	△	△	△	
b. Covering soil	△	X	△	
3-2 Utilities				
a. Fuel	X	X	X	
b. Water	X	X	X	
c. Electricity	X	X	X	
3-3 Chemicals				
a. Insecticide	X	X	X	
b. Monitoring chemicals	X	X	X	

Legend ; ○ : exist / facilitated
 △ : exist / facilitated, but not sufficient
 X : not exist / not facilitated

5.2-13 Evaluation Items for Selection of New Final Disposal Site

(Evaluation Sheet / Sample)

Evaluation Items / Candidate Sites	Score					Remarks
	Site-1	Site-2	Site-3	Site-4	Site-5	
1. Possibility of land acquisition						
- Land use restriction						
- Land ownership						
- Necessity of compensation						
- Other considerations						
2. Acceptability of neighboring consensus						
- Necessity of neighboring consensus						
- Necessity of "out of sight" measures						
- Necessity for isolation from noise, dust and odor						
- Other considerations						
3. Social conditions						
- Competitive development plans						
- Conformity with regional development plan and land use plan						
- Compatibility for land use of adjacent area						
- Direction of urbanization towards the site						
- Flexibility of ultimate land use plan						
- Distance from residential area (related to living amenity)						
- The site is located within administrative boundary or not						
- Impact for arable land and/or pasture						
- Impact for inshore and/or river fishery						
- Other considerations						
4. Environmental conditions						
- Pollution possibility for source of drinking water						
- Impact by surface water pollution						
- Pollution possibility for ground water						
- Possibility of dust, noise and odor hazard						
- Impact by down-stream of main wind (direction)						
- Distance from densely inhabited area						
- Distance from airport and other public facilities						
- Impact for ecological system (fauna and flora)						
- Impact for natural landscape						
- Impact for historic and/or religious places or structures						
- Other considerations						
5. Disaster prevention conditions						
- Impact for flooding						
- Stability of the valley slope						
- Catchment area of the site (should be small)						
- Other considerations						
6. Technical conditions						
- Distance from main waste generation area						
- Land area of the site (capacity of acceptable waste)						
- Life expectancy						
- Availability of covering material						
- Accessibility to the site (w/ access road condition)						
- Traffic volume						
- Present conditions of the site						
a. Land use of the site						
b. Land use of surrounding area						
c. Topographic feature						
d. Geological feature						
e. Hydrological feature (ground water level etc.)						
f. Meteorological conditions (rainfall, wind etc.)						
g. Natural drainage condition						
h. Distance from close river or sea						
- Other considerations						
7. Economical conditions						
- Estimated land price						
- Estimated cost of compensation						
- Land productivity						
- Availability of public utilities/services						
- Economic value of the site upon completion						
- Other considerations						
Synthetic evaluation						

Note; "A" : plus factor for easy selection, "B" : factor of fair, "C" : minus factor for selection, "X" : item not considered

5.2.7 Waste Management Costs

1) Collection and Transport Cost

As most of the surveyed urban communes define their collection service as being door-to-door, daily and having a population coverage rate of 85-100%, it is important to understand what this service costs. In three different parts of the questionnaire, institutional, technical and financial, questions related to the collection and transport costs were addressed. The questions in the financial part were hardly answered. Table 5-2.14 shows the results of the questionnaire based on the replies from the other two parts.

The results of the survey show the need to establish an accounting system to be followed by the urban communes. Only some of the communes include depreciation costs, and there are wide discrepancies in the costs shares by item from one commune to another. Another unclear item is whether the salaries of promotional workers were included or not?

Five of the urban communes provided depreciation costs. Their unit rates ranged between 170 to 380 Dirham/ton. Agdal Ryad costs did not include maintenance costs because vehicles are brand new, and salaries cost is low when compared with the SWM staff (quoted in Table 5.2-5). Therefore the actual unit rate would likely increase by about 30-40 Dirhams. Hay Hassani costs seem to be the most accurate.

Therefore it is estimated that the actual costs for SWM collection and transport range between 300 to 400 Dirhams per ton.

Table 5.2-14 Unit Costs based on Questionnaire Survey

Urban Commune	Share of Cost (%)				*Unit cost (DH/t)	Urban Commune estimate (DH/ton)
	Salary	Maint.	Fuel, others	Deprec.		
A. TENSIFT REGION						
A.1 Marrakech						
(1) Machouar Kasba	88%	3%	8%	1%	230	NA
(2) Menara Gueliz						
(3) Marrakech Medina	86%	5%	9%	0%	260	NA
(4)						
A.2 Safi						
(5) Asfi Biyada	18%	33%	49%	0%	380	NA
(6) Asfi Boudheb	74%	6%	20%	0%	250	NA
(7) Asfi Zaouia	NA	NA	NA	NA	340	70
B. CENTRAL REGION						
B.1 Casablanca						
(8) Hay Hassani	59%	5%	17%	19%	380	299
(9) Ain Sebaa	33%	8%	10%	38%	180	NA
(10) Sidi Belyout	NA	NA	NA	NA	NA	200
B.2 (11) Beni Mellal						
	NA	NA	NA	NA	NA	338
B.3 (12) Mohammedia						
	33%	39%	28%	0%	260	NA
B.4 (13) El Jadida						
	NA	NA	NA	NA	NA	NA
B.5 (14) Khouribga						
B.6 (15) Settat						
	56%	13%	31%	0%	170	NA
C. NORTH-WEST REGION						
C.1 Kenitra						
(16) Kenitra Maamoura						
(17) Kenitra Sakina						
C.2 Rabat						
(18) Agdal Riyad	31%	0%	15%	54%	250	NA
(19) Yaacoub el Mansour	59%	14%	27%	0%	100	NA
C.3 Tangier						
(20) Tangier	NA	90%	10%	0%	230	200
D. CENTRAL NORTH REGION						
D.1 (21) Taza el Jadida						
	67%	19%	14%	0%	140	NA
D.2 Oujda						
(22) Sidi Maafa	NA	NA	NA	NA	NA	NA
(23) Sidi Ziane	63%	9%	17%	11%	170	100

Note: Questionnaires from Urban Communes with no data are left blank.

*Unit cost estimated by Study Team based on the data of the questionnaire, excluding Safi where more detailed study was implemented (Book 4).

2) Disposal Cost

As discussed in section 5.2.6 most of the present disposal sites in Morocco are operated as open dumping with no site presence of community staff. Therefore excluding possible payments for land rent the disposal costs can be considered as zero.

However as reference for future estimation two cases where the disposal costs may be estimated are considered hereafter.

a. Casablanca Control Landfill

Based on the contract price agreed between the Urban Community and private contractor and the Urban Community staffing at the disposal site (for administrative control) the unit cost is estimated at 8 - 10 DH/ton under the following conditions;

- site operated as control landfill
- contractor contract cost includes costs for equipment, manpower and fuel
- urban community staff around 10 persons
- cost does not include land cost and costs for purchasing of cover materials which are unknown

b. World Bank Solid Waste Management Study in Fes

This study was conducted in 1995 with the purpose of comparing the costs of operating SWM activities by the public and private sectors. Unit costs for the sanitary landfill were estimated to be 45.4 Dirham/ton and 39.8 Dirham/ton by the public and private sectors respectively. Costs were estimated under the following conditions:

- Sanitary landfill operation inclusive of leachate treatment
- Equipment and facility depreciation and consumables
- personnel
- Repayment of interest
- Land price is not included

Casablanca unit cost is on the low side indicating that operation of the site is planned to be at the minimum acceptable level of controlled landfill, while in the case of the World Bank the ideal condition is adopted. Unfortunately both do not take into consideration land costs. In the coming phases of this Study estimates shall be developed for landfill sites.

5.2.8 SWM Technical Issues

It is important to understand the SWM issues as evaluated by the actual operators. Therefore the questionnaire survey requested the communes to evaluate a number of SWM issues. The results are shown in Table 5.2-15, along with commentary on the issues from the operation viewpoint solely.

Table 5.2-15 SWM Issues Evaluated by Urban Communes

Unit: Degree of seriousness; A:very serious, B:serious,...

Issue	Degree of seriousness	JICA Study Team evaluation (from operational viewpoint)
1.Limited cooperation from the public	A	Very serious, <i>Efforts of urban communes to gain cooperation and consideration of issues where cooperation is necessary are insufficient</i>
2. Too rapid urbanization	A	Serious. <i>More equipment is necessary to extend service to newly populated areas within the context of an operation plan</i>
3.Lack of legislation	A	Very serious. <i>Legislation on responsibility of industrial wastes generators for disposal and operating rules on discharge of domestic wastes, etc. are needed</i>
4.Old equipment/too frequent breakdowns	B	Serious, <i>but preventive maintenance inadequate</i>
5.Difficulty to hire staff	B	Serious, <i>work conditions and workers status should be improved</i>
6.Difficulty to acquire landfill sites	B	Very serious, <i>system for use of rural commune land by urban communes, and landfill site selection criteria should be studied. Gradual operation improvement to attain sanitary landfill operation, definition of waste types accepted at the disposal sites and eliminate terrible environmental harms caused by present un-controlled open dumping is of urgent priority in dealing with this issue.</i>
7.Financial resource shortage	B	Serious, <i>but proper accounting system needed to evaluate expenditures and eliminate inefficient spending</i>
8.Lack of trained personnel	B	Very serious. <i>Training programs on national as well as local levels required</i>
9.Hazardous waste collection	C	Very serious. <i>Mishandling of hospital and industrial waste is very dangerous.</i>
10.Lack of short-,medium-or long-term planning	C	Serious. <i>Both skills of officials to develop such plans and targets set by central government should be strengthened</i>
11.Deficient service coverage (population not served)	C	Serious. <i>Basis for urban communes estimates of their collection service coverage should be reviewed to get more accurate estimates</i>
12. Shortage of equipment	C	Serious <i>Equipment type and number required should be considered within an efficient operation plan</i>
13.Lack of equipment standardization	C	Serious <i>Equipment selection should be considered in relation with ease of maintenance and operation plan</i>

14. Lack of enforcement measures	D	Serious <i>To what degree should cleansing operators directly be involved in such measures is an important issue</i>
15. Inappropriate institutional set-up of SWM	D	Serious. <i>Establishing a cleansing section within the urban commune, rather than working under the workshop or technical sections should be evaluated</i>
16. Lack of qualified private contractors	D	Serious. <i>Sub-contracting of SWM activities should result in cost savings and more efficient work, therefore data base to identify activity and encourage private sector participation needed</i>
17. Development projects with no SWM consideration	D	Very Serious. <i>SWM should be considered in new industrial estates, housing, and commercial areas. Informal development may pose difficulties for SWM service in terms of difficult access and lack of accurate information</i>
18. Proliferation of squatter areas	D	Problem. <i>This is a social problem in principle but such areas need to be served as well</i>
19. Excessive decentralization among urban communes	D	Problem. <i>With every new urban commune established allocation of vehicle fleet, manpower and workshop is necessary under the present system, regardless of scale of urban commune. More efficient use of limited municipal financial resources should be considered.</i>
20. Deficient service quality	D	Problem. <i>Door-to-door, daily collection service mostly provided at present is high quality, but costly service. To rationalize cost and extend service coverage, reduction in quality (e.g. 2-3 days/week collection and open stations pick-up points) will be necessary. Problem will be to gain citizens understanding and cooperation.</i>
21. Limited cooperation from governmental agencies	D	Serious. <i>Governmental agencies can play a role in issuing standards, training, regulating industrial waste management, evaluation of proposed intermediate treatment facilities, selection of landfill sites, related land acquisition process, public education, among others.</i>
22. Difficult control of contracted out service	E	Problem. <i>At present degree of seriousness is low because private contractors are not used. Once they are used, their contract conditions, work monitoring and control system become considerable issues</i>

5.3 Finance

5.3.1 Overall Local Government Revenues and Expenditures

This section considers solid waste management in the context of the overall financial resource situation of local governments in Morocco. Aggregate information on local government revenues and expenditure, with special reference to external sources of funding, namely the central government and FEC, are described in Section 4 above. Following are further details on the types of activity financed by local governments, and a review of locally generated and administered fiscal resources.

Table 5.3-1 below shows how total local government expenditures have been allocated between operating costs and capital costs over the 1990-94 period. An important feature of this table is that whereas total costs have increased by 42 percent over the period, operating costs have increased by almost 80 percent, while capital costs have only increased by 9 percent, a substantial drop in real terms. One contributor to these trends has been the continued increase in wages and salaries, which grew from 26 to 32 percent of total local government expenditures between 1988 and 1992.

Table 5.3-1 Total Local Government Expenditures 1990-94

Unit: million DH

Expenditures	1990	1991	1992	1993	1994	Total 1990-94	% 1994	% Increase 1990-94
Operating Costs	3,426.6	4,043.3	4,636.0	5,463.4	6,137.0	23,706.3	58.9	79.1
Capital Costs	3,916.1	4,216.5	4,133.5	4,477.8	4,281.9	21,025.8	41.1	9.3
Total	7,342.7	8,259.8	8,769.5	9,941.2	10,418.9	44,732.1	100.0	41.9

Source: Table Ronde

These funds are spent on a wide variety of activities. Data on operating costs of various elements of the local governments' programs are difficult to assess, but data on capital

Table 5.3-2: Allocation of Capital Expenditures by Source of Funding: Local Governments, 1990-94

Unit: million DH

Sector	VAT	Local Resources	Loans	TOTAL	%
I. LOCAL ASSETS	4,802.63	5,193.78	3,523.16	13,519.57	64.3
1. Studies	35.91	103.78	37.97	177.16	0.8
2. Infrastructure	1,631.72	1,937.91	1,901.66	5,471.29	26.0
a. Rural Amenities	306.06	92.40		398.46	1.9
b. Urban Streets and lighting	1,123.67	1,507.39	1,109.54	3,740.60	17.8
c. Sanitation	86.06	147.21	608.29	841.56	4.0
d. Water Supply	115.93	190.91	183.83	490.67	2.3
3. Social Facilities	438.80	637.02	60.73	1,136.64	5.4
4. Specialized Equipment	410.26	132.13	771.08	1,313.42	6.2
5. Administrative Buildings	667.65	740.25		1,407.90	6.7
6. Solid Waste		306.64	401.81	708.45	3.4
7. Urban Transport			87.74	87.74	0.4
8. Materials	250.48	1,088.95		1,339.43	6.4
9. ONEP	768.47	160.61		929.08	4.4
10. Miscellaneous Equipment	599.25	86.49	262.17	947.91	4.5
II. TRANSFERRED ITEMS	4,393.38		889.48	5,282.86	25.1
1. Education	2,259.92			2,259.92	10.7
2. Health	344.30			344.30	1.6
3. Rural Electrification	503.56		889.48	1,393.04	6.6
4. Agriculture	378.44			378.44	1.8
5. National Promotion	778.50			778.50	3.7
6. Civil Protection	67.46			67.46	0.3
7. Miscellaneous	61.20			61.20	0.3
III. SHARED EXPENDITURES	2,230.83			2,230.83	10.6
TOTAL	11,426.84	5,193.78	4,412.64	21,033.26	100.0

Source: Table Ronde.

investment are more readily available. The 21 billion DH of expenditures on capital investment over the 1990-94 period, and sources of this funding are shown in Table 5.3-2 for the various services provided at the local level. It will be noted that central government programs accounted for about 6.6 billion of total VAT transfers, or almost 60 percent of the total. Of this amount, about two thirds was for "transferred items", consisting primarily of large scale development projects such as rural electrification and irrigation, managed entirely by the central government. The other one third was for "shared expenditures", which are primarily activities managed by the Ministry of the Interior for the benefit of all local governments.

Table 5.3-2 shows that overall, the programs managed by the central government programs account for about 37 percent of total investments. Almost 90 percent of this was financed out of the VAT transfer, the remainder being borrowing for rural electrification. Among the explicitly local programs, urban streets and lighting were by far the most important item. Investment in solid waste over the period was of minor significance, accounting for only 3.4 percent of the total. Of the approximately 700 million DH invested in solid waste, about 40 percent was financed from local resources, the remainder by loans from the FEC.

5.3.2 Fees and Taxes Administered by Local Governments

As noted in Section 4.4, there are two types of local taxes, namely those that are administered by the central government and those administered directly by local governments. Local sources of finance administered directly by local governments consist of a number of taxes and fees raised from various economic sectors. Although individually each of these sources of revenue is quite small, on aggregate they contribute significantly to local government budgets. Indeed, they are becoming of increasing importance, and have increased in recent years at a more rapid rate than any other source of income. In 1990, assessed revenues from these taxes constituted 17 percent of local government income, but the local government tax reform implemented in that year increased their importance, and by 1994 their contribution to had risen to 21 percent. Details for 1993 (the latest year for which information is available) are presented in Table 5.3-3 below.

**Table 5.3-3 Local Taxes and Fees Administered by Local Governments:
Actual Revenues, 1993**

Unit: million DH

Taxes and Fees	Prefectures and Provinces	Urban Communities and Communes	Rural Communes	Total	Percent
TAXES					
Revenue from forest products		24.8	135.8	160.6	17.6
Hotel Tax		27.5		27.5	3.0
Taxes on Beverages		24.5		24.5	2.7
Entertainment tax		10.0		10.0	1.0
Tax on Sporting Events		3.4		3.4	0.4
Tax on Private Education		2.8		2.8	0.3
Driver's License Fees	33.1			33.1	3.6
Various rural taxes			324.9	324.9	35.8
Hunting Fees	14.2			14.2	1.6
Other Taxes 1/	58.7	251.2		309.9	34.0
Total Taxes (% Total Taxes versus Total Taxes & Fees)	106.0	344.2	460.7	910.9 (54.7 %)	100.0
FEES					
Market Fees		130.4	95.2	225.6	29.9
Wholesale Markets		175.0		175.0	23.3
Fish Markets		48.1		48.1	6.4
Construction Permits		139.7		139.7	18.5
Land Development Fees		19.1		19.1	2.5
Breakup of Estates		9.0		9.0	1.2
Other Fees 2/		137.5		137.5	18.2
Total Fees (% Total Fees versus Total Taxes & Fees)		658.8	95.2	754.0 (45.3 %)	100.0
TOTAL LOCAL TAXES AND FEES	106.0	1,003.0	555.9	1,664.9	100.0

1/ Other taxes include taxes on commercial displays of goods, and transport licenses.

2/ Other fees include fees from abattoirs, use of civil registry, ambulance service, and concessions.

Source: Ministry of Interior

This table shows that urban communes and communités urbaines between them generate the most local revenues, with prefectures, provinces, and rural communes administering much less. It will be observed that in the urban communities, taxes are less significant than fees, the latter accounting for about two thirds of the total. Major sources of tax income are transport and driver's licenses, as well as taxes on beverages, hotel accommodation, and entertainment. Taxes on forest operations are specially important for rural communes. In total, however, the bulk of such income comes from fees related to various forms of urban market activities.

5.3.3 Local Government Financial Policy

1) Accounting

The study of solid waste management at the local level sought information on local government accounting policies. In particular, it was asked if the accounting system used at the commune level makes a clear distinction between the costs of solid waste management and those of other commune activities. In fact, the study revealed that there is usually no separate accounting for different services provided at the local government level. In practice, there is a great deal of sharing of equipment and manpower. Also, local government accounts only show cash costs, primarily salaries, consumables, and spare parts, and recently, interest payments to the FEC. Disaggregation of local expenditures are typically in terms of inputs (personnel, vehicles, etc), rather than outputs. True costs of services are thus not represented in accounting systems, which therefore provide inadequate information for planning and management of specific services, such as solid waste management.

2) Investment Decisions

To a large degree, the extent to which proposed investment projects are subjected to rigorous appraisal depends upon their source of funding. Communal councils undertake local investments financed out of their own local resources on the basis of analysis by consultants and staff and review by their investment and finance committees. Citizens may, but seldom, attend council meetings. The Ministry of Interior reviews these investments on the basis of a summary description in the proposed budget and requests additional information when a proposed investment appears to be unsound. This sometimes blocks investments even in those communes with substantial funds of their own.

Before the recent reform of the VAT distribution system, local investments financed by the VAT were subject to exceptionally close scrutiny by the Ministry of Interior, which placed high priority on those projects with significant national and regional benefits. The reform in the VAT system now gives much greater freedom to local governments; the Ministry of Interior continues to play an important role in the approval of capital expenditures, but it is planned to reduce this over time. Investments proposed for FEC financing undergo the highest degree of scrutiny; it should be noted that one of the requirements of the FEC is that the borrower has an acceptable debt service ratio. In this respect, local governments in Morocco tend to be in a relatively healthy position, since to date borrowing to finance local investments has been minimal.

3) Revenue Collection

One aspect of Table 5.3-3 above is specially relevant for the current study. It will be noted that total revenues generated by locally-administered taxes and fees in 1993 amounted to 1,665 million DH. This refers to revenues actually collected; in contrast, Table 4.4-1 shows that local tax assessments in that year were 2,106 million DH. As in the case of the three local taxes administered by the central government, there was thus a significant shortfall in revenue collection, in this case being about 21 percent. This situation poses a major problem for the adequate delivery of local services, including, of course, solid waste management.

5.3.4 Projected Financial Requirements for Adequate Solid Waste Management

According to a World Bank estimate, the total cost of "proper" government-provided solid waste management system in Morocco (i.e. including capital depreciation and interest, taxes, personnel, consumables, repairs, insurance and registration) would amount to about 140 DH per capita per year. Although not explicitly defined in the World Bank report, it is assumed here that "proper" means an adequate system, in terms of the quality and frequency of collections, as well as satisfactory methods of disposal. To put this figure in context, in 1994 total local government expenditures (excluding national programs and shared expenditures) were reported at about 300 DH per person; more realistic definition of total costs (including depreciation, taxes etc) might increase this to 400 DH per person.

The next phase of the current study will include refined estimates of the costs of specific improvements in solid waste services as well as estimated present expenditures on solid waste management. This will be based upon detailed analysis based upon site visits by the study team as well as the results of the study on solid waste management at the local level. However, using existing rough estimates for purposes of illustration, the following analytical procedure will be followed:

Estimates will be made (tentative estimates based upon information now available in parentheses) of:

1. Present total local government expenditure (400 DH/per capita/year)
2. Present expenditure on solid waste (80 DH/per capita/year)¹
3. Present total local government expenditure (3.6 percent of GNP); and
4. Present expenditure on solid waste (0.9 percent of GNP)

The annual increase in expenditures necessary to achieve adequate solid waste services, assuming technology and policies unchanged under the above assumptions would be 60 DH per capita which is only about one half of one per cent of the 1994 per capita GNP. (Also note that given the high urban unemployment rate in Morocco, and the high labor-intensity of solid waste management operations, the real cost of the service - and improvements therein - may be even less than the foregoing implies). While on average

¹ This extrapolates from an unpublished World Bank study of solid waste management in Fez for recurrent costs, (i.e. 30% of total recurrent costs plus average capital investments in solid waste 1990-94, with adjustment for depreciation, taxes, etc.

these rough data seem to imply that the fiscal burden of achieving an adequate level of service is small, the average masks considerable variations between local governments in Morocco, where local government expenditures generally vary within the 100 to 400 DH range. The burden is obviously greater in the poorer communities. The new VAT system intends to remedy some of the inequalities between local communities, but discrepancies will remain, particularly as its distribution is still dependent in part upon local fiscal effort.

Actual financial requirements for improved solid waste management should ideally be based upon an analysis of the costs and benefits of alternative scenarios in terms of the adequacy and rate of improvement in services offered. In practice, alternative programs for improving the collection and disposal of solid waste, judged to be feasible and desirable according to international experience, will be set out. This will be a critical element of the next phase of the study. For example, cost estimates will be made based on various assumptions about the frequency of collections from households, industrial and commercial establishments, and hospitals. Improvement in disposal facilities, sometimes involving actual closure, will also be costed. One set of targets that should be considered, and estimates refined, is that contained in the National Strategy for Environment and Sustainable Development, which for municipal waste is as follows:

- An increase in the rate of collection from 85 percent in 1992 to 95 percent in 2020
- This would be paralleled by higher quality service, including standardization of containers for collection
- An increase in the rate of recycling of paper, plastics and organic material from 2 percent in 1992 to 10 percent in 2020
- A reduction in the percentage of waste dumped in illegal sites from 51 percent in 1992 to zero in 2020

The National Strategy also sets out parallel targets for industrial waste.

Such projections should take account of the fact the volume of solid waste will increase as population and incomes increase (an income elasticity of 1.00 has been observed in other countries at similar stages of development). Cost-effective approaches and the financial resources and complementary institutional, legal and other requirements - including the potential for increased revenues - which will permit achievement of the implied targets to be assessed.

From a financial viewpoint, the main sector issue is thus simply the shortage of funds for adequate solid waste management; this can be addressed by increasing revenues or reducing costs, or some combination of the above.

5.3.5 Revenue-Enhancement Possibilities at Local Level

The general issue of revenue enhancement at the local level is beyond the scope of this study. However, the feasibility of increasing local revenues by fees or charges related to the use of solid waste services must be assessed in the context of the overall local fiscal burden and local capacity to pay.

1) Existing Charges for Solid Waste Management

The study of solid waste management at the local level reveals no instance of any user fees, taxes, fines or other penalties, or income from sales that are specifically related to solid waste. Thus there are no charges for household collection, no tipping fees for industrial waste discharge, no penalties for illegal disposal, no fees for industrial or hospital collections. And no instance was cited in which local governments profited from sales of recyclable material or compost. (However, there may be examples in other cities; this should be checked).

2) Criteria for Introduction of Solid Waste Charges

There appears, therefore, to be scope for considering the introduction of mechanisms at the local level for raising revenues and at the same time encourage more efficient use of resources by recycling as well as actual reduction of waste discharged. In principle, charges should be based upon economic costs of the service provided. Examples to be considered should include household fees based on volume or household characteristics; industry tipping fees; special fees for hospitals, etc. The contribution of various sectors to the total waste load and costs of collection and disposal will be assessed. The feasibility of introducing charges for each type of user should then be tested. A possible result will be to find that a tax on industry is administratively feasible, and also yields significant revenues. Criteria for determining the appropriateness of such mechanisms include administrative feasibility, political acceptability, and financial feasibility.

a. Administrative Feasibility

The main issue is whether the cost of the collection mechanism will exceed its benefits. One issue concerns collection of taxes or fees. Already this is a problem in Morocco, with substantial differences between assessments and actual collections recorded for both the local taxes collected by the central government as well as those collected by the local authorities themselves. In such cases it is sometimes proposed that fees should be collected along with electricity and water supply bills, with the possible sanction that supplies of these services to consumers can be cut off in the event of non-payment; however, in Morocco the record of collection of water supply bills, in particular, is not good.

b. Political Acceptability

The system must be acceptable to the local population. Transparency in collection and spending procedures is essential. A particular obstacle in Morocco will be the existence of the tax d'etilite, which formally is supposed to cover the costs of solid waste management, and indeed sanitation in general, but in practice is used for various purposes.

c. Financial Feasibility

This includes capacity and willingness to pay. Per capita costs should be compared with household disposable incomes if such information is available (so far the study of solid

waste management at the local level provides no answers to this question). Household surveys of willingness to pay for waste collection might also be employed.

5.3.6 Cost Containment Possibilities

1) Accounting Reforms

The study of solid waste management at the local level demonstrated the inadequacy of financial information systems at the local level. There is a need to introduce output budgeting and to clearly distinguish the costs of different services provided at the local level. True costs of solid waste management and other local government activities, including capital costs, should be clearly understood to facilitate planning.

2) Privatization

Privatization, by lowering real costs of solid waste management operations, may be one means of addressing the financing gap implied by improved service. Issues to be addressed include, above all, clear legal definition of waste management standards and responsibilities, and removal of impediments to entry such as difficulty of entering into multi-year contracts, and the social implications of a probable reduction in labor force if private operators are involved.

The cost estimates shown in Section 5.4 above further indicate the importance of accounting reform. While the specified targets appear reasonable measured in these real terms, it should be noted that they may be less easy to attain if private enterprise intervention is sought. Existing budgetary procedures substantially understate true costs; the contract terms required to attract private sector operators would therefore place a relatively large burden upon local budgets, and thus accounting reform would appear to be essential if this impediment to local enterprise is to be removed.

3) Technical Measures

A variety of technical measures may be employed to reduce costs; these may include possible economies of scale achieved by merging the solid waste functions of some jurisdictions. Also to be considered would be the introduction of "contestability", in which part of a city is served by a private concessionaire, the rest by the public authority.

References

1. World Bank, First Municipal Finance Project, Kingdom of Morocco, May 1993.
2. National Strategy for Environmental Protection and Sustainable Development, PNUD/UNESCO, Ministry of Environment, Kingdom of Morocco, May 1995.

5.4 Environmental and Sanitary Aspects Related to SWM

5.4.1 Environmental Impacts and Nuisances

1) Waste Landfill

a. Impact Sources

Impact sources are:

- proximity of habitat
- cattle herd
- lack of soil cover
- absence of fencing
- use of inappropriate trucks for transportation of waste to the dumping site
- free discharge of leachate in water bodies

Landfill sites are located without much consideration of the distance to human settlements, particularly habitat, or any sensitive zone. Several landfill sites are established near villages: Taza, Safi (2 villages within a 2km area), Casablanca, Fès. There are rural habitats near the disposal sites of Asfi Zaouia (few villages around the site). In Fès and Settat, access road for dump trucks is inside the residential zone. Proximity of a major road can be seen at Casablanca, Marrakech and secondarily at Mohammedia. There is a shanty town established near the Mohammedia site, and bad smells are perceived in certain quarters and from roads or the highway.

Landfill sites of Mohammedia, Taza, and Rabat are located just on riverbanks. The black color leachate directly discharges into the water bodies. In the case of Taza, wastes are directly discharged into the river during heavy rain conditions. In the case of Rabat disposal site, analysis of the leachate and solid waste have shown high concentrations in toxic substances (heavy metals, insecticides) and in pathogen germs.

In general however, there is some reasonable distance between landfills and inhabitants. With urbanization of land, this distance will decrease and generate a degradation of living conditions. With new requirements for environmental quality and increased awareness for environmental risk, such conditions will be unacceptable by the people.

b. Main Nuisances

Main nuisances are:

- pestilential odors
- smoke
- air pollution
- noise and traffic
- spreading of waste around the site
- spreading of waste along the access road to the site
- degradation of landscape

According to the results of the questionnaire sent to local collectivities, landfill site is generally not mentioned as a SWM problem in comparison with collection related

issues. Complaints against landfill sites have been clearly expressed by the people living at proximity of the landfill sites in Fes, Taza, Marrakech and Casablanca. The case of Casablanca is particularly serious since people complain about the contamination of the water source.

Landfill sites are still more perceived as a resource than as a nuisance for scavengers and owners of herd cattles fodding on the landfill. It is unclear if herd cattle owners are coming from surrounding villages and what is their social condition.

c. Evaluation of Environmental Effects

There is no any form of control about waste disposal sites in Morocco. No siting criteria has been explicitly considered excepted for the location of Rabat and Casablanca sites. Control of the site can be observed in Casablanca (truck scale and fence). However, the fence has no function since it has been partially destroyed for the herd cattle way. There is no any pest control practice on the sites.

The impacts of landfill sites on the environment are supposed to be serious due to the following factors:

- The quality of waste which is landfilled is not known, but it is commonly accepted that hazardous waste are mixed with household waste
- Contamination sources like discharge of leachate or its infiltration into underground are not managed;
- Generation of vectors on sites and the surrounding areas are not controlled.

It seems that investigations have been conducted for the Rabat and Safi landfill sites, concluding about the contamination of surface water by leachate discharge. Water wells located downstream the Casablanca disposal site are considered as contaminated, so that there are propositions to stop their use. However, effects of these sites on the environment and health are not known.

Table 5.4-1 Environmental Nuisances Cited by the Communes

	nuisances that are the object of people complaints in commune (number of responses)	main environmental problems of the commune (number of responses)
pollution	0	2
traffic pollution	0	2
air pollution	1	3
industry (industrial waste)	0	4
solid waste	0	4
waste water	0	10
lack of infrastructure in new urbanized zones	0	1
noise	3	0
leachate (in street)	1	0
disposal site	0	2
street sweeping	1	0
uncivic manner of people	1	0
bad smells	6	0
pest (insects, mosquitoes)	1	0
lack of collection (1 case of truck breakdown)	2	0
waste trucks schedule	2	0
dirty aspect: litter, clandestine dumps, intermediate dumping sites	3	4
plastic bags	2	3
NO ANSWER	7	1

Note: Indicator: disposal site totally or partly within the communal territory
 NA: 1, NO: 13, YES: 4

2) Waste Collection

a. Impact Sources

Impact sources are:

- street litter
- illegal clandestine dumps in streets, rivers, and opened land plots
- opened waste bins
- time spent from deposit of the waste bins to disposal by truck
- fermentation rate of solid waste
- wide use of plastic bags
- uncontrolled animals (dogs, cats)
- traffic of waste trucks
- spreading of leachate along streets
- no collection of waste containers

- lack of street sweeping
- improper handling of waste containers when collected

b. Main Nuisances

Main nuisances generated by the existing conditions of waste collection are the following:

- noise occurred by night traffic of dumping trucks; this issue is also determined by the scavenging activity of waste collectors, which is time consuming and increase exposure to noise of the engine of the truck;
- traffic jam for the same reasons exposed above, but during the day;
- proliferation of pest
- pestilential odors
- health risks for the communities directly exposed to solid waste or to landfills, and for the communities exposed through consumption of contaminated water;

According to the questionnaire sent by the JICA study team to communes, bad smells and noise are the main causes of people's complaints (Table 5.4-1). Nuisances directly or indirectly generated by waste collection conditions are also cited as the main environmental problems of the commune, together with untreated wastewater. For communes, clandestine dumps and littered plastic bags are the main nuisances of waste management conditions.

Clandestine dumps, opened waste bins or bags, and street spreading of leachate are factors of proliferation of pest and pathogen germs. The physical effect of logging of rivers or sewage by solid waste dumping on flooding occurrence has been reported to the study team. Logging related aspects are:

- disfunctioning of the sewerage system, due to logging of the sewage by solid waste materials accumulated by runoff in rainy periods;
- increased risk of flooding as a result of sewage logging, which is impairing proper evacuation of water runoff.

5.4.2 Physical and Social Aspects

1) Physical Aspects

Main potential effects are as follows:

- landscape and amenities (tourism sites, recreation sites)
- degradation of the sea coast (illegal deposits)
- logging of rivers and ravines
- degradation of open land (litter and clandestine piles of SW)
- degradation of water habitats
- loss of wildlife population could be significant since landfill site occurs in depression, possibly wetland or river area
- loss of amenities (visual and sound landscape) and loss of attractivity
- air pollution and air related nuisances

2) Scavenging

a. Street Scavengers

Street scavenging is practiced by the waste collection workers themselves, and by specialized scavengers. There is no any evaluation of their activity, organization, and social and economic conditions. The number of street scavengers is not known, but seems to be important. The study made by the Sale prefecture in 1992 has shown that the recovery activity generates 2000 employments, including the whole chain from scavengers to wholesalers.

Several problems are linked with this activity:

- Traffic jam, or noise in case of night collection, are directly generated by the time used by waste collection workers to separate materials;
- Litter is generated in streets around the waste bins by scavengers when waste deposit is not timely adjusted to track collection, and particularly in case of plastic bags conditioning;
- Opened bags with spreaded waste makes collection a time consuming service, if not refused by the waste worker.

Rationalization of the SWM will result into the loss of the activity and income of the population of scavengers. This social impact must be evaluated, and compensative measures set up. Collective containers for specific materials like paper, plastics, or glass, might be located in public places to solve the problem of street scavenging and its negative interaction with the interface: people / waste collection workers.

b. Waste Disposal Site Scavengers

Scavenging activity at the waste disposal sites is easier to evaluate, but no study has been done. The JICA study team has observed the presence of scavengers in each site visited. Part of the scavengers are permanently living within the disposal site itself. Their number has been evaluated at about 150 in Casablanca site, 20 in Marakkech, 50 in Rabat site. Their income related to this activity would be in the range of 20 to 40DH / day / person. However, the study performed at Beni Mellal (1995) gives an example with lower figures, with an income ranging between 20 to 68DH per person per week. Scavenging activity is always cited as a source of difficulty for the landfill management.

Related problems are:

- return of outdated food products into the market;
- transmission of diseases;
- risk of accidents on the site.

c. Herd Cattle Owners

Landfill sites are attracting an important population of herd cattles (sheets, cows, sometimes pigs), probably under the control of surrounding villagers. There is no study about the role of the discharge as a substitution to locally available fodder resources, about the income generated by the activity, or about the health risks.

Related problems are:

- transmission of diseases
- risk of accidents on the site

3) Social Aspect of Waste Collection

a. General Presentation

On the municipal side, waste collection service is done correctly, in spite of unequal coverage through the city. On the inhabitants side, people have been sensitized for a long time about the need to handle properly their waste: Keeping them in plastic bags, waiting for the collection truck. People know about such needs. However, it seems that the problem of waste collection involves several social factors of degradation and inefficiency of the collection service. These factors are possibly not integrated enough in the waste management activity. Collection conditions are determined by the existing interactions between waste workers, inhabitants, scavengers, and municipality. Objective or subjective arguments from the point of view of inhabitants and waste workers are presented below.

b. Standpoint of Inhabitants

People's arguments as regards the collection service are:

- time schedule of trucks is changing
- time schedule has not been communicated
- waste bins are not properly collected (litter)
- waste bins are stolen
- cleaning of the street is commune's responsibility

c. Standpoint of Waste Collection Workers

Among the problems met by the workers of the waste sector, there are street scavenging, the people's attitude about waste and cleanliness of the public domain, and working conditions, all together. As regards to the scavengers, they find waste bags opened by the scavengers, and sometimes do not collect them. According to a study made at Meknes by the Ministry of Interior (1987), workers'arguments about people's attitude are:

- waste bins have not been deposited at time
- people put the waste in clandestine dumps
- waste bins are not appropriate
- people do not understand them

4) Geographical Aspects

Conditions of solid waste collection are such that it is perceived as the main problem in the field of waste, by the commune and the people. The problem is however of various intensity according to the rate of collection which differs between urban areas. In areas like suburban zones with low equipment, the problem is clearly a lack of collection service, and people are not in position to improve the situation by themselves. In inner city areas, there are various cases where collection service is provided, but remains

inefficient due to inappropriate containers. In such case, the participation of people in order to contribute to the quality of the collection service is needed.

5) Working Conditions

According to the questionnaire fulfilled by the communes, it is unclear if illnesses are recorded or not and by which institution. In 8 responses, the Municipal Office of Hygiene was cited as the agency in charge of health check and recording. In 7 responses, this was not given as a duty of the Municipal Office of Hygiene. In one case, daily medical consultation was mentioned as possible. In another case, annual check by the medical center has been cited. It seems that there is no epidemiological study of the effects of waste related activity on the health of the workers. Health problems and injuries cited by the communes are described in Table 5.4-2.

Table 5.4-2 Questionnaire Results about Recorded Injuries and Illnesses

	number of responses
skin illnesses	2
eyes illnesses	3
respiratory illnesses	1
work accidents	5
road accidents	3
burns	1
bones fracture	2
traumatic lesion	1

5.4.3 Sanitary Management

1) Control of Disease Vectors

a. Disease vectors

Disease vectors are:

- Direct contact with garbage in streets (children are the exposed population)
- Practice of using solid waste for growing vegetables around major cities: ex. of Sale.
- Herd cattles on landfill sites (contamination of alimentary chain)
- Pest vectors like insects and rodents
- Drinking water quality
- Population directly exposed to the handling of waste, and more specifically the scavengers population (with animal herds)
- Waste deposit and littering on littoral (contamination of water)
- Dumping of waste on riverbanks (contamination of water)

b. Pest Control

The Municipal Office of Hygiene is the main agency in charge of salubrity. It belongs to the local administration, but eventually uses the technical competencies of the MoH (Provincial services of environmental hygiene) for proper use of insecticides and chemicals. Actions are mainly pest control, which is generally done in response to people's complaints, and daily check of salubrity conditions. Pest control is done in transfer stations and clandestine dumps when need is identified by the office. The office reports to the concerned service for appropriate actions like eradication of waste dump in street. The hygiene office has no direct action in the field of public awareness.

Pest related nuisances seem to be important in Morocco, specially flies. However, the questionnaire sent to communes has given a minor importance to this problem, as a nuisance or as a control action too.

2) Security and Sanitary Conditions

Working conditions of the solid waste sector have been described by the communes having fulfilled the questionnaire as rather good. Responses have been, in number, good (8), bad (5), and fair (4). However, the field observations made by the JICA study team have shown a complete lack in basic sanitation services and security, in waste disposal sites as well as in work shops. The fact that temporary workers represent an important part of the waste sector employment is certainly an indicator of the bad conditions of work.

This ranking is certainly determined by factors like perception of the quality conditions, municipal policy to improve conditions, existing equipment for waste collection, and others. However, the best reasonable explanation is the lack of awareness of the municipalities about the security and sanitary conditions of the waste sector workers, and more specifically the absence of awareness of the high risks to which these workers are exposed.

In certain cases, protection cloths have been provided but were not used by the workers. Among the reasons why workers did not use them are the fact that part of the workers are temporary workers, and that they resell them on the market to make money.

Accidental injuries can be constated at work and are obviously treated as working accidents. However, work illnesses are recognized as such according to an old legal list (1947), which means that general diseases transmitted by medical waste to the waste workers would never be considered as a work related disease. In addition it seems that law is unclear as regards to the obligation made to communes to establish follow up of the workers health by a labor medical. The health check is organized by the municipality, and there is no authority designated to inspect and control sanitary and medical conditions of work in the waste sector.

Sanitation and medical equipment should be established at work shops and disposal sites, at least in line with requirements of the law for measures of hygiene and security at work place.

There is a need to improve work conditions of waste sector through increased salary, better social and medical care to take into account health risks. However, general awareness of the risks is a prerequisite for adopting measures of physical protection (cloths), and sanitary equipment (showers, potable water source). The first direct benefits would be sedentarization of workers, and better service.

Several points need consideration for improvement of security at work:

- Workers must sometimes carry heavy waste containers;
- There is a high risk of road accident due to traffic;
- The truck platforms used by the workers should be designed for higher security;
- Workers generally do not use protection clothes;
- The opened compactor at the back of the truck is dangerous for workers and could be a cause of accident;
- There is no emergency button for stopping the compactor in case of accident;
- Exhaust gas is located at the back of the truck, which is a source of health nuisance for the workers.

5.5 Public Environmental Education and Participation

1) Description

Minister of Interior's Recommendations to Wilayas and Prefectures can be considered as a major reason for the development of education issues at the communal level. The Minister of Interior has sent recommendations to wilayas and prefectures about the need for communes to heighten public awareness in the field of solid waste. Master plans for the municipal solid waste are recommended. The Direction of Local Administrations is in charge of follow up of the application of these recommendations.

Reaction of the provinces to these recommendations have been positive, and actions have been identified at provincial and communal levels:

- inscription of actions at the order of the day of the provincial technical committees;
- provincial commissions in charge of following up the actions of concerned services for collection;
- sub-commissions to control the collection circuit at municipalities;
- programs for eradication of clandestine dumps;
- sensitization campaigns in urban centers, specially focusing on: a) appropriate waste bins; b) respecting time schedule of waste trucks;
- mobilization of available human and material resources for such operation;
- cleaning campaigns initiated and organized in association with commune councils, citizens and people associations;
- executing a waste collection plan toward urban agglomerations and public institutions, namely health centers and schools;

2) Examples of Awareness Campaigns

Objectives and targets of main campaigns for solid waste are:

- Proper storage of waste for collection
- Eradication of illegal dumping sites

- Cleansing of public areas (streets, recreation areas)
- Conservation of water
- Protection of health
- Reduction of waste quantity

Main examples of awareness campaigns organized at commune level are those of Fes, Tanger, Rabat, Tetouan. Most of the campaigns are focusing on people's attitude for proper conditioning of waste and good timing with the truck schedule. Cleaning campaigns are sometimes involving the participation of associations.

3) Training Needs

The needs for training are quite evident. The lack of human resources is the problem which is mentioned with the highest frequency in response to the question "why is solid waste management a problem". Within the 7 responses stressing this problem, lack of skills or qualified people represents 4, and lack of manpower or human resources 3. Table 5.5-1 gives the results.

Table 5.5-1 Problems Mentioned by Communes about Solid waste Management

	number of responses
lack of financial resources	5
lack of skills / qualified people	4
lack of manpower / human resources	3
lack of awareness	2
lack of material / equipment	3
lack of good maintenance	1
shortage of fuel	1
inefficient collection or difficulty of collection	2
difficulty of access for collection	1
inefficient disposal or treatment	2
medical / industrial waste	1
clandestine dumps	2
urbanization / non built land, source of dumps	2
lack of participation of people	1
solid waste (general ?)	2
leachate, contamination of groundwater	1
bad smells	1
remoteness of disposal site or intermediate dump	2
inefficient management	2
shanty town	2

4) Public Participation

Public participation seems limited according to the JICA Team cities study. As shown in Table 5.5-3, there is a complete lack of people communities collaborating with communes to improve waste management conditions (15 negative responses against 1 positive response). This fact has been stressed in section 5.2.7, showing that limited cooperation of the public is the first issue. In one case, (Sidi Belyout), lack of civic behaviour, meaning the discharge of the waste bin in the public property domain, has been cited as the reason for people's complaint about waste.

Table 5.5-2 shows that cleaning campaigns are systematic, and seem to correspond to public awareness campaigns. These activities are consistent with the mentioned fact of lack of public cooperation.

Table 5.5-2 Questionnaire Results about People's Participation and Public Awareness

	number of responses		
	NA	NO	YES
actions taken by the commune to increase public awareness about hygiene and health issues	0	3	15
educational program or materials for school in order to increase environmental awareness about salubrity / solid waste	2	12	4
cleaning campaigns initiated by commune or community for eradication of waste dumps or collection of litter	0	0	17
organizations of people working together with commune to improve quality of waste management	1	15	1
citizens complaints about nuisances due to solid waste	8	1	9
actions taken by the commune in order to satisfy complaints	7	0	10

Note: NA, no answer, actions taken by the commune in order to satisfy complaints are cleansing (2), closing of activity (1), collection (4), pest control (1), site rehabilitation (1), vehicles maintenance to limit noise (1), sanction (2), awareness campaigns (1)

5) Issues

Many communes and provinces have already initiated public campaigns for cleansing and for environmental protection. Such efforts are important and should be performed

with continuity. However, these campaigns alone would not be enough to increase environmental awareness of people. More basic environmental education should be provided to the citizens and to the children and young. To make the public environmental education effective, it is necessary that the people who have an educational responsibility (school teachers, communes' officials, assembly men and medical doctors) have a good understanding of the environmental and SWM problems. In that sense, those people who are engaged in public education should be the targets of environmental education programs.

It is essential that environmental education can give to the public a clear view of what are the respective roles to be played and actions to be taken by the citizens, enterprises and local governments, and what are the goals and benefits of those actions.

The local governments should encourage and create conditions which will encourage voluntary citizens to participate in such activities as cleansing of public places, providing waste containers in streets, and recycling.

5.6. Privatization of SWM Services

Although there are on going negotiations in Casablanca in the water sector, and a project of privatization for the power station of Jorf Lasfar, privatization is still not very common in public services in Morocco. Distribution of water and energy is performed by public corporations or directly by municipal authorities. We will present the current situation in the SWM sector and then explain the factors affecting privatization.

5.6.1. Current Situation

There are 3 examples of privatization in SWM in Morocco:

- 1) Solid waste collection in the urban commune of Ain Sebaa, Casablanca
- 2) Operation of a waste disposal site in Casablanca
- 3) Waste collection in the Fes medina, using donkeys

1) Solid Waste Collection in the Urban commune of Ain Sebaa, Casablanca

In May 1996, the assembly of the urban communes of Ain Sebaa has decided to make a contract for solid waste collection and street sweeping services with a private contractor, SMARCOLECT, in the urban commune of Ain Sebaa in Casablanca. The contract will be for 7 years to allow complete amortization of the equipment. According to the contract conditions, the contractor must buy the vehicles presently used by the commune and also use commune labor. The workers will be seconded to the contractor but their positions will remain in the commune. Their salaries are expected to increase. The contractor will not have the right to fire them but can ask the commune to replace any of them. All future vehicles will be directly purchased by the contractor.

There will be two contracts, one for collection and one for street sweeping. The first will be priced on a per-ton basis while the second will be on a lump sum basis. Contract. All of Ain Sebaa urban commune territory will be included in the contract, but industrial

waste will not be collected. Maintenance will be the responsibility of the contractor and they will have their own workshop.

The main motivation behind using a private contractor is to improve the hygienic conditions, and to ensure a 100% service collection rate. The contractor's prices may be slightly higher than present costs because better service will be offered. Open tender procedure has not been followed.

The contractor has to request the citizens to discharge waste during certain hours according to the contract conditions. At present, the citizens discharge waste any time. Once the habit of discharging waste at designated hours will be taken, the contractor may reduce the frequency of collection.

Monitoring will be adequate as the commune will organize a committee comprising the commune officials and representatives of the contractors. This committee will monitor complaints of the citizens, and check financial statements of the contract once a year.

The contract document containing the service conditions has not been made available yet for the Study Team, and therefore we cannot so far evaluate the appropriateness of the conditions. However, according to the information given by the commune, the contractor is required to use the commune's existing manpower (workers and drivers for collection) and trucks. An important issue in connection with the privatization of waste collection service is how to handle the existing manpower and equipment after the privatization. The condition of use of the commune's existing manpower and trucks may not be good to the contractor, but may be inevitable to privatize the waste collection service.

This privatization of waste collection service in Ain Sebaa is the first of this kind, and therefore can be viewed as a pilot project for Moroccan communes which deserve close attention in view of the promotion of the privatization of the waste collection service in Morocco.

It would be necessary then for Moroccan communes to develop standard contract conditions applicable to waste collection service and a system for evaluation of the offers for the service.

2) Operation of the Waste Disposal Site in Casablanca

A first contract has been signed with a private company in 1991 to operate the disposal site on a research and experimental basis with the Urban Community of Casablanca. In 1994 a tender has been issued, 10 companies has given an answer, and LOTRAP was selected. They have a 3 years contract with Urban Community. Amount of this contract could be changed according to economic conditions. If obligations of the contractor are not properly performed penalties could be asked to him.

The waste disposal site of Casablanca Urban Community would be the most controlled one in Morocco. Sanitary level of the disposal site could be further upgraded by changes in landfill operation method.

It is advisable that the disposal service contract made between the Casablanca Urban Community and the contractor should include contractor's obligation of application of fill-up landfill method and of provision of on-site access road.

3) Waste Collection in the Fes medina, Using Donkeys

For many years a private contractor has been collecting garbage in the medina of Fes. Collection in this area is rather difficult because of the narrow streets and stairways. Some streets are less than one meter in width. Consequently it is not possible to use vehicles, they use donkeys. A tender is issued each year. Selection is made according to the price. Amount of the contract was 5 850 000 DH in 1995. Manpower was 130 persons and number of donkeys 163. This year the contract is on a 6 months basis, because the budget of the commune is divided in two periods of 6 months. In Marrakech also donkeys are used by a private contractor.

In Tetouan, with the technical assistance of USAID, a privatization experiment had been tried, but was not successful for various reasons which we will analyze with others in the following paragraphs.

5.6.2. Factors Affecting Privatization

Seven main factors have been identified.

1) Lack of Legal Framework

For collection, transport, and disposal of solid waste there is no law giving a clear definition of : domestic waste, industrial and commercial waste, hospital waste, hazardous waste. There is no identification of the respective responsibility of each actor in SWM, namely citizens, industries, hospitals, communes, the urban community, other local governments, and the central administration. It will be necessary to have a precise definition of obligations and rights of each of them.

2) Lack of Procedures for Privatization

We have seen that there are few examples of privatization so far. Communes need guidelines for tender procedures and models for tender documents, giving precise definition of the responsibility of the contractor and the commune itself.

3) Lack of Identification of Private Contractors

SWM is composed of a range of different operations which need different operators from small companies up to international groups. Door to door collection in a medina could be done by small local companies with limited investments for non mechanical equipment. Treatment or recycling could require sophisticated technologies and large capital investment.

4) No Individual Collection and Treatment for Hospital Waste

Presently hospital waste are collected along with domestic waste, and disposed of, in dump sites without any special treatment. Collection and treatment of hospital waste should be managed separately from other waste. Responsibility for issuing specific tenders for these services should be given to hospitals.

5) Lack of Information Concerning Collection and Disposal Costs

Communes are not in a position to give a precise evaluation of waste collection and disposal costs. They have no separate accounting of the various public services. Accordingly they cannot compare offers from private companies with their own costs. If Ain Sebaa is close to a conclusion with SMARCOLECT it is because they have made this evaluation.

6) Lack of Training of Executives of the Communes

Commune officials and engineers are not prepared to negotiate with private service contracts for waste collection and disposal. They need to have training and information on similar expertise in other countries.

7) Use of Temporary Personnel

To face emergency situations, and to get rid of « black spots » or illegal dumping, communes use temporary personnel who receive very low salaries. These operations have a positive but limited effect on the environment.

5.7 Foreign Assistance Projects Related to Municipal SWM

Foreign aid organizations have been involved in a number of studies concerning SWM during the recent years. The agencies involved include amongst others;

- The World Bank
- French government
- German government
- United States USAID
- Danish government

The studies covered a number of themes as described below. The conclusions of these studies may be reported elsewhere in this report.

- Privatization of SWM services
- Specific SWM studies for a number of cities; Meknes, Fes, Azrou, Sefrou, Rabat, Tetouan, etc.
- Compost plants in some cities

The Study Team interviewed some of the funding agencies in Morocco to identify whether SWM projects were actually implemented, such as provision of vehicles and

heavy equipment, construction of intermediate treatment facilities, or disposal sites. The result of these interviews shows that no such aid was done. Vehicle procurement may have been financed indirectly by funds provided by these agencies to FEC.

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