PN-ABL-923

Special Committee on Solid Waste and Waste Water Disposal of the City of Guayaquil, Ecuador

Appraisal Report
on
Committee's Proposal to
Privatize Solid Waste Services

by

Frank B. Ohnesorgen

November 8, 1990

I. INTRODUCTION

This advisor was invited by RHUDO/SA to visit the City of Guayaquil and assess the adequacy of the Special Commission on Solid Waste Proposed Plan for undertaking privatization of Solid Waste Services in that municipality.

This advisor's tasks were to examine, review and comment on the bid and contract documents, and appraise the Commission's proposal on its administrative, technical and financial aspects.

II. ACTIVITIES

Below are the areas that have been reviewed, examined and visited.

1. All information available on the Department of Solid Waste and Street Sweeping.

2. All documents and studies conducted by all the other consultants.

3. Reviewed and examined all proposal documents.

4. Visited with two former city administrators with experience and knowledge of solid waste and street sweeping operations.

5. Visited and reviewed documents from a private consultant that has performed two studies on planning and reorganization for the city of Guayaquil.

6. Visited and toured the various areas of the city that are proposed to be contracted.

7. Visited various areas which have been suggested as possible future landfill sites.

8. Visited one of the city's equipment maintenance facilities.

9. Visited with a priest that is attempting to assist and improve the working and living conditions of the 600 scavengers that live and work at the existing landfill site.

10. Met with members of the Commission and attended several Commission meetings.

III. REVIEW OF PROPOSAL

This advisor's appraisal of the Commission's proposal to privatize the solid waste services in Guayaquil is that it is a sound concept. The Commission has received excellent advise and technical assistance from both the private and public sectors from various countries.

IV. REVIEW BID DOCUMENTS

This advisor examined and discussed the various areas of the proposal with the Commission's technical coordinator, Sanitation Engineer, Guillermo Castillo R. and Dr. Camilo Gomez, a consultant from Bogota, Colombia. Dr. Gomez was hired by the Commission to develop bid and contract documents. The following issues were discussed and recommendations made to refine and clarify some areas of the bid document:

1. That the bid document include a pre-bid conference with mandatory attendance for all perspective bidders to clarify all issues on bid instructions, bid papers to be submitted and key requirements on contracts.

2. That the bid documents include a calendar of events with details and set dates for each part and schedule of the bid and contract process.

3. That the bid documents for collection and street sweeping, identify the service areas, where possible, using major physical natural boundaries such as rivers, mountains, etc.

4. That the criteria on the bid document for collection and street sweeping include a plan to phase in the clean-up of the existing garbage piles in Guayaquil.

5. That collection and sweeping bid documents include criteria for a design plan for equipment maintenance and daily washing and sanitizing collection and sweeping equipment.

6. This advisor also assisted in developing criteria for the evaluation of proposed bids and criteria for the selection of bidders. In addition, this advisor gave the Commission a copy of an actual bid document from a major city in U.S.A. which can serve as a guide to assemble the final bid package.

The bid documents for this proposal are well developed and meet all criteria for soliciting bids.

V. REVIEW AND CONTRACT DOCUMENTS

The contract documents were also examined and discussed with the Commission's staff and the following recommendations were submitted.

1. That the term of contract(s) be limited to 10 years. This should draw more bidders and lower the price of bids.

2. To limit the number of contracts on collection and street sweeping to two. This allows for better control by city, provides two points for comparison of services delivered and a backup reserve in case one contractor encounters problems in the delivery of service.

3. That the unit of payment for all contracts be based on tons which can be certified by weighing. (Tons is the universal unit to measure solid waste.)

4. That the landfill design, construction and operation be one contract. This helps to keep costs low, eliminates finger-pointing between design function and construction function and insures better design and construction because same contractor has to operate system.

The contract documents are basically well designed; however, a lot more work has to be done by an attorney with knowledge of Ecuadorian municipal law to clarify and certify that the recommendations and concepts in the documents are within this nation's legal framework.

VI. REVIEW OF ADMINISTRATIVE, TECHNICAL AND FINANCIAL ASPECTS

This advisor also reviewed the administrative, technical and financial aspects of the Commission's proposal. Below are observations and comment in this areas.

1. <u>Administrative</u>

The administration aspect to manage, monitor, enforce and evaluate the contracts is sound. This is to be performed by an independent contractor. This contractor will also operate the scales at the landfill which will measure and keep track of the total tons collected and delivered by each contractor. The ton is the unit to be used to make payment and measure performance and productivity on each contract.

The area that has not been addressed is who in the municipality will administer and evaluate the contract on the firm that is doing the monitoring. All studies and consultants that have evaluated the administrative capabilities of the Department of Solid Waste and Sweeping indicate that this department does not have the capacity to administer contracts.

This advisor's recommendation is that an enterprise fund be created by the city to provide administrative support for contracts as well as to provide solid waste disposal services in the third of the city that will not be privatized.

The Commission asked this advisor to design an organization plan for this entity. This task has been performed and a copy of this organization is in attachment #1 of this report.

2. Technical

The technical aspects of this proposal are very sound. All aspects dealing with the technical areas in collection and street sweeping are well documented. The technical aspects as to the design and operation of the new landfill had not been developed. The Commission asked this advisor to assist in the development of this criteria. However, this advisor could not develop a specific design for this project due to (1) lack of time, and (2) the new site has not been selected. This advisor has given the Commission a copy of a landfill design and operation criteria that he developed for Costa Rica. This design document needs to be translated to Spanish and is being done so by the Commission's technical staff. Attachment #2 is a copy of this criteria.

3. Financial

The financial aspects of this proposal had not been developed. The Commission asked this advisor to develop this criteria.

This advisor was not able to do much in this area due to lack of financial and budgetary information provided to the commission or to this advisor.

This advisor was only able to estimate the present costs for tons collected. This was from data on estimates provided by a partial budget document and verbal information from former employees of the city's planning department.

Based on limited budget information and estimated costs for the level and quality of service being delivered at present, this advisor feels that financially this proposal could be feasible if bid costs per ton do not exceed the $30 - $35 range.

This advisor will attempt to provide the Commission with comparison costs for similar contracted services next week when he returns to the United States. Attachment #3 includes estimated costs for tons being collected at present.

VII. ADDITIONAL TASK

The Commission also asked this advisor to develop an emergency plan to address the garbage piles in the streets at the present time. The city was declared in a state of health emergency by the national government last week and funds were provided for 30 days to address solid waste, waste water and water problems. This task was completed. Attachment #4 is a copy of the 30 day emergency plan. A copy of the map is not included because of its size.

VIII. TECHNICAL DOCUMENTS

The following is a list of technical documents provided by this advisor to the commission:

Privatizing Municipal Waste Services: Saving dollars and making sense.
National Solid Waste Management Association, Washington, D.C.

Sanitation Objectives Audit
City of Charlotte, N.C. 1#30#1979.

Evaluating Residential Refuse Collection Cost.
National Science Foundation, Washington, D.C.

An Accounting System for Solid Waste Collection.
U.S. Department of Health Education and Welfare, Bureau of Solid Waste.

Heuristic Routing for Waste Collection Vehicles.
U.S. Environmental Protection Agency, 1974

Requests for Proposals: Provision of Sanitation Services, City of Fort Worth. TX.
April 1, 1986

IX. FINAL COMMENTS

Concept of Proposal:

The proposal is to provide a structure for delivery of solid waste services to the citizens of Guayaquil.

These services include refuse collection and street sweeping (commercial and residential) and final treatment (landfilling).

The proposal calls for dividing the city collection and sweeping into 3 parts. One-third (1/3) would continue to be serviced by the city (400 tons a day, the amount they presently service). One-third each (400 tons a day) would be serviced by two private contractors.

The final treatment or landfill would be under a third private contractor who would design an environmentally sound landfill and construct and operate the landfill under environmentally accepted operating criteria. The landfill contractor would also cover, close-out and provide leachate and gas abatement remedies to the present open-air dumpsite.

A fourth contract would provide for a private independent entity to administer the 3 other contracts, monitor the delivery of services and evaluate the results.

The rational for four different and separate contracts is as follows:

1. Because there is no existing data on solid waste services it is difficult to make a good assessment for pure solutions. Multiple contracts are needed to make comparisons and allow flexibility in service delivery.

2. Two separate collection and sweeping contracts and one area collected and swept by the Municipality allows for good comparison of the efficiency and effectiveness of the services delivered. It also allows for a safety margin in case one or two of the systems fail, and competition allows for efficiency and innovation.

3. A separate contract for landfill service allows for the private company to concentrate its resources in the treatment and management of solid waste. It discourages favoritism in the treatment of the three separate entities using the landfill. (If one company collected and operated the landfill, favoritism would be the rule.)

4. A fourth contract is needed to administer the other three (3) contracts because the municipal department does not have the organization, personnel, nor capability to administer, monitor and evaluate a project of this magnitude.

Social Issues not Addressed

1. The proposal does not address the social issues that could be created if municipal employees are replaced by contracted private sector employees. This is an area this advisor can not comment on other than to raise the question. This issue needs to he addressed by someone familiar with Ecuadorian Municipal or National law in regards to employee rights.

2. The proposal does not address the social issue of the 110 families, involving 600 individuals, that make a living and live at the existing garbage dump. These people are called "Chamberos".

   On this issue, this advisor recommends that the landfill operations contract include recycling and composting. These people (Chamberos) could be utilized in the operation. This group of people are currently being organized into a self-supporting cooperative by Father Ignacio de Moreta of the Colegio Javier. The program appears to be working very well.

X. EXPECTED ACHIEVEMENTS

Implementation

If implemented, this proposal should achieve the following:

1. Increase refuse collection and street sweeping from 40% to 99%.

2. Increase operational efficiency and financial self-sufficiency of the solid waste collection and sweeping and final treatment services.

3. Reduce the existing contamination of soil and water and eliminate present health hazards throughout the metropolitan area and the landfill.

4. Improve municipal solid waste collection and street sweeping and landfill administration and fiscal management.

5. Lower the cost of per ton refuse collected for Guayaquil.

GUAYAQUIL, ECUADOR PROJECT

Financial Analysis
November 13, 1990

Cost Comparison Among Cities in the U.S. and Latin America for Refuse Collection, Disposal and Street Sweeping

U.S.A.

City	Collection Cost/Ton	Disposal Cost/Ton	St. Sweeping Cost/Curb Mile
Phoenix, AZ	$ 9.00 (city)	$11.00 (private contract)	-0-
Dallas, TX	$17.18 (city)	(city-included with collection)	-0-
Houston, TX	$20.14 (city)	$27.10 (private contract)	-0-
San Antonio, TX	$20.83 (city)	$ 5.83 (city) $12.68 (private contract)	$10.21 (city)
Los Angeles County (average of 20 cities)	-0-	-0-	$15.21 (city) $ 9.52 (private contract)

LATIN AMERICA

City	Collection Cost/Ton	Disposal Cost/Ton	St. Sweeping Cost/Curb Mile
Bogata, Co.	$33.00 (private contract)	$ 3.00 (private contract)	-0-
Quito, Ec.	$ 4.31 (city)	$ 1.39 (city)	$2.95 (city manual) .54¢ (city mechanical)
Guayaquil, Ec.	$44.58 (city)	-0-	-0-

Things to take into account on comparing bid cost:

1. Low cost of labor in Ecuador.
2. Low cost of fuel in Ecuador (.53¢/gallon November 6, 1990)
3. Term of contract is 10 years - this should make cost come down on bid.

This advisor suggests that Guayaquil work with the Sanitation Department in the city of Quito. This city has an outstandingly well managed organization. Included are computer sheets from Quito's operation.

Guayuquil, Ecuador
November 13, 1990

Sample Estimated Unit Cost/Collection Truck/Ton

Suppose each truck makes 2.0 trips per day and each truck collects an average of 5 tons for a total of 400 tons/day or about 30% of the total waste, plus 10% extra vehicles for reserve backup and an efficiency rate of 90%.

$$\frac{400 \times 9 \times 1.10}{10 \text{ <efficiency>}} = 40 \text{ vehicles}$$

40 vehicles are needed to collect 400 tons.

If the cost of each vehicle is $50,000 with an amortization of 5 years, total investment for 5 years is $2,500,000.

Estimated Unit Cost/Collection Truck/Ton

		$ / Year	$ / Year
a.	Cost of Capital (Depreciation 5 years with 10 year contract)		
	Amortization $50,000 in 5 years 15% annual <0.29832>	14,910	14,910
b.	Maintenance and Fuel		
	Maintenance <50,000/5)(1.0> =	10,000	
	Fuel 300 days x 12 gallon/day x .53¢ =	1,908	
	Tires (1 set/yr 1 x 600)	600	
	Oil, Batteries, etc.	1,000	
			13,508
c.	Personnel		
	1 Driver ($115.00 - s/100,000 month)	1,380	
	3 Laborers ($173.00 - s/150,000 month)	2,076	
	Benefits 80% of salaries	2,765	
			6,221
d.	License, Insurance, etc. (50,000/5)(0.1)	1,000	
			1,000
e.	Administration Cost 20% of personnel and operations	7,127	
			7,127
	Total	42,766	42,766

Efficiency 300 x 10 ton/d x 0.9 = 2,700/yr
Unit Cost/Truck = $15.84 $/Ton*

R 12-Feb-90

MODULO II- BARRIDO Y LIMPIEZA DE CALLES

	1989 ZONA NORTE RECAN.	1989 ZONA NORTE MANUAL	1989 ZONA CENTRO RECAN	1989 ZONA CENTRO MANUAL	1989 ZONA SUR RECAN.	1989 ZONA SUR MANUAL	1989 TOTAL RECAN.	1989 TOTAL MANUAL	1990 ZONA NORTE RECAN.	1990 ZONA NORTE MANUAL	1990 ZONA CENTRO RECAN.	1990 ZONA CENTRO MANUAL	1990 ZONA SUR RECAN.	1990 ZONA SUR MANUAL	1990 TOTAL RECAN.	1990 TOTAL MANUAL	1991 ZONA NORTE RECAN.	1991 ZONA NORTE MANUAL	1991 ZONA CENTRO RECAN.	1991 ZONA CENTRO MANUAL	1991 ZONA SUR RECAN.	1991 ZONA SUR MANUAL	1991 TOTAL RECAN.
1-KMS.CALLES PAVIM.	1000	NA	445	NA	670	NA	2115	NA	1045	NA	447	NA	700	NA	2192	NA	1092	NA	449	NA	732	NA	2273
2-KMS.CALLES S/PAV.	NA	450	NA	36	NA	729	NA	1215	NA	452	NA	36	NA	758	NA	1246	NA	455	NA	36	NA	728	NA
3-% COBERT.BRR.PAVIM	0.00	0.70	0.40	0.80	0.00	0.60	0.08	0.69	0.80	0.75	0.85	0.70	0.60	0.60	0.75	0.59	0.80	0.50	0.90	0.60	0.65	0.40	0.77
4-% COBERT.BR.NO PAV	0.00	0.40	0.00	0.70	0.00	0.30	NA	0.35	0.00	0.40	0.00	0.70	0.00	0.50	NA	0.47	0.00	0.45	0.00	0.70	0.00	0.60	NA
5-KMS BRR.EN PAVIM.	0	700	178	356	0	402	178	1458	836	784	390	313	420	420	1636	1517	674	546	405	270	476	293	1754
KMS BRR.SIN PAVIM.	0	180	0	25	0	219	NA	424	0	181	0	25	0	379	NA	585	0	205	0	25	0	473	NA
6-% INCR/AMO PAVIMEN	0	NA	0	NA	0	NA	NA	NA	0	NA	0	NA	0	NA	NA	NA	0	NA	0	NA	0	NA	NA
7-% INCR/AMO CALL.SP	NA	0	NA	0	NA	0	NA	NA	NA	0	NA	0	NA	0	NA	NA	NA	0	NA	0	NA	0	NA
8-% KMS FRECU.DIARIA	0.0	0.1	0.2	0.3	0.0	0.1	NA	NA	0.2	0.1	0.5	0.2	0.2	0.2	NA	NA	0.2	0.1	0.5	0.2	0.2	0.2	NA
9-% KMS FREC.INTERDI	0.0	0.1	0.2	0.2	0.0	0.1	NA	NA	0.3	0.1	0.2	0.2	0.3	0.2	NA	NA	0.3	0.1	0.2	0.2	0.3	0.1	NA
10-% KMS FREC.BISEMAL	0.0	0.2	0.5	0.1	0.0	0.1	NA	NA	0.1	0.2	0.2	0.1	0.1	0.1	NA	NA	0.1	0.2	0.2	0.1	0.1	0.1	NA
11-% KMS FREC.SEMANAL	0.0	0.1	0.1	0.2	0.0	0.2	NA	NA	0.1	0.2	0.1	0.2	0.2	0.2	NA	NA	0.1	0.2	0.1	0.2	0.2	0.3	NA
12-% KMS FREC.QUINCEN	0.0	0.5	0.0	0.2	0.0	0.5	NA	NA	0.3	0.4	0.0	0.3	0.2	0.3	NA	NA	0.3	0.4	0.0	0.3	0.2	0.3	NA
13-KMS/DIA FRECU.DIAR	0	88	36	114	0	62	36	264	167	96	190	68	84	160	441	324	175	75	202	59	95	153	472
14-KMS/DIA FREC.INTER	0	88	36	76	0	62	36	226	251	96	76	68	126	160	453	324	262	75	81	59	143	77	486
15-KMS/DIA FREC.BISEM	0	176	89	38	0	62	89	276	84	193	76	34	42	80	202	307	87	150	81	29	48	77	216
16-KMS/DIA FREC.SEMAN	0	88	18	76	0	124	18	288	84	193	38	68	84	160	206	420	87	150	40	59	95	230	223
17-KMS/DIA FREC.QUINC	0	440	0	76	0	310	0	827	251	386	0	101	84	240	335	727	262	300	0	88	95	230	357
18-KMS/AMO FRECU.DIAR	0	30800	12460	40026	0	21725	12460	92551	58520	33763	66525	23678	29406	55942	154451	113383	61353	26269	70790	20641	33290	53403	165234
19-KMS/AMO FREC.INTER	0	15400	6230	13342	0	10862	6230	39604	43890	16881	13305	11839	22055	27971	79250	56691	45865	13134	14155	10321	24948	13401	84991
20-KMS/AMO FREC.BISEM	0	20533	10383	4447	0	7242	10383	32222	4753	22509	8870	3946	4901	9324	23524	35778	10192	17513	9439	3440	5540	8934	25179
21-KMS/AMO FREC.SEMAN	0	4576	926	3964	0	6455	926	14996	4347	10032	1977	3519	4369	8311	10693	21842	4543	7806	2103	3067	4946	11946	11592
22-KMS/AMO FREC.QUINC	0	11440	0	1982	0	6669	0	21491	6521	10032	0	2638	2184	6234	8705	18904	6814	7806	0	2300	2473	5973	9287
23-KMS BARRIDOS X AMO	0	82749	29999	63762	0	54353	29999	200864	123031	93217	90676	45620	62915	107781	276623	246618	128568	72527	96496	39769	71226	93856	296284
24-DIAS TRBJO X AMO	350	350	350	350	350	350	NA	NA	350	350	350	350	350	350	NA	NA	350	350	350	350	350	350	NA
25-REND.KMS/DIA	30	2.1	35	1.0	30	1.8	NA	NA	40	3.0	30	1.0	30	2.2	NA	NA	40	3.5	30	1.0	35	2.5	NA
26-BARREDORAS REQUR.	0	NA	2	NA	0	NA	2	NA	9	NA	9	NA	6	NA	23	NA	9	NA	9	NA	6	NA	24
27-TOT.CONDUCT/OPER.	0	1	2	NA	0	1	2	NA	9	NA	9	NA	7	NA	25	NA	10	NA	10	NA	6	NA	27
28-TOT.TRABAJ/PEON	0	115	2	183	0	89	2	387	10	89	10	130	7	140	27	359	11	59	11	116	7	107	26
29-TOT.SUPERV.	0	13	1	20	1	10	2	43	1	10	1	14	1	16	3	40	1	9	1	13	1	12	3
30-KMS/AMO MANTO EQU.	0	NA	870	NA	0	NA	870	NA	527	NA	518	NA	360	NA	1405	NA	521	NA	551	NA	349	NA	1451

G A S T O S (miles de Sucres)

	1989 ZONA NORTE RECAN.	1989 ZONA NORTE MANUAL	1989 ZONA CENTRO RECAN	1989 ZONA CENTRO MANUAL	1989 ZONA SUR RECAN.	1989 ZONA SUR MANUAL	1989 TOTAL RECAN.	1989 TOTAL MANUAL	1990 ZONA NORTE RECAN.	1990 ZONA NORTE MANUAL	1990 ZONA CENTRO RECAN.	1990 ZONA CENTRO MANUAL	1990 ZONA SUR RECAN.	1990 ZONA SUR MANUAL	1990 TOTAL RECAN.	1990 TOTAL MANUAL	1991 ZONA NORTE RECAN.	1991 ZONA NORTE MANUAL	1991 ZONA CENTRO RECAN.	1991 ZONA CENTRO MANUAL	1991 ZONA SUR RECAN.	1991 ZONA SUR MANUAL	1991 TOTAL RECAN.
A.- GASTOS PERSONAL	0.0	157769.7	6493.0	248239.9	1252.6	121717.1	7745.6	527726.8	26035.5	120367.1	24796.8	176719.5	18592.9	189781.4	71425.2	486868.0	28495.9	80272.5	28515.0	154055.6	18041.8	145430.1	75052.7
A.1 CONDUCTORES	0.0	669.1	1326.2		0.0	663.1	1326.2	1326.2	5827.5		6299.3	-	4370.7	—	16497.4	0.0	6698.7		6703.2		4241.2		17643.6
A.2 SUPERVISORES	0.0	7576.5	591.8	12028.1	591.8	5829.6	1183.7	25434.3	663.9	5832.2	652.4	8562.7	452.7	9195.6	1769.0	23590.5	693.8	3889.5	694.3	7464.6	439.3	7046.6	1827.3
A.3 TRABAJ/PEONES	0.0	66305.6	1149.8	105263.7	0.0	51617.8	1149.8	222587.1	5816.2	51040.5	5709.7	74936.2	3961.6	80474.9	15481.5	206451.6	6071.7	34038.8	6075.7	65325.8	3844.2	31668.2	15991.6
A.4 CARGAS SOC/REMUN.	0.0	83224.5	3425.1	130948.1	660.7	64206.5	4085.9	278379.2	13733.9	63494.4	14135.5	93220.6	9807.9	100110.9	37677.3	256325.9	15031.8	42344.2	15041.8	81265.3	9517.1	76715.3	39590.8
B.- SERVICIOS	0.0	3.3	0.0	2.0	0.0	3.3	0.0	5.6							0.0	0.0							6.0
B.1 SERV.MANTO EQUIP.							0.0	0.0							0.0	0.0							0.0
B.2 OTROS SERVICIOS		3.3		3.0		3.3	0.0	5.6							0.0	0.0							0.0
C.- MANTENIM.VEHICULOS	0.0		6193.2		0.0		6193.2		11643.2		10837.1		7519.3		29999.6		12167.1		11532.0		7499.9		31199.0
C.1 M.O TALLER	0.0		1142.8		0.0		1142.8		692.6		680.6		472.2		1845.4		723.8		724.2		458.2		1906.2
C.2 COMBUSTIBLES	0.0		600.0		0.0		600.0		2460.6		1813.5		1258.3		5532.5		2571.4		1929.8		1424.5		5925.7
C.3 AC/LUBRICANTES	0.0		435.0		0.0		435.0		1553.8		1526.9		1059.4		4140.1		1623.7		1624.8		1028.0		4276.6
C.4 LLANTAS/REPUESTOS	0.0		3788.9		0.0		3788.9		6797.6		6680.0		4634.9		18112.5		7103.5		7108.3		4497.5		18709.3
C.5 VARIOS	0.0		228.6		0.0		226.6		136.5		134.1		94.4		369.1		144.8		144.8		91.6		381.2
D.- MATER.PRA BRR/LPZA	0.0	3315.3	57.5	5263.2	0.0	2550.9	57.5	11129.4	290.5	2552.0	285.5	3746.8	198.1	4023.7	774.1	10322.6	303.6	1701.9	303.8	3266.3	192.2	3083.4	799.6
E.- MATER.VARIOS	0.0	331.5	5.7	526.3	0.0	255.1	5.7	1112.9	29.1	255.2	28.5	374.7	19.8	402.4	77.4	1032.3	30.4	170.2	30.4	326.6	19.8	308.3	80.0
F.- DEPRECIACION	0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0
F.1 DEPREC.EQU.BRRIDO							0.0		0.0		0.0		0.0		0.0	—	0.0		0.0		0.0		0.0
F.2 DEPREC.OTROS EQU.	0.0		0.0		0.0		0.0								0.0								0.0
TOTAL GTO DIRECTO	0.0	161419.8	12749.5	254032.4	1252.6	124526.4	14002.1	539978.7	37998.2	123174.4	37948.0	180641.0	26330.1	194207.5	102276.3	498222.9	40997.0	82144.6	40381.1	157648.5	25753.1	148821.9	107131.2
% INLAC. ANUAL								0.0								0.0							
INLACION ACUMUL.								0.0								0.0							
V/R A PREC-CTES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

12-Feb-90

1992 TOTAL RECAN.	1992 TOTAL MANUAL	1992 ZONA NORTE RECAN.	1992 ZONA NORTE MANUAL	1992 ZONA CENTRO RECAN.	1992 ZONA CENTRO MANUAL	1992 ZONA SUR RECAN.	1992 ZONA SUR MANUAL	1993 TOTAL RECAN.	1993 TOTAL MANUAL	1993 ZONA NORTE RECAN.	1993 ZONA NORTE MANUAL	1993 ZONA CENTRO RECAN.	1993 ZONA CENTRO MANUAL	1993 ZONA SUR RECAN.	1993 ZONA SUR MANUAL	1993 TOTAL RECAN.	1993 TOTAL MANUAL	
2273	NA	1141	NA	452	NA	765	NA	2357	NA	1193	NA	454	NA	799	NA	2445	NA	
NA	1279	NA	457	NA	36	NA	820	NA	1313	NA	459	NA	36	NA	853	NA	1348	
0.77	0.49	0.80	0.50	0.90	0.60	0.70	0.40	0.79	0.49	0.80	0.50	0.90	0.60	0.70	0.40	0.79	0.49	
NA	0.55	0.00	0.60	0.00	0.70	0.00	0.70	NA	0.67	0.00	0.65	0.00	0.70	0.00	0.70	NA	0.68	
1754	1106	913	571	407	271	535	306	1855	1147	954	596	409	272	559	320	1922	1188	
NA	703	0	274	0	25	0	574	NA	873	0	298	0	25	0	597	NA	921	
NA	NA	0	NA	0	NA	0	NA	NA	NA	0	NA	0	NA	0	NA	NA	NA	
NA	NA	NA	0		0		0				0		0		0			
NA	NA	0.2	0.1	0.5	0.2	0.2	0.2	NA	NA	0.2	0.1	0.5	0.2	0.2	0.2	NA	NA	
NA	NA	0.3	0.1	0.2	0.2	0.3	0.1	NA	NA	0.3	0.1	0.2	0.2	0.3	0.1	NA	NA	
NA	NA	0.1	0.2	0.2	0.1	0.1	0.1	NA	NA	0.1	0.1	0.2	0.1	0.1	0.1	NA	NA	
NA	NA	0.1	0.2	0.1	0.2	0.2	0.3	NA	NA	0.1	0.1	0.1	0.2	0.2	0.3	NA	NA	
NA	NA	0.3	0.4	0.0	0.3	0.2	0.3	NA	NA	0.3	0.6	0.0	0.3	0.2	0.3	NA	NA	
472	287	183	84	203	59	107	176	493	320	191	89	204	60	112	183	507	332	
486	211	274	84	81	59	161	88	516	232	286	89	82	60	168	92	536	241	
216	256	91	169	81	30	54	88	226	287	95	89	92	30	56	92	232	211	
223	439	91	169	41	59	107	264	239	492	95	89	41	60	112	275	248	24	
357	618	274	338	0	89	107	264	381	691	286	537	0	89	112	275	398	901	
165234	100513	63905	29563	71144	20736	37434	61590	172514	111888	66781	31313	71500	20831	34150	64160	177431	116304	
84991	34856	47929	14781	14229	10368	26098	15397	90256	40547	50086	15656	14300	10415	29363	16040	93749	42112	
25179	29887	10651	19709	9486	3456	6244	10265	26381	33429	11130	10438	9533	3472	6525	10693	27189	24603	
11592	22818	4747	8784	2114	3081	5566	13726	12427	25591	4961	4652	2125	3095	5817	14299	12902	22046	
9287	16079	7181	8784	0	2311	2783	6863	9964	17956	7441	13957	0	2321	2508	7149	10350	23427	
296204	206152	134353	81622	96973	39951	80156	107840	311482	229613	140399	76016	97458	40134	63763	112341	321620	228491	
NA	NA	350	350	350	350	350	350	NA	NA	350	350	350	350	350	350	NA	NA	
NA	NA	40	3.7	30	1.1	35	2.7	NA	NA	40	3.7	30	1.2	35	2.7	NA	NA	
24	NA	10	NA	9	22	7	NA	25	NA	10	NA	9	NA	7	NA	26	NA	
27	NA	11	NA	10	NA	7	NA	28	NA	11	NA	10	NA	8	NA	29	NA	1.00
28	280	11	63	11	104	8	114	29	281	12	59	11	100	8	119	30	277	1.15
3	31	1	7	1	12	1	13	3	31	1	7	1	11	1	13	3	31	0.111
1451	NA	576	NA	554	NA	393	NA	1523	NA	602	NA	557	NA	410	NA	1569	NA	---
75052.7	379758.2	29778.2	85454.7	28657.6	140691.0	20303.9	154721.3	78739.7	380867.0	31118.3	79585.5	28600.9	135189.6	21217.6	161179.0	81136.7	375954.1	
17649.0	0.0	9000.1		6736.9		4772.9		18509.7	0.0	7315.1		6770.4		4987.7		19073.2	0.0	
1827.3	18400.7	725.0	4140.6	697.7	6817.0	494.3	7496.8	1917.1	18454.4	757.6	3856.2	701.2	6550.4	516.6	7809.7	1975.4	18216.4	
15991.6	161032.7	6344.9	36236.2	6106.1	59658.4	4326.2	65600.0	16777.2	161502.9	6830.4	33747.5	6130.7	57325.6	4520.9	66346.4	17268.0	159419.6	
39590.8	200324.8	15708.2	45077.9	15117.0	74215.6	10710.4	81616.4	41535.7	200909.7	16415.1	41981.9	15192.6	71313.3	11192.4	85022.9	42800.1	198318.2	
0.0	0.0							0.0	0.0							0.0	0.0	
0.0	0.0							0.0	0.0							0.0	0.0	
0.0	0.0							0.0	0.0							0.0	0.0	
31199.0		12714.6		11589.6		8440.3		32744.5		13286.8		11647.6		8820.1		33754.5		
1906.2		756.3		727.9		515.9		1999.9		790.4		731.5		538.9		2060.8		
5925.7		2687.1		1939.5		1603.1		6229.6		2808.0		1949.2		1675.3		6432.4		
4276.6		1696.8		1632.9		1156.9		4486.4		1773.1		1641.1		1209.0		4623.2		
18709.3		7423.2		7143.8		5061.4		19628.4		7757.2		7179.5		5289.2		20225.9		
381.2		151.3	0.0	145.6	0.0	103.1		400.0		158.1	0.0	146.3	0.0	107.8		412.2		0.200
799.6	8051.6	317.2	1811.8	305.3	2982.9	216.3	3280.4	838.9	8075.1	331.5	1687.4	306.8	2866.3	226.0	3417.3	864.4	7971.0	0.050
80.0	805.2	31.7	181.2	30.5	298.3	21.6	328.0	83.9	807.5	33.2	168.7	30.7	286.6	22.6	341.7	86.4	797.1	0.100
0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		
0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.000 V/r US#560/25Barr/Sanos
0.0								0.0								0.0		
107131.2	388615.0	42841.8	87447.7	40583.0	143972.2	28982.1	158329.7	112407.0	389749.6	44769.7	81441.6	40786.0	138342.5	30286.3	164938.1	115842.0	384722.2	
	0.0								0.0								0.0	
	0.0								0.0								0.0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

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14-Feb-90 Alternativa (1.)

MODULO III-TRANSFERENCIA/TRANSPORTE Y DISP.FINAL

	1989			1990				1991				1992				1993					
	DF-ZA	DF-CHI	TOTAL	DF-ZA	DF-CHI	TOTAL	DF-ZA	TRANSF.	EI-No.1	TOTAL	DF-ZA	DF-SA	EI-No.1	TRANSF.	TOTAL	DF-ZA	DF-SA	EI-No.1	TRANSF-1	EI-No.2	TRANSF-2
1-TONS-AMO RECOLECC.	95541	170607	266149	103155	181553	284709	310177	197104	197104	310177	131489	212274	212274	212274	343763	0	371906	225665	225665	146241	146241
2-DIAS/AMO OPERAC.	312	312		312	312		312	312	312		312	312	312	312		312	312	312	312	312	312
3-TONS-DIA PROCES.	306	547	853	331	582	913	994	632	632	2256	421	680	680	680	2463	0	1192	723	723	469	469
4-TONS-DIA TRS.ET/DF	NA	NA	---	NA	NA			632		632				680	680				723		469
5-TOT.VJES ET/DF DIA								25		25				27	27				29		19
6-TPO PRM.MIN.1 VJE								120						280					280		220
7-TOT.HRS/DIA TRANSP								51		51				127	127				135		69
8-TOT.HRS/AMO TRANSP								15768		15768				34624	39624				42124		21449
9-HRS TRABJO X DIA	8	8		8	8		8	8	8		8	8	8	8		8	8	8	8	8	8
10-TOT.VEHIC.TRANSP.								6		6				16	16				17		9
11-PROM.HRS ET/DP								30						85					85		44
12-TOT.HRS X DIA								753						2308	2308				2453		1234
13-TOT.KMS X AMO								234.9						720.0	720.0				765.5		384.9
14-TONS-MOV/DIA/TRACT	250	250		250	250		250	250	250		250	250	250	250		250	250	250	250	250	250
15-TOT.CONDUCT.TRANSP								7						17	17				19		9
16-TOT.MAQUIN.EN ET	NA	NA		NA	NA		NA	NA	1	1	NA	NA	1	NA	1	0	0	2	NA	2	NA
17-TOT.MAQUIN.EN DF	1.22	2.19	3.41	1.32	2.33	3.65	3.98		NA	3.98	2	3	NA		4.41	0	5				
18-CAP.VEH.X VIAJE								25						25					25		25
19-TOT.OPERADORES	2.0	2.0	4.0	1.7	3.0	4.7	5.2		1.3	6.5	2.2	3.5	1.3		5.7	0.0	6.2	3.8		2.4	0.0
20-TOT.TRABJ/AYUDANTE	2.0	2.0	4.0	1.7	3.0	4.7	5.2		1.3	6.5	2.2	3.5	1.3		7.0	0.0	6.2	3.8		2.4	0.0
21-TOT.GUARD+PEONES	5.0	8.0	13.0	9.0	5.0	14.0	9.0		5.0	14.0	9.0	9.0	5.0		23.0	9.0	9.0	5.0		5	
22-TOT.SUPERVISORES	0.0	0.0	0.0	4.0	4.0	8.0	2.0	2.0	2.0	6.0	2.0	2.0	2.0	2.0	8.0	2.0	2.0	2.0	2.0	2	2.0
23-TOT.HRS MANTO EQU.	514	919	1433	555	978	1533.0	1670	2653	420	4743.5	708	1143	420	6668	8519	0	2003	1215	7088	787	3609
G A S T O S (miles de sucres)			---	---																	
A.- GASTO SALARIOS	12029.87	15680.2	27710.1	21072.7	18148.0	39220.7	28825.4	12259.0	12454.0	53537.3	18564.8	23974.3	12454.0	27013.2	82006.3	0.0	31884.1	19770.7	28559.2	15835.3	15771.3
A.1 SUPERVISORES	0.0	0.0	0.0	2347.4	2347.4	4734.7	1183.7	1183.7	1183.7	3551.0	1183.7	1183.7	1183.7	1183.7	4734.7	0.0	1183.7	1183.7	1183.7	1183.7	1183.7
A.2 CONDUCT/TRANSP.								4608.1		4608.1				11579.9	11579.9		0.0		12310.4		6263.2
A.3 GUARD/PEONES	2874.6	4599.4	7474.0	5174.3	2874.6	8048.9	5174.3		2874.6	8048.9	5174.3	5174.3	2874.6		13223.2	0.0	5174.3	2874.6		2874.6	
A.4 OPERAD.TRACT/CARG	1659.6	1659.6	3319.2	1426.6	2510.9	3937.5	4289.7		1078.7	5368.5	1816.5	2935.7	1078.7		5833.0	0.0	5143.5	3120.9		2022.5	
A.5 AYUDAN.TRACT/CARG	1149.8	1149.8	2299.7	988.4	1739.6	2728.1	2972.1		747.4	3719.5	1259.9	2034.0	747.4		4041.3	0.0	3563.6	2162.3		1401.3	
A.6 TOT.GAS-SOC+REMUN	6345.0	8271.4	14617.2	11116.0	8655.5	19771.5	15205.0	6460.2	6569.5	23241.3	9728.4	12646.6	6569.5	14249.6	42594.2	0.0	16819.0	10429.2	15065.2	8353.2	8319.5
B.- CONTR.SERVICIOS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00
B.1 PARA MANTO EQUIPO		0																			
B.2 OTROS SERVICIOS																					
C.- GAST.MANTO VEHIC.	1623.4	2898.9	4522.4	1752.8	3084.9	4837.7	5270.5	18084.9	1325.4	24680.7	2234.3	3606.9	1325.4	48038.3	55204.8	0.0	4319.4	16609.9	51068.8	27763.1	25906.1
C.1 MANO OBRA TALLER	675.8	1206.7	1882.4	729.6	1284.1	2013.7	2193.8	5485.2	551.7	6230.7	930.0	1501.4	551.7	8758.1	11741.1	0.0	2630.4	14371.6	9310.6	26312.6	4740.7
C.2 REPUESTOS	947.7	1692.3	2639.9	1023.2	1800.8	2824.0	3076.6	4687.7	773.7	6738.0	1304.2	2105.5	773.7	12282.4	16465.8	0.0	3688.9	2238.4	13057.2	1450.6	6646.4
C.3 LLANTAS								4866.6		4866.6				12279.7	12279.7	0.0	0.0		13054.4		6647.0
C.4 COMBUSTIBLE								4699.0		4699.0				14400.7	14400.7	0.0	0.0		15309.1		7498.1
C.5 AC/LUBRICANTES								126.3		126.3	0.0	0.0		317.5	317.5	0.0	0.0		337.5		171.9
C.6 MAT.VRIOS MANTO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D.- MAT.PARA ET/DF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E.- VARIOS															0.0						
F.- DEPRECIACION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F.1 DEPR.VEHICULOS															0.0						
F.2 DEPR.MAQUIN/EQUIPO															0.0						
TOT.GASTOS DIRECT.	13653.2	18579.1	32232.4	22825.5	21232.9	44056.4	34095.9	30342.9	13779.3	76216.0	20799.1	27581.2	13779.3	75051.5	137211.1	0.0	38203.5	36380.7	79628.0	43598.4	41677.5
INFLAC. ANUAL			0.0			0.0				0.0				0.0				0.0			
INFLAC.ACUMULADA			0.0			0.0				0.0				0.0				0.0			
GAST.V/A CTE.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

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MODULO IV-ANALISIS DE INGRESOS Y GASTOS (millones de Sucres)

	1989 EEQ	1989 T/PRED.	1989 T/COMR.	1989 OTR.ING.	1989 TOTAL	1990 EEQ	1990 T/PRED.	1990 T/COMR.	1990 OTR.ING.	1990 TOTAL
A.- PROS.FACTURACION	15520.7	150.0	40.0		15710.7	16451.9	157.5	40.0		16649.4
Valor Tasa Anual	0.4246	600.0					600.0			
A.1 RESIDENCIAL	4973.5				4973.5	5271.9				5271.9
% crecim.anual						0.060				
A.2 COMERCIAL	3681.0				3681.0	3901.9				3901.9
% crecim.anual						0.060				
A.3 INDUSTRIAL	5522.8				5522.8	5854.2				5854.2
% crecim.anual						0.060				
A.4 ENT.OFICIALES	1055.5				1055.5	1118.8				1118.8
% crecim.anual						0.060				
A.5 AGUA POTABLE	287.9				287.9	305.2				305.2
% crecim.anual						0.060				
MIUSUAR/CONTRIB.	280000	250000					262500			
% crecim.anual		0.05					0.05			
B.- INGR.POTENCIAL DAA	1552.1	150.0	40.0		1742.1	1645.2	157.5	40.0		1842.7
B.1 RESIDENCIAL	497.4	150.0			647.4	527.2	157.5			684.7
% de particip.	0.100	1.00				0.100	1.00			
B.2 COMERCIAL	368.1		40.0		408.1	390.2		40.0		430.2
% de particip.	0.100		1.00			0.100		1.00		
B.3 INDUSTRIAL	552.3				552.3	585.4				585.4
% de particip.	0.100					0.100				
B.4 ENT.OFICIALES	105.6				105.6	111.9				111.9
% de particip.	0.100					0.100				
B.5 AGUA POTABLE	28.8				28.8	30.5				30.5
% de particip.	0.100					0.100				
C.- INGR.POR RECAUDAC.	1332.5	105.0	32.0		1469.5	1428.5	110.3	32.0		1570.8
% real Recaud.	0.86					0.87				
C.1 RESIDENCIAL	452.6	105.0			557.6	474.5	110.3			584.7
% real Recaud.	0.91	0.70				0.90	0.70			
C.2 COMERCIAL	327.6		32.0		359.6	351.2		32.0		383.2
% real Recaud.	0.89		0.80			0.90		0.80		
C.3 INDUSTRIAL	469.4				469.4	497.6				497.6
% real Recaud.	0.85					0.85				
C.4 ENT.OFICIALES	82.3				82.3	83.9				83.9
% real Recaud.	0.78					0.75				
C.5 AGUA POTABLE	0.6				0.6	21.4				21.4
% real Recaud.	0.02					0.70				
D.- DESCUENTOS ESPEC.	352.8				352.8	366.8				366.8
E.- INGRESO NETO	979.7	105.0	32.0	0.0	1116.7	1061.7	110.3	32.0	0.0	1204.0
F.- SALDO CTAS Y COBR.	219.5	45.0	8.0	0.0	272.5	348.4	69.8	12.0	0.0	430.1
F.1 REC.X CTAS-COBRAR					0.0	87.0	22.5	4.0	0.0	114.3
F.2 %REC..						0.4	0.50	0.50		
G.- INGRESO TOTAL	979.7	105.0	32.0	0.0	1116.7	1149.6	132.8	36.0	0.0	1318.3
G A S T O S	RECOLEC.	BARRID.	TRANSF.	D.FINAL	TOTAL	RECOLEC.	BARRID.	TRANSF.	D.FINAL	TOTAL
a.- PERSONAL	749.8	535.5		32.2	1317.6	691.2	558.3		44.1	1293.5
b.- SERVICIOS	26.7	0.0			26.7	26.5	0.0			26.5
c.- MANTENIMIENTO	274.2	6.2			280.4	252.8	30.0			282.8
d.- MATER.Y SUMINIST.	5.1	11.2			16.3	4.7	11.1			15.8
e.- VARIOS	0.0	1.1			1.1	0.0	1.1			1.1
f.- DEPREC. EQUIPOS	0.0	0.0			0.0	0.0	0.0			0.0
g.- TOT.GASTOS DIRECT.	1057.9	554.0	0.0	32.2	1644.1	975.1	600.5	0.0	44.1	1619.7
h.- % GD para ADMON					0.06					0.06
i.- GASTOS ADMON GRAL	62.4	32.7	0.0	1.9	97.0	57.5	35.4	0.0	2.6	95.6
i.1 P/ PERSONAL					68.1					96.8
i.2 P/ SUMINISTR.					7.4					7.3
i.3 P/ VARIOS					0.0					0.0
i.4 P/ EQU.OFICINA					1.6					1.5
TOTAL GASTO	1120.3	586.7	0.0	34.1	1741.1	1032.6	635.9	0.0	46.7	1715.2
INFLAC.MENSUAL					0.00					0.00
INFL.ACUMULADA					0.00					0.00
GAST.A/F CTE					0.0					0.0
DEFIC/SUPERAV.					-624.4					-396.9

	1991 EEQ	1991 T/PRED.	1991 T/COMR.	1991 OTR.ING.	1991 TOTAL	1992 EEQ	1992 T/PRED.	1992 T/COMR.	1992 OTR.ING.	1992 TOTAL
A.- PROS.FACTURACION	17439.1	165.4	40.0		17644.4	18485.4	173.6	40.0		18699.0
Valor Tasa Anual		600.0					600.0			
A.1 RESIDENCIAL	5586.2				5588.2	5923.5				5923.5
% crecim.anual	0.060					0.060				
A.2 COMERCIAL	4136.0				4136.0	4384.1				4384.1
% crecim.anual	0.060					0.060				
A.3 INDUSTRIAL	6205.4				6205.4	6577.7				6577.7
% crecim.anual	0.060					0.060				
A.4 ENT.OFICIALES	1186.0				1186.0	1257.1				1257.1
% crecim.anual	0.060					0.060				
A.5 AGUA POTABLE	323.5				323.5	342.9				342.9
% crecim.anual	0.060					0.060				
MIUSUAR/CONTRIB.		275625					289406			
% crecim.anual		0.05					0.05			
B.- INGR.POTENCIAL DAA	1743.9	165.4	40.0		1949.3	1848.5	173.6	40.0		2062.2
B.1 RESIDENCIAL	558.8	165.4			724.2	592.4	173.6			766.0
% de particip.	0.100	1.00				0.100	1.00			
B.2 COMERCIAL	413.2		40.0		453.6	438.4		40.0		478.4
% de particip.	0.100		1.00			0.100		1.00		
B.3 INDUSTRIAL	620.5				620.5	657.8				657.8
% de particip.	0.100					0.100				
B.4 ENT.OFICIALES	116.6				118.6	125.7				125.7
% de particip.	0.100					0.100				
B.5 AGUA POTABLE	32.3				32.3	34.3				34.3
% de particip.	0.100					0.100				
C.- INGR.POR RECAUDAC.	1539.3	115.8	32.0		1687.1	1631.7	121.6	32.0		1785.2
% real Recaud.	0.88					0.88				
C.1 RESIDENCIAL	582.9	115.8			618.7	533.1	121.6			654.7
% real Recaud.	0.90	0.70				0.90	0.70			
C.2 COMERCIAL	372.2		32.0		404.2	394.6		32.0		426.6
% real Recaud.	0.90		0.80			0.90		0.80		
C.3 INDUSTRIAL	558.5				558.5	592.0				592.0
% real Recaud.	0.90					0.90				
C.4 ENT.OFICIALES	83.0				83.0	88.0				88.0
% real Recaud.	0.70					0.70				
C.5 AGUA POTABLE	22.6				22.6	24.0				24.0
% real Recaud.	0.70					0.70				
D.- DESCUENTOS ESPEC.	261.6				261.6	277.3				277.3
E.- INGRESO NETO	1277.7	115.8	32.0	0	1425.5	1354.4	121.6	32.0	0	1509.0
F.- SALDO CTAS Y COBR.	415.6	64.5	14.0	0	512.1	465.0	94.3	15.0	0	574.4
F.1 REC.X CTAS-COBRAR	139.4	34.9	6.0	0	180.2	165.4	42.2	7.0	0	214.7
F.2 %REC..	0.4	0.50	0.50			0.4	0.50	0.50		
G.- INGRESO TOTAL	1417.1	150.6	38.0	0.0	1605.7	1519.9	163.8	39.0	0.0	1722.6
G A S T O S	RECOLEC.	BARRID.	TRANSF.	D.FINAL	TOTAL	RECOLEC.	BARRID.	TRANSF.	D.FINAL	TOTAL
a.- PERSONAL	521.0	454.8	24.7	28.8	1029.3	468.7	459.6	39.5	42.5	1010.3
b.- SERVICIOS	20.9	0.0	0.0	0.0	20.9	21.0	0.0	0.0	0.0	21.0
c.- MANTENIMIENTO	210.0	31.2	19.4	5.3	265.9	232.0	32.7	49.4	5.8	320.0
d.- MATER.Y SUMINIST.	3.5	8.9	0.0	0.0	12.3	2.9	8.9	0.0	0.0	11.8
e.- VARIOS	0.0	0.9	0.0	0.0	0.9	0.9	0.9	0.0	0.0	0.9
f.- DEPREC. EQUIPOS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
g.- TOT.GASTOS DIRECT.	755.4	495.7	44.1	34.1	1329.3	724.6	502.2	88.8	48.4	1363.9
h.- % GD para ADMON					0.06					0.06
i.- GASTOS ADMON GRAL	42.3	27.8	2.5	1.9	74.4	40.6	28.1	5.0	2.7	76.4
i.1 P/ PERSONAL					67.6					69.4
i.2 P/ SUMINISTR.					5.7					5.8
i.3 P/ VARIOS					0.0					0.0
i.4 P/ EQU.OFICINA					1.2					1.2
TOTAL GASTO	797.7	523.5	46.6	36.0	1403.8	765.1	530.3	93.8	51.1	1440.3
INFLAC.MENSUAL					0.00					0.00
INFL.ACUMULADA					0.00					0.00
GAST.A/F CTE					0.0					0.0
DEFIC/SUPERAV.					202.0					282.3

1993

EEQ	T/PAED.	T/COMA.	OTH.ING.	TOTAL
19594.5	182.3	40.0		19816.9
	600.0			
6278.9				6278.9
0.060				
4647.2				4647.2
0.060				
6972.4				6972.4
0.060				
1332.5				1332.5
0.060				
363.5				363.5
0.060				
	303877			
	0.05			
1959.5	182.3	40.0		2181.8
627.9	182.3			810.2
0.100	1.00			
464.7		40.0		504.7
0.100		1.00		
697.2				697.2
0.100				
133.3				133.3
0.100				
34.3				34.3
0.100				
1729.6	127.6	32.0		1889.2
0.88				
565.1	127.6			692.7
0.90	1.00			
418.2		32.0		450.2
0.90		0.80		
627.5				627.5
0.90				
93.3				93.3
0.70				
25.4				25.4
0.70				
293.9				293.9
1435.7	127.6	32.0	0.0	1595.3
508.9	101.9	15.5	0.0	626.2
186.0	47.2	7.5	0.0	240.7
0.4	0.50	0.50		
1621.7	174.8	39.5	0.0	1836.0

RECOLEC.	BARRID.	TRANSF.	D.FINAL	TOTAL
506.4	457.1	79.9	31.9	1075.3
22.7	0.0	0.0	0.0	22.7
251.0	33.8	121.3	6.3	412.4
3.1	8.8	0.0	0.0	11.9
0.0	0.9	0.0	0.0	0.9
0.0	0.0	0.0	0.0	0.0
783.2	500.6	201.3	38.2	1523.3
				0.06
43.9	26.0	11.3	2.1	85.3
				77.5
				6.5
				0.0
				1.4
827.1	528.6	212.6	40.3	1608.6
				0.00
				0.00
				0.0
				227.4

15-Feb-90 Alternative (1.)

PROYECCIONES DEL FLUJO OPERATIVO ANUAL Y QUINQUENAL (FOA/Q)

MODULO 1-RECOLECCION

NI DESCRIPCION	1989 Z-N	1989 Z-C	1989 Z-S	1989 TOTAL	1990 Z-N	1990 Z-C	1990 Z-S	1990 TOTAL	1991 Z-N	1991 Z-C	1991 Z-S	1991 TOTAL	1992 Z-N	1992 Z-C	1992 Z-S	1992 TOTAL	1993 Z-N	1993 Z-C	1993 Z-S	1993 TOTAL	FACTOR
1.-POBLACION	467800	359800	500600	1328200	487915	363399	522126	1373439	508896	367032	543011	1416939	530776	370702	564731	1466212	552009	374409	587321	1513739	
2.-% CRECIMIO X AÑO	NA	NA	NA		0.043	0.010	0.043		0.043	0.010	0.040		0.043	0.010	0.040		0.040	0.010	0.040		
3.-TONS DE RS X AÑO	122325	126997	104333	363655	139399	129546	109907	378852	146847	132150	115990	394443	154693	134896	121265	410764	162490	137515	127377	427382	
4.-TGS X HAB/AÑO	0.7750	0.9670	0.5710	.	0.7828	0.9767	0.5767		0.7906	0.9864	0.5825		0.7985	0.9963	0.5883		0.8065	1.0063	0.5942		
5.-% CRECIMIO ABS/H/A	NA	NA	NA		0.01	0.01	0.01		0.01	0.01	0.01		0.01	0.01	0.01		0.01	0.01	0.01		
6.-% DE COBERTURA	0.72	0.84	0.61		0.74	0.85	0.65		0.77	0.88	0.70		0.65	0.90	0.75		0.90	0.90	0.80		
7.-TONS/AÑO RECOLECC.	95541	106547	64060	266149	103155	110114	71440	284709	113072	116292	80812	310177	131489	121325	90949	343763	146241	123769	101901	371906	
8.-DIAS/AÑO OPERAC.	312	312	312		312	312	312		312	312	312		312	312	312		312	312	312		
9.-TONS.X DIA RECOL.	306.2	341.5	205.3	853.0	330.6	352.9	229.0	912.5	362.4	372.7	259.0	994.2	421.4	388.9	291.5	1101.8	468.7	396.7	326.6	1192.0	
10-PROM.CAPAC.X VIAJE	4.00	4.00	4.00		4.30	4.30	4.30		5.00	5.00	5.00		5.00	5.00	5.00		5.00	5.00	5.00		
11-NC VIAJES X DIA	76.6	85.4	51.3	213.3	76.9	82.1	53.2	212.2	72.5	74.5	51.6	196.6	84.3	77.6	58.3	220.4	93.7	79.3	65.3	238.4	
12-TPO.RECORRI.X RUTA	159	196	159	NA	107	196	158		107	134	106		107	134	106		107	134	106		TA*2+TF2+
13-TPO.PROMED.X VIAJE	33	70	55	NA	33	70	55		33	52	120		33	58	120		33	58	120		TV2BF*3+T
14-TPO.TOT(HRS) 12+13	195	268	213		140	268	213		140	192	226		140	192	226		140	192	226		
15-TOT.HRS PARA RECOL	235.4	383.6	181.8	797.8	178.8	365.9	188.6	733.3	168.5	237.9	195.1	601.6	196.0	246.2	219.6	663.8	218.4	253.2	246.0	717.2	
16-TPO.TRBJO X DIA	1	8	8		8	8	8		6	8	8		6	8	8		8	8	8		
17-N(VEHICULOS/TURNO	29.4	47.6	22.7	99.7	22.3	45.7	23.6	91.7	21.1	29.7	24.4	75.2	24.5	31.0	27.4	83.0	27.2	31.7	30.8	89.7	
18-TRAJAD.X VEHICULO	5.30	5.40	5.80	NA	5.30	5.40	5.80	NA	5.00	5.00	5.00	NA	4.00	4.00	4.00	NA	4.00	4.00	4.00	NA	
19-CONDUCTORES	36	59	28	123	26	50	29	113	26	37	30	93	30	36	34	102	35	39	38	111	1.235
20-SUPERVISORES	6	13	7	26	6	13	7	26	6	6	6	20	5	7	6	18	6	7	7	19	0.05
21-TOT.PEONES RECOL.	127	209	109	445	96	201	113	411	84	119	98	301	73	93	82	249	82	95	92	269	1.00
22-TOT.KMS RECORR/DIA	2473	2903	2028	7403	2022	2791	2103	6916	1906	1912	1279	5096	2117	1995	2565	6777	2465	2035	2874	7375	
23-KMS.PROM.EN RUTA	24	17	27	NA	18	17	27	NA	18	13	17	NA	18	13	17	NA	18	13	17	NA	DR*2+DF2+
24-KMS.PROM.EN VIAJE	9	18	13	NA	9	18	13	NA	9	13	27	NA	9	13	27	NA	9	13	27	NA	BV*3+DP2+
25-TOT.KMS RECORR/AÑO	771.5	905.7	632.6	2309.7	630.9	676.7	656.2	2157.8	594.6	596.6	711.1	1902.3	691.6	622.4	800.3	2114.4	769.2	634.9	896.7	2300.9	
26-TOT.HRS P/ RTG AÑO	12359	19983	9544	41886	9385	19211	9901	38497	8847	12491	10244	31582	10288	13032	11529	34849	11443	13294	12917	37654	420

PROYECCION DE GASTOS (miles de sucres)

	1989 Z-N	1989 Z-C	1989 Z-S	1989 TOTAL	1990 Z-N	1990 Z-C	1990 Z-S	1990 TOTAL	1991 Z-N	1991 Z-C	1991 Z-S	1991 TOTAL	1992 Z-N	1992 Z-C	1992 Z-S	1992 TOTAL	1993 Z-N	1993 Z-C	1993 Z-S	1993 TOTAL	
a.-COSTOS UNITARIOS																					
a.1 CU HORA M/O TALLER	1313.53	1313.53	1313.53		1313.53	1313.53	1313.53	NA	1313.53	1313.53	1313.53		1313.53	1313.53	1313.53		1313.53	1313.53	1313.53		1313.53
a.2 CU COMBUST.X KM.	20.00	20.00	20.00		20.00	20.00	20.00	NA	20.00	20.00	20.00		20.00	20.00	20.00		20.00	20.00	20.00		20.48
a.3 CU AC/LUBR.X VEHI	176.810	176.810	176.810		176.810	176.810	176.810	NA	176.810	176.810	176.810		176.810	176.810	176.810		176.810	176.810	176.810		176.810
a.4 CU LLANTAS X VEH.	773.516	773.516	773.516		773.516	773.516	773.516	NA	773.516	773.516	773.516		773.516	773.516	773.516		773.516	773.516	773.516		773.516
a.5 CU REPUEST.X VEHI	773.683	773.683	773.683		773.683	773.683	773.683	NA	773.683	773.683	773.683		773.683	773.683	773.683		773.683	773.683	773.683		773.683
a.6 SALAR/MES SUPERV.	49320	49320	49320		49320	49320	49320	NA	49320	49320	49320		49320	49320	49320		49320	49320	49320		42000
a.7 SALAR/MES CONDUCT	55260	55260	55260		55260	55260	55260	NA	55260	55260	55260		55260	55260	55260		55260	55260	55260		38000
a.8 SALAR/MES PEON RE	47910	47910	47910		47910	47910	47910	NA	47910	47910	47910		47910	47910	47910		47910	47910	47910		42000
																					Factor
A.- GASTOS SALARIOS	215165.2	353983.6	180698.5	749847.3	163396.1	349309.8	167454.9	691160.7	145944.5	266058.7	168983.1	520978	138374.9	175372.0	155059.0	468806	153898.9	178794.9	172732.3	506426	
A.1 SUPERVISORES	4819.7	7933.8	4056.3	16811.8	3640.1	7627.3	4210.0	15497.4	3263.3	6607.3	3776.4	11649.0	3369.9	3868.5	3440.1	10398.5	3414.3	3966.7	3854.3	11235.3	
A.2 CONDUCTORES	24098.6	38984.5	18610.2	81673.3	18300.4	37459.4	19306.0	75065.8	17251.4	24356.3	19574.7	61182.3	20021.5	25410.5	22480.1	67951.8	22311.9	25921.3	25187.5	73420.4	
A.3 PEONES RECOLECC.	72745.9	120356.8	62710.5	255813.1	55243.1	115707.6	65055.2	236005.9	48443.2	68394.2	56090.4	172927.7	42250.1	53515.9	47344.3	143110.3	46990.1	54591.6	53045.8	154627.4	
A.4 TOT.CARG.SOC+REM.	113501.0	186726.6	95319.6	395549.1	86172.4	179515.5	98893.6	364591.6	76986.6	106693.0	89139.7	274819.3	72993.6	92457.0	81794.2	247245.3	81182.7	94315.4	91644.6	267142.9	1
B.- GSTO CONTRAT.SERV.	8439.3	13425.3	6844.8	28709.3	6454	12907	7101	26461.2	5922	8118	6880	20919.7	6260	7675	7040	20975.4	6962	7870	7888	22679.8	
B.1 PARA MANT.VEHICULO	4136.0	6345.6	3230.8	13712.4	3185.9	6160.5	3351.6	12638.0	3003.3	3957.0	3499.9	10500.2	3492.4	4170.0	3938.9	11601.3	3834.3	4253.8	4413.2	12551.3	0
B.2 MANT.EQU.Y EDIFIC.	4303.3	7079.7	3616.0	14996.9	3267.9	6806.2	3749.1	13823.2	2916.9	4121.0	3379.7	10419.6	2767.5	3505.4	3101.2	9374.1	3078.0	3575.9	3479.6	10126.5	0
B.3				0.0				0.0				0.0				0.0				0.0	
C.- GASTOS MTO VEHIC.	82719.3	126911.9	64616.2	274247.5	63718.0	122009.5	67032.2	252759.7	60065.5	79940.4	69997.4	210003.3	69848.8	83400.0	78777.1	232026.4	77685.0	85076.9	88263.9	251025.8	
C.1 MANO OBRA TALLER	16233.9	26246.2	12536.6	55018.7	12328.0	25234.3	13005.4	50567.6	11621.3	16407.4	13455.8	41484.6	13514.1	17117.6	15143.6	45775.3	15030.3	17461.7	16967.3	49459.2	
C.2 REPUESTOS	22766.5	36810.6	17581.4	77158.5	17288.8	35388.7	18238.8	70916.3	16297.8	23009.9	18870.5	58178.2	18952.3	24005.9	21237.4	64195.6	21078.5	24488.4	23795.0	69361.9	
C.3 LLANTAS	22761.5	36802.7	17577.6	77141.9	17285.1	35361.1	18234.9	70901.0	16294.3	23004.9	18866.4	58165.6	18946.2	24000.7	21232.8	64181.7	21074.0	24483.1	23785.8	69346.9	
C.4 COMBUSTIBLE	15429.9	18113.0	12651.9	46194.9	12618.6	17413.4	13124.9	43156.9	11895.2	11931.5	14223.0	38049.7	13832.7	12448.0	16007.0	42287.6	15384.5	12698.2	17934.6	46017.4	
C.5 ACEITES Y LUBRIC.	5202.6	8412.3	4817.9	17633.1	3951.0	8087.4	4146.1	16204.5	3724.5	5258.5	4312.5	13295.5	4331.2	5486.1	4853.4	14670.6	4817.1	5596.3	5437.9	15851.3	
C.6 MAT.VRIOS DE MTO.	324.7	525.0	250.7	1100.4	246.6	504.7	260.1	1011.4	232.4	328.1	269.1	829.7	270.3	342.4	302.9	915.5	300.6	349.2	339.3	989.2	0.02
D.- MATER.DE RECOLECC.	1454.9	2467.1	1254.2	5116.3	1104.9	2314.2	1301.1	4720.1	968.9	1367.9	1121.8	3456.6	845.0	1076.3	946.9	2862.2	939.8	1091.8	1060.9	3092.5	0.02
E.- VARIOS								0.0				0.0				0.0				0.0	
F.- DEPRECIACION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
F.1 DEPREC.VEHICULOS				0				0.0				0.0				0.0				0.0	
F.2 DEPREC.MAQ.Y EQUIP				0				0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
TOTAL GAST.DIRECT.	307778.7	496727.9	253413.7	1057920	234472.7	477540.1	262888.9	975102	212901.1	295477.0	246981.9	755360	215328.7	267418.3	241823.0	724570	237486.0	272793.4	270944.9	783224	
INFLAC.ANUAL				0.00				0.00				0.00				0.00				0.00	
INFLAC.ACUMUL.				0.00				0.00				0.00				0.00				0.00	2
GAST.V/K CTE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

ATTACHMENT No. 1

17

PERFIL DE UNA EMPRESA MUNICIPAL DE RESIDUOS SOLIDOS URBANA.
CONCLUSION.

1. El servicio de recoleción sólida urbana se brinda a Guayaquil con una cobertura insuficiente y con bajos niveles de eficiencia, lo que significa que existe una proporción importante de población urbana al margen de los beneficios de este componente fundamental de saneamiento básico y que los sectores de la población efectivamente cubierta, reciben un servicio de alto costo.

2. La situación respecto a la disposición final de las basuras urbanas en Guayaquil ha hecho crisis y requiere de la urgente adopción de medidas que permitan eliminar en un plazo prudente una situación de riesgos significativos para la salud de importantes sectores de la población y de franco deterioro de la calidad ambiental.

3. El servicio de aseo urbano del Municipio está enfrentando una situación generalizada de desfinanciamiento que, impide alcanzar mayor eficiencia, calidad y cobertura. Si bien la legislación vigente permite el cobro de estos servicios al usuario, en la práctica, el servicio de aseo municipal se presenta siempre deficitario debido, fundamentalmente, a que el cálculo de tarifas no responde a la situación actualizada de costos; al no pago del servicio por parte de cierta proporción de los usuarios.

4. Pese a la importancia de las funciones de aseo urbano dentro de la Municipalidad, existe una gran déficit de personal calificado capaz de abordar con criterio técnico la planificación, operación y comercialización de los servicios.

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RECOMENDACIONES.

1. Crear una Empresa Metropolitana de residuos sólidos encargada de programar, implementar y realizar la recolección, el barrido de calles y la disposición final de los residuos sólidos urbanos que se produzcan en la ciudad de Guayaquil.

   Dicha empresa será autónoma y tendrá patrimonio propio.

2. Introducir las modificaciones necesarias a la legislación vigente con el propósito de establecer tarifas diferenciadas acordes con la producción real de basura de los diferentes estratos socio-económicos de la población, de disminuir la proporción de usuarios que no pagan el servicio y asegurar que los fondos recaudados por concepto de pago de los servicios de aseo se utilicen en el financiamiento de las necesidades de la empresa.

3. Elaborar normas sanitarias especificas respecto a la recolección, barrido de calles y del diseño y operación del relleno sanitario.

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PERFIL DE UNA EMPRESA MUNICIPAL DE RESIDUOS SOLIDOS URBANOS DE LA CIUDAD DE GUAYAQUIL, PARA LOS SERVICIOS DE ASEO QUE NO SERAN CONTRATADOS.

OBJETIVOS:

El objetivo que se persigue con la creación de una empresa como la propuesta, es el contar con una estructura orgánica que se responsabilice de dar los servicios de aseo urbano de acuerdo a las normas sanitarias vigentes. Se debe optimizar el uso de recursos materiales y humanos disponibles y asegurando una capacidad de respuesta ágil y flexible ante los requerimientos propios de contingencias de operación, de contratación de personal y de adquisición de equipos y repuestos.

La experiencia que se obtenga en materia de constitución y funcionamiento de la empresa propuesta, deberá ser la base de la formalización de las etapas siguientes:

FUNCIONES: Descripción de la empresa.-

La empresa de residuos sólidos tendría por función el programar, implementar y ejecutar la recolección y transporte de los residuos y la limpieza de vías públicas de los residuos sólidos urbanos producidos en Guayaquil.

ESTRUCTURA:

Para el cumplimiento de sus funciones, la empresa propuesta estaría constituída por:

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1. Junta de Administración.
2. Gerencia.
3. Asesoría.
   3.1 Jurídica.
   3.2 Educación sanitaria y relaciones públicas.
4. Departamento Técnico.
   4.1 Sección de Recolección y transporte.
      4.1.1 Sección de talleres.
      4.1.2 Mantenimiento mecánico.
            Vehículos de recolección.
            Contenedores.
      4.1.3 Lavaderos.
      4.1.4 Sección de planificación.
      4.1.5 Sección de Inspección.
   4.2 Sección de barrido y limpieza de calles.
      4.2.1 Sección de talleres.
            Mantenimiento mecánico.
      4.2.2 Lavaderos.
      4.2.3 Sección de planificación.
            Macrorutas.
            Microrutas.
      4.2.4 Sección de Inspección.
5. Departamento Administrativo.
   5.1 Sección adquisición y suministro.
   5.2 Sección Tesorería y contabilidad.
   5.3 Sección oficina de personal.

CONSTITUCION DE LA JUNTA DE ADMINISTRACION.

La Dirección Superior de la empresa sería ejercida por un Consejo integrado al menos por:

a) Dos representantes de los usuarios.
b) Un representante del Alcalde.

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c) Un representante del Ministerio de Salud.
d) Un representante del personal de la empresa.
e) Un representante de la Cámara de Comercio.
f) Un representante de la Sociedad de Ingenieros del Litoral (S.I.L.).

FUENTES DE FINANCIAMIENTO.

Como fuente de financiamiento se propone:

a) Cobro de la tarifa por concepto de servicios de recolección de basura a cada habitación y negocio.
b) Cobro a particulares que concurran al relleno sanitario a depositar residuos.

Las tarifas deben ser suficientes para que esta empresa se autofinancie por estos cobros.

Responsable de la creación de la Empresa.

Se propone como organismo responsable de crear y de asesorar la puesta en marcha de la empresa al Concejo del Municipio, para lo cual contará con el apoyo y colaboración del Ministerio de Salud.

PROYECTO DE PLANTA DE PERSONAL.

GERENCIA

	PROF.	TEC.	ADM.	OPER.	TOTAL
1. GERENTE	1				
2. ABOGADO	1				
3. RELACIONES PUBLICAS		1			

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4. DIBUJANTE	1		
5. SECRETARIA		3	
6. AUXILIAR		2	

DEPARTAMENTO TECNICO

1. JEFATURA			
1.1 Ingeniero Jefe	1		
1.2 Ingeniero Jefe de Sección	2		
1.3 Secretaria		3	
2. SECCION PLANIFICACION			
2.1 Técnico Jefe	2		
2.2 Secretaria	2		
3. SECCION TALLERES			
3.1 Técnico Jefe	1		
3.2 Mecánico	5		
3.3 Ayudante Mecánico	10		
4. RECOLECCION DE BASURA			
4.1 Técnico Jefe	1		
4.2 Supervisor	2		
4.3 Chofer			50
4.4 Jornaleros			200
4.5 Inspector		2	
5. BARRIDO Y LIMPIEZA DE CALLES			
5.1 Técnico Jefe		1	
5.2 Supervisor		2	
5.3 Barrendero			200
5.4 Chofer			10
5.5 Inspector		2	

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DEPARTAMENTO ADMINISTRATIVO

6. JEFATURA

6.1 Administrador	1		
6.2 Secretaria			1

7. SECCION ADQUISICIONES

7.1 Administrador	1		
7.2 Bodeguero			5

8. SECCION TESORERIA

8.1 Contador	1		
8.2 Ayudante de Contabilidad			4
8.3 Secretaria			1

9. SECCION OFICINA DE PERSONAL

9.1 Administrador	1		
9.2 Secretaria			1
9.3 Programador		1	
9.4 Operador de Computadores		1	

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ATTACHMENT No. 2

ANNEX F

TECHNICAL ANALYSIS

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ANNEX F

TECHNICAL ANALYSIS

Accelerated urban growth in Costa Rica over the past decade has substantially increased the need for improved and expanded solid waste collection and treatment services. This annex sets out the basic technical criteria which will be used by IFAM[1] during project implementation to guide required improvements in municipal solid waste collection systems as well as for the design, construction and operation of a sanitary landfill. It also describes the process and results of preliminary studies of alternative proposed sites for the model sanitary landfill to be developed.

I. CRITERIA FOR MUNICIPAL SOLID WASTE COLLECTION SYSTEMS

Even as IFAM estimates that less than half of the 1,500 metric tons of daily waste generated nationally are collected, solid waste collection and disposal typically constitutes the single largest deficit item in municipal budgets and produces the highest amounts of overdue and uncollectible charges. This section sets out criteria to be utilized during project implementation to improve the efficiency and effectiveness of existing solid waste collection systems in each participating municipality. It is estimated that coverage of collection services can be increased by between 20 to 25 percent through their application.

A. General

1. Purpose, scope, and applicability

   (a) The purpose of this part is to establish minimum criteria for Municipal Solid Waste Collection systems. These minimum criteria ensure the protection of human health and the environment.

   (b) These criteria apply to owners and operators of municipal solid waste collection systems.

   (c) The owners or operator of a municipal solid waste collection system must comply with any other applicable rules, laws, regulations, or other requirements.

1/ While only IFAM is explicitly referred to in this Annex as being responsible for the application of project standards and criteria, the fullest possible participation of other national authorities responsible for specific aspects (e.g. Ministry of Health, SENARA, and A y A) is implied and expected.

B. Routing

1. Existing policies that directly affect routing and collection efficiency should be reviewed, evaluated, and changed. Policies which primarily relate to levels of service, include:

   Point of collection (distances from street to storage)
   Frequency of collection
   Type and weight limits of storage
   Garden waste collection
   Bulky waste (furniture, ect.) collection
   Separated versus combined collection

2. Existing methodologies that directly effect routing and collection efficiency should be reviewed, evaluated, and changed. Methodologies, or on-the-route practices include:

   Crew size
   Type and capacity of collection vehicles
   One-side versus two-sides-of-the-street collection
   Fixed lunch site and time
   Collection by drivers
   Incentive programs
   U-turns and vehicle backing
   Completely filling vehicles before going to disposal site.

3. Macro-routing determines the assignment of daily collection routes to existing disposal sites. The objective is to optimize the use of the disposal facilities in terms of the daily and long-range capacities and operating costs of the facilities, while minimizing the round trip haul time (and hance the hauling costs) from the collection routes to the disposal sites.

   (a) Information essential to macro-routing includes:

   Haul times from routes to the various disposal sites
   crew size
   vehicle capacity
   expected arrival time
   queue time
   service times of site
   short and long-range capacities of site
   location of sites.

4. Districting and route balancing determines a fair day's work and divides the collection areas into balance routes so that all work crews have equal workloads. This is achieved through a careful evaluation of how the collection crew spends its time.

5. Micro-routing looks in detail at each daily collection service area to determine the path that the collection vehicle should follow as it collects from each service on its route.

   (a) The objective is to minimize the driving time on the collection route through minimizing the haul distance (i.e., street segments that have no services or that are traversed more than once), backing of vehicles, u-turns, left turns, collection [illegible] traffic and other delay times

(b) All the information required for routing can be recorded on community maps.

(1) Record on the community map(s) the number and type (residential, apartment, commerical, institutional, industrial) of services per street segment for each side of the street. The remaining street segments with no services on them are non-collection segments.

(2) Identify all one-way, dead-end, and heavily traveled streets. Indicate which corner-lot residents (if any) should be asked to place their waste on a specific street segment.

(3) Indicate, for each street segment or service area, whether the crews are to collect one or both sites of the street on a pass.

(c) Rules for micro-routing

(1) Routes should not be fragmented or overlapping. Each route should be compact, consisting of street segments clustered in the same geographical area.

(2) Total collection plus haul times should be reasonably constant for each route in the community (equalized workloads).

(3) The collection route should be started as close to the garage or motor pool as possible, taking account heavily traveled and one-way streets. (See rules 4 and 5)

(4) Heavily traveled streets should not be collected during rush hours.

(5) In case of one-way streets, it is best to start the route near the upper end of the street, working down it through a looping process.

(6) Services on a dead end streets can be considered as services on the street segments that they intersect, since they can only be collected by passing down that street segment. To keep left turns at a minimum, collect the dead end streets when they are to the right of the truck. They must be collected by walking down, backing down, or making a u-turn.

(7) When practical, steep hills should be collected on both sides of the street while vehicle is moving down hill for safety, ease, speed of collection, and wear on vehicle, and to conserve gas and oil.

(8) High elevations should be at the start of the route.

(9) For collection from one side of the street at a time, it is generally best to route with many clockwise turns around the block.

Rules 8 and 9 emphasize the development of a series of clockwise loops in order to minimize left turns, which generally are more difficult and time-consuming than right turns.

(10) For collection from both sides of the street at the same time, it is generally best to route with long, straight paths across the grit before looping clockwise.

(11) For certain street block configurations within the route, specific routing patterns should be applied.

C. Criteria for Collection System Operations

1. Collection requirements.

All putrescible animal and vegetable waste materials should be collected at least once per week.

2. Vehicles and equipment.

All collection vehicles should have written instructions with diagrams for each collection route, where to dump and procedures to follow in case of accidental spillage.

(a) All collection vehicles should be water tight to prevent the spillige of liquid on routes.

(1) All collection spillages should be cleaned by the operator/crew as soon as possible. All spillages areas should be washed down as soon as possible after clean-up.

(b) All collection vehicles should have a pre-flight check list for operators to check before vehicle leaves garages or motor pool each morning.

(c) All collection vehicles should be in good operating condition and pass safety inspection every morning before leaving garage or motor pool.

(d) Safety procedures for operation of packing mechanizim, backing-up and making u-turns should be adopted and enforced.

(e) Safety procedures for labors riding outside vehicles during collection should be adopted and enforced.

(f) A schedule to stagger collection vehicle arrivals at the landfill should be adopted and enforced. (A staggered schedule allows the landfill operator to spread and compact the waste material more efficiently and to keep the site under better environmental control. It also reduces congestion and elimination of long costly waits by collector crews.)

(g) All collection vehicles should be washed and disinfected a minimum of twice per week.

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D. Criteria for a Record Keeping system of Solid Waste Collection System

1. A basic system of record keeping for collection system should be adopted and enforced. See attached forms for guidelines at end of this annex.

E. Criteria for Cost Accounting of Solid Waste Collection System

1. A basic system of cost accounting and record keeping should be adopted and enforced. See attached forms for guidelines at end of this annex.

II-CRITERIA FOR MUNICIPAL SOLID WASTE LANDFILLS

The project will represent the first attempt to install a technically and environmentally sound approach to the treatment of solid waste. This pilot demonstration effort with participating municipalities will allow other municipalities and the central government to assess both the costs and the benefits of proper solid waste treatment. This section sets out basic criteria to be used for site selection, design and operation and maintenance of the sanitary landfill(s) to be developed under the project. Annex I provides more detailed environmental criteria for the development and operation of project sanitary landfills.

A. General

1. Purpose, Scope, and Applicability

(a) The purpose of this part is to establish minimum criteria, for municipa solid waste landfills. These minimum criteria ensure the protection of human health and the environment.

(b) These criteria apply to owners and operators of municipal solid waste landfills.

(c) These criteria apply to all municipal solid waste landfills.

(d) Municipal solid waste landfills failing to satisfy these criteria are considered open dumps.

2. Definitions

Unless otherwise noted, all terms contained in this part are defined by their plain meaning. This section contains definitions for terms that appear throughout this part; additional definitions appear in the specific sections to which they apply.

"Active life" means the period of operation beginning with the initial receipt of solid waste and ending at completion of closure activities.

"Active portion" means that part of a facility or unit that has received or is receiving wastes and that has not been closed.

"Aquifer" means a geological formation, group of formations, or portion of a formation capable of yielding significant quantities of ground water to wells or springs.

"Closed unit" Means any solid waste disposal unit that no longer receivers solid waste and has received a final layer of cover material.

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"Commercial solid waste" means all types of solid waste generated by stores, offices, restaurants, warehouses, and other nonmanufacturing activities, excluding residential and industrial wastes.

"Existing unit" means any solid waste disposal unit that is receiving solid waste, excluding residential and industrial wastes.

"Existing unit" means any solid waste disposal unit that is receiving solid waste and has not received a final layer of cover material.

"Facility" means all contiguous land and structures, other appurtenances, and improvements on the land used for the disposal of solid waste.

"Ground-water" means water below the land surface in a zone of saturation.

"Household waste" means any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including single and multiple residences, hotels and motels, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

"Industrial solid waste" means solid waste generated by manufacturing or industrial processes that is not a hazardous waste. Such waste may include, but is not limited to, waste resulting from the following manufacturing processes: Electric power generation; fertilizer/agricultural chemicals; food - and related products/by-products; inorganic chemicals; iron and steel manufacturing; leather and leather products; nonferrous metals manufacturing/ foundries; organic chemicals; plastics and resins manufacturing; pulp and paper industry; rubber and miscellaneous plastic products; stone; glass, clay, and concrete products; textile manufacturing; transportation equipment; and water treatment. This term does not include mining waste or oil and gas waste.

"Landfill" means an area of land or an excavation in which wastes are placed for permanente disposal, and that is not a land application unit, surface impoundment, injection well, or waste pile.

"Lateral expansion" means a horizontal expansion of the waste boundaries of an existing landfill unit.

"Leachate" means a liquid that has passed through or emerged from solid waste and contains soluble, suspended, or miscible materials removed from such waste.

"Municipal solid waste landfill" means any landfill or landfill unit that receives household waste. This landfill also may receive other types of wastes, such as commercial waste, nonhazardous sludge, and industrial solid waste. Such a landfill may be publicly or privately owned.

"New unit" means any solid waste disposal unit that has not previously received solid waste. A new unit also means lateral expansions as defined in this section.

"Open burning" means the combustion of solid waste without:

(1) Control of combustion air to maintain adequate temperature for efficie combustion.

(2) Containment of the combustion reaction in an enclosed device to provic sufficient residence time and mixing for complete combustion, and

(3) Control of the emission of the combustion products.

"Operator" means the person responsible for the overall operation of a facility or part of facility.

"Owner" means the person who owns a facility or part of a facility.

"Run-off" means any rainwater, leachate, or other liquid that drains over land from an part of a facility.

"Run-on" means any rainwater, leachate, or other liquid that drains over land onto any pa of a facility.

"Saturated zone" means that part of the earth's crust in which all voids are filled with wat

"Sludge" means any solid, semi-solid, or liquid waste generated from a municipa commercial, or industrial wastewater treatment plant, water supply treatment plant, or a pollution control facility exclusive of the treated effluent from a wastewater treatment plar

"Solid waste" means any garbage, refuse, sludge from a waste treatment plant, wate supply treatment plant, or air pollution control facility and other discarded materia including solid, liquid, semi-solid, or contained gaseous material resulting from industria commercial, and agricultural operations, and from community activities but does nc include solid or dissolved materials in domestic sewage, or solid or dissolved materials i irrigation return flows or industrial discharges.

"Solid waste disposal unit" means a discrete area of land used for the disposal of soli wastes.

"Waste management unit boundary" means a vertical surface located at the hydraulicall downgradient limit of the unit. This vertical surface extends down into the uppermos aquifer.

3. Consideration of other laws.

The owner or operator of a municipal solid waste landfill unit must comply with any othe applicable rules, laws regulations, or other requirements.

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B. Location Restrictions

1. Airways

A municipal solid waste landfill unit that may attract birds and is located within 10,000 feet (3.048 meters) of any airport runway used by turbojet aircraft or within 5,000 feet (1.524 meters) of any airport runway used by only piston-type aircraft shall not pose a bird hazard to aircraft.

2. Floodplains.

(a) A Municipal solid waste landfill unit located in the 100-year floodplain shall not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment.

(b) For purposes of this section:

(1) "Floodplain" means the lowland and relatively flat areas adjoining inland and coastal waters, including flood-prone areas of offshore islands, that are inundated by the 100-year flood.

(2) "100-year flood" means a flood that has a 1-percent or greater chance of recurring in any given year or a flood of a magnitude equalled or exceeded once in 100 years on the average over a significantly long period.

(3) "Washout" means the carrying away of solid waste by waters of the base flood.

3. Wetlands.

(a) Municipal solid waste landfill units shall not be located in wetlands, unless the owner or operator can make the following demostrations.

(1) There is no practicable alternative that would have less adverse impact on the wetlands and would have no other significant adverse environmental consequences;

(2) The landfill will not:

(i) Cause or contribute to violations of any applicable water quality standard.
(ii) Violate any applicable toxic effluent standard.
(iii) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat.

(3) The landfill will not cause or contribute to significant degradation of wetlands;

(4) Appropriate and practicable steps have been taken to minimize potential adverse impacts of the landfill on the wetlands; and

(5) Sufficient information is a available to make a reasonable determination with respect to these demostrations.

(b) As used in this section, "wetlands" means those areas that are inundated or satured by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevlence of vegetation typically adapted for life in saturated soil conditions. Wetlands include, but are not limited to, swamps, marshes, bogs, and similar areas.

4. Fault areas

(a) New units of a municipal solid waste landfill shall not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time.

(b) For the purposes of this section:

(1) "Fault" means a fracture along which strata on one side have been displaced with respect to that on the other side.

(2) "Displacement" means the relative movement of any two sides of a fault measured in any direction.

(3) "Holocene" means the most recent epoch of the Quarternary period, extending from the end of the Pleistocene to the present.

5. Seismic impact zones.

(a) At a new municipal solid waste landfill unit located in a "seismic impact zone," all containment structures, including liners, leachate collection systems, and surface water control systems, must be designed to resist the maximum horizontal acceleration in lithified material for the site.

(b) As used in paragraph (a) of this section, "seismic impact zone" means an area with a 10 percent or greater probability that the maximum horizontal acceleration in hard rock, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 250 years.

(c) As used in paragraph (a) of this section, the "maximum horizontal acceleration in lithified material" means the maximum expected horizontal acceleration depicted on a seismic hazard map, with a 90 percent or greater probability that the acceleration will not be exceeded in 250 years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment.

6. Unstable areas

(a) The owner or operator of a municipal solid waste landfill unit located in ar unstable area must demostrate to IFAM that engineering measures have beer incorporated into the unit's design to ensure the stability of the structura components of the unit. The owner or operator must consider the following factors, at a minimum, when determining whether an area is unstable:

(1) On-site or local soil conditions that may result in significant differentia settling;

(2) On-site or local geologic or geomorphologic features; and

(3) On-site or local human-made features or events (both surface anc subsurface).

(b) As used in this section, "structural components" means liners, leachat collection systems, final covers, run-on/run-off systems, and any othe component necessary for protection of human health and the environment

(c) Units of a municipal solid waste landfill located in unstable areas that cannc make the demonstration specified in paragraph (a) of this section must close.

C. Design Criteria

1. All municipal solid waste landfill units must be designed with liners, leachat collection systems, and final cover systems, as necessary, to ensure that the desig goal established under paragraph (2) of this section is met in the aquifer at the wast management unit boundary, or an alternative boundary, as specified by the IFAI under paragraph (4) of this section.

2. IFAM must establish a design goal for all MSWLF units. This design shall at minimum, achieve a ground-water carcinogenic risk level with an excess lifetim cancer risk level (due to continuous lifetime exposure) within the 1x10-4 to 1x10-7 range.

3. When establishing the design necessary to comply with paragraph (1) of this sectior IFAM shall consider at least the following factors:

(a) The hydrogeologic characteristics of the facility and surrounding land;

(b) The climatic factors of the area;

(c) The volume and physical characteristics of the leachate;

(d) Promixity of gound-water users; and

(e) Quality of ground water.

4. IFAM may establish an alternative boundary to be used in lieu of the waste management unit boundary. The alternative boundary shall not exceed 150 meters from the waste management unit boundary and shall be located on land owned by the owner or operator of the MSWLF. The establishment of the alternative boundary shall be based on analysis and consideration of at least the following factors:

   (a) The hydrogeologic characteristics of the facility and surrounding land;

   (b) The volume and physical and chemical characteristics of the leachate;

   (c) The quantity, quality, and direction of flow of ground water;

   (d) The proximity and withdrawal rate of the ground-water users;

   (e) The availability of alternative drinking water supplies;

   (f) The existing quality of the ground water, including other sources of contamination and their cumulative impacts on the ground water;

   (g) Public health, safety, and welfare effects; and

   (h) Practicable capability of the owner or operator.

   (i) All municipal solid waste landfill units must be equipped at closure with a final cover system that is designed to prevent infiltration of liquid through the cover and into the waste.

D. Operations and Maintenance

1. Fire Protection. An adequate stockpile of earth reasonably close to the active disposal area and sufficient on-site equipment for movement of that earth shall be provided at sites. Accidental fires shall be promptly extinguished. The potential for accidental fires shall be minimized by proper compaction and earth cover.

2. Unloading. Unloading of solid waste shall be confined to as small an area as practical. An attendant shall be on duty during operating hours at sites to direct unloading of solid waste. Where an attendant is not provided, appropriate signs must be used to indicate where vehicles are to unload. The use of forced access lanes, identified by ditches, dikes, fences, or other means, may be used in lieu of signs and may be required by IFAM for the prevention of indiscriminate dumping where signs and/or other methods have proven ineffective.

3. Access Control. Uncontrolled access and dumping of unauthorized materials shall be prevented. Waste unloading shall be closely monitored to assure that only allowable wastes are accepted. Any anauthorized wasted shall be removed from the site and taken to an approved disposal facility.

4. **Control of Windblown Material.** Windblown material shall be collected and returr to the active disposal area as necessary to minimize unhealthy, unsafe, or unsigt conditions. A portable fence or other suitable means shall be employed to cont windblown material resulting from unloading, spreading, and compaction operatic to the smallest area practical.

5. **Easement Protection.** All pipeline and utility easements shall be clearly mark with posts which extend at least six feet above ground level, spaced at intervals greater than 300 feet. No solid waste disposal shall occur within such easeme and associated required buffer zones and in no case shall solid waste disposal occ within 25 feet of the centerline of any utility line or pipe unless otherwise authoriz by IFAM. Where on-site access roads, drainageways, or levees cross su easements, the site operator is responsible for obtaining the concurrence of t easement owner.

6. **Boundary Buffer Zones.** Unless otherwise authorized by IFAM, a minimu separating distance of 50 feet shall be maintained between disposal operations a the boundary of the site to allow area for visual screening, surface drainage facilitie flood protection facilities, and a safety margin for methane gas and leacha migration. In no case shall this zone be narrower than that necessary to provide sa passage for firefighting or other emergency vehicles. IFAM encourages t establishment of a greenbelt along the property line. In all cases, the site boundari as defined in the permit shall be clearly marked. If the site boundaries are not fence posts which extend at least six feet above ground level shall be placed at each corn and along each boundary at intervals no greater than 300 feet. The site operator each existing permitted site shall submit a property description of the site and ma the boundaries in accordance with this section.

7. **Materials Along Route to Site.**

   (a) The site operator shall authorize only persons operating vehicles which comp with the following requirements to dispose of waste at the site.

      (1) All vehicles and equipment used for the collection and transportation municipal solid waste shall be constructed, operated, and maintained prevent loss of liquid or solid waste material and to minimize health ar safety hazards to solid waste management personel and the public.

      (2) Collection vehicles and equipment shall be maintained in a sanita condition to preclude odors and fly breeding.

      (3) Collection vehicles not constructed with an enclosed transport body sha use other devices such as nets or tarpaulins to preclude accident spillage.

(b) Where the site operator fails to enforce these requirements, he shall be responsible for prompt cleanup of all waste materials spilled along and within the rights-of-way of all public access roads serving the site.

8. **Screening of Deposited Waste.** Screening shall be provided to minimize the visibility of deposited waste materials where the department determines a need for such screening or where permit or design requirements so dictate.

9. **Disposal of Large Items.** Special provisions shall be made for the disposal of large, heavy, or bulky items which cannot be incorporated in the regular spreading, compaction, and covering operations.

10. **Burning.** Burning of solid waste is prohibited.

11. **Vector Control.** Conditions favorable to the production or harboring of vectors shall be minimized through proper compaction and covering procedures. Approved chemical controls shall be employed when necessary.

12. **Site Access Roads.**

    (a) All-weather roads shall be provided within the site to the unloading area(s) designated for wet-weather operation. The tracking of mud and trash onto public roadways from the site shall be minimized.

    (b) Dust from on-site and other access roadways shall be prevented from becoming a nuisance to surrounding areas. A water source and necessary equipment or other approved means of dust control shall be provided.

13. **Salvaging and Scavenging.** Salvaging shall not be allowed to interfere with prompt sanitary disposal of solid waste or to create public health nuisances. All salvaged materials shall be removed from the site at such intervals as necessary to prevent an excessive accumulation of the material at the site.

14. **Endangered Species Protection.** The facility and the operation of the facility shall not result in the destruction or adverse modifications of the critical habitat of endangered or threatened species, or cause or contribute to the taking of any endangered or threatened species.

15. **Gas Control.** Methane and other decomposition gases shall not be allowed to migrate laterally from the landfill site so as to endanger structures, vegetation, or occupants of adjacent properties. Any structures subsequently constructed on the landfill site should contain provisions for the venting of decomposition gases to preclude their accumulation in explosive or toxic concentrations beneath or within the structures. The concentration of methane generated by the solid waste site should not exceed 25% of its lower explosive limit in on-site structures (excluding gas control or recovery system components) and it shall not exceed its lower explosive limit at the property boundary. The lower explosive limit is the lowest percent by volume of a mixture of methane which will propagate a flame in air at above 25 grades C and atmospheric pressure.

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16. **Abandoned Water Wells.**

(a) The site operator shall immediately notify IFAM in writing of the location of any and all existing abandoned water wells situated within the site upon such discovery during the course of site development. The site operator shall, within 30 days of such a discovery, provide IFAM with written certification that all such wells have been capped, plugged, and closed.

17. **Compaction, Intermadiate Cover, and Final Cover.**

(a) Solid waste shall be spread and compacted evenly by repeated passages of suitable compaction equipment, such that each layer of solid waste is thoroughly compacted to a thickness of approximately two feet.

(b) Intermediate cover shall be six inches of well compacted earthen material not previously mixed with garbage, rubbish, or other solid waste to prevent the blowing of waste materials and to prevent insect and rodent problems.

(1) Intermediate cover shall be applied as follows:

(i) Where daily cover is required, all solid waste deposited each day shall be provided with intermediate cover by the end of the working day.

(c) The entire surface of each completed portion of the fill shall be provided with final cover within 30 days unless inclement weather would prevent the application of any cover material.

(1) The final cover shall consist of no less than two feet of soil.

(i) The first 1 1/2 feet or more of cover, see paragraph (2) of this subsection, shall be of clayey soil, compacted in layers of no more than six inches to help minimize the water infiltration potential. Other types of soil may be used with prior approval.

(ii) The final six inches of cover shall be of suitable topsoil which will sustain the growth of vegetation, and shall be seeded or sodded during the first growing season following application of final cover to help minimize erosion.

(2) Final cover grades shall not exceed 6.0%--six feet vertical (v) to 100 feet horizontal (h)--unless an erosion control plan has been developed by the owner/operator and approved by IFAM. Disposal of solid waste above natural ground level is prohibited unless pursuant to an engineering Site Development Plan approved by IFAM.

(3) Erosion of cover shall be repaired by restoring the cover material, grading, compacting, and seeding it as necessary. Such periodic inspections and restorations are required during the site operational life and for a minimum of five years after closure.

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(4) The on-site ponding of water upgradient of deposited waste shall be prevented, unless IFAM is assured that such ponding does not pose a potential leachate generation threat.

18. Odor and Air Pollution Control.

(a) Any ponded water at the site shall be controlled to avoid its becoming a source of obnoxious odors. In the event objectionable odors do occur, appropriate measures, such as chemical treatment, shall be taken to alleviate the condition.

E. Final Use of Site

The final use of the proposed landfill site is a planned regional recreation area. It is believed that in approximately 20 years the proposed landfill site will be surround by urban areas of some density.

1. Site Completion and Closure Procedures.

(a) At least one year prior to completion of disposal operations or abandonment of a site, the site operator shall notify IFAM and provide an updated closure schedule for the cessation of waste acceptance and completion of the closure of the site.

2. Post-Closure Maintenance. For at least the first five years after closure, the site operator shall maintain the right-of-entry and periodically inspect his closed site and correct as necessary any problems associated with erosion of cover material, vegetative growth, leachate or methane migration, and subsidence or ponding of water on the site. If any of these problems persist for longer than the first five years, the site operator shall be responsible for their correction until IFAM determines the problems have been adequately resolved.

3. Post -Closure Use of Landfilled Areas.

(a) Because of the potential hazard to public health, groundwater, and the environment if closed landfilled areas are disturbed, IFAM retains regulatory control over any activities which may affect the integrity of the landfill cover drainage, liners, or monitoring system. Activities such as relocating waste from a closed landfill, extracting materials for energy, or material and gas recovery shall not be undertaken unless prior approval is obtained from IFAM.

(b) Although IFAM approval is not necessary for post-closure uses of landfills IFAM believes the information found in paragraphs 1 - 8 of this subsection should be considered.

(1) Enclosed ground level and underground structures should be avoided due to the potential for explosive concentrations of methane gas.

(2) Examples of uses for landfills not requiring enclosures are agriculture lands, parks, playgrounds, golf courses, and open parking or storage areas.

(3) The ponding of water, excessive irrigation, or plowing to a depth below the topsoil should not be allowed unless there is assurance that percolation of moisture into the buried waste will not occur.

(4) Concentrated loadings should be avoided to prevent uneven settlement.

(5) If enclosed structures are built, means must be provided for natural ventilation to prevent the accumulation of the potentially explosive methane gas. An example would be structures which use an open first level for parking, etc., to allow natural ventilation.

(6) The effectiveness of landfill cover and the bottom liner of barrier must not be disturbed when structures are built, particularly when pilings are used.

(7) Consultation with IFAM may be desirable prior to initiating certain activities to determine the types of wastes deposited, depth of waste cells, previous maintenance problems, etc.

(8) Such things as underground utilities that cross one or both of the site boundaries should be avoided. If they cannot, a properly located and gravel-packed gas vent should be placed at each property boundary crossed to prevent methane gas migration along the pipeline, etc., to off-site structures.

F. Criteria for Evaluating Operations and Maintenance of Landfill.

1. Inspection of sites by regulating authorities

(a) Landfill site(s) should be inspected by IFAM personnel a minimum of every 15 days to ensure that operation/owner of landfill site is complying with all the design, operation and monitoring criteria.

2. Criteria Check List

The following criteria check list can be used in evaluating proper landfill operations and maintenance:

(a) Landfill Entrance

Informational and directional signs posted?
Appearance and cleanliness acceptable?
Entrance secured when site not operating?
Security guards when site not operating?

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(b) Personnel

Attendent present when site is in use?
Scale house properly manned?
Safety equipment available and in use?

(c) Disposal Area

Spotter directing traffic at working face?
Unloading area clearly marked?
Public and municipal/commercial operations separated?
Is working face as small as possible?
Litter fences in use?
Refuse burning?
Oder problems?
Dust or litter blowing
Daily cover applied?
Refuse compaction sufficient?
Final cover and vegetation in place?

(d) Salvage Practices

Scavanging prohibited?
Separate salvage area established?
Salvage area free of litter and vermin
Salvage materials promptly removed?

(e) Water Quality

Working and filled areas graded to prevent ponding?
Run off from adjoining areas diverted from site?
Adequate leachate collection system?
Leachate treatment performing as designed?

(f) Vector Controls

Any rodent problem?
Any bird problem?
Any insect problem?

(g) Monitoring Program

Gas and groundwater observation and sampling wells installed?
Gas and groundwater monitoring schedule established?
Monitoring data on file?

(h) Fire Protection?

No smoking rules in force?
Water available at working face?
Stockpile soil available?
Fire extinguishers on all equipment?
Radio or telephone on site?

(i) Housekeeping

Appearance and cleanliness acceptable?
Site pleasing to the eye?
Access roads and entrance litter free?
Site free of scattered litter?

(j) Documents

Permit or license on display?
Development plans available?
Operational plans available?
Operating cost records on file?
Daily records of incoming vehicles and volume and type of waste?

G. Environmental Monitoring Criteria

Reference Environmental Annex I

H. Criteria for Selection and Procurement of Landfill Equipment

1. Selecting the right machine for size of landfill

The most important step in constructing and operating an efficient, effective landfill is machine selection. Landfills must have nearly 100 percent machine availability. Refuse can't wait. It has to be spread, compacted and covered every day!

(a) The sanitary landfill will require appropriate and adequate machinary to:

Prepare site
Spread and compact trash
Excavate and transport cover
Spread and compact daily and final cover
Do utility and clean-up work

(1) Waste spreading and compaction machines dispose of the waste at the site. Track-types tractors and steel-wheeled compactors are the primary machines for such use.

(2) Cover excavating and transportation machines provide daily, intermediate and final cover and do earthmoving functions at the landfill. The landfill may assign cover work and earthmoving functions to a track-type tractor for short hauls of 0-300 feet or wheel tractor-scraper for long hauls of more than 300 feet.

(3) Site preparation, utility work and clean-up can be assigned to track-type tractors and wheel tractor-scrapers.

(b) Total population served and total daily tonnage of landfill governs choice of equipment.

(1) If an area of about 100,000 - 150,000 population generates about 200 tons daily, the landfill criteria should consider a track-type tractor, a steel-wheel compactor and a wheel tractor scraper of medium weight and horse power.

2. Support Machinary

(a) Support machinary such as light pick-up trucks, water spray truck/fire truck should be obtained as needed.

III. Preliminary Studies of Proposed Sites

The preliminary studies of the proposed sites consisted of the following activities.

A. Visits to all proposed sites and all participating municipalities.

1. Since all of the municipalities involved in this project had expressed great concern about the inefficiency of their solid waste collection systems and unsatisfactory methods of solid waste disposal, IFAM conducted a series of visits to each of the cities to explain the real concept of sanitary landfills and the scope of the proposed project.

2. Each municipality was provided with a series of handouts reflecting the minimum criteria as to what a sanitary landfill should encompass.

3. The municipalities were asked to submit at least five potential site locations which would then be visited and evaluated by IFAM engineers and technicians, using basic existing data reference to geology, hydrology, soil analysis and other pertinent criteria.

4. Two seminars were conducted by IFAM for mayor, city councils and city managers to discuss, question and develop a consensus on the proposed project.

5. Following the second seminar, six of the municipalities and the municipal league of Western Alajuela invited 2 members of IFAM and the ICMA consultant to USAID to make presentations at each city's council meeting on waste collection systems and waste disposal methods in the U.S.A. and Latin America.

6. Next, on site visits and primary evaluations of each of the proposed sites were conducted.

(a) The site proposed by Grecia had already been analysed and approved; however, there exists some controvery on that site so they have submitted another location which has not been visited.

(b) The site proposed by Valverde Vega appears adequate in size; however, it appears that the development of the access roads would be too costly. Also, the property is an excellent producting coffee finca which would make the purchase price very high.

(c) The site proposed by San Ramón, an abandoned gravel pit, appears adequate in size. But San Ramón is the farthest location of all the municipalities and this would incur high transportation costs.

(d) The site proposed by Naranjo is centrally located, appears to be of adequate size, and has good access roads.

B. Review of existing technical data on proposed sites

1. Hydrology

Existing well logs were obtained from Servicio Nacional de Aguas Subterraneas, Riego y Avenamiento (SENARA) for all the proposed site locations. These logs appear to have some good basic data as to the location of water wells, depth of wells, depth of static water levels, major aquifer locations, and some core samples of soil profiles. These documents need further study and analysis.

2. Geology

The well logs obtained from (SENARA) also appear to contain some basic data on the geology of the proposed sites. IFAM engineers, and technicians will visit other public agencies in the following weeks to obtain more information on this item.

3. Topography

A preliminary topographic survey has been conducted on the proposed site at San Ramón. All other sites will be surveyed in the next few weeks. In addition, aerial maps are going to be obtained from the Ministry of Transportation of all the proposed sites.

C. Prioritization of Sites

1. A prioritization matrix has been developed to evaluate each site. (See attached) This matrix will be filled in as each of the studies is complete for each site.

ATTACHMENT No. 3

Estimated Costs for Present System

Nov. 6, 1990

City of Guayaquil

* Estimated total population 1990 2,044,000

** Estimated waste generated per day/person .6 kilograms

Estimated total tons/day 1226

Estimated ton collected / day 490.4

Estimated cost/ton of waste collected

*** Estimated total direct costs (1990 City Budget) S/.4,986,164,564

**** Estimated total indirect costs (1990 City Budget) S/.1,932,000,000

Estimated total 1990 Budget for department S/.6,918,164,564

Estimated total waste collected for 1990 178,996 Tons

Estimated Cost per Ton of wasted collected:

$$S/.\ \frac{6,918,164,564}{178,996\ \text{Tons}} = S/.\ 38,650 = \$44.58/\text{Ton}$$

* Oct. 1990 study by Dr. Gomez
** Oct. 1990 report by Dr. Gomez
*** City of Guayaquil 1990 Budget
**** City of Guayaquil 1990 Budget. Ing. Díaz
***** Nov. 6, 1990, S/. 867 to $1 U.S.

ATTACHMENT No. 4

PLAN DE EMERGENCIA DE ASEO URBANO PARA LA CIUDAD DE GUAYAQUIL.

Este plan abarcará tres fases de una duración de 30 días que s describe a continuación:

FASE I.

Limpieza de basura acumulada en calles, vías, plazas y avenidas.

Se ha dividido a la unidad en dos zonas: zona A y zona B y cac zona a su vez ha sido subdividida en subzonas, tal como se indic en el plano adjunto y que a continuación se explica:

1. Zona A: Ha sido dividida en 10 subzonas.

2. Zona B: Ha sido dividida en 14 subzonas.

Se debe mencionar que las subzonas de la zona A son mayores qu las subzonas de la zona B, por considerarse que la zona A tien acumulada menor cantidad de desechos sólidos que la zona B.

Se recomienda que cada subzona esté servida por 3 volquetas de m3 de capacidad cada una y que laborarían durante 30 días. Cad volqueta contará con un chofer y una cuadrilla de 6 personas.

La limpieza de mercados, ferias y grandes acumulaciones d desechos sólidos seria realizada por otro equipo de volquetas co ayuda de cargadores.

FASE 2.

Esta fase se la realizaría al mismo tiempo que la fase 1 y está dirigida a recoger la basura producida diariamente con el equipo de recolectores existentes en el Departamento de Aseo de Calles.

Se ha dividido a la ciudad para esta operación, en dos zonas:

Zona A: Desde el eje central de la calle Portete hacia el Sur.

Zona B: Desde el eje central de la calle Portete hacia el Norte.

Cada zona tendría tres días de recolección por semana:

Zona A: Lunes, miércoles y viernes, desde las 7H00 hasta las 22H00.

Zona B: Martes, jueves y sábados, desde las 7H00 hasta las 22H00.

Cada recolector tendría un chofer y una cuadrilla de 4 hombres.

Fase 3:

Se recomienda realizar una campaña de difusión de los horarios de recolección y áreas de servicio a ser cubiertas, por medio de la radio, periódico y televisión, con el objeto de que la ciudadanía saque la basura a las calles en los días y horas de servicio.