Table 2.3.8 Population Forecasts (persons) for the Target Municipality/Village

Group No.		Municipality/Village	1997 Mun./Vil.	1997 Group	2000 Mun./Vil	2000 Group	2004 Mun./Vil.	2004 Group
1	1	Baka Al-Shrqeah	3,695		4,364		5,447	
	2		1,868	5,563	2,206	6,570	2,754	8,200
2	3	Der Al-Ghosoun	6,555		7,741		9,663	
	4	Al-Jarousheah	741	7,296	875	8,616	1,092	10,755
3	5	Sida	2,709		3,199		3,993	
	6	Ellar	5,123	7,832	6,050	9,249	7,552	11,545
4	7	Ateel	7,664		9,051		11,297	
	8	Zita	2,346	10,010	2,770	11,821	3,458	14,756
5	9	Kofur Zebaad	1,171		1,383		1,726	
	10	Kofur Jammal	1,906		2,251		2,810	
	11	Kofur Abbous	1,111	4,188	1,312	4,946	1,638	6,174
6	12	Shofeh	935		1,104		1,378	
	13	Faroun	2,404		2,839		3,544	
	14	Safareen	779	4,118	920	4,863	1,148	6,070
7	15	Roujeeb	2,915		3,442		4,297	
	16	Der Al-Hatab	1,687	4,602	1,992	5,435	2,487	6,784
8	17	Bait Dajan	2,682		3,167		3,954	
	18	Azmout	2,036		2,404		3,001	
	19	Salim	3,797	8,515	4,484	10,056	5,597	12,552
9	20	Yaseed	1,711		2,021		2,522	
	21	Bait Emmreen	2,151		2,540		3,171	
	22	Nusf Jbail	377		445		556	
	23	Sabastea	2,900	7,139	3,425	8,431	4,275	10,524
10	24	Borqa	3,008		3,552		4,434	
	25	Bezareah	1,608	4,616	1,899	5,451	2,370	6,804
11,12,13	26	Fasayel	650		768		958	
14,15	27	Al-Jiftlek	2,050		2,421		3,022	
	28	Marge Ghazal	278		328		410	
	29	Marge Najeh	583		688		859	
	30	Al-Zobaidat	964	4,525	1,138	5,344	1,421	6,670
16	31	Eain Al-Duke	1,286		1,519		1,896	
	32	Al-Ouja	2,893	4,179	3,416	4,935	4,265	6,160
17	33	Al-Obaydya	7,826	7,826	9,242	9,242	11,536	11,536
18	34	Dar Salah	2,560		3,023		3,774	
	35	Al-Shawawreh	3,400		4,015		5,012	
	36	Ras Al-Wad	620	6,580	732	7,771	914	9,700
19,22	37	Hosan	4,175		4,930		6,154	
	38	Batier	3,095		3,655		4,562	
	47,48	Al-Walajeh/Eain Al-Jowaiza	1,234	8,504	1,457	10,043	1,819	12,536
20	39	Al-Masara	579		684		853	
	40	Marah Rabah	833		984		1,228	
	41	Om Salmouneh	592		699		873	
	42	Jouret Al-Shamma	1,099		1,298		1,620	
	43	Waid Rahal	1,010		1,193		1,489	
	160	Wade Al-Neas	544		642		802	
	161	Marah Maalah	452		534		666	
	162	Khalet Al-Hadadh	308	5,417	364	6,397	454	7,985
21,22	44	Bait Tamer	1,400		1,653		2,064	
	45,46	Braidaah/Hindaza	2,250	3,650	2,657	4,310	3,317	5,380
23	49	Tekoa	6,600	6,600	7,794	7,794	9,729	9,729
24	50	Bait Fajar	7,995	7,995	9,442	9,442	11,785	11,785
25	51	Wadi Fokeen	881		1,040		1,299	
	52	Nahaleen	4,701	5,582	5,552	6,592	6,930	8,228
26	53	Kofur Laquef	682		805		1,005	
	54	Baquet Al-Hatab	1,242		1,467		1,831	
	55	Hajeh	1,796		2,121		2,647	
	56	Jeet	1,649		1,947		2,431	
	57	Emmateen	1,770		2,090		2,609	
	58	Farata	668	7,607	553	8,983	690	11,213
27	59	Kofur Thuluth	3,098	3,098	3,659	3,659	4,567	4,567
28,30	60	Jensafout	1,618		1,911		2,385	
	61	Al-Fondok	468		553		690	
	68	Kofur Qudoom	2,484	4,570	2,933	5,397	3,662	6,737
29,31	62	Ras Ateah	1,137		1,343		1,676	
	63	Ras Al-Tiereh	282		333		416	
	64	Al-Kheameh	300		354		442	
	65	Ezbet Jaloud	101		119		149	
	66	Al-Ashquer	297		351		438	
	67	Al-Mdawer	157		185		231	
	69	Habla	4,368	6,642	5,158	7,844	6,439	9,791
32	70	Ezbet Al-Tabeeb	150		177		221	
	71	Asaleh	631		745		930	
	72	Al-Nabee Eleas	1,059		1,251		1,561	
	73	Jayos	2,349		2,774		3,463	
	74	Falamea	501		592		739	
	75	Seer	382	5,072	451	5,990	563	7,477
33	76	Bait Lageah	5,648		6,670		8,326	
	77	Bait Sira	2,010	7,658	2,374	9,044	2,963	11,289
34	78	Naleen	3,358		3,966		4,950	
	79	Al-Media	926		1,094		1,365	

Group No.		Municipality/Village	1997 Mun./Vil.	1997 Group	2000 Mun./Vil.	2000 Group	2004 Mun./Vil.	2004 Group
34	80	Der Qudees	1,391	5,675	1,643	6,702	2,050	8,365
35	81	Qubeah	3,482		4,112		5,133	
	82	Bodrus	1,068		1,262		1,574	
	83	Shoqba	3,067	7,617	3,622	8,995	4,521	11,228
36	84	Banizaid Al-Gharbiah	4,355	4,355	5,143	5,143	6,420	6,420
37	85	Ranties	2,045		2,415		3,015	
	86	Alleban	1,133		1,338		1,670	
	87	Aboud	1,824	5,002	2,154	5,907	2,689	7,373
38	88	Bait Aour Al-Foka	710		838		1,047	
	89	Al-Tahta	3,065		3,620		4,518	
	90	Safa	2,856	6,631	3,373	7,831	4,210	9,775
39	91	Baleen	1,243		1,468		1,832	
	92	Der Bazeea	1,470		1,736		2,167	
	93	Kofur Neamah	2,740	5,453	3,236	6,440	4,039	8,038
40	94	Kober	2,628		3,103		3,874	
	95	Al-Mazraa Al-Kebleah	2,992		3,533		4,410	
	96	Abu Shkhaidem	1,286	6,906	1,519	8,156	1,896	10,180
41	97	Anata	7,066	7,066	8,344	8,344	10,416	10,416
42	98	Bait Doquo	1,266		1,495		1,866	
	99	Bait Ejza	479	1,745	566	2,061	706	2,572
43	100	Bait Souriek	2,836		3,349		4,181	
	101	Bait Eta	1,163		1,373		1,714	
	102	Al-Nabi Samweel	162	4,161	191	4,914	239	6,134
44	103	Beir Nabala	4,510	4,510	5,326	5,326	6,648	6,648
45	104	Al-Ram	25,164	25,164	29,717	29,717	37,094	37,094
46,47	105	Al-Sawahreh Al-Sharqeah	6,577		7,767		9,695	
	106	Al-Shaikh Saed	5,771		6,815		8,507	
	107	Al-Zuayem	1,840	14,188	2,173	16,755	2,712	20,914
48	108	Bait Anan	3,149		3,719		4,642	
	109	Al-Jeeb	3,439	6,588	4,061	7,780	5,069	9,711
49	110	Katanh	5,517		6,515		8,133	
	111	Al-Kpaba	1,526	7,043	1,802	8,317	2,249	10,382
50	112	Bani Noaim	13,563	13,563	16,017	16,017	19,993	19,993
51	113	Al-Samoua	12,921	12,921	15,259	15,259	19,047	19,047
52	114	Saeer	9,676		11,427		14,263	
	115	Al-Sheukh	5,127	14,803	6,055	17,481	7,558	21,821
53	116	Al-Dahreyah	20,560	20,560	24,280	24,280	30,307	30,307
54	117	Yatta	30,870	30,870	36,455	36,455	45,505	45,505
55	118	Doura	15,476	15,476	18,276	18,276	22,813	22,813
56	119	Ezzna	13,534	13,534	15,983	15,983	19,950	19,950
57	120	Tarkoumeah	10,568	10,568	12,480	12,480	15,578	15,578
58	121	Sureif	9,643	9,643	11,388	11,388	14,215	14,215
59	122	Bait Awla	6,832	6,832	8,068	8,068	10,071	10,071
60	123	Tammoun	8,273		9,770		12,195	
	124	Al-Farah	5,206	13,479	6,148	15,918	7,674	19,869
61,63	125	Bardala	1,154		1,363		1,701	
	126	Ean Al-Baida	789		932		1,163	
	128	Tayaseer	1,748	3,691	2,064	4,359	2,577	5,441
62	127	Aquaba	4,442	4,442	5,246	5,246	6,548	6,548
64	129	Toubas	11,756	11,756	13,883	13,883	17,329	17,329
65	130	Qurawet Bani Hassan	2,703		3,192		3,984	
	131	Al Zaweah	3,796	6,499	4,483	7,675	5,596	9,580
66	132	Der Balout	2,687		3,173		3,961	
	133	Kofur Al-Deek	3,745	6,432	4,423	7,596	5,520	9,481
67	134	Dier Estia	2,802		3,309		4,130	
	135	Kefel Hares	2,353	5,155	2,779	6,088	3,469	7,599
68,69	136	Jalboun	2,170		2,563		3,199	
	137	Der Ghazaleh	637		752		939	
	138	Arabbouneh	742	3,549	876	4,191	1,094	5,232
70,71	139	Serees	3,770		4,452		5,557	
	140	Al-Jdaydeh	4,680	8,450	5,527	9,979	6,899	12,456
72	141	Arrabeh	7,453	7,453	8,801	8,801	10,986	10,986
73	142	Yaabad	10,753	10,753	12,699	12,699	15,851	15,851
74	143	Kofur Raae	7,275		8,591		10,724	
	144	Fahmeh	1,678		1,982		2,474	
	145	Al-Rameh	836	9,789	987	11,560	1,232	14,430
75	146	Al-Moghayer	1,671		1,973		2,463	
	147	Jalkamous	1,590		1,878		2,344	
	148	Om Al-Tout	748		883		1,103	
	149	Al-Matalleh	217	4,226	256	4,991	320	6,230
76	150	Etenek	817		965		1,204	
	151	Aneen	2,775		3,277		4,091	
	152	Zbouba	1,585	5,177	1,872	6,114	2,336	7,631
77	153	Jabaa	6,494	6,494	7,669	7,669	9,573	9,573
78	154	Al-Jalameh	1,719		2,030		2,534	
	155	Araneh	1,691		1,891		2,360	
	156	Al-Dahea	3,950	7,270	4,665	8,585	5,823	10,717
79	157	Anzeh	1,497		1,768		2,207	
	158	Ajjeh	3,838		4,532		5,658	
	159	Al-Zaweah	524	5,859	619	6,919	772	8,637
		Total	540,732	540,732	638,568	638,568	797,089	797,089

(3) Design Waste Volume

1) Unit Generation Rate and Bulk Density

Results of the field survey on unit generation rate for solid waste in Yatta (municipality/village no. 117) and Bait Fajar (municipality/village no. 50) are indicated in Table 2.3.9 (see Appendix for detailed data). Yatta is a medium sized city of 30,000, while Bait Fajar is a small city with population less than several thousand.

Table 2.3.9 ***Results of Unit Generation Rate Survey***

	Yatta city	Bait Fajar city	Average
Unit generation rate (kg/capita/day)	0.74	0.43	0.58
Bulk density (ton/ m^3)	0.34	0.24	0.29

Naturally, the unit generation rate will vary depending on factors of community size, population, level of economic activity, etc. Survey results for Ramallah, one of the major cities in the West Bank, indicate a unit generation rate of 0.85 kg/capita/day which substantiates the appropriateness of the above survey findings.

With consideration to the range of municipality/village size, population, level of economic activity, etc. for the Project area, the average value (0.58 kg/capita/day) for the computational results in the case of Yatta and Bait Fajar is the unit generation rate generally applied under the Project for collection equipment design. In the case of relatively large municipalities/villages (medium sized cities with populations over 15,000 as of 1997) as well as those which exhibit significant commercial activity, the computed value (0.74 kg/capita/day) for Yatta is applied. These municipalities/ villages are as indicated in Table 2.3.10.

Table 2.3.10 ***Municipalities/villages Subject to Application of a Unit Generation Rate of 0.74kg/capita/day***

Group no. ~ municipality /village no.	Municipality/village name	1997 population	Justification
1-1	Baka Al-Shreqeah	3,695	Robust commercial activity
1-2	Nazlet Essa	1,868	Robust commercial activity
9-23	Sabastea	2,900	Tourist area
44-103	Beir Nabala	4,510	Robust commercial activity
45-104	Al-Ram	25,164	Large population; robust commercial activity
53-116	Al-Dahreyah	20,560	Large population
54-117	Yatta	30,870	Large population
55-118	Doura	15,476	Large population; robust commercial activity
64-129	Toubas	1,756	Area hub; robust commercial activity
78-154	Al-Jalameh	1,719	Robust commercial activity

On the other hand, the disposal sites under the Project are regional sites servicing population centers ranging from large municipalities/villages to those of small size with populations of only several hundred. Given the facts that the unit generation rate for the Ramallah city area (a large municipality/village) is 0.85 kg/capita/day, that the results of team survey for Yatta (using for medium-size municipality/village and for those with significant commercial activity) indicates a unit generation rate of 0.74 kg/person/day. and that for other small municipalities/villages rate is applied 0.58 kg/person/day for estimation of solid waste amount, therefore, the average value of 0.7 kg/capita/day is applied in calculating the waste volume at the regional disposal sites.

Based on the above, unit generation rates adopted for the Project are as indicated in Table 2.3.11.

Table 2.3.11 Unit Generation Rates for Solid Waste Applied under the Project

	Unit generation rate (kg/capita/day)	Remarks
Collection equipment design - 1	0.58	Applied to target municipalities/villages except for the 10 indicated in Table 2.3.10
Collection equipment design - 2	0.74	Applied to the 10 municipalities/villages indicated in Table 2.3.10
Disposal equipment design	0.70	Applied to calculation of waste amount received at the target disposal sites

With regard to bulk density, the average value of Yatta and Bait Fajar, 0.29 tons/ m^3 will be applied to equipment design under the Project.

2) Waste Volume Forecast

Generated waste volume in 2004 for the Project area is estimated at 490 tons/day as shown in Table 2.3.12, based on the previously discussed population forecast and the above unit generation rates. Computation results for waste volume at the target regional disposal sites are shown in Table 2.3.13.

Table 2.3.13 Waste Amount to be received at Target Disposal Sites in 2004

Disposal site	Design target population (service population) (persons)	Unit generation rate (kg/capita/day)	Waste amount (tons/day)
Jenin	277,563	0.7	194.3
Toubas	49,086	0.7	34.4
Tulkarem	57,500	0.7	40.3
Jericho	43,750	0.7	30.6
Ramallah	365,145	0.7	255.6
Total	793,044	--	555.2

Tabel 2.3.12 Design Waste Volume of Target Municipality/Village in 2004

Group No.	Municipality/Village	2004 Population	Applied Unit Generation rate	Waste amount 2004 Mun./Vil. ton/day	Waste amount 2004 Group ton/day
1	1 Baka Al-Shrqeah	5,447	0.74	4.03	
	2 Nazlet Essa	2,754	0.74	2.04	6.07
2	3 Der Al-Ghosoun	9,663	0.58	5.60	
	4 Al-Jarousheah	1,092	0.58	0.63	6.24
3	5 Sida	3,993	0.58	2.32	
	6 Ellar	7,552	0.58	4.38	6.70
4	7 Ateel	11,297	0.58	6.55	
	8 Zita	3,458	0.58	2.01	8.56
5	9 Kofur Zebaad	1,726	0.58	1.00	
	10 Kofur Jammal	2,810	0.58	1.63	
	11 Kofur Abbous	1,638	0.58	0.95	3.58
6	12 Shofeh	1,378	0.58	0.80	
	13 Faroun	3,544	0.58	2.06	
	14 Safareen	1,148	0.58	0.67	3.52
7	15 Roujeeb	4,297	0.58	2.49	
	16 Der Al-Hatab	2,487	0.58	1.44	3.93
8	17 Bait Dajan	3,954	0.58	2.29	
	18 Azmout	3,001	0.58	1.74	
	19 Salim	5,597	0.58	3.25	7.28
9	20 Yaseed	2,522	0.58	1.46	
	21 Bait Emmreen	3,171	0.58	1.84	
	22 Nusf Jbail	556	0.58	0.32	
	23 Sabastea	4,275	0.74	3.16	6.79
10	24 Borqa	4,434	0.58	2.57	
	25 Bezareah	2,370	0.58	1.37	3.95
11,12,13	26 Fasayel	958	0.58	0.56	
14,15	27 Al-Jiftlek	3,022	0.58	1.75	
	28 Marge Ghazal	410	0.58	0.24	
	29 Marge Najeh	859	0.58	0.50	
	30 Al-Zobaidat	1,421	0.58	0.82	3.87
16	31 Eain Al-Duke	1,896	0.58	1.10	
	32 Al-Ouja	4,265	0.58	2.47	3.57
17	33 Al-Obaydya	11,536	0.58	6.69	6.69
18	34 Dar Salah	3,774	0.58	2.19	
	35 Al-Shawawreh	5,012	0.58	2.91	
	36 Ras Al-Wad	914	0.58	0.53	5.63
19,22	37 Hosan	6,154	0.58	3.57	
	38 Batier	4,562	0.58	2.65	
	47,48 Al-Walajeh/Eain Al-Jowaiza	1,819	0.58	1.06	7.27
20	39 Al-Masara	853	0.58	0.50	
	40 Marah Rabah	1,228	0.58	0.71	
	41 Om Salmouneh	873	0.58	0.51	
	42 Jouret Al-Shamma	1,620	0.58	0.94	
	43 Waid Rahal	1,489	0.58	0.86	
	160 Wade Al-Neas	802	0.58	0.47	
	161 Marah Maalah	666	0.58	0.39	
	162 Khalet Al-Hadadh	454	0.58	0.26	4.63
21,22	44 Bait Tamer	2,064	0.58	1.20	
	45,46 Braidaah/Hindaza	3,317	0.58	1.92	3.12
23	49 Tekoa	9,729	0.58	5.64	5.64
24	50 Bait Fajar	11,785	0.58	6.84	6.84
25	51 Wadi Fokeen	1,299	0.58	0.75	
	52 Nahaleen	6,930	0.58	4.02	4.77
26	53 Kofur Laquef	1,005	0.58	0.58	
	54 Baquot Al-Hatab	1,831	0.58	1.06	
	55 Hajeh	2,647	0.58	1.54	
	56 Jeet	2,431	0.58	1.41	
	57 Emmsteen	2,609	0.58	1.51	
	58 Farata	690	0.58	0.40	6.50
27	59 Kofur Thuluth	4,567	0.58	2.65	2.65
28,30	60 Jensafout	2,385	0.58	1.38	
	61 Al-Fondok	690	0.58	0.40	
	68 Kofur Qudoom	3,662	0.58	2.12	3.91
29,31	62 Ras Ateah	1,676	0.58	0.97	
	63 Ras Al-Tiereh	416	0.58	0.24	
	64 Al-Khearneh	442	0.58	0.26	
	65 Ezbet Jaloud	149	0.58	0.09	
	66 Al-Ashquer	438	0.58	0.25	
	67 Al-Mdawer	231	0.58	0.13	
	69 Habla	6,439	0.58	3.73	5.68
32	70 Ezbet Al-Tabeeb	221	0.58	0.13	
	71 Asaleh	930	0.58	0.54	
	72 Al-Nabee Eleas	1,561	0.58	0.91	
	73 Jayos	3,463	0.58	2.01	
	74 Falamea	739	0.58	0.43	
	75 Seer	563	0.58	0.33	4.34
33	76 Bait Laqeah	8,326	0.58	4.83	
	77 Bait Sira	2,963	0.58	1.72	6.55
34	78 Naleen	4,950	0.58	2.87	
	79 Al-Media	1,365	0.58	0.79	
34	80 Der Qudees	2,050	0.58	1.19	4.85
35	81 Qubeah	5,133	0.58	2.98	
	82 Bodrus	1,574	0.58	0.91	
	83 Shoqba	4,521	0.58	2.62	6.51
36	84 Banizaid Al-Gharbiah	6,420	0.58	3.72	3.72
37	85 Ranties	3,015	0.58	1.75	
	86 Alleban	1,670	0.58	0.97	
	87 Aboud	2,689	0.58	1.56	4.28
38	88 Bait Aour Al-Foka	1,047	0.58	0.61	
	89 Al-Talsta	4,518	0.58	2.62	
	90 Safa	4,210	0.58	2.44	5.67
39	91 Baleen	1,832	0.58	1.06	
	92 Der Bazeea	2,167	0.58	1.26	
	93 Kofur Neamah	4,039	0.58	2.34	4.66
40	94 Kober	3,874	0.58	2.25	
	95 Al-Mazraa Al-Kebleah	4,410	0.58	2.56	
	96 Abu Shkhaidem	1,896	0.58	1.10	5.90
41	97 Anata	10,416	0.58	6.04	6.04
42	98 Bait Doquo	1,866	0.58	1.08	
	99 Bait Ejza	706	0.58	0.41	1.49
43	100 Bait Souriek	4,181	0.58	2.42	
	101 Bait Ixa	1,714	0.58	0.99	
	102 Al-Nabi Samweel	239	0.58	0.14	3.56
44	103 Beir Nabala	6,648	0.74	4.92	4.92
45	104 Al-Ram	37,094	0.74	27.45	27.45
46,47	105 Al-Sawahreh Al-Shargeah	9,695	0.58	5.62	
	106 Al-Shaikh Saed	8,507	0.58	4.93	
	107 Al-Zuyern	2,712	0.58	1.57	12.13
48	108 Bait Anan	4,642	0.58	2.69	
	109 Al-Jeeb	5,069	0.58	2.94	5.63
49	110 Ketanh	8,133	0.58	4.72	
	111 Al-Kpaba	2,249	0.58	1.30	6.02
50	112 Bani Noaim	19,993	0.58	11.60	11.60
51	113 Al-Samoua	19,047	0.58	11.05	11.05
52	114 Saeer	14,263	0.58	8.27	
	115 Al-Sheukh	7,558	0.58	4.38	12.66
53	116 Al-Dahreyah	30,307	0.74	22.43	22.43
54	117 Yatta	45,505	0.74	33.67	33.67
55	118 Doura	22,813	0.74	16.88	16.88
56	119 Ezmna	19,950	0.58	11.57	11.57
57	120 Tarkoumeah	15,578	0.58	9.04	9.04
58	121 Sureif	14,215	0.58	8.24	8.24
59	122 Bait Awla	10,071	0.58	5.84	5.84
60	123 Tammoun	12,195	0.58	7.07	
	124 Al-Farah	7,674	0.58	4.45	11.52
61,63	125 Bardala	1,701	0.58	0.99	
	126 Ean Al-Baida	1,163	0.58	0.67	
	128 Tayaseer	2,577	0.58	1.49	3.16
62	127 Aquaba	6,548	0.58	3.80	3.80
64	129 Toubas	17,329	0.74	12.82	12.82
65	130 Qurawet Bani Hassan	3,984	0.58	2.31	
	131 Al Zaweah	5,596	0.58	3.25	5.56
66	132 Der Balout	3,961	0.58	2.30	
	133 Kofur Al-Deek	5,520	0.58	3.20	5.50
67	134 Dier Estia	4,130	0.58	2.40	
	135 Kefel Hares	3,469	0.58	2.01	4.41
68,69	136 Jalboun	3,199	0.58	1.86	
	137 Der Ghazaleh	939	0.58	0.54	
	138 Arabbouneh	1,094	0.58	0.63	3.03
70,71	139 Serees	5,557	0.58	3.22	
	140 Al-Jdaydeh	6,899	0.58	4.00	7.22
72	141 Arrabeh	10,986	0.58	6.37	6.37
73	142 Yaabad	15,851	0.58	9.19	9.19
74	143 Kofur Raae	10,724	0.58	6.22	
	144 Fahmeh	2,474	0.58	1.43	
	145 Al-Rameh	1,232	0.58	0.71	8.37
75	146 Al-Moghaver	2,463	0.58	1.43	
	147 Jalkamous	2,344	0.58	1.36	
	148 Om Al-Tout	1,103	0.58	0.64	
	149 Al-Matalleh	320	0.58	0.19	3.61
76	150 Etenek	1,204	0.58	0.70	
	151 Aneen	4,091	0.58	2.37	
	152 Zbouba	2,336	0.58	1.36	4.43
77	153 Jabaa	9,573	0.58	5.55	5.55
78	154 Al-Jalameh	2,534	0.74	1.88	
	155 Aranch	2,360	0.58	1.37	
	156 Al-Dahea	5,823	0.58	3.38	6.62
79	157 Anzeh	2,207	0.58	1.28	
	158 Ajjeh	5,658	0.58	3.28	
	159 Al-Zaweah	772	0.58	0.45	5.01
	Total	797,089		490.26	490.26

Unit generation rate : kg/capita/day

2-3-2-2 Collection Equipment Plan

(1) Design Waste Volume

As discussed earlier, 160 municipalities/villages are targeted under the Project, comprising 68 groups. The waste collection equipment plan encompasses the necessary equipment required to respond to the waste volume on a group-wise basis. Generated waste volume in the Project target year of 2004 is indicated in Table 2.3.12; and as discussed in the section on design approach, the design waste volume is the same as the generated waste. The total waste volume of municipalities/villages targeted in the Project is 490.3 tons per day.

(2) Concept for Existing Equipment

At present, the commonly utilized tractors have low transport capability, resulting in the open dumping of waste at sites on the periphery of the target municipalities/villages. It is thus necessary that these be replaced with vehicles capable of negotiating the medium to long distances to the regional disposal sites. Also, the 5 m^3 container system used in a portion of the cities in the area is effective where generated waste volume is large; however, there are few places where this system would be appropriate for each target municipalities/villages. Furthermore, this equipment is old. Given these factors, a shift will be made under the Project to the compactor truck - container system being pursued by the PA as a standard for the area. Among the existing compactor trucks on hand, it will be necessary to replace those which have been in use beyond the normal vehicle utility life of 8 years. Accordingly, only existing vehicles fabricated after 1992 will be considered as effectively usable under the Project. Also, only existing containers which are 1360 mm width and comparable to the standard used by the PA will be subject to incorporation into the Project.

Table 2.3.14 indicates existing equipment to be utilized under the Project.

Table 2.3.14 Existing Equipment to be Utilized under the Project

Equipment	Group no.	Municipality/village	Nos. on hand	Remarks
I. Compactor trucks:				
	45	104 Al-Ram	1	12 m^3, 1995
II. Containers:				
	23	49 Tekoa	80	1.1 m^3
	42	98 Bait Doquo	19	1.1 m^3
	44	103 Bier Nabala	60	1.1 m^3
	45	104 Al-Ram	75	1.1 m^3
	48	109 Al-Jeeb	45	1.1 m^3
	55	118 Doura	100	1.1 m^3
	64	129 Toubas	40	1.1 m^3

(3) Vehicle Types Studied

The PA is pursuing the establishment of a waste collection system adopting the 12 m^3 compactor truck in tandem with the 1.1 m^3 container as the standard system. However, in consideration of the fact the many of the target municipalities/villages have small populations which can be effectively serviced by a single collection vehicle, and that roads are sometimes narrow to the point where waste collection by a small vehicle would be more appropriate, the three types of compactor truck indicated in Table 2.3.15 were subject to study. The small type dump truck was eliminated from consideration since its transport and waste loading efficiencies are less than that of the small compactor truck, as well as the fact that the PA side strongly desires the compactor truck.

Table 2.3.15 Appropriateness of Studied Vehicle Types

Vehicle type studied	Advantages	Disadvantages
Large compactor truck 12 m^3 (used with 1.1 m^3 container)	Transport efficiency is high. Loading from 1.1 m^3 container is possible.	Roads in the Project area are often narrow, placing a constraint on use.
Medium compactor truck 8 m^3 (used with 1.1 m^3 container)	Appropriate to waste collection conditions in the Project area. Loading from 1.1 m^3 container is possible.	Although transport efficiency is superior to the small compactor truck, it is inferior in terms of suitability throughout the entire area.
Small compactor truck 5 m^3 (used with 0.6 m^3 container)	Most suitable to waste collection conditions throughout the Project area.	Low transport efficiency in the case of long distances. Only loading from 0.6 m^3 container possible.

Currently, many municipalities/villages use tractors for waste collection, capable of operating on narrow roads. In order to provide service on a par with the present, it is better that collection be performed by small vehicles. Use of large vehicles would preclude the ability to cover all roads presently serviced by tractors. However, the fact that appropriateness of equipment to the collection area is not the sole criterion must also be considered. Also it is noted that many of the municipalities/villages will require hauling of collected waste for long distances over rugged terrain. Since the target municipalities/villages are small, in many cases roads in these areas are narrow, and many municipalities/villages need distant transportation the approach under the Project will be to establish a waste collection system utilizing medium and/or small collection vehicles. Because the use of large vehicles in municipalities/villages of a size warranting waste collection by only a single vehicle would limit the roads along which waste collection could be performed, adoption of the large type vehicle will be reserved specifically for those cases were long distance hauling is required.

(4) Calculation of Collection Capacity

a) Load Volume per Single Trip

As discussed earlier, the unit volume weight of collected waste is 0.29 tons/ m^3. Unit volume weight after compaction by the compactor truck is determined at 0.6 tons/ m^3 (compaction rate 1:2), with loading rate set at 90%. Vehicle transport volume per single trip is as follows:

Large (12 m^3) compactor truck:	12 m^3 × 0.6 × 0.9 = 6.5 tons/trip
Medium (8 m^3) compactor truck:	8 m^3 × 0.6 × 0.9 = 4.3 tons/trip
Small (5 m^3)compactor truck:	5 m^3 × 0.6 × 0.9 = 2.7 tons/trip

b) Container Capacity

Assuming appropriate container placement and loading rate to be set at 80% taking into consideration generated waste volume fluctuation by day and season, container capacity is determined as follows:

1.1 m^3 container (net: 0.9 m^3):	0.9 m^3 × 0.29 tons/ m^3 × 0.8 = 0.21 tons/unit
0.6 m^3 container (net: 0.5 m^3):	0.5 m^3 × 0.29 tons/ m^3 × 0.8 = 0.12 tons/unit

Proper distribution of containers considering waste amount to be generated is important to use container efficiently.

c) Cycle Time per Trip

The cycle time per single collection vehicle is calculated as follows. Respective times are determined on the basis of time and motion study results.

Cm = loading time (L) + moving time (M) + travel time (T_1) + unloading time (U) + travel time (T_2)

Where:

Cm	:	cycle time per trip
L + M	:	loading time and moving time (3 min. / container unit)
T_1, T_2	:	travel time (V = 30 km/hour)
U	:	unloading time (U = 10 min)

The 12 m^3 compactor must load 30~35 numbers of 1.1 m^3 container in a single trip. In the case of the 8 m^3 compactor, the required number of 1.1 m^3 container to be loaded in a single trip is 20~25. The 5 m^3 compactor will load around 25 numbers of 0.6 m^3 container in a single trip. Accordingly, loading and moving times are as follows:

12 m^3 compactor truck:	105 min.
8 m^3 compactor truck:	75 min.
5 m^3 compactor truck:	75 min.

Hauling distance measured off maps from each municipality/village group to the regional disposal site, and calculation of cycle time per trip using the above formula are given in Table 2.3.16.

d) Vehicle Collection Capacity

Applying the cycle times calculated in the previous section, possible number of trips and collection/transport capacity per day for each type of vehicle are computed as follows.

Also as discussed earlier, operational rate with respect to total days in a year is 79%. Actual work time per day is 7 hours.

Possible trips per day:	7 hours × 60 minutes/Cm
Collection capacity per day:	load volume per trip × no. of possible trips per day × operational rate (79%)

Based on the above conditions, standard collection capacity per vehicle is as indicated in Table 2.3.17.

Table 2.3.16 Cycle Time per Trip

Group No.	Municipality/Village	(km) Distance	T1(min) Travel time	T2(min) Travel time (2)	U(min) Unloading time (3)	Cycle time per trip (min) 11m³Truck (L+M=105)	8m³Truck (L+M=75)	5m³Truck (L+M=75)
1	1 Baka Al-Sharqeh							
	2 Nazlet Eisa	28	56	56	10	227	197	197
2	3 Dar Al Ghsoun							
	4 Al-Jarushiyah	18	36	36	10	187	157	157
3	5 Sida							
	6 Illar	29	58	58	10	231	201	201
4	7 Atteel							
	8 Zeita	23	46	46	10	207	177	177
5	9 Kofur Zebad							
	10 Kofur Jammal							
	11 Kofur Abboush	13	26	26	10	167	137	137
6	12 Shofeh							
	13 Fareon							
	14 Safareen	8	16	16	10	147	117	117
7	15 Roujeeb							
	16 Dar Al-Hateb	6	12	12	10	139	109	109
8	17 Beit Dajan							
	18 Azmout							
	19 Salem	7	14	14	10	143	113	113
9	20 Yaseed							
	21 Beit Emreen							
	22 Nesf Jbail							
	23 Sabastea	19	38	38	10	191	161	161
10	24 Borqa							
	25 Bezzariah	30	60	60	10	235	205	205
11,12,13	26 Fasayel							
14,15	27 Al-Fill'ek							
	28 Marge Gharb							
	29 Marge Najeh							
	30 Al-Zobaidat	47	94	94	10	303	273	273
16	31 Eain Al-Duba							
	32 Al-Oja	22	44	44	10	203	173	173
17	33 Al-Obaydya	10	20	20	10	155	125	125
18	34 Dar Salah							
	35 Al-Shawawreh							
	36 Ras Al-Wad	16	32	32	10	179	149	149
19,22	37 Hosan							
	38 Battir							
	47,48 Al-Walajeh/Eain Al-Jowaiza	26	52	52	10	219	189	189
20	39 Al-Masara							
	40 Marah Rabah							
	41 Om Salmouneh							
	42 Jourat Al-Shamma							
	43 Wad Rahal							
	160 Wade Al-Nessa							
	161 Marah Maalah							
	162 Khalet Al-Hadadh	30	60	60	10	235	205	205
21,23	44 Beit Tamer							
	45,46 Braidheh/Hindaza	18	36	36	10	187	157	157
23	49 Tekoa	24	48	48	10	211	181	181
24	50 Beit Fajja	35	70	70	10	255	225	225
25	51 Wadi Fokeen							
	52 Nahaleen	31	62	62	10	239	209	209
26	53 Kofur Laquef							
	54 Baqaet Al-Hatab							
	55 Hajah							
	56 Jeet							
	57 Emmateen							
	58 Furata	16	32	32	10	179	149	149
27	59 Kofur Thulath	8	16	16	10	147	117	117
28,30	60 Jenasfout							
	61 Al-Fondok							
	68 Kofur Qaddoum	17	34	34	10	183	153	153
29,31	62 Ras Atiyeh							
	63 Ras Al-Tireh							
	64 Al-Khereneh							
	65 Ezbet Jaloud							
	66 Al-Ashqar							
	67 Al-Mdawer							
	69 Habla	14	28	28	10	171	141	141
32	70 Ezbet Al-Tabeeb							
	71 Azzoun							
	72 Al-Nabee Elias							
	73 Jayous							
	74 Falamea							
	75 Seer	10	20	20	10	155	125	125
33	76 Beit Laqeah							
	77 Beit Sira	29	58	58	10	231	201	201
34	78 Naleen							
	79 Al-Media							

Group No.	Municipality/Village	(km) Distance	T1(min) Travel time (1)	T2(min) Travel time (2)	U(min) Unloading time	Cycle time per trip (min) 11m³Truck (L+M=105)	8m³Truck (L+M=75)	5m³Truck (L+M=75)
34	80 Dar Qudees	24	48	48	10	211	181	181
35	81 Qebiah							
	82 Budrus							
	83 Shoqba	30	60	60	10	235	205	205
36	84 Bouirej Al-Ghabiah	29	58	58	10	231	201	201
37	85 Rantes							
	86 Abdeen							
	87 Aboud	36	72	72	10	259	229	229
38	88 Beit Amer Al-Folka							
	89 Al-Tahta							
	90 Safa	25	50	50	10	215	185	185
39	91 Beleen							
	92 Dar Bazeea							
	93 Kofur Neameh	22	44	44	10	203	173	173
40	94 Kober							
	95 Al-Mazraa Al Kebliah							
	96 Abu Shkheidem	14	28	28	10	171	141	141
41	97 Anata	19	38	38	10	191	161	161
42	98 Beit Doqqo							
	99 Beit Ejza	36	72	72	10	259	229	229
43	100 Beit Sourick							
	101 Beit Exa							
	102 Al-Nabi Samwel	35	70	70	10	255	225	225
44	103 Beit Nabala	28	56	56	10	227	197	197
45	104 Al-Ram	28	56	56	10	227	197	197
46,47	105 Al-Sawahreh Al-Sharqeah							
	106 Al-Shaikh Saed							
	107 Al-Zaayem	7	14	14	10	143	113	113
48	108 Beit Anan							
	109 Al-Yeeb	38	76	76	10	267	237	237
49	110 Katanh							
	111 Al-Kobeba	36	72	72	10	259	229	229
50	112 Beni Naim	11	22	22	10	159	129	129
51	113 Al-Samoua	18	36	36	10	187	157	157
52	114 Seer							
	115 Al-Sheukh	17	34	34	10	183	153	153
53	116 Al-Dahreyeh	28	56	56	10	227	197	197
54	117 Yatta	10	20	20	10	155	125	125
55	118 Doura	18	36	36	10	187	157	157
56	119 Ezmoa	34	68	68	10	251	221	221
57	120 Tarkoumeah	30	60	60	10	235	205	205
58	121 Sureif	34	68	68	10	251	221	221
59	122 Beit Awla	29	58	58	10	231	201	201
60	123 Tammoun							
	124 Al-Farah	8	16	16	10	147	117	117
61,63	125 Bardala							
	126 Ean Al-Baida							
	128 Tayaseer	24	48	48	10	211	181	181
62	127 Aqaaba	14	28	28	10	171	141	141
64	129 Toubas	5	10	10	10	135	105	105
65	130 Qarawet Bani Hassan							
	131 Al Zaweah	24	48	48	10	211	181	181
66	132 Dar Balout							
	133 Kofur Al-Deek	24	48	48	10	211	181	181
67	134 Dier Estia							
	135 Kefel Hares	12	24	24	10	163	133	133
68,69	136 Jalkoun							
	137 Dar Ghazaleh							
	138 Arabboneh	17	34	34	10	183	153	153
70,71	139 Sanoor							
	140 Al-Jdaydeh	18	36	36	10	187	157	157
72	141 Arrabeh	14	28	28	10	171	141	141
73	142 Yaabad	22	44	44	10	203	173	173
74	143 Kofur Raee							
	144 Fahmeh							
	145 Al-Rameh	23	46	46	10	207	177	177
75	146 Al-Mogharyer							
	147 Jalkamous							
	148 Om Al-Touf							
	149 Al-Mateleh	18	36	36	10	187	157	157
76	150 Ebaneh							
	151 Aoran							
	152 Zbouba	22	44	44	10	203	173	173
77	153 Jaba	22	44	44	10	203	173	173
78	154 Al-Jalameh							
	155 Araneh							
	156 Al-Dahra	11	22	22	10	159	129	129
79	157 Anzah							
	158 Ajeh							
	159 Al-Zaweah	20	40	40	10	195	165	165

Table 2.3.17 Collection Vehicle Capacity per Day

Group No.		Municipality/Village	Cycle time (min)			No of trips per day			Collection vehicle capacity			Ton/Day
			12m³Truck (L=M-10)	8m³Truck (L=M-7)	5m³Truck (L=M-5)	12m³Truck	8m³Truck	5m³Truck	12m³Truck (t/day)	8m³Truck (t/day)	5m³Truck (t/day)	Design waste amount
1	1	Ein Al-Sheqeh										
	2	Nahel Esra	227	197	197	1.9	2.1	2.1	9.5	7.5	4.5	6.02
2	3	Dar Al-Ghesoun										
	4	Al-Jaroushah	187	157	157	2.2	2.7	2.7	11.5	9.1	5.7	6.23
3	5	Sida										
	6	Ellar	231	201	201	1.8	2.1	2.1	9.3	7.1	4.5	6.70
4	7	Atoel										
	8	Zeta	207	177	177	2.0	2.4	2.4	10.4	8.1	5.1	8.56
5	9	Kofur Zeid										
	10	Kofur Jammal										
	11	Kofur Abtous	167	137	137	2.5	3.0	3.0	12.9	10.2	6.4	3.58
6	12	Shafeh										
	13	Fanoun										
	14	Safareen	147	117	117	2.9	3.0	3.0	14.6	10.2	6.4	3.52
7	15	Roujeib										
	16	Dar Al-Hatab	139	109	109	3.0	3.0	3.0	15.5	10.2	6.4	3.93
8	17	Bait Dajan										
	18	Azmout										
	19	Salim	143	113	113	2.9	3.0	3.0	15.0	10.2	6.4	7.28
9	20	Yasseil										
	21	Bait Fouraeen										
	22	Nuseibait										
	23	Sabarta	191	161	161	2.2	2.6	2.6	11.3	8.8	5.6	6.79
10	24	Ramp										
	25	Betareah	235	205	205	1.8	2.0	2.0	9.1	7.0	4.4	3.95
11,12,13	26	Fasayel										
14,15	27	Al-Nafleh										
	28	Marge Ghazal										
	29	Marge Najeh										
	30	Al-Zobaidat	303	273	273	1.4	1.5	1.5	7.1	5.3	3.3	3.97
16	31	Ein Al-Duke										
	32	Al-Ouja	203	173	173	2.1	2.4	2.4	10.6	8.3	5.2	3.57
17	33	Al-Obeydia	155	125	125	2.7	3.0	3.0	13.9	10.2	6.4	6.69
18	34	Dar Saleh										
	35	Al-Shawaweesh										
	36	Ras Al-Wad	179	149	149	2.3	2.8	2.8	12.0	9.6	6.0	5.63
19,22	37	Hezan										
	38	Batier										
	47,48	Al-Walajeh Ein Al-Jowaiza	219	189	189	1.9	2.2	2.2	9.8	7.6	4.7	7.27
20	39	Al-Masara										
	40	Marah Rabah										
	41	Om Salmounah										
	42	Foarat Al-Sharrana										
	43	Wadi Rahal										
	160	Wadi Al-Nras										
	161	Marah Maalah										
	162	Khalet Al-Hadadh	235	205	205	1.8	2.0	2.0	9.1	7.0	4.4	4.63
21,22	44	Bait Tamor										
	45,46	Braidah/Hindaza	187	157	157	2.2	2.7	2.7	11.5	9.1	5.7	3.12
23	49	Tekoa	211	181	181	2.0	2.3	2.3	10.2	7.9	4.9	5.64
24	50	Bait Fajar	255	225	225	1.6	1.9	1.9	8.4	6.4	4.0	6.84
25	51	Wadi Fokeen										
	52	Nahaleen	239	209	209	1.8	2.0	2.0	9.0	6.9	4.3	4.77
26	53	Kofur Laquef										
	54	Baquet Al-Hatab										
	55	Hajeh										
	56	Jeet										
	57	Emmatoon										
	58	Farata	179	149	149	2.3	2.8	2.8	12.0	9.6	6.0	6.50
27	59	Kofur Thuluth	147	117	117	2.9	3.0	3.0	14.6	10.2	6.4	2.65
28,30	60	Jenaafout										
	61	Al-Fondek										
	68	Kofur Qudoom	183	153	153	2.3	2.7	2.7	11.7	9.4	5.9	3.91
29,31	62	Ras Ateah										
	63	Ras Al-Tarah										
	64	Al-Kharrub										
	65	Ezbet Jalood										
	66	Al-Ashqar										
	67	Al-Mawar										
	69	Habla	171	141	141	2.5	3.0	3.0	12.6	10.2	6.4	5.68
32	70	Ezbet Al-Taboob										
	71	Araleh										
	72	Al-Nabee Eleas										
	73	Jayos										
	74	Falamea										
	75	Sour	155	125	125	2.7	3.0	3.0	13.9	10.2	6.4	4.34
33	76	Bait Laqeah										
	77	Bait Sira	231	201	201	1.8	2.1	2.1	9.3	7.1	4.5	6.55
34	78	Naleem										
	79	Al-Mafia										
	80	Dar Qudees	211	181	181	2.0	2.3	2.3	10.2	7.9	4.9	4.85
35	81	Qubeah										
	82	Bodrus										
	83	Shogha	235	205	205	1.8	2.0	2.0	9.1	7.0	4.4	6.53
36	84	Bazzaid Al-Gharbiah	231	201	201	1.8	2.1	2.1	9.3	7.1	4.5	3.72

Table 2.3.17 Collection Vehicle Capacity per Day

Group No	Municipality/Village	Cycle time (min)			No of trips per day			Collection vehicle capacity			Total
		10m³Truck (L=34.2km)	8m³Truck (L=34.2km)	5m³Truck (L=34.2km)	10m³Truck	8m³Truck	5m³Truck	10m³Truck (t/day)	8m³Truck (t/day)	5m³Truck (t/day)	Design waste amount
37	85 Rashin										
	86 Allelan										
	87 Abtad	259	229	229	16	18	18	83	63	39	923
38	88 Bait Anan Al-Foka										
	89 Al-Fakha										
	90 Safa	215	185	185	20	23	23	106	77	48	567
39	91 Bafeen										
	92 Der Ibreen										
	93 Kofur Neamah	203	173	173	21	24	24	106	83	52	466
40	94 Kober										
	95 Al-Masraa Al-Kebliah										
	96 Abu Shkhaidem	171	141	141	25	30	30	126	102	64	590
41	97 Anata	191	161	161	22	30	30	113	102	64	604
42	98 Bait Duqqu										
	99 Bait Ejza	259	229	229	16	18	18	83	63	39	349
43	100 Bait Souriek										
	101 Bait Exa										
	102 Al-Nabi Samweel	255	225	225	16	19	19	84	64	40	356
44	103 Beit Nabala	227	197	197	19	21	21	95	73	45	492
45	104 Al-Ram	227	197	197	19	21	21	95	73	45	2745
46,47	105 Al-Sawahreh Al-Sharqeah										
	106 Al-Shaikh Saad										
	107 Al-Zaytem	143	113	113	29	30	30	150	102	64	3233
48	108 Bait Anan										
	109 Al-Jeeb	267	237	237	16	18	18	81	60	38	563
49	110 Kataah										
	111 Al-Kpaba	259	229	229	16	18	18	83	63	39	602
50	112 Bani Noaim	159	129	129	26	30	30	135	102	64	1860
51	113 Al-Sawaya	187	157	157	22	27	27	115	91	57	1105
52	114 Sacer										
	115 Al-Sheikh	193	153	153	23	27	27	117	94	59	1266
53	116 Al-Dahreyah	227	197	197	19	21	21	95	73	45	2243
54	117 Yatta	155	125	125	27	30	30	139	102	64	5367
55	118 Doura	187	157	157	22	27	27	115	91	57	1668
56	119 Ezna	251	221	221	17	19	19	86	65	41	1157
57	120 Tarkoumeah	235	205	205	18	20	20	91	70	44	904
58	121 Sureif	251	221	221	17	19	19	86	65	41	824
59	122 Bait Awla	231	201	201	18	21	21	93	71	45	584
60	123 Tammoun										
	124 Al-Farah	147	117	117	29	30	30	146	102	64	1152
61,63	125 Bardala										
	126 Ean Al-Baida										
	128 Tayaseer	211	181	181	20	23	23	102	79	49	316
62	127 Aqraba	171	141	141	25	30	30	126	102	64	589
64	129 Toubas	135	105	105	31	30	30	159	102	64	1282
65	130 Qarawet Bani Hassan										
	131 Al Zaweah	211	181	181	20	23	23	102	79	49	556
66	132 Der Balout										
	133 Kofur Al-Deek	211	181	181	20	23	23	102	79	49	550
67	134 Deir Estia										
	135 Kefel Hares	163	133	133	26	30	30	132	102	64	441
68,69	136 Jalboun										
	137 Der Ghazaleh										
	138 Arabbouneh	183	153	153	23	27	27	117	94	59	305
70,71	139 Sereis										
	140 Al-Idaydeh	187	157	157	22	27	27	115	91	57	722
72	141 Arraheh	171	141	141	25	30	30	126	102	64	637
73	142 Yaabad	203	173	173	21	24	24	106	83	52	919
74	143 Kofur Rase										
	144 Fahmeh										
	145 Al-Ramch	207	177	177	20	24	24	104	81	51	837
75	146 Al-Mughayer										
	147 Jalkamous										
	148 Om Al-Tout										
	149 Al-Mafalleh	187	157	157	22	27	27	115	91	57	361
76	150 Ekrek										
	151 Aneen										
	152 Zbouba	203	173	173	21	24	24	106	83	52	443
77	153 Jaba	203	173	173	21	24	24	106	83	52	555
78	154 Al-Jalameh										
	155 Araneh										
	156 Al-Dahra	159	129	129	26	30	30	135	102	64	662
79	157 Anzah										
	158 Ajjeh										
	159 Al-Zaweah	195	165	165	22	25	25	110	87	54	301

(5) Selection of Collection Vehicles

With consideration to the fact that almost all of the target municipalities/villages and its common service groups are small in the waste volume they produce, and for the most groups can be serviced by a single collection vehicle, the collection equipment for the Project is selected according to the criteria below. A flow chart for the selection procedure is given in Figure 2.3.2.

a. Municipalities/villages with Large Waste Volume

Al-Ram (group no. 45), Al-Dahreyah (group no. 53) and Yatta (group no. 54) generate large volume of waste, and will require three or more units of medium sized compactor truck ($8m^3$). In order to negotiate narrow roads as well as prevent the number of collection vehicles from being excessive, a combination of medium ($8m^3$) and large ($12m^3$) vehicles will be adopted in the case of these municipalities. The necessary numbers of vehicles for the three municipalities are indicated in Table 2.3-18. Al-Ram already has one unit of 12 m^3 compactor truck on hand, and the number of 12 m^3 compactor truck to be procured under the Project will accordingly be the figure in the table minus one.

Table 2.3.18 ***Vehicle Selection for Municipalities/Villages Requiring 3 or More Medium Compactor Trucks ($8m^3$)***

Group no.	Municipality/ Village		Dis-tance	Waste volume	Capacity		Vehicle		Total capacity	Existing vehicle
					8 m^3	12 m^3	8 m^3	12 m^3		
			km	t/day	t/day	t/day	no.	no.	t/day	
45	104	Al-Ram	28	27.45	7.3	9.5	1	2	26.3	(12 m^3) × 1
53	116	Al-Dahreyah	28	22.43	7.3	9.5	2	1	24.1	
54	117	Yatta	10	33.67	10.2	13.9	2	1	34.3	

b. Municipalities/villages with 1.1 m^3 Containers On Hand

In the case of municipalities/villages with 1.1 m^3 containers on hand, 8 m^3 or 12 m^3 compactor trucks will be adopted to effectively use this existing equipment. Municipalities/villages already in possession of 1.1 m^3 container equipment are the 6 indicated in Table 2.3.19. Given waste volume and capacity of compactor truck, Doura will require 2 units of 8 m^3 compactor truck. Also, Toubas will be supplied with a single 12 m^3 compactor truck as this will be sufficient to service the municipality. The remaining 4 municipalities will be provided with a single 8 m^3 compactor truck each.

Figure 2.3.2 ***Flow Chart for Collection Vehicle Selection***

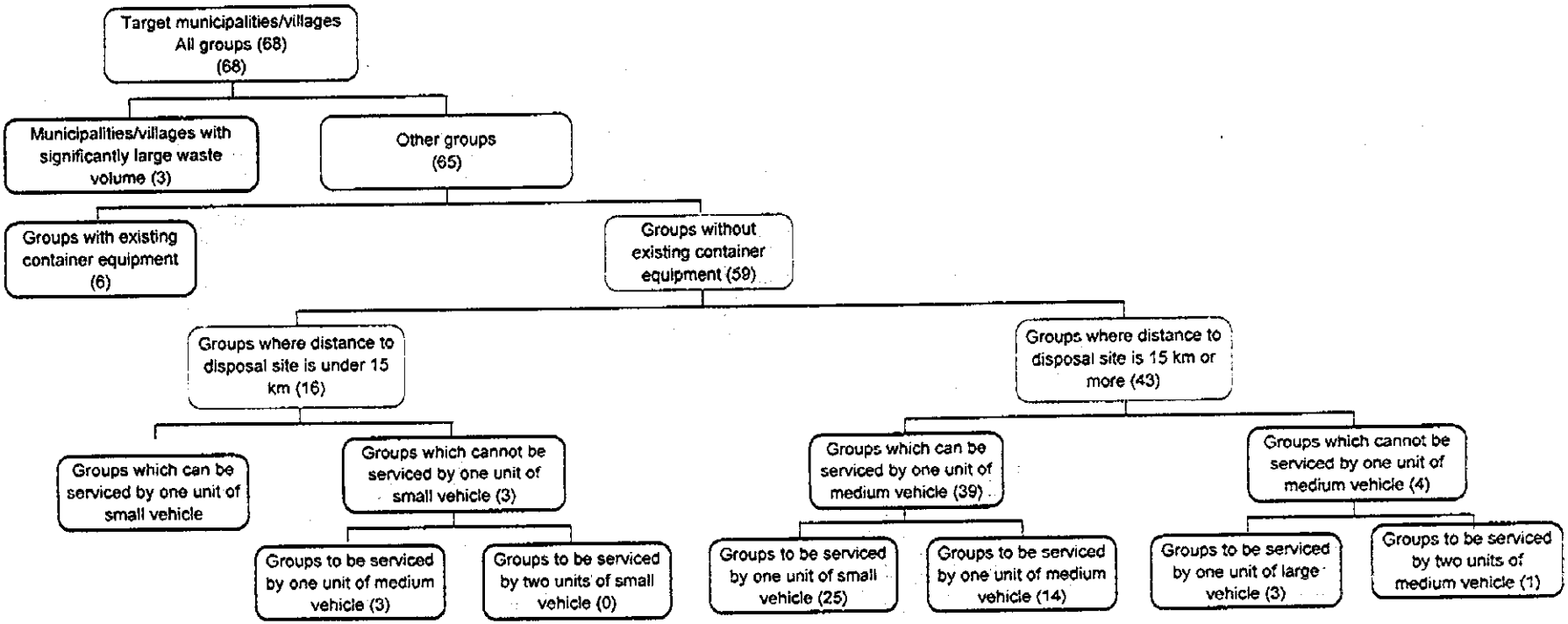


Table 2.3.19 ***Study on Municipality/Village Groups with Existing Container on Hand***

Group no.	Municipality/village		Dis-tance	Design waste volume	8 m³ Compactor		12 m³ Compactor	
					Capacity	No.	Capacity	No.
			Km	t/day	t/day		t/day	
23	49	Tekoa	24	5.64			10.2	1
42	98, 99	Bait Doquo, Bait Eiza	36	1.49			8.3	1
44	103	Beir Nabala	28	4.92			9.5	1
48	108, 109	Bait Anan, Al-Jeeb	38	5.63			8.1	1
55	118	Doura	18	16.88			11.5	2
64	129	Toubas	5	12.82	10.2	2		

c. Other Municipalities/villages with No Container on Hand, and Less than 15 km Hauling Distance

Among the municipalities/villages without container on hand, there are 16 groups where distance to the regional disposal site is under 15 km (excepting the previously discussed Yatta). Since these municipalities/villages do not require long distance hauling of waste, the small compactor truck (5 m³) suited to narrow roads in the communities would be appropriate. Of the said 16 groups, 13 can be serviced by a single small compactor truck (5 m³) . Groups which cannot be so serviced are the three indicated in Table 2.3-20. Group no.46/47 (Al-Sawahreh Al-Sharqeah, etc), group no. 50 (Bani Noaim) and group no. 60 (Tammoun, etc) will be supplied with 1 unit of medium compactor truck (8 m³) as shown in Table 2.3.20.

Table 2.3.20 ***Vehicle Selection for Municipalities/villages with Distance to Disposal Site Less than 15 km, and which Require Two or More Small Compactors (5 m³)***

Group no.	Municipality/village		Dis-tance	Design waste volume	5 m³ Compactor		8 m³ Compactor	
					Capacity	No.	Capacity	No.
			km	t/day	t/day		t/day	
46, 47	105, 106, 107	Al-Sawahreh, Al-Sharqeah, Al-Shaikh Saed, Al-Zuayem	7	12.13	6.4	2	10.2	1
50	112	Bani Noaim	11	11.60	6.4	2	10.2	1
60	123, 124	Tammoun, Al-Farah	8	11.52	6.4	2	10.2	1

= selected equipment

d. Municipalities/villages with No Container on Hand, and 15 km or More Hauling Distance

Among the municipalities/villages without container on hand, there are 43 groups where distance to the regional disposal site is 15 km or more (excepting the previously discussed Al Dahreyah). As these require a type of vehicle that can negotiate narrow roads as well as featuring good transport efficiency, the medium-size compactor truck (8 m³) is mainly appropriate. Of the said 43 groups, 39 groups can be serviced by a single unit of medium-size compactor truck. A further 23 groups within this total can be serviced by one unit of small compactor truck (5 m³) due to small waste volume, and thus will be provided with the small compactor truck (5 m³) under the

Table 2.3.19 ***Study on Municipality/Village Groups with Existing Container on Hand***

Group no.	Municipality/village		Distance	Design waste volume	8 m³ Compactor		12 m³ Compactor	
					Capacity	No.	Capacity	No.
			Km	t/day	t/day		t/day	
23	49	Tekoa	24	5.64	7.9	1	10.2	1
42	98, 99	Bait Doquo, Bait Eiza	36	1.49	6.3	1	8.3	1
44	103	Beir Nabala	28	4.92	7.3	1	9.5	1
48	108, 109	Bait Anan, Al-Jeeb	38	5.63	6.0	1	8.1	1
55	118	Doura	18	16.88	9.1	2	11.5	2
64	129	Toubas	5	12.82	10.2	2	15.9	1

c. Other Municipalities/villages with No Container on Hand, and Less than 15 km Hauling Distance

Among the municipalities/villages without container on hand, there are 16 groups where distance to the regional disposal site is under 15 km (excepting the previously discussed Yatta). Since these municipalities/villages do not require long distance hauling of waste, the small compactor truck (5 m^3) suited to narrow roads in the communities would be appropriate. Of the said 16 groups, 13 can be serviced by a single small compactor truck (5 m^3) . Groups which cannot be so serviced are the three indicated in Table 2.3-20. Group no.46/47 (Al-Sawahreh Al-Sharqeah, etc), group no. 50 (Bani Noaim) and group no. 60 (Tammoun, etc) will be supplied with 1 unit of medium compactor truck (8 m^3) as shown in Table 2.3.20.

Table 2.3.20 ***Vehicle Selection for Municipalities/villages with Distance to Disposal Site Less than 15 km, and which Require Two or More Small Compactors (5 m^3)***

Group no.	Municipality village		Distance	Design waste volume	5 m³ Compactor		8 m³ Compactor	
					Capacity	No.	Capacity	No.
			km	t/day	t/day		t/day	
46, 47	105, 106, 107	Al-Sawahreh, Al-Sharqeah, Al-Shaikh Saed, Al-Zuayem	7	12.13	6.4	2	10.2	1
50	112	Bani Noaim	11	11.60	6.4	2	10.2	1
60	123, 124	Tammoun, Al-Farah	8	11.52	6.4	2	10.2	1

selected equipment

d. Municipalities/villages with No Container on Hand, and 15 km or More Hauling Distance

Among the municipalities/villages without container on hand, there are 43 groups where distance to the regional disposal site is 15 km or more (excepting the previously discussed Al Dahreyah). As these require a type of vehicle that can negotiate narrow roads as well as featuring good transport efficiency, the medium-size compactor truck (8 m^3) is mainly appropriate. Of the said 43 groups, 39 groups can be serviced by a single unit of medium-size compactor truck. A further 23 groups within this total can be serviced by one unit of small compactor truck (5 m^3) due to small waste volume, and thus will be provided with the small compactor truck (5 m^3) under the

Project. The remaining 16 groups will be supplied with the medium-size compactor truck (8 m^3).

The four groups indicated in Table 2.3.21 require 2 units each of medium compactor truck (8 m^3). Of the said groups, 3 groups except group no.56 (Eznna) can be served by a single large compactor (12 m^3), and thus will be provided with 12 m^3 compactor, group no.56 (Eznna) will be supplied with 2 units of medium compactor (8 m^3).

Table 2.3.21 ***Vehicle Selection for Municipalities/villages with Distance to Disposal Site 15 km or More, and which Require Two or More Medium Compactors (8 m^3)***

Group no.	Municipality/village		Dis-tance	Design waste volume	8 m^3 compactor		12 m^3 compactor	
					Capacity	No.	Capacity	No.
			Km	t/day	t/day		t/day	
52	114,115	Saeer, Al-Sheukh	17	12.66	9.4	2		
56	119	Eznna	34	11.57			8.6	2
57	120	Tarkoumeah	30	9.04	7.0	2		
58	121	Sureif	34	8.24	6.5	2		

= selected equipment

(6) Results of Waste Collection Vehicle Selection

In line with the above selection criteria, the results of waste collection vehicle selection for each municipality/village are as indicated in Table 2.3.22.

Project. The remaining 16 groups will be supplied with the medium-size compactor truck (8 m^3).

The four groups indicated in Table 2.3.21 require 2 units each of medium compactor truck (8 m^3). Of the said groups, 3 groups except group no.56 (Eznna) can be served by a single large compactor (12 m^3), and thus will be provided with 12 m^3 compactor, group no.56 (Eznna) will be supplied with 2 units of medium compactor (8 m^3).

Table 2.3.21 ***Vehicle Selection for Municipalities/villages with Distance to Disposal Site 15 km or More, and which Require Two or More Medium Compactors (8 m^3)***

Group no.	Municipality/village		Dis-tance	Design waste volume	8 m compactor		12 m compactor	
					Capacity	No.	Capacity	No.
			Km	t/day	t/day		t/day	
52	114,115	Saeer, Al-Sheukh	17	12.66	9.4	2	11.7	1
56	119	Eznna	34	11.57	6.5	2	8.6	2
57	120	Tarkoumeah	30	9.04	7.0	2	9.1	1
58	121	Sureif	34	8.24	6.5	2	8.6	1

= selected equipment

(6) Results of Waste Collection Vehicle Selection

In line with the above selection criteria, the results of waste collection vehicle selection for each municipality/village are as indicated in Table 2.3.22.

Table 2.3.22 Results of Collection Vehicle Selection

Group No	Municipality & Village	Waste Volume t/d	Distance km	Vehicle Type & Quantity 5	8	12
1	1 Baka Al-Shrqeah					
	2 Nazlet Essa	6.07	28		1	
2	3 Der Al-Ghosoun					
	4 Al-Jarousheah	6.24	18	1		
3	5 Sida					
	6 Eilar	6.70	29		1	
4	7 Ateel					
	8 Zita	8.56	23		1	
5	9 Kofur Zebaad					
	10 Kofur Jammal					
	11 Kofur Abbous	3.58	13	1		
6	12 Shofeh					
	13 Faroun					
	14 Safareen	3.52	8	1		
7	15 Roujeeb					
	16 Der Al-Hatab	3.93	6	1		
8	17 Bait Dajan					
	18 Azmout					
	19 Salim	7.28	7	1		
9	20 Yaseed					
	21 Bait Emmreen					
	22 Nusf Jbail					
	23 Sabastea	6.79	19		1	
10	24 Borqa					
	25 Bezareah	3.95	30	1		
11,12	26 Fasayel					
13,14	27 Al-Jiflek					
15	28 Marge Ghazal					
	29 Marge Najeh					
	30 Al-Zobaidat	3.87	47	1		
16	31 Eain Al-Duke					
	32 Al-Ouja	3.57	22	1		
17	33 Al-Obaydya	6.69	10	1		
18	34 Dar Salah					
	35 Al-Shawawreh					
	36 Ras Al-Wad	5.63	16	1		
19, 22	37 Hosan					
	38 Batier					
	47,48 Al-Walajeh/Eain Al-Jowaiza	7.27	26		1	
20	39 Al-Masara					
20	40 Marah Rabah					
	41 Om Salmouneh					
	42 Jouret Al-Shamma					
	43 Waid Rahal					
	160 Wade Al-Neas					
	161 Marah Maalah					
	162 Khalet Al-Hadadh	4.63	30	1		
21	44 Bait Tamer					
	45,46 Braidaah/Hindaza	3.12	18	1		
23	49 Tekoa	5.64	24		1	
24	50 Bait Fajar	6.84	35		1	
25	51 Wadi Fokeen					
	52 Nahaleen	4.77	31	1		
26	53 Kofur Laquef					
	54 Baquet Al-Hatab					
	55 Hajeh					
	56 Jeer					
	57 Emmateen					
	58 Farata	6.50	16	1		
27	59 Kofur Thuluth	2.65	8	1		
28, 30	60 Jonsafout					
	61 Al-Fondok					
	68 Kofur Qudoom	3.91	17	1		
29, 31	62 Ras Ateah					
	63 Ras Al-Tiereh					
	64 Al-Khearneh					
	65 Ezbet Jaloud					
	66 Al-Ashquer					
	67 Al-Mdawer					
	69 Habla	5.68	14	1		
32	70 Ezbet Al-Tabeeb					
	71 Asaleh					
	72 Al-Nabee Eleas					
	73 Jayos					
	74 Falamea					
	75 Seer	4.34	10	1		
33	76 Bait Laqeah					
	77 Bait Sira	6.55	29		1	
34	78 Naleen					
	79 Al-Modia					
34	80 Der Qudees	4.85	24	1		
35	81 Qubeah					
	82 Bodrus					
	83 Shoqba	6.51	30		1	
36	84 Banizaid Al-Gharbia	3.72	29	1		
37	85 Ranties					
	86 Alleban					
	87 Aboud	4.28	36	1		
38	88 Bait Aour Al-Foka					
	89 Al-Tahta					
	90 Safa	5.67	25	1		
39	91 Baleen					
	92 Der Bazeea					
	93 Kofur Neamah	4.66	22	1		
40	94 Kober					
	95 Al-Mazraa Al-Kebleah					
	96 Abu Shkhaidem	5.90	14	1		
41	97 Anata	6.04	19	1		
42	98 Bait Doquo					
	99 Bait Ejza	1.49	36		1	
43	100 Bait Souriek					
	101 Bait Exa					
	102 Al-Nabi Samweel	3.56	35	1		
44	103 Beir Nabala	4.92	28		1	
45	104 Al-Ram	27.45	28		1	1
46, 47	105 Al-Sawahreh Al-Sharqeah					
	106 Al-Shaikh Saed					
	107 Al-Zuaytem	12.13	7		1	
48	108 Bait Anan					
	109 Al-Jeeb	5.63	38		1	
49	110 Katanh					
	111 Al-Kpaba	6.02	36		1	
50	112 Bani Noaim	11.60	11		1	
51	113 Al-Samoua	11.05	18		1	
52	114 Saeer					
	115 Al-Sheukh	12.66	17			1
53	116 Al-Dahreyah	22.43	28		2	1
54	117 Yatta	33.67	10		2	1
55	118 Doura	16.88	18		2	
56	119 Ezzna	11.57	34		2	
57	120 Tarkoumeah	9.04	30			1
58	121 Sureif	8.24	34			1
59	122 Bait Awla	5.84	29		1	
60	123 Tammoun					
	124 Al-Farah	11.52	8		1	
61, 63	125 Bardala					
	126 Ean Al-Baida					
	128 Tayaseer	3.16	24	1		
62	127 Aquaba	3.80	14	1		
64	129 Toubas	12.82	5			1
65	130 Qurawet Bani Hassan					
	131 Al Zaweah	5.56	24	1		
66	132 Der Balout					
	133 Kofur Al-Deek	5.50	24	1		
67	134 Dier Estia					
	135 Kefel Hares	4.41	12	1		
68, 69	136 Jalboun					
	137 Der Ghazaleh					
	138 Arabbouneh	3.03	17	1		
70, 71	139 Serees					
	140 Al-Jdaydeh	7.22	18		1	
72	141 Arrabeh	6.37	14	1		
73	142 Yaabad	9.19	22		1	
74	143 Kofur Raae					
	144 Fahmeh					
	145 Al-Rameh	8.37	23		1	
75	146 Al-Moghayer					
	147 Jalkamous					
	148 Om Al-Tout					
	149 Al-Matalleh	3.61	18	1		
76	150 Etenek					
	151 Aneen					
	152 Zbouba	4.43	22	1		
77	153 Jabaa	5.55	22	1		
78	154 Al-Jalameh					
	155 Araneh					
	156 Al-Dahea	6.62	11	1		
79	157 Anzeh					
	158 Ajjeh					
	159 Al-Zaweah	5.01	20	1		
	Total	490.26		38	30	7

(7) Quantity of Containers

The necessary quantity of containers is calculated on the basis of frequency of collection from each container, design waste volume, and capacity per container. In particular, this required quantity varies greatly depending on the frequency of collection from the containers (in the case of collection every other day, twice the number of containers become necessary compared with collection everyday). Under the Project, the approach will be to procure the minimum necessary quantity which corresponds to the required quantity for everyday collection. On the basis of this strategy, the necessary quantity of containers is computed considering the operational rate (79%) for waste collection vehicles.

> Required quantity of containers = design waste volume / container capacity / operation rate of collection vehicle (79%)

As discussed in section (4) under calculation of collection capacity, the 1.1 m^3 container is to be utilized with the 12 m^3 and 8 m^3 compactor trucks, and the 0.6 m^3 container with the 5 m^3 compactor truck. Container capacities of respective type are as follows,

1.1 m^3 container:	0.21 ton/unit
0.6 m^3 container:	0.12 ton/unit

The municipalities/villages shown in Table 2.3.23 already possess 1.1 m^3 containers. In order to effectively use these, the quantity to be purchased under the Project corresponds to the computed quantity minus the number of this equipment on hand.

Table 2.3.23 Number of Containers for Municipalities/villages with Existing Containers (1.1 m^3) on Hand

Group No.	Municipality/village No.		Waste volume t/day	Computed quantity	No. on hand	No. to be procured
23	49	Tekoa	5.64	34	80	0
42	98	Bait Doquo	1.49	9	19	0
44	103	Bait Nabala	4.92	30	60	0
45	104	Al-Ram	27.45	165	75	90
48	109	Al-Jeeb	5.63	34	45	0
55	118	Doura	16.88	102	100	2
64	129	Toubas	12.82	77	40	37

The container quantities for each target municipality/village group are as shown in Table 2.3.24.

Table 2.3.24 Container Quantities for the Target Municipalities/Villages

Group No	Municipality & Village	Waste Quant t/d	Type & Quantity 0.6m3	1.1m3
1	1 Baka Al-Shrqeah			
	2 Nazlet Rasa	6.07		37
2	3 Der Al-Ghosoun			
	4 Al-Jarousheah	6.24	66	
3	5 Sida			
	6 Ellar	6.70		40
4	7 Ateel			
	8 Zita	8.56		51
5	9 Kofur Zebaad			
	10 Kofur Jammal			
	11 Kofur Abbous	3.58	38	
6	12 Shofeh			
	13 Farqun			
	14 Safareen	3.52	37	
7	15 Roujeeb			
	16 Der Al-Hatab	3.93	41	
8	17 Bait Dajan			
	18 Azmout			
	19 Salim	7.28	77	
9	20 Yaseed			
	21 Bait Emmreen			
	22 Nusf Jbeil			
	23 Sabastea	6.79		41
10	24 Borqa			
	25 Bezareah	3.93	42	
11,12	26 Faqayel			
13,14	27 Al-Jiflek			
15	28 Marge Ghazal			
	29 Marge Najeh			
	30 Al-Zobeidat	3.87	41	
16	31 Ein Al-Dnke			
	32 Al-Ouja	3.57	38	
17	33 Al-Obaydya	6.69	70	
18	34 Der Salah			
	35 Al-Shawawreh			
	36 Ras Al-Wad	5.63	59	
19,22	37 Hosan			
	38 Bather			
	47,48 Al-Walajeh/Ein Al-Jawaza	7.27		44
20	39 Al-Masara			
20	40 Marah Rabah			
	41 Om Salmoungh			
	42 Jouret Al-Shamma			
	43 Waid Rahal			
	160 Wade Al-Neas			
	161 Marah Maalah			
	162 Khalet Al-Hadadh	4.63	49	
21	44 Bait Tamer			
	45,46 Braidaah/Hindaza	3.12	33	
23	49 Tekoa	5.64		0
24	50 Bait Fajar	6.84		41
25	51 Wadi Fokeen			
	52 Nahaleen	4.77	50	
26	53 Kofur Laquef			
	54 Baquet Al-Hatab			
	55 Hajeh			
	56 Jeet			
	57 Emmateen			
	58 Farata	6.50	68	
27	59 Kofur Thuluth	2.65	28	
28,30	60 Jensafout			
	61 Al-Fondok			
	68 Kofur Qadoom	3.91	41	
29,31	62 Ras Ateah			
	63 Ras Al-Tireh			
	64 Al-Khesmeh			
	65 Ezbet Jaloud			
	66 Al-Ashqar			
	67 Al-Mdawer			
	69 Habla	5.68	60	
32	70 Ezbet Al-Tabeeb			
	71 Asaleh			
	72 Al-Nabee Elees			
	73 Jayes			
	74 Fajamea			
	75 Seer	4.34	46	
33	76 Bait Laqeah			
	77 Bait Sira	6.55		39
34	78 Naleen			
	79 Al-Media			
34	80 Der Qadees	4.85	51	
35	81 Qubeah			
	82 Bodrus			
	83 Shoqba	6.51		39
36	84 Ramizaid Al-Gharbia	3.72	39	
37	85 Ranties			
	86 Alleban			
	87 Abeud	4.28	45	
38	88 Bait Aour Al-Foka			
	89 Al-Tahta			
	90 Safa	5.67	60	
39	91 Baleen			
	92 Der Bazeea			
	93 Kofur Naamah	4.66	49	
40	94 Kober			
	95 Al-Mazraa Al-Kebleah			
	96 Abu Shkhaidem	5.90	62	
41	97 Aneta	6.04	64	
42	98 Bait Doqqo			
	99 Bait Ejza	1.49		0
43	100 Bait Sounek			
	101 Bait Ixa			
	102 Al-Nabi Samweel	3.56	37	
44	103 Beir Nabala	4.92		0
45	104 Al-Ram	27.45		90
46,47	105 Al-Sawahreh Al-Sharqeah			
	106 Al-Shaikh Saed			
	107 Al-Zuayem	12.13		73
48	108 Bait Anan			
	109 Al-Jeeb	5.63		0
49	110 Katanh			
	111 Al-Kpaba	6.02		36
50	112 Bani Naeim	11.60		70
51	113 Al-Samoua	11.05		66
52	114 Saeer			
	115 Al-Sheukh	12.66		76
53	116 Al-Dahreyah	22.43		135
54	117 Yatta	33.67		202
55	118 Doura	16.88		2
56	119 Ezna	11.57		70
57	120 Tarkoumeah	9.04		54
58	121 Sureif	8.24		50
59	122 Bait Awla	5.84		35
60	123 Tammoun			
	124 Al-Farah	11.52		69
61,63	125 Bardala			
	126 Ein Al-Baida			
	128 Tayaseer	3.16	33	
62	127 Aquaba	3.80	40	
64	129 Toubas	12.82		37
65	130 Qurawet Baru Hassan			
	131 Al Zaweah	5.56	59	
66	132 Der Balout			
	133 Kofur Al-Deek	5.50	58	
67	134 Deir Estia			
	135 Kefel Hares	4.41	46	
68,69	136 Jalboun			
	137 Der Ghazaleh			
	138 Arabbouneh	3.03	32	
70,71	139 Sereea			
	140 Al-Jdaydeh	7.22		43
72	141 Arrabeh	6.37	67	
73	142 Yaabad	9.19		55
74	143 Kofur Rasse			
	144 Fahmeh			
	145 Al-Rameh	8.37		50
75	146 Al-Mogheyer			
	147 Jalkamous			
	148 Om Al-Tout			
	149 Al-Matalleh	3.61	38	
76	150 Etenek			
	151 Aneon			
	152 Zbouba	4.43	47	
77	153 Jabaa	5.55	58	
78	154 Al-Jalameh			
	155 Aranch			
	156 Al-Dalieh	6.62	70	
79	157 Anzeh			
	158 Ajjeh			
	159 Al-Zaweah	5.01	53	
	Total	490.26	1,892	1,545

(8) Summary of Waste Collection Equipment

Procurement quantity totals for waste collection vehicles and containers are as shown in Table 2.3.25.

Table 2.3.25 Procurement Quantity Totals for Waste Collection Equipment

	Waste collection vehicles			Containers	
	12 m^3	8 m^3	5 m^3	1.1 m^3	0.6 m^3
Procurement quantities	7	30	38	1,545	1,892

2-3-2-3 Disposal Site Equipment Plan

(1) Project Disposal Sites

As discussed previously, the target disposal sites for equipment procurement under the Project are the following four:

i) Jenin disposal site
ii) Toubas disposal site
iii) Tulkarem
iv) Jericho disposal site
v) Ramallah disposal site

Also as indicated earlier, the service populations in the Project year (2004) for the target disposal sites are as shown in Table 2.3.26.

Table 2.3.26 Service Populations for the Target Disposal Sites

Disposal site	Service population (persons)
Jenin	277,563
Toubas	49,086
Tulkarem	57,500
Jericho	43,750
Ramallah	365,145
Total	793,044

(2) Design Waste Volume

As discussed previously, design waste volume is the waste intake volume in the year (2004). Disposal site equipment design is accordingly carried out based on this design waste volume. The said design waste volumes are calculated from the earlier discussed waste intake volumes, and are as indicated in Table 2.3.27.

Table 2.3.27 Design Waste Volume for the Target Disposal Sites

Disposal site	Service population (persons)	Waste intake volume (tons/day)
Jenin	277,563	194.3
Toubas	49,086	34.4
Tulkareem	57,500	40.3
Jericho	43,750	30.6
Ramallah	365,145	255.6
Total	793,044	555.2

(3) Work Quantity

In order to implement sanitary landfill disposal of waste at the disposal sites, necessary works can be classified into four types, i.e. (i) spreading and compaction of waste, (ii) spreading and compaction of covering soil, (iii) excavation and loading of covering soil and (iv) transport of covering soil. Work quantities per day as computed from the design waste volume are as indicated in Table 2.3.28.

Table 2.3.28 Work Quantities at the Project Disposal Sites

Disposal site	Spreading/ compaction of waste (m^3/day) ①	Spreading/ compaction of covering soil (m^3/day) ②	Covering soil excavation (m^3/day) ③	Covering soil transport (m^3/day) ④
Jenin	555.1	63.1	47.2	75.5
Toubas	98.3	10.9	8.4	13.4
Tulkarem	115.1	12.7	9.8	15.7
Jericho	87.4	9.7	7.5	12.0
Ramallah	730.3	80.7	62.1	99.4
Total	1,586.2	175.3	135.0	216.0

Note:
① Waste amount converted to volume before compaction (waste density: 0.35 t/ m^3)
② Soil volume prior to compacting: Compaction ratio of waste after compaction: 0.5, Covering soil thickness after compaction: 17% of waste layer thickness after compaction (waste layer: 2 m; covering soil: 35 cm), volume change rate: 1.3.
③ Excavated volume (volume change rate: 1.3)
④ Loose soil (volume change rate: 1.6)

(4) Equipment Plan

Landfill disposal work at the sites with scale corresponding to those under the Project requires combined work by the equipment indicated below.

i) Bulldozer: spreading/compacting of waste and covering soil
ii) Backhoe: excavation/loading of covering soil
iii) Dump truck: transport of covering soil

Bulldozers are to be equipped with trash racks to improve spread and compaction efficiency.

However, procurement of a full set of the above equipment will not be necessary in the case of the Toubas, Tulkarem and Jericho disposal sites, as the design waste volume is small. Instead, a single unit of versatile track loader will be supplied to each site for carrying out the required multiple tasks.

As a result, necessary equipment at each disposal site is computed as follows based on the design work quantities.

(a) Jenin Disposal Site

(a)-1 Spreading/compacting equipment for waste and covering soil

The 165 ps class (20 ton) and 110 ps class (13 ton) bulldozer capacities were comparatively studied.

Respective spreading and compacting capacities are computed as indicated below, and shown in Table 2.3.29.

Calculation of Bulldozer Work Capacity

Bulldozer spread and compacting capacity is computed according to the following formula:

$$Q = (60 \cdot q \cdot fl \cdot E) / Cm$$

where:

- Q : work quantity per 1 hour of operation (m^3/h)
- q : spread volume per one time (m^3)
- fl : soil conversion coefficient (equivalent to 1 for the purpose here of computing loose volume work quantity).
- E : Work efficiency per 1 hour of operation (0.7)
- Cm : cycle time (min.)

$$q = 0.6 \cdot l \cdot h^2$$

where:

- l : blade width (approx. 3 m for 110 ps class; approx. 3.3 m for 165 ps class)
- h : blade height (In the case of soil spreading: approx. 0.9 m for 110 ps class; approx. 1.3 m for 165 ps class. In the case of waste spreading: approx. 1.3 m for 110 ps class; approx. 1.9 m for 165 ps class.)

$$Cm = L/V_1 + L/V_2 + Tg$$

where:

- L : average spread distance (a general 30 m is applied here)
- V_1 : forward velocity (here, 50 m/min. is applied)
- V_2 : backward velocity (here, 50 m/min. is applied)
- Tg : gear change time (here, 0.3 min. is applied)

Table 2.3.29 Bulldozer Work Capacity

Type	Work category	Capacity (m^3/h)	Remarks
110 ps class	Soil spreading/compacting	40.8	
	Waste spreading/compacting	85.2	w/ trash rack
165 ps class	Soil spreading/compacting	93.7	
	Waste spreading/compacting	200.1	w/ trash rack

On the basis of the above work capacity and previously discussed work quantities, the net operating times per day are around 10.1 hours and 4.3 hours for the 110 ps class

and 165 ps class bulldozers, respectively. Considering standby time for waste delivery, soil transport, etc., the work time in the case of the 110 ps class bulldozer becomes excessively long, precluding effective work execution. Accordingly, one unit of 165 ps class bulldozer will be deployed to the site under the Project.

Table 2.3.30 Bulldozer Work Time (Jenin)

Type	Work category	Work quantity (m^3/day)	Capacity (m^3/h)	Operational efficiency	Work time (h/day)
110 ps class	Soil spreading/compacting	61.3	40.8	79%	1.9
	Waste spreading/compacting	555.1	85.2	79%	8.2
	Total				10.1
165 ps class	Soil spreading/compacting	61.3	93.7	79%	0.8
	Waste spreading/compacting	555.1	200.1	79%	3.5
	Total				4.3

(a)-2 Excavating/loading equipment for covering soil

It is planned to supply a single unit of versatile 0.8 m^3 class backhoe (net capacity 0.7 m^3) for excavating and loading covering soil. Also, it will be necessary to provide a breaker attachment given the fact that ground at the site consists of a hard limestone layer.

Excavation and loading capacity for the 0.8 m^3 class backhoe is computed at 13.8 m^3/h according to the formula below. Also, the appropriate 1,000 kg class breaker attachment for the 0.8 m^3 class backhoe has a work capacity of 25 m^3/h. Accordingly, the work time per day is around 6.7 hours (as indicated in Table 2.3.31) based on the previously discussed work quantities, and this equipment is thus considered sufficient to accomplish the required daily work load.

Calculation of Backhoe Work Capacity

Backhoe excavation and loading capacity is computed according to the following formula:

$$Q = (3600 \cdot q \cdot K \cdot fl \cdot E) / Cs$$

where:

Q : raw excavation volume per 1 hour of operation (m^3/h)
q : bucket level-scoop capacity (here, 0.7 m^3 is applied)
K : bucket coefficient (here, 0.65 is applied)
fl : soil volume conversion coefficient (here 0.6 is applied)
E : work efficiency per 1 hour of operation (0.45 is applied as loading works must also be performed)
Cs : cycle time (32 seconds is applied taking into consideration required 180 degree rotation)

Table 2.3.31 *Backhoe Work Time (Jenin)*

Type	Work category	Work quantity (m^3/day)	Capacity (m^3/h)	Operational efficiency	Work time (h/day)
0.8 m^3	Excavating/loading	47.2	13.8	79%	4.3
class	Breaker work	47.2	25.0	79%	2.4
	Total				6.7

(a)-3 Transport equipment for covering soil

Dump truck equipment will be necessary to transport excavated covering soil within the disposal site. Since transport quantity will be small, a single dump truck will be deployed at the site. The volume of soil which can be transported within the site by a single dump truck is computed as follows, and shown in Table 2.3.32.

Calculation of Dump Truck Work Capacity

Dump truck soil transport capacity is computed according to the following formula:

$$Q = (60 \cdot C \cdot fl \cdot Et) / Cmt$$

where:

Q : transport quantity per 1 hour of operation (m^3/h)
C : load volume per one time (loose soil) (8 ton class: 5 m^3; 15 ton class: 9.3 m^3)
fl : soil conversion coefficient (equivalent to 1 for the purpose here of computing loose volume work quantity).
Et : work efficiency per 1 hour of operation (0.9)
Cmt : cycle time (min.)

$$Cmt = (Cms \cdot n) / (60 \cdot Es) + T$$

where:

Cms : cycle time for loading equipment (here, 32 sec. for the backhoe is applied)
n : no. of cycles by loading equipment per single dump truck load
Es : loading work efficiency (here, the general 0.9 is applied)
T : required time for one round-trip by dump truck (here, 6 min. is applied)

$$n = C / (q \cdot K)$$

where:

q : bucket capacity of loading equipment (here, 0.7 m^3 for the backhoe is applied)
K : bucket coefficient of loading equipment (here, 0.65 m^3 for the backhoe is applied)

Table 2.3.32 *Dump Truck Work Capacity*

Type	Maximum load (t/vehicle)	Transport capacity (m^3/vehicle)	Transport capacity (m^3/h)
8 ton class	8	5.0	21.58
15 ton class	15	9.3	27.73

Dump truck work time is computed as shown in Table 2.3.33, based on the required soil transport volume per day of 75.5 m^3 indicated in Table 2.3.28.

Table 2.3.33 *Dump Truck Work Time (Jenin)*

Type	transport quantity (m^3/day)	Transport capacity (m^3/h)	Operational efficiency	Work time (h/day)
8 ton class	75.5	21.58	79%	4.4
15 ton class	75.5	27.73	79%	3.4

The 8 ton class dump truck is sufficient for the envisioned soil transport works. Accordingly, one unit of 8 ton dump truck will be deployed at the site under the Project.

(b) Toubas Disposal Site

The following study was carried out assuming the need to supply the 120 ps class (1.8 m^3) track-loader in order to effectively carry out the required spreading/compaction of waste and covering soil using a single unit of equipment.

Work capacity for the 120 ps class track-loader is computed as indicated below, and shown in Table 2.3.34. This equipment is capable of small quantity soil scooping (not the large scale excavation as in the case of the backhoe considering soil condition of the site), and short distance transport of excavated soil collected in the bucket.

Calculation of Track-loader Work Capacity

(1) Track-loader spread and compacting capacity

$$Q = (60 \cdot q \cdot fl \cdot E) / Cm$$

where:

Q : work quantity per 1 hour of operation (m^3/h)
q : spread volume per one time (her, 1.8m^3 is applied)
fl : soil conversion coefficient (equivalent to 1 for the purpose here of computing loose volume work quantity).
E : Work efficiency per 1 hour of operation (0.7)
Cm : cycle time (min.)

$$Cm = L/V_1 + L/V_2 + Tg$$

where:

L : average spread distance (the general 30 m is applied here)
V_1 : forward velocity (here, 50 m/min. is applied)
V_2 : backward velocity (here, 50 m/min. is applied)
Tg : gear change time (here, 0.3 min. is applied)

(2) Track-loader scooping capacity

$$Q = (3600 \cdot q \cdot K \cdot fl \cdot E) / Cs$$

where:
Q : raw scooping volume per 1 hour of operation (m^3/h)
q : level-scoop capacity of bucket (here, 0.34 m^3 is applied corresponding to scooping depth of 15 cm and bucket height of 15 cm)
K : bucket coefficient (here, 0.4 is applied)
fl : soil volume conversion coefficient (ratio of raw excavated volume to loose soil. here, 0.6 is applied)
E : work efficiency per 1 hour of operation (here, 0.6 is applied)
Cs : cycle time (sec.)

$$Cs = m \cdot L + T$$

where:
m : maneuverability coefficient (here, 1.5 is applied since equipment is crawler type)
L : scooping distance (here, 6 m is applied as the distance required to scoop up 1.8 m^3 of soil)
T : scooping time (here, 40 sec. is applied as the time required to gather one scoop of soil)

(3) Track-loader soil transport capacity:

$$Q = (3600 \cdot q \cdot K \cdot fl \cdot E) / Cs$$

where:
Q : transport volume per 1 hour of operation (m^3/h)
q : level-scoop capacity of bucket (here, 1.8 m^3 is applied)
K : bucket coefficient (here, 0.4 is applied)
fl : soil volume conversion coefficient (here, 1 is applied since transport load is loose soil)
E : work efficiency per 1 hour of operation (here, 0.6 is applied)
Cs : cycle time (sec.)

$$Cs = m \cdot L + T$$

where:
m : maneuverability coefficient (here, 1.5 is applied since equipment is crawler type)
L : transport distance (here, 50 m is applied)
T : scooping time (here, 40 sec. is applied as the time required to gather one scoop of soil)

Table 2.3.34 Track-loader Work Capacity

Type	Spreading and compaction of waste (m^3/h)	Spreading and compaction of covering soil (m^3/h)	Covering soil scooping (m^3/h)	Covering soil transport (50 m) (m^3/h)
120 ps class	50.4	50.4	3.6	13.5

On the basis of the above work capacity and the previously discussed work quantities, the track-loader work time is calculated as shown in Table 2.3.35. Since this equipment can perform only small quantity scooping, construction wastes will in principal be transported to and used at the site for covering soil. However, a scooping time equivalent to roughly 50% of the necessary covering soil volume is taken into consideration in order to respond to emergencies.

Table 2.3.35 Track-loader Work Time (Toubas)

Type	Work category	Work quantity (m^3/day)	Capacity (m^3/h)	Operational efficiency	Work time (h/day)
120 ps class	Waste spreading/compacting	98.3	50.4	79%	2.5
	Soil spreading/compacting	10.9	50.4	79%	0.3
	Soil scooping	4.2	3.6	79%	1.5
	Soil transport (50 m)	13.4	13.5	79%	1.3
	Total				5.6

On the basis of the above, it is concluded that deployment of one unit of 120 ps (1.8 m^3) class track-loader will be sufficient to effectively carry out the required range of waste and covering soil spreading/compaction, and covering soil scooping/transport required at the site.

(c) Tulkarem Disposal Site

As in the case of the Toubas disposal site, it will be necessary to supply the 120 ps class (1.8 m^3) track-loader for Tulkarem disposal site in order to effectively carry out the required spreading/compaction of waste and covering soil using a single unit of equipment.

Applying the same study as for Toubas, the work time for the 120 ps class track-loader based on work capacity and quantities of Tulkarem disposal site is computed as shown in Table 2.3.36.

Table 2.3.36 Track-loader Work Time (Tulkarem)

Type	Work category	Work quantity (m^3/day)	Capacity (m^3/h)	Operational efficiency	Work time (h/day)
120 ps class	Waste spreading/compacting	115.1	50.4	79%	2.9
	Soil spreading/compacting	12.7	50.4	79%	0.3
	Soil scooping	4.9	3.6	79%	1.7
	Soil transport (50 m)	15.7	13.5	79%	1.5
	Total				6.4

On the basis of the above, it is concluded that deployment of a single 120 ps (1.8 m^3) class track-loader will be sufficient to effectively carry out the required range of waste and covering soil spreading/compaction, and covering soil scooping/transport required at the site.

(d) Jericho Disposal Site

As in the case of the Toubas disposal site, it will be necessary to supply the 120 ps class (1.8 m^3) track-loader for Jericho disposal site in order to effectively carry out the required spreading/compaction of waste and covering soil using a single unit of equipment.

Applying the same study as for Toubas, the work time for the 120 ps class track-loader based on work capacity and quantities is computed as shown in Table 2.3.36.

Table 2.3.37 Track-loader Work Time (Jericho)

Type	Work category	Work quantity (m^3/day)	Capacity (m^3/h)	Operational efficiency	Work time (h/day)
120 ps class	Waste spreading/compacting	87.4	50.4	79%	2.2
	Soil spreading/compacting	9.7	50.4	79%	0.2
	Soil scooping	3.8	3.6	79%	1.3
	Soil transport (50 m)	12.0	13.5	79%	1.1
	Total				4.8

On the basis of the above, it is concluded that deployment of a single 120 ps (1.8 m^3) class track-loader will be sufficient to effectively carry out the required range of waste and covering soil spreading/compaction, and covering soil scooping/transport required at the site.

(e) Ramallah Disposal Site

(e)-1 Spreading/compacting equipment for waste and covering soil

The same study was applied for Ramallah disposal site as in the case of the Jenin disposal site. On the basis of the work capacity and quantities, the net operating times per day are around 13.4 hours and 5.7 hours for the 110 ps class and 165 ps class bulldozers, respectively, as shown in Table 2.3.38. Considering standby time for waste delivery, soil transport, etc., the work time in the case of the 110 ps class bulldozer becomes excessively long, precluding effective work execution. Accordingly, one unit of 165 ps class bulldozer will be deployed to the site under the Project.

Table 2.3.38 *Bulldozer Work Time (Ramallah)*

Type	Work category	Work quantity (m^3/day)	Capacity (m^3/h)	Operational efficiency	Work time (h/day)
110 ps	Soil spreading/compacting	80.7	40.8	79%	2.5
Class	Waste spreading/compacting	730.3	85.2	79%	10.9
	Total				13.4
165 ps	Soil spreading/compacting	80.7	93.7	79%	1.1
Class	Waste spreading/compacting	730.3	200.1	79%	4.6
	Total				5.7

(e)-2 Excavating/loading equipment for covering soil

The same study was applied as in the case of the Jenin disposal site. On the basis of work capacity and quantities, work time per day is around 8.8 hours as indicated in Table 2.3.39, and this equipment is thus considered to accomplish the required daily work load. Accordingly, one unit of 0.8 m^3 class backhoe (with breaker attachment) will be procured for this site under the Project.

Table 2.3.39 *Backhoe Work Time (Ramallah)*

Type	Work category	Work quantity (m^3/day)	Capacity (m^3/h)	Operational efficiency	Work time (h/day)
0.8 m^3	Excavating/loading	62.1	13.8	79%	5.7
class	Breaker work	62.1	25.0	79%	3.1
	Total				8.8

(e)-3 Transport equipment for covering soil

The same study was applied as in the case of the Jenin disposal site. Dump truck work time is computed as shown in Table 2.3.40, based on the required soil transport volume per day of 99.4 m^3 indicated in Table 2.3.28.

Table 2.3.40 *Dump Truck Work Time (Ramallah)*

Type	transport quantity (m^3/day)	Transport capacity (m^3/h)	Operational efficiency	Work time (h/day)
8 ton class	99.4	21.58	79%	5.8
15 ton class	99.4	27.73	79%	4.5

The 8 ton class dump truck is sufficient for the envisioned soil transport works. Accordingly, one unit of 8 ton dump truck will be deployed at the site under the Project.

(4) Design Equipment Summary

On the basis of the above study, the disposal site equipment indicated in Table 2.3.41 will be supplied under the Project.

Table 2.3.41 Quantities for Disposal Site Equipment

Disposal site	165 ps class bulldozer	0.8 m^3 class backhoe (w/ breaker)	8 ton class dump truck	120 ps (1.8 m^3) class truck-loader
Jenin	1 unit	1unit	1unit	--
Toubas	--	--	--	1unit
Tulkarem	--	--	--	1unit
Jericho	--	--	--	1unit
Ramallah	1 unit	1unit	1unit	
Total	2 units	2 units	2 units	3 units

2-3-2-4 Spare Parts Plan

(1) Parts to be Procured

In order to use the equipment efficiently and continuously, it is important to carry out regular replacement of consumable parts and repair/replacement of worn parts based on the guidelines of maintenance manuals for the respective equipment.

Regular replacement parts and spare parts for repair are to be procured on the basis of the following criteria, and in line with specifications and quantities of procured equipment under the Project.

① Vehicle type equipment (waste compactor truck and dump truck)
: parts necessary for approx. 50,000 km of running (approx. 2 years).
② Construction related equipment (bulldozer, backhoe & track-loader)
: parts necessary for approx. 5,000 hours of operation (approx. 2 years)

Regular replacement parts and spare parts for repair are as follows,

a. Periodical replacement parts
oil filter element,
air cleaner element,
fuel filter element
b. Spare parts for repair
engine pistons, liners and bearings ,
clutch & brake system parts,
frequently replaced electric parts, rubber hoses,
body hydraulic system parts

Spare parts of generally infrequent repair and those required in the case of accident, etc. are not covered in the above listed parts. Accordingly, it will be noted that the spare parts excluded the above list, be procured by the PA side. After consuming the spare parts procured under the Project, it is necessary to prepare the budget for spare parts by the PA side, which is recommended to be 5 % of the equipment body price per year respectively.

(2) Parts Management

Conventionally, it is desirable that the management of spare parts be carried out by the owner of the related equipment. However, as equipment quantities to be procured for the target municipalities/villages are small (ranging from 1 to several units), it would be difficult to manage parts by each municipality/village. Accordingly, management of spare parts procured under the Project is to be carried out by the central warehouse of spare parts in Ramallah, planned by the Ministry of Local Government, and distributed to the regional workshops including 2 workshops of Jericho Municipality and Nablus Municipality.

2-3-2-5 Design Equipment Specifications

On the basis of the above study, the equipment indicated in Table 2.3.42 will be procured under the Project. Also, equipment specifications are shown in Table 2.3.43; and preliminary equipment drawings are given in Figure 2.3.3 ~ Figure 2.3.11

Table 2.3.42 Summary of Equipment to be Procured

No.	Equipment	Specifications	Unit	Quantity
I	Collection equipment:			
I-1	Compactor truck	12 m^3 class	1 no.	7
I-2	Compactor truck	8 m^3 class	1 no.	30
I-3	Compactor truck	5 m^3 class	1 no.	38
I-4	Container	1.1 m^3 for use with compactor truck	1 no.	1,545
	Container	0.6 m^3 for use with compactor truck	1 no.	1,892
II	Disposal site equipment:			
II-1	Bulldozer	165 ps class	1 no.	2
II-2	Backhoe	0.8 m^3 class	1 no.	2
II-3	Track-loader	120 ps, 1.8 m^3	1 no.	3
II-4	Dump truck	5 m^3, 8 ton class	1 no.	2
III	Spare parts		1 set	1

Table 2.3-43 Specifications of the Equipment

Item	Specifications	Note
I. Collection Equipment		
1. 12m³ Compactor Truck		
(1) Main Specifications		
– Type of vehicle	12cm³ Compactor Truck	
– Steering wheel	Left-hand, forward control	
– Traction	4×2 rear traction	
– Max. payload	Not less than 7,200kg	
– Gross vehicle weight	Not less than 16,500kg	
(2) Dimensions		
– Overall length	Approx. 8,200mm	
– Overall width	Approx. 2,500mm	
– Overall height	Approx. 3,500mm	
– Wheel base	Approx. 4,100mm	
– Min. turning radius	Approx. 7,500mm	
– Tire	Depend on manufacturer standard (ref. 315/80R22.5)	
(3) Engine		
– Type	Water-cooled, 4-cycle, diesel engine	
– Max. output	Not less than 220PS	
(4) Attachments		
– Body volume	Approx. 12m³	Arm lifting device for 1.1m³ container (European S.T.D EN840-2)
– Hopper volume	Not less than 1m³	
– Container lift	Lifting capacity : 700kg	
2. 8m³ Compactor Truck		
(1) Main Specifications		
– Type of vehicle	8m³ Compactor Truck	
– Steering wheel	Left-hand, forward control	
– Traction	4×2 rear traction	
– Max. payload	Not less than 4,800kg	
– Gross vehicle weight	Not less than 11,000kg	
(2) Dimensions		
– Overall length	Approx. 7,700mm	
– Overall width	Approx. 2,300mm	
– Overall height	Approx. 3,200mm	
– Wheel base	Approx. 3,900mm	
– Min. turning radius	Approx. 7,000mm	
– Tire	Depend on manufacturer standard (ref. 275/80R22.5)	
(3) Engine		
– Type	Water-cooled, 4-cycle, diesel engine	
– Max. output	Not less than 210PS	
(4) Attachments		
– Body volume	Approx. 8m³	Arm lifting device for 1.1 and 0.6m³ container (European S.T.D EN840-2)
– Hopper volume	Not less than 1m³	
– Container lift	Lifting capacity : 700kg	

Item	Specifications	Note
3. 5 m^3 Compactor Truck		
(1) Main Specifications		
– Type of vehicle	5m^3 Compactor Truck	
– Steering wheel	Left-hand, forward control	
– Traction	4×2 rear traction	
– Max. payload	Not less than 3,00kg	
– Gross vehicle weight	Not less than 7,500kg	
(2) Dimensions		
– Overall length	Approx. 6,400mm	
– Overall width	Approx. 2,050mm	
– Overall height	Approx. 2,300mm	
– Wheel base	Approx. 3,400mm	
– Tire	Depend on manufacturer standard (ref. 215/75R17.5)	
(3) Engine		
– Type	Water-cooled, 4-cycle, diesel engine	
– Max. output	Not less than 130PS	
(4) Attachments		
– Body volume	Approx. 5m^3	Arm lifting device for 0.6m^3 container (European S.T.D EN840-2)
– Hopper volume	Approx. 0.6m^3	
– Container lift	Lifting capacity : 350kg	
4. 1.1m^3 Container	All-steel welded construction European S.T.D Type	
(1) Dimensions		
– Overall length	Approx. 1,360mm	
– Overall width	Approx. 1,080mm	
– Overall height	Approx. 1,200mm	
(2) Body volume	1.1m^3 (Net 0.8-0.9m^3)	
(3) Weight	Approx. 120kg	
5. 0.6m^3 Container	All-steel welded construction European S.T.D Type	
(1) Dimensions		
– Overall length	Approx. 1,360mm	
– Overall width	Approx. 765mm	
– Overall height	Approx. 1,100mm	
(2) Body volume	0.6m^3	
(3) Weight	Approx. 90kg	

Item	Specifications	Note
II. Disposal Equipment		
1. Bulldozer	165PS Bulldozer	
(1) Dimensions		
– Overall length	Approx. 5,300mm	
– Overall width	Approx. 2,500mm	
– Overall height	Approx. 3,200mm	
– Ground clearance	Approx. 380mm	
(2) Blade	Semi-U tilt type, trash rack	
(3) Operation weight	Approx. 20,000kg	
(4) Engine		
– Type	Direct injection, 4-cycle, water cooled, diesel	
– Max. output	Not less than 165PS	
– Max. forward speed	Approx. 11km/h	
(5) Track		
– Type	Sealed and lubricated tracks	
– Width	Approx. 560mm	
(6) Attachments		
– Cab	ROPS canopy steel cab	
– Air conditioner		
– Engine hood with side covers		
– Radiator guard		
– Trash rack	Height : Approx. 500mm	
2. Excavator	0.8m^3 Bucket Type	
(1) Dimensions		
– Shipping length	Approx. 9,400mm	
– Shipping height	Approx. 2,900mm	
– Shipping overall width	Approx. 2,800mm	
– Ground clearance	Approx. 450mm	
– Pipping depth	Approx. 6,600mm	
– Leaching length	Approx. 9,700mm	
– Cutting height	Approx. 9,400mm	
– Loading height	Approx. 6,500mm	
(2) Bucket	0.8m^3 (SAE heaped)	
(3) Weight	Approx. 20,000kg	
(4) Engine		
– Type	Direct injection, 4-cycle, water cooled	
– Maximum output	Not less than 130PS	
(5) Track		
– Type	Sealed and lubricated	
– Width	Not less than 600mm	
(6) Others		
– Cab	Steel, air-condition	
– Breaker	Hydraulic breaker and quick hydraulic changer	

Item	Specifications	Note
3. Track Loader	120PS class	
(1) Dimensions		
– Overall length	Approx. 6,000mm	
– Overall height	Approx. 3,100mm	
– Overall width	Approx. 2,150mm	
– Ground clearance	Approx. 360mm	
(2) Bucket	Approx. 1.8m^3	
(3) Weight	Approx. 15,000kg	
(4) Engine		
– Type	Direct injection, 4-cycle, water cooled, turbo charged, diesel engine	
– Flywheel power	Not less than 120PS	
(5) Track		
– Type	Sealed and lubricated	
– Shoe width	Approx. 400mm	
(6) Cab	ROPS, steel, air-condition	
4. 8ton Dump Truck		
(1) Main Specifications		
– Type of vehicle	8ton Dump Truck	
– Steering wheel	Left-hand, forward control	
– Traction	4×2 rear traction	
– Max. payload	Not less than 8,000kg	
– Gross vehicle weight	Not less than 14,500kg	
(2) Dimensions		
– Overall length	Approx. 7,500mm	
– Overall width	Approx. 2,500mm	
– Overall height	Approx. 3,000mm	
– Wheel base	Approx. 4,200mm	
– Min. turning radius	Approx. 6,300mm	
– Tire	Depend on manufacturer standard. (Ref. 315/80R22.5)	
(3) Engine		
– Type	Water-cooled, 4-cycle, diesel engine	
– Max. output	Not less than 210PS	
(4) Attachments		
– Body volume	5m^3	

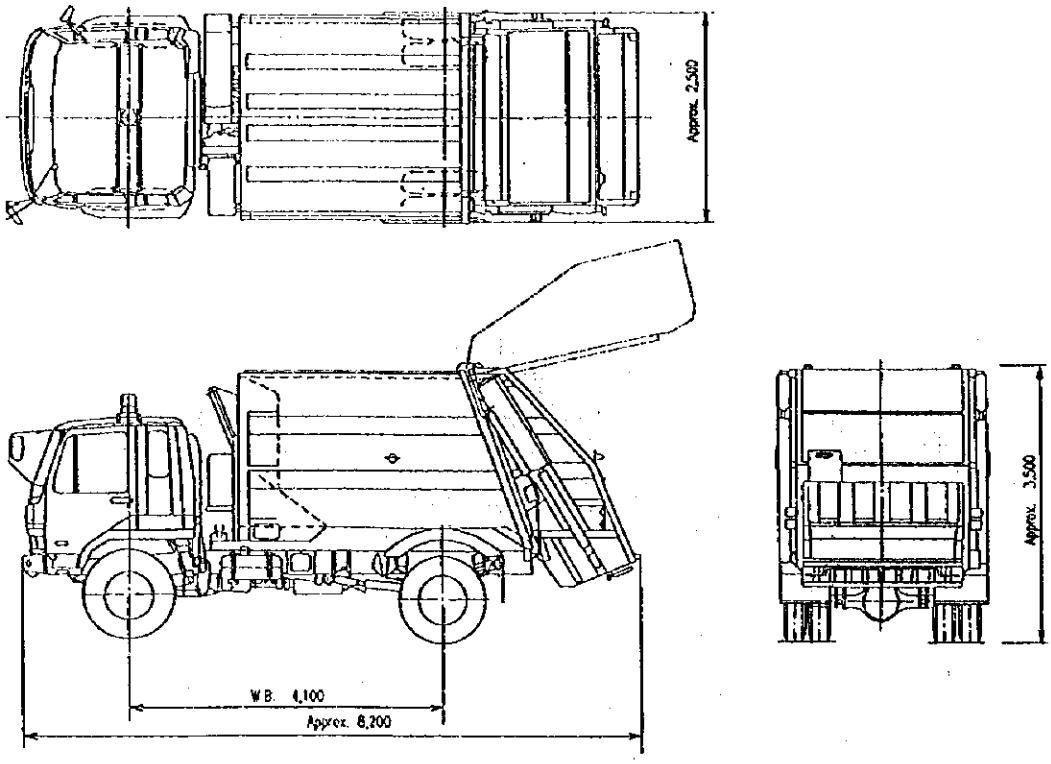


Fig. 2.3.3 12 m^3 Compactor Truck

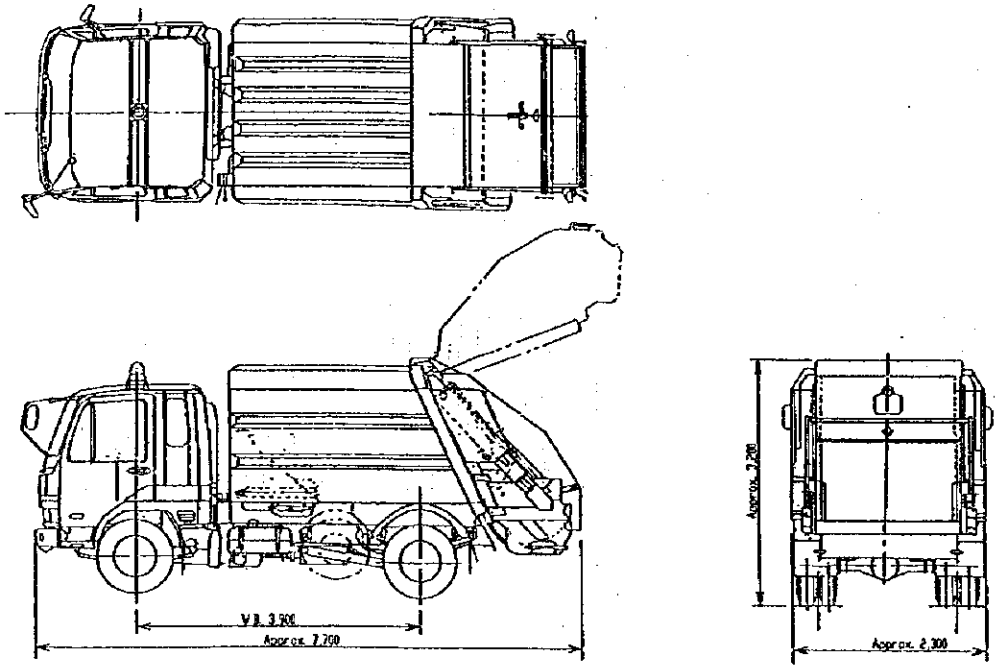


Fig. 2.3.4 8 m^3 Compactor Truck

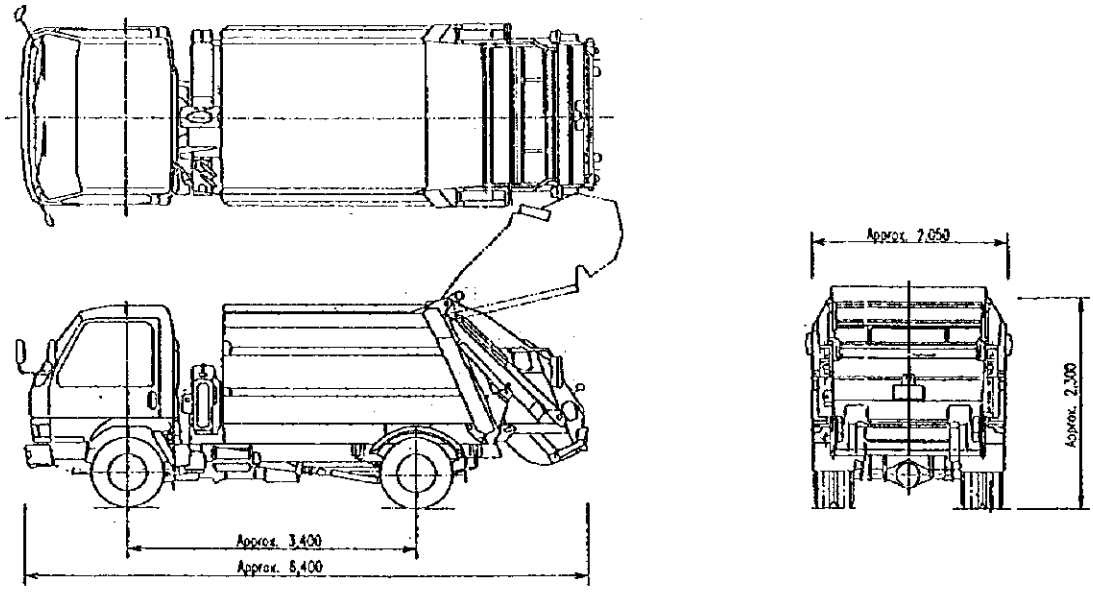


Fig. 2.3.5 5 m^3 Compactor Truck

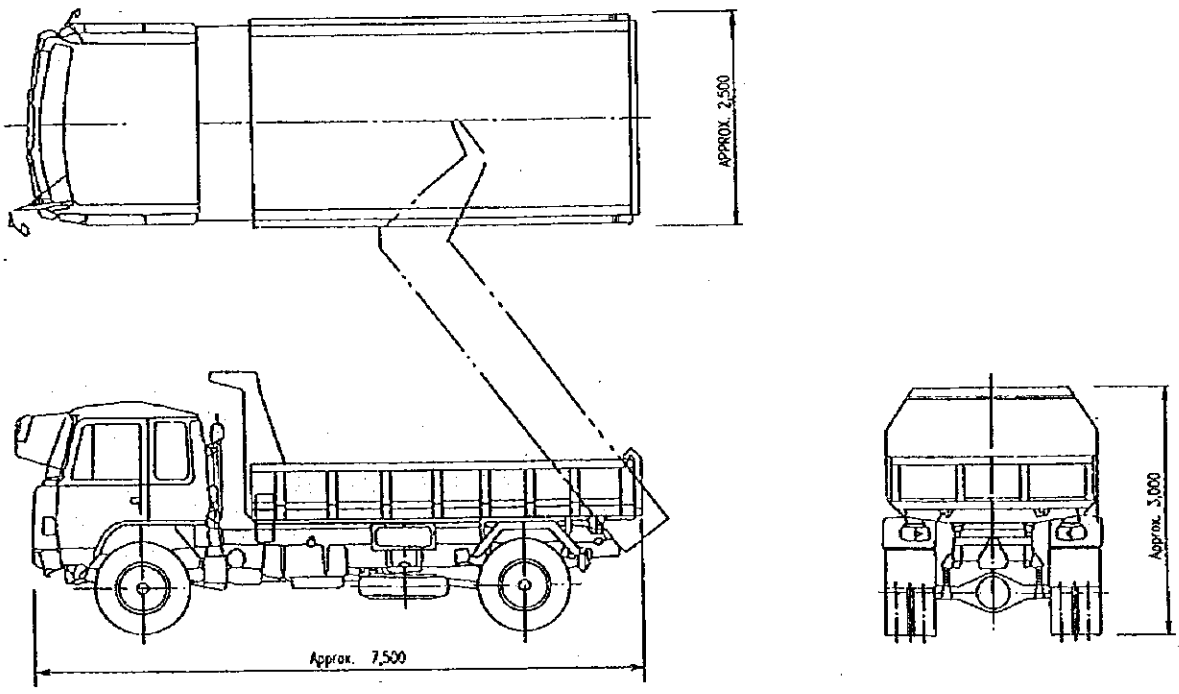


Fig. 2.3.6 8 ton Dump Truck

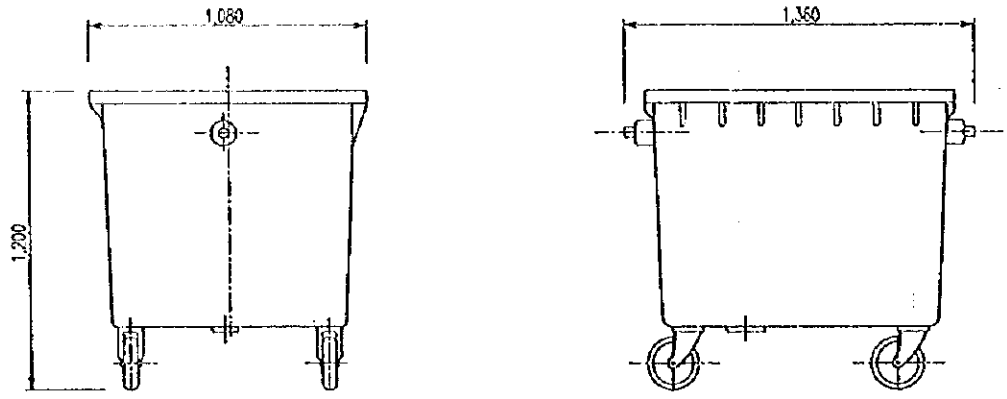


Fig. 2.3.7 1.1 m^3 Container

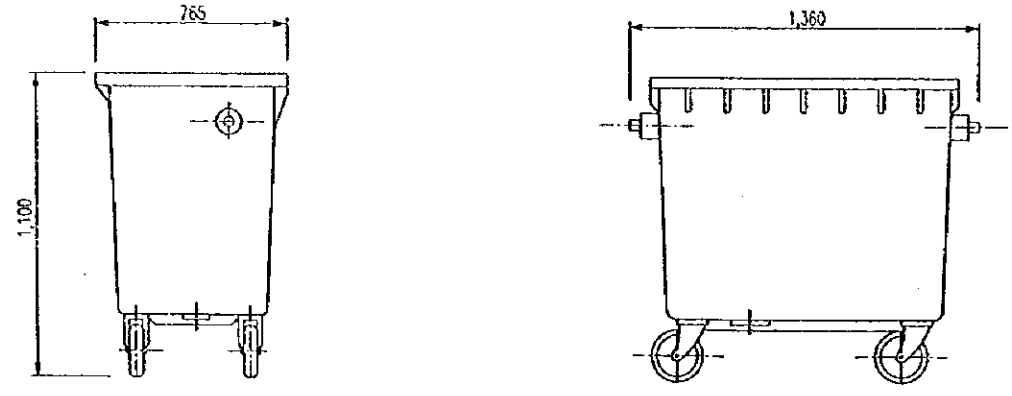


Fig. 2.3.8 0.6 m^3 Container

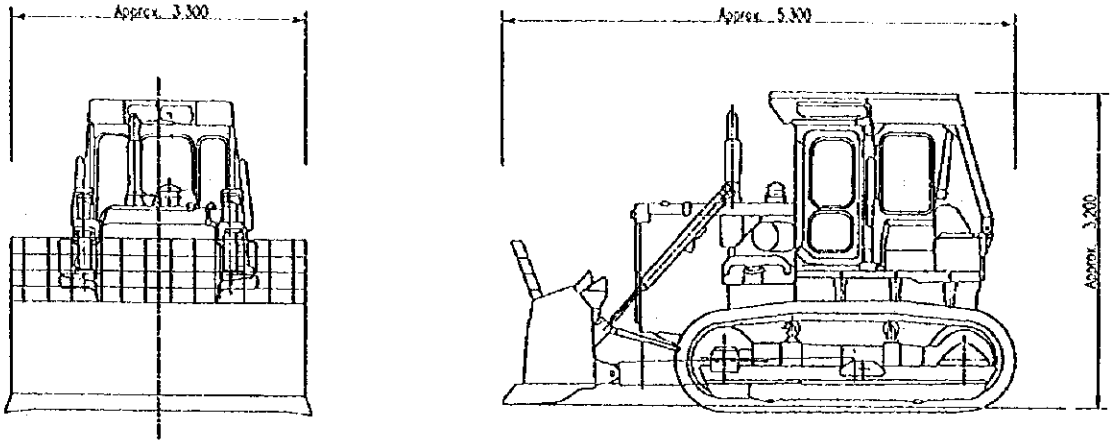


Fig. 2.3.9 165PS Bulldozer

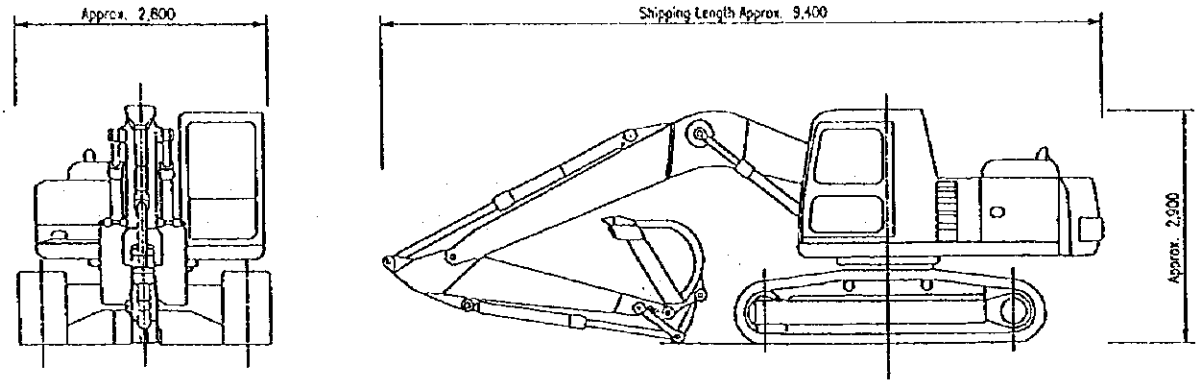


Fig. 2.3.10 0.8 m^3 Excavator

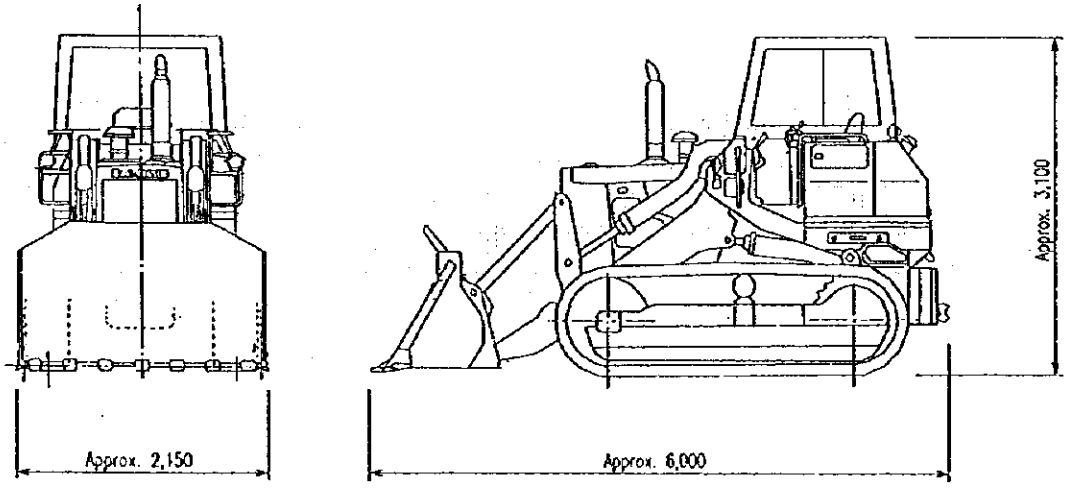


Fig. 2.3.11 120PS Track Loader

Chapter 3 Implementation Plan

3.1 Implementation Plan

3.1.1 Implementation Concept

The Project will be implemented within the framework of Japan's Grant Aid System and will formally commence with the Exchange of the Notes (E/N) between both Japan and the PA upon approval of the Project by the Government of Japan. The PA will then select the Consultant (Japanese firm) to prepare the tender document and to assist the tender process for procurement of equipment. With the completion of the tender documents, the Contractor (a Japanese Firm) which is the successful bidder, will conduct the assigned work and supply the vehicles and equipment. The basic principles and points to note for the implementation of the Project are explained below.

(1) Project Implementing Body

The Responsible Agency of the Project on the PA side will be the Ministry of Planning and International Cooperation and the Ministry of Local Government. Implementing Agency of the Project on the PA side will be the Ministry of Local Government, targeted 160 municipalities/villages comprising 68 joint service group, and 5 major cities (Jenin, Toubas, Tulkarem, Jericho and Ramallah) operating regional disposal sites. It will be necessary for the PA to appoint a key person responsible for the implementation of the Project in order to maintain close communication and consultation with the Japanese Consultant and the Contractor to ensure the Project's successful progress.

This key person must ensure that all the parties concerned of this Project may successfully implement their responsibility by explaining and answering their questions, and provide all possible assistance for the smooth progress of the Project.

(2) Consultant

The Consultant (a Japanese firm) selected by the PA will enter into a design and work supervision agreement with the PA to proceed to the equipment procurement stage of the Project. The consultant will prepare the tender document for the equipment to be procured under Japan's grant aid and will then supervise the procurement process. The Consultant will also conduct the tender process in accordance with the contract between the PA and the Consultant.

(3) Contractor

The Contractor, a Japanese firm, selected by open tender according to the procedure of the Japan's grant aid system, will procure and supply the equipment. Also, the Contractor will provide following training for staffs nominated by the PA to level up their maintenance capability.

a. Training of mechanics at authorized dealer of manufacturer
b. Training of operator and mechanics at the time of delivery

As the vehicles and heavy equipment will require the supply of spare parts and the provision of after-service in the case of breakdown following the completion of the Project, the Contractor should pay close attention to the need to establish communication links between the recipient side and the Contractor after the delivery of the equipment..

(4) Necessity of Dispatch of Japanese Engineers

This Project is for procurement of equipment consisting of collection vehicles and disposal site equipment supplied to the implementing agencies of the Project. Therefore, there are no installation work. However, it will be necessary to dispatch an engineer for the training of staffs of implementing agencies at the time of delivery about one month. In this training methods of inspection and maintenance will be lectured and practiced for the collection vehicles and disposal sites equipment.

3.1.2 Implementation Conditions

(1) Conditions of the Procurement in the PA

Conditions of the procurement of vehicles and heavy equipment in the PA are as follows.

① There are no manufacturers of vehicles and heavy equipment in the PA.
② There are several manufacturer of similar container in the PA
③ As the PA adopts same regulations and standards of Israeli for vehicles, collection vehicle and dump truck to be procured shall meet these regulations and standards.
④ There are several Agents of vehicles and heavy equipment manufacturers in the PA. They have workshops for maintenance and repair of vehicles and equipment and can provide sufficient after-service.

(2) Points to Note

1) The equipment to be procured in the Project is not manufactured in the PA. Therefore it shall be procured from Japan or third countries. Specially, collection vehicles and dump trucks shall meet regulations and standards in Israeli.
2) It is desirable to choose vehicles and equipment commonly used in the PA considering proper maintenance and operation, and also training of staffs.
3) Procurement of standardized vehicles shall be considered as much as possible, in order to ensure ease of operation and maintenance.

3.1.3 Scope of Works

The division of work between the Japanese side and the PA side is as follows.

(1) Works by the Japanese Side
1) Procurement of collection vehicles and containers
2) Procurement of disposal site equipment

3) Procurement of spare parts for the above

(2) Items to be borne by the PA Side

1) Construction of garages for collection vehicles and disposal site equipment
2) Improvement of regional disposal sites
3) Construction of Toubas and Tulkarem disposal sites
4) Construction of regional workshops and a central warehouse of spare parts

3.1.4 Consultant Supervision

In according with the Japan Grant Aid System, the consultant will organize a project team to conduct the preparation of tender documents and work supervision, taking all the basic design principals into consideration. At the work supervision, the consultant will also dispatch an engineer to advice for follow-up works to be done by the recipient country.

(1) Basic Principal of Consultant Supervision

The consultant will adopt the following principal to fulfill his responsibility to supervise and guide the Contractor in view of the punctual and safe completion of the Project related work within the planned period. The scope of work for the Consultant is shown in Table 3.1-1.

Table 3.1.1 Contents of Consultant Work in the Project
(conducted in each phase)

1.	Pre-supply stage	Preparation of tender documents Assistance of tender process Evaluation of tender results Contract work assistance
2.	Supply stage	Supervision of procurement Inspections Report preparation, etc.

1) Schedule Control

a) The Consultant shall ensure that the Contractor always checks the progress of manufacture and delivery of the equipment against the original plan to ascertain the state of work progress.
b) The consultant shall control each work item on a monthly basis so that the Contractor adheres to the contracted work schedule.

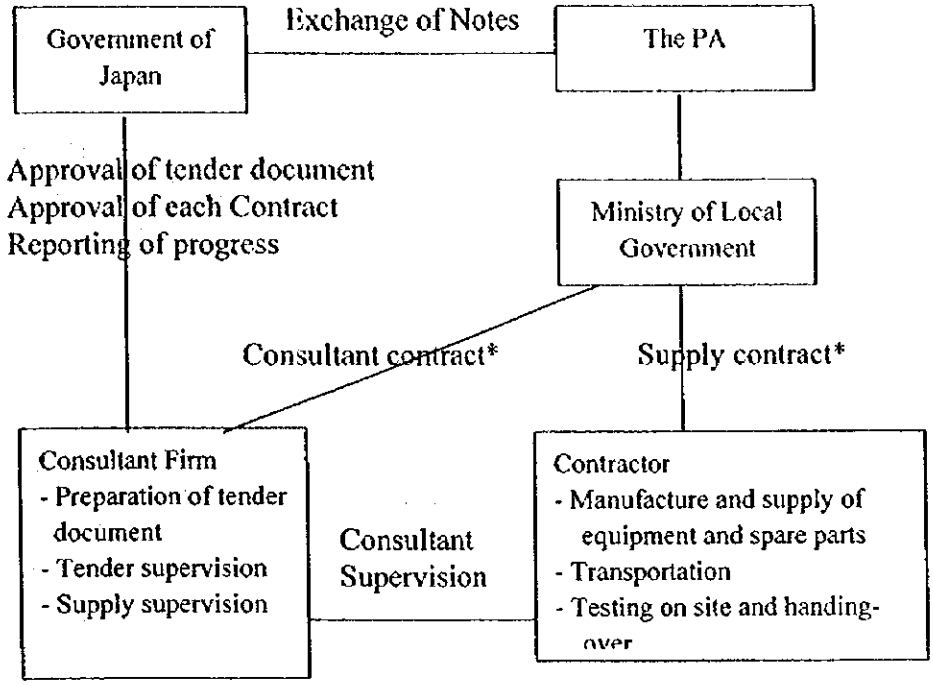
2) Quality Control

a) The Consultant shall confirm that the specifications and quality of equipment and materials to be procured meet the requirements specified in the detailed design documents.
b) The Consultant shall witness the quality inspections and various performance tests in connection with the equipment to be procured at the completion of manufacturing

work.

(2) Work Supervision System

The system to supervise the actual procurement process and the involvement of the related organizations are shown in Figure 3.1-1.



*Note: Consultant contract and Supply contract require the official approval of the Government of Japan

Fig.3.1.1 Project Implementation Relationship Chart

3.1.5 Procurement Plan

Since the collection vehicles and disposal equipment to be procured under this Project are not manufactured in the PA, the equipment will be procured from Japan and/or third countries taking into consideration all the required standards, specifications, quality, stable supply, production volume and supply stability, delivery time and ease of operation and maintenance. Spare parts of equipment, these shall also be procured from Japan and third country. Containers will be procured from the PA

3.1.6 Implementation Schedule

In the case that the Project is extended to the implementation stage with grant aid provided by the Government of Japan, the actual procurement will be conducted in two stages following the signing of E/N, i.e., (i) tender process and signing of the supply contract, and (ii) actual procurement.

(1) Tender and Contract

As soon as the E/N has been signed, the Japanese Consultant will conclude a consultant agreement with the PA side and commence to prepare tender documents for the procurement.

The consultant will announce the tender, hold a tender explanation meeting and distribute the tender documents to the prospective bidders on behalf of the PA. Upon receipt of bid prices and application documents, the Consultant will promptly examine them to facilitate the contract between the PA and Japanese contractor. The tender will be witnessed by all applicants and representatives of related organizations. If the contents of the bid with the lowest price are assessed as being appropriate, the bid will be accepted and the bidder will conclude a contract with the PA.

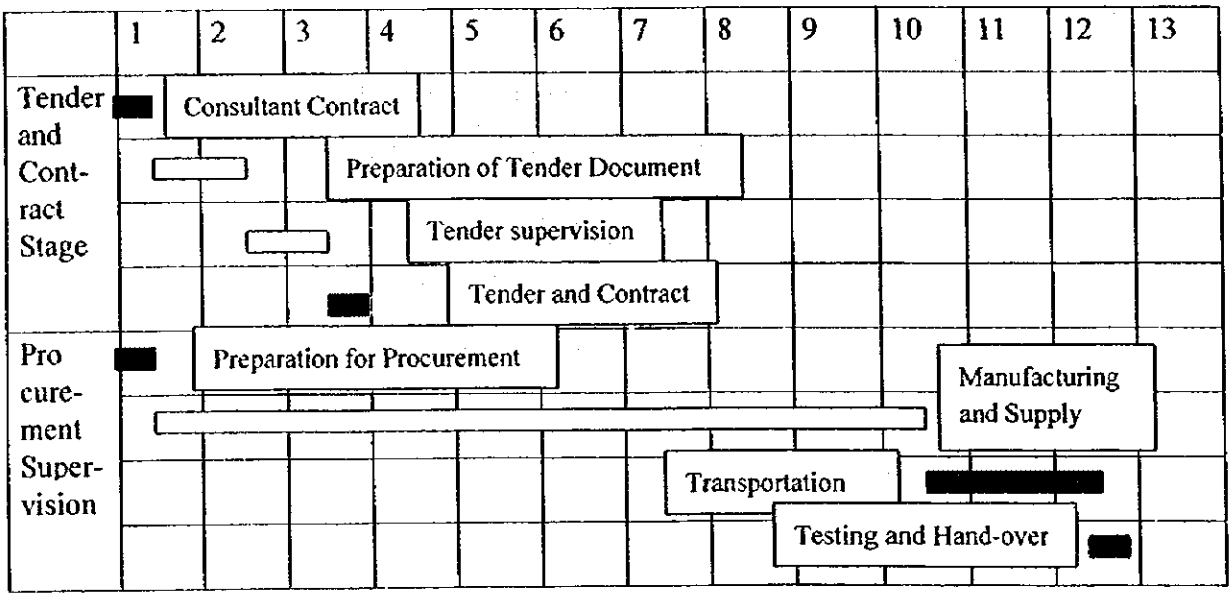
The time required from tender announcement to signing of the procurement contract is expected to be 1.0 month.

(2) Procurement of Equipment

Following signing of the supply contract and its official approval by the Government of Japan, the contractor will commence the procurement work. It is predicted that, considering of the size of this Project, it will take 12 months, if procurement of equipment and works to be done by the PA side are smoothly carried out.

The consultant will conduct detailed arrangements prior to the commencement of the procurement work, and supervise the Contractor in regard to the manufacturing, transportation of equipment and work schedule, etc. The Consultant will also enforce schedule control, as well as quality control, in order to complete the entire work within the period stipulated in the E/N. The Project implementation schedule is shown in Table 3.1-2.

Table 3.1.2 Project Implementation Schedule



3.1.7 Work to be Undertaken by Recipient Country

The items to be undertaken by the PA side are as follows:

1) to provide necessary data and information for the Project;
2) to construct a garage for the equipment supplied under the Project;
3) to improve regional disposal sites.(Jenin, Jericho and Ramallah);
4) to improve regional disposal sites and preparation of equipment for covering soil (Salfit, Nablus and Hebron);
5) to construct Toubas and Tulkarem disposal sites;
6) to construct regional workshops (Jenin, Ramallah, Bethlehem and Hebron) and a central warehouse of spare parts (Ramallah) ;
7) to implement proper soil covering using supplied equipment;
8) to secure a budget for operation and maintenance following Project implementation;
9) to secure personnel to operate and maintain the equipment supplied under the Project;
10) to maintain properly and effectively the equipment supplied under the Project;
11) to support prompt unloading and customs clearance of the equipment supplied under the Project;
12) to tax exemptions and provide necessary conveniences for the equipment supplied and Japanese nationals dispatched under the Project;
13) to support customs duty exemptions for the equipment supplied under the Project;
14) to bear payment commissions and expenses for opening an account with a Japanese foreign exchange bank; and
15) to bear all expenses other than those covered by the Grant, necessary for the execution of the Project.

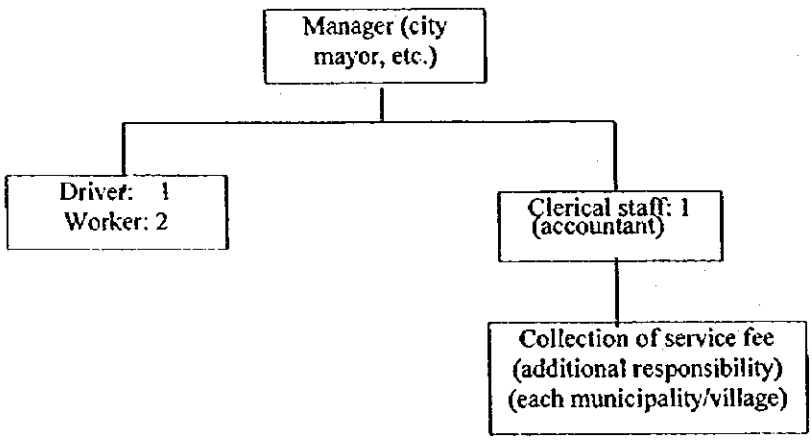
3.2 Operation and Maintenance Plan

3.2.1 Organization for Operational and Maintenance

(1) Solid Waste Collection

Waste collection equipment will be operated by each joint service group. For this purpose, a garage will be constructed at a representative municipality/village within each group, where the said equipment will be kept. Subsequent operation of the waste collection equipment would then be carried out jointly by the group centering on the representative municipality/village. Also, equipment operation and maintenance costs would be borne jointly by the group, with a service charge (including waste collection and disposal cost, and equipment operation and maintenance cost) being collected in each municipality/village corresponding to service population and waste volume. To achieve this, the following operational structure must be established.

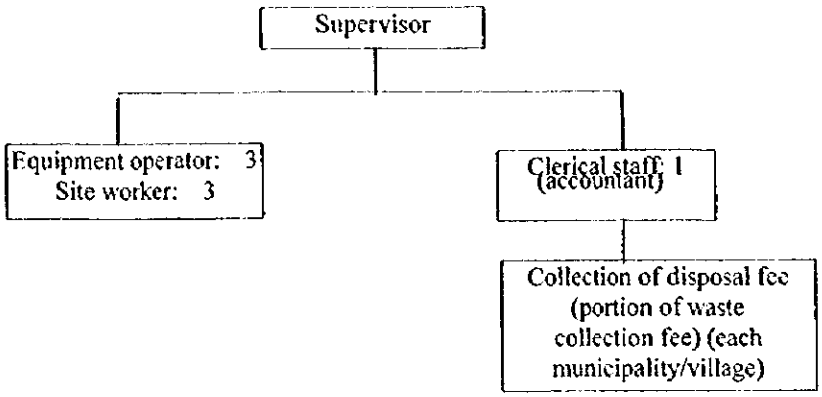
Figure 3.2.1 ***Waste Collection Organization (groups with a single waste collection vehicle)***



(2) Disposal Site

Disposal site equipment will be operated by the major municipality which manages the regional disposal site. Since the municipalities/villages using the regional disposal sites will be charged a disposal charge depending on waste volume, the following operational structure is necessary.

Figure 3.2.2 *Disposal Site Organization (Jenin, Ramallah)*

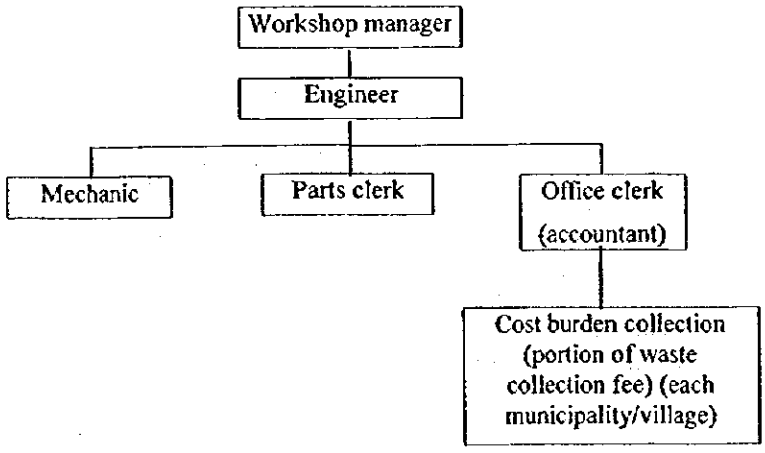


(3) Workshop

Four regional workshops; Jenin, Ramallah, Bethlehem and Hebron, will be jointly managed by the Ministry of Local Government and the relevant major municipalities. The workshops at Nablus and Jericho are operated by the respective municipality. Spare parts will be kept at the central warehouse in Ramallah and supplied to the workshops on an as-needed basis.

Work performed at the workshops will comprise mainly regular inspection/maintenance and minor and medium scale repairs. Overhaul, body work and other major repairs will be subcontracted to the private sector. The necessary organization for operation of the workshops and parts management is as follows:

Figure 3.2.3 *Workshop Organization*



3.2.2 Maintenance Plan

(1) Basic Strategy

Among the executing agencies, there are currently only 7 municipalities/villages with waste collection vehicles on hand, and only 18 municipalities/villages with agricultural-use tractors on hand. These municipalities/villages subcontract maintenance for this equipment to nearby private repair shops. In almost all cases, other municipalities/villages rent agricultural-use tractors for waste collection, and engage in virtually no vehicle or construction equipment maintenance. As a result, the PA is pursuing a plan to establish regional workshops.

In the case of the equipment to be procured under the Project, it is concluded that effective operation and maintenance is possible through preventive maintenance corresponding to the type of mandatory regular and annual vehicle inspection carried out in Japan. Accordingly, vehicle maintenance would be carried out in the following three stages, centering mainly on the planned regional workshops.

Daily inspection:	to be performed by the driver, or at a nearby private vehicle repair shop
Regular inspection and minor repairs:	at the planned regional workshops
Major repairs:	subcontracted to the private workshops (manufacturer's agent)

The purpose of regular inspection is not only to constantly maintain vehicles in good operating condition, but also to minimize vehicle damage by identifying causes of potential malfunction as early as possible. From this standpoint, a preventive, regular inspection and maintenance system is to be adopted equipment procured under the Project. At the time of equipment supply as well, inspection and repair manuals will be provided and instruction given in maintenance procedures.

(2) Maintenance Work Content

In the case of vehicle maintenance in Japan, there is a legally mandatory inspection and maintenance framework established by the Ministry of Transportation which specifies the content for monthly, quarterly and annual inspection and maintenance procedures. Under this Project as well, a similar type framework will be the basis for planned maintenance work content given the fact that the equipment supplied is intended for public waste collection service. Since the operational conditions affecting each vehicle will be different, however, inspection and maintenance will be carried out in line with specified running distance rather than stipulated time period.

a. Vehicles

The maintenance work recommended for regular execution with regard to vehicles (compactor trucks, dump truck) is as shown in Table 3.2.1.

Table 3.2.1 *Maintenance Work for Vehicles*

No.	Item	Running distance	Maintenance content
1.	Minor maintenance	Approx. every 3,000 km	Lubrication, inspection and adjustment where necessary of power train, hydraulic systems, electrical parts and wheel, axle and suspension system. This preventive maintenance is particularly important.
2.	Medium scale maintenance	Approx. every 12,000 km	Although wear, deformation, cracking, breakage, etc. may not occur in a uniform manner for the various vehicle parts depending on operational conditions, medium scale maintenance is to be carried out approx. every 12,000 km. This would comprise adjustment, repair and part replacement for engine, power transmission system, wheel, axle and suspension system, and all hydraulic systems. Given the nature of the required equipment for this maintenance work, it will be necessary to bring the vehicle to the appropriate repair shop. Also, body hydraulic mechanism maintenance, metal surface painting works, etc. would be carried out where necessary.
3.	Major maintenance	Approx. every 36,000 km	Maintenance content is basically the same as that for medium scale maintenance. However, particular attention would be given to brakes, clutch lining and wheel, axle and suspension systems (particularly springs).

b. Construction Machinery

In the case of construction machinery (bulldozer, backhoe, truck-loader, etc.), inspection and maintenance would be carried out for every 50 hours and 250 hours of operation, respectively, in addition to the regular daily equipment check. This inspection and maintenance must be performed in line with the maintenance framework for each specific type of equipment.

Table 3.2.2 *Maintenance Work for Construction Machinery*

No.	Item	Inspection / maintenance content
1.	Daily inspection / maintenance	Upon completion of operation each day, the equipment operator would inspect, adjust, clean and lubricate the equipment, refuel, and add cooling water.
2.	Weekly inspection / maintenance (approx. every 50 hours of operation)	This would comprise inspection and maintenance which is not possible on a daily basis, oil change, element replacement, equipment lubrication, etc.
3.	Monthly inspection / maintenance (approx. every 250 hours of operation)	This would comprise further detailed inspection, adjustments, parts replacement, etc. not performed at the weekly maintenance level.

Although the utility life of equipment can vary greatly depending on conditions of actual use, both the vehicle and construction equipment supplied under the Project will require replacement every 8 years.

(3) Spare Parts

a. Spare parts will be prepared in two categories; one is regular replacement parts in accordance with running distance, the other is general repair/replacement of worn parts essential to sustain the equipment utility life and respond to extraordinary breakdown. Items and quantities for these spare parts would need to be constantly on hand in line with the regular maintenance plan as discussed previously.

b. Under the Project, the regular replacement parts and important spare parts for general repair, as discussed previously, are to be procured, corresponding to 50,000 km running distance (approximately two years worth) for vehicles, and 5,000 hours of operational time (approximately two years worth) for construction equipment.

Infrequently used repair parts, and parts only sporadically required in the case of accident, etc. are not included. The PA side will thus assume responsibility for the procurement of these as needed, as well as readying funding for purchase of spare parts to cover the period after exhaustion of the above spare parts component included under the Project (approximately 5% the main equipment price annually).

c. Spare parts for vehicles will be managed and kept at the central warehouse in Ramallah and will be distributed to the four regional workshops planned at Ramallah, Jenin, Hebron and Bethlehem. In the case of the Nablus and Jericho workshops, the parts will subsequently be supplied from the central warehouse on an as-needed basis. Also, parts for construction machinery will be managed at the central warehouse.

(3) Cost Burden Method

Each municipality/village must bear the cost for maintenance of waste collection equipment, and pay this cost to the respective workshop. To effect this, the workshops and municipalities/villages (groups) must enter into contract to ensure regular maintenance.

3.2.3 Required Personnel for Operation and Maintenance

Required personnel for operation and maintenance is as follows:

(1) Waste Collection

One driver and two workers will be necessary for each unit of waste collection vehicle. Also, one office clerical staff will be required in each group for accountant and service fee collection.

Groups requiring two or more collection vehicles, and corresponding number of necessary personnel are as follows:

Table 3.2.3 ***Necessary Personnel for Groups Requiring Two or More Collection Vehicles***

	Equipment quantity (no.)			Necessary staff (person)		
	5 m^3	8 m^3	12 m^3	Driver	Worker	Clerical
45. Al Ram		1	2	3	6	3
53. Al Dahreyah		2	1	3	6	3
54. Yatta		2	1	3	6	3
55. Doura		2		2	4	2
56. Eznna		2		2	4	2

Note: Equipment quantity for Al Ram includes existing equipment on hand.

(2) Disposal Site

Necessary personnel for the disposal sites is as follows:

Table 3.2.4 ***Necessary Personnel for Disposal Sites***

	Jenin	Ramallah	Toubas	Tulkarem	Jericho
Supervisor	1	1	1	1	1
Clerical	1	1	1	1	1
Site worker	3	3	1	1	1
Equipment operator	3	3	1	1	1
Total	8	8	4	4	4

(3) Workshop

The planned workshops are primarily intended for the maintenance of equipment procured under assistance from Spain, and it will accordingly be necessary to secure staff to respond to the increase in equipment quantities under the Project. The additional personnel required at each workshop in order to maintain the equipment procured by this Project are computed according to the criteria indicated below, and results are as shown in Table 3.2.5.

a. Work content at the workshops will comprise regular inspection/maintenance and minor and medium scale repairs. Overhaul, body work and other major repair work will be subcontracted to private repair shops.
b. Regular inspection/maintenance and repair will entail bringing in each unit of equipment two times per month.
c. Work time required on each unit of equipment brought in will be one day per time.
d. Operational days per month for each workshop is 25 days.
e. Number of mechanics for each unit of equipment brought in is 1.5 persons (3 persons per 2 units of equipment).

Table 3.2.5 Additional Personnel Required at Each Workshop

	Ramallah	Jenin	Hebron	Bethlehem	Nablus	Jericho	Total
No. of equipment subject to maintenance (units)	18	16	16	8	13	2	76
No. of equipment brought in per month (units/mo.)	36	32	32	16	26	4	152
No. of equipment brought in per day (units/day)	1.4	1.3	1.3	0.6	1.0	0.2	
Necessary personnel:							
Engineer (persons)	1	1	1	0	1	0	4
Mechanic (persons)	3	2	2	1	2	1	11
Parts clerk (persons)	1	1	1	0	1	0	4
Total (persons)	5	4	4	1	4	1	19

3.2.4 Operation and Maintenance Cost

(1) Solid Waste Collection

Operating and maintenance cost for each collection vehicle is calculated according to the following conditions.

Condition of cost estimation for solid waste collection

a.	Depreciation	
	Utility life of equipment is determined as follows:	
	Waste collection vehicles:	8 years
	Containers:	5 years
b.	Personnel cost	
	Clerical:	NIS 2,000/month/person
	Driver:	NIS 2,000/month/person
	Worker.	NIS 1,500/month/person
	Overtime allowance: (driver and worker)	20% increase over hourly wage
c.	Fuel and lubricant cost	
	Diesel unit cost:	NIS 1.5/liter
	Fuel consumption rate:	0.048 liters/HP/hour
	Work time:	7 hours per day
	Lubricant cost:	20% of fuel cost
d.	Maintenance cost	
	5% of vehicle purchase cost	
e.	Other costs	
	5% of total cost excluding prime cost depreciation	

Results of computation according to the above criteria indicates an operation and maintenance cost per vehicle as Table 3.2.6

Table 3.2.6 Operating Cost per Vehicle (in the case of 7 hours of operation per day)

(NIS/month)

Vehicle type:	5 m³ compactor	8 m³ compactor	12 m³ compactor
Prime cost depreciation	3,422	5,005	6,042
Personnel cost	7,000	7,000	7,000
Maintenance cost	969	1,552	1,917
Fuel/lubricant cost	1,748	2,476	2,915
Other costs	386	451	492
Total O&M cost (excluding prime cost depreciation)	13,524 (10,102)	16,485 (11,480)	18,365 (12,323)

In order to achieve a 100% waste collection rate in 2004, however, overtime work by waste collection personnel will be necessary. The collection cost for each group with consideration to the necessary overtime cost for 100% collection rate, and per household cost (including disposal cost) are indicated in Table 3.2.11.

(2) Disposal Sites

Operating and maintenance cost for disposal sites is computed according to the following conditions:

Conditions of cost estimation for disposal site

a.	Depreciation	
	Utility life of construction equipment and dump trucks is 8 years.	
b.	Personnel cost	
	Supervisor:	NIS 2,500/month/person
	Clerical:	NIS 2,000/month/person
	Site worker:	NIS 1,500/month/person
	Equipment operator:	NIS 2,500/month/person
c.	Fuel and lubricant cost	
	Diesel unit cost:	NIS 1.5/liter
	Fuel consumption rate:	determined separately for each type of equipment
	Work time:	7 hours per day
	Lubricant cost:	20% of fuel cost
d.	Maintenance cost	
	5% of equipment purchase cost	
e.	Other costs	
	5% of total cost excluding prime cost depreciation	

Table 3.2.7 Operation and Maintenance Cost of Disposal Site

	Jenin	Ramallah	Toubas	Tulkarem	Jericho
Prime cost depreciation (NIS/month)	18,995	18,995	6,641	6,641	6,641
Personnel cost (NIS/month)	16,500	16,500	8,500	8,500	8,500
Maintenance cost (NIS/month)	7,198	7,198	2,656	2,656	2,656
Fuel & lubricant cost (NIS/month)	12,468	12,468	4,085	4,085	4,085
Other costs (5%) (NIS/month)	1,808	1,808	762	762	762
Total O&M cost (NIS/month)	59,969 (37,974)	59,969 (37,974)	22,644 (16,003)	22,644 (16,003)	22,644 (16,003)
Design waste volume (tons/day)	194.3	255.6	34.4	40.3	30.6
Unit cost per ton (NIS/month/(ton-day)	309 (195)	235 (149)	658 (465)	562 (397)	740 (523)
Population (persons)	277,563	365,154	49,080	43,750	43,750
Per household unit cost (NIS/month/household)	1.5(1.0)	1.1 (0.7)	3.2 (2.3)	2.8 (1.9)	3.6 (2.6)

Note: Figures in parentheses exclude prime cost depreciation.

Along with the waste collection cost, the service fee to cover the above cost must be collected and paid by each municipality/village (in proportion to population and waste volume) to the major municipality which manages the relevant disposal site.

(3) Workshops

Additional cost at each workshop for maintenance of equipment procured in the Project is computed according to the following conditions:

Condition of cost estimation for workshops

a.	Personnel cost	
	Engineer:	NIS 3,000/month/person
	Mechanic:	NIS 2,000/month/person
	Parts clerk:	NIS 2,000/month/person
b.	Parts cost:	NIS 200 each time one unit of equipment is brought in
c.	Other costs:	10% of the above costs

Table 3.2.8 ***Required Additional Operating Cost for Each Workshop***

	Ramallah	Jenin	Hebron	Bethlehem	Nablus	Jericho	Total
Personnel cost	11,000	9,000	9,000	2,000	9,000	2,000	42,000
Parts cost	7,200	6,400	6,400	3,200	6,400	800	30,400
Other costs	1,820	1,540	1,540	520	1,540	280	7,240
Total	20,020	16,940	16,940	5,720	16,940	3,080	79,640

Workshop cost is computed as a part of the waste collection fee under the category of maintenance. The total maintenance cost for the target municipalities/villages is as follows, from which each municipality/village will pay the appropriate cost to the relevant workshop. Also as discussed earlier, it will be necessary for municipalities/villages and workshops to enter into maintenance agreements to ensure full execution of regular equipment inspection and maintenance.

Table 3.2.9 Total Maintenance Cost for the Target Municipalities/villages

(NIS/month)

Vehicle type	No. of units	Unit maintenance cost	Total maintenance cost	Remarks
5 m^3 compactor truck	38	969	36,822	
8 m^3 compactor truck	30	1,552	46,560	
12 m^3 compactor truck	8*	1,917	15,336	
Total	76*		98,718	

Note: * includes the existing 1 unit of compactor truck at Al Ram

3.2.5 Cost Burden of Residents in Each Municipality/village

The required cost burden of residents in each municipality/village to cover the above operating cost (excluding prime cost depreciation) for waste collection equipment as well as disposal cost in 2004 is computed according to the following conditions.

Condition of estimation for cost burden by residents

a.	Population, and no. of family members per household	
	Population:	estimated population in 2004
	No. of family members per household:	7 persons
b.	Disposal cost	
	Jenin, Ramallah:	NIS 2/month/household
	Toubas:	NIS 3.2/month/household
	Jericho:	NIS 3.6/month/household
	Tulkarem Nablus, Salfit:	NIS 2/month/household
	Qalqiteah, Jerusalem, Bethlehem:	NIS 3/month/household
	Hebron:	NIS 2/month/household

The cost burden per household naturally increases with greater waste transport distance. It also increases the smaller the group size in comparison to the transport capacity of collection vehicles. On the other hand, the average ability to bear cost burden is considered at NIS 15/month.

In 2004, roughly half of the target groups under the Project will be able to achieve a 100% waste collection rate with the procured equipment. The remaining half of the municipalities/villages will require overtime work on the part of their personnel to achieve a 100% waste collection rate. Group-wise cost in order to effect a 100% waste collection rate in 2004 (including overtime cost) is as shown in Table 3.2.11, and it will be necessary to collect service charges from residents to cover this cost along with disposal cost.

Since the collectable service fee from residents is considered at NIS 15/month, it will be necessary in the case of the following 5groups to either further combine service with other municipalities/villages nearby, or require a higher cost burden by the residents in the said groups.

Table 3.2.10 ***Groups with High Cost Burden by Residents***

(NIS/household)

Municipality/village	Collection cost	Disposal cost	Total
11-15 Al-Jiftlek	12.2	3.6	15.8
21 Bait Tamer	12.2	3.0	15.2
27 Kuf Thuluth	14.0	3.0	17.0
42 Bait Doquo	26.1	3.0	29.1
61,63 Tayaseer	12.3	3.2	15.5

In the case of groups 27 and 61,63 cost burden per household is high; however, there is surplus equipment transport capacity. Nevertheless, since nearby groups are already of suitable size, it is recommended that new municipalities/villages to share service be identified in the adjacent area in order to reduce the cost burden per household. Group 42 as well exhibits surplus collection capacity given its small size. Furthermore, service fees greatly exceed the assumed ability of residents to pay. The PA side will accordingly need to effect appropriate measures to address this situation.

In the case of the 11-15 group, on the other hand, cost burden is high due to greater transport distance. It will thus be necessary to explore means of securing a funding source to cover this higher cost.

Table 3.2.11 Operation and Maintenance Cost of Each Group

Group No	Mun/Vil No.	Name of Municipality/Villa	Dis. km	Popu. 2004	Waste Amoun	Work hour	OM cost (NIS/month) Collectio	Disposal	Total	Unit cost/hh Coll.	Dis	Total
1	1,2	Baka Al-Shrqeah	28	8,200	6.1	5.8	11,141	3,280	14,421	9.5	2.8	12.3
2	3,4	Der Al-Ghosoun	18	10,755	6.2	7.7	10,974	4,302	15,276	7.1	2.8	9.9
3	5,6	Ellar	29	11,545	6.7	6.6	11,433	4,618	16,051	6.9	2.8	9.7
4	7,8	Ateel	23	14,756	8.6	7.4	12,085	5,902	17,988	5.7	2.8	8.5
5	9,10,11	Kofur Jammal	13	6,174	3.6	3.9	9,394	2,470	11,864	10.7	2.8	13.5
6	12,13,14	Faroun	8	6,070	3.5	3.9	9,377	2,428	11,805	10.8	2.8	13.6
	Sub total			57,500	34.7		64,405	23,000	87,405	7.8	2.8	10.6
7	15,16	Roujeeb	6	6,784	3.9	4.3	9,495	1,938	11,433	9.8	2.0	11.8
8	17-19	Salim	7	12,552	7.3	8.0	11,322	3,586	14,909	6.3	2.0	8.3
9	20-23	Sabastea	19	10,524	6.8	5.3	10,963	3,007	13,970	7.3	2.0	9.3
10	24,25	Borqa	30	6,804	4.0	6.3	10,015	1,944	11,959	10.3	2.0	12.3
	Nablus	Total		36,664	22.0		41,795	10,475	52,270	8.0	2.0	10.0
11-15	26-30	Al-Jiftlek	47	6,670	3.9	8.2	11,609	3,430	15,039	12.2	3.6	15.8
16	31,32	Al-Ouja	22	6,160	3.6	4.8	9,628	3,168	12,796	10.9	3.6	14.5
	Sub total			12,830	7.4		21,237	6,598	27,835	11.6	3.6	15.2
17	33	Al-Obaydya	10	11,536	6.7	7.3	10,572	4,944	15,516	6.4	3.0	9.4
18	34-36	Al-Shawawreh	16	9,700	5.6	6.6	10,090	4,157	14,247	7.3	3.0	10.3
19,22	37,38,47	Hosan	26	12,536	7.3	6.7	11,467	5,373	16,839	6.4	3.0	9.4
20	39-43 +160-162	Jouret Al-Shamma	30	7,985	4.6	7.4	10,628	3,422	14,051	9.3	3.0	12.3
21	44,45	Bait Tamer	18	5,380	3.1	3.8	9,372	2,306	11,678	12.2	3.0	15.2
23	49	Tekoa	24	9,729	5.6	5.0	10,836	4,170	15,005	7.8	3.0	10.8
24	50	Bait Fajar	35	11,785	6.8	7.5	12,192	5,051	17,242	7.2	3.0	10.2
25	51,52	Nahaleen	31	8,228	4.8	7.8	11,093	3,526	14,619	9.4	3.0	12.4
	Sub totoal			76,879	44.6		86,249	32,948	119,197	7.9	3.0	10.9
26	53-58	Hajeh	16	11,213	6.5	7.6	10,881	4,806	15,687	6.8	3.0	9.8
27	59	Kofur Thuluth	8	4,567	2.7	2.9	9,127	1,957	11,085	14.0	3.0	17.0
28,30	60,61,68	Kofur Qudoom	17	6,737	3.9	4.6	9,584	2,887	12,471	10.0	3.0	13.0
29,31	62-67,69	Habla	14	9,791	5.7	6.2	9,996	4,196	14,193	7.1	3.0	10.1
32	70-75	Jayos	10	7,477	4.3	4.7	9,612	3,204	12,817	9.0	3.0	12.0
	Sub total			39,785	23.1		49,201	17,051	66,252	8.7	3.0	11.7
33	76,77	Bait Laqeah	29	11,289	6.6	6.5	11,378	3,225	14,603	7.1	2.0	9.1
34	78,79,80	Nalcen	24	8,365	4.9	6.9	10,184	2,390	12,574	8.5	2.0	10.5
35	81-83	Qubeah	30	11,228	6.5	6.5	11,397	3,208	14,605	7.1	2.0	9.1
36	84	Banizaid Al-	29	6,420	3.7	5.8	9,885	1,834	11,719	10.8	2.0	12.8
37	85-87	Ranties	36	7,373	4.3	7.7	10,996	2,107	13,103	10.4	2.0	12.4
38	88-90	Al-Tahta	25	9,775	5.7	8.3	11,679	2,793	14,471	8.4	2.0	10.4
39	91-93	Kofur Neamah	22	8,038	4.7	6.3	10,012	2,297	12,309	8.7	2.0	10.7
40	94-96	Al-Mazraa Al-	14	10,180	5.9	6.5	10,059	2,909	12,968	6.9	2.0	8.9
	Sub total			72,668	42.1		85,591	20,762	106,353	8.2	2.0	10.2
41	97	Anata	19	10,416	6.0	6.6	10,100	4,464	14,564	6.8	3.0	9.8
42	98,99	Bait Doquo	36	2,572	1.5	1.7	9,594	1,102	10,697	26.1	3.0	29.1
43	100-102	Bait Souriek	35	6,134	3.6	6.2	10,001	2,629	12,630	11.4	3.0	14.4
44	103	Beir Nabala	28	6,648	4.9	4.7	10,732	2,849	13,581	11.3	3.0	14.3
45	104	Al Ram	28	37,094	27.5	7.3	37,635	15,897	53,533	7.1	3.0	10.1
46,47	105-107	Al-Sawahreh Al-Sharqeah	7	20,914	12.1	8.3	13,265	8,963	22,228	4.4	3.0	7.4
48	108,109	Al-Jeeb	38	9,711	5.6	6.6	11,419	4,162	15,581	8.2	3.0	11.2
49	110,111	Katanh	36	10,382	6.0	6.7	11,464	4,449	15,913	7.7	3.0	10.7
	Sub total			103,871	67.2		114,210	44,516	158,726	7.7	3.0	10.7

Table 3.2.11 Operation and Maintenance Cost of Each Group

Group No	Mun/Vil No.	Name of Municipality/Villa	Dis. km	Popu. 2004	Waste Amoun	Work hour	OM cost (NIS/month)			Unit cost/hh		
							Collectio	Disposal	Total	Coll.	Dis	Total
1	1,2	Baka Al-Shrqeah	28	8,200	6.1	5.8	11,141	3,280	14,421	9.5	2.8	12.3
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3	5,6	Ellar	29	11,515	6.7	6.6	11,433	4,618	16,051	6.9	2.8	9.7
4	7,8	Ateel	23	14,756	8.6	7.4	12,085	5,902	17,988	5.7	2.8	8.5
5	9,10,11	Kofur Jammal	13	6,174	3.6	3.9	9,394	2,470	11,864	10.7	2.8	13.5
6	12,13,14	Faroun	8	6,070	3.5	3.9	9,377	2,428	11,805	10.8	2.8	13.6
	Sub total			57,500	34.7		64,405	23,000	87,405	7.8	2.8	10.6
7	15,16	Roujeeb	6	6,784	3.9	4.3	9,495	1,938	11,433	9.8	2.0	11.8
8	17-19	Salim	7	12,552	7.3	8.0	11,322	3,586	14,909	6.3	2.0	8.3
9	20-23	Sabastea	19	10,524	6.8	5.3	10,963	3,007	13,970	7.3	2.0	9.3
10	24,25	Borqa	30	6,804	4.0	6.3	10,015	1,944	11,959	10.3	2.0	12.3
	Nablus	Total		36,664	22.0		41,795	10,475	52,270	8.0	2.0	10.0
11-15	26-30	Al-Jiftlek	47	6,670	3.9	8.2	11,609	3,430	15,039	12.2	3.6	15.8
16	31,32	Al-Ouja	22	6,160	3.6	4.8	9,628	3,168	12,796	10.9	3.6	14.5
	Sub total			12,830	7.4		21,237	6,598	27,835	11.6	3.6	15.2
17	33	Al-Obaydya	10	11,536	6.7	7.3	10,572	4,944	15,516	6.4	3.0	9.4
18	34-36	Al-Shawawreh	16	9,700	5.6	6.6	10,090	4,157	14,247	7.3	3.0	10.3
19,22	37,38,47	Hosan	26	12,536	7.3	6.7	11,467	5,373	16,839	6.4	3.0	9.4
20	39-43 +160-162	Jouret Al-Shamma	30	7,985	4.6	7.4	10,628	3,422	14,051	9.3	3.0	12.3
21	44,45	Bait Tamer	18	5,380	3.1	3.8	9,372	2,306	11,678	12.2	3.0	15.2
23	49	Tekoa	24	9,729	5.6	5.0	10,836	4,170	15,005	7.8	3.0	10.8
24	50	Bait Fajar	35	11,785	6.8	7.5	12,192	5,051	17,242	7.2	3.0	10.2
25	51,52	Nahaleen	31	8,228	4.8	7.8	11,093	3,526	14,619	9.4	3.0	12.4
	Sub totoal			76,879	44.6		86,249	32,948	119,197	7.9	3.0	10.9
26	53-58	Hajeh	16	11,213	6.5	7.6	10,881	4,806	15,687	6.8	3.0	9.8
27	59	Kofur Thuluth	8	4,567	2.7	2.9	9,127	1,957	11,085	14.0	3.0	17.0
28,30	60,61,68	Kofur Qudoom	17	6,737	3.9	4.6	9,584	2,887	12,471	10.0	3.0	13.0
29,31	62-67,69	Habla	14	9,791	5.7	6.2	9,996	4,196	14,193	7.1	3.0	10.1
32	70-75	Jayos	10	7,477	4.3	4.7	9,612	3,204	12,817	9.0	3.0	12.0
	Sub total			39,785	23.1		49,201	17,051	66,252	8.7	3.0	11.7
33	76,77	Bait Laqeah	29	11,289	6.6	6.5	11,378	3,225	14,603	7.1	2.0	9.1
34	78,79,80	Naleen	24	8,365	4.9	6.9	10,184	2,390	12,574	8.5	2.0	10.5
35	81-83	Qubeah	30	11,228	6.5	6.5	11,397	3,208	14,605	7.1	2.0	9.1
36	84	Banizaid Al-	29	6,420	3.7	5.8	9,885	1,834	11,719	10.8	2.0	12.8
37	85-87	Ranties	36	7,373	4.3	7.7	10,996	2,107	13,103	10.4	2.0	12.4
38	88-90	Al-Tahta	25	9,775	5.7	8.3	11,679	2,793	14,471	8.4	2.0	10.4
39	91-93	Kofur Neamah	22	8,038	4.7	6.3	10,012	2,297	12,309	8.7	2.0	10.7
40	94-96	Al-Mazraa Al-	14	10,180	5.9	6.5	10,059	2,909	12,968	6.9	2.0	8.9
	Sub total			72,668	42.1		85,591	20,762	106,353	8.2	2.0	10.2
41	97	Anata	19	10,416	6.0	6.6	10,100	4,464	14,564	6.8	3.0	9.8
42	98,99	Bait Doquo	36	2,572	1.5	1.7	9,594	1,102	10,697	26.1	3.0	29.1
43	100-102	Bait Souriek	35	6,134	3.6	6.2	10,001	2,629	12,630	11.4	3.0	14.4
44	103	Beir Nabala	28	6,648	4.9	4.7	10,732	2,849	13,581	11.3	3.0	14.3
45	104	Al Ram	28	37,094	27.5	7.3	37,635	15,897	53,533	7.1	3.0	10.1
46,47	105-107	Al-Sawahreh Al-Sharqeah	7	20,914	12.1	8.3	13,265	8,963	22,228	4.4	3.0	7.4
48	108,109	Al-Jeeb	38	9,711	5.6	6.6	11,419	4,162	15,581	8.2	3.0	11.2
49	110,111	Katanh	36	10,382	6.0	6.7	11,464	4,449	15,913	7.7	3.0	10.7
	Sub total			103,871	67.2		114,210	44,516	158,726	7.7	3.0	10.7

Table 3.2.11 Operation and Maintenance Cost of Each Group

Group No	Mun/Vil No.	Name of Municipality/Villa	Dis. km	Popu. 2004	Waste Amoun	Work hour	OM cost (NIS/month) Collectio	Disposal	Total	Unit cost/hh Coll.	Dis	Total
50	112	Bani Noaim	11	19,993	11.6	8.0	12,802	5,712	18,514	4.5	2.0	6.5
51	113	Al Samoua	18	19,047	11.1	8.5	13,488	5,442	18,930	5.0	2.0	7.0
52	114,115	Saeer	17	21,821	12.7	7.6	13,192	6,235	19,427	4.2	2.0	6.2
53	116	Al-Dahreyah	28	30,307	22.4	6.5	35,010	8,659	43,669	8.1	2.0	10.1
54	117	Yatta	10	45,505	33.7	6.9	35,431	13,001	48,432	5.5	2.0	7.5
55	118	Doura	18	22,813	16.9	6.5	22,782	6,518	29,300	7.0	2.0	9.0
56	119	Eznna	34	19,950	11.6	6.2	22,587	5,700	28,287	7.9	2.0	9.9
57	120	Tarkoumeah	30	15,578	9.0	7.0	12,403	4,451	16,854	5.6	2.0	7.6
58	121	Sureif	34	14,215	8.2	6.7	12,295	4,061	16,357	6.1	2.0	8.1
59	122	Bait Awla	29	10,071	5.8	5.8	11,118	2,877	13,995	7.7	2.0	9.7
	Sub total			219,300	143.0		191,108	62,657	253,765	6.1	2.0	8.1
60	123,124	Tammoun	8	19,869	11.5	7.9	12,732	9,083	21,815	4.5	3.2	7.7
61,63	125,126, 128	Tayaseer	24	5,441	3.2	4.5	9,551	2,487	12,038	12.3	3.2	15.5
62	127	Aquaba	14	6,548	3.8	4.2	9,457	2,993	12,451	10.1	3.2	13.3
64	129	Toubas	5	17,329	12.8	5.6	11,831	7,922	19,753	4.8	3.2	8.0
	Sub total			49,187	31.3		43,571	22,485	66,056	6.2	3.2	9.4
65	130,131	Al-Zaweah	24	9,580	5.6	7.9	11,299	2,737	14,037	8.3	2.0	10.3
66	132,133	Kofur Al-Deek	24	9,481	5.5	7.9	11,200	2,709	13,909	8.3	2.0	10.3
67	134,135	Dier Estia	12	7,599	4.4	4.8	9,632	2,171	11,803	8.9	2.0	10.9
	Sub total			26,660	15.5		32,131	7,617	39,749	8.4	2.0	10.4
68,69	136-138	Jalboun	17	5,232	3.0	3.6	9,310	1,495	10,805	12.5	2.0	14.5
70,71	139,140	Al-Jadaydeh	18	12,456	7.2	5.6	11,042	3,559	14,601	6.2	2.0	8.2
72	141	Arrabeh	14	10,986	6.4	7.0	10,194	3,139	13,333	6.5	2.0	8.5
73	142	Yaabad	22	15,851	9.2	7.8	12,534	4,529	17,063	5.5	2.0	7.5
74	143-145	Kofur Raae	23	14,430	8.4	7.2	11,876	4,123	15,999	5.8	2.0	7.8
75	146-149	Al-Moghayer	18	6,230	3.6	4.4	9,530	1,780	11,310	10.7	2.0	12.7
76	150-152	Aneen	22	7,631	4.4	6.0	9,931	2,180	12,111	9.1	2.0	11.1
77	153	Jabaa	22	9,573	5.6	7.5	10,751	2,735	13,486	7.9	2.0	9.9
78	154-156	Al-Dahea	11	10,717	6.6	7.2	10,483	3,062	13,545	6.8	2.0	8.8
79	157-159	Ajjeh	20	8,637	5.0	6.5	10,070	2,468	12,538	8.2	2.0	10.2
	Sub total			101,743	59.4		105,722	29,069	134,791	7.3	2.0	9.3
Grand total				797,087	490.3		835,219	277,180	1,112,399	7.3	2.4	9.8

Note : Working hour shows actual working hour; shows more than 8.0 hours
Unit cost/hh is unit cost/month/household shows more than 15 NIS/month/household

Table 3.2.11 Operation and Maintenance Cost of Each Group

Group No	Mun/Vil No.	Name of Municipality/Villa	Dis. km	Popu. 2004	Waste Amoun	Work hour	OM cost (NIS/month)			Unit cost/hh		
							Collectio	Disposal	Total	Coll.	Dis	Total
50	112	Bani Noaim	11	19,993	11.6	8.0	12,802	5,712	18,514	4.5	2.0	6.5
51	113	Al Samoua	18	19,047	11.1	8.5	13,488	5,442	18,930	5.0	2.0	7.0
52	114,115	Saeer	17	21,821	12.7	7.6	13,192	6,235	19,427	4.2	2.0	6.2
53	116	Al-Dahreyah	28	30,307	22.4	6.5	35,010	8,659	43,669	8.1	2.0	10.1
54	117	Yatta	10	45,505	33.7	6.9	35,431	13,001	48,432	5.5	2.0	7.5
55	118	Doura	18	22,813	16.9	6.5	22,782	6,518	29,300	7.0	2.0	9.0
56	119	Ezna	34	19,950	11.6	6.2	22,587	5,700	28,287	7.9	2.0	9.9
57	120	Tarkoumeah	30	15,578	9.0	7.0	12,403	4,451	16,854	5.6	2.0	7.6
58	121	Sureif	34	14,215	8.2	6.7	12,295	4,061	16,357	6.1	2.0	8.1
59	122	Bait Awla	29	10,071	5.8	5.8	11,118	2,877	13,995	7.7	2.0	9.7
	Sub total			219,300	143.0		191,108	62,657	253,765	6.1	2.0	8.1
60	123,124	Tammoun	8	19,869	11.5	7.9	12,732	9,083	21,815	4.5	3.2	7.7
61,63	125,126, 128	Tayaseer	24	5,441	3.2	4.5	9,551	2,487	12,038	12.3	3.2	15.5
62	127	Aquaba	14	6,548	3.8	4.2	9,457	2,993	12,451	10.1	3.2	13.3
64	129	Toubas	5	17,329	12.8	5.6	11,831	7,922	19,753	4.8	3.2	8.0
	Sub total			49,187	31.3		43,571	22,485	66,056	6.2	3.2	9.4
65	130,131	Al-Zaweah	24	9,580	5.6	7.9	11,299	2,737	14,037	8.3	2.0	10.3
66	132,133	Kofur Al-Deek	24	9,481	5.5	7.9	11,200	2,709	13,909	8.3	2.0	10.3
67	134,135	Dier Estia	12	7,599	4.4	4.8	9,632	2,171	11,803	8.9	2.0	10.9
	Sub total			26,660	15.5		32,131	7,617	39,749	8.4	2.0	10.4
68,69	136-138	Jalboun	17	5,232	3.0	3.6	9,310	1,495	10,805	12.5	2.0	14.5
70,71	139,140	Al-Jadaydeh	18	12,456	7.2	5.6	11,042	3,559	14,601	6.2	2.0	8.2
72	141	Arrabeh	14	10,986	6.4	7.0	10,194	3,139	13,333	6.5	2.0	8.5
73	142	Yaabad	22	15,851	9.2	7.8	12,534	4,529	17,063	5.5	2.0	7.5
74	143-145	Kofur Raae	23	14,430	8.4	7.2	11,876	4,123	15,999	5.8	2.0	7.8
75	146-149	Al-Moghayer	18	6,230	3.6	4.4	9,530	1,780	11,310	10.7	2.0	12.7
76	150-152	Aneen	22	7,631	4.4	6.0	9,931	2,180	12,111	9.1	2.0	11.1
77	153	Jabaa	22	9,573	5.6	7.5	10,751	2,735	13,486	7.9	2.0	9.9
78	154-156	Al-Dahea	11	10,717	6.6	7.2	10,483	3,062	13,545	6.8	2.0	8.8
79	157-159	Ajjeh	20	8,637	5.0	6.5	10,070	2,468	12,538	8.2	2.0	10.2
	Sub total			101,743	59.4		105,722	29,069	134,791	7.3	2.0	9.3
Grand total				797,087	490.3		835,219	277,180	1,112,399	7.3	2.4	9.8

Note : Working hour shows actual working hour shows more than 8.0 hours
Unit cost/hh is unit cost/month/household shows more than 15 NIS/month/household