8.6.2 Cost Estimation of New Landfill Site

(1) Case 1 Landfill Waste Amount (100% Ruai and Ngong Road Forest)

(a) Total Waste Amount

Table 8.6-3 Disposal Site Capacity Requirement

Year	(1) Landfill Waste Amount (t/d)	(2) Landfill Waste Amount (m^3/d) (2)/*1.0		(3) Landfill Waste Amount (m^3/year) (3)x365			(4) Total Waste Amount (m^3)
		Ruai	Ngong	Ruai	Ngong	total	
1998	1,509	778	731	-	-	550,785	550,785
1999	1,587	822	765	-	-	579,255	1,130,040
2000	1,667	868	799	-	-	608,455	1,738,495
2001	1,758	914	844	333,610	308,060	641,670	641,670
2002	1,855	959	896	350,035	327,040	677,075	1,318,745
2003	1,959	1,008	951	367,920	347,115	715,035	2,033,780
2004	2,077	1,069	1,008	390,185	367,920	758,105	2,791,885
2005	2,190	1,121	1,068	409,165	389,820	799,350	3,591,235
2006	2,316	1,186	1,131	432,890	412,815	845,340	4,436,575
2007	2,451	1,250	1,201	456,250	438,365	894,615	5,331,190
2008	2,594	1,320	1,274	481,800	465,010	946,810	6,278,000
Total	-			3,221,855	3,056,145		8,016,495

* Bulky density of waste in the site is from 0.7 till 1.4.(1.0)

(b) Heavy Equipment Cost

(i) Ruai

Table 8.6-4 List of Heavy Equipment

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	10	147.0
2. Excavator	4.4	2	8.8
3. truck	4.8	2	9.6
4. Jeep	1.6	1	1.6
5. Total	-	-	167.0

* Bulldozer, Excavator and Truck = One is standby

Bulldozer: Spread and Compaction (Capability 45m^3/hour)
Waste: 1,320 (t/day) x1.5 / 45 m^3 / 6 hours = 7.4 8
Soil : 1,320 x1.5x 0.1 / 45 / 6 = 0.7 1

Excavator: Soil excavation (Capability 60 m^3/hour)

	Soil : 1,320 x1.5x 0.10 / 60 / 6 = 0.6	1
Truck:	Soil Transportation (Capability 25m^3, L=1km)	
	Soil : 1,320 x 0.10 / 25 / 6 = 0.9	1

(ii) Ngong Road Forest

Table 8.6-5 List of Heavy Equipment

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	10	147.0
2. Excavator	4.4	2	8.8
3. truck	4.8	2	9.6
4. Jeep	1.6	1	1.6
5. Total	-	-	167.0

* Bulldozer, Excavator and Truck = One is standby

Bulldozer:	Spread and Compaction (Capability 45m^3/hour)	
	Waste: 1,274 (t/day) x1.5 / 45 m^3 / 6 hours = 7.1	8
	Soil : 1,274 x1.5x 0.10 / 45 / 6 = 0.7	1
Excavator:	Soil excavation (Capability 60 m^3/hour)	
	Soil : 1,274 x1.5x 0.10 / 60 / 6 = 0.5	1
Truck	Soil Transportation (Capability 25m^3, L=1km)	
	Soil : 1,274 x 0.10 / 25 / 6 = 0.8	1

(c) Operation and Maintenance Cost

(i) Engineering Cost (Ruai and Ngong Road Forest)

Table 8.6-6 The Engineering Cost in Ruai

Class	Monthly Fee (Ksh)	Number	Total Cost
Site Manager	16,800	1	16,800
Secretary	8,400	1	8,400
Chief of engineering section	11,200	1	11,200
Truck scale engineer	9,800	3	29,400
Site Inspector	9,800	3	29,400
Chief Operator	9,800	1	9,800
Operator	8,400	21	176,400
Total Cost	-	31	280,400
Unit Cost (Ruai 1,320 t/day)	-	-	7.1
Unit Cost (Ngong road Forest 1,274 t/day)			7.3

* 40% Overtime charge included

(ii) Operation Cost

- Ruai

Fuel

Bulldozer for waste compaction 7.4 x 6 x 20 x 33 = 29,304

for cover soil work 0.7 x 6 x 20 x 33 = 2,772

Excavator for cover soil work 0.6 x 6 x 20 x 33 = 2,376

Truck for soil transportation 0.9 x 6 x 20 x 33 = 3,564

Jeep for inspection 100/5 x 33 = 660

Total (29,304 + 2,772 + 2,376 + 3,564 + 660) = 38,676

Unit Cost (Per ton) 38,676/1,320/1.5= 19.5

Spare parts of Heavy equipment

(167,000,000 X 0.1)/12/30/1,320 = 35.1ksh/ton

Electricity

Office 3kw x 8hours x 30 day x 5.2 = 3,744

Site (5.5 + 3.7 +3.7) x 24 x 30 = 9,288

Total 3,744 + 9,288 = 13,032

Unit Cost 13,032/1,320/30 = 0.3

Water

Office 200 l/person x 31 x 20 x 25 = 3,100

Site 20 x 20 x 25 = 10,000

Total 3,100 + 10,000 = 13,100

Unit Cost 13,100/20/1,320/1.5 = 0.3

Cover Soil

1,320x 0.10 x 1,300 ÷ 1,320 = 130

Table 8.6-7 Summary of Operation and Maintenance Cost of Ruai

Item	Unit Cost (Ksh/ton)	Remarks
1. Engineering Fee	7.1	- working day is 20days in a month. - 1,320 ton/day waste will be brought into the site
2. Fuel	19.5	
3. Spear Parts	35.1	
4. Electricity	0.3	
5. Water	0.3	
6. Cover soil	(130)	
Total Cost	62.3 (192.3)	

Ngong Road Forest

Fuel

Bulldozer	for waste compaction	7.1 x 6 x 20 x 33 = 28,116
	for cover soil work	0.7 x 6 x 20 x 33 = 2,772
Excavator	for cover soil work	0.5 x 6 x 20 x 33 = 1,980
Truck	for soil transportation	0.8 x 6 x 20 x 33 = 3,168
Jeep	for inspection	100/5 x 33 = 660
Total		(28,116+ 2,772 + 1,980 + 3,168 + 660) = 36,696
Unit Cost (Per ton)		36,696/1,274/1.5= 19.2

Spare parts of Heavy equipment

(167,000,000 X 0.1)/12/30/1,274 = 36.4 ksh/ton

Electricity

Office	3kw x 8hours x 30 day x 5.2 = 3,744
Site	(5.5 + 3.7 +3.7) x 24 x 30 = 9,288
Total	3,744 + 9,288 = 13,032
Unit Cost	13,032/1,274/30 = 0.3

Water

Office	200 l/person x 31 x 20 x 25 = 3,100
Site	20 x 20 x 25 = 10,000
Total	3,100 + 10,000 = 13,100
Unit Cost	13,100/20/1,274/1.5 = 0.3

Cover Soil

1,274x 0.10 x 1,300 ÷ 1,274= 130

Table 8.6-8 Summary of Operation and Maintenance Cost of Ruai

Item	Unit Cost (Ksh/ton)	Remarks
1. Engineering Fee	7.3	- working day is 20days in a month. - 1,274 ton/day waste will be brought into the site
2. Fuel	19.2	
3. Spear Parts	36.4	
4. Electricity	0.3	
5. Water	0.3	
6. Cover soil	(130)	
Total Cost	63.5 (193.5)	

(e) Summary of Disposal Cost

Annual expenditures of each sanitary level(Level 2+, Level 3, Level 3+,Level 4) required for the period 1999 - 2008 is shown in **Tables 8.6-9~12.**

Table 8.6-9 Ruai Disposal Expenditures (Level 2+)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		32,543				32,543
2000			365,193	167,000		532,193
2001	333,610		285,673 (227,000)		20,784	306,457 (533,457)
2002	350,035				21,807	21,807
2003	367,920				22,921	22,921
2004	390,185				24,309	24,309
2005	409,165				25,491	25,491
2006	432,890				26,969	26,969
2007	456,250				28,424,	28,424
2008	481,800				30,016	30,016
Total	3,221,855	32,543	650,866 (877,866)	167,000	200,721	1,051,130 (1,278,130)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-10 Ruai Disposal Expenditures (Level 3)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		34,906				34,906
2000			391,405	167,000		558,405
2001	333,610		306,661 (227,000)		20,784	327,445 (554,445)
2002	350,035				21,807	21,807
2003	367,920				22,921	22,921
2004	390,185				24,309	24,309
2005	409,165				25,491	25,491
2006	432,890				26,969	26,969
2007	456,250				28,424	28,424
2008	481,800				30,016	30,016
Total	3,221,855	34,906	698,066 (825,066)	167,000	200,721	1,100,693 (1,327,693)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-11 Ruai Disposal Expenditures (Level 3+)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		37,959				37,959
2000			452,772	167,000		619,772
2001	333,610		306,403 (227,000)		20,784	327,187 (554,187)
2002	350,035				21,807	21,807
2003	367,920				22,921	22,921
2004	390,185				24,309	24,309
2005	409,165				25,491	25,491
2006	432,890				26,969	26,969
2007	456,250				28,424	28,424
2008	481,800				30,016	30,016
Total	3,221,855	37,959	698,066 (986,175)	167,000	200,721	1,164,855 (1,391,855)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-12 Ruai Disposal Expenditures (Level 4)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		41,293				41,293
2000			519,120	167,000		686,120
2001	333,610		306,744 (227,000)		20,784	327,528 (554,528)
2002	350,035				21,807	21,807
2003	367,920				22,921	22,921
2004	390,185				24,309	24,309
2005	409,165				25,491	25,491
2006	432,890				26,969	26,969
2007	456,250				28,424	28,424
2008	481,800				30,016	30,016
Total	3,221,855	41,293	825,864 (1,052,864)	167,000	200,721	1,234,878 (1,461,878)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Ngong Road Forest

Table 8.6-13 Annual Disposal Expenditures (Level 2+)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		34,211				34,211
2000			357,323	167,000		524,323
2001	308,060		326,896 (227,000)		19,562	346,458 (573,458)
2002	327,040				20,767	20,767
2003	347,115				22,042	22,042
2004	367,920				23,363	23,363
2005	389,820				24,754	24,754
2006	412,815				26,214	26,214
2007	438,365				27,836	27,836
2008	465,010				29,528	29,528
Total	3,056,145	34,211	684,219 (911,219)	167,000	194,066	1,079,496 (1,306,496)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-14 Annual Disposal Expenditures (Level 3)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		38,961				38,961
2000			412,260	167,000		579,260
2001	308,060		366,964 (227,000)		19,562	386,526 (613,526)
2002	327,040				20,767	20,767
2003	347,115				22,042	22,042
2004	367,920				23,363	23,363
2005	389,820				24,754	24,754
2006	412,815				26,214	26,214
2007	438,365				27,836	27,836
2008	465,010				29,528	29,528
Total	3,056,145	38,961	779,224 (1,006,224)	167,000	194,066	1,179,251 (1,406,251)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-15 Annual Disposal Expenditures (Level 3+)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		42,492				42,492
2000			482,880	167,000		649,880
2001	308,060		366,964 (227,000)		19,562	386,526 (613,526)
2002	327,040				20,767	20,767
2003	347,115				22,042	22,042
2004	367,920				23,363	23,363
2005	389,820				24,754	24,754
2006	412,815				26,214	26,214
2007	438,365				27,836	27,836
2008	465,010				29,528	29,528
Total	3,056,145	42,492	849,844 (1,076,844)	167,000	194,066	1,253,402 (1,480,402)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-16 Annual Disposal Expenditures (Level 4)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		123,673				123,673
2000			549,351	167,000		716,351
2001	308,060		368,823 (227,000)		19,562	388,385 (615,385)
2002	327,040				20,767	20,767
2003	347,115				22,042	22,042
2004	367,920				23,363	23,363
2005	389,820				24,754	24,754
2006	412,815				26,214	26,214
2007	438,365				27,836	27,836
2008	465,010				29,528	29,528
Total	3,056,145	123,673	918,174 (1,145,174)	167,000	194,066	1,402,913 (1,629,913)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

(2) Case 2 Landfill Waste Amount (Ruai 100%)

Table 8.6-17 Disposal Site Capacity Requirement

Year	(1) Landfill Waste Amount (t/d)	(2) Landfill Waste Amount (m³/d) (2)/*1.0	(3) Landfill Waste Amount (m³/year) (3)x365	(4) Total Waste Amount (m³)
1998	1,509	1,509	550,785	550,785
1999	1,587	1,587	579,255	1,130,040
2000	1,667	1,667	608,455	1,738,495
2001	1,758	1,758	641,670	641,670
2002	1,855	1,855	677,075	1,318,745
2003	1,959	1,959	715,035	2,033,780
2004	2,077	2,077	758,105	2,791,885
2005	2,190	2,190	799,350	3,591,235
2006	2,316	2,316	845,340	4,436,575
2007	2,451	2,451	894,615	5,331,190
2008	2,594	2,594	946,810	6,278,000
Total	-	-		8,016,495

* Bulky density of waste in the site is from 0.7 till 1.4.(1.0)

(a) Heavy Equipment Cost

Table 8.6-18 List of Heavy Equipment

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	18	264.6
2. Excavator	4.4	3	13.2
3. truck	4.8	3	14.4
4. Jeep	1.6	1	1.6
5. Total	-	-	293.8

* Bulldozer, Excavator and Truck = One is standby

Bulldozer:	Spread and Compaction (Capability 45m^3/hour)	
	Waste: 2,594 (t/day) x1.5 / 45 m^3 / 6 hours = 14.4	15
	Soil : 2,594 x1.5x 0.1 / 45 / 6 = 1.4	2
Excavator:	Soil excavation (Capability 60 m^3/hour)	
	Soil : 2,594 x1.5x 0.10 / 60 / 6 = 1.1	2
Truck	Soil Transportation (Capability 25m^3, L=1km)	
	Soil : 2,594 x 0.10 / 25 / 6 = 1.7	2

(b) Operation and Maintenance Cost

(i) Engineering Cost (Ruai and Ngong Road Forest)

Table 8.6-19 The Engineering Cost in Ruai

Class	Monthly Fee (Ksh)	Number	Total Cost
Site Manager	16,800	1	16,800
Secretary	8,400	1	8,400
Chief of engineering section	11,200	1	11,200
Truck scale engineer	9,800	3	29,400
Site Inspector	9,800	3	29,400
Chief Operator	9,800	1	9,800
Operator	8,400	36	302,400
Total Cost	-	46	407,400
Unit Cost (2,594 t/day)	-	-	5.2

* 40% Overtime charge included

(ii) Operation Cost

- Ruai

Fuel

Bulldozer for waste compaction · 14.4 x 6 x 20 x 33 = 57,024

	for cover soil work	1.4 x 6 x 20 x 33 = 5,544
Excavator	for cover soil work	1.1 x 6 x 20 x 33 = 4,356
Truck	for soil transportation	1.7 x 6 x 20 x 33 = 6,732
Jeep	for inspection	100/5 x 33 = 660
Total		(57,042 + 5,544 + 4,356 + 6,732 + 660) = 74,334
Unit Cost (Per ton)		74,334/2,594/1.5= 19.1

Spare parts of Heavy equipment

(293,800,000 X 0.1)/12/30/2,594 = 31.5ksh/ton

Electricity

Office	3kw x 8hours x 30 day x 5.2 = 3,744
Site	(5.5 + 3.7 +3.7) x 24 x 30 = 9,288
Total	3,744 + 9,288 = 13,032
Unit Cost	13,032/2,594/30 = 0.2

Water

Office	200 l/person x 46 x 20 x 25 = 4,600
Site	20 x 20 x 25 = 10,000
Total	4,600 + 10,000 = 14,600
Unit Cost	14,600/20/2,594/1.5 = 0.2

Cover Soil

2,594x 0.10 x 1,300 ÷ 2,594 = 130

Table 8.6-20 Summary of Operation and Maintenance Cost of Ruai

Item	Unit Cost (Ksh/ton)	Remarks
1. Engineering Fee	5.2	- working day is 20days in a month. - 2,594 ton/day waste will be brought into the site
2. Fuel	19.1	
3. Spear Parts	31.5	
4. Electricity	0.2	
5. Water	0.2	
6. Cover soil	(130)	
Total Cost	56.2 (186.2)	

(c) Summary of Disposal Cost

Annual expenditures of each sanitary level(Level 2+, Level 3, Level 3+,Level 4) required for the period 1999 - 2008 is shown in Tables **8.6-21~24.**

Table 8.6-21 Annual Disposal Expenditures (Level 2+)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		53,353				53,353
2000			402,090	293,800		695,890
2001	641,670		296,010 (227,000)		36,062	332,072 (559,072)
2002	677,075		368,960		37,052	406,012
2003	715,035				40,185	40,185
2004	758,105				42,606	42,606
2005	799,350				44,923	44,923
2006	845,340				47,508	47,508
2007	894,615				50,277	50,277
2008	946,810				53,211	53,211
Total	6,278,000	53,353	1,067,060 (1,294,060)	293,800	351,824	1,766,037 (1,993,037)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-22 Annual Disposal Expenditures (Level 3)

Year	Waste Amount	Cost ($x10^3$ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		58,935				58,935
2000			437,038	293,800		730,838
2001	641,670		338,007 (227,000)		36,062	374,069 (601,069)
2002	677,075		403,648		37,052	440,700
2003	715,035				40,185	40,185
2004	758,105				42,606	42,606
2005	799,350				44,923	44,923
2006	845,340				47,508	47,508
2007	894,615				50,277	50,277
2008	946,810				53,211	53,211
Total	6,278,000	58,935	1,178,693 (1,405,693)	293,800	351,824	1,883,252 (2,110,252)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-23 Annual Disposal Expenditures (Level 3+)

Year	Waste Amount	Cost ($x10^3$ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		64,695				64,695
2000			552,240	293,800		846,040
2001	641,670		338,007 (227,000)		36,062	374,069 (601,069)
2002	677,075		403,648		37,052	440,700
2003	715,035				40,185	40,185
2004	758,105				42,606	42,606
2005	799,350				44,923	44,923
2006	845,340				47,508	47,508
2007	894,615				50,277	50,277
2008	946,810				53,211	53,211
Total	6,278,000	64,695	1,293,895 (1,520,895)	293,800	351,824	2,004,214 (2,231,214)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-24 Annual Disposal Expenditures (Level 4)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		70,548				70,548
2000			667,857	293,800		961,657
2001	641,670		338,007 (227,000)		36,062	374,069 (601,069)
2002	677,075		405,100		37,052	442,152
2003	715,035				40,185	40,185
2004	758,105				42,606	42,606
2005	799,350				44,923	44,923
2006	845,340				47,508	47,508
2007	894,615				50,277	50,277
2008	946,810				53,211	53,211
Total	6,278,000	70,548	1,410,964 (1,637,964)	293,800	351,824	2,127,136 (2,354,136)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

(3) Case 3 Landfill Waste Amount (Ruai 80%)

Table 8.6-25 Disposal Site Capacity Requirement

Year	(1) Landfill Waste Amount (t/d)	(2) (1)x80%	(2) Landfill Waste Amount (m^3/d) (2)/*1.0	(3) Landfill Waste Amount (m^3/year) (3)x365	(4) Total Waste Amount (m^3)
1998	1,509	1,207	1,207	440,555	440,555
1999	1,587	1,270	1,270	463,550	904,105
2000	1,667	1,334	1,334	486,910	1,391,015
2001	1,758	1,406	1,406	513,190	513,190
2002	1,855	1,484	1,484	541,660	1,054,850
2003	1,959	1,567	1,567	571,955	1,626,805
2004	2,077	1,662	1,662	606,630	2,233,435
2005	2,190	1,752	1,752	639,480	2,872,915
2006	2,316	1,853	1,853	676,345	3,549,260
2007	2,451	1,961	1,961	715,765	4,265,025
2008	2,594	2,075	2,075	757,375	5,022,400
Total	-		-		6,413,415

* Bulky density of waste in the site is from 0.7 till 1.4.(1.0)

(a) Heavy Equipment Cost

Table 8.6-26 List of Heavy Equipment

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	15	220.5
2. Excavator	4.4	2	8.8
3. truck	4.8	3	14.4
4. Jeep	1.6	1	1.6
5. Total	-	-	245.3

* Bulldozer, Excavator and Truck = One is standby

Bulldozer:	Spread and Compaction (Capability 45m^3/hour)	
	Waste: 2,075(t/day) x1.5 / 45 m^3 / 6 hours = 11.5	12
	Soil : 2,075 x1.5x 0.1 / 45 / 6 = 1.2	2
Excavator:	Soil excavation (Capability 60 m^3/hour)	
	Soil : 2,075 x1.5x 0.10 / 60 / 6 = 0.9	1
Truck	Soil Transportation (Capability 25m^3, L=1km)	
	Soil : 2,075 x 0.10 / 25 / 6 = 1.4	2

(b) Operation and Maintenance Cost

(i) Engineering Cost (Ruai)

Table 8.6-27 The Engineering Cost in Ruai

Class	Monthly Fee (Ksh)	Number	Total Cost
Site Manager	16,800	1	16,800
Secretary	8,400	1	8,400
Chief of engineering section	11,200	1	11,200
Truck scale engineer	9,800	3	29,400
Site Inspector	9,800	3	29,400
Chief Operator	9,800	1	9,800
Operator	8,400	30	252,000
Total Cost	-	40	357,000
Unit Cost (2075 t/day)	-	-	5.7

* 40% Overtime charge included

(ii) Operation Cost

Ruai

Fuel

Bulldozer for waste compaction 11.5 x 6 x 20 x 33 = 45,540

for cover soil work 1.2 x 6 x 20 x 33 = 4,752

Excavator for cover soil work 0.9 x 6 x 20 x 33 = 3,564

Truck for soil transportation 1.4 x 6 x 20 x 33 = 5,544

Jeep for inspection 100/5 x 33 = 660

Total (45,540 + 4,752 + 3,564 + 5,544 + 660) = 60,060

Unit Cost (Per ton) 60,060/2,075/1.5= 19.3

Spare parts of Heavy equipment

(245,300,000 X 0.1)/12/30/2,075 = 32.8ksh/ton

Electricity

Office 3kw x 8hours x 30 day x 5.2 = 3,744

Site (5.5 + 3.7 +3.7) x 24 x 30 = 9,288

Total 3,744 + 9,288 = 13,032

Unit Cost 13,032/2,075/30 = 0.2

Water

Office 200 l/person x 40 x 20 x 25 = 4,000

Site 20 x 20 x 25 = 10,000

Total 4,000 + 10,000 = 14,000

Unit Cost 14,000/20/2,075/1.5 = 0.2

Cover Soil

2,075x 0.10 x 1,300 ÷ 2,075 = 130

Table 8.6-28 Summary of Operation and Maintenance Cost of Ruai

Item	Unit Cost (Ksh/ton)	Remarks
1. Engineering Fee	5.7	- working day is 20days in a month. - 2,075 ton/day waste will be brought into the site
2. Fuel	19.3	
3. Spear Parts	32.8	
4. Electricity	0.2	
5. Water	0.2	
6. Cover soil	(130)	
Total Cost	58.2 (188.2)	

(c) Summary of Disposal Cost

Annual expenditures of each sanitary level(Level 2+, Level 3, Level 3+,Level 4) required for the period 1999 - 2008 is shown in **Tables 8.6-29~8.6-32.**

Table 8.6-29 Annual Disposal Expenditures (Level 2+)

Year	Waste Amount	Cost ($x10^3$ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		53,353				53,353
2000			402,090	245,300		647,390
2001	513,190		296,010 (227,000)		29,868	325,878 (552,878)
2002	541,660		368,960		31,525	400,485
2003	571,955				33,288	33,288
2004	606,630				35,306	35,306
2005	639,480				37,218	37,218
2006	676,345				39,363	39,363
2007	715,765				41,658	41,658
2008	757,375				44,079	44,079
Total	5,022,400	53,353	1,067,060 (1,294,060)	245,300	292,305	1,658,018 (1,885,018)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-30 Annual Disposal Expenditures (Level 3)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		58,935				58,935
2000			437,038	245,300		682,338
2001	513,190		338,007 (227,000)		29,868	367,875 (594,875)
2002	541,660		403,648		31,525	435,173
2003	571,955				33,288	33,288
2004	606,630				35,306	35,306
2005	639,480				37,218	37,218
2006	676,345				39,363	39,363
2007	715,765				41,658	41,658
2008	757,375				44,079	44,079
Total	5,022,400	58,935	1,178,693 (1,405,693)	245,300	292,305	1,775,233 (2,002,233)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-31 Annual Disposal Expenditures (Level 3+)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		64,695				64,695
2000			552,240	245,300		797,540
2001	513,190		338,007 (227,000)		29,868	367,875 (594,875)
2002	541,660		403,648		31,525	435,173
2003	571,955				33,288	33,288
2004	606,630				35,306	35,306
2005	639,480				37,218	37,218
2006	676,345				39,363	39,363
2007	715,765				41,658	41,658
2008	757,375				44,079	44,079
Total	5,022,400	64,695	1,293,895 (1,520,895)	245,300	292,305	1,896,195 (2,123,195)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-32 Annual Disposal Expenditures (Level 4)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		70,548				70,548
2000			667,857	245,300		913,157
2001	513,190		338,007 (227,000)		29,868	367,875 (594,875)
2002	541,660		405,100		31,525	436,625
2003	571,955				33,288	33,288
2004	606,630				35,306	35,306
2005	639,480				37,218	37,218
2006	676,345				39,363	39,363
2007	715,765				41,658	41,658
2008	757,375				44,079	44,079
Total	5,022,400	70,548	1,410,964 (1,637,964)	245,300	292,305	2,019,117 (2,246,117)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

(4) Case 4 Landfill Waste Amount (Ruai 60%)

Table 8.6-33 Disposal Site Capacity Requirement

Year	(1) Landfill Waste Amount (t/d)	(2) (1)x60%	(2) Landfill Waste Amount (m^3/d) (2)/*1.0	(3) Landfill Waste Amount (m^3/year) (3)x365	(4) Total Waste Amount (m^3)
1998	1,509	905	905	330,325	330,325
1999	1,587	952	952	347,480	677,805
2000	1,667	1,000	1,000	365,000	1,042,805
2001	1,758	1,055	1,055	385,075	385,075
2002	1,855	1,113	1,113	406,245	791,320
2003	1,959	1,175	1,175	428,875	1,220,195
2004	2,077	1,246	1,246	454,790	1,674,985
2005	2,190	1,314	1,314	479,610	2,154,595
2006	2,316	1,390	1,390	507,350	2,661,945
2007	2,451	1,471	1,471	536,915	3,198,860
2008	2,594	1,556	1,556	567,940	3,766,800
Total	-		-		4,809,605

* Bulky density of waste in the site is from 0.7 till 1.4.(1.0)

(a) Heavy Equipment Cost

Table 8.6-34 List of Heavy Equipment

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	11	161.7
2. Excavator	4.4	2	8.8
3. truck	4.8	3	14.4
4. Jeep	1.6	1	1.6
5. Total	-	-	186.5

* Bulldozer, Excavator and Truck = One is standby

Bulldozer:	Spread and Compaction (Capability 45m³/hour)	
	Waste: 1,556 (t/day) x1.5 / 45 m³ / 6 hours = 8.6	9
	Soil : 1,556 x1.5x 0.1 / 45 / 6 = 0.9	1
Excavator:	Soil excavation (Capability 60 m³/hour)	
	Soil : 1,556 x1.5x 0.10 / 60 / 6 = 0.6	1
Truck	Soil Transportation (Capability 25m³, L=1km)	
	Soil : 1,556 x 0.10 / 25 / 6 = 1.0	2

(b) Operation and Maintenance Cost

(i) Engineering Cost (Ruai)

Table 8.6-35 The Engineering Cost in Ruai

Class	Monthly Fee (Ksh)	Number	Total Cost
Site Manager	16,800	1	16,800
Secretary	8,400	1	8,400
Chief of engineering section	11,200	1	11,200
Truck scale engineer	9,800	3	29,400
Site Inspector	9,800	3	29,400
Chief Operator	9,800	1	9,800
Operator	8,400	24	201,600
Total Cost	-	34	306,600
Unit Cost (1,556 t/day)	-	-	6.6

* 40% Overtime charge included

(ii) Operation Cost

Ruai

Fuel

Bulldozer for waste compaction 8.6 x 6 x 20 x 33 = 34,056

for cover soil work 0.9 x 6 x 20 x 33 = 3,564

Excavator for cover soil work 0.6 x 6 x 20 x 33 = 2,376

Truck for soil transportation 1.0 x 6 x 20 x 33 = 3,960

Jeep for inspection 100/5 x 33 = 660

Total (34,056 + 3,564 + 2,376 + 3,960 + 660) = 44,616

Unit Cost (Per ton) 44,616/1,556/1.5= 19.1

Spare parts of Heavy equipment

(186,500,000 X 0.1)/12/30/1,556 = 33.3 ksh/ton

Electricity

Office 3kw x 8hours x 30 day x 5.2 = 3,744

Site (5.5 + 3.7 +3.7) x 24 x 30 = 9,288

Total 3,744 + 9,288 = 13,032

Unit Cost 13,032/1,556/30 = 0.3

Water

Office 200 l/person x 34 x 20 x 25 = 3,400

Site 20 x 20 x 25 = 10,000

Total 3,400 + 10,000 = 13,400

Unit Cost 13,400/20/1,556/1.5 = 0.3

Cover Soil

1,556x 0.10 x 1,300 ÷ 1,556 = 130

Table 8.6-36 Summary of Operation and Maintenance Cost of Ruai

Item	Unit Cost (Ksh/ton)	Remarks
1. Engineering Fee	6.6	- working day is 20days in a month. - 1,556 ton/day waste will be brought into the site
2. Fuel	19.1	
3. Spear Parts	33.3	
4. Electricity	0.3	
5. Water	0.3	
6. Cover soil	(130)	
Total Cost	59.6 (189.6)	

(c) Summary of Disposal Cost

Annual expenditures of each sanitary level(Level 2+, Level 3, Level 3+,Level 4) required for the period 1999 - 2008 is shown in **Tables 8.6-37~8.6-40.**

Table 8.6-37 Annual Disposal Expenditures (Level 2+)

Year	Waste Amount	Cost ($x10^3$ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		53,353				53,353
2000			402,090	186,500		588,590
2001	385,075		296,010 (27,000)		22,950	318,960 (545,960)
2002	406,245		368,960		24,212	393,172
2003	428,875				25,561	25,561
2004	454,790				27,105	27,105
2005	479,610				28,585	28,585
2006	507,350				30,238	30,238
2007	536,915				32,000	32,000
2008	567,940				33,849	33,849
Total	3,766,800	53,353	1,067,060 (1,294,060)	186,500	224,500	1,531,413 (1,758,413)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-38 Annual Disposal Expenditures (Level 3)

Year	Waste Amount	Cost ($x10^3$ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		58,935				58,935
2000			437,038	186,500		623,538
2001	385,075		338,007 (227,000)		22,950	360,957 (587,957)
2002	406,245		403,648		24,212	427,860
2003	428,875				25,561	25,561
2004	454,790				27,105	27,105
2005	479,610				28,585	28,585
2006	507,350				30,238	30,238
2007	536,915				32,000	32,000
2008	567,940				33,849	33,849
Total	3,766,800	58,935	1,178,693 (1,405,693)	186,500	224,500	1,648,628 (1,875,628)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-39 Annual Disposal Expenditures (Level 3+)

Year	Waste Amount	Cost ($x10^3$ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		64,695				64,695
2000			552,240	186,500		738,740
2001	385,075		338,007 (27,000)		22,950	360,957 (587,957)
2002	406,245		403,648		24,212	427,860
2003	428,875				25,561	25,561
2004	454,790				27,105	27,105
2005	479,610				28,585	28,585
2006	507,350				30,238	30,238
2007	536,915				32,000	32,000
2008	567,940				33,849	33,849
Total	3,766,800	64,695	1,293,895 (1,520,895)	186,500	224,500	1,769,590 (1,996,590)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-40 Annual Disposal Expenditures (Level 4)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		70,548				70,548
2000			667,857	186,500		854,357
2001	385,075		338,007 (227,000)		22,950	360,957 (587,957)
2002	406,245		405,100		24,212	429,312
2003	428,875				25,561	25,561
2004	454,790				27,105	27,105
2005	479,610				28,585	28,585
2006	507,350				30,238	30,238
2007	536,915				32,000	32,000
2008	567,940				33,849	33,849
Total	3,766,800	70,548	1,410,964 (1,637,964)	186,500	224,500	1,892,512 (2,119,512)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Case 5 Landfill Waste Amount (Ruai 40%)

Table 8.6-41 Disposal Site Capacity Requirement

Year	(1) Landfill Waste Amount (t/d)	(2) (1)x40%	(2) Landfill Waste Amount (m^3/d) (2)/*1.0	(3) Landfill Waste Amount (m^3/year) (3)x365	(4) Total Waste Amount (m^3)
1998	1,509	604	604	220,460	220,460
1999	1,587	635	635	231,775	452,235
2000	1,667	667	667	243,455	695,690
2001	1,758	703	703	256,595	256,595
2002	1,855	742	742	270,830	527,425
2003	1,959	784	784	286,160	813,585
2004	2,077	831	831	303,315	1,116,900
2005	2,190	876	876	319,740	1,436,640
2006	2,316	926	926	337,990	1,774,630
2007	2,451	980	980	357,700	2,132,330
2008	2,594	1,038	1,038	378,870	2,511,200
Total	-		-		3,206,890

* Bulky density of waste in the site is from 0.7 till 1.4.(1.0)

(a) Heavy Equipment Cost

(b)

Table 8.6-42 List of Heavy Equipment

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	8	117.6
2. Excavator	4.4	2	8.8
3. truck	4.8	2	9.6
4. Jeep	1.6	1	1.6
5. Total	-	-	137.6

* Bulldozer, Excavator and Truck = One is standby

Bulldozer:	Spread and Compaction (Capability 45m³/hour)	
	Waste: 1,038 (t/day) x1.5 / 45 m³ / 6 hours = 5.8	6
	Soil : 1,038 x1.5x 0.1 / 45 / 6 = 0.6	1
Excavator:	Soil excavation (Capability 60 m³/hour)	
	Soil : 1,038 x1.5x 0.10 / 60 / 6 = 0.4	1
Truck	Soil Transportation (Capability 25m³, L=1km)	
	Soil : 1,038 x 0.10 / 25 / 6 = 0.7	1

(b) Operation and Maintenance Cost

(i) Engineering Cost (Ruai and Ngong Road Forest)

Table 8.6-43 The Engineering Cost in Ruai

Class	Monthly Fee (Ksh)	Number	Total Cost
Site Manager	16,800	1	16,800
Secretary	8,400	1	8,400
Chief of engineering section	11,200	1	11,200
Truck scale engineer	9,800	3	29,400
Site Inspector	9,800	3	29,400
Chief Operator	9,800	1	9,800
Operator	8,400	18	151,200
Total Cost	-	28	256,200
Unit Cost (1038 t/day)	-	-	8.2

* 40% Overtime charge included

(ii) Operation Cost

Ruai

Fuel

Bulldozer for waste compaction 5.8 x 6 x 20 x 33 = 22,968

for cover soil work 0.6 x 6 x 20 x 33 = 2,376

Excavator for cover soil work 0.4 x 6 x 20 x 33 = 1,584

Truck for soil transportation 0.7 x 6 x 20 x 33 = 2,772

Jeep for inspection 100/5 x 33 = 660

Total (22,968 +2,376 + 1,584 +2,772 + 660) = 30,360

Unit Cost (Per ton) 30,360/1,038/1.5= 19.5

Spare parts of Heavy equipment

(137,600,000 X 0.1)/12/30/1,038 = 36.8ksh/ton

Electricity

Office 3kw x 8hours x 30 day x 5.2 = 3,744

Site (5.5 + 3.7 +3.7) x 24 x 30 = 9,288

Total 3,744 + 9,288 = 13,032

Unit Cost 13,032/1,038/30 = 0.4

Water

Office 200 l/person x 28 x 20 x 25 = 2,800

Site 20 x 20 x 25 = 10,000

Total 2,800 + 10,000 = 12,800

Unit Cost 12,800/20/1,038/1.5 = 0.4

Cover Soil

1,038x 0.10 x 1,300 ÷ 1,038 = 130

Table 8.6-44 Summary of Operation and Maintenance Cost of Ruai

Item	Unit Cost (Ksh/ton)	Remarks
1. Engineering Fee	8.2	- working day is 20days in a month. - 1,038 ton/day waste will be brought into the site
2. Fuel	19.5	
3. Spear Parts	36.8	
4. Electricity	0.4	
5. Water	0.4	
6. Cover soil	(130)	
Total Cost	65.3 (195.3)	

(c) Summary of Disposal Cost

Annual expenditures of each sanitary level(Level 2+, Level 3, Level 3+,Level 4) required for the period 1999 - 2008 is shown in **Tables 8.6-45~8.6-48.**

Table 8.6-45 Annual Disposal Expenditures (Level 2+)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		53,353				53,353
2000			402,090	137,600		539,690
2001	256,595		296,010 (227,000)		16,756	312,766 (539,766)
2002	270,830		368,960		17,685	386,645
2003	286,160				18,686	18,686
2004	303,315				19,806	19,806
2005	319,740				20,879	20,879
2006	337,990				22,071	22,071
2007	357,700				23,358	23,358
2008	378,870				24,740	24,740
Total	2,511,200	53,353	1,067,060 (1,291,060)	137,600	163,981	1,421,994 (1,648,994)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-46 Annual Disposal Expenditures (Level 3)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		58,935				58,935
2000			437,038	137,600		574,638
2001	256,595		338,007 (227,000)		16,756	354,763 (581,763)
2002	270,830		403,648		17,685	421,333
2003	286,160				18,686	18,686
2004	303,315				19,806	19,806
2005	319,740				20,879	20,879
2006	337,990				22,071	22,071
2007	357,700				23,358	23,358
2008	378,870				24,740	24,740
Total	2,511,200	58,935	1,178,693 (1,405,693)	137,600	163,981	1,539,209 (1,766,209)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-47 Annual Disposal Expenditures (Level 3+)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		64,695				64,695
2000			552,240	137,600		689,840
2001	256,595		338,007 (227,000)		16,756	354,763 (581,763)
2002	270,830		403,648		17,685	421,333
2003	286,160				18,686	18,686
2004	303,315				19,806	19,806
2005	319,740				20,879	20,879
2006	337,990				22,071	22,071
2007	357,700				23,358	23,358
2008	378,870				24,740	24,740
Total	2,511,200	64,695	1,293,895 (1,520,895)	137,600	163,981	1,660,171 (1,887,171)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-48 Annual Disposal Expenditures (Level 4)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		70,548				70,548
2000			667,857	137,600		805,457
2001	256,595		338,007 (227,000)		16,756	354,763 (581,763)
2002	270,830		405,100		17,685	422,785
2003	286,160				18,686	18,686
2004	303,315				19,806	19,806
2005	319,740				20,879	20,879
2006	337,990				22,071	22,071
2007	357,700				23,358	23,358
2008	378,870				24,740	24,740
Total	2,511,200	70,548	1,410,964 (1,637,964)	137,600	163,981	1,783,093 (2,010,093)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Case 6 Landfill Waste Amount (Ruai 2000-2003 60%, 2004-2007 80%, 2008 100%)

Table 8.6-49 Disposal Site Capacity Requirement

Year	(1) Landfill Waste Amount (t/d)	(2) (1)x60%	(2) Landfill Waste Amount (m^3/d) (2)/*1.0	(3) Landfill Waste Amount (m^3/year) (3)x365	(4) Total Waste Amount (m^3)
1998	1,509	905	905	330,325	330,325
1999	1,587	952	952	347,480	677,805
2000	1,667	1,000	1,000	365,000	1,042,805
2001	1,758	1,055	1,055	385,075	385,075
2002	1,855	1,113	1,113	406,245	791,320
2003	1,959	1,175	1,175	428,875	1,220,195
2004	2,077	1,662	1,662	606,630	1,826,825
2005	2,190	1,752	1,752	639,480	2,466,305
2006	2,316	1,853	1,853	676,345	3,142,650
2007	2,451	1,961	1,961	715,765	3,860,415
2008	2,594	2,594	2,594	946,810	4,807,225
Total	-		-		5,849,030

* Bulky density of waste in the site is from 0.7 till 1.4.(1.0)

(a) Heavy Equipment Cost

Table 8.6-50 List of Heavy Equipment 2001, (to 2003)

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	9	132.3
2. Excavator	4.4	2	8.8
3. truck	4.8	2	9.6
4. Jeep	1.6	1	1.6
5. Total	-	-	152.3

* Bulldozer, Excavator and Truck = One is standby

Bulldozer: Spread and Compaction (Capability 45m³/hour)
Waste: 1,175 (t/day) x1.5 / 45 m³ / 6 hours = 6.5 → 7
Soil : 1,175 x1.5x 0.1 / 45 / 6 = 0.7 → 1

Excavator: Soil excavation (Capability 60 m³/hour)
Soil : 1,175 x1.5x 0.10 / 60 / 6 = 0.5 → 1

Truck Soil Transportation (Capability 25m³, L=1km)
Soil : 1,175 x 0.10 / 25 / 6 = 0.8 → 1

Table 8.6-51 List of Heavy Equipment 2004 (to 2007)

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	14(5)	(73.5)
2. Excavator	4.4	2(0)	(0)
3. truck	4.8	3(1)	(4.8)
4. Jeep	1.6	1(0)	(0)
5. Total	-	-	(78.3)

* Bulldozer, Excavator and Truck = One is standby

Bulldozer: Spread and Compaction (Capability 45m³/hour)
Waste: 1,961(t/day) x1.5 / 45 m³ / 6 hours = 10.9 → 11
Soil : 1,961 x1.5x 0.1 / 45 / 6 = 1.1 → 2

Excavator: Soil excavation (Capability 60 m³/hour)
Soil : 1,961 x1.5x 0.10 / 60 / 6 = 0.8 → 1

Truck Soil Transportation (Capability 25m³, L=1km)
Soil : 1,961 x 0.10 / 25 / 6 = 1.3 → 2

Table 8.6-52 List of Heavy Equipment 2007 (to 2008)

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	18(4)	(58.8)
2. Excavator	4.4	3(1)	(4.4)
3. truck	4.8	3(0)	(0)
4. Jeep	1.6	1(0)	(0)
5. Total	-	-	(63.2)

* Bulldozer, Excavator and Truck = One is standby

Bulldozer:	Spread and Compaction (Capability 45m³/hour)	
	Waste: 2,594 (t/day) x1.5 / 45 m³ / 6 hours = 14.4	15
	Soil : 2,594 x1.5x 0.1 / 45 / 6 = 1.4	2
Excavator:	Soil excavation (Capability 60 m³/hour)	
	Soil : 2,594 x1.5x 0.10 / 60 / 6 = 1.1	2
Truck	Soil Transportation (Capability 25m³, L=1km)	
	Soil : 2,594 x 0.10 / 25 / 6 = 1.7	2

(b) Operation and Maintenance Cost

Table 8.6-53 Summary of Operation and Maintenance Cost of Ruai

Item	Unit Cost (Ksh/ton)	Remarks
1.2001-2003(60%)	59.6 (189.6)	- working day is 20days in a month.
2.2004-2007(80%)	58.2 (188.2)	
3.2008(100%)	56.2 (186.2)	

(c) Summary of Disposal Cost

Annual expenditures of each sanitary level(Level 2+, Level 3, Level 3+,Level 4) required for the period 1999 - 2008 is shown in **Tables 8.6-54~57.**

Table 8.6-54 Annual Disposal Expenditures (Level 2+)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		53,353				53,353
2000			402,090	152,300		554,390
2001	385,075		296,010 (227,000)		22,950	318,960 (545,960)
2002	406,245		368,960		24,212	393,172
2003	428,875			78,300	25,561	103,861
2004	606,630				35,306	35,306
2005	639,480				37,218	37,218
2006	676,345				39,363	39,363
2007	715,765			63,200	41,658	104,858
2008	946,810				53,211	53,211
Total	4,805,225	53,353	1,067,060 (1,294,060)	293,800	279,479	1,693,692 (1,920,692)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-55 Annual Disposal Expenditures (Level 3)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		58,935				58,935
2000			437,038	152,300		589,338
2001	385,075		338,007 (227,000)		22,950	360,957 (587,957)
2002	406,245		403,648		24,212	427,860
2003	428,875			78,300	25,561	103,861
2004	606,630				35,306	35,306
2005	639,480				37,218	37,218
2006	676,345				39,363	39,363
2007	715,765			63,200	41,658	104,858
2008	946,810				53,211	53,211
Total	4,805,225	58,935	1,178,693 (1,405,693)	293,800	279,479	1,810,907 (2,037,907)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-56 Annual Disposal Expenditures (Level 3+)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		64,695				64,695
2000			552,240	152,300		704,540
2001	385,075		338,007 (227,000)		22,950	360,957 (587,957)
2002	406,245		403,648		24,212	427,860
2003	428,875			78,300	25,561	103,861
2004	606,630				35,306	35,306
2005	639,480				37,218	37,218
2006	676,345				39,363	39,363
2007	715,765			63,200	41,658	104,858
2008	946,810				53,211	53,211
Total	4,805,225	64,695	1,293,895 (1,520,895)	293,800	279,479	1,931,869 (2,158,869)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-57 Annual Disposal Expenditures (Level 4)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		70,548				70,548
2000			667,857	152,300		820,157
2001	385,075		338,007 (227,000)		22,950	360,957 (587,957)
2002	406,245		405,100		24,212	429,312
2003	428,875			78,300	25,561	103,861
2004	606,630				35,306	35,306
2005	639,480				37,218	37,218
2006	676,345				39,363	39,363
2007	715,765			63,200	41,658	104,858
2008	946,810				53,211	53,211
Total	4,805,225	70,548	1,410,964 (1,637,964)	293,800	279,479	2,054,791 (2,281,791)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

(7) Case 7 Landfill Waste Amount (Ruai 2000- 2003 40%, 2004-2007 50%, 2008 60%)

Table 8.6-58 Disposal Site Capacity Requirement

Year	(1) Landfill Waste Amount (t/d)	(2) (1)x40% x50% x60%	(2) Landfill Waste Amount (m^3/d) (2)/*1.0	(3) Landfill Waste Amount (m^3/year) (3)x365	(4) Total Waste Amount (m^3)
1998	1,509	604	604	220,460	220,460
1999	1,587	635	635	231,775	452,235
2000	1,667	667	667	243,455	695,690
2001	1,758	703	703	256,595	256,595
2002	1,855	742	742	270,830	527,425
2003	1,959	784	784	286,160	813,585
2004	2,077	1,039	1,039	379,235	1,192,820
2005	2,190	1,095	1,095	399,675	1,592,495
2006	2,316	1,158	1,158	422,670	2,015,165
2007	2,451	1,226	1,226	447,490	2,462,655
2008	2,594	1,556	1,556	567,940	3,030,595
Total	-		-		3,726,285

* Bulky density of waste in the site is from 0.7 till 1.4.(1.0)

(a) Heavy Equipment Cost

Table 8.6-59(1) List of Heavy Equipment 2001 (2003)

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	7	102.9
2. Excavator	4.4	2	8.8
3. truck	4.8	2	9.6
4. Jeep	1.6	1	1.6
5. Total	-	-	122.9

* Bulldozer, Excavator and Truck = One is standby

Bulldozer:	Spread and Compaction (Capability 45m^3/hour)	
	Waste: 784 (t/day) x1.5 / 45 m^3 / 6 hours = 4.4	5
	Soil : 784 x1.5x 0.1 / 45 / 6 = 0.4	1
Excavator:	Soil excavation (Capability 60 m^3/hour)	
	Soil : 784 x1.5x 0.10 / 60 / 6 = 0.3	1
Truck	Soil Transportation (Capability 25m^3, L=1km)	
	Soil : 784 x 0.10 / 25 / 6 = 0.5	1

Table 8.6-59(2) List of Heavy Equipment 2003 (2007)

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	9(2)	29.4
2. Excavator	4.4	2(0)	0
3. truck	4.8	2(0)	0
4. Jeep	1.6	1(0)	0
5. Total	-	-	29.4

* Bulldozer, Excavator and Truck = One is standby

Bulldozer:	Spread and Compaction (Capability 45m³/hour)	
	Waste: 1,226 (t/day) x1.5 / 45 m³ / 6 hours = 6.8	7
	Soil : 1,226 x1.5x 0.1 / 45 / 6 = 0.5	1
Excavator:	Soil excavation (Capability 60 m³/hour)	
	Soil : 1,226 x1.5x 0.10 / 60 / 6 = 0.5	1
Truck	Soil Transportation (Capability 25m³, L=1km)	
	Soil : 1,226 x 0.10 / 25 / 6 = 0.8	1

Table 8.6-59(3) List of Heavy Equipment 2007 (to2008)

Items	Unit Cost (million Ksh)	Number	Cost
1. Bulldozer	14.7	11(2)	29.4
2. Excavator	4.4	2(0)	0
3. truck	4.8	3(1)	4.8
4. Jeep	1.6	1(0)	0
5. Total	-	-	34.2

* Bulldozer, Excavator and Truck = One is standby

Bulldozer:	Spread and Compaction (Capability 45m³/hour)	
	Waste: 1,556 (t/day) x1.5 / 45 m³ / 6 hours = 8.6	9
	Soil : 1,556 x1.5x 0.1 / 45 / 6 = 0.9	1
Excavator:	Soil excavation (Capability 60 m³/hour)	
	Soil : 1,556 x1.5x 0.10 / 60 / 6 = 0.6	1
Truck	Soil Transportation (Capability 25m³, L=1km)	
	Soil : 1,556 x 0.10 / 25 / 6 = 1.0	2

(b) Operation and Maintenance Cost

(i) Engineering Cost (Ruai 50% Collection)

Table 8.6-60(1) The Engineering Cost in Ruai

Class	Monthly Fee (Ksh)	Number	Total Cost
Site Manager	16,800	1	16,800
Secretary	8,400	1	8,400
Chief of engineering section	11,200	1	11,200
Truck scale engineer	9,800	3	29,400
Site Inspector	9,800	3	29,400
Chief Operator	9,800	1	9,800
Operator	8,400	21	176,400
Total Cost	-	31	281,400
Unit Cost (1038 t/day)	-	-	7.7

* 40% Overtime charge included

(ii) Operation Cost

Fuel

Bulldozer for waste compaction 6.8 x 6 x 20 x 33 = 26,928

for cover soil work 0.5 x 6 x 20 x 33 = 1,980

Excavator for cover soil work 0.5 x 6 x 20 x 33 = 1,980

Truck for soil transportation 0.8 x 6 x 20 x 33 = 3,168

Jeep for inspection 100/5 x 33 = 660

Total (26,928 +1,980 + 1,980 +3,168 + 660) = 34,760

Unit Cost (Per ton) 34,760/1,226/1.5= 18.9

Spare parts of Heavy equipment

(152,300,000 X 0.1)/12/30/1,226= 34.5ksh/ton

Table 8.6-60(2) Summary of Operation and Maintenance Cost of Ruai

Item	Unit Cost (Ksh/ton)	Remarks
1. Engineering Fee	7.7	- working day is 20days in a month. - 1,038 ton/day waste will be brought into the site
2. Fuel	18.9	
3. Spear Parts	34.5	
4. Electricity	0.4	
5. Water	0.4	
6. Cover soil	(130)	
Total Cost	61.9 (191.9)	

Table 8.6-61 Summary of Operation and Maintenance Cost of Ruai

Item	Unit Cost (Ksh/ton)	Remarks
1. 2001 - 2003	65.3	- working day is 20days in a month.
2. 2004 – 2007	61.9	
3. 2008	59.6	

(c) Summary of Disposal Cost

Annual expenditures of each sanitary level(Level 2+, Level 3, Level 3+,Level 4) required for the period 1999 - 2008 is shown in **Tables 8.6-62~65**.

Table 8.6-62 Annual Disposal Expenditures (Level 2+)

Year	Waste Amount	Cost ($x10^3$ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		53,353				53,353
2000			402,090	122,900		569,090
2001	256,595		296,010 (227,000)		16,756	312,766 (539,766)
2002	270,830		368,960		17,685	386,645
2003	286,160			29,400	18,686	48,086
2004	379,235				23,475	23,475
2005	399,675				24,740	24,740
2006	422,670				26,163	26,163
2007	447,490			34,200	27,700	61,900
2008	567,940				33,849	33,849
Total	3,030,595	53,353	1,067,060 (1,294,060)	186,500	189,054	1,495,967 (1,722,967)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-63 Annual Disposal Expenditures (Level 3)

Year	Waste Amount	Cost ($x10^3$ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		58,935				58,935
2000			437,038	122,900		604,038
2001	256,595		338,007 (227,000)		16,756	354,763 (377,463)
2002	270,830		403,648		17,685	421,333
2003	286,160			29,400	18,686	48,086
2004	379,235				23,475	23,475
2005	399,675				24,740	24,740
2006	422,670				26,163	26,163
2007	447,490			34,200	27,700	61,900
2008	567,940				33,849	33,849
Total	3,030,595	58,935	1,178,693 (1,405,693)	186,500	189,054	1,613,182 (1,840,182)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-64 Annual Disposal Expenditures (Level 3+)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		64,695				64,695
2000			552,240	122,900		719,240
2001	256,595		338,007 (227,000)		16,756	354,763 (581,763)
2002	270,830		403,648		17,685	421,333
2003	286,160			29,400	18,686	48,086
2004	379,235				23,475	23,475
2005	399,675				24,740	24,740
2006	422,670				26,163	26,163
2007	447,490			34,200	27,700	61,900
2008	567,940				33,849	33,849
Total	3,030,595	64,695	1,293,895 (1,520,895)	186,500	189,054	1,734,144 (1,756,844)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Table 8.6-65 Annual Disposal Expenditures (Level 4)

Year	Waste Amount	Cost (x10³ Ksh)				
		*Design	Construction	Heavy equipment	O/M Cost	Total Cost
1999		70,468				70,468
2000			667,549	122,900		790,449
2001	256,595		337,263 (227,000)		16,756	354,019 (581,019)
2002	270,830		404,544		17,685	422,229
2003	286,160			29,400	18,686	48,086
2004	379,235				23,475	23,475
2005	399,675				24,740	24,740
2006	422,670				26,163	26,163
2007	447,490			34,200	27,700	61,900
2008	567,940				33,849	33,849
Total	3,030,595	70,468	1,409,356 (1,636,356)	186,500	189,054	1,855,378 (2,082,378)

*Design cost is 5 % of construction cost.
( ) is closure work of Dandora site.

Summarized Construction Cost

(x 1000 kshs)

Site	Case			Level 4	Level 3+	Level 3	Level 2+
Ruai	A-1	B-1	Case 1	825,864	759,175	698,126	651,866
		B-2	Case 2	822,630	-	-	-
	A-2,3	B-1	Case 3	1,410,964	1,293,895	1,178,693	1,067,060
		B-2	Case 4	1,409,356	-	-	-
Ngong	A-1	B-1	Case 5	918,174	849,844	779,224	684,219
		B-2	Case 6	916,438	-	-	-

Cost Estimation Cases

Designing Case	**Case 1**	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**
Site	Ruai				Ngong Road Forest	
Area	20 ha		40 ha		27 ha	
Alternative Plans for Preliminary Screening	Case A-1		Case A-2 or Case A-3		Case A-1	
Alternative Plans for Final Selection	Case B-1	Case B-2	Case B-1	Case B-2	Case B-1	Case B-2
Minimum Landfill Capacity	2,700 x 10^3m^3	1,500 x 10^3m^3	5,300 x 10^3m^3	3,000 x 10^3m^3	2,600 x 10^3m^3	1,400 x 10^3m^3
Table No.	8-5-65 8-5-66 8-5-67 8-5-68	8-5-69	8-5-70 8-5-71 8-5-72 8-5-73	8-5-74	8-5-75 8-5-76 8-5-77 8-5-78	8-5-79

Minimum Landfill Capacity means the volume of landfilling solid wastes with cover materials since 2001 to 2008.

Table 8-7-1 Facility Construction Cost (Case 1, Level 4)

	Works	Subitem	Unit	Quantity 1st Stage	Quantity 2nd Stage	Quantity Total	Unit Price	Amount (10^3Kshs) 1st Stage	Amount (10^3Kshs) 2nd Stage	Amount (10^3Kshs) Total	Remarks
Preparing Work	Weeding		m2	53,280	0	53,280	3	159	0	159	
	Root of Wood Removing		m2	229,200	0	229,200	63	14,439	0	14,439	
	Weed and Root Burning		m2	282,500	0	282,500	5	1,412	0	1,412	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	62,170	82,430	144,600	105	6,527	8,656	15,183	
		Dumptruck Transport (1km)	m3	80,820	107,180	188,000	92	7,435	9,861	17,296	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	66,240	96,060	162,300	531	35,173	51,008	86,181	
		Excavator Loading	m3	86,110	124,890	211,000	121	10,419	15,112	25,533	
		Dumptruck Transport (500m)	m3	19,390	20,210	39,600	99	1,919	2,001	3,920	
		Dumptruck Transport (1km)	m3	66,720	104,680	171,400	112	7,472	11,724	19,196	
	Banking(Excavated Soil)		m3	11,910	10,660	22,570	64	762	682	1,444	
	Banking(Bought Soil)		m3	45,400	37,610	83,010	1,285	58,339	48,328	106,667	
	Side-slope Adjusting		m2	19,330	16,330	35,660	194	3,750	3,168	6,918	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	8,540	0	8,540	105	896	0	896	
		Dumptruck Transport (1km)	m3	11,100	0	11,100	92	1,021	0	1,021	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	14,420	0	14,420	531	7,657	0	7,657	
		Excavator Loading	m3	18,750	0	18,750	121	2,268	0	2,268	
		Dumptruck Transport (1km)	m3	18,750	0	18,750	112	2,100	0	2,100	
	Side-slope Adjusting		m2	6,240	0	6,240	194	1,210	0	1,210	
	Land Adjusting		m2	3,760	0	3,760	180	676	0	676	Machine Work
	Liner Laying Work		m2	10,000	0	10,000	3,000	30,000	0	30,000	
	Piping Work		m	10.22	0	10.22	700	7	0	7	
	Pump Installing Work	Submersible Pump	unit	2	0	2	100,000	200	0	200	Included Tunit a
		Pump Installing	unit	1	0	1	50000	50	0	50	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	10,220	0	10,220	105	1,073	0	1,073	
		Dumptruck Transport (1km)	m3	13,290	0	13,290	92	1,222	0	1,222	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	12,060	0	12,060	531	6,403	0	6,403	
		Excavator Loading	m3	15,680	0	15,680	121	1,897	0	1,897	
		Dumptruck Transport (1km)	m3	15,680	0	15,680	112	1,756	0	1,756	
	Side-slope Adjusting		m2	5,810	0	5,810	194	1,127	0	1,127	
	Land Adjusting		m2	6,058	0	6,058	180	1,090	0	1,090	Machine Work
	Liner Laying Work		m2	11,870	0	11,870	3,000	35,610	0	35,610	
	Piping Work		m	48.5	0	48.5	700	33	0	33	
	Pump Installing Work	Submersible Pump	unit	2	0	2	100,000	200	0	200	
		Pump Installing	unit	1	0	1	50,000	50	0	50	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	79.5	0	79.5	23,702	1,884	0	1,884	Under Dike
		Main pipe Laying(2)	m	355	770	1,125	12,182	4,324	9,380	13,704	Others
		Branch pipe Laying	m	1,329	1,985	3,314	3,441	4,573	6,830	11,403	
	Leachate Collection Pit	Pit work	unit	3	0	3	80,000	240	0	240	3m x 5m x 4m
		Piping Work	m	51	0	51	700	35	0	35	
		Submersible Pump	unit	7	0	7	1,100,000	7,700	0	7,700	Included Tunit a
		Pump Installing	unit	6	0	6	250,000	1,500	0	1,500	Stand-by Pump
Gas Exhaust Equipment	Vertical Type		unit	5	7	12	128,600	643	900	1,543	
	Part of Side Slope		m	65.5	95	160.2	1,766	115	167	282	
Rainwater Collection System	Gutter(1) Installing	0.7m x 0.6m	m	0	400	400	2,500	0	3,000	3,000	
	Gutter(2) Installing	0.8m x 0.8m	m	320	213	533	9,500	3,040	2,023	5,063	
	Gutter(3) Installing	1.4m x 1.4m	m	463	0	463	26,500	12,269	0	12,269	
	Gutter(4) Installing	0.6m x 0.5m	m	200	270	470	6,500	1,300	1,755	3,055	
	Gutter(5) Installing	1.2m x 0.9m	m	397	0	397	15,500	6,153	0	6,153	
	Gutter(6) Installing	1.5m x 1.5m	m	330	0	330	28,500	9,405	0	9,405	
Access Road	Surface Course	t=50mm, W=6m	m	0	6,518	6,518	5,100	0	33,241	33,241	
	Base and Subase	t=150,200mm W=6m	m	6,518	0	6,518	11,100	72,349	0	72,349	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	2,859	2,859	93	0	266	266	Excavated Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	93	0	93	270	25	0	25	Excavated Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	1	2	13,500,000	13,500	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	3,878	3,878	1,840	0	7,135	7,135	
Gate	Gate Work	W=8m H=2.2m	unit	0	1	1	120,000	0	120	120	
Adm. Facilities	Control Office		m2	200	0	200	25,000	5,000	0	5,000	
	Rest House		m2	0	200	200	22,000	0	4,400	4,400	
	Truck scale		unit	2	0	2	1,750,000	3,500	0	3,500	
	Car wash Equip	10m x 3m x 0.5m	unit	1	0	1	80,000	80	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	1	800,000	800	0	800	
	Workshop and Garage		m2	200	0	200	22,000	4,400	0	4,400	
	Parking Lot		m2	1,000	1,000	2,000	2,700	2,700	2,700	5,400	
Total								399,887	235,957	635,844	
Auxiliary Works			L.S			1		119,966	70,787	190,753	Total x 30%
Direct Cost Total								519,853	306,744	826,597	

Table 8-7-2 Facility Construction Cost (Case 1, Level 3+)

Item	Works	Subitem	Unit	Quantity 1st Stage	Quantity 2nd Stage	Quantity Total	Unit Price	Amount (10^3Kshs) 1st Stage	Amount (10^3Kshs) 2nd Stage	Amount (10^3Kshs) Total	Remarks
Preparing Work	Weeding		m2	53,280	0	53,280	3	159	0	159	
	Root of Wood Removing		m2	214,850	0	214,850	63	13,535	0	13,535	
	Weed and Root Burning		m2	268,150	0	268,150	5	1,340	0	1,340	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	62,170	82,430	144,600	105	6,527	8,656	15,183	
		Dumptruck Transport (1km)	m3	80,820	107,180	188,000	92	7,435	9,861	17,296	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	66,240	96,060	162,300	531	35,173	51,008	86,181	
		Excavator Loading	m3	86,310	124,896	211,000	121	10,419	15,112	25,531	
		Dumptruck Transport (500m)	m3	12,970	26,120	39,090	99	1,284	2,585	3,869	
		Dumptruck Transport (1km)	m3	73,140	98,770	171,910	112	8,191	11,062	19,253	
	Banking(Excavated Soil)		m3	11,910	10,660	22,570	64	762	682	1,444	
	Banking(Bought Soil)		m3	45,400	37,610	83,010	1,285	58,339	48,328	106,667	
	Side-slope Adjusting		m2	19,330	16,330	35,660	194	3,750	3,168	6,918	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	8,540	0	8,540	105	896	0	896	
		Dumptruck Transport (1km)	m3	11,100	0	11,100	92	1,021	0	1,021	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	14,420	0	14,420	531	7,657	0	7,657	
		Excavator Loading	m3	18,750	0	18,750	121	2,268	0	2,268	
		Dumptruck Transport (1km)	m3	18,750	0	18,750	112	2,100	0	2,100	
	Side-slope Adjusting		m2	6,240	0	6,240	194	1,210	0	1,210	
	Land Adjusting		m2	3,760	0	3,760	180	676	0	676	Machine Work
	Liner Laying Work		m2	10,000	0	10,000	3,000	30,000	0	30,000	
	Piping Work		m	10 22	0	10 22	700	7	0	7	
	Pump Installing Work	Submersible Pump	unit	2	0	2	100,000	200	0	200	Included Unit a
		Pump Installing	unit	1	0	1	50000	50	0	50	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	105	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	92	0	0	0	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	0	0	0	531	0	0	0	
		Excavator Loading	m3	0	0	0	121	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	112	0	0	0	
	Side-slope Adjusting		m2	0	0	0	194	0	0	0	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Piping Work		m	0	0	0 0	700	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	100,000	0	0	0	
		Pump Installing	unit	0	0	0	50,000	0	0	0	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	79 5	0	79 5	23,702	1,884	0	1,884	Under Dike
		Main pipe Laying(2)	m	355	770	1,125	12,182	4,324	9,380	13,704	Others
		Branch pipe Laying	m	1,329	1,985	3,314	3,441	4,573	6,830	11,403	
	Leachate Collection Pit	Pit work	unit	3	0	3	80,000	240	0	240	3m x 5m x 4m
		Piping Work	m	51	0	51	700	35	0	35	
		Submersible Pump	unit	7	0	7	1,100,000	7,700	0	7,700	Included Unit a
		Pump Installing	unit	6	0	6	250,000	1,500	0	1,500	Stand-by Pump
Gas Exhaust Equipment	Vertical Type		unit	5	7	12	128,600	643	900	1,543	
	Part of Side Slope		m	65 5	95	160 2	1,766	115	167	282	
Rainwater Collection System	Gutter(1) Installing	0 7m x 0 6m	m	0	400	400	7,500	0	3,000	3,000	
	Gutter(2) Installing	0 8m x 0 8m	m	287	213	500	9,500	2,726	2,024	4,750	
	Gutter(3) Installing	1 4m x 1 4m	m	430	0	430	26,500	11,395	0	11,395	
	Gutter(4) Installing	0 6m x 0 5m	m	200	270	470	6,500	1,300	1,755	3,055	
	Gutter(5) Installing	1 2m x 0 9m	m	397	0	397	15,500	6,153	0	6,153	
	Gutter(6) Installing	1 5m x 1 5m	m	363	0	363	28,500	10,345	0	10,345	
Access Road	Surface Course	t=50mm, W=6m	m	0	6,518	6,518	5,100	0	33,241	33,241	
	Base and Subase	t=150,200mm W=6m	m	6,518	0	6,518	11,100	72,349	0	72,349	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	2,259	2,259	93	0	210	210	Excavated Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	93	0	93	270	25	0	25	Excavated Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	1	2	13,500,000	13,500	13,500	27,000	
Net fence	Net fence Work	H=2 4m	m	0	3,808	3,808	1,840	0	7,006	7,006	
Gate	Gate Work	W=8m H=2 2m	unit	0	1	1	120,000	0	120	120	
Adm Facilities	Control Office		m2	200	0	200	25,000	5,000	0	5,000	
	Rest House		m2	0	200	200	22,000	0	4,400	4,400	
	Truck scale		unit	2	0	2	1,750,000	3,500	0	3,500	
	Car wash Equip	10m x 3m x 0 5m	unit	1	0	1	80,000	80	0	80	
	Septic Tank	4m x 5m x 3 5m	unit	1	0	1	800,000	800	0	800	
	Workshop and Garage		m2	200	0	200	22,000	4,400	0	4,400	
	Parking Lot		m2	1,000	1,000	2,000	2,700	2,700	2,700	5,400	
Total								348,286	235,695	583,981	
Auxiliary Works			LS			1		104,486	70,708	175,194	Total x 30%
Direct Cost Total								452,772	306,403	759,175	

Table 8-7-3 Facility Construction Cost (Case I, Level 3)

Item	Works	Subitem	Unit	Quantity 1st Stage	Quantity 2nd Stage	Quantity Total	Unit Price	Amount (10³Kshs) 1st Stage	Amount (10³Kshs) 2nd Stage	Amount (10³Kshs) Total	Remarks
Preparing Work	Weeding		m2	53,280	0	53,280	3	159	0	159	
	Root of Wood Removing		m2	204,050	0	204,050	63	12,855	0	12,855	
	Weed and Root Burning		m2	257,350	0	257,350	5	1,286	0	1,286	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	62,370	82,430	144,800	105	6,527	8,656	15,183	
		Dumptruck Transport (1km)	m3	80,820	107,180	188,000	92	7,435	9,861	17,296	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	66,240	96,060	162,300	531	35,173	51,008	86,181	
		Excavator Loading	m3	86,110	124,890	211,000	121	10,419	15,112	25,531	
		Dumptruck Transport (500m)	m3	19,390	19,700	39,090	99	1,919	1,950	3,869	
		Dumptruck Transport (1km)	m3	66,720	105,190	171,910	112	7,472	11,781	19,253	
	Banking(Excavated Soil)		m3	11,910	10,660	22,570	64	762	682	1,444	
	Banking(Bought Soil)		m3	45,400	37,610	83,010	1,285	58,339	48,328	106,667	
	Side-slope Adjusting		m2	19,330	16,330	35,660	194	3,750	3,168	6,918	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	105	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	92	0	0	0	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	0	0	0	531	0	0	0	
		Excavator Loading	m3	0	0	0	121	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	112	0	0	0	
	Side-slope Adjusting		m2	0	0	0	194	0	0	0	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Piping Work		m	0	0	0	700	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	100,000	0	0	0	Included Unit a
		Pump Installing	unit	0	0	0	50000	0	0	0	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	105	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	92	0	0	0	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	0	0	0	531	0	0	0	
		Excavator Loading	m3	0	0	0	121	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	112	0	0	0	
	Side-slope Adjusting		m2	0	0	0	194	0	0	0	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Piping Work		m	0	0	0	700	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	100,000	0	0	0	
		Pump Installing	unit	0	0	0	50,000	0	0	0	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	79.5	0	79.5	23,702	1,884	0	1,884	Under Dike
		Main pipe Laying(2)	m	355	770	1,125	12,182	4,324	9,380	13,704	Others
		Branch pipe Laying	m	1,329	1,985	3,314	3,441	4,573	6,830	11,403	
	Leachate Collection Pit	Pit work	unit	3	0	3	80,000	240	0	240	3m x 5m x 4m
		Piping Work	m	51	0	51	700	35	0	35	
		Submersible Pump	unit	7	0	7	1,100,000	7,700	0	7,700	Included Unit a
		Pump Installing	unit	6	0	6	250,000	1,500	0	1,500	Stand-by Pump
Gas Exhaust Equipment	Vertical Type		unit	5	7	12	128,600	643	900	1,543	
	Part of Side Slope		m	65.5	95	160.2	1,766	115	167	282	
Rainwater Collection System	Gutter(1) Installing	0.7m x 0.6m	m	0	400	400	7,500	0	3,000	3,000	
	Gutter(2) Installing	0.8m x 0.8m	m	260	240	500	9,500	2,470	2,280	4,750	
	Gutter(3) Installing	1.4m x 1.4m	m	430	0	430	26,500	11,395	0	11,395	
	Gutter(4) Installing	0.6m x 0.5m	m	200	270	470	6,500	1,300	1,755	3,055	
	Gutter(5) Installing	1.2m x 0.9m	m	397	0	397	15,500	6,153	0	6,153	
	Gutter(6) Installing	1.5m x 1.5m	m	363	0	363	28,500	10,345	0	10,345	
Access Road	Surface Course	t=50mm, W=6m	m	0	6,518	6,518	5,100	0	33,241	33,241	
	Base and Subase	t=150,200mm W=6m	m	6,518	0	6,518	11,100	72,349	0	72,349	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	1,805	1,805	93	0	167	167	Excavated Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	93	0	93	270	25	0	25	Excavated Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	1	2	13,500,000	13,500	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	3,754	3,754	1,840	0	6,907	6,907	
Gate	Gate Work	W=8m H=2.2m	unit	0	1	1	120,000	0	120	120	
Adm. Facilities	Control Office		m2	200	0	200	25,000	5,000	0	5,000	
	Rest House		m2	0	200	200	22,000	0	4,400	4,400	
	Truck scale		unit	2	0	2	1,750,000	3,500	0	3,500	
	Car wash Equip	10m x 3m x 0.5m	unit	1	0	1	80,000	80	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	1	800,000	800	0	800	
	Workshop and Garage		m2	200	0	200	22,000	4,400	0	4,400	
	Parking Lot		m2	1,000	1,000	2,000	2,700	2,700	2,700	5,400	
Total								301,127	235,893	537,020	
Auxiliary Works			LS			1		90,338	70,768	161,106	Total x 30%
Direct Cost Total								391,465	306,661	698,126	

Table 8-7-4 Facility Construction Cost (Case 1, Level 2+)

Item	Works	Subitem	Unit	Quantity 1st Stage	Quantity 2nd Stage	Quantity Total	Unit Price	Amount (10³Kshs) 1st Stage	Amount (10³Kshs) 2nd Stage	Amount (10³Kshs) Total	Remarks
Preparing Work	Weeding		m2	53,280	0	53,280	3	159	0	159	
	Root of Wood Removing		m2	204,050	0	204,050	63	12,855	0	12,855	
	Weed and Root Burning		m2	257,350	0	257,350	5	1,286	0	1,286	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	62,170	82,430	144,600	105	6,527	8,656	15,183	
		Dumptruck Transport (1km)	m3	80,820	107,180	188,000	92	7,435	9,861	17,296	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	66,240	96,060	162,300	531	35,173	51,008	86,181	
		Excavator Loading	m3	86,110	124,890	211,000	121	10,419	15,112	25,531	
		Dumptruck Transport (500m)	m3	15,830	14,720	30,550	99	1,567	1,457	3,024	
		Dumptruck Transport (1km)	m3	70,280	110,170	180,450	112	7,871	12,339	20,210	
	Banking(Excavated Soil)		m3	11,910	10,660	22,570	64	762	682	1,444	
	Banking(Bought Soil)		m3	45,400	37,610	83,010	1,285	58,339	48,328	106,667	
	Side-slope Adjusting		m2	19,330	16,330	35,660	194	3,750	3,168	6,918	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	105	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	92	0	0	0	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	0	0	0	531	0	0	0	
		Excavator Loading	m3	0	0	0	121	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	112	0	0	0	
	Side-slope Adjusting		m2	0	0	0	194	0	0	0	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Piping Work		m	0	0	0	700	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	100,000	0	0	0	Included 1unit a
		Pump Installing	unit	0	0	0	50000	0	0	0	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	105	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	92	0	0	0	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	0	0	0	531	0	0	0	
		Excavator Loading	m3	0	0	0	121	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	112	0	0	0	
	Side-slope Adjusting		m2	0	0	0	194	0	0	0	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Piping Work		m	0	0	0	700	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	100,000	0	0	0	
		Pump Installing	unit	0	0	0	50,000	0	0	0	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	0	0	0	23,702	0	0	0	Under Dike
		Main pipe Laying(2)	m	0	0	0	12,182	0	0	0	Others
		Branch pipe Laying	m	0	0	0	3,441	0	0	0	
	Leachate Collection Pit	Pit work	unit	0	0	0	80,000	0	0	0	3m x 5m x 4m
		Piping Work	m	0	0	0	700	0	0	0	
		Submersible Pump	unit	0	0	0	1,100,000	0	0	0	Included 1unit a
		Pump Installing	unit	0	0	0	250,000	0	0	0	Stand-by Pump
Gas Exhaust Equipment	Vertical Type		unit	5	7	12	128,600	643	900	1,543	
	Part of Side Slope		m	65.5	95	160.2	1,766	115	167	282	
Rainwater Collection System	Gutter(1) Installing	0.7m x 0.6m	m	0	400	400	7,500	0	3,000	3,000	
	Gutter(2) Installing	0.8m x 0.8m	m	260	240	500	9,500	2,470	2,280	4,750	
	Gutter(3) Installing	1.4m x 1.4m	m	430	0	430	26,500	11,395	0	11,395	
	Gutter(4) Installing	0.6m x 0.5m	m	200	270	470	6,500	1,300	1,755	3,055	
	Gutter(5) Installing	1.2m x 0.9m	m	397	0	397	15,500	6,153	0	6,153	
	Gutter(6) Installing	1.5m x 1.5m	m	363	0	363	28,500	10,345	0	10,345	
Access Road	Surface Course	t=50mm, W=6m	m	0	6,518	6,518	5,100	0	33,241	33,241	
	Base and Subase	t=150,200mm W=6m	m	6,518	0	6,518	11,100	72,349	0	72,349	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	1,805	1,805	93	0	167	167	Excavated Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	93	0	93	270	25	0	25	Excavated Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	1	2	13,500,000	13,500	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	3,754	3,754	1,840	0	6,907	6,907	
Gate	Gate Work	W=8m H=2.2m	unit	0	1	1	120,000	0	120	120	
Adm. Facilities	Control Office		m2	200	0	200	25,000	5,000	0	5,000	
	Rest House		m2	0	200	200	22,000	0	4,400	4,400	
	Truck scale		unit	2	0	2	1,750,000	3,500	0	3,500	
	Car wash Equip	10m x 3m x 0.5m	unit	1	0	1	80,000	80	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	1	800,000	800	0	800	
	Workshop and Garage		m2	200	0	200	22,000	4,400	0	4,400	
	Parking Lot		m2	1,000	1,000	2,000	2,700	2,700	2,700	5,400	
Total								280,918	219,748	500,666	
Auxiliary Works			LS			1		84,275	65,925	150,200	Total x 30%
Direct Cost Total								365,193	285,673	650,866	

Table 8-7-5 Facility Construction Cost (Case 2, Level 4)

Item	Works	Subitem	Unit	Quantity 1st Stage	Quantity 2nd Stage	Quantity Total	Unit Price	Amount (10^3Kshs) 1st Stage	Amount (10^3Kshs) 2nd Stage	Amount (10^3Kshs) Total	Remarks
Preparing Work	Weeding		m2	53,280	0	53,280	3	159	0	159	
	Root of Wood Removing		m2	229,200	0	229,200	63	14,439	0	14,439	
	Weed and Root Burning		m2	282,500	0	282,500	5	1,412	0	1,412	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	62,170	82,430	144,600	105	6,527	8,656	15,183	
		Dumptruck Transport (1km)	m3	80,820	107,180	188,000	92	7,435	9,861	17,296	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	66,240	96,060	162,300	531	35,173	51,008	86,181	
		Excavator Loading	m3	86,110	124,890	211,000	121	10,419	15,112	25,531	
		Dumptruck Transport (500m)	m3	19,350	20,140	39,490	99	1,915	1,994	3,909	
		Dumptruck Transport (1km)	m3	66,760	104,750	171,510	112	7,477	11,732	19,209	
	Barking(Excavated Soil)		m3	13,910	10,660	22,570	64	762	682	1,444	
	Barking(Bought Soil)		m3	45,490	37,619	83,010	1,285	58,339	48,328	106,667	
	Side-slope Adjusting		m2	19,330	16,330	35,660	194	3,750	3,168	6,918	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	8,540	0	8,540	105	896	0	896	
		Dumptruck Transport (1km)	m3	11,100	0	11,100	92	1,021	0	1,021	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	14,420	0	14,420	531	7,657	0	7,657	
		Excavator Loading	m3	18,750	0	18,750	121	2,268	0	2,268	
		Dumptruck Transport (1km)	m3	18,750	0	18,750	112	2,100	0	2,100	
	Side-slope Adjusting		m2	6,240	0	6,240	194	1,210	0	1,210	
	Land Adjusting		m2	3,760	0	3,760	180	676	0	676	Machine Work
	Liner Laying Work		m2	10,000	0	10,000	3,000	30,000	0	30,000	
	Piping Work		m	10 22	0	10 22	700	7	0	7	
	Pump Installing Work	Submersible Pump	unit	2	0	2	100,000	200	0	200	Included 1unit a
		Pump Installing	unit	1	0	1	50000	50	0	50	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	10,220	0	10,220	105	1,073	0	1,073	
		Dumptruck Transport (1km)	m3	13,290	0	13,290	92	1,222	0	1,222	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	12,060	0	12,060	531	6,403	0	6,403	
		Excavator Loading	m3	15,680	0	15,680	121	1,897	0	1,897	
		Dumptruck Transport (1km)	m3	15,680	0	15,680	112	1,756	0	1,756	
	Side-slope Adjusting		m2	5,810	0	5,810	194	1,127	0	1,127	
	Land Adjusting		m2	6,058	0	6,058	180	1,090	0	1,090	Machine Work
	Liner Laying Work		m2	11,870	0	11,870	3,000	35,610	0	35,610	
	Piping Work		m	48 5	0	48 5	700	33	0	33	
	Pump Installing Work	Submersible Pump	unit	2	0	2	100,000	200	0	200	
		Pump Installing	unit	1	0	1	50,000	50	0	50	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	79 5	0	79 5	23,702	1,884	0	1,884	Under Dike
		Main pipe Laying(2)	m	355	770	1,125	12,182	4,324	9,380	13,704	Others
		Branch pipe Laying	m	1,329	1,985	3,314	3,441	4,573	6,830	11,403	
	Leachate Collection Pit	Pit work	unit	3	0	3	80,000	240	0	240	3m x 5m x 4m
		Piping Work	m	51	0	51	700	35	0	35	
		Submersible Pump	unit	7	0	7	1,100,000	7,700	0	7,700	Included 1unit a
		Pump Installing	unit	6	0	6	250,000	1,500	0	1,500	Stand-by Pump
Gas Exhaust Equipment	Vertical Type		unit	5	7	12	70,675	353	495	848	
	Part of Side Slope		m	65 5	95	160 2	1,766	115	167	282	
Rainwater Collection System	Gutter(1) Installing	0 7m x 0 6m	m	0	400	400	7,500	0	3,000	3,000	
	Gutter(2) Installing	0 8m x 0 8m	m	320	213	533	9,500	3,040	2,023	5,063	
	Gutter(3) Installing	1 4m x 1 4m	m	463	0	463	26,500	12,269	0	12,269	
	Gutter(4) Installing	0 6m x 0 5m	m	200	270	470	6,500	1,300	1,755	3,055	
	Gutter(5) Installing	1 2m x 0 9m	m	397	0	397	15,500	6,153	0	6,153	
	Gutter(6) Installing	1 5m x 1 5m	m	330	0	330	28,500	9,405	0	9,405	
Access Road	Surface Course	t=50mm, W=6m	m	0	6,518	6,518	5,100	0	33,241	33,241	
	Base and Subase	t=150,200mm W=6m	m	6,518	0	6,518	11,100	72,349	0	72,349	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	2,869	2 869	93	0	266	266	Excavated Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	93	0	93	270	25	0	25	Excavated Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	1	2	13,500,000	13,500	13,500	27,000	
Net fence	Net fence Work	H=2 4m	m	0	3,878	3,878	1,840	0	7,135	7,135	
Gate	Gate Work	W=8m H=2 2m	unit	0	1	1	120,000	0	120	120	
Adm. Facilities	Control Office		m2	200	0	200	25,000	5,000	0	5,000	
	Rest House		m2	0	200	200	22,000	0	4,400	4,400	
	Truck scale		unit	2	0	2	1,750,000	3,500	0	3,500	
	Car wash Equip	10m x 3m x 0 5m	unit	1	0	1	80,000	80	0	80	
	Septic Tank	4m x 5m x 3 5m	unit	1	0	1	800,000	800	0	800	
	Workshop and Garage		m2	200	0	200	22,000	4,400	0	4,400	
	Parking Lot		m2	1,000	1,000	2,000	2,700	2,700	2,700	5,400	
Total								399,598	235,553	635,151	
Auxiliary Works			L S			1		119,879	70,666	190,545	Total x 30%
Direct Cost Total								519,477	306,219	825,696	

Table 8-7-6 Facility Construction Cost (Case 3, Level 4)

Item	Works	Subitem	Unit	Quantity 1st Stage	2nd Stage	3rd Stage	Total	Unit Price	Amount (10^3Kshs) 1st Stage	2nd Stage	3rd Stage	Total	Remarks
Preparing Work	Weeding		m2	44,780	0	0	44,780	3	134	0	0	134	
	Root of Wood Removing		m2	442,400	0	0	442,400	63	27,871	0	0	27,871	
	Weed and Root Burning		m2	487,200	0	0	487,200	5	2,436	0	0	2,436	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	62,170	145,400	100,330	307,900	105	6,527	15,267	10,535	32,329	
		Dumptruck Transport (1km)	m3	80,820	189,000	130,480	400,300	92	7,435	17,388	12,004	36,827	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	66,240	178,400	120,860	365,500	531	35,173	94,730	64,177	194,080	
		Excavator Loading	m3	86,110	231,900	157,190	475,200	121	10,419	28,059	19,021	57,499	
		Dumptruck Transport (500m)	m3	20,120	24,900	28,440	73,460	99	1,991		5,281	7,272	
		Dumptruck Transport (1km)	m3	65,990	207,000	128,750	401,740	112	7,390		37,604	44,994	
	Banking(Excavated Soil)		m3	18,910	11,160	12,860	35,930	61	762	714	823	2,299	
	Banking(Bought Soil)		m3	43,740	38,650	47,040	130,430	1,285	57,490	49,665	60,447	167,602	
	Side-slope Adjusting		m2	19,330	18,730	18,620	56,680	194	3,750	3,633	3,612	10,995	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	16,300	0	0	16,300	105	1,711	0	0	1,711	
		Dumptruck Transport (1km)	m3	21,190	0	0	21,190	92	1,949	0	0	1,949	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	33,470	0	0	33,470	531	17,772	0	0	17,772	
		Excavator Loading	m3	43,510	0	0	43,510	121	5,264	0	0	5,264	
		Dumptruck Transport (1km)	m3	43,510	0	0	43,510	112	4,873	0	0	4,873	
	Side-slope Adjusting		m2	6,552	0	0	6,552	194	1,271	0	0	1,271	
	Land Adjusting		m2	11,280	0	0	11,280	180	2,030	0	0	2,030	Machine Work
	Liner Laying Work		m2	17,830	0	0	17,830	3,000	53,490	0	0	53,490	
	Piping Work		m	10.22	0	0	10.22	700	7	0	0	7	
	Pump Installing Work	Submersible Pump	unit	2	0	0	2	100,000	200	0	0	200	Included Unit 2
		Pump Installing	unit	1	0	0	1	50000	50	0	0	50	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	17,970	0	0	17,970	105	1,886	0	0	1,886	
		Dumptruck Transport (1km)	m3	23,360	0	0	23,360	92	2,149	0	0	2,149	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	22,710	0	0	22,710	531	12,059	0	0	12,059	
		Excavator Loading	m3	29,520	0	0	29,520	121	3,571	0	0	3,571	
		Dumptruck Transport (1km)	m3	29,520	0	0	29,520	112	3,306	0	0	3,306	
	Side-slope Adjusting		m2	7,533	0	0	7,533	194	1,461	0	0	1,461	
	Land Adjusting		m2	12,520	0	0	12,520	180	2,253	0	0	2,253	Machine Work
	Liner Laying Work		m2	20,050	0	0	20,050	3,000	60,150	0	0	60,150	
	Piping Work		m	48.5	0	0	48.5	700	33	0	0	33	
	Pump Installing Work	Submersible Pump	unit	2	0	0	2	100,000	200	0	0	200	
		Pump Installing	unit	1	0	0	1	50,000	50	0	0	50	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	79.5	0	0	79.5	29,183	2,320	0	0	2,320	Under Dike
		Main pipe Laying(2)	m	355	1,200	982	2,537	18,322	6,504	21,986	17,992	46,482	Others
		Branch pipe Laying	m	1,329	2,999	2,596	6,924	3,441	4,573	10,319	8,933	23,825	
	Leachate Collector Pit	Pit work	unit	3	0	0	3	80,000	240	0	0	240	3m x 5m x 4m
		Piping Work	m	76.5	0	0	76.5	700	53	0	0	53	
		Submersible Pump	unit	10	0	0	10	1,100,000	11,000	0	0	11,000	Included Unit 2
		Pump Installing	unit	9	0	0	9	250,000	2,250	0	0	2,250	Stand-by Pump
Gas Exhaust Equipment	Vertical Type		unit	5	12	9	26	111,565	557	1338	1005	2,900	
	Part of Side Slope		m	65.5	110.8	119.9	296.2	1,766	115	195	213	523	
Rainwater Collection System	Gutter(1) Installing	0.8m x 0.8m	m	200	457	690	1,347	9,500	1,900	4,341	6,555	12,796	
	Gutter(2) Installing	1.2m x 0.9m	m	320	340	395	1,055	15,500	4,960	5,270	6,122	16,352	
	Gutter(3) Installing	2.0m x 1.4m	m	400	0	0	400	30,000	12,000	0	0	12,000	
	Gutter(4) Installing	1.6m x 1.2m	m	397	0	0	397	20,000	7,940	0	0	7,940	
	Gutter(5) Installing	2.2m x 1.4m	m	108	0	0	108	31,000	3,348	0	0	3,348	
	Gutter(6) Installing	2.2m x 1.5m	m	315	0	0	315	32,500	10,237	0	0	10,237	
Access Road	Surface Course	t=50mm, W=6m	m	0	0	7,083	7,083	5,100	0	0	36,123	36,123	
	Base and Subase	t=150,200mm W=6m	m	7,083	0	0	7,083	11,100	78,621	0	0	78,621	
Maintenance Road	Road Construction	Crushed Stone, t=200mm, W=3m	m	0	0	3,523	3,523	93	0	0	327	327	Excavated Clashed Stone
On-site Road	Road Construction	Crushed Stone, t=300mm, W=6m	m	95.2	0	47.8	143	270	25	0	13	38	Excavated Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	0	1	2	13,500,000	13,500	0	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	0	3,918	3,918	1,840	0	0	7,209	7,209	
Gate	Gate Work	W=8m H=2.2m	unit	0	0	1	1	120,000	0	0	120	120	
Adm. Facilities	Control Office		m2	200	0	0	200	25,000	5,000	0	0	5,000	
	Rest House		m2	0	200	0	200	22,000	0	4,400	0	4,400	
	Truck scale		unit	2	0	0	2	1,750,000	3,500	0	0	3,500	
	Car wash Equip	10m x 3m x 0.5m	unit	1	0	0	1	80,000	80	0	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	0	1	800,000	800	0	0	800	
	Workshop and Garage		m2	200	0	0	200	22,000	4,400	0	0	4,400	
	Parking Lot		m2	1,000	1,000	0	2,000	2,700	2,700	2,700	0	5,400	
Total									533,736	260,005	311,616	1,085,357	
Auxiliary Works			L.S	1	1	1	1		154,121	78,002	93,484	325,607	Total x 30%
Direct Cost Total									687,857	338,007	405,100	1,410,964	

Table 8-7-7 Facility Construction Cost (Case 3, Level 3+)

Item	Works	Solution	Unit	Quantity 1st Stage	2nd Stage	3rd Stage	Total	Unit Price	Amount (10^3Kshs) 1st Stage	2nd Stage	3rd Stage	Total	Remarks	List of Price
Preparing Work	Weeding		m2	44,780	0	0	44,780	3	134	0	0	134		P-1
	Root of Wood Removing		m2	442,400	0	0	442,400	63	27,871	0	0	27,871		P-3
	Weed and Root Burning		m2	464,600	0	0	464,600	5	2,323	0	0	2,323		P-4
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	62,170	145,400	100,330	307,900	105	6,527	15,267	10,535	32,329		A-1
		Dumptruck Transport (1km)	m3	80,820	189,000	130,480	400,300	92	7,435	17,388	12,004	36,827		A-3
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	66,240	178,400	120,860	365,500	531	35,173	94,730	64,177	194,080		A-5
		Excavator Loading	m3	86,110	231,900	157,190	475,200	121	10,419	28,059	19,021	57,499		A-9
		Dumptruck Transport (500m)	m3	20,120	24,900	27,810	72,830	99	1,991		5,219	7,210		A-10
		Dumptruck Transport (1km)	m3	65,990	207,000	129,380	402,370	112	7,390		37,675	45,065		A-10-1
	Banking(Excavated Soil)		m3	11,910	11,160	12,860	35,930	64	762	714	823	2,299		A-11
	Banking(Bought Soil)		m3	44,740	38,650	47,040	130,430	1,285	57,490	49,665	60,447	167,602		A-13
	Side-slope Adjusting		m2	19,330	18,730	18,620	56,680	194	3,750	3,633	3,612	10,995		A-14
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	16,300	0	0	16,300	105	1,711	0	0	1,711		A-1
		Dumptruck Transport (1km)	m3	21,190	0	0	21,190	92	1,949	0	0	1,949		A-3
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	33,470	0	0	33,470	531	17,772	0	0	17,772		A-5
		Excavator Loading	m3	43,510	0	0	43,510	121	5,264	0	0	5,264		A-9
		Dumptruck Transport (1km)	m3	43,510	0	0	43,510	112	4,873	0	0	4,873		A-10-1
	Side-slope Adjusting		m2	6,552	0	0	6,552	194	1,271	0	0	1,271		A-14
	Land Adjusting		m2	11,280	0	0	11,280	180	2,030	0	0	2,030	Machine Work	
	Liner Laying Work		m2	17,830	0	0	17,830	3,000	53,490	0	0	53,490		A-15
	Piping Work		m	10.22	0	0	10.22	700	7	0	0	7		A-16
	Pump Installing Work	Submersible Pump	unit	2	0	0	2	100,000	200	0	0	200	Included Unit a	A-17
		Pump Installing	unit	1	0	0	1	50000	50	0	0	50	Stand-by Pump	A-18
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	0	105	0	0	0	0		A-1
		Dumptruck Transport (1km)	m3	0	0	0	0	92	0	0	0	0		A-3
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	0	0	0	0	531	0	0	0	0		A-5
		Excavator Loading	m3	0	0	0	0	121	0	0	0	0		A-9
		Dumptruck Transport (1km)	m3	0	0	0	0	112	0	0	0	0		A-10-1
	Side-slope Adjusting		m2	0	0	0	0	194	0	0	0	0		A-14
	Land Adjusting		m2	0	0	0	0	180	0	0	0	0	Machine Work	
	Liner Laying Work		m2	0	0	0	0	3,000	0	0	0	0		A-15
	Piping Work		m	0	0	0	0.0	700	0	0	0	0		A-16
	Pump Installing Work	Submersible Pump	unit	0	0	0	0	100,000	0	0	0	0		A-17
		Pump Installing	unit	0	0	0	0	50,000	0	0	0	0		A-18
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	79.5	0	0	79.5	29,183	2,320	0	0	2,320	Under Dike	A-25-2
		Main pipe Laying(2)	m	355	1,200	982	2,537	18,322	6,504	21,936	17,992	46,482	Others	A-21-2
		Branch pipe Laying	m	1,329	2,999	2,596	6,924	3,441	4,573	10,319	8,933	23,825		A-24-1
	Leachate Collection Pit	Pit work	unit	3	0	0	3	80,000	240	0	0	240	3m x 5m x 4m	A-28
		Piping Work	m	76.5	0	0	76.5	700	53	0	0	53		A-17
		Submersible Pump	unit	10	0	0	10	1,100,000	11,000	0	0	11,000	Included Unit a	A-19
		Pump Installing	unit	9	0	0	9	250,000	2,250	0	0	2,250	Stand-by Pump	A-20
Gas Exhaust Equipment	Vertical Type		unit	5	12	9	26	111,565	557	1338	1005	2,900		A-33-2
	Part of Side Slope		m	65.5	110.8	119.9	296.2	1,766	115	195	213	523		A-26-1
Rainwater Collection System	Gutter(1) Installing	0.8m x 0.8m	m	200	457	690	1,347	9,500	1,900	4,341	6,555	12,796		
	Gutter(2) Installing	1.2m x 0.9m	m	320	330	350	1,000	15,500	4,960	5,270	5,270	15,500		
	Gutter(3) Installing	2.0m x 1.4m	m	400	0	0	400	30,000	12,000	0	0	12,000		
	Gutter(4) Installing	1.6m x 1.2m	m	397	0	0	397	20,000	7,940	0	0	7,940		
	Gutter(5) Installing	2.2m x 1.4m	m	53	0	0	53	31,000	1,643	0	0	1,643		
	Gutter(5) Installing	2.2m x 1.5m	m	315	0	0	315	32,500	10,237	0	0	10,237		
Access Road	Surface Course	t=50mm, W=6m	m	0	0	7,083	7,083	5,100	0	0	36,123	36,123		A-33
	Base and Subase	t=150,200mm W=6m	m	7,083	0	0	7,083	11,100	78,621	0	0	78,621		A-33-1
Maintenance Road	Road Construction	Crushed Stone t=200mm, W=3m	m	0	0	2,759	2,759	93	0	0	256	256	Excavated Crushed Stone	A-35-1
On-site Road	Road Construction	Crushed Stone, t=300mm, W=6m	m	95.2	0	47.8	143	270	25	0	13	38	Excavated Crushed Stone	A-35-1
Well for Ground-water Monitoring	Well Work	Φ = 200m	unit	1	0	1	2	13,500,000	13,500	0	13,500	27,000		A-36
Net fence	Net fence Work	H=2.4m	m	0	0	3,808	3,808	1,840	0	0	7,006	7,006		A-37
Gate	Gate Work	W=8m,H=2.2m	unit	0	0	1	1	120,000	0	0	120	120		A-38
Adm. Facilities	Control Office		m2	200	0	0	200	25,000	5,000	0	0	5,000		A-39
	Rest House		m2	0	200	0	200	22,000	0	4,400	0	4,400		A-41
	Truck scale		unit	2	0	0	2	1,750,000	3,500	0	0	3,500		A-40
	Car wash Equip	10m x 3m x 0.5m	unit	1	0	0	1	80,000	80	0	0	80		A-42
	Septic Tank	4m x 5m x 3.5m	unit	1	0	0	1	800,000	800	0	0	800		A-43
	Workshop and Garage		m2	200	0	0	200	22,000	4,400	0	0	4,400		A-41
	Parking Lot		m2	1,000	1,000	0	2,000	2,700	2,700	2,700	0	5,400		A-44
Total									424,800	260,005	310,499	995,304		
Auxiliary Works			LS	1	1	1	1		127,440	78,002	93,149	298,591	Total x 30%	
Direct Cost Total									552,240	338,007	403,648	1,293,895		

Table 8-7-8 Facility Construction Cost (Case 3, Level 3)

Item	Works	Subitem	Unit	Quantity 1st Stage	2nd Stage	3rd Stage	Total	Unit Price	Amount (10³Kshs) 1st Stage	2nd Stage	3rd Stage	Total	Remarks
Preparing Work	Weeding		m2	44,780	0	0	44,780	3	134	0	0	134	
	Root of Wood Removing		m2	442,400	0	0	442,400	63	27,871	0	0	27,871	
	Weed and Root Burning		m2	464,600	0	0	464,600	5	2,323	0	0	2,323	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	62,170	145,400	100,330	307,900	105	6,527	15,267	10,535	32,329	
		Dumptruck Transport (1km)	m3	80,820	189,000	130,480	400,300	92	7,435	17,388	12,004	36,827	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	66,240	178,400	120,860	365,500	531	35,173	94,730	64,177	194,080	
		Excavator Loading	m3	86,110	231,900	157,190	475,200	121	10,419	28,059	19,021	57,499	
		Dumptruck Transport (500m)	m3	20,120	24,900	27,810	72,830	99	1,991		5,219	7,210	
		Dumptruck Transport (1km)	m3	65,990	207,000	129,380	402,370	112	7,390		37,675	45,065	
	Banking(Excavated Soil)		m3	11,910	18,160	12,860	35,930	64	762	714	823	2,299	
	Banking(Bought Soil)		m3	44,740	38,650	47,040	130,430	1,285	57,490	49,665	60,447	167,602	
	Side-slope Adjusting		m2	19,330	18,730	18,620	56,680	194	3,750	3,633	3,612	10,995	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	0	105	0	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	0	92	0	0	0	0	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	0	0	0	0	531	0	0	0	0	
		Excavator Loading	m3	0	0	0	0	121	0	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	0	112	0	0	0	0	
	Side-slope Adjusting		m2	0	0	0	0	194	0	0	0	0	
	Land Adjusting		m2	0	0	0	0	180	0	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	0	3,000	0	0	0	0	
	Piping Work		m	0	0	0	0	700	0	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	0	100,000	0	0	0	0	Included Unit a
		Pump Installing	unit	0	0	0	0	50000	0	0	0	0	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	0	105	0	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	0	92	0	0	0	0	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	0	0	0	0	531	0	0	0	0	
		Excavator Loading	m3	0	0	0	0	121	0	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	0	112	0	0	0	0	
	Side-slope Adjusting		m2	0	0	0	0	194	0	0	0	0	
	Land Adjusting		m2	0	0	0	0	180	0	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	0	3,000	0	0	0	0	
	Piping Work		m	0	0	0	0	700	0	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	0	100,000	0	0	0	0	
		Pump Installing	unit	0	0	0	0	50,000	0	0	0	0	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	79.5	0	0	79.5	29,183	2,320	0	0	2,320	Under Dike
		Main pipe Laying(2)	m	355	1,200	982	2,537	18,322	6,504	21,986	17,992	46,482	Others
		Branch pipe Laying	m	1,329	2,999	2,596	6,924	3,441	4,573	10,319	8,933	23,825	
	Leachate Collection Pit	Pit work	unit	3	0	0	3	80,000	240	0	0	240	3m x 5m x 4m
		Piping Work	m	76.5	0	0	76.5	700	53	0	0	53	
		Submersible Pump	unit	10	0	0	10	1,100,000	11,000	0	0	11,000	Included Unit a
		Pump Installing	unit	9	0	0	9	250,000	2,250	0	0	2,250	Stand-by Pump
Gas Exhaust Equipment	Vertical Type		m	5	12	9	26	111,565	557	1338	1005	2,900	
	Part of Side Slope		m	65.5	110.8	119.9	296.2	1,765	115	195	213	523	
Rainwater Collection System	Gutter(1) Installing	0.8m x 0.8m	m	200	457	690	1,347	9,500	1,900	4,341	6,555	12,796	
	Gutter(2) Installing	1.2m x 0.9m	m	320	340	340	1,000	15,500	4,960	5,270	5,270	15,500	
	Gutter(3) Installing	2.0m x 1.4m	m	400	0	0	400	30,000	12,000	0	0	12,000	
	Gutter(4) Installing	1.6m x 1.2m	m	397	0	0	397	20,000	7,940	0	0	7,940	
	Gutter(5) Installing	2.2m x 1.4m	m	53	0	0	53	31,000	1,643	0	0	1,643	
	Gutter(6) Installing	2.2m x 1.5m	m	315	0	0	315	32,500	10,237	0	0	10,237	
Access Road	Surface Course	t=50mm, W=6m	m	0	0	7,083	7,083	5,100	0	0	36,123	36,123	
	Base and Subase	t=150,200mm W=6m	m	7,083	0	0	7,083	11,100	78,621	0	0	78,621	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	0	2,759	2,759	93	0	0	256	256	Excavated Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	95.2	0	47.8	143	270	25	0	13	38	Excavated Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	0	1	2	13,500,000	13,500	0	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	0	3,808	3,808	1,840	0	0	7,006	7,006	
Gate	Gate Work	W=8m H=2.2m	unit	0	0	1	1	120,000	0	0	120	120	
Adm. Facilities	Control Office		m2	200	0	0	200	25,000	5,000	0	0	5,000	
	Rest House		m2	0	200	0	200	22,000	0	4,400	0	4,400	
	Truck scale		unit	2	0	0	2	1,750,000	3,500	0	0	3,500	
	Car wash Equip	10m x 3m x 0.5m	unit	1	0	0	1	80,000	80	0	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	0	1	800,000	800	0	0	800	
	Workshop and Garage		m2	200	0	0	200	22,000	4,400	0	0	4,400	
	Parking Lot		m2	1,000	1,000	0	2,000	2,700	2,700	2,700	0	5,400	
Total									335,183	260,065	310,499	906,687	
Auxiliary Works			LS	1	1	1	1		100,855	78,002	93,149	272,006	Total x 30%
Direct Cost Total									437,038	338,067	403,648	1,178,693	

Table 8-7-9 Facility Construction Cost (Case 3, Level 2+)

Item	Works	Subitem	Unit	Quantity 1st Stage	2nd Stage	3rd Stage	Total	Unit Price	Amount (10^3Kshs) 1st Stage	2nd Stage	3rd Stage	Total	Remarks
Preparing Work	Weeding		m2	44,780	0	0	44,780	3	134	0	0	134	
	Root of Wood Removing		m2	442,490	0	0	442,490	63	27,871	0	0	27,871	
	Weed and Root Burning		m2	464,600	0	0	464,600	5	2,323	0	0	2,323	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	62,170	145,400	100,330	307,900	105	6,527	15,267	10,535	32,329	
		Dumptruck Transport (1km)	m3	80,830	189,000	130,480	400,300	92	7,435	17,388	12,004	36,827	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	66,240	178,400	120,860	365,500	531	35,173	94,730	64,177	194,080	
		Excavator Loading	m3	86,110	231,900	157,490	475,200	121	10,419	28,059	19,021	57,499	
		Dumptruck Transport (500m)	m3	15,820	14,760	19,340	49,920	99	1,566		3,376	4,942	
		Dumptruck Transport (1km)	m3	70,290	227,140	137,850	425,280	112	7,872		39,759	47,631	
	Banking(Excavated Soil)		m3	11,910	11,160	12,860	35,930	64	762	714	823	2,299	
	Banking(Bought Soil)		m3	44,740	38,650	47,040	130,430	1,285	57,490	49,665	60,447	167,602	
	Side-slope Adjusting		m2	19,330	18,730	18,620	56,680	194	3,750	3,633	3,612	10,995	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	0	105	0	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	0	92	0	0	0	0	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	0	0	0	0	531	0	0	0	0	
		Excavator Loading	m3	0	0	0	0	121	0	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	0	112	0	0	0	0	
	Side-slope Adjusting		m2	0	0	0	0	194	0	0	0	0	
	Land Adjusting		m2	0	0	0	0	180	0	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	0	3,000	0	0	0	0	
	Piping Work		m	0	0	0	0	700	0	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	0	100,000	0	0	0	0	Included Unit a
		Pump Installing	unit	0	0	0	0	50000	0	0	0	0	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	0	105	0	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	0	92	0	0	0	0	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	0	0	0	0	531	0	0	0	0	
		Excavator Loading	m3	0	0	0	0	121	0	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	0	112	0	0	0	0	
	Side-slope Adjusting		m2	0	0	0	0	194	0	0	0	0	
	Land Adjusting		m2	0	0	0	0	180	0	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	0	3,000	0	0	0	0	
	Piping Work		m	0	0	0	0	700	0	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	0	100,000	0	0	0	0	
		Pump Installing	unit	0	0	0	0	50,000	0	0	0	0	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	0	0	0	0	29,183	0	0	0	0	Under Dike
		Main pipe Laying(2)	m	0	0	0	0	18,322	0	0	0	0	Others
		Branch pipe Laying	m	0	0	0	0	3,441	0	0	0	0	
	Leachate Collection Pit	Pit work	unit	0	0	0	0	80,000	0	0	0	0	3m x 5m x 4m
		Piping Work	m	0	0	0	0	200	0	0	0	0	
		Submersible Pump	unit	0	0	0	0	1,100,000	0	0	0	0	Included Unit a
		Pump Installing	unit	0	0	0	0	250,000	0	0	0	0	Stand-by Pump
Gas Exhaust Equipment	Vertical Type		unit	5	12	9	26	111,565	557	1338	1005	2,900	
	Part of Side Slope		m	655	1108	1199	2962	1,766	115	195	213	523	
Rainwater Collection System	Gutter(1) Installing	0.8m x 0.8m	m	200	457	690	1,347	9,500	1,900	4,344	6,555	12,796	
	Gutter(2) Installing	1.2m x 0.9m	m	320	310	340	1,000	15,500	4,960	5,270	5,270	15,500	
	Gutter(3) Installing	2.0m x 1.4m	m	400	0	0	400	30,000	12,000	0	0	12,000	
	Gutter(4) Installing	1.6m x 1.2m	m	397	0	0	397	20,000	7,940	0	0	7,940	
	Gutter(5) Installing	2.2m x 1.4m	m	53	0	0	53	31,000	1,643	0	0	1,643	
	Gutter(6) Installing	2.2m x 1.5m	m	315	0	0	315	32,500	10,237	0	0	10,237	
Access Road	Surface Course	t=50mm, W=6m	m	0	0	7,083	7,083	5,100	0	0	36,123	36,123	
	Base and Subase	t=150,200mm W=6m	m	7,083	0	0	7,083	11,100	78,621	0	0	78,621	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	0	2,759	2,759	93	0	0	256	256	Excavated Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	952	0	478	143	270	25	0	13	38	Excavated Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	0	1	2	13,500,000	13,500	0	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	0	3,808	3,808	1,849	0	0	7,006	7,006	
Gate	Gate Work	W=8m H=2.2m	unit	0	0	1	1	120,000	0	0	120	120	
Adm. Facilities	Control Office		m2	200	0	0	200	25,000	5,000	0	0	5,000	
	Rest House		m2	0	200	0	200	22,000	0	4,400	0	4,400	
	Truck scale		unit	2	0	0	2	1,750,000	3,500	0	0	3,500	
	Car wash Equip	10m x 3m x 0.5m	unit	1	0	0	1	80,000	80	0	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	0	1	800,000	800	0	0	800	
	Workshop and Garage		m2	200	0	0	200	22,000	4,400	0	0	4,400	
	Parking Lot		m2	1,000	1,000	0	2,000	2,700	2,700	2,700	0	5,400	
Total									309,300	227,700	283,835	820,835	
Auxiliary Works			LS	1	1	1	1		92,790	68,310	85,145	246,245	Total x 30%
Direct Cost Total									402,090	296,010	368,960	1,067,666	

Table 8-7-10 Facility Construction Cost (Case 4, Level 4)

Item	Works	Subitem	Unit	Quantity 1st Stage	2nd Stage	3rd Stage	Total	Unit Price	Amount (10³Kshs) 1st Stage	2nd Stage	3rd Stage	Total	Remarks
Preparing Work	Weeding		m2	44,780	0	0	44,780	3	134	0	0	134	
	Root of Wood Removing		m2	442,400	0	0	442,400	63	27,871	0	0	27,871	
	Weed and Root Burning		m2	487,200	0	0	487,200	5	2,436	0	0	2,436	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	62,170	145,400	100,330	307,900	165	6,527	15,267	10,535	32,329	
		Dumptruck Transport (1km)	m3	89,820	189,000	130,480	409,300	92	7,435	17,388	12,004	36,827	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	66,240	178,400	120,860	365,500	531	35,173	94,730	64,177	194,080	
		Excavator Loading	m3	86,110	231,900	157,190	475,200	121	10,419	28,059	19,021	57,499	
		Dumptruck Transport (500m)	m3	20,090	24,810	28,380	73,280	99	1,988		5,266	7,254	
		Dumptruck Transport (1km)	m3	66,020	207,090	128,810	401,920	112	7,394		37,621	45,015	
	Banking(Excavated Soil)		m3	11,910	13,160	12,860	35,930	64	762	714	823	2,299	
	Banking(Bought Soil)		m3	44,740	38,650	47,040	130,430	1,285	57,490	49,665	60,447	167,602	
	Side-slope Adjusting		m2	19,330	18,730	18,620	56,680	194	3,750	3,633	3,612	10,995	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	16,300	0	0	16,300	105	1,711	0	0	1,711	
		Dumptruck Transport (1km)	m3	21,190	0	0	21,190	92	1,949	0	0	1,949	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	33,470	0	0	33,470	531	17,772	0	0	17,772	
		Excavator Loading	m3	43,510	0	0	43,510	121	5,264	0	0	5,264	
		Dumptruck Transport (1km)	m3	43,510	0	0	43,510	112	4,873	0	0	4,873	
	Side-slope Adjusting		m2	6,552	0	0	6,552	194	1,271	0	0	1,271	
	Land Adjusting		m2	11,280	0	0	11,280	180	2,030	0	0	2,030	Machine Work
	Liner Laying Work		m2	17,830	0	0	17,830	3,000	53,490	0	0	53,490	
	Piping Work		m	10.22	0	0	10.22	700	7	0	0	7	
	Pump Installing Work	Submersible Pump	unit	2	0	0	2	100,000	200	0	0	200	Included Unit a
		Pump Installing	unit	1	0	0	1	50000	50	0	0	50	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	17,970	0	0	17,970	105	1,886	0	0	1,886	
		Dumptruck Transport (1km)	m3	23,360	0	0	23,360	92	2,149	0	0	2,149	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	22,710	0	0	22,710	531	12,059	0	0	12,059	
		Excavator Loading	m3	29,520	0	0	29,520	121	3,571	0	0	3,571	
		Dumptruck Transport (1km)	m3	29,520	0	0	29,520	112	3,306	0	0	3,306	
	Side-slope Adjusting		m2	7,533	0	0	7,533	194	1,461	0	0	1,461	
	Land Adjusting		m2	12,520	0	0	12,520	180	2,253	0	0	2,253	Machine Work
	Liner Laying Work		m2	20,050	0	0	20,050	3,000	60,150	0	0	60,150	
	Piping Work		m	48.5	0	0	48.5	700	33	0	0	33	
	Pump Installing Work	Submersible Pump	unit	2	0	0	2	100,000	200	0	0	200	
		Pump Installing	unit	1	0	0	1	50,000	59	0	0	50	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	79.5	0	0	79.5	29,183	2,320	0	0	2,320	Under Dike
		Main pipe Laying(2)	m	355	1,200	982	2,537	18,322	6,504	21,986	17,992	46,482	Others
		Branch pipe Laying	m	1,329	2,999	2,596	6,924	3,441	4,573	10,319	8,933	23,825	
	Leachate Collection Pit	Pit work	unit	3	0	0	3	80,000	240	0	0	240	3m x 5m x 4m
		Piping Work	m	76.5	0	0	76.5	700	53	0	0	53	
		Submersible Pump	unit	10	0	0	10	1,100,000	11,000	0	0	11,000	Included Unit a
		Pump Installing	unit	9	0	0	9	250,000	2,250	0	0	2,250	Stand-by Pump
Gas Exhaust Equipment	Vertical Type		unit	5	12	9	26	63,870	319	766	575	1,660	
	Part of Side Slope		m	65.5	110.8	119.9	296.2	1,766	115	195	233	523	
Rainwater Collection System	Gutter(1) Installing	0.8m x 0.8m	m	200	457	690	1,347	9,500	1,900	4,341	6,555	12,796	
	Gutter(2) Installing	1.2m x 0.9m	m	320	340	395	1,055	15,500	4,960	5,270	6,122	16,352	
	Gutter(3) Installing	2.0m x 1.4m	m	400	0	0	400	30,000	12,000	0	0	12,000	
	Gutter(4) Installing	1.6m x 1.2m	m	397	0	0	397	20,000	7,940	0	0	7,940	
	Gutter(5) Installing	2.2m x 1.4m	m	108	0	0	108	31,000	3,348	0	0	3,348	
	Gutter(6) Installing	2.2m x 1.5m	m	315	0	0	315	32,500	10,237	0	0	10,237	
Access Road	Surface Course	t=50mm, W=6m	m	0	0	7,083	7,083	5,100	0	0	36,123	36,123	
	Base and Subase	t=150,200mm W=6m	m	7,083	0	0	7,083	11,100	78,621	0	0	78,621	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	0	3,523	3,523	93	0	0	327	327	Excavated Crashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm W=6m	m	952	0	478	143	270	25	0	13	38	Excavated Crashed Stone
Well for Groundwater Monitoring	Well Work	D = 200m	unit	1	0	1	2	13,500,000	13,500	0	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	0	3,918	3,918	1,840	0	0	7,209	7,209	
Gate	Gate Work	W=8m H=2.2m	unit	0	0	1	1	120,000	0	0	120	120	
Adm. Facilities	Control Office		m2	200	0	0	200	25,000	5,000	0	0	5,000	
	Rest House		m2	0	200	0	200	22,000	0	4,400	0	4,400	
	Truck scale		unit	2	0	0	2	1,750,000	3,500	0	0	3,500	
	Car wash Equip	10m x 3m x 0.5m	unit	1	0	0	1	80,000	80	0	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	0	1	800,000	800	0	0	800	
	Workshop and Garage		m2	200	0	0	200	22,000	4,400	0	0	4,400	
	Parking Lot		m2	1,000	1,000	0	2,000	2,700	2,700	2,700	0	5,400	
Total									533,499	259,433	311,188	1,084,120	
Auxiliary Works			LS	1	1	1	1		154,050	77,830	93,356	325,236	Total x 30%
Direct Cost Total									687,549	337,263	404,544	1,409,356	

Table 8-7-11 Facility Construction Cost (Case 5, Level 4)

Item	Works	Subitem	Unit	Quantity 1st Stage	Quantity 2nd Stage	Quantity Total	Unit Price	Amount (10^3Kshs) 1st Stage	Amount (10^3Kshs) 2nd Stage	Amount (10^3Kshs) Total	Remarks
Preparing Work	Weeding		m2	318,700	0	318,700	3	956	0	956	
	Wood Cutting		m2	263,000	0	263,000	4	1,052	0	1,052	
	Root of Weed Removing		m2	263,000	0	263,000	63	16,569	0	16,569	
	Weed and Root Burning		m2	318,700	0	318,700	5	1,593	0	1,593	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	180,200	309,600	489,800	105	18,921	32,508	51,429	
		Dumptruck Transport (1km)	m3	234,300	402,700	637,000	92	21,555	37,049	58,604	
	Banking(Bought Soil)		m3	114,220	71,100	185,320	1,285	146,772	91,364	238,136	
	Side-slope Adjusting		m2	21,080	12,520	33,600	194	4,089	2,429	6,518	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Protective Layer of Soil for Liner Facility		m2	0	0	0	1,639	0	0	0	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	33,560	0	33,560	105	3,523	0	3,523	
		Dumptruck Transport (1km)	m3	43,620	0	43,620	92	4,013	0	4,013	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	8,965	0	8,965	531	4,760	0	4,760	
		Excavator Loading	m3	11,650	0	11,650	121	1,409	0	1,409	
		Dumptruck Transport (1km)	m3	11,650	0	11,650	112	1,304	0	1,304	
	Side-slope Adjusting		m2	7,200	0	7,200	194	1,396	0	1,396	
	Land Adjusting		m2	5,050	0	5,050	180	909	0	909	Machine Work
	Liner Laying Work		m2	12,250	0	12,250	3,000	36,750	0	36,750	
	Piping Work		m	13.3	0	13.3	700	9	0	9	
	Pump Installing Work	Submersible Pump	unit	2	0	2	100,000	200	0	200	Included Funit a
		Pump Installing	unit	1	0	1	50000	50	0	50	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	26,990	0	26,990	105	2,833	0	2,833	
		Dumptruck Transport (1km)	m3	35,090	0	35,090	92	3,228	0	3,228	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	903.9	0	903.9	531	479	0	479	
		Excavator Loading	m3	1,175	0	1,175	121	142	0	142	
		Dumptruck Transport (1km)	m3	1,175	0	1,175	112	131	0	131	
	Side-slope Adjusting		m2	6,757	0	6,757	194	1,310	0	1,310	
	Land Adjusting		m2	7,058	0	7,058	180	1,270	0	1,270	Machine Work
	Liner Laying Work		m2	13,820	0	13,820	3,000	41,460	0	41,460	
	Piping Work		m	42	0	42	700	29	0	29	
	Pump Installing Work	Submersible Pump	unit	2	0	2	100,000	200	0	200	
		Pump Installing	unit	1	0	1	50,000	50	0	50	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	120	0	120	22,668	2,712	0	2,712	Under Dike
		Main pipe Laying(2)-1	m	1,140	0	1,140	20,852	23,771	0	23,771	Others-1
		Main pipe Laying(2)-2	m	0	1,165	1,165	12,716	0	14,814	14,814	Others-2
		Branch pipe Laying	m	2,377	2,412	4,789	6,637	15,776	16,008	31,784	
Gas Exhaust Equipment	Vertical Type		unit	10	13	23	159,780	1,597	2,077	3,674	
	Part of Side Slope		m	103.2	117.6	220.8	3,262	336	384	720	
Rainwater Collection System	Gutter(1) Installing	0.7m x 0.6m	m	1,165	1,320	2,485	7,500	8,737	9,900	18,637	
	Gutter(2) Installing	1.5m x 1.5m	m	150	0	150	28,500	4,275	0	4,275	
	Gutter(3) Installing	2m x 1.4m	m	360	0	360	30,000	10,800	0	10,800	
Access Road	Surface Course	t=50mm, W=6m	m	0	630	630	5,100	0	3,213	3,213	
	Base and Subase	t=150,200mm W=6m	m	630	0	630	11,100	6,993	0	6,993	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	12,690	12,690	3,621	0	45,950	45,950	Bought Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	100	25	125	6,390	639	159	798	Bought Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	1	2	13,500,000	13,500	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	3,878	3,878	1,840	0	7,135	7,135	
Gate	Gate Work	W=8m H=2.2m	unit	0	1	1	120,000	0	120	120	
Adm. Facilities	Control Office		m2	200	0	200	25,000	5,000	0	5,000	
	Rest House		m2	0	200	200	22,000	0	4,400	4,400	
	Truck scale		unit	2	0	2	1,750,000	3,500	0	3,500	
	Car wash Equip	10m x 3m x 0.5m,	unit	1	0	1	80,000	80	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	1	800,000	800	0	800	
	Workshop and Garage		m2	200	0	200	22,000	4,400	0	4,400	
	Parking Lot		m2	1,000	1,000	2,000	2,700	2,700	2,700	5,400	
Total								422,578	283,710	706,288	
Auxiliary Works			L.S			1		126,773	85,113	211,886	Total x 30%
Direct Cost Total								549,351	368,823	918,174	

Table 8-7-12 Facility Construction Cost (Case 5, Level 3+)

Item	Works	Subitem	Unit	Quantity 1st Stage	Quantity 2nd Stage	Quantity Total	Unit Price	Amount (10^3Kshs) 1st Stage	Amount (10^3Kshs) 2nd Stage	Amount (10^3Kshs) Total	Remarks
Preparing Work	Weeding		m2	318,700	0	318,700	3	956	0	956	
	Wood Cutting		m2	263,000	0	263,000	4	1,052	0	1,052	
	Root of Wood Removing		m2	263,000	0	263,000	63	16,569	0	16,569	
	Weed and Root Burning		m2	318,700	0	318,700	5	1,593	0	1,593	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	180,200	309,600	489,800	105	18,921	32,508	51,429	
		Dumptruck Transport (1km)	m3	231,300	402,700	637,000	92	21,555	37,049	58,604	
	Banking(Bought Soil)		m3	114,220	71,100	185,320	1,285	146,772	91,364	238,136	
	Side-slope Adjusting		m2	21,080	12,520	33,600	194	4,089	2,429	6,518	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Protective Layer of Soil for Liner facility		m2	0	0	0	1,639	0	0	0	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	33,560	0	33,560	105	3,523	0	3,523	
		Dumptruck Transport (1km)	m3	43,620	0	43,620	92	4,013	0	4,013	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	8,965	0	8,965	531	4,760	0	4,760	
		Excavator Loading	m3	11,650	0	11,650	121	1,409	0	1,409	
		Dumptruck Transport (1km)	m3	11,650	0	11,650	112	1,304	0	1,304	
	Side-slope Adjusting		m2	7,200	0	7,200	194	1,396	0	1,396	
	Land Adjusting		m2	5,050	0	5,050	180	909	0	909	Machine Work
	Liner Laying Work		m2	12,250	0	12,250	3,000	36,750	0	36,750	
	Piping Work		m	13.3	0	13.3	700	9	0	9	
	Pump Installing Work	Submersible Pump	unit	2	0	2	100,000	200	0	200	Included Unit a
		Pump Installing	unit	1	0	1	50000	50	0	50	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	105	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	92	0	0	0	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	0	0	0.0	531	0	0	0	
		Excavator Loading	m3	0	0	0	121	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	112	0	0	0	
	Side-slope Adjusting		m2	0	0	0	194	0	0	0	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Piping Work		m	0	0	0	700	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	100,000	0	0	0	
		Pump Installing	unit	0	0	0	50,000	0	0	0	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	120	0	120	22,608	2,712	0	2,712	Under Dike
		Main pipe Laying(2)-1	m	1,140	0	1,140	20,852	23,771	0	23,771	Others-1
		Main pipe Laying(2)-2	m	0	1,165	1,165	12,716	0	14,814	14,814	Others-2
		Branch pipe Laying	m	2,377	2,412	4,789	6,637	15,776	16,008	31,784	
Gas Exhaust Equipment	Vertical Type		unit	10	13	23	159,780	1,597	2,077	3,674	
	Part of Side Slope		m	103.2	117.6	220.8	3,262	336	384	720	
Rainwater Collection System	Gutter(1) Installing	0.7m x 0.6m	m	1,165	1,320	2,485	7,500	8,737	9,900	18,637	
	Gutter(2) Installing	1.5m x 1.5m	m	150	0	150	28,500	4,275	0	4,275	
	Gutter(3) Installing	2m x 1.4m	m	360	0	360	30,000	10,800	0	10,800	
Access Road	Surface Course	t=50mm, W=6m	m	0	630	630	5,100	0	3,213	3,213	
	Base and Subase	t=150,200mm W=6m	m	630	0	630	11,100	6,993	0	6,993	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	12,295	12,295	3,621	0	44,520	44,520	Bought Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	100	25	125	6,390	639	159	798	Bought Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	1	2	13,500,000	13,500	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	3,878	3,878	1,840	0	7,135	7,135	
Gate	Gate Work	W=8m H=2.2m	unit	0	1	1	120,000	0	120	120	
Adm. Facilities	Control Office		m2	200	0	200	25,000	5,000	0	5,000	
	Rest House		m2	0	200	200	22,000	0	4,400	4,400	
	Truck scale		unit	2	0	2	1,750,000	3,500	0	3,500	
	Car wash Equip	10m x 3m x 0.5m	unit	1	0	1	80,000	80	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	1	800,000	800	0	800	
	Workshop and Garage		m2	200	0	200	22,000	4,400	0	4,400	
	Parking Lot		m2	1,000	1,000	2,000	2,700	2,700	2,700	5,400	
Total								371,446	282,280	653,726	
Auxiliary Works			LS			1		111,431	84,684	196,118	Total x 30%
Direct Cost Total								483,880	366,964	849,844	

Table 8-7-13 Facility Construction Cost (Case 5, Level 3)

Item	Works	Subitem	Unit	Quantity 1st Stage	Quantity 2nd Stage	Quantity Total	Unit Price	Amount (10^3Kshs) 1st Stage	Amount (10^3Kshs) 2nd Stage	Amount (10^3Kshs) Total	Remarks
Preparing Work	Weeding		m2	318,700	0	318,700	3	956	0	956	
	Wood Cutting		m2	263,000	0	263,000	4	1,052	0	1,052	
	Root of Wood Removing		m2	263,000	0	263,000	63	16,569	0	16,569	
	Weed and Root Burning		m2	318,700	0	318,700	5	1,593	0	1,593	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	180,200	309,600	489,800	105	18,921	32,508	51,429	
		Dumptruck Transport (1km)	m3	234,300	402,700	637,000	92	21,555	37,049	58,604	
	Banking(Bought Soil)		m3	114,220	71,100	185,320	1,285	146,772	91,364	238,136	
	Side-slope Adjusting		m2	21,080	12,520	33,600	194	4,089	2,429	6,518	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Protective Layer of Soil for Liner facility		m2	0	0	0	1,639	0	0	0	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	105	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	92	0	0	0	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	0	0	0	533	0	0	0	
		Excavator Loading	m3	0	0	0	121	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	112	0	0	0	
	Side-slope Adjusting		m2	0	0	0	194	0	0	0	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Piping Work		m	0	0	0	700	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	100,000	0	0	0	Included Funit a
		Pump Installing	unit	0	0	0	50000	0	0	0	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	105	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	92	0	0	0	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	0	0	0	531	0	0	0	
		Excavator Loading	m3	0	0	0	121	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	112	0	0	0	
	Side-slope Adjusting		m2	0	0	0	194	0	0	0	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Piping Work		m	0	0	0	700	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	100,000	0	0	0	
		Pump Installing	unit	0	0	0	50,000	0	0	0	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	120	0	120	22,608	2,712	0	2,712	Under Dike
		Main pipe Laying(2)-1	m	1,140	0	1,140	20,852	23,771	0	23,771	Others-1
		Main pipe Laying(2)-2	m	0	1,165	1,165	12,716	0	14,814	14,814	Others-2
		Branch pipe Laying	m	2,377	2,412	4,789	6,637	15,776	16,008	31,784	
Gas Exhaust Equipment	Vertical Type		unit	10	13	23	159,780	1,597	2,077	3,674	
	Part of Side Slope		m	103.2	117.6	220.8	3,262	336	384	720	
Rainwater Collection System	Gutter(1) Installing	0.7m x 0.5m	m	1,165	1,320	2,485	7,500	8,737	9,900	18,637	
	Gutter(2) Installing	1.5m x 1.5m	m	150	0	150	28,500	4,275	0	4,275	
	Gutter(3) Installing	2m x 1.4m	m	360	0	360	30,000	10,800	0	10,800	
Access Road	Surface Course	t=50mm, W=6m	m	0	630	630	5,100	0	3,213	3,213	
	Base and Subase	t=150,200mm W=6m	m	630	0	630	11,100	6,993	0	6,993	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	12,295	12,295	3,621	0	44,520	44,520	Bought Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	100	25	125	6,390	639	159	798	Bought Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	1	2	13,500,000	13,500	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	3,878	3,878	1,840	0	7,135	7,135	
Gate	Gate Work	W=8m H=2.2m	unit	0	1	1	120,000	0	120	120	
Adm. Facilities	Control Office		m2	200	0	200	25,000	5,000	0	5,000	
	Rest House		m2	0	200	200	22,000	0	4,400	4,400	
	Truck scale		unit	2	0	2	1,750,000	3,500	0	3,500	
	Car wash Equip	10m x 3m x 0.5m	unit	1	0	1	80,000	80	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	1	890,000	800	0	800	
	Workshop and Garage		m2	200	0	200	22,000	4,400	0	4,400	
	Parking Lot		m2	1,000	1,000	2,000	2,700	2,700	2,700	5,400	
Total								317,123	282,280	599,403	
Auxiliary Works			L.S			1		95,137	84,684	179,821	Total x 30%
Direct Cost Total								412,260	366,964	779,224	

Table 8-7-14 Facility Construction Cost (Case 5, Level 2+)

Item	Works	Subitem	Unit	Quantity 1st Stage	Quantity 2nd Stage	Quantity Total	Unit Price	Amount (10^3Kshs) 1st Stage	Amount (10^3Kshs) 2nd Stage	Amount (10^3Kshs) Total	Remarks
Preparing Work	Weeding		m2	318,700	0	318,700	3	956	0	956	
	Wood Cutting		m2	263,000	0	263,000	4	1,052	0	1,052	
	Root of Wood Removing		m2	263,000	0	263,000	63	16,569	0	16,569	
	Weed and Root Burning		m2	318,700	0	318,700	5	1,593	0	1,593	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	180,200	309,600	489,800	105	18,921	32,508	51,429	
		Dumptruck Transport (1km)	m3	234,300	402,700	637,000	92	21,555	37,049	58,604	
	Banking(Bought Soil)		m3	114,220	71,100	185,320	1,285	146,772	91,364	238,136	
	Side-slope Adjusting		m2	21,080	12,520	33,600	194	4,089	2,429	6,518	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Protective Layer of Soil for Liner facility		m2	0	0	0	1,639	0	0	0	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	105	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	92	0	0	0	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	0	0	0	531	0	0	0	
		Excavator Loading	m3	0	0	0	121	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	112	0	0	0	
	Side-slope Adjusting		m2	0	0	0	194	0	0	0	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Piping Work		m	0	0	0	700	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	100,000	0	0	0	Included Item a
		Pump Installing	unit	0	0	0	50000	0	0	0	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	0	0	0	105	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	92	0	0	0	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	0	0	0	531	0	0	0	
		Excavator Loading	m3	0	0	0	121	0	0	0	
		Dumptruck Transport (1km)	m3	0	0	0	112	0	0	0	
	Side-slope Adjusting		m2	0	0	0	194	0	0	0	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Piping Work		m	0	0	0	700	0	0	0	
	Pump Installing Work	Submersible Pump	unit	0	0	0	100,000	0	0	0	
		Pump Installing	unit	0	0	0	50,000	0	0	0	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	0	0	0	22,608	0	0	0	Under Dike
		Main pipe Laying(2)-1	m	0	0	0	20,852	0	0	0	Others-1
		Main pipe Laying(2)-2	m	0	0	0	12,716	0	0	0	Others-2
		Branch pipe Laying	m	0	0	0	6,637	0	0	0	
Gas Exhaust Equipment	Vertical Type		unit	10	13	23	159,780	1,597	2,077	3,674	
	Part of Side Slope		m	103.2	117.6	220.8	3,262	336	384	720	
Rainwater Collection System	Gutter(1) Installing	0.7m x 0.6m	m	1,165	1,320	2,485	7,500	8,737	9,900	18,637	
	Gutter(2) Installing	1.5m x 1.5m	m	150	0	150	28,500	4,275	0	4,275	
	Gutter(3) Installing	2m x 1.4m	m	360	0	360	30,000	10,800	0	10,800	
Access Road	Surface Course	t=50mm, W=6m	m	0	630	630	5,100	0	3,213	3,213	
	Base and Subase	t=150,200mm W=6m	m	630	0	630	11,100	6,993	0	6,993	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	12,295	12,295	3,621	0	44,520	44,520	Bought Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	100	25	125	6,390	639	159	798	Bought Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	1	2	13,500,000	13,500	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	3,878	3,878	1,849	0	7,135	7,135	
Gate	Gate Work	W=8m H=2.2m	unit	0	1	1	120,000	0	120	120	
Adm. Facilities	Control Office		m2	200	0	200	25,000	5,000	0	5,000	
	Rest House		m2	0	200	200	22,000	0	4,400	4,400	
	Truck scale		unit	2	0	2	1,750,000	3,500	0	3,500	
	Car wash Equip	10m x 3m x 0.5m	unit	1	0	1	80,000	80	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	1	800,000	800	0	800	
	Workshop and Garage		m2	200	0	200	22,000	4,400	0	4,400	
	Parking Lot		m2	1,000	1,000	2,000	2,700	2,700	2,700	5,400	
Total								274,864	251,458	526,322	
Auxiliary Works			L.S			1		82,459	75,438	157,897	Total x 30%
Direct Cost Total								357,323	326,896	684,219	

Table 8-7-15 Facility Construction Cost (Case 6, Level 4)

Item	Works	Subitem	Unit	Quantity 1st Stage	Quantity 2nd Stage	Quantity Total	Unit Price	Amount (10^3Kshs) 1st Stage	Amount (10^3Kshs) 2nd Stage	Amount (10^3Kshs) Total	Remarks
Preparing Work	Weeding		m2	318,700	0	318,700	3	956	0	956	
	Wood Cutting		m2	263,000	0	263,000	4	1,052	0	1,052	
	Root of Wood Removing		m2	263,000	0	263,000	63	16,569	0	16,569	
	Weed and Root Burning		m2	318,700	0	318,700	5	1,593	0	1,593	
Structure for Solid Wastes Retaining	Excavating (Clay)	Excavator Excavating and Loading	m3	180,200	309,600	489,800	105	18,921	32,508	51,429	
		Dumptruck Transport (1km)	m3	234,300	402,700	637,000	92	21,555	37,049	58,604	
	Banking(Bought Soil)		m3	114,220	71,100	185,320	1,285	146,772	91,364	238,136	
	Side-slope Adjusting		m2	21,080	12,520	33,600	194	4,089	2,429	6,518	
	Land Adjusting		m2	0	0	0	180	0	0	0	Machine Work
	Liner Laying Work		m2	0	0	0	3,000	0	0	0	
	Protective Layer of Soil for Liner facility		m2	0	0	0	1,639	0	0	0	
Retention Pond	Excavating (Clay)	Excavator Excavating and Loading	m3	33,560	0	33,560	105	3,523	0	3,523	
		Dumptruck Transport (1km)	m3	43,620	0	43,620	92	4,013	0	4,013	
	Excavating (Rock)	Ripper Bulldozer and Breaker Excavating	m3	8,965	0	8,965	531	4,760	0	4,760	
		Excavator Loading	m3	11,650	0	11,650	121	1,409	0	1,409	
		Dumptruck Transport (1km)	m3	11,650	0	11,650	112	1,304	0	1,304	
	Side-slope Adjusting		m2	7,200	0	7,200	194	1,396	0	1,396	
	Land Adjusting		m2	5,050	0	5,050	180	909	0	909	Machine Work
	Liner Laying Work		m2	12,250	0	12,250	3,000	36,750	0	36,750	
	Piping Work		m	13.3	0	13.3	700	9	0	9	
	Pump Installing Work	Submersible Pump	unit	2	0	2	100,000	200	0	200	Included Unit a
		Pump Installing	unit	1	0	1	50000	50	0	50	Stand-by Pump
Leachate Treatment Facility	Excavating (Clay)	Excavator Excavating and Loading	m3	26,990	0	26,990	105	2,833	0	2,833	
		Dumptruck Transport (1km)	m3	35,090	0	35,090	92	3,228	0	3,228	
	Excavating (Rock)	Ripper Bulldozer Excavating	m3	903.9	0	903.9	531	479	0	479	
		Excavator Loading	m3	1,175	0	1,175	121	142	0	142	
		Dumptruck Transport (1km)	m3	1,175	0	1,175	112	131	0	131	
	Side-slope Adjusting		m2	6,757	0	6,757	194	1,310	0	1,310	
	Land Adjusting		m2	7,058	0	7,058	180	1,270	0	1,270	Machine Work
	Liner Laying Work		m2	13,820	0	13,820	3,000	41,460	0	41,460	
	Piping Work		m	42	0	42	700	29	0	29	
	Pump Installing Work	Submersible Pump	unit	2	0	2	100,000	200	0	200	
		Pump Installing	unit	1	0	1	50,000	50	0	50	
Leachate Collection and Drain	Piping Work	Main pipe Laying(1)	m	120	0	120	22,608	2,712	0	2,712	Under Dike
		Main pipe Laying(2)-1	m	1,140	0	1,140	20,852	23,771	0	23,771	Others-1
		Main pipe Laying(2)-2	m	0	1,165	1,165	12,716	0	14,814	14,814	Others-2
		Branch pipe Laying	m	2,377	2,412	4,789	6,637	15,776	16,008	31,784	
Gas Exhaust Equipment	Vertical Type		unit	10	13	23	101,666	1,016	1,322	2,338	
	Part of Side Slope		m	103.2	117.6	220.8	3,262	336	384	720	
Rainwater Collection System	Gutter(1) Installing	0.7m x 0.6m	m	1,165	1,320	2,485	7,500	8,737	9,900	18,637	
	Gutter(2) Installing	1.5m x 1.5m	m	150	0	150	28,500	4,275	0	4,275	
	Gutter(3) Installing	2m x 1.4m	m	360	0	360	30,000	10,800	0	10,800	
Access Road	Surface Course	t=50mm, W=6m	m	0	630	630	5,100	0	3,213	3,213	
	Base and Subase	t=150,200mm W=6m	m	630	0	630	11,100	6,993	0	6,993	
Maintenance Road	Road Construction	Crashed Stone, t=200mm, W=3m	m	0	12,690	12,690	3,621	0	45,950	45,950	Bought Clashed Stone
On-site Road	Road Construction	Crashed Stone, t=300mm, W=6m	m	100	25	125	6,390	639	159	798	Bought Clashed Stone
Well for Ground-water Monitoring	Well Work	D = 200m	unit	1	1	2	13,500,000	13,500	13,500	27,000	
Net fence	Net fence Work	H=2.4m	m	0	3,878	3,878	1,840	0	7,135	7,135	
Gate	Gate Work	W=8m H=2.2m	unit	0	1	1	120,000	0	120	120	
Adm. Facilities	Control Office		m2	200	0	200	25,000	5,000	0	5,000	
	Rest House		m2	0	200	200	22,000	0	4,400	4,400	
	Truck scale		unit	2	0	2	1,750,000	3,500	0	3,500	
	Car wash Equip.	10m x 3m x 0.5m	unit	1	0	1	80,000	80	0	80	
	Septic Tank	4m x 5m x 3.5m	unit	1	0	1	800,000	800	0	800	
	Workshop and Garage		m2	200	0	200	22,000	4,400	0	4,400	
	Parking Lot		m2	1,000	1,000	2,000	2,700	2,700	2,700	5,400	
Total								421,997	282,955	704,952	
Auxiliary Works			L.S			1		126,599	84,887	211,486	Total x 30%
Direct Cost Total								548,596	367,842	916,438	

8.7
METEOROLOGICAL DATA

** Note: all times are in GMT

STATION NAME: NAIROBI J KIA
LATITUDE: 01 19'S LONGITUDE: 36 55'E

STATION NUMBER: 9136/168
ALTITUDE: 5327 FEET 1624 METRES

	ATMOSPHERIC PRESSURE (hPa) (1959–90)		TEMPERATURE (degrees Celcius) (1959–90)									RELATIVE HUMIDITY (%)			RAINFALL (mm) (1958–90)				NUMBER OF DAYS OF (1958 – 90)	
			MEANS		EXTREMES			DRY BULB		DEW POINT										
MONTH	0600	1200	MAX	MIN	RANGE	HIGHEST	LOWEST	0600	1200	0600	1200	0300	0600	1200	MEAN	HIGH	LOW	MAX24HR	RAIN	THUNDER
January	840.3	836.8	26.7	12.1	14.6	32.2	4.7	18.4	25.6	13.8	11.2	94	76	42	49	271	0	60.2	4	2
February	840.0	836.3	27.9	12.4	15.4	32.0	6.9	18.7	26.8	13.9	13.2	89	75	46	37	305	0	76.2	4	2
March	840.2	836.6	27.8	13.4	14.4	32.7	6.3	18.8	26.6	15.0	11.5	94	80	40	73	203	1	66.4	8	5
April	841.1	837.1	25.9	14.6	11.3	32.5	6.1	18.3	24.6	15.8	13.9	97	86	53	153	348	1	101.9	13	6
May	842.0	838.0	24.5	13.7	10.9	28.8	6.3	17.5	23.4	15.0	14.1	97	84	55	116	373	3	71.9	8	4
June	842.4	839.5	23.7	11.6	12.1	28.9	4.9	15.7	22.5	13.2	12.4	95	84	53	24	121	0	45.5	3	1
July	842.4	839.8	22.7	10.7	11.9	28.1	4.6	14.9	21.6	12.2	11.4	94	85	53	11	64	0	19.8	1	1
August	842.4	839.3	23.3	10.9	12.3	31.0	4.4	15.1	22.1	12.6	11.2	93	82	51	15	87	0	38.1	3	1
September	842.0	838.3	25.8	11.2	14.6	31.1	4.2	16.4	24.5	12.6	10.7	94	78	43	18	78	0	36.8	3	2
October	841.6	837.4	26.7	12.8	13.9	30.8	5.0	16.1	25.5	13.7	10.8	95	77	41	42	162	1	67.6	5	1
November	841.1	837.2	25.3	13.4	11.9	30.2	5.8	17.8	23.8	15.0	13.0	97	84	52	118	484	15	62.8	12	2
December	840.7	837.0	25.4	12.9	12.5	36.5	7.0	18.2	24.3	14.7	12.5	97	80	49	83	276	6	112.3	7	2
Year	841.3	837.8	25.5	12.5	13.0	36.5	4.2	17.3	24.8	13.9	12.2	94	81	47	749	484	0	112.3	71	29

	DAILY SUNSHINE (Hours) (1960–90)			DAILY RADIATION (1971 – 90) MJ/sq.m MEAN			EVAPORATION (mm) (1968–90) PAN TYPE "A"			CLOUD AMOUNTS (oktas) (1959 – 90)				DAILY WINDRUN (km)	WIND SPEED (knots) (1959–90)		CALMS (days) (1966–90)		VISIBILITY (days) (1961–90)			
										TOTAL		LOW							FOG		MIST/HAZE	
MONTH	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	HIGH	LOW	0600	1200	0600	1200	1968–90	0600	1200	0600	1200	0600	1200	0600	1200
January	9.4	11.3	5.6	21.6	24.1	17.5	222	292	135	4.6	4.6	3.0	3.4	246.6	7	12	3	1	3	0	1	1
February	9.5	11.1	6.2	22.1	24.9	17.6	224	292	111	4.5	4.7	2.9	3.4	262.7	6	12	4	1	2	0	2	1
March	8.5	10.4	5.1	20.7	24.4	15.8	246	457	113	5.7	5.1	4.4	4.1	273.4	6	13	4	1	3	0	1	1
April	6.9	9.8	3.5	17.9	21.7	13.0	177	236	121	6.7	5.9	5.3	5.0	199.8	5	11	6	1	1	0	1	1
May	5.9	8.4	3.6	16.6	20.3	12.3	138	209	114	6.4	6.1	5.2	5.4	153.5	5	8	8	2	2	0	1	1
June	5.2	8.3	2.8	15.0	19.2	10.6	117	241	50	6.1	5.8	4.9	5.2	146.8	5	7	7	2	1	0	2	1
July	4.0	7.3	1.7	14.0	20.4	9.3	117	201	57	6.6	6.2	5.2	5.6	151.9	5	6	7	2	1	0	2	1
August	4.0	6.8	1.6	14.3	20.6	9.3	126	225	89	6.5	6.2	5.5	5.7	155.2	5	7	8	2	1	0	2	1
September	6.1	8.5	3.0	17.8	23.1	12.4	171	235	144	6.0	5.5	5.3	5.0	193.6	4	8	8	1	1	0	1	1
October	7.1	9.5	4.1	19.0	25.0	13.3	210	268	171	6.0	5.6	5.3	5.0	244.1	5	10	5	0	2	0	1	1
November	6.8	9.1	3.3	18.5	23.8	13.4	169	457	129	6.5	5.7	5.8	4.9	256.4	7	11	3	1	3	1	1	1
December	8.5	10.6	4.3	20.2	24.7	14.5	196	274	125	5.2	5.0	4.5	4.1	262.7	8	13	2	0	3	1	1	1
Year	6.8	9.2	3.7	18.1	22.7	13.2	2114	457	50	5.9	5.5	4.8	4.7	213.3	6	10	64	13	24	1	17	8

STATION NAME: WILSON MET. STATION
LATITUDE: 01 19'S LONGITUDE: 36 49'E

STATION NUMBER: 9136/130
ALTITUDE: 5525 FEET 1683 METRES

	ATMOSPHERIC PRESSURE (hPa) (1965–90)		TEMPERATURE (degrees Celcius) (1961–90)									RELATIVE HUMIDITY (%)			RAINFALL (mm) (1951–90)				NUMBER OF DAYS OF (1951 – 90)	
			MEANS			EXTREMES		DRY BULB		DEW POINT										
MONTH	0600	1200	MAX	MIN	RANGE	HIGHEST	LOWEST	0600	1200	0600	1200	0300	0600	1200	MEAN	HIGH	LOW	MAX24HR	RAIN	THUNDER
January	834.9	831.5	26.1	13.3	12.8	31.1	7.2	18.4	25.2	13.1	10.3	90	73	40	55	251	0	107.8	3	2
February	834.8	831.1	27.2	13.6	13.5	32.5	7.7	18.7	26.1	13.4	9.7	88	71	37	50	346	0	94.3	5	2
March	834.8	831.3	27.2	14.6	12.5	31.5	7.1	18.6	25.5	14.6	10.6	91	78	40	81	271	0	93.1	9	3
April	834.8	831.8	25.2	15.1	10.1	30.1	8.0	17.7	24.0	15.4	13.5	95	85	53	190	451	8	109.2	15	4
May	835.9	833.1	23.8	14.2	9.6	29.4	8.0	17.2	22.7	14.7	13.9	96	86	58	157	577	2	146.6	12	2
June	836.8	834.5	23.6	12.2	10.7	30.0	5.2	15.6	21.8	12.9	12.2	93	85	55	36	171	0	107.2	3	1
July	837.1	834.7	22.9	11.5	10.6	28.8	5.4	14.5	21.0	12.0	11.2	93	84	54	16	125	0	47.0	3	1
August	837.0	834.2	22.7	11.5	11.2	30.1	5.9	14.7	21.5	11.8	10.7	92	83	51	19	137	0	82.4	4	1
September	836.6	833.1	25.2	12.1	13.2	31.1	5.9	16.0	24.2	12.3	9.7	92	79	41	25	100	0	68.7	3	1
October	836.1	832.2	26.0	13.7	12.3	29.9	6.9	17.5	24.9	13.4	10.2	92	78	41	49	204	5	63.7	5	1
November	835.6	832.2	24.5	14.4	10.1	30.3	8.6	17.4	23.2	14.5	12.6	94	83	52	126	551	13	82.0	14	2
December	835.1	831.8	24.8	14.0	10.7	29.0	8.4	16.9	24.1	14.1	11.7	92	78	47	85	321	9	106.7	8	2
Year	835.8	832.6	24.9	13.4	11.4	32.5	5.2	17.0	23.7	13.5	11.4	92	80	48	889	577	0	147	83	20

	DAILY SUNSHINE (Hours)			DAILY RADIATION MJ/sq.m			EVAPORATION (mm)			CLOUD AMOUNTS (oktas) (1961 – 90)				DAILY WINDRUN (km)	WIND SPEED (knots) (1961–90)		CALMS (days) (1966–90)		VISIBILITY (days) (1961–90)			
				MEAN			PAN TYPE "A"			TOTAL		LOW							FOG		MIST/HAZE	
MONTH	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	HIGH	LOW	0600	1200	0600	1200		0600	1200	0600	1200	0600	1200	0600	1200
January										4.6	4.5	3.2	3.5		8	12	4	1	1	0	1	1
February										4.6	4.7	3.1	3.6		7	12	3	1	1	0	2	1
March										5.9	5.2	4.8	4.4		7	13	5	1	1	0	1	1
April										6.8	6.0	5.7	5.2		6	11	7	2	1	0	1	1
May										6.5	6.0	5.6	5.5		5	8	11	2	1	0	2	1
June										6.5	6.0	5.3	5.4		4	7	13	3	1	0	2	1
July										6.8	6.4	5.7	5.6		5	7	12	3	2	0	2	1
August										6.8	6.3	6.0	5.7		4	8	12	3	1	0	2	1
September										6.3	5.6	5.6	5.1		5	9	11	2	1	1	1	1
October										6.3	5.8	5.7	5.2		6	10	6	1	1	0	1	1
November										6.8	5.9	6.0	5.0		3	12	3	1	1	1	2	1
December										5.6	4.7	4.7	4.1		8	12	4	1	1	0	1	1
Year										6.1	5.6	5.1	4.9		6	10	90	21	12	1	21	8

* All Time is in GMT time

STATION NAME NAIROBI (D.CORNER) STATION NUMBER 9136164
LATITUDE 01 18'S LONGITUDE 36 45'E ALTITUDE 5900 FEET 1798 METRES

	ATMOSPHERIC PRESSURE (H.P.A) (1955–90)		TEMPERATURE (Centigrade) (1955 – 90)									RELATIVE HUMIDITY (%)			RAINFALL (mm) (1954–90)				NUMBER OF DAYS OF (1954 – 90)	
			MEANS		EXTREMES			DRY BULB		DEW POINT										
MONTH	0600	1200	MAX	MIN	RANGE	HIGHEST	LOWEST	0600	1200	0600	1200	0300	0600	1200	MEAN	HIGH	LOW	MAX24HR	RAIN	THUNDER
January	823.3	819.7	24.6	11.9	12.8	29.7	3.3	17.4	23.3	12.8	11.0	92	75	45	62	253	0	77.0	4	2
February	822.6	819.4	25.9	11.9	13.9	30.4	4.7	17.8	25.0	12.8	12.5	90	74	41	55	201	2	104.6	5	2
March	822.6	819.5	25.8	13.4	12.4	30.6	6.4	17.6	24.9	14.0	13.5	93	79	44	95	299	15	98.0	9	4
April	822.8	819.9	24.1	14.2	9.9	29.8	7.8	17.1	23.0	14.8	13.4	95	86	42	227	531	20	139.1	16	7
May	823.6	821.3	22.7	13.4	9.3	27.1	7.2	16.3	21.7	14.1	13.5	96	87	61	185	478	50	104.5	13	4
June	824.5	822.3	21.6	11.4	10.2	26.8	4.4	14.7	20.8	12.3	12.0	94	86	58	35	141	2	85.5	5	2
July	824.7	822.5	20.8	10.5	10.4	25.9	2.5	13.6	19.9	11.4	11.3	93	87	58	18	85	1	46.7	3	1
August	824.6	822.2	21.5	10.5	11.0	26.7	2.9	13.8	20.5	11.4	11.0	90	85	55	23	67	1	53.7	4	1
September	824.2	821.3	23.9	10.9	13.0	29.1	3.9	15.0	22.9	11.9	12.7	93	83	46	32	138	2	54.4	4	1
October	825.4	820.6	24.7	12.7	12.0	28.7	5.0	16.5	23.7	13.0	13.0	94	80	44	54	196	9	56.3	7	1
November	823.4	820.3	23.2	13.4	9.8	29.9	6.7	16.5	22.2	14.0	12.7	94	86	56	148	523	41	83.0	15	2
December	823.0	820.0	23.5	12.9	10.6	27.8	5.3	17.0	22.7	13.5	12.2	94	80	53	102	379	8	112.3	8	2
Year	823.7	820.7	23.5	12.2	11.3	30.6	2.5	16.1	22.5	13.0	12.4	93	82	50	1036	623	0	139.1	92	28

	DAILY SUNSHINE (Hours) (1955 – 90)			DAILY RADIATION (1957 – 90) (MJ/M2) MEAN			MONTHLY EVAPORATION (mm) (1964 – 90)			CLOUD AMOUNTS (1955 – 90) (oktas)				DAILY WIND (64–90)	(1955–90)		CALMS (1966–90)		VISIBILITY (1961 – 90)			
										TOTAL		LOW		RUN	SPEED (knots)				FOG		MIST/HAZE	
MONTH	MEAN	MAX	MIN	MEAN	MAX	MINIMUM	MEAN	HIGH	LOW	0600	1200	0600	1200	(KM)	0300	1200	0600	1200	0600	1200	0600	1200
January	9.2	11.1	5.6	22.92	27.05	18.61	184	247	132	4.7	4.4	3.1	3.2	160.5	7	10	3	1	1	1	0	2	1
February	8.9	10.4	6.3	23.69	27.61	19.02	183	256	134	4.6	4.6	3.0	3.4	152.9	6	10	3	1	1	1	0	4	1
March	8.4	10.1	5.2	22.58	26.34	17.61	192	255	133	5.9	5.1	4.9	3.9	160.7	6	10	4	0	1	0	1	4	1
April	6.9	9.7	3.9	18.58	23.17	14.07	145	186	90	6.9	6.0	5.9	4.8	124.1	4	6	6	1	1	1	1	5	1
May	7.3	8.1	3.4	16.99	20.87	13.48	120	173	92	6.6	6.0	5.8	5.2	95.0	4	6	10	2	1	1	1	4	1
June	5.4	8.3	2.7	15.57	19.39	11.61	99	150	82	6.5	5.8	5.6	5.1	87.5	3	6	13	3	2	1	0	5	1
July	4.3	7.2	1.8	13.90	18.40	8.97	91	115	72	6.8	6.4	6.0	5.5	86.2	3	6	13	3	2	1	0	6	1
August	4.3	6.9	1.8	14.79	19.33	9.77	102	137	78	6.8	6.3	6.3	5.5	96.1	3	6	12	2	2	1	1	5	1
September	6.2	8.3	3.3	19.16	23.23	12.93	138	176	103	6.3	5.3	5.7	4.7	120.8	4	7	8	1	1	1	1	5	1
October	7.4	9.5	4.8	20.34	23.81	14.04	163	211	134	6.3	5.4	5.8	4.7	146.3	6	9	3	1	1	1	0	4	1
November	6.7	9.1	3.8	19.00	23.34	14.15	139	173	117	6.7	5.5	6.0	4.5	151.4	7	9	3	0	1	0	0	5	1
December	8.4	10.5	4.7	21.31	25.43	14.71	156	197	119	5.5	4.6	4.5	3.9	158.6	7	10	3	1	1	1	1	3	1
Year	6.9	9.1	4.0	19.07	23.16	13.98	1711	256	72	6.1	5.4	5.2	4.5	128.3	5	8	80	15	13	4	49	8	

STATION NAME: NAIROBI NATIONAL LABORATORIES STATION NUMBER: 9136/025
LATITUDE: 01 15'S LONGITUDE: 36 46'E ALTITUDE: 5700 FEET 1737 METRES

	ATMOSPHERIC PRESSURE (hPa)		TEMPERATURE (degrees Celcius) (1921–80)									RELATIVE HUMIDITY (%)			RAINFALL (mm) (1923–80)				NUMBER OF DAYS OF	
			MEANS			EXTREMES		DRY BULB		DEW POINT										
MONTH	0600	1200	MAX	MIN	RANGE	HIGHEST	LOWEST	0600	1200	0600	1200	0300	0600	1200	MEAN	HIGH	LOW	MAX24HR	RAIN	THUNDER
January			25.2	12.6	12.6	30.8	3.3	18.2	24.1	12.8	11.1		70.0	44.0	53.0	230	0.0	77.3	6.0	
February			26.4	12.8	13.6	33.3	3.9	18.6	25.4	13.2	10.4		70.0	40.0	48.0	207	0.0	122.4	5.0	
March			26.0	13.8	12.2	32.2	3.9	18.3	24.9	14.4	11.4		77.0	43.0	102.0	291	3.0	83.6	9.0	
April			24.3	14.4	9.9	30.6	7.8	17.7	22.9	15.2	13.5		85.0	55.0	219.0	493	15.0	100.6	17.0	
May			23.0	13.4	9.6	28.0	3.9	16.9	21.7	14.4	13.8		85.0	62.0	174.0	512	34.0	165.2	15.0	
June			21.9	11.9	10.0	29.0	2.8	15.3	20.8	12.7	12.4		84.0	58.0	43.0	199	0.0	130.5	4.0	
July			20.9	10.3	10.6	27.1	2.2	14.4	19.6	11.8	11.3		84.0	59.0	19.0	130	0.0	75.7	4.0	
August			21.6	11.1	10.5	29.4	1.7	14.3	20.1	11.6	11.1		83.0	57.0	26.0	86	1.0	60.3	5.0	
September			23.9	11.6	12.3	30.0	2.2	15.7	22.4	11.9	10.2		78.0	45.0	24.0	111	1.0	44.2	2.0	
October			24.9	12.8	12.1	30.6	2.2	17.2	23.6	13.2	10.8		78.0	45.0	55.0	187	3.0	58.4	6.0	
November			23.3	13.5	9.8	29.4	0.0	17.1	22.0	14.2	12.9		82.0	56.0	135.0	587	33.0	71.1	15.0	
December			23.7	13.1	10.6	31.4	2.8	17.2	22.4	13.7	12.8		78.0	54.0	83.0	348	4.0	110.2	7.0	
Year			23.8	12.6	11.2	33.3	1.7	16.8	22.5	13.3	11.8		80	52	981.0	1829.0	511.0	165.2	96	

	DAILY SUNSHINE (Hours) (1939–80)		DAILY RADIATION (1963–80) MJ/sq.m			EVAPORATION (mm) PAN TYPE "A"			CLOUD AMOUNTS (oktas)				DAILY WINDRUN MILES	WIND SPEED (knots)		CALMS (days)		VISIBILITY (days)			
									TOTAL		LOW							FOG		MIST/HAZE	
MONTH	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	HIGH	LOW	0600	1200	0600	1200	1963–80	0600	1200	0600	1200	0600	1200	0600	1200
January	9.2	11.1	6.2	499.0	620.0	383.0								78.3								
February	9.3	10.6	6.4	512.0	615.0	355.0								77.5								
March	8.8	9.8	4.9	490.0	594.0	366.0								78.2								
April	6.5	8.8	4.1	406.0	506.0	306.0								67.5								
May	5.7	8.0	3.6	349.0	452.0	261.0								51.5								
June	4.9	7.5	2.0	324.0	459.0	235.0								45.4								
July	4.1	5.3	2.4	300.0	397.0	196.0								45.9								
August	4.1	5.6	2.4	336.0	402.0	264.0								47.9								
September	6.1	8.3	4.2	438.0	491.0	306.0								59.0								
October	7.1	9.1	5.8	469.0	545.0	324.0								69.2								
November	6.4	8.3	3.7	406.0	486.0	254.0								72.8								
December	8.1	10.1	4.9	449.0	602.0	346.0								75.1								
Year	6.7	7.4	5.4	415.0	458.0	366.0								64.0								

STATION NAME: KABETE UNIVERSITY F. STATION STATION NUMBER: 9136/208
LATITUDE: 01 15'S LONGITUDE: 36 44'E ALTITUDE: 6359 FEET 1942 METRES

	ATMOSPHERIC PRESSURE (hPa)		TEMPERATURE (degrees Celcius) (1972–90)									RELATIVE HUMIDITY (%)			RAINFALL (mm) (1972–90)				NUMBER OF DAYS OF (1972–90)	
			MEANS			EXTREMES		DRY BULB		DEW POINT										
MONTH	0600	1200	MAX	MIN	RANGE	HIGHEST	LOWEST	0600	1200	0600	1200	0300	0600	1200	MEAN	HIGH	LOW	MAX24HR	RAIN	THUNDER
January			24.7	12.9	11.7	32.5	5.4	17.6	23.4	13.0	11.9		75.2	48.6	48.3	135	0.0	71.1	3.8	
February			25.8	13.2	12.9	32.5	8.5	17.9	24.6	13.3	11.3		74.2	42.7	56.4	181	0.2	82.6	4.3	
March			25.7	13.9	11.8	33.0	9.0	17.9	24.5	14.2	11.4		76.6	45.5	95.2	220	6.0	90.0	8.6	
April			24.1	14.5	9.6	31.5	11.0	17.2	22.6	14.9	13.7		87.4	58.4	228.2	506	23.7	128.3	15.9	
May			22.9	13.8	9.0	29.0	9.8	16.4	21.5	14.3	13.9		87.3	62.4	194.7	497	9.7	158.2	13.7	
June			21.8	11.9	9.8	29.0	6.4	14.9	20.5	12.7	12.7		86.5	61.2	36.2	95	6.1	97.8	5.4	
July			21.1	11.1	10.1	28.5	5.0	13.8	19.7	11.8	11.9		87.7	61.2	24.0	44	2.0	35.6	4.6	
August			21.4	11.1	10.3	29.0	5.5	13.9	20.1	11.6	11.6		85.9	58.3	21.9	47	2.0	21.0	3.5	
September			23.8	11.7	12.0	29.0	6.5	15.3	22.5	12.3	10.8		82.8	47.9	36.9	91	4.3	42.5	4.7	
October			24.4	13.1	11.4	31.5	7.5	16.5	23.2	13.4	12.0		81.9	47.4	62.7	149	4.4	56.7	7.3	
November			23.0	13.7	9.3	31.5	4.5	16.5	21.7	14.2	13.1		86.3	58.3	128.7	274	26.0	58.9	14.7	
December			23.3	13.3	10.0	31.0	4.6	17.1	22.1	13.7	13.1		80.9	56.8	91.9	321	15.3	108.8	8.4	
Year			23.5	12.8	10.7	33.0	4.5	15.3	22.2	13.3	12.3		83	54	1025.0	506.0	0.0	158.2	95	

	DAILY SUNSHINE (Hours) (1972–90)			DAILY RADIATION (1972 – 90MJ/sq.m MEAN			EVAPORATION (mm) (1972–90) PAN TYPE "A"			CLOUD AMOUNTS (oktas) (1981 – 90) TOTAL		LOW		DAILY WINDRUN (km)	WIND SPEED (knots) (1981–90)		CALMS (days) (1972–90)		VISIBILITY (days) (1981–90) FOG		MIST/HAZE	
MONTH	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	HIGH	LOW	0600	1200	0600	1200	1972–90	0600	1200	0600	1200	0600	1200	0600	1200
January	8.4	11.1	2.8	25.2	30.5	15.1	160	192	93	3.4	5.1	1.1	3.3	95.1	3	4	3	1	0	0	6	2
February	8.3	11.1	2.1	24.2	30.2	12.9	157	189	95	3.8	5.0	1.2	3.4	97.7	3	4	2	1	0	0	7	2
March	7.5	10.9	1.9	23.7	30.4	11.8	181	247	157	4.6	5.5	1.5	3.9	105.7	4	5	3	1	0	0	3	0
April	6.2	10.9	1.1	21.3	29.2	8.7	140	173	110	5.5	6.3	1.7	4.2	84.5	3	3	4	1	0	0	3	0
May	6.6	10.3	1.9	22.2	28.8	13.9	144	173	117	4.4	6.2	1.6	4.4	74.6	3	3	4	1	0	0	7	1
June	7.6	10.5	2.0	22.6	28.0	14.0	132	150	102	3.7	4.8	1.2	3.5	71.6	3	3	2	0	0	0	8	1
July	6.9	10.2	1.8	22.8	27.9	11.6	137	153	119	3.6	5.1	1.5	4.0	74.2	3	3	2	0	0	0	7	0
August	7.5	10.4	1.9	22.7	29.7	13.1	150	175	131	3.9	5.2	1.6	4.0	78.7	3	3	1	1	0	0	4	0
September	7.0	10.5	1.8	23.3	30.0	14.0	152	174	137	3.4	5.5	1.3	4.1	82.6	3	3	1	1	0	0	2	0
October	7.3	10.8	2.5	23.0	30.2	15.2	155	183	123	4.3	5.8	1.2	3.6	88.1	3	3	1	1	0	0	1	0
November	6.6	11.0	1.6	22.3	29.7	14.3	146	161	137	4.3	6.0	1.3	4.1	99.2	4	5	1	0	0	0	2	0
December	6.0	11.2	1.3	24.1	31.0	14.9	167	201	143	3.9	5.0	1.1	3.4	109.3	4	5	1	0	0	0	2	0
Year	7.3	10.7	1.9	23.1	29.6	13.3	1821	247	93	4.1	5.5	1.4	3.8	88.4	3	4	24	8	1	1	54	8

Form No.592

METEOROLOGICAL DEPARTMENT

STATION MAB 9186087

READINGS OF Total Monthly Rainfall FOR ..... 19.....

Date	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1	44.5	41.3	79.0	183.0	136.7	38.1	16.7	28.8	26.3	52.7	122.9	77.0	Long T. M
2													
3	268.1	90.2	216.9	391.3	339.2	156.8	70.4	95.6	82.2	178.2	281.0	248.6	Highest
4													
5	0	0	0	4.1	0	0	0	0	0	0	2.5	0.4	Lowest
6													
7													
8													
9													
10													
11													
12													
13													
14													
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31													

METEOROLOGICAL DEPARTMENT

STATION Ruiru Sukari Ranch. 9136007.

READINGS OF Total Monthly Rainfall FOR ..... 19 ....

Date	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1	37·7	40·5	81·6	170·8	4·4	28·9	14·0	15·3	18·0	50·1	139·0	67·1	L.T.M
2													
3	122·7	173·0	242·1	392·9	393·6	232·5	116·8	74·0	81·9	205·0	469·0	397·8	Highest
4													
5	0	0	0	2·5	0·9	0	0	0	0	0	1·58	0	Lowest
6													
7													
8													
9													
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DATA BOOK 9

ENVIRONMENTAL IMPACT ASSESSMENT

9.1

TERMS OF REFERENCE FOR THE ENVIRONMENTAL IMPACT ASSESSMENT