

7.3 Cost Estimate

7.3.1 Conditions and Assumptions for Cost Estimate

The following are the conditions and assumptions for the project cost estimate.

- 1) Project cost is estimated at the price level as of June 1997.
- 2) Exchange rates used in the cost estimate are shown as follows:
US\$ 1.0 = Birr 6.8 = J. Yen 114.7 (as of June 1997)
- 3) Construction works will be executed on contract basis through international competitive bidding. All the labor, materials and equipment required for the construction works will be provided by the contractors themselves.
- 4) Resettlement cost is estimated based on the rule, which is controlled by the Works and Urban Development Bureau, Region 14 Administration. Resettlement cost does not include land acquisition cost, because the whole land belongs to the Government of Ethiopia.
- 5) Engineering services, such as design and supervision, will be executed on international contract basis.
- 6) Cost is estimated in foreign currency and local currency portions. The foreign currency portion includes foreign labor wages, imported materials and equipment cost, international transportation cost and contractors' indirect cost. The local currency portion includes local labor wages, local materials cost, inland transportation cost, contractors' indirect cost, resettlement cost and administration cost.
- 7) Physical contingency is provided as 10% of the total of construction cost, resettlement cost, engineering services cost and administration cost.
- 8) Price contingency is calculated based on the escalation rates of 3% per annum for foreign currency portion and of 6% for local currency portion.
- 9) Tax is included in the project cost estimate. Custom tax is estimated as 10% of CIF price of imported materials and 5% of net depreciation cost on CIF basis of imported construction equipment. Sales tax is estimated as 10% of net material price purchased domestically and 12% of net depreciation cost on CIF basis of imported construction equipment.

7.3.2 Unit Prices of Construction Works

(1) Labor Wage

The net wage of a daily common worker is Birr 8 for temporary employment in Addis Ababa. The prevailing labor wages in Addis Ababa are given in Table 7.3.1.

(2) Price of Construction Materials

Basic prices of some major construction materials are obtained through a simple market survey and from the Report on average retail prices of goods and services published by the Central statistical authority. The prevailing purchasing prices of major construction materials at Addis Ababa is given in Table 7.3.2.

(3) Operation Unit Cost of Construction Equipment

Assuming that contractors import the construction equipment, the operation unit cost of such equipment is estimated as listed in Table 7.3.3.

(4) Unit Prices of Construction Works

Construction unit prices of major works are estimated through unit rate analysis and through comparison with the actual contract data. Unit prices of construction works are listed in Table 7.3.4. Breakdown of unit price of major construction works is given in Table 7.3.5.

Table 7.2.1 Estimated Material Volume to be Disposed

| Work item | Unit | Kechene river | | Bantiyketu river | | | Total |
|--|------|---------------|--------------------|---------------------|-----------------|------------------------|----------------|
| | | Kechene weir | Kostre regul. pond | Bantyi. regul. pond | Channel improv. | Urban drainage improv. | |
| 1. Work quantities | | | | | | | |
| 1.1 Clearing and stripping | m2 | 6,000 | 9,400 | 34,500 | 13,450 | 6,600 | 69,950 |
| 1.2 Excavation, common | m3 | 6,200 | 24,500 | 74,100 | 0 | 7,200 | 112,000 |
| 1.3 Excavation, river bed | m3 | 0 | 0 | 0 | 10,500 | 0 | 10,500 |
| 1.4 Excavation, rock | m3 | 10,200 | 9,600 | 19,800 | 10,000 | 0 | 49,600 |
| 1.5 Backfill | m3 | 1,400 | 1,400 | 1,600 | 10,100 | 5,500 | 20,000 |
| 1.6 Embankment | m3 | 0 | 700 | 7,300 | 400 | 0 | 8,400 |
| 1.7 Wet masonry | m3 | 0 | 3,300 | 5,500 | 6,100 | 0 | 14,900 |
| 1.8 Gabion mattress | m3 | 200 | 1,200 | 2,100 | 300 | 0 | 3,800 |
| 2. Quantities to be produced | | | | | | | |
| 2.1 Clearing and stripping | m3 | 1,200 | 1,880 | 6,900 | 2,690 | 1,320 | 13,990 |
| 2.2 Excavation, common | m3 | 6,200 | 24,500 | 74,100 | 0 | 7,200 | 112,000 |
| 2.3 Excavation, river bed | m3 | 0 | 0 | 0 | 10,500 | 0 | 10,500 |
| 2.4 Excavation, rock (Swell factor= 1.65) | m3 | 16,830 | 15,840 | 32,670 | 16,500 | 0 | 81,840 |
| 3. Quantities to be diverted | | | | | | | |
| 3.1 Soil, common | m3 | 1,400 | 2,100 | 8,900 | 10,500 | 5,500 | 28,400 |
| 3.2 Rock | m3 | 200 | 4,500 | 7,600 | 6,400 | 0 | 18,700 |
| 4. Quantities to be disposed | | | | | | | |
| 4.1 Clearing and stripping | m3 | 1,200 | 1,880 | 6,900 | 2,690 | 1,320 | 13,990 |
| 4.2 Excavation, common | m3 | 4,800 | 22,400 | 65,200 | 10,500 | 1,700 | 83,600 |
| 4.3 Excavation, mud | m3 | 0 | 0 | 0 | 10,500 | 0 | 10,500 |
| 4.4 Excavation, rock | m3 | 16,630 | 11,340 | 25,070 | 10,100 | 0 | 63,140 |
| Total of 4. | | | | | | | 171,230 |

Note: The volume is calculated based on estimated work quantities.

Table 7.2.2 Estimated Workable Days

(Unit: day)

| No. | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Total |
|-----|---|------|------|------|-----|------|------|------|------|------|------|------|-------|
| a. | Number of days on calendar | | | | | | | | | | | | |
| | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| b. | Sunday(*1) | | | | | | | | | | | | |
| | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 52 |
| c. | National Holiday(*2) | | | | | | | | | | | | |
| | 3 | 0 | 1 | 3 | 3 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 13 |
| d. | Number of days when daily precipitation is more than 20mm(*3) | | | | | | | | | | | | |
| | 0 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 3 | 1 | 0 | 0 | 18 |
| e. | Monthly rate of Sunday and National Holiday(= (b.+c.)/a.) | | | | | | | | | | | | |
| | 23% | 14% | 19% | 23% | 26% | 13% | 16% | 16% | 20% | 13% | 17% | 13% | 18% |
| f. | Estimated work suspension days (= b.+c.+d.x(1-e.)) | | | | | | | | | | | | |
| | 7 | 5 | 7 | 8 | 9 | 6 | 8 | 8 | 8 | 5 | 5 | 4 | 80 |
| g. | Workable days (= a.-f.) | | | | | | | | | | | | |
| | 24 | 23 | 24 | 22 | 22 | 24 | 23 | 23 | 22 | 26 | 25 | 27 | 285 |

Note: (*1) International calendar of 1998

(*2) Number of days is given based on the Ethiopian calendar of 1997-1998. Please refer to Table 7.2.3.

(*3) The number of days is given on an average calculated based on the daily precipitation data in Addis Ababa for 46 years from 1951 to 1996.

Table 7.2.3 National Holiday in Ethiopia

| No. | Date | Name of Holiday |
|-----|--------------|--|
| 1. | January 7 | Ethiopian Christmas |
| 2. | January 19 | Ethiopian Epiphany |
| 3. | January 28 | Id Al Fater (Ramadan) |
| 4. | March 2 | Victory of Adwa |
| 5. | April 6 | Id Al Adaha (Arafa) |
| 6. | April 9 | Ethiopian Easter |
| 7. | April 17 | Ethiopian Good Friday |
| 8. | May 1 | International Labour Day |
| 9. | May 5 | Patriots Victory Day |
| 10. | May 28 | Down Fall of the Dergue |
| 11. | July 6 | Birth of the Prophet Mohammed (Moulid) |
| 12. | September 11 | Ethiopian New Year |
| 13. | September 27 | Maskal (The Finding of the True Cross) |

Note: The dates are given based on the Ethiopian calender of 1997-1998.

Table 7.2.4 Major Temporary Works at Each Work Site

| No. | Temporary works |
|-----------|---|
| 1. | Temporary works for the Kechene weir |
| | 1) Access road |
| | <u>Primary access</u> |
| | - L= 120m |
| | - Access point= 100m southwest from the proposed weir site, on the Abera Gizaw Street |
| | - L: From the access point downhill to the proposed weir site along the right bank of the Kechene river |
| | <u>Secondary access</u> |
| | - L= 500m (L1= 300m, L2= 200m) |
| | - Access point= 100m southwest from the proposed weir site, on the Abera Gizaw Street |
| | - L1: from the access point to the north along the right side bank of the river |
| | - L2: from the end of L1 to the proposed weir site across the river to the left side river course |
| | 2) Dewatering (for river stream) |
| | - Pipe culvert through the whole construction work stage at the secondary access road crossing point |
| | - Half closure of river stream for excavation work of left bank, stone work and concrete works of sub weir, stilling basin and left side main weir body |
| | - Pipe aqueduct for excavation work of right bank and concrete works of right side main weir body, from the downstream tip of the said pipe culvert to the downstream tip of the sub weir |
| 2. | Temporary works for the Kostre regulating pond |
| | 1) Access road |
| | - Two approaches |
| | - One (L= 20m) from the Dejazmach Haile Silase Street |
| | - Another (L= 20m) from the Graz. Inku Silase Bantyyidagn Street |
| | 2) Dewatering |
| | - Half closure of river stream for the embankment and inlet dike works (L= 200m) |
| | 3) Relocation |
| | - Relocation of a power line and supporting poles (L= 170m) |
| 3. | Temporary works for the Bantyyiketu regulating pond |
| | 1) Access road |
| | - An approach (L= 20m) from the Yohanis Street |
| | 2) Dewatering |
| | - Some cover pipes and extension to the river for pond excavation work, for hot spring |
| | - Half closure of river stream for the embankment and inlet dyke works (L= 900m) |
| | 3) Relocation |
| | - Relocation of sewerage pipe line (L= 900m) with 10 manholes |
| 4. | Temporary works for the Bantyyiketu river channel improvement |
| | 1) Dewatering |
| | - Half closure of river stream for the excavation and wet masonry works |
| | 2) Relocation |
| | - Relocation of sewerage pipe lines |
| 5. | Temporary works for the urban drainage improvement |
| | 1) Traffic control |
| | - Some traffic control works, such as raising up sign board showing "Under construction" and setting demarcation pegs around work site |

Table 7.3.1 Labor Wage

| No. | Particular | Unit | F.C. (US\$) | L.C. (Birr) |
|-----|--------------------|-----------|----------------|----------------|
| 1. | Foreman | man-day | 0 | 80 |
| 2. | Operator | man-day | 0 | 60 |
| 3. | Assistant operator | man-day | 0 | 45 |
| 4. | Driver | man-day | 0 | 30 |
| 5. | Mechanic | man-day | 0 | 80 |
| 6. | Electrician | man-day | 0 | 70 |
| 7. | Rigger | man-day | 0 | 60 |
| 8. | Welder | man-day | 0 | 60 |
| 9. | Rebar worker | man-day | 0 | 40 |
| 10. | Plumber | man-day | 0 | 60 |
| 11. | Carpenter | man-day | 0 | 40 |
| 12. | Plasterer | man-day | 0 | 40 |
| 13. | Concrete worker | man-day | 0 | 40 |
| 14. | Mason | man-day | 0 | 45 |
| 15. | Pavement worker | man-day | 0 | 55 |
| 16. | Boring worker | man-day | 0 | 40 |
| 17. | Grout worker | man-day | 0 | 40 |
| 18. | Tunnel worker | man-day | 0 | 40 |
| 19. | Driller | man-day | 0 | 40 |
| 20. | Blaster | man-day | 0 | 60 |
| 21. | Skilled labor | man-day | 0 | 30 |
| 22. | Common labor | man-day | 0 | 10 |
| 23. | Engineer, senior | man-month | 0 | 1,850 |
| 24. | Engineer, junior | man-month | 0 | 1,290 |
| 25. | Technician, senior | man-month | 0 | 1,050 |
| 26. | Technician, junior | man-month | 0 | 710 |
| 27. | Surveyor | man-month | 0 | 600 |
| 28. | Draftman | man-month | 0 | 500 |
| 29. | Typist | man-month | 0 | 600 |
| 30. | Office clerk | man-month | 0 | 500 |
| 31. | Cook | man-month | 0 | 300 |
| 32. | Maid | man-month | 0 | 250 |
| 33. | Night keeper | man-month | 0 | 250 |

Note: The value indicates the prevailing wage at Addis Ababa.
Price level; June 1997, US\$ 1.0 = Birr 6.8 = J.Yen 114.7

Table 7.3.2 Construction Material Price

| No. | Materials | Unit | Net price | | Tax | | Total price | |
|-----|---------------------------------------|------|----------------|----------------|----------------|----------------|----------------|----------------|
| | | | F.C. (US\$) | L.C. (Birr) | F.C. (US\$) | L.C. (Birr) | F.C. (US\$) | L.C. (Birr) |
| 1. | Gasoline | lit. | 0.39 | 0 | 0 | 0 | 0.39 | 0 |
| 2. | Gas oil (=Light oil) | lit. | 0.29 | 0 | 0 | 0 | 0.29 | 0 |
| 3. | Electric power | kWh | 0 | 0.16 | 0 | 0.02 | 0 | 0.18 |
| 4. | Lubricant | lit. | 0 | 8.2 | 0 | 0.8 | 0 | 9 |
| 5. | Grease | kg | 0 | 31 | 0 | 3 | 0 | 34 |
| 6. | Portland cement | kg | 0 | 0.45 | 0 | 0.05 | 0 | 0.5 |
| 7. | Reinforcing bar, deformed | kg | 0.54 | 0 | 0.05 | 0 | 0.59 | 0 |
| 8. | Binding wire | kg | 0 | 9.1 | 0 | 0.9 | 0 | 10 |
| 9. | Annealed iron wire | kg | 0 | 9.1 | 0 | 0.9 | 0 | 10 |
| 10. | Nail | kg | 0 | 9.1 | 0 | 0.9 | 0 | 10 |
| 11. | Steel plate | kg | 0 | 9.1 | 0 | 0.9 | 0 | 10 |
| 12. | Channel steel | kg | 0 | 9.1 | 0 | 0.9 | 0 | 10 |
| 13. | Angle steel | kg | 0 | 9.1 | 0 | 0.9 | 0 | 10 |
| 14. | H-Shape steel | kg | 0 | 9.1 | 0 | 0.9 | 0 | 10 |
| 15. | Steel sheet pile | kg | 0 | 9.1 | 0 | 0.9 | 0 | 10 |
| 16. | Dynamite, in open | kg | 18.4 | 0 | 1.8 | 0 | 20.2 | 0 |
| 17. | Dynamite, in tunnel | kg | 18.4 | 0 | 1.8 | 0 | 20.2 | 0 |
| 18. | ANFO powder | kg | 5.8 | 0 | 0.6 | 0 | 6.4 | 0 |
| 19. | Electric detonator | no. | 4 | 0 | 0.4 | 0 | 4.4 | 0 |
| 20. | Timber, plank | m3 | 0 | 2,909 | 0 | 291 | 0 | 3,200 |
| 21. | Timber, square | m3 | 0 | 2,636 | 0 | 264 | 0 | 2,900 |
| 22. | Timber, log | m3 | 0 | 2,364 | 0 | 236 | 0 | 2,600 |
| 23. | Plywood | m3 | 602 | 0 | 60 | 0 | 662 | 0 |
| 24. | Form oil | lit. | 0 | 7.3 | 0 | 0.7 | 0 | 8 |
| 25. | Brick | m3 | 0 | 364 | 0 | 36 | 0 | 400 |
| 26. | Galvanized iron pipe, 1/2in | m | 0 | 7.3 | 0 | 0.7 | 0 | 8 |
| 27. | Galvanized iron pipe, 1in | m | 0 | 14.5 | 0 | 1.5 | 0 | 16 |
| 28. | Galvanized iron pipe, 1+1/2in | m | 0 | 23 | 0 | 2 | 0 | 25 |
| 29. | PVC pipe, 2in | m | 0 | 7.3 | 0 | 0.7 | 0 | 8 |
| 30. | PVC pipe, 4in | m | 0 | 22.7 | 0 | 2.3 | 0 | 25 |
| 31. | Aggregate, fine (= sand) | m3 | 0 | 76.4 | 0 | 7.6 | 0 | 84 |
| 32. | Aggregate, coarse | m3 | 0 | 91 | 0 | 9 | 0 | 100 |
| 33. | Crusher-run | m3 | 0 | 91 | 0 | 9 | 0 | 100 |
| 34. | Stone | m3 | 0 | 46 | 0 | 4 | 0 | 50 |
| 35. | Ready mixed concrete, 160kg | m3 | 0 | 498 | 0 | 50 | 0 | 548 |
| 36. | Ready mixed concrete, 240kg | m3 | 0 | 554 | 0 | 55 | 0 | 609 |
| 37. | Ready mixed concrete, 240kg, at seite | m3 | 0 | 639 | 0 | 64 | 0 | 703 |
| 38. | Water | m3 | 0 | 0.77 | 0 | 0.08 | 0 | 0.85 |

Note: - Total price indicates the prevailing purchasing price at Addis Ababa as of June 1997.
 - US\$ 1.0 = Birr 6.8 = J.Yen 114.7

Table 7.3.3 Unit Operation Cost of Construction Equipment

| No. | Equipment | Class | Unit | Net cost ^{*1)} | | Tax ^{*2)} | | Total cost ^{*3)} | |
|-----|-----------------------|-----------|------|-------------------------|----------------|--------------------|----------------|---------------------------|----------------|
| | | | | F.C. (US\$) | L.C. (Birr) | F.C. (US\$) | L.C. (Birr) | F.C. (US\$) | L.C. (Birr) |
| 1. | Bulldoser | 11ton | Hour | 19.45 | 18.71 | 1.90 | 0.00 | 21.36 | 18.71 |
| 2. | Bulldoser | 15ton | Hour | 25.87 | 24.89 | 2.53 | 0.00 | 28.41 | 24.89 |
| 3. | Bulldoser | 21ton | Hour | 42.81 | 41.17 | 4.19 | 0.00 | 47.00 | 41.17 |
| 4. | Bulldoser | 32ton | Hour | 57.49 | 61.12 | 5.19 | 0.00 | 62.68 | 61.12 |
| 5. | Bulldoser w/ripper | 21ton | Hour | 45.81 | 47.24 | 4.25 | 0.00 | 50.06 | 47.24 |
| 6. | Bulldoser w/ripper | 32ton | Hour | 56.64 | 60.22 | 5.11 | 0.00 | 61.75 | 60.22 |
| 7. | Backhoe | 0.35m3 | Hour | 12.31 | 10.97 | 1.27 | 0.00 | 13.58 | 10.97 |
| 8. | Backhoe | 0.60m3 | Hour | 17.72 | 15.78 | 1.83 | 0.00 | 19.55 | 15.78 |
| 9. | Backhoe | 0.70m3 | Hour | 22.70 | 20.22 | 2.34 | 0.00 | 25.05 | 20.22 |
| 10. | Wheel loader | 1.4m3 | Hour | 15.60 | 15.17 | 1.52 | 0.00 | 17.12 | 15.17 |
| 11. | Wheel loader | 2.3m3 | Hour | 23.94 | 24.11 | 2.26 | 0.00 | 26.20 | 24.11 |
| 12. | Dump truck | 8ton | Hour | 9.46 | 10.59 | 0.81 | 0.00 | 10.27 | 10.59 |
| 13. | Dump truck | 10ton | Hour | 10.85 | 12.14 | 0.93 | 0.00 | 11.78 | 12.14 |
| 14. | Cargo truck | 4ton | Hour | 5.76 | 6.10 | 0.52 | 0.00 | 6.28 | 6.10 |
| 15. | Cargo truck | 8ton | Hour | 9.07 | 9.61 | 0.82 | 0.00 | 9.89 | 9.61 |
| 16. | Cargo truck, w/crane | 4ton/2ton | Hour | 7.04 | 7.23 | 0.65 | 0.00 | 7.70 | 7.23 |
| 17. | Truck crane, hyd. | 15-16ton | Hour | 22.47 | 22.69 | 2.12 | 0.00 | 24.59 | 22.69 |
| 18. | Wheel crane | 25ton | Hour | 34.28 | 32.92 | 3.36 | 0.00 | 37.63 | 32.92 |
| 19. | Giant breaker, hyd. | 1300kg | Day | 92.60 | 58.89 | 11.33 | 0.00 | 103.93 | 58.89 |
| 20. | Crawler drill, hyd. | 150kg | Hour | 68.88 | 63.33 | 6.96 | 0.00 | 75.84 | 63.33 |
| 21. | Motor grader | 3.1m | Hour | 19.23 | 19.45 | 1.81 | 0.00 | 21.04 | 19.45 |
| 22. | Macadam roller | 10-12ton | Hour | 11.36 | 12.11 | 1.02 | 0.00 | 12.39 | 12.11 |
| 23. | Tire roller | 8-20ton | Hour | 12.84 | 13.69 | 1.16 | 0.00 | 14.00 | 13.69 |
| 24. | Tamper | 80kg | Hour | 0.94 | 0.74 | 0.10 | 0.00 | 1.04 | 0.74 |
| 25. | Agitator truck | 3.2m3 | Hour | 8.81 | 8.56 | 0.86 | 0.00 | 9.66 | 8.56 |
| 26. | Sprinkler truck | 6kl | Hour | 8.43 | 8.49 | 0.80 | 0.00 | 9.23 | 8.49 |
| 27. | Submersible pump | 50mmx10m | Day | 0.96 | 1.25 | 0.07 | 0.00 | 1.03 | 1.25 |
| 28. | Diesel generator | 5kVA | Day | 4.59 | 4.03 | 0.48 | 0.00 | 5.07 | 4.03 |
| 29. | Diesel generator | 10kVA | Day | 8.38 | 7.37 | 0.87 | 0.00 | 9.25 | 7.37 |
| 30. | Diesel generator | 25kVA | Day | 17.42 | 16.68 | 1.71 | 0.00 | 19.13 | 16.68 |
| 31. | Diesel generator | 45kVA | Day | 20.73 | 19.84 | 2.04 | 0.00 | 22.76 | 19.84 |
| 32. | Diesel generator | 100kVA | Day | 30.84 | 29.53 | 3.03 | 0.00 | 33.87 | 29.53 |
| 33. | Diesel generator | 200kw | Day | 58.68 | 60.27 | 5.45 | 0.00 | 64.13 | 60.27 |
| 34. | Diesel generator | 250kw | Day | 75.52 | 77.57 | 7.02 | 0.00 | 82.54 | 77.57 |
| 35. | Port. concrete mixer | 0.2m3 | Day | 24.55 | 26.76 | 2.17 | 0.00 | 26.72 | 26.76 |
| 36. | Concrete bucket, man. | 1.0m3 | Day | 50.66 | 50.32 | 4.84 | 0.00 | 55.50 | 50.32 |
| 37. | Concrete vibrator | 38mm | Day | 2.06 | 1.90 | 0.21 | 0.00 | 2.27 | 1.90 |
| 38. | Engine welder | 250A | Day | 9.35 | 9.29 | 0.89 | 0.00 | 10.25 | 9.29 |

Note: *1) - Cost includes depreciation cost and maintenance cost of the equipment.
*2) - Tax includes custom and sales taxes.
*3) - Cost is estimated assuming that the equipment is imported and operated by contractors.
- Price level; as of June 1997, US\$ 1.0 = Birr 6.8 = J. Yen 114.7

Table 7.3.4 Unit Price of Construction Works

| Work item | Work description | Unit | Net price | | Tax | | Total unit price | | |
|--------------------------|--------------------------|---|----------------|----------------|----------------|----------------|------------------|----------------|---------|
| | | | F.C. (US\$) | L.C. (Birr) | F.C. (US\$) | L.C. (Birr) | F.C. (US\$) | L.C. (Birr) | |
| 1. Earthworks | | | | | | | | | |
| 1.1 | Clearing and stripping | cut t=20cm, dozing, load, h.=7.5km, unload, spread. | m2 | 1.1 | 1.6 | 0.1 | 0.0 | 1.2 | 1.6 |
| 1.2 | Excavation, common | excavation, load, haul.=7.5km, unload, spread. | m3 | 5.4 | 8.1 | 0.3 | 0.0 | 5.7 | 8.1 |
| 1.3 | Excavation, rock | excavation, loading, haul.=5km, unloading | m3 | 12.7 | 14.9 | 0.9 | 0.0 | 13.6 | 14.9 |
| 1.4 | Excavation, river bed | excavation, load, haul.=7.5km, unload, spread. | m3 | 4.5 | 53.3 | 0.2 | 0.0 | 4.8 | 53.3 |
| 1.5 | Backfilling | spreading, compaction | m3 | 0.5 | 0.8 | 0.0 | 0.0 | 0.5 | 0.8 |
| 1.6 | Embankment | spreading, compaction | m3 | 0.5 | 0.8 | 0.0 | 0.0 | 0.5 | 0.8 |
| 1.7 | Tree vegetation work | purchase, hauling, planting | m2 | 0.1 | 5.5 | 0.0 | 0.2 | 0.1 | 5.7 |
| 2. Concrete works | | | | | | | | | |
| 2.1 | Mass concrete, 160kg | ready mixed, haul, placing, crane, compact, curing | m3 | 18.7 | 744.4 | 1.2 | 56.7 | 19.9 | 801.1 |
| 2.2 | Ordinary concrete, 240kg | ready mixed, haul, placing, crane, compact, curing | m3 | 18.7 | 823.7 | 1.2 | 62.4 | 19.9 | 886.1 |
| 2.3 | Form, for concrete | plywood, setting, oil painting, removal | m2 | 10.3 | 54.2 | 0.8 | 1.6 | 11.1 | 55.8 |
| 2.4 | Reinforcing bar, deform. | deformed, cutting, bending, assembling | kg | 0.9 | 0.4 | 0.1 | 0.0 | 0.9 | 0.4 |
| 2.5 | Shotcrete | purchase, hauling, placing | m2 | 6.3 | 127.2 | 0.3 | 9.7 | 6.6 | 136.9 |
| 2.6 | Filter mat | purchase, hauling, setting | m2 | 10.1 | 1.5 | 1.0 | 0.0 | 11.1 | 1.5 |
| 3. Masonry works | | | | | | | | | |
| 3.1 | Wet masonry | mortal 1:4, royalty, haul, unload, masonning | m3 | 0.0 | 393.0 | 0.0 | 24.2 | 0.0 | 417.2 |
| 3.2 | Gabion mattress | incl. wire net, royalty, haul, unload, masonning | m3 | 9.3 | 201.9 | 0.6 | 11.7 | 9.9 | 213.6 |
| 3.3 | Gravel metalling | crusher run, spreading, compaction | m3 | 0.3 | 152.2 | 0.0 | 11.1 | 0.3 | 163.3 |
| 3.4 | Weep hole | iron pipe, dia=50mm, cutting, setting | no. | 0.0 | 14.7 | 0.0 | 1.3 | 0.0 | 16.0 |
| 4. Metal works | | | | | | | | | |
| 4.1 | Flap gate | stainless steel, install, paint, 1.5m x 1.5m class | kg | 41.0 | 34.0 | 4.0 | 0.0 | 45.0 | 34.0 |
| 4.2 | Structural steel works | section steel, process, assembl, weld, for bridge | kg | 10.1 | 0.9 | 0.0 | 0.9 | 10.1 | 1.8 |
| 4.3 | Iron pipe, dia.=1,000mm | upto install, incl. piping upto valve | m | 0.0 | 4,246.0 | 0.0 | 307.0 | 0.0 | 4,553.0 |

Note: Price level; June 1997, US\$ 1.0= Birr 6.8= J.Yen 114.7
Tax includes custom and sales taxes.

Table 7.3.5 Breakdown of Unit Price (1/10)

| | | | | |
|--------------------|---|----------|------|-------|
| Code: | U1100 | | | |
| Work item: | Clearing and stripping, h.=7.5km | | | |
| Description: | cutting, t=20cm, clearing, dozing, loading, hauling 7.5km, unloading, spreading | | | |
| Unit of work q'ty: | m ² | Total | F.C. | L.C. |
| Unit price (Net): | in local currency; | Birr 9.1 | 7.4 | 1.6 |
| | (in foreign currency; | US\$ 1.3 | 1.1 | 0.2) |
| | | 100% | 82% | 18% |

Qty for calculation: 1000 m²

| Code | Description | Unit | Qty | F.C. portion | | L.C. portion | | Remarks |
|-----------------------|--|------|-------|--------------------|----------------|--------------------|----------------|---------|
| | | | | Unit price US\$ | Amount US\$ | Unit price Birr | Amount Birr | |
| Labor | | | | | | | | |
| (cutting, bulldozing) | | | | | | | | |
| L0010 | Foreman | m.d. | 0.727 | | | 80 | 58 | |
| L0110 | Operator | m.d. | 0.073 | | | 60 | 4 | |
| (loading) | | | | | | | | |
| L0010 | Foreman | m.d. | 1.12 | | | 80 | 90 | |
| L0110 | Operator | m.d. | 0.11 | | | 60 | 7 | |
| (hauling, unloading) | | | | | | | | |
| L0110 | Operator | m.d. | 5.66 | | | 60 | 340 | |
| (spreading) | | | | | | | | |
| L0110 | Operator | m.d. | 0.459 | | | 60 | 28 | |
| B301 | Miscellaneous cost for labor, Type 1 | | 3% | | | | 16 | |
| | Sub-total | | | | | | 542 | 7% |
| Material | | | | | | | | |
| (cutting, bulldozing) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 81.2 | 0.29 | 24 | | | |
| M010301 | Lubricant | lit. | 0.81 | | | 8.2 | 7 | |
| (loading) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 76.4 | 0.29 | 22 | | | |
| M010301 | Lubricant | lit. | 0.76 | | | 8.2 | 6 | |
| (hauling, unloading) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 474 | 0.29 | 137 | | | |
| M010301 | Lubricant | lit. | 4.74 | | | 8.2 | 39 | |
| (spreading) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 46.9 | 0.29 | 14 | | | |
| M010301 | Lubricant | lit. | 0.47 | | | 8.2 | 4 | |
| B401 | Miscellaneous cost for materials, Type 1 | | 3% | | 6 | | 2 | |
| | Sub-total | | | | 203 | | 57 | 20% |
| Equipment | | | | | | | | |
| (cutting, bulldozing) | | | | | | | | |
| E0101-11-210 | Bulldozer, 21ton | Hour | 2.84 | 42.8082183 | | 122 | 41.1733687 | 117 |
| (loading) | | | | | | | | |
| E0202-21-060 | Backhoe, 0.60m ³ | Hour | 4.39 | 17.7197523 | | 78 | 15.7840678 | 69 |
| (hauling, unloading) | | | | | | | | |
| E0301-12-110 | Dump truck, 10ton | Hour | 35.4 | 10.8497854 | | 384 | 12.1407725 | 430 |
| (spreading) | | | | | | | | |
| E0101-11-210 | Bulldozer, 21ton | Hour | 1.64 | 42.8082183 | | 70 | 41.1733687 | 68 |
| B501 | Miscellaneous cost for equipment, Type 1 | | 3% | | | 20 | 21 | |
| | Sub-total | | | | | 673 | 704 | 73% |
| | Total | | | | | 876 | 1,303 | 100% |
| B601 | Overhead, Type 1 | | 25% | | | 219 | 326 | |
| Total | per 1000 m ² | | | | | 1,095 | 1,629 | |
| Unit price | per 1 m ² | | | | | 1.1 | 1.6 | |

Note: Price level: June, 1997, US\$ 1.0= Birr 6.8

Tax is excluded in the unit price.

Table 7.3.5 Breakdown of Unit Price (2/10)

| | | | | |
|-------------------|--|--------------|-------------|-------------|
| Code: | U1200 | | | |
| Work item: | Excavation, common, h.=7.5km | | | |
| Description: | excavation, loading, hauling 7.5km, unloading, spreading | | | |
| Unit of work qty: | m ³ | Total | F.C. | L.C. |
| Unit price (Net): | in local currency; | Birr 44.8 | 36.7 | 8.1 |
| | (in foreign currency; | US\$ 6.6 | 5.4 | 1.2) |
| | | 100% | 82% | 18% |

Qty for calculation: 200 m³

| Code | Description | Unit | Qty | F.C. portion | | L.C. portion | | Remarks |
|-----------------------|---|------|-------|--------------------|----------------|--------------------|----------------|---------|
| | | | | Unit price US\$ | Amount US\$ | Unit price Birr | Amount Birr | |
| Labor | | | | | | | | |
| (cutting, bulldozing) | | | | | | | | |
| L0010 | Foreman | m.d. | 0.727 | | | 80 | 58 | |
| L0110 | Operator | m.d. | 0.073 | | | 60 | 4 | |
| (loading) | | | | | | | | |
| L0010 | Foreman | m.d. | 1.12 | | | 80 | 90 | |
| L0110 | Operator | m.d. | 0.11 | | | 60 | 7 | |
| (hauling, unloading) | | | | | | | | |
| L0110 | Operator | m.d. | 5.66 | | | 60 | 340 | |
| (spreading) | | | | | | | | |
| L0110 | Operator | m.d. | 0.459 | | | 60 | 28 | |
| B301 | Miscellaneous cost for labor, Type I Sub-total | | 3% | | | | 16 542 | 8% |
| Material | | | | | | | | |
| (cutting, bulldozing) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 74.9 | 0.29 | 22 | | | |
| M010301 | Lubricant | lit. | 0.75 | | | 8.2 | 6 | |
| (loading) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 76.1 | 0.29 | 22 | | | |
| M010301 | Lubricant | lit. | 0.76 | | | 8.2 | 6 | |
| (hauling, unloading) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 474 | 0.29 | 137 | | | |
| M010301 | Lubricant | lit. | 4.74 | | | 8.2 | 39 | |
| (spreading) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 46.9 | 0.29 | 14 | | | |
| M010301 | Lubricant | lit. | 0.47 | | | 8.2 | 4 | |
| B401 | Miscellaneous cost for materials, Type I Sub-total | | 3% | | 6 201 | | 2 57 | 20% |
| Equipment | | | | | | | | |
| (cutting, bulldozing) | | | | | | | | |
| E0101-11-210 | Bulldozer, 21ton | Hour | 2.62 | 42.8082183 | 112 | 41.1733687 | 108 | |
| (loading) | | | | | | | | |
| E0202-21-060 | Backhoe, 0.60m ³ | Hour | 4.39 | 17.7197523 | 78 | 15.7840678 | 69 | |
| (hauling, unloading) | | | | | | | | |
| E0301-12-410 | Dump truck, 10ton | Hour | 35.4 | 10.8497854 | 384 | 12.1407725 | 430 | |
| (spreading) | | | | | | | | |
| E0101-11-210 | Bulldozer, 21ton | Hour | 1.64 | 42.8082183 | 70 | 41.1733687 | 68 | |
| B501 | Miscellaneous cost for equipment, Type I Sub-total | | 3% | | 19 664 | | 20 695 | 73% |
| | Total | | | | 864 | | 1,293 | 100% |
| B601 | Overhead, Type I | | 25% | | 216 | | 323 | |
| Total | per 200 m ³ | | | | 1,080 | | 1,616 | |
| Unit price | per 1 m ³ | | | | 5.4 | | 8.1 | |

Note: Price level, June, 1997, US\$ 1.0= Birr 6.8

Tax is excluded in the unit price.

Table 7.3.5 Breakdown of Unit Price (3/10)

| | | | | | |
|-------------------|--|------|-------|------|-------|
| Code: | U1400 | | | | |
| Work item: | Excavation, river bed, h.=7.5km | | | | |
| Description: | excavation, loading, hauling 7.5km, unloading, spreading | | | | |
| Unit of work qty: | m3 | | | | |
| Unit price (Net): | in local currency; | Birr | Total | F.C. | L.C. |
| | (in foreign currency; | US\$ | 84.2 | 30.9 | 53.3 |
| | | | 12.4 | 4.5 | 7.8) |
| | | | 100% | 37% | 63% |

Qty for calculation: 200 m3

| Code | Description | Unit | Qty | F.C. portion | | L.C. portion | | Remarks |
|-----------------------|--|------|-------|--------------------|----------------|--------------------|----------------|---------|
| | | | | Unit price US\$ | Amount US\$ | Unit price Birr | Amount Birr | |
| Labor | | | | | | | | |
| (excavation, man pow) | | | | | | | | |
| L0010 | Foreman | m.d. | 21 | | | 80 | 1,680 | |
| L0620 | Common labor | m.d. | 210 | | | 10 | 2,100 | |
| (short hauling, max = | | | | | | | | |
| L0010 | Foreman | m.d. | 19 | | | 80 | 1,520 | |
| L0620 | Common labor | m.d. | 190 | | | 10 | 1,900 | |
| (loading) | | | | | | | | |
| L0010 | Foreman | m.d. | 1.12 | | | 80 | 90 | |
| L0110 | Operator | m.d. | 0.11 | | | 60 | 7 | |
| (hauling, unloading) | | | | | | | | |
| L0110 | Operator | m.d. | 5.66 | | | 60 | 340 | |
| (spreading) | | | | | | | | |
| L0110 | Operator | m.d. | 0.459 | | | 60 | 28 | |
| B301 | Miscellaneous cost for labor, Type 1 | | 3% | | | | 230 | |
| | Sub-total | | | | | | 7,893 | 59% |
| Material | | | | | | | | |
| (loading) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 76.4 | 0.29 | 22 | | | |
| M010304 | Lubricant | lit. | 0.76 | | | 8.2 | 6 | |
| (hauling, unloading) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 474 | 0.29 | 137 | | | |
| M010304 | Lubricant | lit. | 4.74 | | | 8.2 | 39 | |
| (spreading) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 46.9 | 0.29 | 14 | | | |
| M010301 | Lubricant | lit. | 0.47 | | | 8.2 | 4 | |
| B401 | Miscellaneous cost for materials, Type 1 | | 3% | | 5 | | 1 | |
| | Sub-total | | | | 178 | | 50 | 9% |
| Equipment | | | | | | | | |
| (loading) | | | | | | | | |
| E0202-21-060 | Backhoe, 0.60m3 | Hour | 4.39 | 17.7197523 | 78 | 15.7840678 | 69 | |
| (hauling, unloading) | | | | | | | | |
| E0301-12-110 | Dump truck, 10ton | Hour | 35.4 | 10.8497854 | 384 | 12.1407725 | 430 | |
| (spreading) | | | | | | | | |
| E0101-11-210 | Bulldozer, 21ton | Hour | 1.64 | 42.8082183 | 70 | 41.1733687 | 68 | |
| B501 | Miscellaneous cost for equipment, Type 1 | | 3% | | 16 | | 17 | |
| | Sub-total | | | | 548 | | 584 | 32% |
| | Total | | | | 726 | | 8,527 | 100% |
| B601 | Overhead, Type 1 | | 25% | | 182 | | 2,132 | |
| Total | per 200 m3 | | | | 908 | | 10,659 | |
| Unit price | per 1 m3 | | | | 4.5 | | 53.3 | |

Note: Price level; June, 1997, US\$ 1.0= Birr 6.8

Tax is excluded in the unit price.

Table 7.3.5 Breakdown of Unit Price (4/10)

Code: U1600
 Work item: Embankment
 Description: spreading, compaction
 Unit of work q'ty: m3
 Unit price (Net): in local currency;
 (in foreign currency;

| | Total | F.C. | L.C. |
|------|-------|------|-------|
| Birr | 4.2 | 3.4 | 0.8 |
| US\$ | 0.6 | 0.5 | 0.1) |
| | 100% | 80% | 20% |

Q'ty for calculation: 100 m3

| Code | Description | Unit | Q'ty | F.C. portion | | L.C. portion | | Remarks |
|---------------------|--|------|-------|--------------------|----------------|--------------------|----------------|---------|
| | | | | Unit price US\$ | Amount US\$ | Unit price Birr | Amount Birr | |
| Labor | | | | | | | | |
| (spreading) | | | | | | | | |
| L0010 | Foreman | m.d. | 0.025 | | | 80 | 2 | |
| L0110 | Operator | m.d. | 0.252 | | | 60 | 15 | |
| (compaction) | | | | | | | | |
| L0010 | Foreman | m.d. | 0.013 | | | 80 | 1 | |
| L0110 | Operator | m.d. | 0.13 | | | 60 | 8 | |
| L0620 | Common labor | m.d. | 0.5 | | | 10 | 5 | |
| B301 | Miscellaneous cost for labor, Type 1 | | 3% | | | | 1 | |
| | Sub-total | | | | | | 32 | 9% |
| Material | | | | | | | | |
| (spreading) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 19.3 | 0.29 | 6 | | | |
| M010301 | Lubricant | lit. | 0.193 | | | 8.2 | 2 | |
| (compaction) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 3.67 | 0.29 | 1 | | | |
| M010301 | Lubricant | lit. | 0.037 | | | 8.2 | 0 | |
| B401 | Miscellaneous cost for materials, Type 1 | | 3% | | 0 | | 0 | |
| | Sub-total | | | | 7 | | 2 | 14% |
| Equipment | | | | | | | | |
| (spreading) | | | | | | | | |
| E0101-11-150 | Bulldozer, 15ton | Hour | 0.99 | 25.8739645 | 26 | 24.8858355 | 25 | |
| (compaction) | | | | | | | | |
| E0802-12-020 | Tire roller, 8-20ton | Hour | 0.51 | 12.843589 | 7 | 13.6864442 | 7 | |
| B501 | Miscellaneous cost for equipment, Type 1 | | 3% | | 1 | | 1 | |
| | Sub-total | | | | 33 | | 33 | 76% |
| | Total | | | | 40 | | 66 | 100% |
| B601 | Overhead, Type 1 | | 25% | | 10 | | 17 | |
| Total | per 100 m3 | | | | 50 | | 83 | |
| Unit price | per 1 m3 | | | | 0.5 | | 0.8 | |

Note: Price level, June, 1997, US\$ 1.0= Birr 6.8

Tax is excluded in the unit price.

Table 7.3.5 Breakdown of Unit Price (5/10)

| | | | | |
|--------------------|--|------|-------|-------|
| Code: | U2210 | | | |
| Work item: | Mass concrete (160kg), crane | | | |
| Description: | ready mixed, hauling, placing by crane, compaction, curing | | | |
| Unit of work q'ty: | m ³ | | | |
| Unit price (Net): | in local currency; | Birr | Total | F.C. |
| | (in foreign currency; | US\$ | 871.6 | 127.2 |
| | | | 128.2 | 18.7 |
| | | 100% | 15% | 85% |

Qty for calculation: 10 m³

| Code | Description | Unit | Qty | F.C. portion | | L.C. portion | | Remarks |
|-----------------------|--|----------------|-------|--------------------|----------------|--------------------|----------------|---------|
| | | | | Unit price US\$ | Amount US\$ | Unit price Birr | Amount Birr | |
| Labor | | | | | | | | |
| (hauling) | | | | | | | | |
| L0110 | Operator | m.d. | 0.86 | | | 60 | 52 | |
| (placing, compaction) | | | | | | | | |
| L0010 | Foreman | m.d. | 0.18 | | | 80 | 14 | |
| L0410 | Concrete worker | m.d. | 1.25 | | | 40 | 50 | |
| L0110 | Operator | m.d. | 0.37 | | | 60 | 22 | |
| L0620 | Common labor | m.d. | 1.63 | | | 10 | 16 | |
| (curing) | | | | | | | | |
| L0620 | Common labor | m.d. | 0.73 | | | 10 | 7 | |
| B301 | Miscellaneous cost for labor, Type 1 | | 3% | | | | 5 | |
| | Sub-total | | | | | | 167 | 2% |
| Material | | | | | | | | |
| (hauling) | | | | | | | | |
| M180501 | Ready mixed concrete, 160kg | m ³ | 11 | | | 498 | 5,478 | |
| M010102 | Gas oil (=Light oil) | lit. | 41.7 | 0.29 | 12 | | | |
| M010301 | Lubricant | lit. | 0.417 | | | 8.2 | 3 | |
| (placing, compaction) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 14.85 | 0.29 | 4 | | | |
| M010301 | Lubricant | lit. | 0.149 | | | 8.2 | 1 | |
| B101 | Miscellaneous cost for materials, Type 1 | | 3% | | | 0 | 164 | |
| | Sub-total | | | | | 17 | 5,647 | 83% |
| Equipment | | | | | | | | |
| (placing, compaction) | | | | | | | | |
| E0902-12-032 | Agitator truck, 3.2m ³ | Hour | 4.3 | 8.80792882 | 38 | 8.56116092 | 37 | |
| E0401-11-050 | Crawler crane, 50ton | Hour | 1.36 | 59.4716305 | 81 | 66.4129543 | 90 | |
| E2003-17-100 | Concrete bucket, man., 1.0m ³ | Day | 0.2 | 50.6615385 | 10 | 50.32 | 10 | |
| B501 | Miscellaneous cost for equipment, Type 1 | | 3% | | | 4 | 4 | |
| | Sub-total | | | | | 133 | 141 | 15% |
| | Total | | | | | 150 | 5,955 | 100% |
| B601 | Overhead, Type 1 | | 25% | | | 37 | 1,489 | |
| Total | per 10 m ³ | | | | | 187 | 7,444 | |
| Unit price | per 1 m ³ | | | | | 18.7 | 744.4 | |

Note: Price level; June, 1997, US\$ 1.0= Birr 6.8 Tax is excluded in the unit price.

Table 7.3.5 Breakdown of Unit Price (6/10)

| | | | | |
|--------------------|---|--------------|-------------|-------------|
| Code: | U2230 | | | |
| Work item: | Ordinary concrete (240kg), crane | | | |
| Description: | redy mixed, hauling, placing by crane, compaction, curing | | | |
| Unit of work q'ty: | m ³ | <u>Total</u> | <u>F.C.</u> | <u>L.C.</u> |
| Unit price (Net): | in local currency; | Birr 950.9 | 127.2 | 823.7 |
| | (in foreign currency; | US\$ 139.8 | 18.7 | 121.1) |
| | | 100% | 13% | 87% |

Q'ty for calculation: 10 m³

| Code | Description | Unit | Q'ty | F.C. portion | | L.C. portion | | Remarks |
|-----------------------|--|----------------|-------|--------------------|----------------|--------------------|----------------|---------|
| | | | | Unit price US\$ | Amount US\$ | Unit price Birr | Amount Birr | |
| Labor | | | | | | | | |
| (hauling) | | | | | | | | |
| L0110 | Operator | m d. | 0.86 | | | 60 | 52 | |
| (placing, compaction) | | | | | | | | |
| L0010 | Foreman | m d. | 0.18 | | | 80 | 14 | |
| L0410 | Concrete worker | m d. | 1.25 | | | 40 | 50 | |
| L0110 | Operator | m d. | 0.37 | | | 60 | 22 | |
| L0620 | Common labor | m d. | 1.63 | | | 10 | 16 | |
| (curing) | | | | | | | | |
| L0620 | Common labor | m d. | 0.73 | | | 10 | 7 | |
| B301 | Miscellaneous cost for labor, Type I | | 3% | | | | 5 | |
| | Sub-total | | | | | | 167 | 2% |
| Material | | | | | | | | |
| (hauling) | | | | | | | | |
| M180503 | Ready mixed concrete, 240kg | m ³ | 11 | | | 554 | 6,094 | |
| M010102 | Gas oil (=Light oil) | lit. | 41.7 | 0.29 | 12 | | | |
| M010301 | Lubricant | lit. | 0.417 | | | 8.2 | 3 | |
| (placing, compaction) | | | | | | | | |
| M010102 | Gas oil (=Light oil) | lit. | 14.85 | 0.29 | 4 | | | |
| M010301 | Lubricant | lit. | 0.149 | | | 8.2 | 1 | |
| B401 | Miscellaneous cost for materials, Type I | | 3% | | 0 | | 183 | |
| | Sub-total | | | | 17 | | 6,282 | 84% |
| Equipment | | | | | | | | |
| (placing, compaction) | | | | | | | | |
| E0902-12-032 | Agitator truck, 3.2m ³ | Hour | 4.3 | 8,807,928.82 | 38 | 8,561,160.92 | 37 | |
| E0401-11-050 | Crawler crane, 50ton | Hour | 1.36 | 59,471,630.5 | 81 | 66,412,954.3 | 90 | |
| E2003-17-100 | Concrete bucket, man., 1.0m ³ | Day | 0.2 | 50,661,538.5 | 10 | 50,32 | 10 | |
| B501 | Miscellaneous cost for equipment, Type I | | 3% | | 4 | | 4 | |
| | Sub-total | | | | 133 | | 141 | 14% |
| | Total | | | | 150 | | 6,590 | 100% |
| B601 | Overhead, Type I | | 25% | | 37 | | 1,647 | |
| Total | per 10 m ³ | | | | 187 | | 8,237 | |
| Unit price | per 1 m ³ | | | | 18.7 | | 823.7 | |

Note: Price level, June, 1997, US\$ 1.0= Birr 6.8

Tax is excluded in the unit price.

Table 7.3.5 Breakdown of Unit Price (7/10)

| | | | | |
|--------------------|---|------|-------|-------|
| Code: | U2100 | | | |
| Work item: | Form, for ordinary concrete | | | |
| Description: | plywood, setting, oil painting, removal | | | |
| Unit of work q'ty: | m ² | | | |
| Unit price (Net): | in local currency; | Birr | Total | F.C. |
| | (in foreign currency; | US\$ | 124.3 | 70.2 |
| | | | 18.3 | 10.3 |
| | | | 100% | 56% |
| | | | | L.C. |
| | | | | 54.2 |
| | | | | 8.0) |
| | | | | 44% |

Qty for calculation: 100 m²

| Code | Description | Unit | Qty | F.C. portion | | L.C. portion | | Remarks |
|------------------|--|----------------|-------|--------------------|----------------|--------------------|----------------|---------|
| | | | | Unit price US\$ | Amount US\$ | Unit price Birr | Amount Birr | |
| Labor | | | | | | | | |
| L0010 | Foreman | m.d | 3.2 | | | 80 | 256 | |
| L0320 | Carpenter | m.d | 45.5 | | | 40 | 1,820 | |
| L0620 | Common labor | m.d | 21.5 | | | 10 | 215 | |
| L0110 | Operator | m.d | 1.97 | | | 60 | 118 | |
| B301 | Miscellaneous cost for labor, Type 1 | | 3% | | | | 72 | |
| | Sub-total | | | | | | 2,481 | 25% |
| Material | | | | | | | | |
| M060500 | Plywood | m ³ | 0.88 | 602 | 530 | | | |
| M060200 | Timber, square | m ³ | 0.44 | | | 2636 | 1,160 | |
| M030303 | Nail | kg | 2 | | | 9.1 | 18 | |
| M070310 | Form oil | lit. | 50 | | | 7.3 | 365 | |
| M010102 | Gas oil (=Light oil) | lit | 92.7 | 0.29 | 27 | | | |
| M010301 | Lubricant | lit. | 0.927 | | | 8.2 | 8 | |
| B401 | Miscellaneous cost for materials, Type 1 | | 3% | | | 17 | 47 | |
| | Sub-total | | | | | 573 | 1,597 | 55% |
| Equipment | | | | | | | | |
| E0402-22-016 | Truck crane, hyd. 15-16ton | Hour | 10.9 | 22.470504 | 245 | 22.6902998 | 247 | |
| B501 | Miscellaneous cost for equipment, Type 1 | | 3% | | | 7 | 7 | |
| | Sub-total | | | | | 252 | 255 | 20% |
| | Total | | | | | 826 | 4,333 | 100% |
| B601 | Overhead, Type 1 | | 25% | | | 206 | 1,083 | |
| Total | per 100 m ² | | | | | 1,032 | 5,417 | |
| Unit price | per 1 m ² | | | | | 10.3 | 54.2 | |

Note: Price level: June, 1997, US\$ 1.0= Birr 6.8

Tax is excluded in the unit price.

Table 7.3.5 Breakdown of Unit Price (8/10)

Code: U2300
 Work item: Reinforcing bar, deformed
 Description: deformed, cutting, bending, assembling
 Unit of work q'ty: kg
 Unit price (Net): in local currency;
 (in foreign currency;

| | Total | F.C. | L.C. |
|------|-------|------|-------|
| Birr | 6.3 | 5.9 | 0.4 |
| US\$ | 0.9 | 0.9 | 0.1) |
| | 100% | 94% | 6% |

Q'ty for calculation: 1000 kg

| Code | Description | Unit | Qty | F.C. portion | | L.C. portion | | Remarks |
|-----------------------|--|------|-------|--------------------|----------------|--------------------|----------------|---------|
| | | | | Unit price US\$ | Amount US\$ | Unit price Birr | Amount Birr | |
| Labor | | | | | | | | |
| (cutting, bending) | | | | | | | | |
| L0250 | Rebar worker | m.d. | 2.25 | | | 40 | 90 | |
| L0620 | Common labor | m.d. | 1.5 | | | 10 | 15 | |
| (assembling) | | | | | | | | |
| L0250 | Rebar worker | m.d. | 3.75 | | | 40 | 150 | |
| L0620 | Common labor | m.d. | 3.25 | | | 10 | 33 | |
| L0110 | Operator | m.d. | 0.098 | | | 60 | 6 | |
| B301 | Miscellaneous cost for labor, Type 1 | | 3% | | | | 9 | |
| | Sub-total | | | | | | 302 | 6% |
| Material | | | | | | | | |
| (hauling) | | | | | | | | |
| M030202 | Reinforcing bar, deformed | kg | 1200 | 0.54 | 648 | | | |
| M010102 | Gas oil (=Light oil) | lit. | 4.62 | 0.29 | 1 | | | |
| M010301 | Lubricant | lit. | 0.046 | | | 8.2 | 0 | |
| B402 | Miscellaneous cost for materials, Type 2 | | 5% | | | 32 | 0 | |
| | Sub-total | | | | | 682 | 0 | 92% |
| Equipment | | | | | | | | |
| (placing, compaction) | | | | | | | | |
| E0402-22-016 | Truck crane, hyd., 15-16ton | Hour | 0.544 | 22.470504 | | 12 | 22.6902998 | 12 |
| B501 | Miscellaneous cost for equipment, Type 1 | | 3% | | | 0 | 0 | |
| | Sub-total | | | | | 13 | 13 | 2% |
| | Total | | | | | 694 | 315 | 100% |
| B601 | Overhead, Type I | | 25% | | | 174 | 79 | |
| Total | per 1000 kg | | | | | 868 | 394 | |
| Unit price | per 1 kg | | | | | 0.9 | 0.4 | |

Note: Price level; June, 1997, US\$ 1.0= Birr 6.8

Tax is excluded in the unit price.

Table 7.3.5 Breakdown of Unit Price (9/10)

| | | | | |
|-------------------|--|------|-------|------------------------------|
| Code: | U3100 | | | |
| Work item: | Wet masonry | | | |
| Description: | mortar 1:4, royalty, hauling, unloading, masonning | | | |
| Unit of work qty: | m ³ | | | |
| Unit price (Net): | in local currency; | Birr | Total | F.C. |
| | (in foreign currency; | US\$ | 393.0 | |
| | | | 57.8 | |
| | | 100% | 0% | L.C. 393.0 57.8) 100% |

Qty for calculation: 10 m³

| Code | Description | Unit | Qty | E.C. portion | | L.C. portion | | Remarks |
|------------------|--|----------------|------|--------------------|----------------|--------------------|----------------|---------|
| | | | | Unit price US\$ | Amount US\$ | Unit price Birr | Amount Birr | |
| Labor | | | | | | | | |
| (stone pitching) | | | | | | | | |
| L0420 | Mason | m d. | 5.25 | | | 45 | 236 | |
| L0620 | Common labor | m d. | 10.2 | | | 10 | 102 | |
| (mortaring) | | | | | | | | |
| L0410 | Concrete worker | m d. | 4.5 | | | 40 | 180 | |
| L0620 | Common labor | m d. | 9 | | | 10 | 90 | |
| (filling behind) | | | | | | | | |
| L0620 | Common labor | m d. | 1.7 | | | 10 | 17 | |
| B301 | Miscellaneous cost for labor, Type 1 | | 3% | | | | 19 | |
| | Sub-total | | | | | | 644 | 20% |
| Material | | | | | | | | |
| (stone pitching) | | | | | | | | |
| M180302 | Stone | m ³ | 11.3 | | | 46 | 520 | |
| (mortaring) | | | | | | | | |
| M180505 | Ready mixed concrete, 240kg, at site | m ³ | 2.75 | | | 639 | 1,757 | |
| (filling behind) | | | | | | | | |
| M180302 | Stone | m ³ | 2.26 | | | 46 | 104 | |
| B402 | Miscellaneous cost for materials, Type 2 | | 5% | | | | 119 | |
| | Sub-total | | | | | | 2,500 | 80% |
| Equipment | | | | | | | | |
| B501 | Miscellaneous cost for equipment, Type 1 | | 3% | | | | | |
| | Sub-total | | | | | | | 0% |
| | Total | | | | | | 3,144 | 100% |
| B601 | Overhead, Type 1 | | 25% | | | | 786 | |
| Total | per 10 m ³ | | | | | | 3,930 | |
| Unit price | per 1 m ³ | | | | | | 393.0 | |

Note: Price level; June, 1997, US\$ 1.0= Birr 6.8 Tax is excluded in the unit price.

Table 7.3.5 Breakdown of Unit Price (10/10)

| | | | | |
|-------------------|--|--------------|-------------|-------------|
| Code: | U3200 | | | |
| Work item: | Gabion mattress | | | |
| Description: | including wire net, royalty, hauling, unloading, masonning | | | |
| Unit of work qty: | m3 | <u>Total</u> | <u>F.C.</u> | <u>L.C.</u> |
| Unit price (Net): | in local currency; | Birr 265.0 | 63.1 | 201.9 |
| | (in foreign currency; | US\$ 39.0 | 9.3 | 29.7) |
| | | 100% | 24% | 76% |

Qty for calculation: 6 m3

| Code | Description | Unit | Qty | E.C. portion | | L.C. portion | | Remarks |
|------------------|--|------|-------|--------------------|----------------|--------------------|----------------|---------|
| | | | | Unit price US\$ | Amount US\$ | Unit price Birr | Amount Birr | |
| Labor | | | | | | | | |
| 1.0010 | Foreman | m.d. | 0.3 | | | 80 | 24 | |
| 1.0420 | Mason | m.d. | 2.5 | | | 45 | 113 | |
| 1.0620 | Common labor | m.d. | 2.25 | | | 10 | 23 | |
| 1.0110 | Operator | m.d. | 0.532 | | | 60 | 32 | |
| B301 | Miscellaneous cost for labor, Type 1 | | 3% | | | | 6 | |
| | Sub-total | | | | | | 197 | 15% |
| Material | | | | | | | | |
| M030302 | Annealed iron wire | kg | 50 | | | 9.1 | 455 | |
| M180302 | Stone | m3 | 5.7 | | | 46 | 262 | |
| M010102 | Gas oil (=light oil) | lit | 33.1 | 0.29 | 10 | | | |
| M010301 | Lubricant | lit. | 0.331 | | | 8.2 | 3 | |
| B401 | Miscellaneous cost for materials, Type 1 | | 3% | | | 0 | 22 | |
| | Sub-total | | | | | 10 | 742 | 64% |
| Equipment | | | | | | | | |
| E0202-21-060 | Backhoe, 0.60m3 | Hour | 1.9 | 17.7197523 | | 34 | 15.7840678 | 30 |
| B501 | Miscellaneous cost for equipment, Type 1 | | 3% | | | 1 | 1 | |
| | Sub-total | | | | | 35 | 31 | 21% |
| | Total | | | | | 45 | 969 | 100% |
| B601 | Overhead, Type 1 | | 25% | | | 11 | 242 | |
| Total | per 6 m3 | | | | | 56 | 1,211 | |
| Unit price | per 1 m3 | | | | | 9.3 | 201.9 | |

Note: Price level, June, 1997, US\$ 1.0= Birr 6.8

Tax is excluded in the unit price.

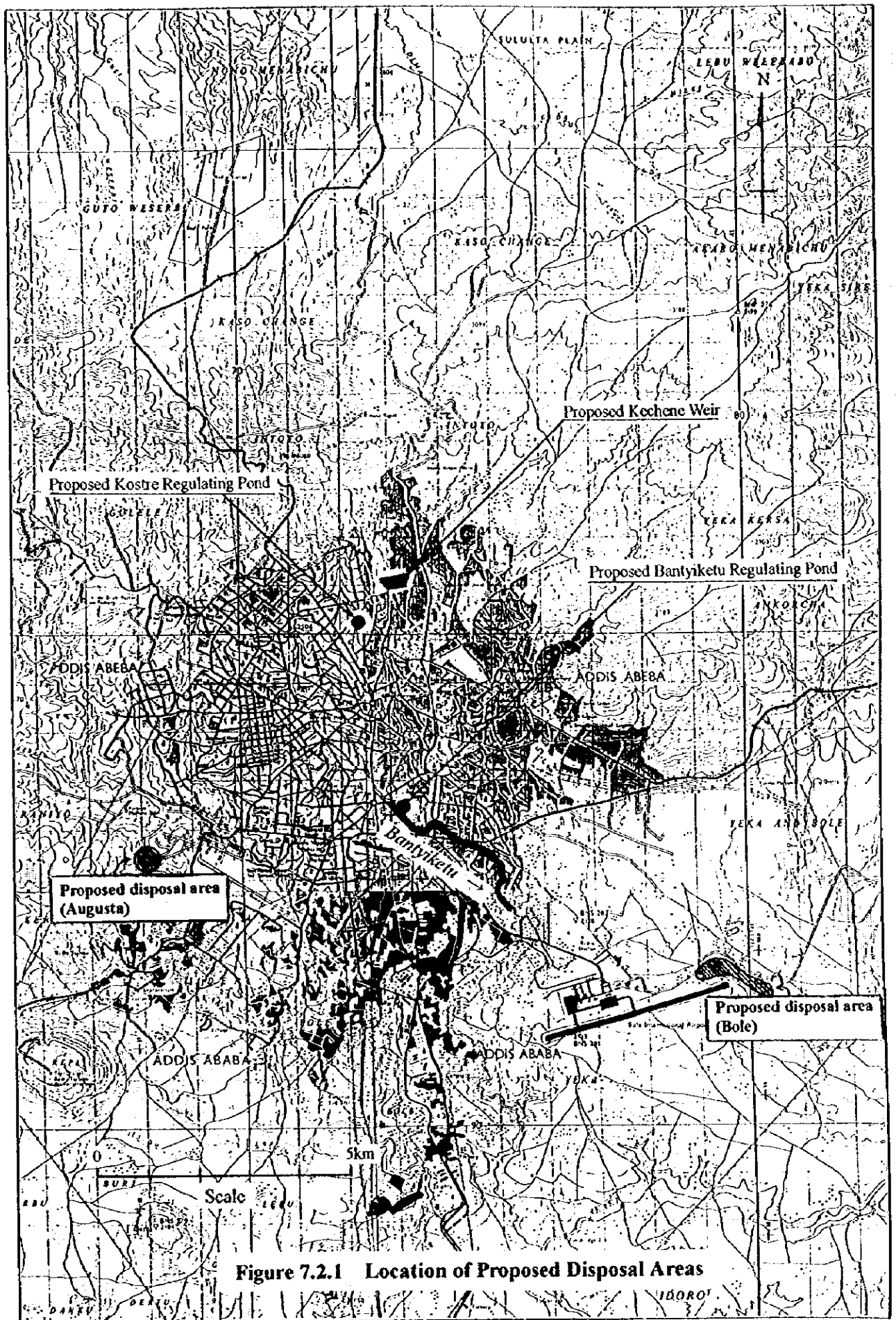


Figure 7.2.1 Location of Proposed Disposal Areas

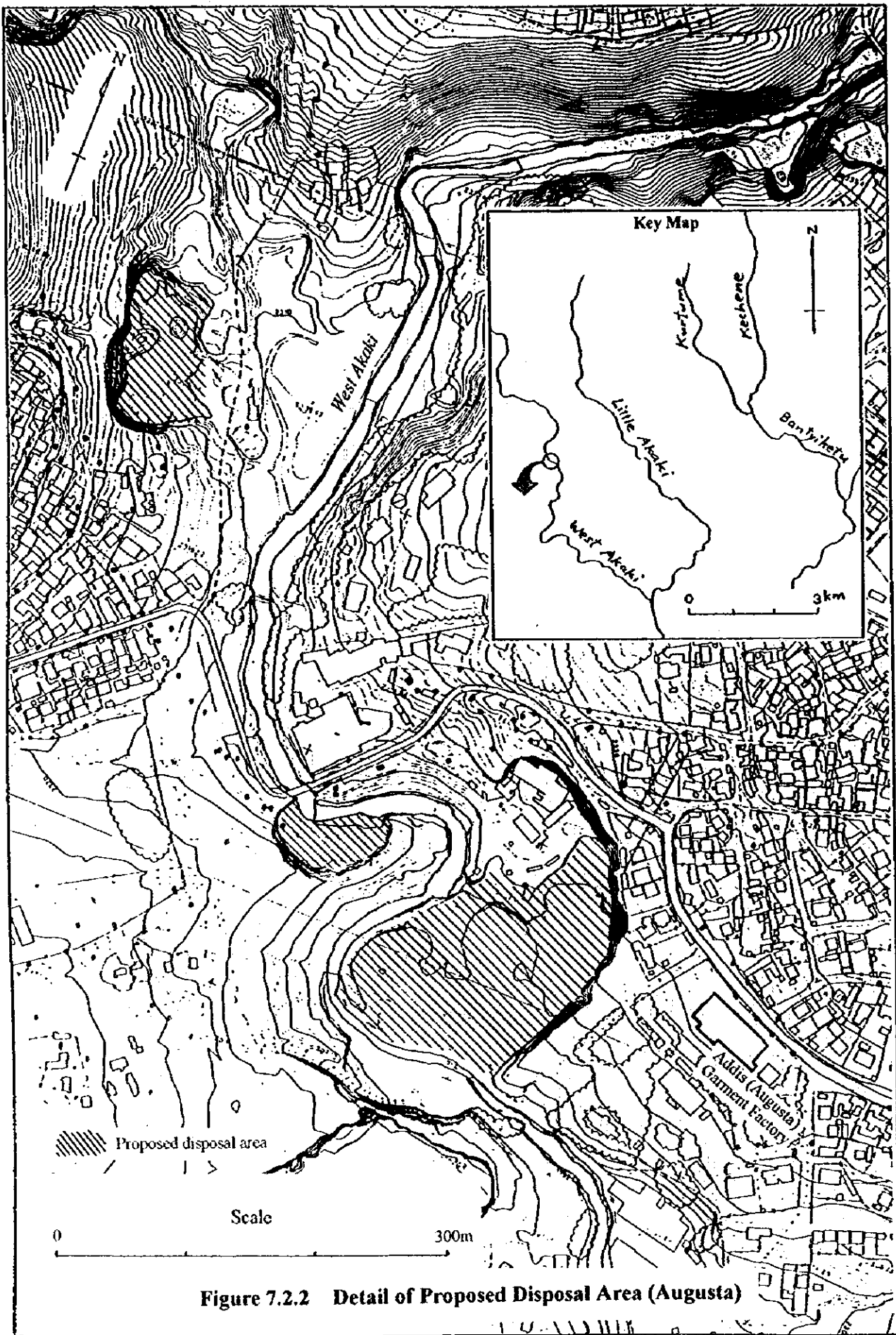
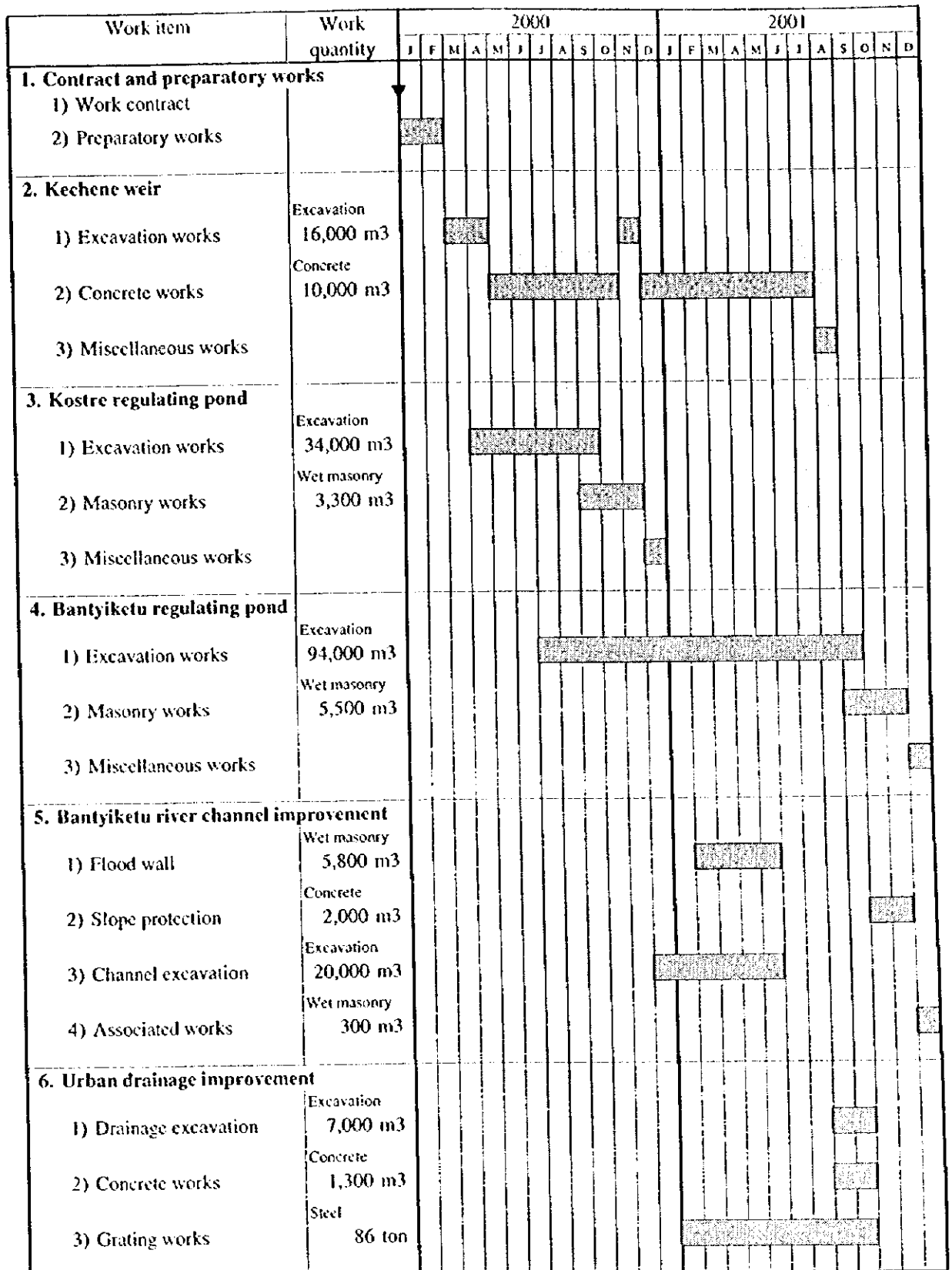


Figure 7.2.2 Detail of Proposed Disposal Area (Augusta)



Note: - June, July, August and September: Rainy season
 - Construction of upper facilities will be commenced prior to downstream facilities.

Figure 7.2.3 Construction Schedule

**THE STUDY ON ADDIS ABABA
FLOOD CONTROL PROJECT**

CHAPTER 8

**ORGANIZATION AND
INSTITUTION**

**THE STUDY
ON
ADDIS ABABA FLOOD CONTROL PROJECT
IN
THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA**

CHAPTER 8 ORGANIZATION AND INSTITUTION

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8. ORGANIZATION AND INSTITUTION

8.1 General

The major river systems of the Bantiyketu, Kebena, Little Akaki and West Akakki, and Hanku rivers have been managed by the Region 14 Administration. The existing AFCPO under the Steering Committee directly administrates and manages all flood control facilities of the above mentioned rivers.

On the other hand, the following are major proposed components of the priority projects that are to be newly incorporated in the river management.

8.1.1 Structural Measures

1) Bantiyketu river

- Channel improvement (consisting mainly of widening of the existing river channel, construction of floodwalls and protection works of bank slopes) and
- Construction of Bantiyketu regulating pond.

2) Lower Kebena river

- Slope protection works.

3) Kechene river

- Construction of Kostre regulating pond,
- Construction of Kechene weir with orifice and
- Construction of floodwall.

4) Urban drainage

- Construction of road side-ditch with grating and
- Others

8.1.2 Non-Structural Measures

- 1) Authorization of river zone and regulation of illegal activity(garbage disposal, utilization of river area for private use and construction of private facilities in river area) for river management, and

2) Flood warning system, flood fighting system and social education for flood risk management.

8.2 Organization and Institution

8.2.1 Required Organization and Institution for Project Implementation

The priority projects would be a pilot for flood control and damage mitigation measures in not only Addis Ababa but also Ethiopia. It is expected that through implementation of the priority projects, a lot of staff who can apply the basic technologies to the flood control and damage mitigation measures be provided to the country.

Required organizations including community level as a participation of inhabitants need to be established for an implementation of the priority projects and river management, and the subsequent projects in the master plan.

Figure 8.2.1 shows the proposed overall organization for project implementation. Figure 8.2.2 shows the proposed organization of Addis Ababa River Board and Addis Ababa River Management Authority.

(1) Addis Ababa River Board

Addis Ababa River Board to be newly organized is entirely responsible for project implementation.

The President of Region 14 Administration designates and authorizes Addis Ababa River Board that is entirely responsible for project implementation of long, medium and short terms structural and non-structural measures on flood prevention, urban drainage, and resettlement in Region 14 Administration.

The President chairs the board that is organized by heads of the concerned Bureaus and Authorities of Region 14 Administration. Addis Ababa River Board takes charge of coordination with all relevant governmental agencies and regional organizations in implementing the project.

(2) Addis Ababa River Management Authority

A new organization of **Addis Ababa River Management Authority** needs to be established by reorganizing the existing AFCPO and assigning staff required for execution of the project and river management. Under the direction of the Addis Ababa River Board, Addis Ababa River Management Authority functions as the **Executing Body** of the project.

Addis Ababa River Management Authority is designated and authorized by Region 14 Administration that is responsible for implementations of river management, flood prevention and urban drainage projects, and resettlement with administrative power.

This Authority is functionally and institutionally same with those of AAWSA (Addis Ababa Water Supply and Sewerage Authority) and AARA (Addis Ababa Road Authority) in the Region 14 Administration. The budget of AARMA is all covered by Region 14 Administration. Required personnel numbers will be around 50.

Consultants are to be employed to assist the implementation of the priority projects including basic design, detailed design and construction supervision. The construction system will be a full contracting basis through an international competitive bidding.

(3) Community Organizations

Each community with guidance by AARB and AARMA basically operates the flood fighting and social education systems in the non-structural measures. A participation of inhabitants is requisite for the system operations.

Figure 8.2.3 presents the organization and communication chart for the community organization. For this purpose, required institutional support needs to be established in line with the regulations of Region 14 Administration.

8.2.2 Roles and Development of Each Organization

Roles of each organization are specified as follows.

Addis Ababa River Board (AARB)

Overall management and coordination with relevant organizations:

- Coordination with relevant organizations,
- Formulation of institutional system,
- Establishment of required organization,
- Financial arrangement,
- Arrangement of social education ,
- Land acquisition, and
- Others.

Addis Ababa River Management Authority (AARMA)

For implementation stage:

- Overall river management,
- Investigation, study and detailed design of construction works,
- Preparation of tender document,
- Tendering,
- Resettlement, and
- Construction supervision,

For operation and maintenance stage:

- River management for structural and non-structural measures,
- Operation and maintenance for the rivers and river structures, and
- Direction and guidance of flood fighting and social education for flood risk mitigation.

Zone and Wereda

- Direction and supervision of flood fighting system under the direction of Investigation and Survey Division of AARMA, and
- Direction of social education for rivers and flooding under the direction of Administration Division of AARMA.

Kebele and Community

- Operation of flood fighting system (self defense by community level), and
- Social education for rivers and flooding.

Establishment of these organizations needs to be progressed with required institutional development in line with the regulations and institutions of the Region 14 Administration. The organizations of the project implementation need to be developed according to the following three stages.

(1) Preparatory Stage

In order to mobilize the project smoothly, AARB establishes AARMA organization as required in minimum and assigns a group of staff and commences the preparatory works immediately after JICA study. AARB takes an initiative for all activities in the preparatory stage.

The staff is selected from various sectors in Region 14 Administration including some of the counterpart personnel of the present JICA study team. The major tasks in the preparatory stage are as follows:

- Detailed implementation program for priority projects,
- Budget arrangement,
- Establishment of AARMA organization,
- Formulation of institutional system of AARMA
- Institution for the river zone and illegal activity,
- Institution for flood risk management (flood warning and fighting) and social education, in cooperation with Zone/Wereda, and
- Direction of establishment of community organization.

(2) Implementation Stage

The required organization is fully established based on the detailed implementation program prepared in the preparatory stage. AARB takes charge of coordination and management for the project implementation. On the other hand, AARMA mobilizes as the executing body for project implementation. Major tasks in this stage are as follows.

AARB

- Coordination with relevant organizations,
- Employment of consultants,
- Coordination and management for detailed design and construction works,
- Land acquisition, and
- Coordination and management for non-structural measures.

AARMA

- River management,
- Carrying out detailed design and preparation of tender documents,

- Resettlement,
- Tendering for construction works,
- Construction supervision, and
- Activities of non-structural measure in cooperation with relevant organizations and communities.

The organization of AARMA needs at least the following technical key staff.

- Project manager,
- River management staff,
- Administrative and finance officers,
- Officers for resettlement,
- River engineer,
- Design engineer,
- Hydrologist,
- Surveyor, and
- Quality control engineer.

(3) Operation and Maintenance Stage

Activities of operation and maintenance for river and river structures starts just after the completion of the priority projects. AARMA takes charge of operation and maintenance work for structural measures.

For non- structural measures, AARMA also takes charge of operation and management in cooperation with relevant organizations. Division of River Management and O/M in Figure 8.2.2 is mainly in charge of O/M for structural measures of river and river structures and for non-structural measures.

The following key personnel needs to be additionally assigned for river management, and operation and maintenance (O/M) of the completed priority projects.

- Personnel for river management including non-structural measures, and
- Personnel for operation and maintenance of river and structures.

8.2.3 Detail Job Description of Addis Ababa River Management Authority

Major jobs of the respective divisions in AARMA are specified in the following.

(1) Administration and Finance Department

This department consists of 2 divisions of Administration and Finance. Major jobs are as follows:

Administration Division

- Administration of general matters in the office and staff, and
- Arrangement of social education of people for rivers and flooding.

Finance Division

- Arrangement and management of financial matters in the office.

(2) Planning and Design Department

There are 3 divisions of Resettlement, Survey and Investigation, and Planning and Design Division. Major tasks are specified as follows:

Resettlement Division

- Investigation of areas that are subject to damage by flooding,
- Preparation of questionnaire for objective people,
- Categorization of type of houses and transfer document to Planning and Design Division, and
- Implementation of resettlement works.

Survey and Investigation

- Carrying out surveys consisting of river section, hydrological matters and construction works,
- Observation and collection of meteorological and hydrological data,
- Analysis of data and operation of flood warning, and
- Issuance order for flood fighting under the direction of AARB and AARMA.

Planning and Design Division

- Planning of river improvement works including related works and building,
- Design for the above, and
- Preparation of tender document for construction works of flood control and resettlement.

(3) Operation Department

The operation department consists of 2 divisions of Procurement and Supervision, and River Management and O/M. Major tasks are as follows:

Procurement and Supervision Division

- Assistance AARB to employ consultant,
- Carrying out tendering, and
- Supervision of construction works and preparation of completion report.

River Management and O/M Division

- Assistance Law Section of Region 14 Administration for institutional matters of river management and flood risk management,
- River management, and
- Operation and maintenance of the completed works.

8.2.4 Institutions for Non-Structural Measures

In addition to the institutional setup for the respective organizations required for project implementation, the following institutional systems are established for the non-structural measures.

(1) Institutions for River Zone

For authorization of the river zone, an institutional support with bylaw is required for an overall river management system. The concerned law-section in the Region 14 Administration and Addis Ababa River Management Authority which are directed by Addis Ababa River Board, take charge of these institutional matters in accordance with the regulations of Region 14 Administration. The following are the required institutional support items:

- Designation of the highest responsible administrator (President) in the river management for rivers and river structures,
- Rivers, river stretches and river widths to be designated,
- Regulation of land use in the riverine area
- Permission system for utilization and construction of facilities in the river zone, and

- Regulation of and penalty for illegal activities such as illegal utilization of river zone, and garbage and soil disposals.

(2) Institutions for Flood Warning and Flood Fighting System

To operating the flood warning system needs required institutional system in relation with flood fighting system that is to be operated by community organizations.

From the above, the following major matters are authorized by the regulations and institutions of the Region 14 Administration.

For Flood Warning System

- System and flowchart of information and warning, and
- Relationship with related organizations.

For Flood Fighting System

- Community organization for flood fighting,
- Communication system and flood fighting activities (flood fighting plan),
- Organization and responsibility of community (flood fighting team),
- Responsible administrator of each community (leader of flood fighting team),
- Annual training of flood fighting activities,
- Installation of storage house for flood prevention works,
- Designation of location of safety shelter and evacuation route in emergency case,
- Commendation system for outstanding community,
- Sharing of cost for activities, and
- Opening of public hearing.

For Social Education

- Seminar for community leaders,
- Seminar for people in each community,
- Campaign through TV and radio,
- Designation of River Day and annual River Festival (Love River),
- Annual demonstration of flood fighting activity, and
- Commendation system for outstanding community.

8.3 Operation and Maintenance

As described in the above section 8.2, AARMA under the direction of AARB is responsible for overall management for all completed river structures and established

non-structural measures in the priority projects. Activity on operation and maintenance starts immediately after the completion of the priority projects. River Management and O/M Division in AARMA as shown in Figure 8.2.2, takes charge of operation and maintenance for completed works and non-structural measures.

Operation is an efforts to manage river and river structures for their multi functions. Maintenance is an efforts to conserve functions of river and river structures in good condition including activities of rehabilitation works. In this regard, main task after completion of the priority projects is river management consisting of the following jobs.

Structural measures

- Inspection and monitoring of river channels and structures,
- Inspection and monitoring against illegal activities,
- Operation of river structures,
- Maintenance of river channel and river structures,
 - Grass cutting of river banks
 - Removal of obstacles from river courses
 - Refilling of scour pits
 - Small repair works
 - Others
- Rehabilitation works, and
- Maintenance of equipment.

Non-structural measures

- Inspection and monitoring of administrative river zone and illegal activities, and
- Operation and maintenance of flood warning and flood fighting systems.

The detail operation and maintenance manual for the priority projects will be prepared in due time of the subsequent detailed design stage.

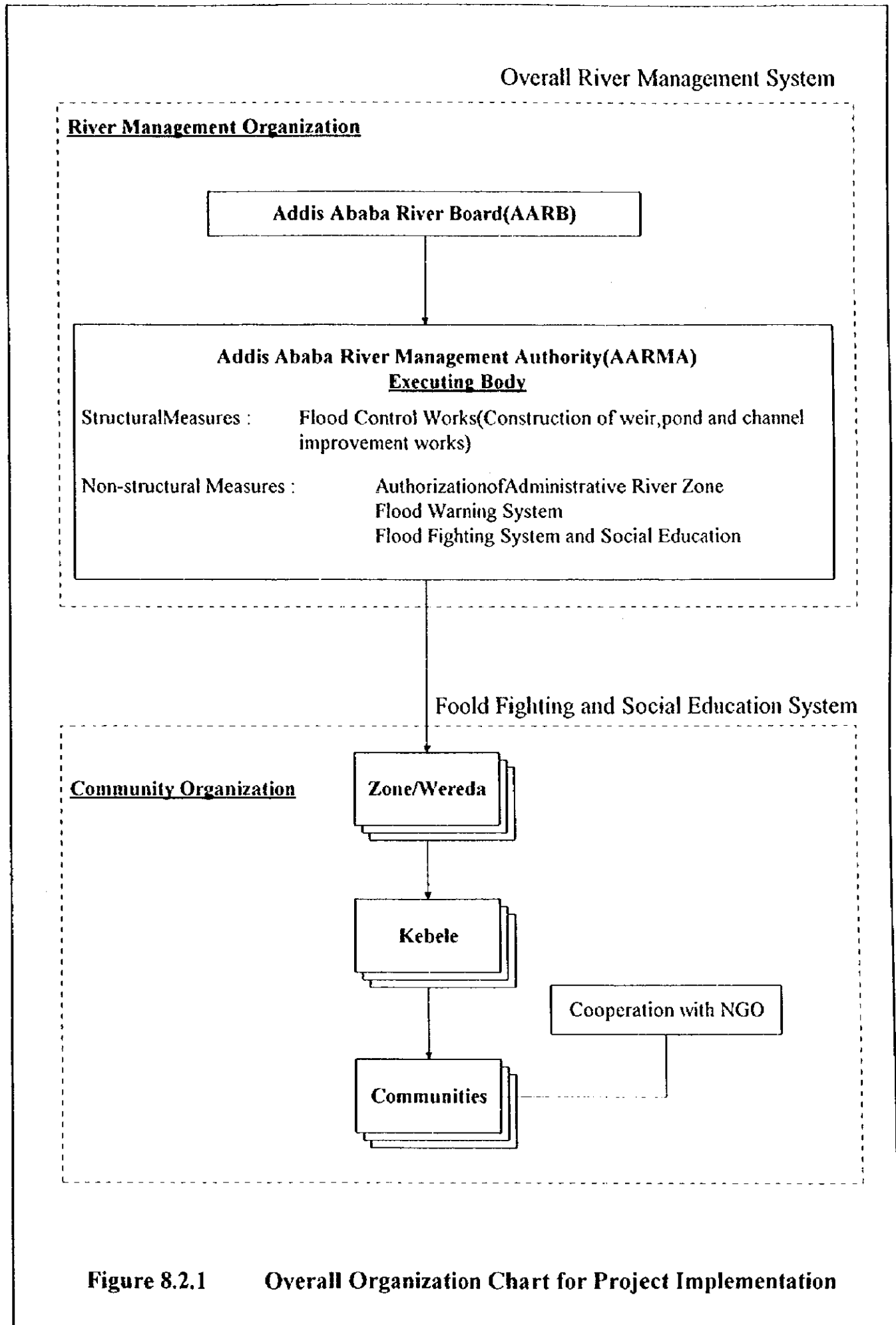
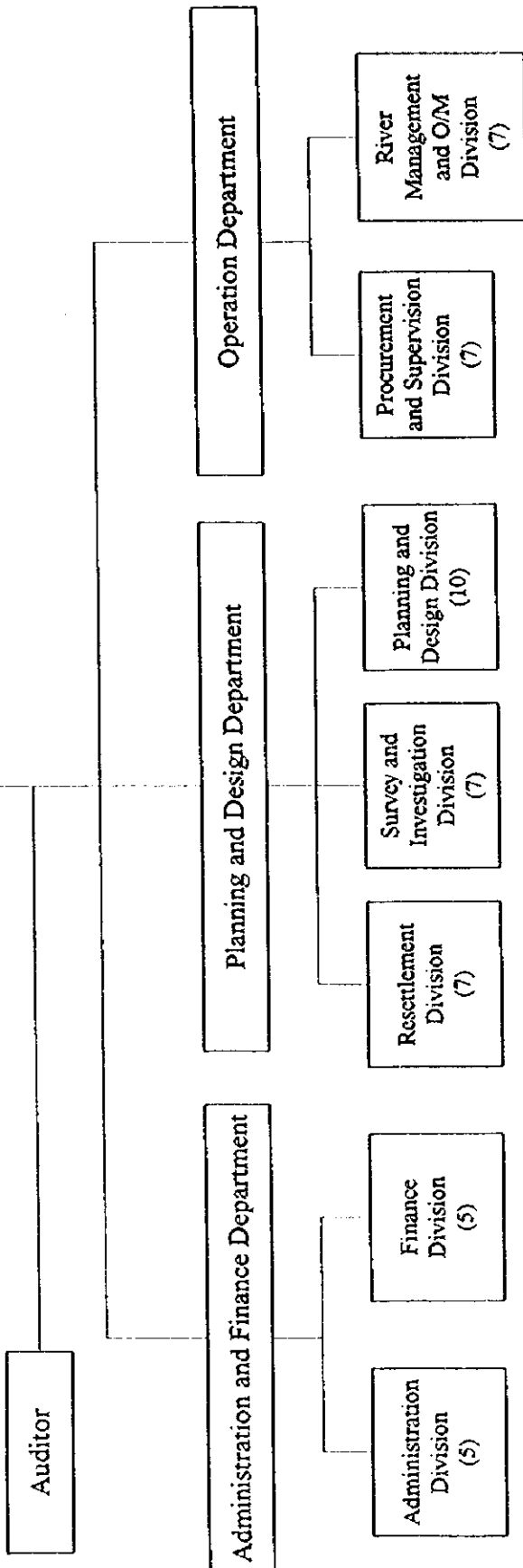
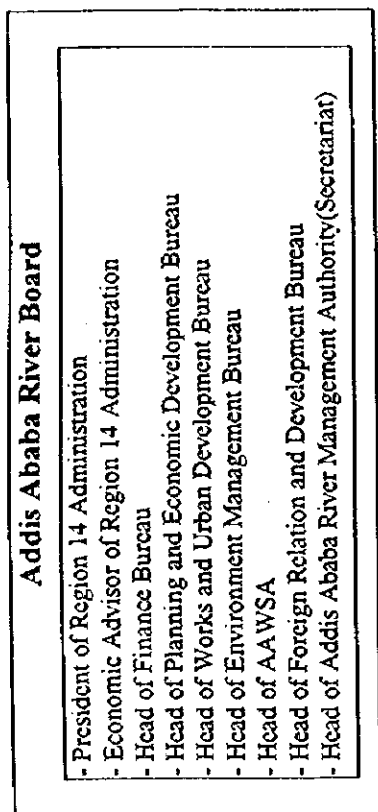


Figure 8.2.1 Overall Organization Chart for Project Implementation



Note: () means required persons.

Figure 8.2.2 Proposed Organization of Addis Ababa River Board and River Management Authority

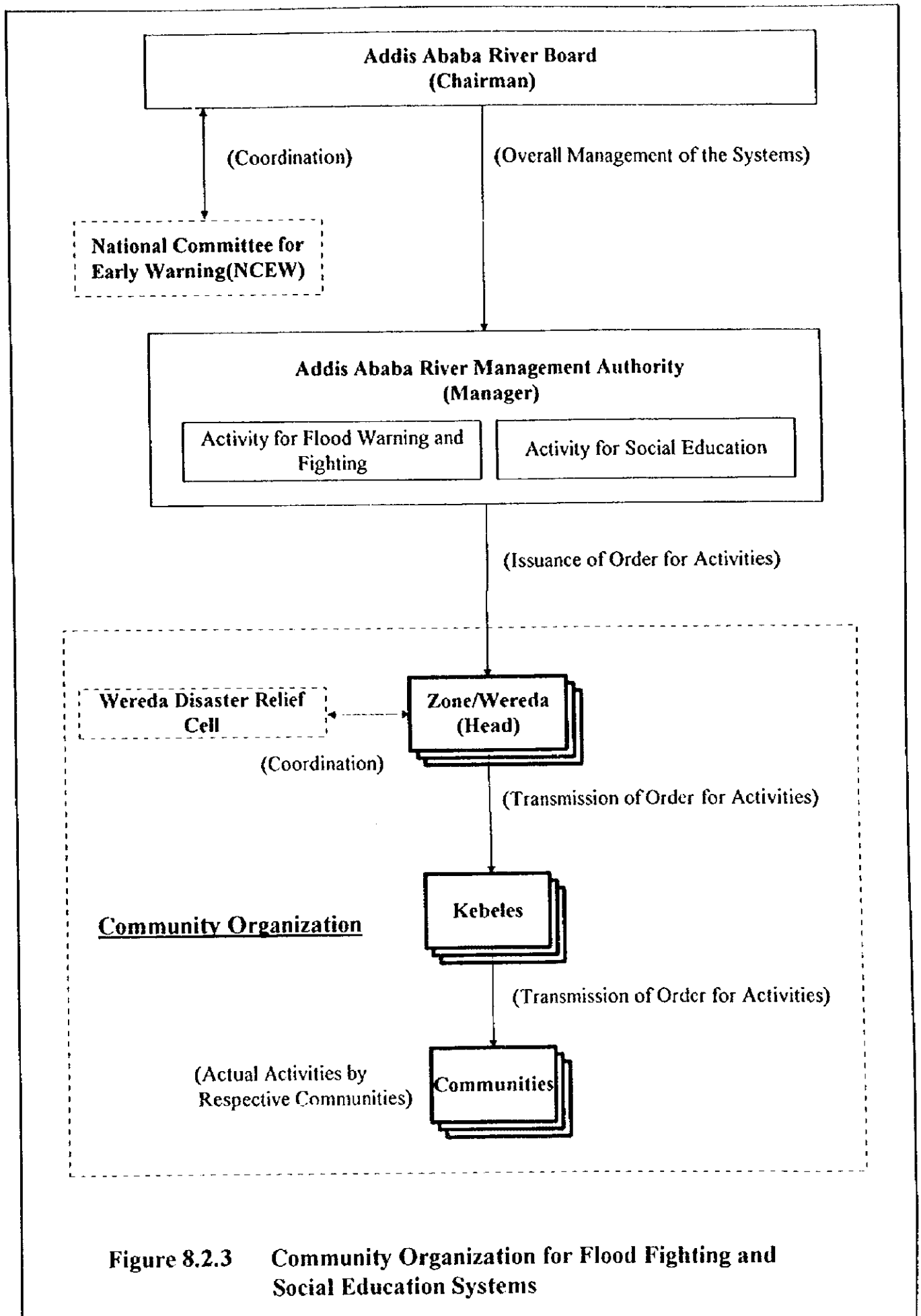


Figure 8.2.3 Community Organization for Flood Fighting and Social Education Systems

**THE STUDY ON ADDIS ABABA
FLOOD CONTROL PROJECT**

CHAPTER 9

PROJECT COST

THE STUDY
ON
ADDIS ABABA FLOOD CONTROL PROJECT
IN
THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

CHAPTER 9 PROJECT COST

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9. PROJECT COST

9.1 General

Initial investment cost for structural measures comprises 1) construction cost, 2) engineering service cost, 3) resettlement cost, 4) administration cost, 5) physical contingency and 6) price contingency. Initial investment cost for non-structural measures comprises 1) installation cost, 2) administration cost, 3) physical contingency and 4) price contingency.

Annual operation and maintenance (O&M) cost comprises those of structural measures and non-structural measures.

9.2 Project Cost

9.2.1 Project Cost

Project cost is estimated in Table 9.2.1.

9.2.2 Construction/Installation Cost

Breakdown of construction cost of structural measures is given in Table 9.2.2. Breakdown of installation cost of non-structural measures is given in Table 9.2.3.

9.2.3 Resettlement Cost

Breakdown of resettlement cost is given in Table 9.2.4.

9.2.4 Engineering Services Cost

Breakdown of engineering services cost is given in Table 9.2.5.

9.2.5 Administration Cost

Breakdown of administration cost for structural measures is given in Table 9.2.6. Breakdown of administration cost for non-structural measures is given in Table 9.2.7.

9.2.6 Annual Disbursement Schedule

Annual disbursement schedule including price escalation is given in Table 9.2.8.

9.2.7 Annual O&M Cost

Breakdown of annual O&M cost of structural measures is given in Table 9.2.9.

Breakdown of annual O&M cost of non-structural measures is given in Table 9.2.10.

Table 9.2.1 Project Cost (1/4)

| Summary | | (Unit: US\$, thousand) | | |
|--|--|------------------------|---------------------|----------------------|
| | Item | F.C. | L.C. | Total |
| <i>Structural measures</i> | | | | |
| 1. | Construction cost | | | |
| | 1) Kechene weir | 724 | 1,700 | 2,424 |
| | 2) Kostre regulating pond | 405 | 397 | 802 |
| | 3) Bantyketu regulating pond | 967 | 707 | 1,674 |
| | 4) Bantyketu river channel improvement | | | |
| | - Flood wall | 33 | 548 | 581 |
| | - Slope protection | 635 | 495 | 1,130 |
| | - Channel excavation | 224 | 128 | 352 |
| | - Associated works | 0 | 103 | 103 |
| | Sub-total of 4) | 892 | 1,274 | 2,166 |
| | 5) Urban drainage improvement | 1,338 | 321 | 1,659 |
| | Sub-total of 1. | 4,326 | 4,399 | 8,725 |
| 2. | Engineering services cost | 1,780 | 61 | 1,841 |
| 3. | Resettlement cost | 0 | 30 | 30 |
| 4. | Administration cost | 269 | 749 | 1,018 |
| | Sub-total of (1. - 4.) | <u>6,375</u> | <u>5,239</u> | <u>11,614</u> |
| 5. | Physical contingency | 635 | 526 | 1,161 |
| | Sub-total of (1. - 5.) | <u>7,010</u> | <u>5,765</u> | <u>12,775</u> |
| 6. | Price contingency | 718 | 1,243 | 1,961 |
| | Total of (1. - 6.) | 7,728 | 7,008 | 14,736 |
| <i>Non-structural measures</i> | | | | |
| 1. | Installation cost | | | |
| | 1) River zone | 0 | 189 | 189 |
| | 2) Flood warning system | 64 | 92 | 156 |
| | 3) Flood fighting system | 3 | 79 | 82 |
| | 4) Social education | 0 | 5 | 5 |
| | Sub-total of 1. | 67 | 365 | 432 |
| 2. | Administration cost | 3 | 49 | 52 |
| | Sub-total of (1. - 2.) | <u>70</u> | <u>414</u> | <u>484</u> |
| 3. | Physical contingency | 7 | 41 | 48 |
| | Sub-total of (1. - 3.) | <u>77</u> | <u>455</u> | <u>532</u> |
| 4. | Price contingency | 7 | 85 | 92 |
| | Total of (1. - 4.) | 84 | 540 | 624 |
| <i>Total of structural and non-structural measures</i> | | | | |
| | Project cost | <u>7,812</u> | <u>7,548</u> | <u>15,360</u> |

Note: - Price level; June 1997, US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 - Tax is included in the cost.

Table 9.2.1 Project Cost (2/4)

(Unit: US\$, thousand)

| Component | 1. Koshice zone | | 2. Kunitz zone | | 3. Banko z. zone | | 4. Flood wall | | 5. Heavy channel exca. | | 6. Associated works | | 7. Subtotal of 3. | | 8. Urban drainage | | 9. Total of (1.-9.) | | | | | | | | | | | | | | |
|------------------------------|-----------------|-------|----------------|------|------------------|-------|---------------|-------|------------------------|------|---------------------|-------|-------------------|------|-------------------|------|---------------------|-------|----|-----|-----|-------|-------|-------|-------|-----|-------|-------|-------|--------|---|
| | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | | | | | | | | | | | | | |
| 1. Construction cost | 724 | 1,700 | 2,424 | 405 | 397 | 802 | 667 | 707 | 1,674 | 33 | 548 | 581 | 635 | 495 | 1,130 | 224 | 128 | 352 | 0 | 103 | 103 | 892 | 1,274 | 2,166 | 1,338 | 321 | 1,659 | 4,326 | 4,399 | 8,725 | |
| 2. Engineering services cost | 495 | 17 | 511 | 164 | 6 | 169 | 342 | 12 | 353 | 119 | 4 | 123 | 231 | 8 | 238 | 72 | 2 | 74 | 21 | 1 | 22 | 442 | 15 | 457 | 338 | 12 | 350 | 1,780 | 61 | 1,841 | |
| 3. Reglement cost | 0 | 30 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 30 | 0 | 0 |
| 4. Administration cost | 75 | 208 | 283 | 25 | 69 | 94 | 52 | 144 | 195 | 18 | 50 | 68 | 35 | 97 | 132 | 11 | 30 | 41 | 3 | 9 | 12 | 67 | 186 | 253 | 51 | 142 | 194 | 269 | 749 | 1,618 | |
| Sub-total of (1.-4.) | 1,293 | 1,955 | 3,248 | 529 | 521 | 1,050 | 1,060 | 865 | 2,023 | 102 | 602 | 721 | 790 | 643 | 1,400 | 302 | 161 | 467 | 22 | 113 | 137 | 1,201 | 1,375 | 2,576 | 1,723 | 475 | 2,203 | 6,375 | 5,232 | 11,607 | |
| 5. Physical contingency | 129 | 196 | 325 | 59 | 48 | 107 | 136 | 86 | 222 | 17 | 60 | 77 | 89 | 61 | 150 | 30 | 16 | 46 | 2 | 12 | 14 | 138 | 149 | 287 | 173 | 47 | 220 | 635 | 556 | 1,191 | |
| Sub-total of (1.-5.) | 1,422 | 2,151 | 3,573 | 588 | 569 | 1,157 | 1,206 | 951 | 2,245 | 119 | 662 | 808 | 879 | 704 | 1,550 | 332 | 177 | 513 | 24 | 125 | 151 | 1,339 | 1,624 | 3,163 | 1,901 | 552 | 2,453 | 7,010 | 5,788 | 12,798 | |
| 6. Price contingency | 134 | 439 | 573 | 59 | 98 | 157 | 153 | 207 | 360 | 17 | 158 | 175 | 107 | 154 | 261 | 37 | 41 | 78 | 2 | 30 | 32 | 163 | 382 | 545 | 209 | 117 | 326 | 718 | 1,243 | 1,961 | |
| Total of (1.-6.) | 1,556 | 2,590 | 4,146 | 711 | 618 | 1,329 | 1,359 | 1,158 | 2,604 | 203 | 820 | 1,023 | 1,086 | 815 | 1,911 | 373 | 218 | 591 | 26 | 154 | 183 | 1,701 | 2,006 | 3,708 | 2,110 | 629 | 2,738 | 7,728 | 7,008 | 14,736 | |

Note: - Price level: June 1997, US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 * Tax is included in the cost.
 * Engineering services cost and administration cost are allocated to each component on the ratio of construction cost.

(Unit: US\$, thousand)

| Component | 1. River zone | | 2. Flood warning sys. | | 3. Flood refuge sys. | | 4. Social education | | 5. Total of (1.-4.) | | | | | | |
|-------------------------|---------------|------|-----------------------|------|----------------------|-------|---------------------|------|---------------------|------|------|-------|----|-----|-----|
| | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | | | |
| 1. Installation cost | 0 | 189 | 189 | 64 | 92 | 156 | 3 | 79 | 82 | 0 | 5 | 5 | 67 | 365 | 432 |
| 2. Administration cost | 1 | 22 | 23 | 1 | 17 | 18 | 1 | 9 | 10 | 0 | 1 | 1 | 3 | 49 | 52 |
| Sub-total of (1.-2.) | 1 | 211 | 212 | 65 | 109 | 174 | 4 | 88 | 92 | 0 | 6 | 6 | 70 | 414 | 484 |
| 3. Physical contingency | 0 | 21 | 21 | 7 | 11 | 18 | 0 | 9 | 9 | 0 | 0 | 0 | 7 | 41 | 48 |
| Sub-total of (1.-3.) | 1 | 232 | 233 | 72 | 120 | 192 | 4 | 97 | 101 | 0 | 6 | 6 | 77 | 455 | 532 |
| 4. Price contingency | 0 | 44 | 44 | 7 | 22 | 29 | 0 | 18 | 18 | 0 | 1 | 1 | 7 | 85 | 92 |
| Total of (1.-4.) | 1 | 275 | 277 | 79 | 142 | 221 | 4 | 115 | 119 | 0 | 7 | 7 | 84 | 540 | 624 |

Note: - Price level: June 1997, US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 * Tax is included in the cost.
 * Administration cost is allocated to each component on the ratio of installation cost.

Table 9.2.1 Project Cost (3/4)

(Unit: US\$, thousand)

| Component | 1. Machine work | | | 2. Normal work | | | 3. Repair work | | | 4. Reinforced concrete channel improvement | | | 5. Fixed work | | | 6. Stone masonry | | | 7. River channel work | | | 8. Miscellaneous works | | | 9. Subtotal of 4 | | | 10. Urban drain imp. | | | Total of (1.-5.) | | |
|------------------------------|-----------------|-------|-------|----------------|------|-------|----------------|-------|-------|--|------|-------|---------------|------|-------|------------------|------|-------|-----------------------|------|-------|------------------------|-------|-------|------------------|-------|-------|----------------------|--------|--------|------------------|---|---|
| | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | | | |
| 1. Construction cost | 877 | 2,261 | 3,138 | 487 | 520 | 1,008 | 1,180 | 954 | 2,134 | 40 | 750 | 791 | 780 | 678 | 1,458 | 275 | 175 | 450 | 0 | 142 | 1,095 | 1,746 | 2,841 | 1,645 | 439 | 2,084 | 5,285 | 5,921 | 11,205 | | | | |
| 2. Engineering services cost | 590 | 22 | 612 | 195 | 8 | 203 | 407 | 15 | 422 | 142 | 5 | 146 | 275 | 10 | 286 | 86 | 3 | 88 | 25 | 1 | 26 | 527 | 19 | 546 | 404 | 15 | 419 | 2,123 | 79 | 2,202 | | | |
| 3. Resettlement cost | 0 | 37 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4. Administration cost | 89 | 270 | 359 | 29 | 89 | 118 | 62 | 146 | 248 | 22 | 65 | 86 | 41 | 126 | 167 | 13 | 39 | 52 | 3 | 12 | 15 | 79 | 242 | 321 | 61 | 183 | 246 | 320 | 972 | 1,291 | | | |
| Sub-total of (1.-4.) | 1,556 | 2,890 | 4,446 | 711 | 618 | 1,329 | 1,649 | 1,155 | 2,804 | 203 | 820 | 1,023 | 1,096 | 815 | 1,911 | 373 | 218 | 591 | 28 | 154 | 193 | 1,701 | 2,066 | 3,768 | 2,110 | 639 | 2,748 | 7,728 | 7,908 | 14,736 | | | |

Note: - Price level: June 1997, US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 - Tax is included in the cost.
 - Each item includes its physical and price contingencies.

Itemized Cost of Non-structural Measures by Component

(Unit: US\$, thousand)

| Component | 1. Road/June | | | 2. Flood warning sys. | | | 3. Flood lights sys. | | | 4. Social education | | | Total of (1.-4.) | | |
|------------------------|--------------|------|-------|-----------------------|------|-------|----------------------|------|-------|---------------------|------|-------|------------------|------|-------|
| | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total |
| 1. Installation cost | 0 | 248 | 248 | 78 | 121 | 198 | 3 | 104 | 107 | 0 | 6 | 6 | 81 | 478 | 559 |
| 2. Administration cost | 1 | 27 | 29 | 1 | 23 | 24 | 1 | 12 | 13 | 0 | 1 | 1 | 3 | 62 | 65 |
| Sub-total of (1.-2.) | 1 | 275 | 276 | 79 | 143 | 222 | 4 | 115 | 119 | 0 | 7 | 7 | 84 | 540 | 624 |

Note: - Price level: June 1997, US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 - Tax is included in the cost.
 - Each item includes its physical and price contingencies.

Table 9.2.1 Project Cost (4/4)

| Cost by Fund | (Unit: US\$, thousand) | | | |
|--|------------------------|---------------------|----------------------|-------|
| | Item | F.C. | L.C. | Total |
| <i>Structural measures</i> | | | | |
| <i>Foreign fund</i> | | | | |
| 1. Construction cost (Net) | 5,045 | 5,561 | 10,606 | |
| 2. Engineering services cost (Net) | 2,105 | 75 | 2,180 | |
| <u>Sub-total of (1. - 2.)</u> | <u>7,150</u> | <u>5,636</u> | <u>12,786</u> | |
| <i>Internal fund</i> | | | | |
| 3. Resettlement cost (incl. Tax) | 0 | 37 | 37 | |
| 4. Administration cost (incl. Tax) | 320 | 972 | 1,292 | |
| 5. Tax for 1. & 2. | 258 | 363 | 621 | |
| <u>Sub-total of (3. - 5.)</u> | <u>578</u> | <u>1,372</u> | <u>1,950</u> | |
| Total of (1. - 5.) | 7,728 | 7,008 | 14,736 | |
| <i>Non-structural measures</i> | | | | |
| <i>Foreign fund</i> | | | | |
| 1. Installation cost (Net) | 73 | 447 | 520 | |
| <i>Internal fund</i> | | | | |
| 2. Administration cost (incl. Tax) | 3 | 62 | 65 | |
| 3. Tax for 1. | 8 | 31 | 39 | |
| <u>Sub-total of (2. - 3.)</u> | <u>11</u> | <u>93</u> | <u>104</u> | |
| Total of (1. - 3.) | 84 | 540 | 624 | |
| <i>Total of structural and non-structural measures</i> | | | | |
| <i>Foreign fund</i> | <u>7,223</u> | <u>6,083</u> | <u>13,306</u> | |
| <i>Internal fund</i> | <u>589</u> | <u>1,465</u> | <u>2,054</u> | |
| <u>Project cost</u> | <u>7,812</u> | <u>7,548</u> | <u>15,360</u> | |

- Note:
- Price level; June 1997, US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 - Each item includes of its physical and price contingencies.
 - *Foreign fund* includes the cost which may be assisted by foreign fund in the future.
 - *Internal fund* includes the cost which should be burdened by the Government of Ethiopia.

Table 9.2.2 Breakdown of Construction Cost of Structural Measures (1/10)

| Work item | Component | | 1. Kechere weir | | | | | | 2. Kestere regulating pond | | | | | |
|-------------------------------------|----------------|---------------------------|-----------------|--------|-----|------------------|-----------|-------------|----------------------------|------------------|--------|-------------|--------------|-----------|
| | Unit | Unit price ^(*) | E.C. (US\$) | | Qty | Amount (x 1,000) | | E.C. (US\$) | Qty | Amount (x 1,000) | | E.C. (US\$) | Total (US\$) | |
| | | | (US\$) | (Birr) | | (Birr) | sq.(US\$) | | | (US\$) | (Birr) | | | sq.(US\$) |
| 1. Preparatory works ⁽²⁾ | L.S. | | 53 | 980 | 144 | 207 | 35 | 254 | 24 | 59 | | | | |
| 2. Earthworks | | | | | | | | | | | | | | |
| 2.1 Clearing and stripping | m ² | 1.1 | 6,000 | 7 | 10 | 8 | 10 | 15 | 2 | 12 | | | | |
| 2.2 Excavation, common | m ³ | 5.4 | 6,200 | 33 | 50 | 7 | 40 | 198 | 29 | 161 | | | | |
| 2.3 Excavation, rock | m ³ | 12.7 | 14.9 | 10,200 | 130 | 152 | 152 | 143 | 21 | 143 | | | | |
| 2.4 Excavation, river bed | m ³ | 4.5 | 53.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| 2.5 Backfill | m ³ | 0.5 | 0.8 | 1,400 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| 2.6 Embankment | m ³ | 0.5 | 0.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| 2.7 Tree vegetation works | m ² | 0.1 | 5.5 | 26,400 | 3 | 145 | 21 | 24 | 0 | 0 | | | | |
| 2.8 Other works ⁽³⁾ | L.S. | | | | 17 | 36 | 5 | 22 | 27 | 36 | 5 | 32 | | |
| Sub-total of 2. | | | | | 191 | 294 | 56 | 257 | 292 | 394 | 57 | 349 | | |
| 3. Concrete works | | | | | | | | | | | | | | |
| 3.1 Concrete, mass | m ³ | 18.7 | 744.4 | 9,240 | 173 | 6,878 | 1,012 | 1,185 | 0 | 0 | | | | |
| 3.2 Concrete, reinforced | m ³ | 18.7 | 823.7 | 1,155 | 23 | 951 | 140 | 162 | 210 | 4 | 173 | 25 | 29 | |
| 3.3 Form work | m ² | 10.3 | 54.2 | 3,800 | 39 | 206 | 30 | 69 | 700 | 7 | 38 | 6 | 13 | |
| 3.4 Reinforcing bar | kg | 0.9 | 0.4 | 27,500 | 25 | 11 | 2 | 27 | 5,000 | 5 | 2 | 0 | 5 | |
| 3.5 Shotcrete | m ² | 6.3 | 127.2 | 3,600 | 23 | 458 | 67 | 90 | 0 | 0 | 0 | 0 | 0 | |
| 3.6 Filter mat | m ² | 10.1 | 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3.7 Other works ⁽³⁾ | L.S. | | | | 28 | 850 | 125 | 153 | 2 | 21 | 3 | 5 | | |
| Sub-total of 3. | | | | | 310 | 9,355 | 1,376 | 1,686 | 18 | 334 | 24 | 52 | | |
| 4. Masonry works | | | | | | | | | | | | | | |
| 4.1 Wet masonry | m ³ | 6.0 | 393.0 | 0 | 0 | 0 | 0 | 0 | 3,300 | 191 | 191 | | | |
| 4.2 Gabion mattress | m ³ | 9.3 | 201.9 | 200 | 2 | 40 | 6 | 8 | 1,200 | 11 | 252 | 36 | 47 | |
| 4.3 Gravel installing | m ³ | 0.3 | 152.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 4.4 Weep hole | no. | 0.0 | 14.7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 4.5 Other works ⁽³⁾ | L.S. | | | | 0 | 4 | 1 | 1 | 1 | 1 | 154 | 23 | 24 | |
| Sub-total of 4. | | | | | 2 | 44 | 7 | 2 | 2 | 1693 | 250 | 252 | | |
| 5. Metal works | | | | | | | | | | | | | | |
| 5.1 Flap gate, stainless steel | kg | 41.0 | 34.0 | 0 | 0 | 0 | 0 | 0 | 500 | 21 | 17 | 3 | 24 | |
| 5.2 Structural steel works | kg | 10.1 | 0.9 | 11,000 | 111 | 10 | 1 | 112 | 0 | 0 | 0 | 0 | 0 | |
| 5.3 Iron pipe, dia=1,000mm | m | 0.0 | 4,246.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 5.4 Other works ⁽³⁾ | L.S. | | | | 11 | 1 | 1 | 11 | 2 | 2 | 2 | 0 | 2 | |
| Sub-total of 5. | | | | | 122 | 11 | 1 | 123 | 23 | 19 | 2 | 26 | | |
| Total of (1. + 5.) | | | | | 688 | 10,785 | 1,584 | 2,272 | 380 | 2,574 | 378 | 758 | | |

Note: *1) Price level: June 1997.

USS 1.0 = Birr 6.8 = J.Yen 114.7

Unit price excludes tax.

*2) Preparatory works; 10% of total permanent works

*3) Other works; 10% of billing amount

Table 9.2.2 Breakdown of Construction Cost of Structural Measures (2/10)

| Work item | Component | | 3. Bantiyketu regulating pond | | | | | | 4. Bantiyketu river channel improvement | | | | | |
|------------------------------------|----------------|-------------|-------------------------------|-------------|-----|------------------|-------------|-------------|---|------------------|-------------|-------------|--------------|--|
| | Unit | E.C. (US\$) | Unit price** | | Qty | Amount (x 1,000) | | E.C. (US\$) | Qty | Amount (x 1,000) | | E.C. (US\$) | Total (US\$) | |
| | | | E.C. (US\$) | L.C. (Birr) | | E.C. (US\$) | L.C. (Birr) | | | E.C. (US\$) | L.C. (Birr) | | | |
| 1. Preparatory works ^{*)} | L.S. | | | | | | | | | | | | | |
| 2. Earthworks | | | | | | | | | | | | | | |
| 2.1 Clearing and stripping | m ² | 1.1 | 1.6 | 34,500 | 82 | 418 | 52 | 145 | | | | | | |
| 2.2 Excavation, common | m ³ | 5.4 | 8.1 | 74,100 | 38 | 55 | 8 | 46 | 3,590 | 6 | 1 | 5 | | |
| 2.3 Excavation, rock | m ³ | 12.7 | 14.9 | 19,800 | 251 | 295 | 43 | 294 | | | | | | |
| 2.4 Excavation, river bed | m ³ | 4.5 | 53.3 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 2.5 Backfill | m ³ | 0.5 | 0.8 | 1,600 | 1 | 1 | 0 | 1 | 10,100 | 5 | 8 | 6 | | |
| 2.6 Embankment | m ³ | 0.5 | 0.8 | 7,300 | 4 | 6 | 1 | 5 | | | | | | |
| 2.7 Tree vegetation works | m ² | 0.1 | 5.5 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 2.8 Other works** | L.S. | | | | 69 | 96 | 14 | 83 | | | | | | |
| Sub-total of 2. | | | | | 263 | 1,053 | 154 | 917 | | | | | | |
| 3. Concrete works | | | | | | | | | | | | | | |
| 3.1 Concrete mass | m ³ | 18.7 | 744.4 | 0 | 0 | 0 | 0 | 0 | 735 | 12 | 547 | 80 | 94 | |
| 3.2 Concrete, reinforced | m ³ | 18.7 | 823.7 | 210 | 4 | 173 | 25 | 29 | | | | | | |
| 3.3 Form work | m ² | 10.3 | 54.2 | 1,300 | 13 | 70 | 10 | 23 | | | | | | |
| 3.4 Reinforcing bar | kg | 0.9 | 0.4 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 3.5 Shoucrete | m ² | 6.3 | 127.2 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 3.6 Filter mat | m ² | 10.1 | 1.5 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 3.7 Other works** | L.S. | | | | 2 | 24 | 4 | 6 | | | | | | |
| Sub-total of 3. | | | | | 10 | 268 | 39 | 58 | | | | | | |
| 4. Masonry works | | | | | | | | | | | | | | |
| 4.1 Wet masonry | m ³ | 0.0 | 393.0 | 5,500 | 0 | 2,162 | 318 | 318 | 5,800 | 0 | 2,279 | 335 | 335 | |
| 4.2 Gabion mattress | m ³ | 9.3 | 201.9 | 2,100 | 20 | 424 | 62 | 82 | 300 | 3 | 61 | 9 | 12 | |
| 4.3 Gravel mottling | m ³ | 0.3 | 152.2 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 4.4 Weep hole | no. | 0.0 | 14.7 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 4.5 Other works** | L.S. | | | | 2 | 259 | 38 | 40 | | | | | | |
| Sub-total of 4. | | | | | 22 | 2,811 | 418 | 440 | | | | | | |
| 5. Metal works | | | | | | | | | | | | | | |
| 5.1 Flap gate, stainless steel | kg | 41.0 | 34.0 | 500 | 21 | 17 | 3 | 24 | | | | | | |
| 5.2 Structural steel works | kg | 10.1 | 0.9 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 5.3 Iron pipe, dia=1,000mm | m | 0.0 | 4,246.0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 5.4 Other works** | L.S. | | | | 2 | 2 | 2 | 2 | | | | | | |
| Sub-total of 5. | | | | | 23 | 19 | 3 | 26 | | | | | | |
| Total of (1. - 5.) | | | | | 910 | 4,602 | 676 | 1,586 | | | | | | |
| | | | | | | | | | 31 | 3,510 | 515 | 546 | | |

Note: *) Price level: June 1997.
 US\$ 1.0 = Birr 6.8 = J.Yen 114.7

Unit price excludes tax.

*) Preparatory works; 10% of total permanent works

*) Other works; 10% of billing amount

Table 9.2.2 Breakdown of Construction Cost of Structural Measures (3/10)

| Work item | Unit | Unit price ¹⁾ | | 4. Bantiyketu river channel improvement (2) Slope protection | | | | 4. Bantiyketu river channel improvement (3) River channel excavation | | | |
|------------------------------------|------|--------------------------|----------------|---|------------------|----------------|------------|---|----------------|------------|------------|
| | | E.C. (US\$) | L.C. (Birr) | Qty | Amount (x 1,000) | | Qty | Amount (x 1,000) | | | |
| | | | | | E.C. (US\$) | L.C. (Birr) | | E.C. (US\$) | L.C. (Birr) | | |
| 1. Preparatory works ²⁾ | L.S. | | | | 2.9 | 2.2 | 2.8 | 1.2 | 1.1 | | |
| 2. Earthworks | m2 | 1.1 | 1.6 | 9,000 | 11 | 16 | 2 | 13 | 0 | 0 | 0 |
| 2.1 Cleaning and stripping | m3 | 5.4 | 8.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.2 Excavation, common | m3 | 12.7 | 14.9 | 0 | 0 | 0 | 0 | 0 | 10,000 | 127 | 149 |
| 2.3 Excavation, rock | m3 | 4.5 | 53.3 | 0 | 0 | 0 | 0 | 0 | 10,500 | 47 | 560 |
| 2.4 Excavation, river bed | m3 | 0.5 | 0.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.5 Backfill | m3 | 0.5 | 0.8 | 0 | 0 | 0 | 0 | 0 | 300 | 0 | 0 |
| 2.6 Embankment | m2 | 0.5 | 0.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.7 Tree vegetation works | m2 | 0.1 | 5.5 | 0 | 1 | 2 | 0 | 1 | 0 | 17 | 71 |
| 2.8 Other works ³⁾ | L.S. | | | | 1.2 | 1.7 | 2 | 1.4 | 19.1 | 78.0 | 11.4 |
| Sub-total of 2. | | | | | | | | | | | |
| 3. Concrete works | m3 | 18.7 | 744.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.1 Concrete, mass | m3 | 18.7 | 823.7 | 945 | 18 | 778 | 114 | 132 | 0 | 0 | 0 |
| 3.2 Concrete, reinforced | m2 | 10.3 | 54.2 | 8,100 | 83 | 439 | 65 | 148 | 0 | 0 | 0 |
| 3.3 Form work | kg | 0.9 | 0.4 | 238,900 | 215 | 96 | 14 | 229 | 0 | 0 | 0 |
| 3.4 Reinforcing bar | m2 | 6.3 | 127.2 | 9,900 | 62 | 1,259 | 185 | 237 | 0 | 0 | 0 |
| 3.5 Shotcrete | m2 | 10.1 | 1.5 | 9,000 | 100 | 15 | 2 | 102 | 0 | 0 | 0 |
| 3.6 Filter mat | L.S. | | | | 48 | 259 | 38 | 86 | 0 | 0 | 0 |
| 3.7 Other works ³⁾ | L.S. | | | | 52.6 | 2,846 | 418 | 944 | 0 | 0 | 0 |
| Sub-total of 3. | | | | | | | | | | | |
| 4. Masonry works | m3 | 0.0 | 393.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4.1 Wet masonry | m3 | 9.3 | 201.9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4.2 Gabion mattress | m3 | 0.3 | 152.2 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 5 |
| 4.3 Gravel metalling | no. | 0.0 | 14.7 | 1,460 | 0 | 21 | 3 | 3 | 0 | 0 | 0 |
| 4.4 Weep hole | L.S. | | | | 0 | 2 | 2 | 2 | 0 | 0 | 0 |
| 4.5 Other works ³⁾ | L.S. | | | | 0 | 2.4 | 2 | 2 | 0 | 0 | 1 |
| Sub-total of 4. | | | | | | | | | | | |
| 5. Metal works | kg | 41.0 | 34.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5.1 Flap gate, stainless steel | kg | 10.1 | 0.9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5.2 Structural steel works | m | 0.0 | 4,246.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5.3 Iron pipe, dia=1,600mm | L.S. | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5.4 Other works ³⁾ | L.S. | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-total of 5. | | | | | | | | | | | |
| Total of (1. + 5.) | | | | | 592 | 3,176 | 445 | 1,057 | 210 | 863 | 127 |

Note: *1) Price level: June 1997.
 US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 Unit price excludes tax.
 *2) Preparatory works: 10% of total permanent works
 *3) Other works: 10% of billing amount

Table 9.2.2 Breakdown of Construction Cost of Structural Measures (4/10)

| Component | | 4. Bantiyketu river channel improvement | | | | | 4. Bantiyketu river channel improvement | | | | | | | | | |
|--------------------------------|------|---|-------------|------------------|-------------|--------------|---|-------------|-------------|-----------------|-------|-------------|-------------|--------------|-------|-------|
| Work item | Unit | Unit price** | | Amount (x 1,000) | | | Amount (x 1,000) | | | Sub-total of 4. | | | | | | |
| | | F.C. (US\$) | L.C. (Birr) | F.C. (US\$) | L.C. (Birr) | Total (US\$) | Q'ty | F.C. (US\$) | L.C. (Birr) | Total (US\$) | Q'ty | F.C. (US\$) | L.C. (Birr) | Total (US\$) | | |
| 1. Preparatory works** | L.S. | | | 0 | 60 | 2 | | | 0 | 76 | 2 | | | 76 | 110 | 186 |
| 2. Earthworks | | | | | | | | | | | | | | | | |
| 2.1 Cleaning and stripping | m2 | 1.1 | 1.6 | 0 | 0 | 0 | 13,450 | 0 | 0 | 15 | 22 | 3 | 18 | 0 | 0 | 0 |
| 2.2 Excavation, common | m3 | 5.4 | 8.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.3 Excavation, rock | m3 | 12.7 | 14.9 | 0 | 0 | 0 | 10,000 | 0 | 0 | 127 | 149 | 22 | 149 | 22 | 149 | 149 |
| 2.4 Excavation, river bed | m3 | 4.5 | 53.3 | 0 | 0 | 0 | 10,500 | 0 | 0 | 47 | 560 | 82 | 129 | 82 | 129 | 129 |
| 2.5 Backfill | m3 | 0.5 | 0.8 | 0 | 0 | 0 | 10,100 | 0 | 0 | 5 | 8 | 1 | 6 | 1 | 6 | 6 |
| 2.6 Embankment | m2 | 0.5 | 0.8 | 0 | 0 | 0 | 400 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.7 Tree vegetation works | m2 | 0.1 | 5.5 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 74 | 10 | 29 | 10 | 29 | 29 |
| 2.8 Other works**) | L.S. | | | 0 | 0 | 0 | 0 | 0 | 0 | 213 | 812 | 118 | 431 | 118 | 431 | 431 |
| Sub-total of 2. | | | | | | | | | | | | | | | | |
| 3. Concrete works | | | | | | | | | | | | | | | | |
| 3.1 Concrete, mass | m3 | 18.7 | 744.4 | 0 | 0 | 0 | 735 | 0 | 0 | 14 | 547 | 80 | 94 | 80 | 94 | 94 |
| 3.2 Concrete, reinforced | m3 | 18.7 | 823.7 | 0 | 0 | 0 | 945 | 0 | 0 | 18 | 778 | 114 | 132 | 114 | 132 | 132 |
| 3.3 Form work | m2 | 10.3 | 54.2 | 0 | 0 | 0 | 8,100 | 0 | 0 | 83 | 439 | 65 | 148 | 65 | 148 | 148 |
| 3.4 Reinforcing bar | kg | 0.9 | 0.4 | 0 | 0 | 0 | 2,48,900 | 0 | 0 | 215 | 96 | 14 | 229 | 14 | 229 | 229 |
| 3.5 Shotcrete | m2 | 6.3 | 127.2 | 0 | 0 | 0 | 9,500 | 0 | 0 | 62 | 1,259 | 185 | 247 | 185 | 247 | 247 |
| 3.6 Filter mat | m2 | 10.1 | 1.5 | 0 | 0 | 0 | 9,500 | 0 | 0 | 100 | 15 | 2 | 102 | 2 | 102 | 102 |
| 3.7 Other works**) | L.S. | | | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 313 | 46 | 95 | 46 | 95 | 95 |
| Sub-total of 3. | | | | | | | | | | | | | | | | |
| 4. Masonry works | | | | | | | | | | | | | | | | |
| 4.1 Wet masonry | m3 | 0.0 | 393.0 | 0 | 0 | 0 | 6,100 | 0 | 0 | 0 | 2,397 | 352 | 352 | 352 | 352 | 352 |
| 4.2 Gabion mattress | m3 | 9.3 | 201.9 | 0 | 0 | 0 | 300 | 0 | 0 | 3 | 61 | 9 | 12 | 9 | 12 | 12 |
| 4.3 Gravel installing | m3 | 0.3 | 152.2 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 5 | 1 | 1 | 1 | 1 | 1 |
| 4.4 Weep hole | no. | 0.0 | 14.7 | 0 | 0 | 0 | 1,460 | 0 | 0 | 0 | 21 | 3 | 3 | 3 | 3 | 3 |
| 4.5 Other works**) | L.S. | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 248 | 36 | 36 | 36 | 36 | 36 |
| Sub-total of 4. | | | | | | | | | | | | | | | | |
| 5. Metal works | | | | | | | | | | | | | | | | |
| 5.1 Flap gate, stainless steel | kg | 41.0 | 34.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5.2 Structural steel works | kg | 10.1 | 0.9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5.3 Iron pipe, dia=1,000mm | m | 0.0 | 4,246.0 | 100 | 0 | 0 | 425 | 62 | 62 | 0 | 425 | 62 | 62 | 62 | 62 | 62 |
| 5.4 Other works**) | L.S. | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 6 | 6 | 6 | 6 | 6 |
| Sub-total of 5. | | | | | | | | | | | | | | | | |
| Total of (1. - 5.) | | | | 0 | 656 | 96 | | | 0 | 833 | 8,205 | 1,203 | 2,056 | 1,203 | 2,056 | 2,056 |

Note: *1) Price level: June 1997.
 US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 Unit price excludes tax.
 *2) Preparatory works: 10% of total permanent works
 *3) Other works: 10% of billing amount

Table 9.2.2 Breakdown of Construction Cost of Structural Measures (S/10)

| Component | | S. Urban drainage improvement | | | | | | | | | | Total of (1. - 5.) | |
|------------------------------------|------|-------------------------------|-------------|--------|------------------|-------------|--------------|------------------|-------------|--------------|------------------|--------------------|--------------|
| Work item | Unit | Unit price ¹⁾ | | Qty | Amount (x 1,000) | | Total (US\$) | Amount (x 1,000) | | Total (US\$) | Amount (x 1,000) | | Total (US\$) |
| | | E.C. (US\$) | L.C. (Birr) | | E.C. (US\$) | L.C. (Birr) | | E.C. (US\$) | L.C. (Birr) | | E.C. (US\$) | L.C. (Birr) | |
| 1. Preparatory works ²⁾ | L.S. | | | | 120 | 180 | 26 | 146 | 322 | 2,559 | 326 | 753 | |
| 2. Earthworks | | | | | | | | | | | | | |
| 2.1 Clearing and stripping | m2 | 1.11 | 1.6 | 6,600 | 7 | 11 | 2 | 9 | 77 | 112 | 16 | 93 | |
| 2.2 Excavation, common | m3 | 5.4 | 8.1 | 7,200 | 39 | 58 | 9 | 48 | 604 | 907 | 133 | 737 | |
| 2.3 Excavation, rock | m3 | 12.71 | 14.9 | 0 | 0 | 0 | 0 | 0 | 630 | 749 | 108 | 738 | |
| 2.4 Excavation, river bed | m3 | 4.5 | 53.3 | 0 | 0 | 0 | 0 | 0 | 47 | 560 | 62 | 129 | |
| 2.5 Backfill | m3 | 0.5 | 0.8 | 5,500 | 3 | 4 | 1 | 4 | 11 | 16 | 2 | 13 | |
| 2.6 Embankment | m3 | 0.5 | 0.8 | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 1 | 5 | |
| 2.7 Tree vegetation works | m2 | 0.1 | 5.5 | 0 | 0 | 0 | 0 | 0 | 3 | 145 | 21 | 24 | |
| 2.8 Other works ³⁾ | L.S. | | | | 5 | 7 | 1 | 6 | 137 | 249 | 35 | 172 | |
| Sub-total of 2. | | | | | 24 | 81 | 13 | 62 | 1,513 | 2,724 | 208 | 1,911 | |
| 3. Concrete works | | | | | | | | | | | | | |
| 3.1 Concrete, mass | m3 | 18.7 | 244.4 | 315 | 6 | 234 | 34 | 40 | 193 | 7,660 | 1,126 | 1,319 | |
| 3.2 Concrete, reinforced | m3 | 18.7 | 823.7 | 1,950 | 20 | 865 | 127 | 147 | 68 | 2,941 | 431 | 409 | |
| 3.3 Form work | m2 | 10.3 | 54.2 | 6,300 | 65 | 341 | 50 | 115 | 207 | 1,095 | 161 | 368 | |
| 3.4 Reinforcing bar | kg | 0.9 | 0.4 | 64,500 | 58 | 26 | 4 | 62 | 303 | 134 | 20 | 323 | |
| 3.5 Shotcrete | m2 | 6.3 | 127.2 | 0 | 0 | 0 | 0 | 0 | 85 | 1,717 | 252 | 337 | |
| 3.6 Filter mat | m2 | 10.1 | 1.5 | 0 | 0 | 0 | 0 | 0 | 100 | 15 | 2 | 102 | |
| 3.7 Other works ³⁾ | L.S. | | | | 15 | 147 | 22 | 37 | 96 | 1,356 | 200 | 296 | |
| Sub-total of 3. | | | | | 164 | 1,613 | 237 | 401 | 1,052 | 14,918 | 2,192 | 2,244 | |
| 4. Masonry works | | | | | | | | | | | | | |
| 4.1 Wet masonry | m3 | 0.0 | 393.0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,856 | 861 | 861 | |
| 4.2 Gabion mattress | m3 | 9.3 | 201.9 | 0 | 0 | 0 | 0 | 0 | 36 | 767 | 113 | 149 | |
| 4.3 Gravel metalling | m3 | 0.3 | 152.2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 1 | |
| 4.4 Weep hole | no. | 0.0 | 14.7 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 3 | 3 | |
| 4.5 Other works ³⁾ | L.S. | | | | 0 | 0 | 0 | 0 | 3 | 665 | 98 | 101 | |
| Sub-total of 4. | | | | | 0 | 0 | 0 | 0 | 39 | 7,314 | 1,076 | 1,115 | |
| 5. Metal works | | | | | | | | | | | | | |
| 5.1 Flap gate, stainless steel | kg | 41.0 | 34.0 | 500 | 21 | 17 | 3 | 24 | 63 | 51 | 9 | 72 | |
| 5.2 Structural steel works | kg | 10.1 | 0.9 | 86,200 | 871 | 78 | 11 | 882 | 982 | 87 | 12 | 994 | |
| 5.3 Iron pipe, dia.=1,000mm | m | 0.0 | 4,246.0 | 0 | 0 | 0 | 0 | 0 | 0 | 425 | 62 | 62 | |
| 5.4 Other works ³⁾ | L.S. | | | | 89 | 9 | 1 | 90 | 104 | 56 | 7 | 111 | |
| Sub-total of 5. | | | | | 981 | 102 | 15 | 996 | 1,149 | 619 | 98 | 1,239 | |
| Total of (1. - 5.) | | | | | 1,319 | 1,978 | 291 | 1,610 | 4,150 | 28,144 | 4,132 | 8,262 | |

Note: ¹⁾ Price level: June 1997.

US\$ 1.0 = Birr 6.8 = J. Yen 114.7

Unit price excludes tax.

²⁾ Preparatory works. 10% of total permanent works

³⁾ Other works: 10% of billing amount

Table 9.2.2 Breakdown of Construction Cost of Structural Measures (6/10)

| Work Item | Unit | 1. Kachene weir | | | | | | 2. Koster regulating pond | | | | | | | | | |
|------------------------------------|----------------|-----------------|--------|------------------------|---------|---------|--------|---------------------------|---------|--------|--------|------------------------|--------|--------|--------|--------|--------|
| | | Custom | | Unit tax ¹⁾ | | Qty | Amount | | | Custom | | Unit tax ¹⁾ | | Qty | Amount | | |
| | | F.C. | (US\$) | E.C. | (US\$) | | F.C. | (US\$) | L.C. | (US\$) | F.C. | (US\$) | L.C. | | (US\$) | F.C. | (US\$) |
| 1. Preparatory works ²⁾ | L.S. | 1,400 | 1,803 | 71,929 | 10,578 | 12,881 | | 1,045 | 1,193 | 11,088 | 1,763 | 2,956 | 4,002 | | | | |
| 2. Earthworks | | | | | | | | | | | | | | | | | |
| 2.1 Cleaning and stripping | m ² | 0.018 | 0.044 | 0.006 | 0 | 377 | 5 | 169 | 414 | 56 | 8 | 422 | 8 | 583 | 8 | 591 | |
| 2.2 Excavation, common | m ³ | 0.089 | 0.214 | 0.028 | 6,200 | 1,879 | 26 | 552 | 5,243 | 686 | 101 | 5,344 | 101 | 7,424 | 101 | 7,525 | |
| 2.3 Excavation, rock | m ³ | 0.428 | 0.452 | 0.024 | 10,200 | 4,610 | 36 | 4,646 | 4,339 | 230 | 34 | 4,373 | 34 | 8,448 | 34 | 8,482 | |
| 2.4 Excavation, river bed | m ³ | 0.073 | 0.174 | 0.025 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2.5 Backfill | m ³ | 0.009 | 0.023 | 0.002 | 1,400 | 32 | 3 | 32 | 6 | 3 | 0 | 32 | 45 | 0 | 45 | 0 | |
| 2.6 Embankment | m ³ | 0.009 | 0.023 | 0.002 | 0 | 0 | 0 | 0 | 6 | 16 | 1 | 0 | 22 | 0 | 22 | 0 | |
| 2.7 Tree vegetation works | m ² | 0.002 | 0.004 | 0.167 | 26,400 | 53 | 106 | 449 | 648 | 754 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2.8 Other works ³⁾ | L.S. | 5,601 | 6,973 | 5,353 | 787 | 12,574 | 787 | 13,361 | 71,526 | 11,048 | 1,075 | 158 | 11,706 | 158 | 18,322 | | |
| Sub-total of 2. | | | | | | | | | | | | | | | | | |
| 3. Concrete works | | | | | | | | | | | | | | | | | |
| 3.1 Concrete, mass | m ³ | 0.352 | 0.845 | 56.097 | 9,240 | 3,252 | 7,808 | 52,380 | 77,041 | 84,849 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3.2 Concrete, reinforced | m ³ | 0.352 | 0.845 | 62.362 | 1,155 | 407 | 976 | 72,028 | 10,592 | 11,568 | 1,383 | 10,592 | 11,975 | 210 | 74 | 177 | 13,096 |
| 3.3 Form work | m ² | 0.614 | 0.168 | 1.583 | 3,800 | 2,333 | 638 | 6,015 | 885 | 1,523 | 2,971 | 885 | 3,856 | 700 | 430 | 118 | 1,108 |
| 3.4 Reinforcing bar | kg | 0.063 | 0.001 | 0.000 | 27,500 | 1,733 | 28 | 0 | 28 | 1,761 | 0 | 0 | 5 | 5,000 | 315 | 5 | 0 |
| 3.5 Shotcrete | m ² | 0.117 | 0.144 | 9.688 | 3,600 | 421 | 518 | 34,877 | 5,129 | 5,647 | 939 | 5,129 | 6,068 | 0 | 0 | 0 | 0 |
| 3.6 Filter mat | m ² | 1.000 | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.7 Other works ⁴⁾ | L.S. | 8,961 | 10,265 | 700,481 | 103,012 | 111,972 | 19,826 | 103,012 | 122,938 | 201 | 330 | 15,625 | 2,298 | 2,628 | 1,231 | 2,298 | 3,629 |
| Sub-total of 3. | | | | | | | | | | | | | | | | | |
| 4. Masonry works | | | | | | | | | | | | | | | | | |
| 4.1 Wet masonry | m ³ | 0.000 | 0.000 | 24.175 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,300 | 0 | 0 | 11,732 |
| 4.2 Gabion mattress | m ³ | 0.175 | 0.421 | 11.684 | 200 | 35 | 84 | 2,337 | 344 | 428 | 119 | 344 | 463 | 1,200 | 210 | 505 | 14,021 |
| 4.3 Gravel metalling | m ³ | 0.005 | 0.013 | 11.124 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4.4 Weep hole | no. | 0.000 | 0.000 | 1.300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4.4 Other works ⁵⁾ | L.S. | 4 | 8 | 234 | 34 | 42 | 8 | 234 | 34 | 42 | 12 | 34 | 46 | 21 | 51 | 51 | 9,380 |
| Sub-total of 4. | | | | | | | | | | | | | | | | | |
| 5. Metal works | | | | | | | | | | | | | | | | | |
| 5.1 Flap gate, stainless steel | kg | 4.000 | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 500 | 2,000 | 0 | 2,000 |
| 5.2 Structural steel works | kg | 0.000 | 0.000 | 0.000 | 11,000 | 0 | 0 | 9,900 | 1,456 | 1,456 | 0 | 1,456 | 0 | 0 | 0 | 0 | 0 |
| 5.3 Iron pipe, dia. = 1,000mm | m | 0.000 | 0.000 | 307.000 | 0 | 0 | 0 | 990 | 146 | 146 | 0 | 146 | 146 | 200 | 0 | 0 | 200 |
| 5.4 Other works ⁵⁾ | L.S. | 0 | 0 | 10.950 | 1,601 | 1,601 | 0 | 10,950 | 1,601 | 1,601 | 0 | 1,601 | 1,601 | 2,200 | 2,200 | 0 | 2,200 |
| Sub-total of 5. | | | | | | | | | | | | | | | | | |
| Total of (1.-5.) | | 16,061 | 19,833 | 791,223 | 116,356 | 136,189 | 35,894 | 116,356 | 152,250 | 11,504 | 13,127 | 131,865 | 19,392 | 32,519 | 24,631 | 19,392 | 44,023 |

Note: ¹⁾ Price level: June 1997.
²⁾ US\$ 1.0 = Birr 6.8 = J.Yen 114.7
³⁾ Preparatory works: 10% of total permanent works
⁴⁾ Other works: 10% of billing amount

Table 9.2.2 Breakdown of Construction Cost of Structural Measures (7/10)

| Estimate of Tax | | | Component | | | 3. Hantayiketu regulating pond | | | | 4. Hantayiketu river channel improvement | | | | | | |
|------------------------------------|----------------|------------------------|-------------|-------------|--------|--------------------------------|-------------|-----------------|--------------|--|-------------|-------------------|-------------------|--------------|--------------|--------|
| Work item | Unit | Unit tax ^{*)} | Custom | | Qty | Amount | | | Amount | | | Total L.C. (US\$) | Total E.C. (US\$) | Total (US\$) | | |
| | | | E.C. (US\$) | L.C. (US\$) | | E.C. (US\$) | L.C. (US\$) | Per unit (US\$) | Total (US\$) | E.C. (US\$) | L.C. (US\$) | | | | Total (US\$) | |
| | | | (US\$) | (US\$) | | (US\$) | (US\$) | (US\$) | (US\$) | (US\$) | (US\$) | (US\$) | (US\$) | (US\$) | | |
| 1. Preparatory works ^{*)} | | | | | | | | | | | | | | | | |
| 2. Earthworks | L.S. | | | 2,621 | | 3,020 | 19,297 | 2,838 | 5,897 | | | | 125 | 20,298 | 2,000 | |
| 2.1 Cleaning and stripping | m ² | 0.018 | 0.044 | 621 | 1,518 | 207 | 1,448 | 30 | 1,448 | 34,500 | 3,450 | 0 | 156 | 21 | 3 | 223 |
| 2.2 Excavation, common | m ³ | 0.089 | 0.214 | 6,595 | 15,857 | 2,075 | 16,162 | 305 | 22,757 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.3 Excavation, rock | m ³ | 0.428 | 0.482 | 8,474 | 8,950 | 475 | 9,020 | 70 | 17,494 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.4 Excavation, river bed | m ³ | 0.073 | 0.174 | 0 | 0 | 0 | 0 | 0 | 0 | 10,100 | 0 | 0 | 0 | 0 | 0 | 326 |
| 2.5 Backfill | m ³ | 0.009 | 0.023 | 14 | 37 | 3 | 37 | 51 | 0 | 51 | 0 | 0 | 232 | 20 | 3 | 326 |
| 2.6 Embankment | m ² | 0.009 | 0.023 | 66 | 168 | 15 | 170 | 234 | 236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.7 Tree vegetation works | m ² | 0.002 | 0.004 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.8 Other works ^{*)} | L.S. | | | 1,577 | 2,653 | 277 | 41 | 2,694 | 41 | 4,271 | 16 | 39 | 0 | 0 | 0 | 56 |
| Sub-total of 2. | | | | 17,347 | 29,383 | 3,052 | 449 | 29,632 | 449 | 46,970 | 171 | 427 | 0 | 0 | 0 | 605 |
| 3. Concrete works | | | | | | | | | | | | | | | | |
| 3.1 Concrete, mass | m ³ | 0.352 | 0.845 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.2 Concrete, reinforced | m ³ | 0.352 | 0.845 | 74 | 177 | 13,096 | 1,926 | 2,103 | 251 | 1,926 | 785 | 0 | 0 | 0 | 0 | 0 |
| 3.3 Form work | m ² | 0.614 | 0.168 | 798 | 218 | 2,088 | 304 | 521 | 1,016 | 305 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.4 Reinforcing bar | kg | 0.063 | 0.001 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.5 Sholecrete | m ² | 0.117 | 0.144 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.6 Filter mat | m ² | 1.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.7 Other works ^{*)} | L.S. | | | 87 | 40 | 1,515 | 223 | 263 | 127 | 350 | 26 | 62 | 0 | 0 | 0 | 701 |
| Sub-total of 3. | | | | 952 | 435 | 16,649 | 2,451 | 2,886 | 1,304 | 2,351 | 235 | 652 | 0 | 0 | 0 | 702 |
| 4. Masonry works | | | | | | | | | | | | | | | | |
| 4.1 Wet masonry | m ³ | 0.000 | 0.000 | 0 | 0 | 132,963 | 19,553 | 19,553 | 0 | 19,553 | 5,800 | 0 | 0 | 140,215 | 20,620 | 20,620 |
| 4.2 Gabion mattress | m ³ | 0.175 | 0.421 | 168 | 884 | 24,536 | 3,608 | 4,492 | 1,352 | 3,608 | 300 | 53 | 126 | 3,508 | 515 | 694 |
| 4.3 Gravel installing | m ³ | 0.005 | 0.013 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4.4 Weep hole | no. | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4.4 Other works ^{*)} | L.S. | | | 37 | 88 | 15,750 | 2,316 | 2,404 | 125 | 2,441 | 0 | 0 | 13 | 14,372 | 2,114 | 2,132 |
| Sub-total of 4. | | | | 405 | 972 | 173,249 | 25,478 | 26,350 | 1,372 | 25,378 | 58 | 58 | 130 | 158,092 | 23,249 | 23,388 |
| 5. Metal works | | | | | | | | | | | | | | | | |
| 5.1 Flap gate, stainless steel | kg | 4.000 | 0.000 | 2,000 | 0 | 0 | 0 | 0 | 0 | 2,000 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5.2 Structural steel works | kg | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5.3 Iron pipe, dia.=1,000mm | m | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5.4 Other works ^{*)} | L.S. | | | 2,300 | 0 | 0 | 0 | 0 | 0 | 2,300 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-total of 5. | | | | 23,000 | 0 | 0 | 0 | 0 | 0 | 2,300 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total of (1. - 5.) | | | | 23,002 | 53,649 | 212,267 | 31,216 | 64,846 | 66,651 | 47,347 | 5,800 | 5,800 | 1,374 | 224,375 | 32,996 | 34,935 |

Note: *1) Price level: June 1997.
 *2) USS 1.0 = Birr 6.8 = J.Yen 114.7
 *3) Preparatory works: 10% of total permanent works
 *4) Other works: 10% of billing amount

Table 9.2.2 Breakdown of Construction Cost of Structural Measures (9/10)

| Work item | Unit | Component | | | | | | | | | |
|------------------------------------|----------------|--|-------------------------|---------|--------------------------|----------------|--|-------------------------|-------------------------|-------------------------|--------|
| | | 4. Baniwicketu river channel improvement | | | | | 4. Baniwicketu river channel improvement | | | | |
| | | Sub-total of 4. | | | | | Sub-total of 4. | | | | |
| Custom E.C. (US\$) | E.C. (US\$) | Sales L.C. (Birr) | Total L.C. (US\$) | Q/ty | Custom E.C. (US\$) | E.C. (US\$) | Sales L.C. (Birr) | Total L.C. (US\$) | Total L.C. (US\$) | Total L.C. (US\$) | |
| | | | | | | | | | | | Amount |
| 1. Preparatory works ^{a1} | L.S. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2. Earthworks | | | | | | | | | | | |
| 2.1 Clearing and stripping | m ² | 0.018 | 0.044 | 0.006 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2.2 Excavation, common | m ³ | 0.089 | 0.214 | 0.024 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2.3 Excavation, rock | m ³ | 0.428 | 0.452 | 0.024 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2.4 Excavation, river bed | m ³ | 0.073 | 0.174 | 0.025 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2.5 Backfill | m ³ | 0.009 | 0.023 | 0.002 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2.6 Embankment | m ³ | 0.009 | 0.023 | 0.002 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2.7 Tree vegetation works | m ² | 0.002 | 0.004 | 0.167 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2.8 Other works ^{a2} | L.S. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Sub-total of 2. | | | | | | | | | | | |
| 3. Concrete works | | | | | | | | | | | |
| 3.1 Concrete, mass | m ³ | 0.352 | 0.845 | 56.697 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3.2 Concrete, reinforced | m ³ | 0.352 | 0.845 | 62.362 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3.3 Form work | m ² | 0.614 | 0.168 | 1.583 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3.4 Reinforcing bar | kg | 0.063 | 0.001 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3.5 Shotcrete | m ² | 0.117 | 0.144 | 9.688 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3.6 Filler mat | m ² | 1.000 | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3.7 Other works ^{a3} | L.S. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Sub-total of 3. | | | | | | | | | | | |
| 4. Masonry works | | | | | | | | | | | |
| 4.1 Wet masonry | m ³ | 0.000 | 0.000 | 24.175 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 4.2 Gabion mattress | m ³ | 0.175 | 0.421 | 11.684 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 4.3 Gravel metalling | m ³ | 0.005 | 0.013 | 11.124 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 4.4 Weep hole | no. | 0.000 | 0.000 | 1.300 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 4.4 Other works ^{a4} | L.S. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Sub-total of 4. | | | | | | | | | | | |
| 5. Metal works | | | | | | | | | | | |
| 5.1 Flip gate, stainless steel | kg | 4.000 | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 5.2 Structural steel works | kg | 0.000 | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 5.3 Iron pipe, dia. = 1,000mm | m | 0.000 | 0.000 | 307.000 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 5.4 Other works ^{a5} | L.S. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Sub-total of 5. | | | | | | | | | | | |
| Total of (1 - 5) | | | | | | | | | | | |

Note: ^{a1} Price level: June 1997.
^{a2} USS 1.0 = Birr 6.8 = J. Yen 114.7
^{a3} Preparatory works; 10% of total permanent works
^{a4} Other works; 10% of billing amount

Table 9.2.2 Breakdown of Construction Cost of Structural Measures (10/10)

| Work Item | Unit | Estimate of Tax | | Component | | | | | | | | | | Total of (1.-5.) | | | | |
|------------------------------------|----------------|------------------------|-------|-----------|-------|---------|--------|--------|--------|---------|--------|-----------|---------|------------------|---------|---------|---------|-------|
| | | Unit tax ^{*)} | | Custom | | Sales | | Amount | | Sales | | Amount | | Total | | | | |
| | | E.C. | L.C. | E.C. | L.C. | E.C. | L.C. | E.C. | L.C. | E.C. | L.C. | E.C. | L.C. | E.C. | L.C. | Total | Total | |
| (US\$) | (Riy) | (US\$) | (Riy) | (US\$) | (Riy) | (US\$) | (Riy) | (US\$) | (Riy) | (US\$) | (Riy) | (US\$) | (Riy) | (US\$) | (Riy) | (US\$) | (Riy) | |
| 1. Preparatory works ^{*)} | L.S. | | | | | | | | | | | | | | | | | |
| 2. Earthworks | | | | | | | | | | | | | | | | | | |
| 2.1 Clearing and stripping | m ² | 0.018 | 0.044 | 119 | 290 | 40 | 296 | 6 | 415 | 1,259 | 3,078 | 61 | 3,139 | 4,337 | 61 | 4,398 | | |
| 2.2 Excavation, common | m ³ | 0.089 | 0.214 | 641 | 1,541 | 202 | 1,571 | 30 | 2,212 | 9,989 | 23,988 | 3,136 | 24,330 | 33,937 | 462 | 34,399 | | |
| 2.3 Excavation, rock | m ³ | 0.428 | 0.452 | 0 | 0 | 0 | 0 | 0 | 0 | 21,259 | 22,419 | 1,190 | 22,594 | 43,648 | 175 | 43,823 | | |
| 2.4 Excavation, river bed | m ³ | 0.073 | 0.174 | 0 | 0 | 0 | 0 | 0 | 0 | 767 | 1,827 | 263 | 1,866 | 2,594 | 39 | 2,633 | | |
| 2.5 Backfill | m ³ | 0.009 | 0.023 | 50 | 127 | 11 | 129 | 2 | 179 | 181 | 460 | 40 | 465 | 641 | 5 | 646 | | |
| 2.6 Embankment | m ³ | 0.009 | 0.023 | 0 | 0 | 0 | 0 | 0 | 0 | 76 | 193 | 17 | 195 | 269 | 2 | 271 | | |
| 2.7 Tree vegetation works | m ² | 0.002 | 0.004 | 0 | 0 | 0 | 0 | 0 | 0 | 53 | 106 | 4,409 | 648 | 754 | 159 | 648 | 807 | |
| 2.8 Other works ^{*)} | L.S. | | | 81 | 196 | 25 | 206 | 4 | 281 | 3,354 | 5,206 | 947 | 5,346 | 8,560 | 140 | 8,700 | | |
| Sub-total of 2. | | | | 891 | 2,153 | 277 | 2,195 | 41 | 2,856 | 36,888 | 57,827 | 10,422 | 58,790 | 94,145 | 1,533 | 95,678 | | |
| 3. Concrete works | | | | | | | | | | | | | | | | | | |
| 3.1 Concrete, mass | m ³ | 0.352 | 0.845 | 111 | 266 | 17,860 | 2,626 | 2,892 | 3,003 | 3,622 | 8,695 | 583,412 | 85,795 | 94,490 | 12,317 | 85,795 | 98,112 | |
| 3.2 Concrete, reinforced | m ³ | 0.352 | 0.845 | 370 | 887 | 65,480 | 9,629 | 10,516 | 1,247 | 1,248 | 3,016 | 222,632 | 32,739 | 35,755 | 4,274 | 32,739 | 37,013 | |
| 3.3 Form work | m ² | 0.614 | 0.168 | 3,808 | 1,058 | 9,973 | 1,467 | 2,525 | 6,393 | 12,402 | 3,393 | 31,977 | 4,704 | 8,097 | 15,795 | 4,704 | 20,499 | |
| 3.4 Reinforcing bar | kg | 0.043 | 0.021 | 4,064 | 65 | 0 | 65 | 0 | 4,129 | 21,163 | 337 | 0 | 0 | 337 | 21,500 | 0 | 21,500 | |
| 3.5 Shotcrete | m ² | 0.117 | 0.144 | 0 | 0 | 0 | 0 | 0 | 0 | 1,579 | 1,944 | 130,788 | 19,234 | 21,178 | 3,523 | 19,234 | 22,757 | |
| 3.6 Filter mat | m ² | 1.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | 9,900 | 0 | 0 | 0 | 9,900 | 0 | 9,900 | 0 | |
| 3.7 Other works ^{*)} | L.S. | | | 841 | 228 | 9,331 | 1,372 | 1,600 | 2,441 | 4,993 | 1,740 | 96,881 | 14,248 | 15,988 | 6,733 | 14,248 | 20,981 | |
| Sub-total of 3. | | | | 9,263 | 2,503 | 102,641 | 15,095 | 17,689 | 26,853 | 54,917 | 19,124 | 1,065,600 | 150,719 | 175,344 | 74,032 | 156,719 | 230,761 | |
| 4. Masonry works | | | | | | | | | | | | | | | | | | |
| 4.1 Wet masonry | m ³ | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 360,208 | 52,972 | 52,972 | 0 | 52,972 | 52,972 | |
| 4.2 Gabbion mattress | m ³ | 0.175 | 0.421 | 0 | 0 | 0 | 0 | 0 | 0 | 666 | 1,599 | 44,399 | 6,529 | 8,128 | 2,265 | 6,529 | 8,794 | |
| 4.3 Gravel installing | m ³ | 0.005 | 0.013 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 334 | 49 | 49 | 0 | 49 | 49 | |
| 4.4 Weep hole | no. | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,898 | 279 | 279 | 0 | 279 | 279 | |
| 4.4 Other works ^{*)} | L.S. | | | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 160 | 40,684 | 5,983 | 6,143 | 227 | 5,983 | 6,210 | |
| Sub-total of 4. | | | | 0 | 0 | 0 | 0 | 0 | 0 | 733 | 1,759 | 447,522 | 65,812 | 67,571 | 2,492 | 65,812 | 68,304 | |
| 5. Metal works | | | | | | | | | | | | | | | | | | |
| 5.1 Flap gate, stainless steel | kg | 4.000 | 0.000 | 2,000 | 0 | 0 | 0 | 0 | 2,000 | 6,000 | 0 | 0 | 0 | 0 | 6,000 | 0 | 6,000 | 6,000 |
| 5.2 Structural steel works | kg | 0.000 | 0.000 | 0 | 0 | 77,580 | 11,409 | 11,409 | 11,409 | 0 | 0 | 87,480 | 12,865 | 12,865 | 0 | 12,865 | 12,865 | |
| 5.3 Iron pipe, dia.=1,600mm | m | 0.000 | 0.000 | 200 | 0 | 7,758 | 1,141 | 1,141 | 1,341 | 600 | 0 | 30,700 | 4,515 | 4,515 | 0 | 4,515 | 4,515 | |
| 5.4 Other works ^{*)} | L.S. | | | 2,200 | 0 | 85,338 | 12,550 | 12,550 | 14,750 | 6,600 | 0 | 118,818 | 1,738 | 1,738 | 600 | 1,738 | 2,338 | |
| Sub-total of 5. | | | | 13,580 | 5,124 | 207,086 | 30,454 | 35,578 | 49,158 | 109,052 | 85,955 | 1,818,995 | 267,499 | 353,454 | 195,007 | 267,499 | 462,566 | |
| Total of (1.-5.) | | | | | | | | | | | | | | | | | | |

Note: *) Price level: June 1997.
 US\$ 1.0 = Riy 6.8 = 1 Yen 114.7
 **) Preparatory works; 10% of total permanent works
 ***) Other works; 10% of billing amount

Table 9.2.3 Breakdown of Installation Cost of Non-structural Measures (1/2)

Estimate of Net Cost

| Work item | Unit | Unit price ^{*)} | | Qty | Amount (x 1,000) | | Total (US\$) | |
|---|------|--------------------------|------------|--------|------------------|----------------------|--------------|-----|
| | | F.C. (US\$) | L.C. (Bir) | | F.C. (US\$) | L.C. (Bir) eq (US\$) | | |
| 1. River zone | | | | | | | | |
| 1.1 Staking, @ 10m, both sides | m | 0.0 | 28.0 | 38,800 | 0 | 1,086 | 160 | 160 |
| 1.2 Other works ^{*)} | L.S. | | | | 0 | 109 | 16 | 16 |
| Sub-total of 1. | | | | | 0 | 1,195 | 176 | 176 |
| 2. Flood warning system | | | | | | | | |
| 2.1 Rainfall observatory station | no. | 2,000.0 | 14,000.0 | 3 | 6 | 42 | 6 | 12 |
| 2.2 Walkie-talkie | set | 600.0 | 0.0 | 3 | 2 | 0 | 0 | 2 |
| 2.3 System line | m | 0.8 | 3.0 | 5,300 | 4 | 16 | 2 | 6 |
| 2.4 Support, @ 12m | no. | 0.0 | 325.0 | 42 | 0 | 144 | 21 | 21 |
| 2.5 Tower with siren | no. | 4,000.0 | 34,000.0 | 10 | 40 | 340 | 50 | 90 |
| 2.6 Staff gauge, 3m | no. | 50.0 | 100.0 | 10 | 1 | 1 | 0 | 1 |
| 2.7 Other works ^{*)} | L.S. | | | | 58 | 54 | 8 | 13 |
| Sub-total of 2. | | | | | 58 | 597 | 88 | 146 |
| 3. Flood fighting system | | | | | | | | |
| 3.1 Storage house, 35m ² | no. | 0.0 | 40,000.0 | 5 | 0 | 200 | 29 | 29 |
| 3.2 Walkie-talkie | set | 600.0 | 0.0 | 5 | 3 | 0 | 0 | 3 |
| 3.3 Sand bag/Scoop/Handy light/ Helmet/Raincoat/etc. | L.S. | 0.0 | 50,000.0 | 5 | 0 | 250 | 37 | 37 |
| 3.4 Other works ^{*)} | L.S. | | | | 0 | 45 | 7 | 7 |
| Sub-total of 3. | | | | | 3 | 495 | 73 | 76 |
| 4. Social education | | | | | | | | |
| 4.1 Blackboard | no. | 0.0 | 2,000.0 | 5 | 0 | 10 | 1 | 1 |
| 4.2 Sign board, against illegal act | no. | 0.0 | 750.0 | 20 | 0 | 15 | 2 | 2 |
| 4.3 Other works ^{*)} | L.S. | | | | 0 | 3 | 0 | 0 |
| Sub-total of 4 | | | | | 0 | 28 | 3 | 3 |
| Total of (1. - 4.) | | | | | 61 | 2,314 | 340 | 401 |

Note: *) Price level June 1997.
 US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 Unit price excludes tax.
 *) Other works: 10% of billing amount

Table 9.2.3 Breakdown of Installation Cost of Non-structural Measures (2/2)

Estimate of Tax

| Work item | Unit | Unit tax ¹⁾ | | | Qty | Amount | | | | | | | |
|---|--------|------------------------|--------|---------|--------|--------------|----------|----------------|---------------|---------------|--------------|---------------|---------------|
| | | Custom | | Sales | | F.C. | Sales | | | Total | Total F.C. | Total L.C. | Total (US\$) |
| | | F.C. | F.C. | L.C. | | | F.C. | L.C. | Total | | | | |
| (US\$) | (US\$) | (Birr) | (US\$) | (US\$) | (Birr) | eq (US\$) | (US\$) | (US\$) | (US\$) | (US\$) | (US\$) | | |
| 1. Administrative river zone | | | | | | | | | | | | | |
| 1.1 Staking, @ 10m, both sides | m | 0.0 | 0.0 | 2.0 | 38,800 | 0 | 0 | 77,600 | 11,412 | 11,412 | 0 | 11,412 | 11,412 |
| 1.2 Other works ²⁾ | L.S. | | | | | 0 | 0 | 7,760 | 1,141 | 1,141 | 0 | 1,141 | 1,141 |
| Total of 1. | | | | | | 0 | 0 | 85,360 | 12,553 | 12,553 | 0 | 12,553 | 12,553 |
| 2. Flood warning system | | | | | | | | | | | | | |
| 2.1 Rainfall observatory station | no. | 200.0 | 0.0 | 1,050.0 | 3 | 600 | 0 | 3,150 | 463 | 463 | 600 | 463 | 1,063 |
| 2.2 Walkie-talkie | set | 60.0 | 0.0 | 0.0 | 3 | 180 | 0 | 0 | 0 | 0 | 180 | 0 | 180 |
| 2.3 System line | m | 0.08 | 0.0 | 0.1 | 5,300 | 424 | 0 | 530 | 78 | 78 | 424 | 78 | 502 |
| 2.4 Support, @ 12m | no. | 0.0 | 0.0 | 25.0 | 442 | 0 | 0 | 11,050 | 1,625 | 1,625 | 0 | 1,625 | 1,625 |
| 2.5 Tower with siren | no. | 400.0 | 0.0 | 1,080.0 | 10 | 4,000 | 0 | 10,800 | 1,588 | 1,588 | 4,000 | 1,588 | 5,588 |
| 2.6 Staff gauge, 3m | no. | 5.0 | 0.0 | 5.0 | 10 | 50 | 0 | 50 | 7 | 7 | 50 | 7 | 57 |
| 2.7 Other works ²⁾ | L.S. | | | | | 525 | 0 | 2,558 | 376 | 376 | 525 | 376 | 901 |
| Total of 2. | | | | | | 5,779 | 0 | 28,138 | 4,138 | 4,138 | 5,779 | 4,138 | 9,917 |
| 3. Flood fighting system | | | | | | | | | | | | | |
| 3.1 Storage house | no. | 0.0 | 0.0 | 2,000.0 | 5 | 0 | 0 | 10,000 | 1,471 | 1,471 | 0 | 1,471 | 1,471 |
| 3.2 Walkie-talkie | set | 60.0 | 0.0 | 0.0 | 5 | 300 | 0 | 0 | 0 | 0 | 300 | 0 | 300 |
| 3.3 Sand bag/Scoop/Handy light/ Helmet/Raincoat/etc. | L.S. | 0.0 | 0.0 | 5,000.0 | 5 | 0 | 0 | 25,000 | 3,676 | 3,676 | 0 | 3,676 | 3,676 |
| 3.4 Other works ²⁾ | L.S. | | | | | 30 | 0 | 3,500 | 515 | 515 | 30 | 515 | 545 |
| Total of 3. | | | | | | 330 | 0 | 38,500 | 5,662 | 5,662 | 330 | 5,662 | 5,992 |
| 4. Social education | | | | | | | | | | | | | |
| 4.1 Blackboard | no. | 0.0 | 0.0 | 200.0 | 5 | 0 | 0 | 1,000 | 147 | 147 | 0 | 147 | 147 |
| 4.2 Sign board, against illegal act | no. | 0.0 | 0.0 | 70.0 | 20 | 0 | 0 | 1,400 | 206 | 206 | 0 | 206 | 206 |
| 4.3 Other works ²⁾ | L.S. | | | | | 0 | 0 | 240 | 35 | 35 | 0 | 35 | 35 |
| Total of 4. | | | | | | 0 | 0 | 2,640 | 388 | 388 | 0 | 388 | 388 |
| Total of (1. - 4.) | | | | | | 6,109 | 0 | 154,638 | 22,741 | 22,741 | 6,109 | 22,741 | 28,850 |

Note: *1) Price level: June 1997.
 US\$ 1.0 = Birr 6.8 = J.Yea 114.7
 *2) Other works, 10% of billing amount

Table 9.2.4 Breakdown of Resettlement Cost

Breakdown of unit cost

| No. | Item | Unit | Kind of house | | | | Total |
|---|---|---------------------|---------------|----------|---------|---------|-----------|
| | | | Chika | C. block | Brick | Stone | |
| Conditions for estimate | | | | | | | |
| 1) | Number of houses per 10,000m ² | no. | 30.0 | 2.0 | 2.0 | 2.0 | 36.0 |
| 2) | Averaged floor space per house | m ² | 44 | 44 | 67 | 67 | |
| I. Compensation | | | | | | | |
| 1) House | | | | | | | |
| - | Construction cost | Birr/m ² | 450 | 1,000 | 1,200 | 1,500 | |
| - | Averaged passing time | year | 30 | 20 | 30 | 30 | |
| - | Annual depreciation ratio | | 1.00% | 0.50% | 0.25% | 0.25% | |
| - | Present value, unit | Birr/m ² | 333 | 905 | 1,113 | 1,391 | |
| - | Present value per house | Birr | 14,646 | 39,803 | 74,584 | 93,229 | |
| 2) Wet masonry wall | | | | | | | |
| - | Total floor space per 10,000m ² | m ² | 1,320 | 88 | 134 | 134 | 1,676 |
| - | Estimated net residential area | m ² | | | | | 5,000 |
| - | Estimated occupying space | m ² | 3,938 | 263 | 400 | 400 | 5,000 |
| - | - do -, per house | m ² | 131 | 131 | 200 | 200 | |
| - | Estimated wall length per house | m | 23 | 23 | 28 | 28 | |
| - | Estimated wall height | m | 2 | 2 | 2 | 2 | |
| - | Estimated wall width | m | 0.5 | 0.5 | 0.5 | 0.5 | |
| - | Estimated wall volume per house | m ³ | 23 | 23 | 28 | 28 | |
| - | Construction cost | Birr/m ³ | 150 | 150 | 150 | 150 | |
| - | Averaged passing time | year | 30 | 30 | 30 | 30 | |
| - | Annual depreciation ratio | | 0.50% | 0.50% | 0.50% | 0.50% | |
| - | Present value, unit | Birr/m ³ | 129 | 129 | 129 | 129 | |
| - | Present value per house | Birr | 2,957 | 2,957 | 3,649 | 3,649 | |
| 3) Tree | | | | | | | |
| - | Estimated number of trees | no. | 3 | 3 | 4 | 6 | |
| - | Unit value of tree, Euclypt | Birr | 200 | 200 | 200 | 200 | |
| - | Present value per house | Birr | 600 | 600 | 800 | 1,200 | |
| 4) Yearly crop | | | | | | | |
| - | Estimated cropping area | m ² | 75 | 75 | 100 | 200 | |
| - | Compensation unit price per ha | Birr | 700 | 700 | 700 | 700 | |
| - | Present value per house | Birr | 5 | 5 | 7 | 14 | |
| - | Sub total, 1) - 4) | Birr | 18,209 | 43,365 | 79,040 | 98,093 | |
| 5) | Transportation | 5% Birr | 910 | 2,168 | 3,952 | 4,905 | |
| 6) | Miscellaneous | 15% Birr | 2,731 | 6,505 | 11,856 | 14,714 | |
| - | Total, 1) - 6) | Birr | 21,850 | 52,038 | 94,848 | 117,711 | |
| 2. Demolition | | | | | | | |
| - | Estimated height of house | m | 2.0 | 2.0 | 2.0 | 2.0 | |
| - | Estimated volume of house | m ³ | 88 | 88 | 134 | 134 | |
| - | Demol. vol. of house & wall per house | m ³ | 111 | 111 | 162 | 162 | |
| - | Unit demolition cost, hauling=7.5km | Birr/m ³ | 53 | 53 | 53 | 53 | |
| - | Demolition cost per house | Birr | 5,878 | 5,878 | 8,601 | 8,601 | |
| 3. Construction of new house apartment | | | | | | | |
| - | Local hotel room charge per night | Birr | 16 | 16 | 16 | 16 | |
| - | Suppose: the room= 4m x 3m | m ² | 12 | 12 | 12 | 12 | |
| - | Hotel charge for 3 yeays | Birr | 17,520 | 17,520 | 17,520 | 17,520 | |
| - | Estimated building construction cost | Birr | 17,520 | 17,520 | 17,520 | 17,520 | |
| - | Building construction cost per m ² | Birr | 1,460 | 1,460 | 1,460 | 1,460 | |
| - | Floor area per house hold= 4m x 4.5m | m ² | 18 | 18 | 18 | 18 | |
| - | Building construction cost per house hold | Birr | 17,520 | 17,520 | 17,520 | 17,520 | |
| 3. Total | | | | | | | |
| - | Total cost per house | Birr | 45,249 | 75,437 | 120,968 | 143,812 | |
| - | Cost per 10,000m ² | Birr | 1,357,462 | 150,874 | 241,937 | 287,664 | 2,037,936 |
| - | Cost per m ² | Birr | 136 | 15 | 24 | 29 | 204 |

Resettlement cost

| No. | Item | Unit | Unit price | | Qty | Amount | | Total (US\$) | |
|-----|-------------------|----------------|-------------|-------------|-------|-------------|-------------|--------------|--------|
| | | | F.C. (US\$) | L.C. (Birr) | | F.C. (US\$) | L.C. (Birr) | | |
| 1. | Resettlement cost | m ² | 0 | 204 | 1,000 | 0 | 204,000 | 30,000 | 30,000 |

Note: - Price level, June 1997
 - US\$ 1.0 = Birr 6.8 = J.Yen 114.7

Table 9.2.5 Breakdown of Engineering Services Cost (1/4)

Estimate of Net Cost

| No. | Item | Unit | Unit price ²⁾ | | Qty | Amount (x 1,000) | | | |
|--------------------------------------|---|----------|--------------------------|----------------|-------|------------------|----------------|-------------------------------|--------------|
| | | | F.C. (US\$) | L.C. (Birr) | | F.C. (US\$) | L.C. (Birr) | Total equivalent (US\$) | |
| 1. Detailed design ²⁾ | | | | | | | | | |
| 1) Remuneration | | | | | | | | | |
| Foreign expert | | | | | | | | | |
| | - Team leader (Flood control) | M/M | 10,000 | (0) | 1 | 10 | (0) | 0 | 10 |
| | - Hydrologist/hydraulic engineer | M/M | 10,000 | (0) | 3 | 30 | (0) | 0 | 30 |
| | - Design engineer-A | M/M | 10,000 | (0) | 6 | 60 | (0) | 0 | 60 |
| | - Design engineer-B | M/M | 10,000 | (0) | 2 | 20 | (0) | 0 | 20 |
| | - Engineering geologist | M/M | 10,000 | (0) | 2 | 20 | (0) | 0 | 20 |
| | - Construction plan/Cost estimator | M/M | 10,000 | (0) | 2 | 20 | (0) | 0 | 20 |
| | - Specification specialist | M/M | 10,000 | (0) | 2 | 20 | (0) | 0 | 20 |
| | - Senior surveyor | M/M | 10,000 | (0) | 4 | 40 | (0) | 0 | 40 |
| | - Institutional expert | M/M | 10,000 | (0) | 12 | 120 | (0) | 0 | 120 |
| | Sub-total of foreign expert | | | | 34 | 340 | (0) | 0 | 340 |
| Local expert | | | | | | | | | |
| | - Design engineers | M/M | 0 | (1,500) | 8 | 0 | (12) | 2 | 2 |
| | - Surveyors | M/M | 0 | (1,000) | 12 | 0 | (12) | 2 | 2 |
| | - Draftmen | M/M | 0 | (750) | 20 | 0 | (15) | 2 | 2 |
| | Sub-total of local expert | | | | 40 | 0 | (39) | 6 | 6 |
| | Sub-total of 1) | | | | | 340 | (39) | 6 | 346 |
| 2) Transportation | | | | | | | | | |
| | - International air fare | round | 10,000 | (0) | 9 | 90 | (0) | 0 | 90 |
| | - Allowance for foreign consultants | day | 100 | (0) | 1,020 | 102 | (0) | 0 | 102 |
| | - Vehicle rental charge (incl. drivers) | unit/day | 100 | (0) | 540 | 54 | (0) | 0 | 54 |
| | Sub-total of 2) | | | | | 246 | (0) | 0 | 246 |
| 3) Field/Laboratory test | | | | | | | | | |
| | - Boring | m | 0 | (600) | 300 | 0 | (180) | 26 | 26 |
| | - Hydraulic model test | L.S. | | | | 85 | (0) | 0 | 85 |
| | Sub-total of 3) | | | | | 85 | (180) | 26 | 111 |
| 4) Report binding | | | | | | | | | |
| | - 300pages x 30vol. | page | 0 | (1.82) | 9,000 | 0 | (16) | 2 | 2 |
| 5) Equipment (depreciation basis) | | | | | | | | | |
| | - Computer | unit/day | 8 | (0) | 1,020 | 8 | (0) | 0 | 8 |
| | - Total station | unit/day | 36 | (0) | 120 | 4 | (0) | 0 | 4 |
| | - Theodolite | unit/day | 5 | (0) | 120 | 1 | (0) | 0 | 1 |
| | - Leveling instrument | unit/day | 3 | (0) | 120 | 0 | (0) | 0 | 0 |
| | - Photo copy machine | unit/day | 0 | (182) | 180 | 0 | (33) | 5 | 5 |
| | Sub-total of 5) | | | | | 13 | (33) | 5 | 18 |
| 6) Office running cost | | | | | | | | | |
| | - Office | month | 0 | (682) | 6 | 0 | (4) | 1 | 1 |
| 7) Overhead (100% of foreign expert) | | | | | | | | | |
| | | L.S. | 100% | 100% | | 340 | (0) | 0 | 340 |
| Total of 1. | | | | | | 1,024 | (272) | 40 | 1,064 |

Table 9.2.5 Breakdown of Engineering Services Cost (2/4)

| <i>Estimate of Net Cost</i> | | | | | | | | | |
|---|---------------------------------|-------|--------------------------|-------------|-------|------------------|--------------|-------------------|--------------|
| No. | Item | Unit | Unit price ^{*)} | | Qty | Amount (x 1,000) | | | Total (US\$) |
| | | | F.C. (US\$) | L.C. (Birr) | | F.C. (US\$) | L.C. (Birr) | equivalent (US\$) | |
| 2. Construction supervision | | | | | | | | | |
| 1) Remuneration | | | | | | | | | |
| Foreign expert | | | | | | | | | |
| | - Team leader (Flood control) | M/M | 10,000 | (0) | 2 | 20 | (0) | 0 | 20 |
| | - Design/supervision engineer-A | M/M | 10,000 | (0) | 24 | 240 | (0) | 0 | 240 |
| | - Design/supervision engineer-B | M/M | 10,000 | (0) | 4 | 40 | (0) | 0 | 40 |
| | Sub-total of foreign expert | | | | 30 | 300 | (0) | 0 | 300 |
| Local expert | | | | | | | | | |
| | - Design engineers | M/M | 0 | (1,500) | 48 | 0 | (72) | 11 | 11 |
| | - Surveyors | M/M | 0 | (1,000) | 12 | 0 | (12) | 2 | 2 |
| | - Drivers | M/M | 0 | (900) | 12 | 0 | (11) | 2 | 2 |
| | Sub-total of local expert | | | | 72 | 0 | (95) | 14 | 14 |
| | Sub-total of 1) | | | | | 300 | (95) | 14 | 314 |
| 2) Transportation | | | | | | | | | |
| | - International air fare | round | 10,000 | (0) | 3 | 30 | (0) | 0 | 30 |
| 3) Report binding | | | | | | | | | |
| | - 300pages x 30vol. | page | 0 | (1.82) | 9,000 | 0 | (16) | 2 | 2 |
| 4) Equipment | | | | | | | | | |
| | - Vehicle (4WD) | unit | 26,000 | (0) | 1 | 26 | (0) | 0 | 26 |
| | - Computer | unit | 3,500 | (0) | 1 | 4 | (0) | 0 | 4 |
| | - Theodolite | unit | 1,700 | (0) | 1 | 2 | (0) | 0 | 2 |
| | - Leveling instrument | unit | 1,100 | (0) | 1 | 1 | (0) | 0 | 1 |
| | - Photo copy machine | unit | 3,500 | (0) | 1 | 4 | (0) | 0 | 4 |
| | Sub-total of 4) | | | | | 37 | (0) | 0 | 37 |
| 5) Office running cost | | | | | | | | | |
| | - Office | month | 0 | (682) | 12 | 0 | (8) | 1 | 1 |
| 6) House rental charge | | | | | | | | | |
| | - House | month | 3,000 | (0) | 24 | 72 | (0) | 0 | 72 |
| 7) Overhead (100% of foreign expert) | | | | | | | | | |
| | | L.S. | 100% | 100% | | 300 | (0) | 0 | 300 |
| Total of 2. | | | | | | 739 | (119) | 17 | 756 |
| Total of (1. - 2.) | | | | | | 1,763 | (392) | 58 | 1,821 |

Note: *) - Price level: June 1997. US\$ 1.0 = Birr 6.8 = J.Yen 114.7

- Unit price excludes tax.

*) - Cost is estimated assumed that all the services are carried out and completed in Ethiopia for six months.

Table 9.2.5 Breakdown of Engineering Services Cost (3/4)

Estimate of Tax

| No. | Item | Unit | Unit tax ²⁾ | | | | Amount | | | | | | | | | | | |
|---|---------------------------------------|----------|------------------------|----------------|----------------|-------|--------|----------------|----------------|----------------|------------------|-----------------|----------------|----------------|-----------------|-------|-------|-------|
| | | | Custom | | Sales | | Qty | Custom | | Sales | | | Total | | | | | |
| | | | F.C. (US\$) | E.C. (US\$) | L.C. (Birr) | | | F.C. (US\$) | E.C. (US\$) | L.C. (Birr) | equiv. (US\$) | Total (US\$) | F.C. (US\$) | L.C. (US\$) | Total (US\$) | | | |
| I. Detailed design | | | | | | | | | | | | | | | | | | |
| 1) Remuneration | | | | | | | | | | | | | | | | | | |
| Foreign expert | | | | | | | | | | | | | | | | | | |
| - | Team leader (Flood control) | MM | 0 | 0 | (0) | 1 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Hydrologist/hydraulic engineer | MM | 0 | 0 | (0) | 3 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Design engineer-A | MM | 0 | 0 | (0) | 6 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Design engineer-B | MM | 0 | 0 | (0) | 2 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Engineering geologist | MM | 0 | 0 | (0) | 2 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Construction plan/Cost estimator | MM | 0 | 0 | (0) | 2 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Specification specialist | MM | 0 | 0 | (0) | 2 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Senior surveyor | MM | 0 | 0 | (0) | 4 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Institutional expert | MM | 0 | 0 | (0) | 12 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Sub-total of foreign expert | | | | | 34 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Local expert | | | | | | | | | | | | | | | | | | |
| - | Design engineers | MM | 0 | 0 | (0) | 8 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Surveyors | MM | 0 | 0 | (0) | 12 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Draftmen | MM | 0 | 0 | (0) | 20 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Sub-total of local expert | | | | | 40 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Sub-total of 1) | | | | | | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2) Transportation | | | | | | | | | | | | | | | | | | |
| - | International air fare | round | 0 | 0 | (0) | 9 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Allowance for foreign consultants | day | 0 | 0 | (0) | 1,020 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Vehicle rental charge (incl. drivers) | unit/day | 0 | 10 | (0) | 540 | 0 | 5,400 | (0) | 0 | 0 | 5,400 | 0 | 5,400 | 0 | 5,400 | 0 | |
| | Sub-total of 2) | | | | | | 0 | 5,400 | (0) | 0 | 0 | 5,400 | 0 | 5,400 | 0 | 5,400 | 0 | |
| 3) Field/Laboratory test | | | | | | | | | | | | | | | | | | |
| - | Boring | m | 0 | 0 | (0) | 300 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| - | Hydraulic model test | L.S | | | | | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Sub-total of 3) | | | | | | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 4) Report binding | | | | | | | | | | | | | | | | | | |
| - | 300pages x 30vol | page | 0 | 0 | (0.18) | 9,000 | 0 | 0 | (1,620) | 238 | 238 | 0 | 238 | 238 | 0 | 238 | 238 | |
| 5) Equipment (depreciation basis) | | | | | | | | | | | | | | | | | | |
| - | Computer | unit/day | 0 | 0.4 | (6.53) | 1,020 | 0 | 408 | (6,661) | 980 | 980 | 408 | 980 | 1,388 | 0 | 1,388 | 1,388 | |
| - | Total station | unit/day | 0 | 1.8 | (29.4) | 120 | 0 | 216 | (3,526) | 518 | 518 | 216 | 518 | 734 | 0 | 734 | 734 | |
| - | Theodolite | unit/day | 0 | 0.25 | (4.08) | 120 | 0 | 30 | (490) | 72 | 72 | 30 | 72 | 102 | 0 | 102 | 102 | |
| - | Leveling instrument | unit/day | 0 | 0.15 | (2.45) | 120 | 0 | 18 | (291) | 43 | 43 | 18 | 43 | 61 | 0 | 61 | 61 | |
| - | Photo copy machine | unit/day | 0 | 0 | (18) | 180 | 0 | 0 | (3,240) | 476 | 476 | 0 | 476 | 476 | 0 | 476 | 476 | |
| | Sub-total of 5) | | | | | | 0 | 672 | (11,210) | 2,090 | 2,090 | 672 | 2,090 | 2,762 | 0 | 2,762 | 2,762 | |
| 6) Office running cost | | | | | | | | | | | | | | | | | | |
| - | Office | month | 0 | 0 | (68) | 6 | 0 | 0 | (98) | 60 | 60 | 0 | 60 | 60 | 0 | 60 | 60 | |
| 7) Overhead (100% of foreign expert) | | | | | | | | | | | | | | | | | | |
| | | L.S. | 100% | 100% | 100% | | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Total of I. | | | | | | | | 0 | 6,072 | (16,238) | 2,388 | 2,388 | 6,072 | 2,388 | 8,460 | 0 | 8,460 | 8,460 |

Table 9.2.5 Breakdown of Engineering Services Cost (4/4)

Estimate of Tax

| No. | Item | Unit | Unit tax ²⁾ | | | Qty | Amount | | | | | | | |
|---|---------------------------------|-------|------------------------|----------------|----------------|------|----------------|----------------|----------------|------------------|-----------------|----------------|----------------|-----------------|
| | | | Custom | | Sales | | Custom | | Sales | | | Total | | |
| | | | E.C. (US\$) | F.C. (US\$) | L.C. (Birr) | | E.C. (US\$) | F.C. (US\$) | L.C. (Birr) | equiv. (US\$) | Total (US\$) | E.C. (US\$) | L.C. (US\$) | Total (US\$) |
| 2. Construction supervision | | | | | | | | | | | | | | |
| 1) Remuneration | | | | | | | | | | | | | | |
| Foreign expert | | | | | | | | | | | | | | |
| | - Team leader (Flood control) | MM | 0 | 0 | (0) | 2 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 |
| | - Design/supervision engineer-A | MM | 0 | 0 | (0) | 24 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 |
| | - Design/supervision engineer-B | MM | 0 | 0 | (0) | 4 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 |
| | Sub-total of foreign expert | | | | | 30 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 |
| Local expert | | | | | | | | | | | | | | |
| | - Design engineers | MM | 0 | 0 | (0) | 48 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 |
| | - Surveyors | MM | 0 | 0 | (0) | 12 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 |
| | - Drivers | MM | 0 | 0 | (0) | 12 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 |
| | Sub-total of local expert | | | | | 72 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 |
| | Sub-total of 1) | | | | | | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 |
| 2) Transportation | | | | | | | | | | | | | | |
| | - International air fare | round | 0 | 0 | (0) | 3 | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 |
| 3) Report binding | | | | | | | | | | | | | | |
| | - 300pages x 30vol. | page | 0 | 0 | (0.18) | 9000 | 0 | 0 | (1,620) | 238 | 238 | 0 | 238 | 238 |
| 4) Equipment | | | | | | | | | | | | | | |
| | - Vehicle (4WD) | unit | 2,600 | 0 | (0) | 1 | 2,600 | 0 | (0) | 0 | 2,600 | 2,600 | 0 | 2,600 |
| | - Computer | unit | 350 | 0 | (0) | 1 | 350 | 0 | (0) | 0 | 350 | 350 | 0 | 350 |
| | - Theodolite | unit | 170 | 0 | (0) | 1 | 170 | 0 | (0) | 0 | 170 | 170 | 0 | 170 |
| | - Leveling instrument | unit | 110 | 0 | (0) | 1 | 110 | 0 | (0) | 0 | 110 | 110 | 0 | 110 |
| | - Photo copy machine | unit | 350 | 0 | (0) | 1 | 350 | 0 | (0) | 0 | 350 | 350 | 0 | 350 |
| | Sub-total of 4) | | | | | | 3,580 | 0 | (0) | 0 | 3,580 | 3,580 | 0 | 3,580 |
| 5) Office running cost | | | | | | | | | | | | | | |
| | - Office | month | 0 | 0 | (68) | 12 | 0 | 0 | (816) | 120 | 120 | 0 | 120 | 120 |
| 6) House rental charge | | | | | | | | | | | | | | |
| | - House | month | 0 | 300 | (0) | 24 | 0 | 7,200 | (0) | 0 | 0 | 7,200 | 0 | 7,200 |
| 7) Overhead (100% of foreign expert) | | | | | | | | | | | | | | |
| | L.S. | | 100% | 100% | 100% | | 0 | 0 | (0) | 0 | 0 | 0 | 0 | 0 |
| Total of 2. | | | | | | | 3,580 | 7,200 | (2,436) | 358 | 3,938 | 10,780 | 358 | 11,138 |
| Total of (1. - 2.) | | | | | | | 3,580 | 13,272 | (18,674) | 2,746 | 6,326 | 16,852 | 2,746 | 19,598 |

Note: ^{*)} - Price level, June 1997, US\$ 1.0 = Birr 6.8 = J Yen 114.7

Table 9.2.6 Breakdown of Administration Cost for Structural Measures

| No. | Item | Unit | Unit price ¹⁾ | | Qty ²⁾ | Amount (x 1,000) | | | |
|---|---|----------|--------------------------|----------------|-------------------|------------------|----------------|----------------------|-----------------|
| | | | F.C. (US\$) | L.C. (Birr) | | F.C. (US\$) | L.C. (Birr) | equivalent (US\$) | Total (US\$) |
| 1. Common expenses | | | | | | | | | |
| 1) Personnel cost | | | | | | | | | |
| | - Preparatory stage, 21 staffs x 2 years | M/M | 0 | (1,000) | 504 | 0 | (504) | 74 | 74 |
| | - Implementation stage, 42 staffs x 2 years | M/M | 0 | (1,000) | 1,008 | 0 | (1,008) | 148 | 148 |
| | Sub-total of 1) | | | | | 0 | (1,512) | 222 | 222 |
| 2) Furniture | | | | | | | | | |
| | - Desk and chair, bookshelf, conference table, etc. | unit | 0 | (500) | 50 | 0 | (25) | 4 | 4 |
| 3) Equipment cost | | | | | | | | | |
| | - Procurement of vehicles | | | | | | | | |
| | 8 pick-ups (4WD) | unit | 0 | (250,000) | 8 | 0 | (2,000) | 294 | 294 |
| | 1 sedan | unit | 0 | (120,000) | 1 | 0 | (120) | 18 | 18 |
| | - O&M cost of vehicles for 4 years ³⁾ | unit/M | 0 | (600) | 384 | 0 | (230) | 34 | 34 |
| | - Procurement of computer | unit | 0 | (30,000) | 4 | 0 | (120) | 18 | 18 |
| | - Photo copy machine | unit | 0 | (40,000) | 1 | 0 | (40) | 6 | 6 |
| | - Theodolite | unit | 0 | (50,000) | 1 | 0 | (50) | 7 | 7 |
| | - Leveling instrument | unit | 0 | (15,000) | 2 | 0 | (30) | 4 | 4 |
| | Sub-total of 3) | | | | | 0 | (2,590) | 381 | 381 |
| 4) Office running cost | | | | | | | | | |
| | - Office for 4 years, including consumables | month | 0 | (750) | 48 | 0 | (36) | 5 | 5 |
| | - Wage of driver | M/M | 0 | (900) | 384 | 0 | (346) | 51 | 51 |
| | Sub-total of 4) | | | | | 0 | (382) | 56 | 56 |
| | Sub-total of 1) - 4) | | | | | 0 | (4,509) | 663 | 663 |
| 5) Others | | | | | | | | | |
| | | L.S. | 10% | 10% | | 0 | (451) | 66 | 66 |
| | Total of 1. | | | | | 0 | (4,960) | 729 | 729 |
| 2. EIA cost (international contract basis) | | | | | | | | | |
| | - Expert-A (foreign) for 6 months | M/M | 10,000 | (0) | 6 | 60 | (0) | 0 | 60 |
| | - Expert-B (foreign) for 3 months | M/M | 10,000 | (0) | 3 | 30 | (0) | 0 | 30 |
| | - 3 experts (local) for 6 months | M/M | 0 | (1,500) | 18 | 0 | (27) | 4 | 4 |
| | - 6 local assistants for 6 months | M/M | 0 | (750) | 36 | 0 | (27) | 4 | 4 |
| | - International air fare | round | 10,000 | (0) | 2 | 20 | (0) | 0 | 20 |
| | - Allowance for foreign expert | day | 100 | (0) | 270 | 27 | (0) | 0 | 27 |
| | - Vehicle rental charge | unit/day | 110 | (0) | 360 | 40 | (0) | 0 | 40 |
| | - Rental charge of photo copy machine | unit/day | 0 | (200) | 360 | 0 | (72) | 11 | 11 |
| | - Computer | unit/day | 9 | (0) | 270 | 2 | (0) | 0 | 2 |
| | - Report binding (100page x 30 vol.) | page | 0 | (2) | 3,000 | 0 | (6) | 1 | 1 |
| | - Overhead (100% of foreign expert) | L.S. | 100% | 100% | | 90 | (0) | 0 | 90 |
| | Total of 2. | | | | | 269 | (132) | 19 | 288 |
| | Total of (1.-2.) | | | | | 269 | (5,092) | 749 | 1,018 |

Note: *1) - Price level; June 1997. US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 - Unit price includes tax.
 *2) - The quantities are estimated for the preparatory and implementation stages of 4 years.
 *3) - The quantity for an existing pick-up is included.

Table 9.2.7 Breakdown of Administration Cost for Non-structural Measures

| No. | Item | Unit | Unit price ^{*1)} | | Qty ^{*2)} | Amount (x 1,000) | | | Total (US\$) | |
|-------------------------------|---|--------|---------------------------|-------------|--------------------|------------------|--------------|-------------------|--------------|--|
| | | | F.C. (US\$) | L.C. (Birr) | | F.C. (US\$) | L.C. (Birr) | equivalent (US\$) | | |
| I. Common expenses | | | | | | | | | | |
| 1) Personnel cost | | | | | | | | | | |
| | - Preparatory stage, 4 staffs x 2 years | M/M | 0 | (1,000) | 96 | 0 | (96) | 14 | 14 | |
| | - Implementation stage, 8 staffs for 1 year | M/M | 0 | (1,000) | 96 | 0 | (96) | 14 | 14 | |
| | Sub-total of 1) | | | | | 0 | (192) | 28 | 28 | |
| 2) Furniture | | | | | | | | | | |
| | - Desk and chair, bookshelf, conference table, etc. | unit | 0 | (500) | 10 | 0 | (5) | 1 | 1 | |
| 3) Equipment cost | | | | | | | | | | |
| | - O&M cost of vehicles for 3 years | unit/M | 0 | (600) | 72 | 0 | (43) | 6 | 6 | |
| | - Procurement of overhead projector | unit | 2,500 | (0) | 1 | 3 | (0) | 0 | 3 | |
| | Sub-total of 3) | | | | | 3 | (43) | 6 | 9 | |
| 4) Office running cost | | | | | | | | | | |
| | - Wage of driver ^{*3)} | M/M | 0 | (900) | 72 | 0 | (65) | 10 | 10 | |
| | Sub-total of 1) - 4) | | | | | 3 | (365) | 45 | 48 | |
| | 5) Others | L.S. | 10% | 10% | | 0 | (31) | 4 | 4 | |
| | Total of I. | | | | | 3 | (336) | 49 | 52 | |

Note: *1) - Price level: June 1997. US\$ 1.0 = Birr 6.8 = J.Yen 114.7

- Unit price includes tax.

*2) - The quantities are estimated for the preparatory and implementation stages of 3 years.

Table 9.2.8 Annual Disbursement Schedule

(Unit: US\$, thousand)

| Item | 1998 | | | 1999 | | | 2000 | | | 2001 | | | Total | | |
|--|------|------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| | F.C. | L.C. | Total | F.C. | L.C. | Total | F.C. | L.C. | Total | F.C. | L.C. | Total | F.C. | L.C. | Total |
| Structural measures | | | | | | | | | | | | | | | |
| 1. Construction cost | | | | | | | | | | | | | | | |
| 1) Kechebe weir | 0 | 0 | 0 | 0 | 0 | 0 | 543 | 1,275 | 1,818 | 181 | 425 | 606 | 724 | 1,700 | 2,424 |
| 2) Kosire regulating pond | 0 | 0 | 0 | 0 | 0 | 0 | 405 | 397 | 802 | 0 | 0 | 0 | 405 | 397 | 802 |
| 3) Bantiyiketu regulating pond | 0 | 0 | 0 | 0 | 0 | 0 | 434 | 354 | 837 | 484 | 354 | 837 | 967 | 707 | 1,674 |
| 4) Bantiyiketu river channel improvement | | | | | | | | | | | | | | | |
| - 1 Flood wall | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 137 | 145 | 25 | 411 | 436 | 33 | 548 | 581 |
| - 2 Slope protection | 0 | 0 | 0 | 0 | 0 | 0 | 159 | 134 | 283 | 476 | 371 | 848 | 635 | 495 | 1,130 |
| - 3 River channel excavation | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 32 | 88 | 168 | 96 | 264 | 224 | 128 | 352 |
| - 4 Associated works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 26 | 0 | 77 | 77 | 0 | 103 | 103 |
| Sub-total of 4) | 0 | 0 | 0 | 0 | 0 | 0 | 223 | 319 | 542 | 669 | 956 | 1,625 | 892 | 1,274 | 2,166 |
| 5) Urban development works | 0 | 0 | 0 | 0 | 0 | 0 | 335 | 80 | 415 | 1,004 | 241 | 1,244 | 1,338 | 321 | 1,659 |
| Sub-total of 1. | 0 | 0 | 0 | 0 | 0 | 0 | 1,989 | 2,424 | 4,413 | 2,337 | 1,975 | 4,312 | 4,326 | 4,399 | 8,725 |
| 2. Engineering services cost | 0 | 0 | 0 | 890 | 31 | 921 | 445 | 15 | 460 | 445 | 15 | 460 | 1,780 | 61 | 1,841 |
| 3. Resettlement cost | 0 | 0 | 0 | 0 | 30 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 30 |
| 4. Administration cost | 27 | 75 | 102 | 81 | 225 | 305 | 81 | 225 | 305 | 81 | 225 | 305 | 269 | 749 | 1,018 |
| Sub-total of (1. - 4.) | 27 | 75 | 102 | 971 | 285 | 1,256 | 2,515 | 2,664 | 5,179 | 2,863 | 2,215 | 5,077 | 6,375 | 5,239 | 11,614 |
| 5. Physical contingency | 3 | 7 | 10 | 97 | 29 | 126 | 249 | 269 | 518 | 286 | 221 | 508 | 635 | 526 | 1,161 |
| Sub-total of (1. - 5.) | 30 | 82 | 112 | 1,068 | 314 | 1,381 | 2,764 | 2,933 | 5,697 | 3,149 | 2,436 | 5,585 | 7,010 | 5,765 | 12,775 |
| 6. Price contingency | 1 | 5 | 6 | 65 | 39 | 104 | 256 | 500 | 816 | 395 | 639 | 1,035 | 718 | 1,243 | 1,961 |
| Sub-total of (1. - 6.) | 30 | 87 | 118 | 1,133 | 352 | 1,485 | 3,020 | 3,493 | 6,513 | 3,544 | 3,076 | 6,620 | 7,728 | 7,008 | 14,736 |
| Non-structural measures | | | | | | | | | | | | | | | |
| 1. Installation cost | | | | | | | | | | | | | | | |
| 1) River zone | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 189 | 189 | 0 | 0 | 0 | 0 | 189 | 189 |
| 2) Flood warning system | 0 | 0 | 0 | 0 | 0 | 0 | 64 | 92 | 156 | 0 | 0 | 0 | 64 | 92 | 156 |
| 3) Flood fighting system | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 79 | 82 | 0 | 0 | 0 | 3 | 79 | 82 |
| 4) Social education | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 0 | 0 | 0 | 0 | 5 | 5 |
| Sub-total of 1. | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 365 | 432 | 0 | 0 | 0 | 67 | 365 | 432 |
| 2. Administration cost | 1 | 10 | 10 | 1 | 15 | 16 | 2 | 25 | 26 | 0 | 0 | 0 | 3 | 49 | 52 |
| Sub-total of (1. - 2.) | 1 | 10 | 10 | 1 | 15 | 16 | 69 | 390 | 458 | 0 | 0 | 0 | 70 | 414 | 484 |
| 3. Physical contingency | 0 | 1 | 1 | 0 | 1 | 2 | 7 | 39 | 46 | 0 | 0 | 0 | 7 | 41 | 48 |
| Sub-total of (1. - 3.) | 1 | 11 | 11 | 1 | 16 | 17 | 75 | 428 | 504 | 0 | 0 | 0 | 77 | 455 | 532 |
| 4. Price contingency | 0 | 1 | 1 | 0 | 2 | 2 | 7 | 82 | 89 | 0 | 0 | 0 | 7 | 85 | 92 |
| Sub-total of (1. - 4.) | 1 | 11 | 12 | 1 | 18 | 19 | 82 | 510 | 593 | 0 | 0 | 0 | 84 | 540 | 624 |
| Total of structural and non-structural measures | | | | | | | | | | | | | | | |
| Project cost | 31 | 99 | 130 | 1,134 | 371 | 1,505 | 3,103 | 3,003 | 7,106 | 3,544 | 3,076 | 6,620 | 7,812 | 7,548 | 15,360 |

Note: - Price level, June 1997, US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 - Tax is included in the cost.

Table 9.2.9 Breakdown of O&M Cost for Structural Measures

| No. | Item | Unit | Unit price ^{*1} | | Qty ^{*2} | Amount (x 1,000) | | | Total (US\$) |
|--|--|--------|--------------------------|-------------|-------------------|------------------|-------------|-------------------|--------------|
| | | | F.C. (US\$) | L.C. (Birr) | | F.C. (US\$) | L.C. (Birr) | equivalent (US\$) | |
| 1. Common expenses | | | | | | | | | |
| 1) Personnel cost | | | | | | | | | |
| | - 3 staffs x 12 months | M/M | 0 | (1,000) | 36 | 0 | (36) | 5 | 5 |
| 2) Vehicle running cost | | | | | | | | | |
| | - O&M cost for 1 vehicle | unit/M | 0 | (600) | 12 | 0 | (7) | 1 | 1 |
| | - Wage of driver | M/M | 0 | (900) | 12 | 0 | (11) | 2 | 2 |
| | Sub-total of 2) | | | | | 0 | (18) | 3 | 3 |
| | Sub-total of 1) - 2) | | | | | 0 | (54) | 8 | 8 |
| | 3) Others | L.S. | 10% | 10% | | 0 | (5) | 1 | 1 |
| | Total of 1. | | | | | 0 | (59) | 9 | 9 |
| 2. Maintenance cost of structures | | | | | | | | | |
| | - Excavation, reservoir & pond | m3 | 4.7 | (53.3) | 1,000 | 5 | (53) | 8 | 13 |
| | - Excavation, river | m3 | 4.7 | (53.3) | 120 | 1 | (6) | 1 | 2 |
| | - Wet masonry | m3 | 0 | (417.2) | 160 | 0 | (67) | 10 | 10 |
| | - Other works | L.S. | | | | 1 | (13) | 2 | 3 |
| | Total of 2. | | | | | 7 | (139) | 20 | 27 |
| 3. Annual reserve for replacement of gate | | | | | | | | | |
| | - Annual reserve, replac. cycle = 20 years (1 gate = US\$ 21,000 + Birr 17,000) | no. | 1,050 | (850) | 3 | 3 | (3) | 0 | 3 |
| | Total of (1-3.) | | | | | 10 | (201) | 30 | 40 |

Note: *1) - Price level, June 1997. US\$ 1.0 = Birr 6.8 = J.Yen 114.7
 - Unit price includes tax.
 *2) - The quantities are estimated on annual basis.

Table 9.2.10 Breakdown of O&M Cost for Non-structural Measures

| No. | Item | Unit | Unit price ^{*1} | | Qty ^{*2} | Amount (x 1,000) | | | |
|--|---|--------|--------------------------|----------------|-------------------|------------------|-------------------------------------|-----------------|----|
| | | | F.C. (US\$) | L.C. (Birr) | | F.C. (US\$) | L.C. (Birr) equivalent (US\$) | Total (US\$) | |
| 1. Common expenses | | | | | | | | | |
| 1) Personnel cost | | | | | | | | | |
| | - 9 staffs x 12 months | M/M | 0 | (1,000) | 108 | 0 | (108) | 16 | 16 |
| 2) Vehicle running cost | | | | | | | | | |
| | - O&M cost for 1 vehicle | unit/M | 0 | (600) | 12 | 0 | (7) | 1 | 1 |
| | - Wage of driver | M/M | 0 | (900) | 12 | 0 | (11) | 2 | 2 |
| | Sub-total of 2) | | | | | 0 | (18) | 3 | 3 |
| | Sub-total of 1) - 2) | | | | | 0 | (126) | 19 | 19 |
| | 3) Others | L.S. | 10% | 10% | | 0 | (13) | 2 | 2 |
| | Total of 1. | | | | | 0 | (139) | 20 | 20 |
| 2. O&M of non-structural measures | | | | | | | | | |
| | - Maintenance of stakes, @10m. both sides | m | 0 | (30) | 368 | 0 | (12) | 2 | 2 |
| | - Maintenance of flood warning system | L.S. | 900 | (9400) | 1 | 1 | (9) | 1 | 2 |
| | - Maintenance of flood fighting system | L.S. | 5 | (2500) | 1 | 0 | (3) | 0 | 0 |
| | - Publicity of bylaw | no. | 0 | (10) | 2,000 | 0 | (20) | 3 | 3 |
| | - Poster of River Festival | no. | 0 | (100) | 50 | 0 | (5) | 1 | 1 |
| | - Others | L.S. | | | | 0 | (5) | 1 | 1 |
| | Total of 2. | | | | | 1 | (53) | 8 | 9 |
| | Total of (1.-2.) | | | | | 1 | (192) | 28 | 29 |

Note: *1) - Price level: June 1997, US\$ 1.0 = Birr 6.8 = J.Yen 114.7

- Unit price includes tax.

*2) - The quantities are estimated on annual basis.

**THE STUDY ON ADDIS ABABA
FLOOD CONTROL PROJECT**

CHAPTER 10

**SOCIAL AND
ENVIRONMENTAL
IMPACT ASSESSMENT**

**THE STUDY
ON
ADDIS ABABA FLOOD CONTROL PROJECT
IN
THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA**

CHAPTER 10 SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT

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10. SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT

10.1 General

Environmental impact assessment of the priority projects is prepared on the basis of the draft Environmental Impact Assessment Guideline prepared by the Environmental Protection Authority of the Federal Democratic Republic of Ethiopia and in consideration of the JICA guideline for the environmental impact consideration for development projects. The details on the said Environmental Impact Assessment Guideline are presented in the subsequent sections.

10.2 Legal Situation on Environmental Impact Assessment

The Environmental Policy of Ethiopia (EPE) was issued in April 2, 1997 by Secretariat for the Conservation Strategy of Ethiopia, Environmental Protection Authority in collaboration with the Ministry of Economic Development and Cooperation.

Following the approval of the said policy, preparation for the legislation of related regulations has been conducted by the Environmental Protection Authority, Federal Democratic Republic of Ethiopia.

As of December, 1997, the draft Environmental Impact Assessment Guideline has been prepared. This consists of the Volume I : Procedural Guideline, Volume II : EIA Guideline for Industrial Sector Development Projects, Volume III : EIA Guideline for Agricultural Sector Development Projects, Volume IV : EIA Guideline for Transport Sector Development Projects.

Volume V : EIA guideline for Mining is now under preparation. EIA guideline for flood control sector development projects is not prepared but EIA guideline for Dams and Reservoirs are now under preparation.

The coming procedures for the legislation of the environmental impact assessment are:

- to pass through workshop(s) by concerned agencies,
- to pass through the Environmental Council,
- to pass through the Council of Ministers.

It is expected that the legislation of some of the above-mentioned guidelines be achieved within one year if everything goes smoothly. Accordingly the priority projects will have to go through this environmental impact assessment on its implementation stage.

10.3 The Outline of the Guideline for Environmental Impact Assessment

10.3.1 Procedural Guideline

The general flow of procedure specified in the said draft procedural guideline is as follows:

- (1) Initial screening should be conducted by the proposed project proponent and the Initial Environmental Impact Statements (IEIS) should be submitted to the Competent Agency for review.
- (2) The Competent Agency shall make its decision regarding revision, exemption, or conducting detailed study.
- (3) When detailed study on environmental impact assessment is requested by the Competent Agency, the project proponent shall prepare TOR for the study and the TOR should be submitted to the Competent Agency for approval.
- (4) Based on the approved TOR, the project proponent should conduct the Environmental Impact Study on its own cost and the result report "Environmental Impact Statement (EIS)" should be submitted to the Competent Agency.
- (5) The Competent Agency shall review the EIS in consultation with other concerned and interested bodies. The consulted bodies shall submit their comments to the Competent Agency.
- (6) The Competent Agency shall provide the project proponent with a clear statement of rejection or conditions attached with granting of Environmental Clearance Certificate.

10.3.2 Environmental Impact Statement

The said Environmental Impact Statement should include the following:

- 1) Potential impacts of the proposed projects
- 2) Significance of the impacts
- 3) Alternatives for mitigating the likely adverse impacts and the costs
- 4) Management plan to mitigate negative impacts
- 5) Economic evaluation of environmental costs and benefits
- 6) Detailed plan to monitor the implementation of mitigative measures

10.3.3 Sectoral Guideline

According to the said Sectoral Guidelines, the following are the common checklists for screening projects:

- 1) Will it cause pollution on water, air, or soil ?
- 2) Will it cause erosion and sedimentation ?
- 3) Will it cause waste problems ?
- 4) Will it affect areas with conservation-worthy objects or landscape ?
- 5) Will it affect areas with conservation-worthy fauna or flora or other especially vulnerable ecosystems ?
- 6) Will it affect cultural and/or historical monuments or relics ?
- 7) Will it change the people way of life ?
- 8) Will it lead to increased risk of infections and diseases and/or medication ?
- 9) Will it cause hydrological impacts ?
- 10) Will it cause adverse socio-economic impacts ?
- 11) Will it contain a risk for accidents with serious consequences for the population and nature ?
- 12) Will it cause conflicts based on access to land ?
- 13) Will it prevent or cause changes to the local population's use of other natural resources and areas than those directly affected by the project ?

10.4 Social and Environmental Impact Assessment

The present conditions of the priority projects area are described in chapter 2 from the social and environmental view points. Based on that present social and environmental conditions of the project area and the major features of the priority projects and the construction plan, and based on the above-mentioned guideline for environmental impact assessment, the following assessment is conducted:

10.4.1 Positive Impacts

(1) Overall

The project is evaluated to have only positive impacts to the society during the operation stage since the project mitigates the habitual inundation conditions in the objective area reducing the inundation damage and accordingly reducing the possibility of infection to diseases and contributing to the cleanness of the city.

(2) Creation of Job Opportunity

Positive impact is also expected during the construction stage of the project. The project implementation will create job opportunity to local people. According to the construction plan, approximately 60,000 man-day labors including machine operators will be needed for the construction during the construction period of about 2 years..

10.4.2 Negative Impacts

Conceivable negative impacts are expected only during the construction stage. The following are the conceivable negative impacts of the project and the mitigative measures :

(1) Resettlement

One of the conceivable important negative impact by the priority projects is resettlement mainly for the construction of the Kechene weir. Approximately 4 houses will be needed to move to other place since those houses area will be submerged during the design flood for retention function of the weir.

The compensation method is already established for resettlement. The land and houses should be prepared by the responsible agency. The responsible agency for the resettlement for this project is Addis Ababa Flood Control and Prevention Project Office. Since the number of resettlement is very limited, it is expected that the resettlement will be smoothly conducted in time.

(2) Air Pollution

One of the negative impacts is air pollution by the passage of dump trucks to transport the excavated soil to disposal area. It was observed that the passage of dump trucks for the construction of the Sheraton Hotel raised a cloud of dust. The excavation work was only for laying the drainage ditch and pipes for the length of about 300 m. The mitigation measure to this is watering on the road. The countermeasure should be adopted for implementation of the priority projects. The necessary length of the road to be watered is estimated at about 500 m from the loading site.

(3) Traffic Disturbance

Other negative impact by the priority projects during the constructions stage will be the disturbance of the traffic. The passage of heavy vehicles between the construction site and disposal area, between the construction site and mixed concrete plant may create the heavy traffic volume along the road. The traffic volume for dumping soil is estimated at about 4,500 car-days. The traffic volume for transporting ready-mixed concrete by mixer car for the construction of Kechene weir is estimated at about 3,100 cars.

In addition, the construction of the drainage ditch across main streets is also planned in the projects. The planned streets for the said structures are the Churchil Avenue, the Menili II Avenue, the Ras Danitew Street, the Yohanis Street, Ras Mekonin Avenue, and they have usually heavy volume of traffic. But those streets have more than 4 lanes and it is possible to avoid one way traffic during the construction of the facilities. Traffic control during the construction stage should be conducted with the cooperation of the traffic police.

During the construction stage of the Kechene weir, the foundation works may cause some increase of sediment in the Kechene river. But since the basic river-bed material is rock, the volume of sediment to be increased by the construction works is estimated to be limited.

10.4.3 Others

The consideration to the other features is made as follows:

(1) Impact to Conservation-worthy Objects or Landscape

Presently there exist no conservation-worthy objects or landscape along the objective reaches of the river. No impact is expected.

(2) Impact to Conservation-worthy Flora or fauna

Presently there exist no conservation-worthy flora or fauna along the objective reaches of the river. No impact is expected.

(3) Impact to Ecosystem

Presently there exist no conservation-worthy ecosystem along the objective reaches of the river. No impact is expected.

(4) Impact to Cultural and/or Historical Monuments or Relics

Presently there exist no cultural and/or historical monuments or relics along the objective reaches of the river. No impact is expected.

(5) Impact to Increase of Infections and Diseases and/or Medication

As mentioned in the section of overall, the project may contribute to decrease of the infections and diseases since the inundation conditions will be decreased by the project.

(6) Impact to the People Way of Life

After the construction, the river water can be used again for washing clothes at the Kechene weir site. The water storing at the site during a flood continues only for several hours. The project is estimated that it will not change the people way of life.

(7) Hydrological Impacts

It is generally said that mitigation of flood at some place may cause increase of flood at downstream sites. This project aims at mitigation of flood peak before entering into the urban area of Addis Ababa. Accordingly the project will not cause any increase of flood at downstream reaches.

(8) Impact to Others

The project is evaluated that it will not cause any adverse effect to the features other than those mentioned in the above.