

**TABLA G.3.5 COSTO UNITARIO DE OBRAS DE TIERRA
Y ENCESPEDAMIENTO**

| Code 38 Excavation (sandy soil) 100 m ³ | | | | | | | |
|--|------|------|---------------|---------------|---------------|---------------|---------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| 0.6 m ³ Backhoe | hour | 3.14 | 16.73 | 256.40 | 52.51 | 804.77 | 857.28 |
| Common Labor | man | 1.50 | 20.00 | 0.00 | 30.00 | 0.00 | 30.00 |
| Total | | | | | 82.51 | 804.77 | 887.28 |
| Unit Price | | | | | 0.83 | 8.05 | 8.87 |
| Unit Cost | | | | | 1.03 | 10.06 | 11.09 |
| L/C : F/C | | | | | 0.09 | 0.91 | 1.00 |

| Code 38-1 Banking(sandy soil) 100 m ³ -Transport. & Compac.(L=200m) | | | | | | | |
|--|------|------|---------------|---------------|---------------|----------------|----------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| 11 t Dump Truck | hour | 6.23 | 4.86 | 191.1 | 30.28 | 1190.37 | 1220.64 |
| 15t. Bulldozer | hour | 2.32 | 17.19 | 311.59 | 39.88 | 722.89 | 762.77 |
| Common Labor | man | 1.50 | 20.00 | 0.00 | 30.00 | 0.00 | 30.00 |
| Total | | | | | 100.16 | 1913.25 | 2013.41 |
| Unit Price | | | | | 1.00 | 19.13 | 20.13 |
| Unit Cost | | | | | 1.25 | 23.92 | 25.17 |
| L/C : F/C | | | | | 0.05 | 0.95 | 1.00 |

| Code 42 Spoiling (0.60m ³ backhoe+11t dump truck L:1km) (river works) | | | | | | | |
|--|------|------|---------------|---------------|---------------|----------------|----------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| 11t Dump truck | hour | 7.69 | 4.86 | 191.07 | 37.38 | 1469.77 | 1507.15 |
| 15t Bulldozer | hour | 2.22 | 17.19 | 311.59 | 38.20 | 692.42 | 730.62 |
| Common labor | L.S. | 0.50 | 20.00 | 0.00 | 10.00 | 0.00 | 10.00 |
| Total | | | | | 85.58 | 2162.19 | 2247.78 |
| Unit Price | | | | | 0.86 | 21.62 | 22.48 |
| Unit cost | | | | | 1.07 | 27.03 | 28.10 |
| L/C : F/C | | | | | 0.04 | 0.96 | 1.00 |

| Code 39 Filling (bulldozer:L=60m) 100 m ³ (river works) | | | | | | | |
|--|------|------|---------------|---------------|---------------|----------------|----------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| 15t Bulldozer | hour | 3.43 | 17.19 | 311.59 | 58.89 | 1067.45 | 1126.34 |
| 15t Bulldozer | hour | 2.32 | 17.19 | 311.59 | 39.86 | 722.44 | 762.30 |
| Common labor | L.S. | 3.00 | 20.00 | 0.00 | 60.00 | 0.00 | 60.00 |
| Total | | | | | 158.75 | 1789.90 | 1948.64 |
| Unit Price | | | | | 1.59 | 17.90 | 19.49 |
| Unit Cost | | | | | 1.98 | 22.37 | 24.36 |
| L/C : F/C | | | | | 0.08 | 0.92 | 1.00 |

| Code 40 Excavation and pushing (swamp bulldozer:L=60m) 100 m ³ (river works) | | | | | | | |
|---|------|------|---------------|---------------|---------------|----------------|----------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| 16t Bulldozer | hour | 6.47 | 17.24 | 316.25 | 111.59 | 2047.06 | 2158.65 |
| 13t Bulldozer | hour | 3.17 | 16.64 | 250.98 | 52.73 | 795.40 | 848.13 |
| Foreman | m/d | 1.00 | 75.00 | 0.00 | 75.00 | 0.00 | 75.00 |
| Common labor | L.S. | 3.00 | 20.00 | 0.00 | 60.00 | 0.00 | 60.00 |
| Total | | | | | 299.33 | 2842.46 | 3141.78 |
| Unit Price | | | | | 2.99 | 28.42 | 31.42 |
| Unit Cost | | | | | 3.74 | 35.53 | 39.27 |
| L/C : F/C | | | | | 0.10 | 0.90 | 1.00 |

| Code 16 Sodding on slope 100 m ² | | | | | | | |
|---|------|-------|---------------|---------------|---------------|---------------|---------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Turf | sq.m | 100.0 | 0.50 | 0.00 | 50.00 | 0.00 | 50.00 |
| Forman | m/d | 1.0 | 75.00 | 0.00 | 75.00 | 0.00 | 75.00 |
| Common labor | m/d | 24.00 | 20.00 | 0.00 | 480.00 | 0.00 | 480.00 |
| Miscellaneous | L.S. | | | | 21.20 | 0.00 | 21.20 |
| Total | | | | | 626.20 | 0.00 | 626.20 |
| Unit Price | | | | | 6.26 | 0.00 | 6.26 |
| Unit Cost | | | | | 7.83 | 0.00 | 7.83 |
| L/C : F/C | | | | | 1.00 | 0.00 | 1.00 |

TABLA G.3.6 COSTO UNITARIO DE REVESTIMIENTO, GAVION Y OBRAS DE TABLESTACAS (1)

| Code 37 - 1 | | Concrete Base of Revetment(H=1.25m, T=0.5m, L=1.0m) | | | | | |
|----------------|------|--|---------------|---------------|---------------|---------------|---------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Excavallon | cu.m | 0.95 | 7.88 | 25.6 | 7.49 | 24.33 | 31.82 |
| Concrete | cu.m | 0.28 | 176.85 | 76.44 | 49.52 | 21.40 | 70.92 |
| Cobblestone | cu.m | 0.14 | 70.00 | 0.00 | 9.80 | 0.00 | 9.80 |
| Form | sq.m | 1.10 | 40.72 | 10.5 | 44.79 | 11.58 | 56.38 |
| Filling gravel | cu.m | 0.53 | 65.00 | 0.00 | 34.45 | 0.00 | 34.45 |
| Foreman | m/d | 0.10 | 75.00 | 0.00 | 7.50 | 0.00 | 7.50 |
| Common labor | m/d | 1.14 | 20.00 | 0.00 | 22.80 | 0.00 | 22.80 |
| Total | | | | | 176.35 | 57.32 | 233.66 |
| Unit cost | | | | | 220.43 | 71.64 | 292.08 |
| L/C : F/C | | | | | 0.75 | 0.25 | 1.00 |

| Code 37 - 2 | | Concrete diaphragm foot for Revetment (H=1.25m, T=0.5 - 0.75m, L=1.0m) | | | | | |
|--------------|------|---|---------------|---------------|---------------|---------------|---------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Excavation | cu.m | 3.47 | 33.78 | 14.0 | 117.22 | 48.68 | 165.90 |
| Concrete | cu.m | 0.34 | 176.85 | 76.44 | 60.13 | 25.99 | 86.12 |
| Cobblestone | cu.m | 0.15 | 70.00 | 0.00 | 10.50 | 0.00 | 10.50 |
| Form | sq.m | 1.15 | 40.72 | 10.5 | 46.83 | 12.11 | 58.94 |
| Foreman | m/d | 0.02 | 75.00 | 0.00 | 1.50 | 0.00 | 1.50 |
| Common labor | m/d | 0.52 | 20.00 | 0.00 | 10.40 | 0.00 | 10.40 |
| Total | | | | | 246.57 | 86.78 | 333.36 |
| Unit cost | | | | | 308.22 | 108.48 | 416.70 |
| L/C : F/C | | | | | 0.74 | 0.26 | 1.00 |

| Code 37 - 3 | | Wet masonry with cobble for Revetment (H=5.1m, Slope length=13.4m/m) | | | | | |
|--------------|------|--|---------------|---------------|---------------|---------------|----------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Excavation | cu.m | 7.37 | 42.23 | 17.5 | 311.24 | 129.27 | 440.50 |
| Concrete | cu.m | 0.44 | 176.85 | 76.44 | 77.81 | 33.63 | 111.45 |
| Cobblestone | cu.m | 3.19 | 70.00 | 0.00 | 223.30 | 0.00 | 223.30 |
| Pit sand | cu.m | 2.01 | 35.00 | 0.00 | 70.35 | 0.00 | 70.35 |
| Mason | m/d | 4.82 | 30.00 | 0.00 | 144.72 | 0.00 | 144.72 |
| Common labor | m/d | 5.63 | 20.00 | 0.00 | 112.56 | 0.00 | 112.56 |
| Total | | | | | 939.98 | 162.90 | 1102.88 |
| Unit cost | | | | | 1174.97 | 203.63 | 1378.60 |
| L/C : F/C | | | | | 0.85 | 0.15 | 1.00 |

| Code 37 | | Revetment (per 201sq.m) | | | | | |
|----------------|------|-------------------------|---------------|---------------|-----------------|----------------|-----------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Diaphragm wall | m | 15.00 | 220.43 | 71.64 | 3306.49 | 1074.67 | 4381.16 |
| Foot wall | m | 15.00 | 308.22 | 108.48 | 4623.26 | 1627.18 | 6250.44 |
| Wet masonry | m | 14.00 | 1174.97 | 203.63 | 16449.63 | 2850.81 | 19300.44 |
| Others | L.S. | 1.00 | | | 4400.00 | 0.00 | 4400.00 |
| Total | sq.m | 201.00 | | | 28779.38 | 5552.66 | 34332.04 |
| Unit cost | sq.m | 1.00 | | | 143.18 | 27.03 | 170.21 |
| L/C : F/C | | | | | 0.87 | 0.13 | 1.00 |

TABLA G.3.6 COSTO UNITARIO DE REVESTIMIENTO, GAVION Y OBRAS DE TABLESTACAS (2)

| Cuc 10 | | Gablon(box type)2.00m-1.00m-1.00m | | | | | |
|--------------|-------|-----------------------------------|---------------|---------------|---------------|---------------|---------------|
| Item | Unit | Qty | Unit price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Gablon | ps | 1.00 | 0.00 | 133.92 | 0.00 | 133.92 | 133.92 |
| Cobble | cu.m | 1.80 | 40.00 | 0 | 72.00 | 0.00 | 72.00 |
| Common labor | m/d | 2.20 | 20.00 | 0.00 | 44.00 | 0.00 | 44.00 |
| Total | | | | | 116.00 | 133.92 | 249.92 |
| Unit cost | | | | | 145.00 | 167.40 | 312.40 |
| Unit cost | 1 cm3 | | | | 72.50 | 83.70 | 156.20 |
| L/C : F/C | | | | | 0.46 | 0.54 | 1.00 |

| Code 32 - 1 | | Sheet pile II type L=4m, Width=40cm (N<22, 30kw vibrohammer) | | | | | |
|-------------------|------|---|---------------|---------------|---------------|----------------|----------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Sheet pile | m | 4.00 | 0.00 | 323.14 | 0.00 | 1292.54 | 1292.54 |
| 30kw vib.hammer | hrs | 0.15 | 0.88 | 121.14 | 0.13 | 18.21 | 18.34 |
| 25-27t Craw.crane | hrs | 0.15 | 19.06 | 397.16 | 2.86 | 59.69 | 62.56 |
| 10t Truck crane | hrs | 0.15 | 17.31 | 205.66 | 2.60 | 30.91 | 33.51 |
| 100KVA Generter | hrs | 0.15 | 6.02 | 79.36 | 0.90 | 11.93 | 12.83 |
| Formman | m/d | 0.02 | 75.00 | 0.00 | 1.76 | 0.00 | 1.76 |
| Scaffolder | m/d | 0.14 | 30.00 | 0.00 | 4.23 | 0.00 | 4.23 |
| Common labor | m/d | 0.07 | 20.00 | 0.00 | 1.41 | 0.00 | 1.41 |
| Subtotal | | | | | 13.90 | 1413.28 | 1427.18 |
| Miscellaneous | L.S. | | | | 0.42 | 42.40 | 71.36 |
| Total | | | | | 14.32 | 1455.7 | 1498.5 |
| Unit cost | m | 0.40 | | | 17.90 | 1819.60 | 1837.50 |
| Unit cost | m2 | 1.00 | | | 11.19 | 1137.25 | 1148.43 |
| L/C : F/C | | | | | 0.01 | 0.99 | 1.00 |
| | | | | | | | say 1,150/m2 |

| Code 32 - 2 | | Sheet pile III type L=4m, Width=40cm (N<22, 30kw vibrohammer) | | | | | |
|-------------|----|--|--|--|-------|---------|--------------|
| Unit cost | m2 | 1.00 | | | 14.10 | 1433.92 | 1448.03 |
| L/C : F/C | | | | | 0.01 | 0.99 | 1.00 |
| | | | | | | | say 1,450/m2 |

TABLA G.3.7 COSTO UNITARIO COMPUESTO DE ESTRUCTURAS DE CONTROL DE INUNDACION (1)

| Cuc 15 | | Concrete box culvert 3-3-10m-2 L=10m | | | | | |
|------------------|------|--------------------------------------|------------|---------|----------|----------|-----------|
| Item | Unit | Qty | Unit price | | Estimate | | |
| | | | L/C | F/C | L/C | F/C | |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | |
| Concrete | cu.m | 62.00 | 186.84 | 79.44 | 11584.08 | 4925.28 | 16509.36 |
| Foundation work | cu.m | 13.00 | 149.5 | 0 | 1943.50 | 0.00 | 1943.50 |
| Wooden form | sq.m | 199.00 | 101.40 | 12.70 | 20178.60 | 2527.30 | 22705.90 |
| Supporting | cu.m | 180.00 | 69.26 | 15.11 | 12466.80 | 2719.80 | 15186.60 |
| Deformed bar | kg | 5580.00 | 2.06 | 1.64 | 11466.90 | 9123.30 | 20590.20 |
| Steel wire 4mm | kg | 37.20 | 0.00 | 7.32 | 0.00 | 272.30 | 272.30 |
| Concrete pile 5m | ps | 25.00 | 999.64 | 1015.00 | 24991.00 | 25375.00 | 50366.00 |
| Excavation | cu.m | 65.00 | 33.78 | 14.03 | 2195.70 | 911.95 | 3107.65 |
| Banking | cu.m | 130.00 | 2.25 | 26.75 | 292.50 | 3477.50 | 3770.00 |
| Subtotal | | | | | 85119.08 | 49332.43 | 134451.51 |
| Others | | | | | 340.48 | 197.33 | 6722.58 |
| Total | | | | | 85459.56 | 49529.76 | 141174.09 |
| Unit price | | | | | 1378.38 | 798.87 | 14117.41 |
| Unit cost | | | | | 1722.98 | 998.58 | 2721.56 |
| L/C : F/C | | | | | 0.56 | 0.44 | 1.00 |

| Cuc 16 | | T beam bridge (L=10m, W=5.5m) (design load 20 ton) | | | | | |
|--|------|--|------------|---------|-----------|-----------|-----------|
| Item | Unit | Qty | Unit price | | Estimate | | |
| | | | L/C | F/C | L/C | F/C | |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | |
| Concrete abutment (H=5m, W=5.5m) | | | | | | | |
| Concrete | cu.m | 85.30 | 176.85 | 76.44 | 15085.31 | 6520.33 | 21605.64 |
| Foundation work | cu.m | 13.00 | 149.50 | 0 | 1943.50 | 0.00 | 1943.50 |
| Wooden form | sq.m | 145.20 | 77.50 | 11.60 | 11253.00 | 1684.32 | 12937.32 |
| Supporting | cu.m | 35.00 | 62.06 | 3.81 | 2172.10 | 133.35 | 2305.45 |
| Deformed bar | kg | 300.72 | 2.06 | 1.64 | 617.98 | 491.68 | 1109.66 |
| Steel wire 4mm | kg | 1.50 | 0.00 | 7.32 | 0.00 | 10.98 | 10.98 |
| Concrete pile 5m | ps | 33.00 | 999.64 | 1015.00 | 32988.12 | 33495.00 | 66483.12 |
| Excavation | cu.m | 52.00 | 33.78 | 14.03 | 1756.56 | 729.56 | 2486.12 |
| Banking | cu.m | 52.50 | 2.25 | 26.75 | 118.13 | 1404.38 | 1522.50 |
| Subtotal | | | | | 65934.69 | 44469.59 | 110404.28 |
| 2 Abutments | | | | | 131869.38 | 88939.19 | 220808.57 |
| T-Beam bridge(L=10m, W=5.5m) | | | | | | | |
| Concrete(rein.) | cu.m | 51.48 | 186.84 | 79.44 | 9618.52 | 4089.57 | 13708.09 |
| Deformed bar | kg | 7722.00 | 2.06 | 1.64 | 15868.71 | 12625.47 | 28494.18 |
| Steel wire 4mm | kg | 38.61 | 0.00 | 7.32 | 0.00 | 282.63 | 282.63 |
| Wooden form | sq.m | 147.20 | 101.40 | 12.70 | 14926.08 | 1869.44 | 16795.52 |
| Supporting | cu.m | 220.00 | 69.26 | 15.11 | 15237.20 | 3324.20 | 18561.40 |
| Subtotal | | | | | 55650.51 | 22191.31 | 77841.82 |
| Newel post(4 post) H=1.3m, W=0.6M | | | | | | | |
| Concrete | cu.m | 1.88 | 176.85 | 76.44 | 332.48 | 143.71 | 476.19 |
| Wooden form | sq.m | 12.40 | 40.72 | 10.53 | 504.93 | 130.57 | 635.50 |
| Foundation work | cu.m | 1.52 | 149.50 | 0 | 227.24 | 0.00 | 227.24 |
| Subtotal | | | | | 1064.65 | 274.28 | 1338.93 |
| Handrall L=10m, H=0.8m | | | | | | | |
| Concrete(rein.) | cu.m | 2.60 | 186.84 | 79.44 | 485.78 | 206.54 | 692.33 |
| Deformed bar | kg | 780.00 | 2.06 | 1.64 | 1602.90 | 1275.30 | 2878.20 |
| Steel wire 4mm | kg | 3.90 | 0.00 | 7.32 | 0.00 | 28.55 | 28.55 |
| Wooden form | sq.m | 32.00 | 40.72 | 10.53 | 1303.04 | 336.96 | 1640.00 |
| Subtotal | | | | | 3391.72 | 1847.35 | 5239.08 |
| Total | sq.m | 55.00 | | | 191976.26 | 113252.13 | 305228.39 |
| per 1 sq.m | sq.m | 1.00 | | | 3490.48 | 2059.13 | 5549.61 |
| Unit cost | sq.m | 1.00 | | | 4363.10 | 2573.91 | 6937.01 |
| L/C : F/C | | | | | 0.63 | 0.37 | 1.00 |

TABLA G.3.7 COSTO UNITARIO COMPUESTO DE ESTRUCTURAS DE CONTROL DE INUNDACION (2)

| Cuc 19 | | Small reinforced concrete structure 1.0 m ³ (steel bar=40kg/cu.m) (Pier,etc.) | | | | | |
|-----------------|------|---|------------|--------|----------|--------|---------|
| Item | Unit | Qty | Unit price | | Estimate | | Total |
| | | | L/C | F/C | L/C | F/C | |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | (Lps.) |
| Concrete(rein.) | cu.m | 1.00 | 186.84 | 79.44 | 186.84 | 79.44 | 266.28 |
| Deformed bar | kg | 40.00 | 2.06 | 1.64 | 82.20 | 65.40 | 147.60 |
| Wooden form | sq.m | 2.66 | 101.40 | 12.70 | 269.72 | 33.78 | 303.51 |
| Foundation work | cu.m | 0.50 | 149.50 | 0 | 74.75 | 0.00 | 74.75 |
| Excavation | cu.m | 0.75 | 33.78 | 14.03 | 25.34 | 10.52 | 35.86 |
| Total | | | | | 638.85 | 189.14 | 827.99 |
| Unit cost | | | | | 798.56 | 236.43 | 1034.99 |
| L/C : F/C | | | | | 0.77 | 0.23 | 1.00 |

| Cuc 20 | | Weir Type structure 1.0 m ³ (steel bar=5kg/cu.m) (Gravity type abutment, etc.) | | | | | |
|-----------------|------|--|------------|--------|----------|--------|--------|
| Item | Unit | Qty | Unit price | | Estimate | | Total |
| | | | L/C | F/C | L/C | F/C | |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | (Lps.) |
| Concrete(rein.) | cu.m | 1.00 | 186.84 | 79.44 | 186.84 | 79.44 | 266.28 |
| Deformed bar | kg | 5.00 | 2.06 | 1.64 | 10.28 | 8.18 | 18.45 |
| Wooden form | sq.m | 1.60 | 101.40 | 12.70 | 162.24 | 20.32 | 182.56 |
| Foundation work | cu.m | 0.50 | 149.50 | 0 | 74.75 | 0.00 | 74.75 |
| Excavation | cu.m | 1.25 | 33.78 | 14.03 | 42.23 | 17.54 | 59.76 |
| Total | | | | | 476.33 | 125.47 | 601.80 |
| Unit cost | | | | | 595.41 | 156.84 | 752.25 |
| L/C : F/C | | | | | 0.79 | 0.21 | 1.00 |

TABLA G.3.8 PRECIO UNITARIO DE ESCLUSA

US\$ 1.0 = Lps 6.2 = \110.0 in June 1993

| Code | a | b | n*Hw | 2.4(a*a+b*b) | D/E | SORT(ABS(Fn)) | t(cm) | W(ton) | 1,000 | Unit Price | Unit Price |
|-------|-----|-----|---------|--------------|-----------|---------------|-------|--------|-------|----------------------|-----------------------|
| | | | | | | | | | | \1000/m ² | Lps.(m ²) |
| G 060 | 60 | 60 | 0.00024 | 17280 | 1.369E-08 | 0.000117851 | 0.42 | 0.01 | 230 | 639 | 38,333 |
| G 080 | 80 | 80 | 0.00024 | 30720 | 7.813E-09 | 8.83883E-05 | 0.57 | 0.03 | 282 | 441 | 26,438 |
| G 100 | 100 | 100 | 0.00024 | 48000 | 5E-09 | 7.07107E-05 | 0.71 | 0.06 | 390 | 390 | 23,400 |
| G 125 | 125 | 100 | 0.00024 | 61500 | 3.902E-09 | 6.24695E-05 | 0.78 | 0.09 | 435 | 348 | 20,880 |
| G 125 | 125 | 125 | 0.00024 | 75000 | 3.2E-09 | 5.65885E-05 | 0.88 | 0.12 | 503 | 322 | 19,315 |
| G 150 | 150 | 100 | 0.00024 | 78000 | 3.077E-09 | 5.547E-05 | 0.83 | 0.11 | 490 | 327 | 19,600 |
| G 150 | 150 | 125 | 0.00024 | 91500 | 2.623E-09 | 5.12148E-05 | 0.96 | 0.16 | 595 | 317 | 19,040 |
| G 150 | 150 | 150 | 0.00024 | 108000 | 2.222E-09 | 4.71405E-05 | 1.06 | 0.21 | 632 | 281 | 16,853 Mean |
| G 175 | 175 | 150 | 0.00024 | 127500 | 1.882E-09 | 4.33861E-05 | 1.14 | 0.26 | 680 | 259 | 15,543 15000/m2 |
| G 175 | 175 | 175 | 0.00024 | 147000 | 1.633E-09 | 4.04061E-05 | 1.24 | 0.33 | 782 | 255 | 15,321 |
| G 175 | 175 | 200 | 0.00024 | 169500 | 1.416E-09 | 3.76288E-05 | 1.32 | 0.41 | 815 | 233 | 13,971 |
| G 200 | 200 | 150 | 0.00024 | 150000 | 1.6E-09 | 0.00004 | 1.20 | 0.32 | 790 | 263 | 15,800 |
| G 200 | 200 | 175 | 0.00024 | 169500 | 1.416E-09 | 3.76288E-05 | 1.32 | 0.41 | 836 | 239 | 14,331 Mean |
| G 200 | 200 | 200 | 0.00024 | 192000 | 1.25E-09 | 3.53553E-05 | 1.41 | 0.50 | 886 | 222 | 13,290 13000/m2 |

Note: Formula(Bach's)

$$t = a \cdot b \cdot \text{SORT}(\text{ABS}(\text{Fn}))$$

- t : gate skin plate thickness (cm)
- a : rectangular shorter side length (cm)
- b : rectangular longer side length (cm)
- SORT (ABS(Fn)) : value of square root on Fn
- Fn : $f \cdot Hw / (2 \cdot Tsa \cdot (a \cdot a + b \cdot b))$
- f : pressure factor 0.8
- Hw : hydraulic pressure 0.0003 ton/cm² (water depth h=3m)
- Tsa : allowable tensile stress 1.2 ton/cm²

TABLA G.3.9 COSTO UNITARIO COMPUESTO DE ESTRUCTURAS DE CONTROL DE ESCOMBROS (1)

(Exchange rates US\$1.0=Lps.6.2=1110, June in 1993)

Compound Unit Cost of Sabo (Check) Dam :Total Construction Cost /Total Concrete Volume of Sabo Dam
 17,207,768/15,604=1,103 (Ref.Jutosa Dam)
 14,587,026/13,197=1,105 (Ref.Majaina Dam)
 Say 1,100 /cu.m

1) CE - 1 Jutosa Dam (Rio Jutosa)

No. 1 Main Dam

| Name | Qty | Unit | Unit price | | Estimate | | Total |
|---------------------|-------|------|---------------|---------------|---------------|---------------|------------|
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Clearing | 4800 | cu.m | 2.81 | 0.00 | 13,488 | 0 | 13,488 |
| Excavation work | | | | | | | |
| Excavation(B) | 1702 | cu.m | 10.45 | 248.11 | 17,708 | 418,928 | 436,716 |
| Excavation(B) | 2837 | cu.m | 10.05 | 234.09 | 28,512 | 664,113 | 692,625 |
| Excavation(G) | 6809 | cu.m | 1.64 | 35.23 | 11,166 | 239,874 | 251,040 |
| Subtotal | 11348 | cu.m | | | 57,466 | 1,322,916 | 1,380,382 |
| Backfilling work | 4539 | cu.m | 2.93 | 35.16 | 13,300 | 159,598 | 172,898 |
| Spoil bank work | 6809 | cu.m | 4.08 | 68.62 | 27,780 | 467,220 | 495,000 |
| Boulder concrete w. | 13596 | cu.m | 255.16 | 202.08 | 3,469,155 | 2,747,480 | 6,216,635 |
| Form work | 6767 | sq.m | 96.84 | 14.49 | 655,316 | 98,054 | 753,370 |
| Support A (trans.) | 13534 | cu.m | 41.95 | 2.38 | 567,751 | 32,211 | 599,962 |
| Support B (racking) | 13534 | sq.m | 77.58 | 4.76 | 1,049,968 | 64,422 | 1,114,390 |
| Total | 13596 | cu.m | | | 5,854,225 | 4,891,900 | 10,746,125 |

No. 2 Sub-Dam

| Name | Qty | Unit | Unit price | | Estimate | | Total |
|---------------------|------|------|---------------|---------------|---------------|---------------|-----------|
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Excavation work | | | | | | | |
| Excavation(B) | 870 | cu.m | 10.05 | 234.09 | 8,745 | 203,682 | 212,428 |
| Excavation(G) | 1616 | cu.m | 1.64 | 35.23 | 2,650 | 56,928 | 59,578 |
| Subtotal | 2486 | cu.m | | | 11,395 | 260,610 | 272,004 |
| Backfilling work | 497 | cu.m | 2.93 | 35.16 | 1,457 | 17,482 | 18,938 |
| Spoil bank work | 1989 | cu.m | 4.09 | 68.62 | 8,134 | 136,471 | 144,606 |
| Boulder concrete w. | 864 | cu.m | 255.16 | 202.08 | 220,458 | 174,597 | 395,055 |
| Form work | 1133 | sq.m | 96.80 | 14.50 | 109,674 | 16,429 | 126,103 |
| Support A (trans.) | 2266 | cu.m | 41.95 | 2.38 | 95,059 | 5,393 | 100,452 |
| Support B (racking) | 2266 | sq.m | 77.58 | 4.76 | 175,796 | 10,788 | 186,582 |
| Total | 864 | cu.m | | | 621,973 | 621,768 | 1,243,741 |

No. 3 Slide Wall

| Name | Qty | Unit | Unit price | | Estimate | | Total |
|---------------------|------|------|---------------|---------------|---------------|---------------|---------|
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Excavation work | | | | | | | |
| Excavation(B) | 717 | cu.m | 10.05 | 234.09 | 7,204 | 167,798 | 175,000 |
| Excavation(G) | 1331 | cu.m | 1.64 | 35.23 | 2,183 | 46,898 | 49,081 |
| Subtotal | 2048 | cu.m | | | 9,387 | 214,694 | 224,081 |
| Backfilling work | 410 | cu.m | 2.93 | 35.16 | 1,200 | 14,402 | 15,602 |
| Spoil bank work | 1638 | cu.m | 4.08 | 68.62 | 6,685 | 112,427 | 119,112 |
| Boulder concrete w. | 370 | cu.m | 255.16 | 202.08 | 94,409 | 74,770 | 169,179 |
| Form work | 262 | sq.m | 96.80 | 14.50 | 25,362 | 3,799 | 29,161 |
| Support A (trans.) | 524 | cu.m | 41.95 | 2.38 | 21,982 | 1,247 | 23,229 |
| Support B (racking) | 524 | sq.m | 77.58 | 4.76 | 40,652 | 2,494 | 43,146 |
| Total | 370 | cu.m | | | 159,024 | 421,338 | 580,363 |

TABLA G.3.9 COSTO UNITARIO COMPUESTO DE ESTRUCTURAS DE CONTROL DE ESCOMBROS (2)

| No. 4 | | Apron | | Unit price | | Estimate | | Total |
|-----------------------------|--------------|----------------|----------|------------|------------------|------------------|-----|-------------------|
| Name | Qty | Unit | L/C | F/C | L/C | F/C | L/C | (Lps.) |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | | (Lps.) |
| Boulder concrete w. | 774 | cu.m | 255.16 | 202.08 | 197,494 | 156,410 | | 353,904 |
| Form work | 73 | sq.m | 50.90 | 13.16 | 3,716 | 961 | | 4,676 |
| Total | 774 | cu.m | | | 201,210 | 157,371 | | 358,580 |
| No. 5 | | Road works | | Unit price | | Estimate | | Total |
| Name | Qty | Unit | L/C | F/C | L/C | F/C | L/C | (Lps.) |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | | (Lps.) |
| Run-off road | 400.00 | m | 828.37 | 382.63 | 331,348 | 153,052 | | 484,400 |
| No. 6 | | Temporary Work | | Unit price | | Estimate | | Total |
| Name | Qty | Unit | L/C | F/C | L/C | F/C | L/C | (Lps.) |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | | (Lps.) |
| Cofferdam (H=1.5m) | 200 | m | 73.08 | 1118.52 | 14,612 | 223,704 | | 238,316 |
| Drainage | | | | | | | | |
| S.Pump 11kw | 2128.81 | hrs | 0.09 | 10.98 | 192 | 23,374 | | 23,566 |
| 35KVA Generat. | 2128.81 | hrs | 5.56 | 42.58 | 11,836 | 90,645 | | 102,481 |
| Foreman | 6.25 | m/d | 75 | 0 | 469 | 0 | | 469 |
| Common labor | 443.50 | m/d | 20 | 0 | 8,870 | 0 | | 8,870 |
| 4.81 tru.crane | 40.00 | hrs | 16.82 | 121.22 | 673 | 4,849 | | 5,522 |
| Subtotal | | | | | 22,039 | 118,868 | | 140,907 |
| Temporary road | 200 | m | 164.82 | 640.02 | 32,964 | 128,004 | | 160,968 |
| Concrete plants work | | | | | | | | |
| Staging | 4.00 | set | 10946.47 | 713.81 | 43,786 | 2,855 | | 46,641 |
| 4.81 tru.crane | 128.00 | hrs | 16.82 | 121.22 | 2,153 | 15,516 | | 17,669 |
| Forman | 10.00 | m/d | 75 | 0 | 750 | 0 | | 750 |
| Scaffolder | 10.00 | m/d | 30 | 0 | 300 | 0 | | 300 |
| Common labor | 50.00 | m/d | 20 | 0 | 1,000 | 0 | | 1,000 |
| Miscellaneous | | L.S. | | | 205 | 0 | | 205 |
| Subtotal | | | | | 48,194 | 18,371 | | 66,565 |
| Road Improvement | 2200.00 | m | 150.21 | 71.93 | 330,462 | 158,248 | | 488,708 |
| Road maintenance | 2200.00 | m | 220.02 | 47.37 | 484,044 | 104,214 | | 588,258 |
| Bank road malnte. | 8000.00 | m | 68.46 | 30.04 | 547,680 | 240,320 | | 788,000 |
| Others | 1.00 | L.S. | | | 787,491 | 535,346 | | 1,322,837 |
| Total | | | | | 2,267,488 | 1,527,073 | | 3,794,559 |
| Sum Total | 15604 | cu.m | | | 9,435,266 | 7,772,502 | | 17,207,768 |
| | | Unit Cos/cu.m | | | | | | 1,103 |
| | | L/C:F/C | | | 55 | 45 | | |

TABLA G.3.9 COSTO UNITARIO COMPUESTO DE ESTRUCTURAS DE CONTROL DE ESCOMBROS (3)

2) CE - 2 Majalme Dam (Rio Majalme)

| <u>No. 1</u> | | <u>Main Dam</u> | | | | | | |
|---------------------|--------------|-----------------|---------------|---------------|------------------|------------------|------------------|--|
| Name | Qty | Unit | Unit price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Clearing | 4400 | cu.m | 2.81 | 0.00 | 12,364 | 0 | 12,364 | |
| Excavation work | | | | | | | | |
| Excavation(B) | 3362 | cu.m | 10.05 | 234.09 | 33,793 | 787,116 | 820,909 | |
| Excavation(G) | 6245 | cu.m | 1.64 | 35.23 | 10,241 | 219,995 | 230,237 | |
| Subtotal | 9607 | cu.m | | | 44,034 | 1,007,111 | 1,051,145 | |
| Backfilling work | 3843 | cu.m | 2.93 | 35.16 | 11,259 | 135,113 | 146,372 | |
| Spill bank work | 5764 | cu.m | 4.08 | 68.62 | 23,518 | 395,538 | 419,057 | |
| Boulder concrete w. | 10982 | cu.m | 255.16 | 202.08 | 2,802,167 | 2,219,243 | 5,021,410 | |
| Form work | 5660 | sq.m | 96.80 | 14.50 | 547,888 | 82,070 | 629,958 | |
| Support A (trans.) | 11320 | cu.m | 41.95 | 2.38 | 474,874 | 26,942 | 501,816 | |
| Support B (racking) | 11320 | sq.m | 77.58 | 4.76 | 878,206 | 53,883 | 932,089 | |
| Total | 10982 | cu.m | | | 4,794,310 | 3,919,901 | 8,714,211 | |

| <u>No. 2</u> | | <u>Sub-Dam</u> | | | | | | |
|---------------------|------------|----------------|---------------|---------------|----------------|----------------|------------------|--|
| Name | Qty | Unit | Unit price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Excavation work | | | | | | | | |
| Excavation(B) | 964 | cu.m | 10.05 | 234.09 | 9,687 | 225,639 | 235,327 | |
| Excavation(G) | 1790 | cu.m | 1.64 | 35.23 | 2,936 | 63,065 | 66,001 | |
| Subtotal | 2754 | cu.m | | | 12,623 | 288,705 | 301,328 | |
| Backfilling work | 551 | cu.m | 2.93 | 35.16 | 1,614 | 19,366 | 20,980 | |
| Spill bank work | 2203 | cu.m | 4.09 | 68.62 | 9,011 | 151,164 | 160,195 | |
| Boulder concrete w. | 903 | cu.m | 255.16 | 202.08 | 230,409 | 182,478 | 412,888 | |
| Form work | 753 | sq.m | 96.80 | 14.50 | 72,890 | 10,919 | 83,809 | |
| Support A (trans.) | 1506 | cu.m | 41.95 | 2.38 | 63,177 | 3,584 | 66,761 | |
| Support B (racking) | 1506 | sq.m | 77.58 | 4.76 | 116,835 | 7,169 | 124,004 | |
| Total | 903 | cu.m | | | 506,560 | 663,404 | 1,169,964 | |

| <u>No. 3</u> | | <u>Slide Wall</u> | | | | | | |
|---------------------|------------|-------------------|---------------|---------------|----------------|----------------|----------------|--|
| Name | Qty | Unit | Unit price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Excavation work | | | | | | | | |
| Excavation(B) | 1017 | cu.m | 10.05 | 234.09 | 10,218 | 238,011 | 248,229 | |
| Excavation(G) | 1888 | cu.m | 1.64 | 35.23 | 3,097 | 66,523 | 69,620 | |
| Subtotal | 2905 | cu.m | | | 13,315 | 304,534 | 317,849 | |
| Backfilling work | 581 | cu.m | 2.93 | 35.16 | 1,702 | 20,428 | 22,130 | |
| Spill bank work | 2324 | cu.m | 4.08 | 68.62 | 9,482 | 159,473 | 168,955 | |
| Boulder concrete w. | 361 | cu.m | 255.16 | 202.08 | 92,113 | 72,951 | 165,064 | |
| Form work | 258 | sq.m | 96.80 | 14.50 | 24,974 | 3,741 | 28,715 | |
| Support A (trans.) | 516 | cu.m | 41.95 | 2.38 | 21,646 | 1,228 | 22,874 | |
| Support B (racking) | 518 | sq.m | 77.58 | 4.76 | 40,031 | 2,456 | 42,487 | |
| Total | 361 | cu.m | | | 203,264 | 564,811 | 768,075 | |

TABLA G.3.9 COSTO UNITARIO COMPUESTO DE ESTRUCTURAS DE CONTROL DE ESCOMBROS (4)

| No. 4 | | Apron | | | | | | |
|----------------------|------------|----------------|---------------|---------------|------------------|------------------|------------------|--|
| Name | Qty | Unit | Unit price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Boulder concrete w. | 951 | cu.m | 255.16 | 202.08 | 242,657 | 192,178 | 434,835 | |
| Form work | 82 | sq.m | 50.90 | 13.16 | 4,174 | 1,079 | 5,253 | |
| Total | 951 | cu.m | | | 246,831 | 193,257 | 440,088 | |
| No. 5 | | Road works | | | | | | |
| Name | Qty | Unit | Unit price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Run-off road | 400.00 | m | 828.37 | 382.63 | 331,348 | 153,052 | 484,400 | |
| No. 6 | | Temporary Work | | | | | | |
| Name | Qty | Unit | Unit price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Cofferdam (H=1.5m) | 200 | m | 73.06 | 1118.52 | 14,612 | 223,704 | 238,316 | |
| Drainage | | | | | | | | |
| S.Pump 1 tkw | 2457.59 | hrs | 0.09 | 10.98 | 221 | 26,984 | 27,205 | |
| 35KVA Generat. | 2457.59 | hrs | 5.56 | 42.58 | 13,664 | 104,644 | 118,308 | |
| Foreman | 5.00 | m/d | 75 | 0 | 375 | 0 | 375 | |
| Common labor | 512.00 | m/d | 20 | 0 | 10,240 | 0 | 10,240 | |
| 4.8t tru.crane | 32 | hrs | 16.82 | 121.22 | 538 | 3,879 | 4,417 | |
| Subtotal | | | | | 25,039 | 135,508 | 160,546 | |
| Temporary road | 200 | m | 164.82 | 640.02 | 32,964 | 128,004 | 160,968 | |
| Concrete plants work | | | | | | | | |
| Staging | 4.00 | set | 10946.47 | 713.81 | 43,786 | 2,855 | 46,641 | |
| 4.8t tru.crane | 48.00 | hrs | 18.82 | 121.22 | 807 | 5,819 | 6,626 | |
| Forman | 7.50 | m/d | 75 | 0 | 563 | 0 | 563 | |
| Scaffolder | 7.50 | m/d | 30 | 0 | 225 | 0 | 225 | |
| Common labor | 67.50 | m/d | 20 | 0 | 1,350 | 0 | 1,350 | |
| Miscellaneous | 1.00 | L.S. | | | 107 | 0 | 107 | |
| Subtotal | | | | | 46,838 | 8,674 | 55,511 | |
| Road Improvement | 1000.00 | m | 150.21 | 71.93 | 150,210 | 71,930 | 222,140 | |
| Road maintenance | 1000.00 | m | 220.02 | 47.37 | 220,020 | 47,370 | 267,390 | |
| Bank road(r) ment. | 8500.00 | m | 68.48 | 30.04 | 581,910 | 255,340 | 837,250 | |
| others | 1.00 | L.S. | | | 589,376 | 478,791 | 1,068,167 | |
| Total | | | | | 1,660,968 | 1,349,320 | 3,010,288 | |
| Sum Total | 13197 | cu.m | | | 7,743,281 | 6,843,748 | 14,587,029 | |
| | | Unit Cost/cu.m | | | | | 1,105 | |
| | | L/C:F/C | | | 53 | 47 | | |

TABLA G.3.10 COSTOS UNITARIOS DE ESTRUCTURAS DE CONTROL DE ESCOMBROS (1)

| Code 1 Site Clearing and Grubbing 100 m ² (sparse forest land) | | | | | | | | |
|---|------|------|---------------|---------------|---------------|---------------|---------------|--|
| Item | Unit | Qty | Unit Price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Foreman | m/d | 1.00 | 75.00 | 0.00 | 75.00 | 0.00 | 75.00 | |
| Labor | m/d | 7.50 | 20.00 | 0.00 | 150.00 | 0.00 | 150.00 | |
| Miscellaneous | L.S. | 1.00 | | | 0.00 | 0.00 | 0.00 | |
| Total | | | | | 225.00 | 0.00 | 225.00 | |
| Unit Price | | | | | 2.25 | 0.00 | 2.25 | |
| Unit Cost | | | | | 2.81 | 0.00 | 2.81 | |
| L/C : F/C | | | | | 1.00 | 0.00 | 1.00 | |

| Code 5 Rock Work (medium hard rock) 10 m ³ | | | | | | | | |
|---|------|------|---------------|---------------|---------------|----------------|----------------|--|
| Item | Unit | Qty | Unit Price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| 0.6 m ³ Backhoe | hour | 3.94 | 16.73 | 256.40 | 65.87 | 1009.58 | 1075.45 | |
| 1300 kg Breaker | hour | 3.15 | 0.47 | 152.66 | 1.48 | 480.88 | 482.36 | |
| 21t Bulldozer | hour | 0.87 | 18.71 | 495.29 | 16.26 | 430.37 | 446.62 | |
| Miscellaneous | L.S. | 1.00 | | | 0.00 | 48.09 | 48.09 | |
| Total | | | | | 83.61 | 1968.91 | 2052.52 | |
| Unit Price | | | | | 8.36 | 196.89 | 205.25 | |
| Unit Cost | | | | | 10.45 | 246.11 | 256.57 | |
| L/C : F/C | | | | | 0.04 | 0.96 | 1.00 | |

| Code 7 Rock Work (boulder) 10 m ³ (size : > 1.0 m) | | | | | | | | |
|---|------|------|---------------|---------------|---------------|----------------|----------------|--|
| Item | Unit | Qty | Unit Price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| 0.6 m ³ Backhoe | hour | 3.75 | 16.73 | 256.40 | 62.74 | 961.50 | 1024.24 | |
| 1300 kg Breaker | hour | 3.00 | 0.47 | 152.66 | 1.41 | 457.98 | 459.39 | |
| 21t Bulldozer | hour | 0.87 | 18.71 | 495.29 | 16.26 | 430.37 | 446.62 | |
| Miscellaneous | L.S. | 1.00 | | | 0.00 | 22.90 | 22.90 | |
| Total | | | | | 80.40 | 1872.75 | 1953.15 | |
| Unit Price | | | | | 8.04 | 187.27 | 195.32 | |
| Unit Cost | | | | | 10.05 | 234.09 | 244.14 | |
| L/C : F/C | | | | | 0.04 | 0.96 | 1.00 | |

| Code 8 Excavation (gravelly soil) 100 m ³ (for debris barrier) | | | | | | | | |
|---|------|------|---------------|---------------|---------------|----------------|----------------|--|
| Item | Unit | Qty | Unit Price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| 0.6 m ³ Backhoe | hour | 3.53 | 16.73 | 256.40 | 59.07 | 905.37 | 964.44 | |
| 21t Bulldozer | hour | 3.86 | 18.71 | 495.29 | 72.27 | 1913.06 | 1985.32 | |
| Total | | | | | 131.34 | 2818.42 | 2949.76 | |
| Unit Price | | | | | 1.31 | 28.18 | 29.50 | |
| Unit Cost | | | | | 1.64 | 35.23 | 36.87 | |
| L/C : F/C | | | | | 0.04 | 0.96 | 1.00 | |

| Code 11 Spoil Bank (earth and sand, L=10km) 100 m ³ | | | | | | | | |
|--|------|-------|---------------|---------------|---------------|----------------|----------------|--|
| Item | Unit | Qty | Unit Price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| 0.6 m ³ Backhoe | hour | 3.53 | 16.73 | 256.40 | 59.07 | 905.37 | 964.44 | |
| 11t Dump Truck | hour | 29.15 | 4.56 | 111.22 | 132.94 | 3242.57 | 3375.51 | |
| 15t Bulldozer | hour | 4.31 | 17.19 | 311.56 | 74.02 | 1341.55 | 1415.57 | |
| Common Labor | m/d | 3.00 | 20.00 | 0.00 | 60.00 | 0.00 | 60.00 | |
| Total | | | | | 326.04 | 5489.48 | 5815.52 | |
| Unit Price | | | | | 3.26 | 54.89 | 58.16 | |
| Unit Cost | | | | | 4.08 | 68.62 | 72.69 | |
| L/C : F/C | | | | | 0.06 | 0.94 | 1.00 | |

TABLA G.3.10 COSTOS UNITARIOS DE ESTRUCTURAS DE CONTROL DE ESCOMBROS (2)

| Code 13 | | Backfilling 100 m ³ (debris barrier) | | | | | |
|---------------------------|------|---|------------|--------|---------------|----------------|----------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C | F/C | L/C | F/C | |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | (Lps.) |
| 0.6m ³ Backhoe | hour | 3.14 | 16.73 | 256.40 | 52.51 | 804.77 | 857.28 |
| 15t Bulldozer | hour | 5.13 | 17.19 | 311.59 | 88.24 | 1599.54 | 1687.78 |
| Hand guide R. | hour | 7.94 | 4.26 | 51.48 | 33.81 | 408.57 | 442.38 |
| Common labor | m/d | 3.00 | 20.00 | 0.00 | 60.00 | 0.00 | 60.00 |
| Total | | | | | 234.56 | 2812.88 | 3047.45 |
| Unit Price | | | | | 2.35 | 28.13 | 30.47 |
| Unit Cost | | | | | 2.93 | 35.16 | 38.09 |
| L/C : F/C | | | | | 0.08 | 0.92 | 1.00 |

| Code 18 | | Formwork 10 m ² (for small structure) | | | | | |
|------------------------------|------|--|------------|--------|----------|--------|--------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C | F/C | L/C | F/C | |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | (Lps.) |
| Manufacture | | | | | | | |
| Plank lumber | cu.m | 0.16 | 1567.97 | 0.00 | 250.88 | 0.00 | 250.88 |
| Square lumder | cu.m | 0.20 | 1343.98 | 0.00 | 268.80 | 0.00 | 268.80 |
| Steel nail | kg | 2.00 | 0.00 | 10.58 | 0.00 | 21.16 | 21.16 |
| Carpenter | m/d | 4.50 | 30.00 | 0.00 | 135.00 | 0.00 | 135.00 |
| Earthworker | m/d | 4.50 | 25.00 | 0.00 | 112.50 | 0.00 | 112.50 |
| Subtotal: A | | | | | 767.17 | 21.16 | 788.33 |
| per one time: B | | | | | 255.72 | 7.05 | 262.78 |
| Framing and Stripping | | | | | | | |
| Spare lumber | cu.m | 0.01 | 1343.98 | 0.00 | 13.44 | 0.00 | 13.44 |
| Panel oil | lit. | 1.00 | 0.00 | 71.40 | 0.00 | 71.40 | 71.40 |
| Steel nail | kg | 1.50 | 0.00 | 10.58 | 0.00 | 15.87 | 15.87 |
| Steel wire | kg | 1.50 | 0.00 | 7.32 | 0.00 | 10.98 | 10.98 |
| Carpenter | m/d | 2.10 | 30.00 | 0.00 | 63.00 | 0.00 | 63.00 |
| Earthworker | m/d | 3.00 | 25.00 | 0.00 | 75.00 | 0.00 | 75.00 |
| Subtotal: C | | | | | 151.4 | 98.25 | 249.69 |
| Total(B+C) | | | | | 407.16 | 105.30 | 512.47 |
| Unit price | | | | | 40.72 | 10.53 | 51.25 |
| Unit cost | | | | | 50.90 | 13.16 | 64.06 |
| L/C : F/C | | | | | 0.79 | 0.21 | 1.00 |

| Code 19 | | Formwork 10 m ² (for debris barrier, abutment and pier) | | | | | |
|------------------------------|------|--|------------|--------|----------|--------|---------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C | F/C | L/C | F/C | |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | (Lps.) |
| Manufacture | | | | | | | |
| Plank lumber | cu.m | 0.20 | 1567.97 | 0.00 | 313.59 | 0.00 | 313.59 |
| Square lumder | cu.m | 0.35 | 1343.98 | 0.00 | 470.39 | 0.00 | 470.39 |
| Steel nail | kg | 2.50 | 0.00 | 10.58 | 0.00 | 26.45 | 26.45 |
| Carpenter | m/d | 5.25 | 30.00 | 0.00 | 157.50 | 0.00 | 157.50 |
| Earthworker | m/d | 5.25 | 25.00 | 0.00 | 131.25 | 0.00 | 131.25 |
| Subtotal: A | | | | | 1072.74 | 26.45 | 1099.19 |
| per one time: B | | | | | 536.37 | 13.23 | 549.59 |
| Framing and Stripping | | | | | | | |
| Spare lumber | cu.m | 0.02 | 1343.98 | 0.00 | 26.88 | 0.00 | 26.88 |
| Panel oil | lit. | 1.00 | 0.00 | 71.40 | 0.00 | 71.40 | 71.40 |
| Steel nail | kg | 1.75 | 0.00 | 10.58 | 0.00 | 18.52 | 18.52 |
| Steel wire | kg | 1.75 | 0.00 | 7.32 | 0.00 | 12.81 | 12.81 |
| Carpenter | m/d | 3.30 | 30.00 | 0.00 | 99.00 | 0.00 | 99.00 |
| Earthworker | m/d | 4.50 | 25.00 | 0.00 | 112.50 | 0.00 | 112.50 |
| Subtotal: C | | | | | 238.38 | 102.73 | 341.10 |
| Total(B+C) | | | | | 774.75 | 115.95 | 890.70 |
| Unit price | | | | | 77.47 | 11.60 | 89.07 |
| Unit cost | | | | | 96.84 | 14.49 | 111.34 |
| L/C : F/C | | | | | 0.87 | 0.13 | 1.00 |

TABLA G.3.10 COSTOS UNITARIOS DE ESTRUCTURAS DE CONTROL DE ESCOMBROS (3)

| Code 21 | | General supporting A 10 m ³ space (for transport) | | | | | | |
|--|------|--|---------------|---------------|---------------|---------------|---------------|--|
| Item | Unit | Qty | Unit Price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Scaffolding log(L:6m, D:10cm) | ps | 4.00 | 46.98 | 0.00 | 187.94 | 0.00 | 187.94 | |
| Scaffolding log(L:3.6m, D:12cm) | cu.m | 0.05 | 692.74 | 0.00 | 34.64 | 0.00 | 34.64 | |
| Scaffold. board(L:3.6m, W:24cm, T:4.5cm) | cu.m | 0.04 | 725.06 | 0.00 | 29.00 | 0.00 | 29.00 | |
| Steel wire(4mm) | kg | 2.60 | 0.00 | 7.32 | 0.00 | 19.03 | 19.03 | |
| Skilled labor | m/d | 2.40 | 25.00 | 0.00 | 60.00 | 0.00 | 60.00 | |
| Common labor | m/d | 1.20 | 20.00 | 0.00 | 24.00 | 0.00 | 24.00 | |
| Total | | | | | 335.58 | 19.03 | 354.61 | |
| Unit price | | | | | 33.56 | 1.90 | 35.46 | |
| Unit cost | | | | | 41.95 | 2.38 | 44.33 | |
| L/C : F/C | | | | | 0.95 | 0.05 | 1.00 | |

| Code 22 | | General supporting B 100 m ² racking | | | | | | |
|---|------|---|---------------|---------------|----------------|---------------|----------------|--|
| This is for the staging has to assemble in proportion to the height of structure (retaining wall, abutment, pier, debris barrier and etc.). | | | | | | | | |
| Item | Unit | Qty | Unit Price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Scaffolding log(L:6m, D:10cm) | ps | 91.00 | 46.98 | 0.00 | 4275.57 | 0.00 | 4275.57 | |
| Scaffold. board(L:3.6m, W:24cm, T:4.5cm) | cu.m | 0.78 | 725.06 | 0.00 | 565.55 | 0.00 | 565.55 | |
| Steel wire(4mm) | kg | 52.00 | 0.00 | 7.32 | 0.00 | 380.64 | 380.64 | |
| Skilled labor | m/d | 39.00 | 25.00 | 0.00 | 975.00 | 0.00 | 975.00 | |
| Common labor | m/d | 19.50 | 20.00 | 0.00 | 390.00 | 0.00 | 390.00 | |
| Total | | | | | 6206.11 | 380.64 | 6586.75 | |
| Unit price | | | | | 62.06 | 3.81 | 65.87 | |
| Unit cost | | | | | 77.58 | 4.76 | 82.33 | |
| L/C : F/C | | | | | 0.94 | 0.06 | 1.00 | |

| Code 24 | | Staging for concrete plants (0.6 m ³ concrete mixer) | | | | | | |
|--|-------|---|---------------|---------------|----------------|---------------|----------------|--|
| Item | Unit | Qty | Unit Price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Scaffolding log(L:3.6m, D:12cm) | cu.m | 6.89 | 692.74 | 0.00 | 4772.95 | 0.00 | 4772.95 | |
| Scaffold. board(L:3.6m, W:24cm, T:4.5cm) | cu.m | 0.85 | 725.06 | 0.00 | 612.68 | 0.00 | 612.68 | |
| Clamp Iron | ps | 84.50 | 0.00 | 3.83 | 0.00 | 323.64 | 323.64 | |
| Steel wire(4mm) | kg | 33.80 | 0.00 | 7.32 | 0.00 | 247.42 | 247.42 | |
| Carpenter | m/d | 15.21 | 30.00 | 0.00 | 456.30 | 0.00 | 456.30 | |
| Skilled labor | m/d | 76.05 | 25.00 | 0.00 | 1901.25 | 0.00 | 1901.25 | |
| Common labor | m/d | 50.70 | 20.00 | 0.00 | 1014.00 | 0.00 | 1014.00 | |
| Total | | | | | 8757.18 | 571.05 | 9328.23 | |
| Unit cost | Place | 1.00 | | | 10946.47 | 713.81 | 11660.28 | |
| L/C : F/C | | | | | 0.94 | 0.06 | 1.00 | |

| Code 25 | | Sandbag 100 pices | | | | | | |
|----------------|------|-------------------|---------------|---------------|---------------|---------------|---------------|--|
| Item | Unit | Qty | Unit Price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Earth | cu.m | 2.00 | 27.60 | 0.00 | 55.20 | 0.00 | 55.20 | |
| Common labor | m/d | 12.60 | 20.00 | 0.00 | 252.00 | 0.00 | 252.00 | |
| Sandbag(62*48) | ps | 100.00 | 0.00 | 3.30 | 0.00 | 330.00 | 330.00 | |
| Miscellaneous | L.S. | | | | 3.07 | 3.30 | 6.37 | |
| Total | | | | | 310.27 | 333.30 | 643.57 | |
| Unit Price | | | | | 3.10 | 3.33 | 6.44 | |
| Unit Cost | | | | | 3.88 | 4.17 | 8.04 | |
| L/C : F/C | | | | | 0.48 | 0.52 | 1.00 | |

TABLA G.3.10 COSTOS UNITARIOS DE ESTRUCTURAS DE CONTROL DE ESCOMBROS (4)

| Code 26 | | Sandbag work 10 m ² (area=vertical line*elongation) | | | | | |
|----------------|------|--|---------------|---------------|---------------|---------------|---------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Sandbag(62*48) | ps | 170.00 | 3.10 | 3.33 | 3.10 | 566.10 | 669.20 |
| Miscellaneous | L.S. | | | | 0.03 | 5.66 | 5.69 |
| Total | | | | | 3.13 | 571.76 | 574.89 |
| Unit Price | | | | | 0.31 | 57.18 | 57.49 |
| Unit Cost | | | | | 0.39 | 71.47 | 71.86 |
| L/C : F/C | | | | | 0.01 | 0.99 | 1.00 |

| Code 27 | | Temporary Cofferdam 10 m (height:1.5m,slope=1:1.5,crown=3.0m) (including removal) | | | | | |
|----------------|------|--|---------------|---------------|---------------|----------------|----------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Earth | cu.m | 157.50 | | | | | |
| 21t Bulldozer | hrs | 6.08 | 18.71 | 495.3 | 113.82 | 3013.06 | 3126.88 |
| 0.6m*3 Backhoe | hrs | 4.04 | 16.73 | 256.40 | 67.67 | 1037.06 | 1104.72 |
| 15t Bulldozer | hrs | 3.65 | 17.19 | 311.59 | 62.77 | 1137.85 | 1200.62 |
| Sandbag(62*48) | sq.m | 30.00 | 0.31 | 57.18 | 9.30 | 1715.40 | 1724.70 |
| 0.6m*3 Backhoe | hrs | 2.15 | 16.73 | 256.40 | 36.02 | 552.11 | 588.13 |
| 11t Dump truck | hrs | 24.45 | 16.70 | 248.50 | 408.25 | 6074.85 | 6483.10 |
| 15t Bulldozer | hrs | 1.94 | 17.19 | 311.59 | 33.42 | 605.77 | 639.19 |
| Foreman | m/d | 0.50 | 75.00 | 0.00 | 37.50 | 0.00 | 37.50 |
| Common labor | m/d | 3.00 | 20.00 | 0.00 | 60.00 | 0.00 | 60.00 |
| Total | | | | | 584.49 | 8948.13 | 9532.62 |
| Unit Price | | | | | 58.45 | 894.81 | 953.26 |
| Unit Cost | | | | | 73.06 | 1118.52 | 1181.58 |
| L/C : F/C | | | | | 0.06 | 0.94 | 1.00 |

| Code 28 | | Run-off road 10m (including removal) | | | | | |
|----------------|------|---|---------------|---------------|----------------|----------------|----------------|
| Item | Unit | Qty | Unit Price | | Estimate | | Total |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | |
| Earth | cu.m | 200.00 | | | | | |
| 21t Bulldozer | hrs | 7.72 | 18.71 | 495.3 | 144.53 | 3826.11 | 3970.65 |
| 0.6m*3 Backhoe | hrs | 5.14 | 16.73 | 256.40 | 85.93 | 1316.90 | 1402.82 |
| 15t Bulldozer | hrs | 4.64 | 17.19 | 311.59 | 79.71 | 1444.89 | 1524.60 |
| Sandbag(62*48) | sq.m | 20.00 | 0.31 | 57.18 | 6.20 | 1143.60 | 1149.80 |
| Pit-sand | cu.m | 90.00 | 35.00 | 0.00 | 3150.00 | 0.00 | 3150.00 |
| Gravel | cu.m | 45.00 | 70.00 | 0.00 | 3150.00 | 0.00 | 3150.00 |
| 15t Bulldozer | hrs | 3.13 | 17.19 | 311.59 | 53.81 | 975.30 | 1029.11 |
| 3t Vib. roller | hrs | 2.25 | 16.95 | 159.90 | 38.14 | 359.78 | 397.91 |
| Macadam roller | hrs | 3.33 | 16.14 | 174.71 | 53.80 | 582.37 | 636.17 |
| Foreman | m/d | 1.00 | 75.00 | 0.00 | 75.00 | 0.00 | 75.00 |
| Common labor | m/d | 5.00 | 20.00 | 0.00 | 100.00 | 0.00 | 100.00 |
| Total | | | | | 6626.94 | 3061.04 | 9687.98 |
| Unit Price | | | | | 662.69 | 306.10 | 968.80 |
| Unit Cost | | | | | 828.37 | 382.63 | 1211.00 |
| L/C : F/C | | | | | 0.68 | 0.32 | 1.00 |

TABLA G.3.10 COSTOS UNITARIOS DE ESTRUCTURAS DE CONTROL DE ESCOMBROS (5)

| Cuc 1 Concrete agitating 9.0 m ³ (220kg) (debris barrier) | | | | | | | | |
|--|------|------|---------------|---------------|----------------|----------------|----------------|--|
| Item | Unit | Qty | Unit price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Concrete plant | hrs | 1.00 | 0.99 | 226.54 | 0.99 | 226.54 | 227.53 | |
| Belt conveyor | hrs | 3.00 | 0.16 | 16.76 | 0.48 | 50.28 | 50.76 | |
| Truck mixer | hrs | 2.00 | 5.18 | 182.36 | 10.36 | 364.72 | 375.08 | |
| 35t Truck crane | hrs | 1.34 | 3.06 | 518.16 | 4.10 | 693.96 | 698.06 | |
| Concrete measure | hrs | 1.00 | 0.06 | 13.00 | 0.06 | 13.00 | 13.06 | |
| 0.8m ³ con.bucket | hrs | 2.00 | 0.04 | 9.08 | 0.08 | 18.16 | 18.24 | |
| 5cm Turbin pump | hrs | 1.00 | 0.05 | 6.65 | 0.05 | 6.65 | 6.70 | |
| 60mm con. vibrator | hrs | 2.00 | 0.08 | 16.95 | 0.16 | 33.90 | 34.06 | |
| 45KVA Generator | hrs | 1.00 | 5.88 | 48.08 | 5.88 | 48.08 | 53.96 | |
| Cement | ton | 2.04 | 258.75 | 86.25 | 527.69 | 175.90 | 703.59 | |
| Sand | cu.m | 4.73 | 65.00 | 0.00 | 307.13 | 0.00 | 307.13 | |
| Gravel | cu.m | 8.69 | 70.00 | 0.00 | 608.58 | 0.00 | 608.58 | |
| Skilled labor | m/d | 8.25 | 25.00 | 0.00 | 206.25 | 0.00 | 206.25 | |
| Total | | | | | 1671.81 | 1631.19 | 3303.00 | |
| Unit price | | | | | 185.76 | 181.24 | 367.00 | |
| Unit cost | | | | | 232.20 | 226.55 | 458.75 | |
| L/C : F/C | | | | | 0.51 | 0.49 | 1.00 | |

| Cuc 2 Concrete agitating 9.0 m ³ (260kg) (reinforced concrete) | | | | | | | | |
|---|------|------|---------------|---------------|----------------|---------------|----------------|--|
| Item | Unit | Qty | Unit price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Concrete plant | hrs | 1.00 | 0.99 | 226.54 | 0.99 | 226.54 | 227.53 | |
| Belt conveyor | hrs | 3.00 | 0.16 | 16.76 | 0.48 | 50.28 | 50.76 | |
| Truck mixer | hrs | 2.00 | 5.18 | 182.36 | 10.36 | 364.72 | 375.08 | |
| Concrete measure | hrs | 1.00 | 0.06 | 13.00 | 0.06 | 13.00 | 13.06 | |
| 0.8m ³ con.bucket | hrs | 2.00 | 0.04 | 9.08 | 0.08 | 18.16 | 18.24 | |
| 5cm Turbin pump | hrs | 1.00 | 0.05 | 6.65 | 0.05 | 6.65 | 6.70 | |
| 40mm con. vibrator | hrs | 2.00 | 0.03 | 5.57 | 0.06 | 11.14 | 11.20 | |
| 45KVA Generator | hrs | 1.00 | 5.88 | 48.08 | 5.88 | 48.08 | 53.96 | |
| Cement | ton | 2.41 | 258.75 | 86.25 | 623.64 | 207.88 | 831.52 | |
| Sand | cu.m | 5.48 | 65.00 | 0.00 | 356.27 | 0.00 | 356.27 | |
| Gravel | cu.m | 7.37 | 70.00 | 0.00 | 515.97 | 0.00 | 515.97 | |
| Skilled labor | m/d | 6.75 | 25.00 | 0.00 | 168.75 | 0.00 | 168.75 | |
| Total | | | | | 1681.59 | 719.91 | 2401.50 | |
| Unit price | | | | | 186.84 | 79.99 | 266.83 | |
| Unit cost | | | | | 233.55 | 99.99 | 333.54 | |
| L/C : F/C | | | | | 0.70 | 0.30 | 1.00 | |

| Cuc 3 Concrete agitating 9.0 m ³ (220kg) (plain concrete) | | | | | | | | |
|--|------|------|---------------|---------------|----------------|---------------|----------------|--|
| Item | Unit | Qty | Unit price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Concrete plant | hrs | 1.00 | 0.99 | 226.54 | 0.99 | 226.54 | 227.53 | |
| Belt conveyor | hrs | 3.00 | 0.16 | 16.76 | 0.48 | 50.28 | 50.76 | |
| Truck mixer | hrs | 2.00 | 5.18 | 182.36 | 10.36 | 364.72 | 375.08 | |
| Concrete measure | hrs | 1.00 | 0.06 | 13.00 | 0.06 | 13.00 | 13.06 | |
| 0.8m ³ con.bucket | hrs | 2.00 | 0.04 | 9.08 | 0.08 | 18.16 | 18.24 | |
| 5cm Turbin pump | hrs | 1.00 | 0.05 | 6.65 | 0.05 | 6.65 | 6.70 | |
| 40mm con. vibrator | hrs | 2.00 | 0.03 | 5.57 | 0.06 | 11.14 | 11.20 | |
| 45KVA Generator | hrs | 1.00 | 5.88 | 48.08 | 5.88 | 48.08 | 53.96 | |
| Cement | ton | 2.04 | 258.75 | 86.25 | 527.69 | 175.90 | 703.59 | |
| Sand | cu.m | 4.73 | 65.00 | 0.00 | 307.13 | 0.00 | 307.13 | |
| Gravel | cu.m | 8.69 | 70.00 | 0.00 | 608.58 | 0.00 | 608.58 | |
| Skilled labor | m/d | 5.25 | 25.00 | 0.00 | 131.25 | 0.00 | 131.25 | |
| Total | | | | | 1591.62 | 687.93 | 2279.55 | |
| Unit price | | | | | 176.85 | 76.44 | 253.28 | |
| Unit cost | | | | | 221.06 | 95.55 | 316.60 | |
| L/C : F/C | | | | | 0.70 | 0.30 | 1.00 | |

TABLA G.3.10 COSTOS UNITARIOS DE ESTRUCTURAS DE CONTROL DE ESCOMBROS (6)

| Cuc 4 | | Boulder 10.0 m ³ (Includ. on loading & off) | | | Estimate | | |
|-----------------|------|--|------------|--------|---------------|---------------|----------------|
| Item | Unit | Qty | Unit price | | L/C | F/C | Total |
| | | | L/C | F/C | | | |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | (Lps.) |
| Boulder(>25cm) | cu.m | 10.00 | 75.35 | 14.57 | 753.50 | 145.70 | 899.20 |
| Common labor | m/d | 9.00 | 20.00 | 0 | 180.00 | 0.00 | 180.00 |
| 35t Truck crane | hrs | 0.87 | 3.05 | 518.16 | 2.66 | 452.36 | 455.02 |
| Total | | | | | 936.16 | 598.06 | 1534.22 |
| Unit price | | | | | 93.62 | 59.81 | 153.42 |
| Unit cost | | | | | 117.02 | 74.76 | 191.78 |
| L/C : F/C | | | | | 0.61 | 0.39 | 1.00 |

| Cuc 5 | | Boulder concrete 1.0 m ³ (ratio 4:6) | | | Estimate | | |
|-----------------|------|---|------------|--------|---------------|---------------|---------------|
| Item | Unit | Qty | Unit price | | L/C | F/C | Total |
| | | | L/C | F/C | | | |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | (Lps.) |
| Concrete | cu.m | 0.76 | 185.76 | 181.24 | 141.18 | 137.74 | 278.92 |
| Boulder | cu.m | 0.40 | 93.62 | 59.81 | 37.45 | 23.92 | 61.37 |
| Concrete worker | m/d | 1.02 | 25.00 | 0.00 | 25.50 | 0.00 | 25.50 |
| Total | | | | | 204.13 | 161.67 | 365.79 |
| Unit price | | | | | 255.16 | 202.08 | 457.24 |
| Unit cost | | | | | 0.56 | 0.44 | 1.00 |
| L/C : F/C | | | | | | | |

| Cuc 6 | | Temporary road 10 m | | | Estimate | | |
|----------------------------|------|---------------------|------------|--------|----------------|----------------|----------------|
| Item | Unit | Qty | Unit price | | L/C | F/C | Total |
| | | | L/C | F/C | | | |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | (Lps.) |
| 0.35m ³ Backhoe | hrs | 1.84 | 15.85 | 147.41 | 29.14 | 270.97 | 300.11 |
| 15t Bulldozer | hrs | 1.73 | 17.19 | 311.59 | 29.78 | 539.84 | 569.63 |
| 3t Bulldozer | hrs | 3.04 | 16.91 | 95.15 | 51.43 | 289.41 | 340.85 |
| Pit sand | cu.m | 12.00 | 30.00 | 0 | 360.00 | 0.00 | 360.00 |
| Gravel | cu.m | 9.00 | 70.00 | 0 | 630.00 | 0.00 | 630.00 |
| V.Compact | hrs | 4.45 | 4.26 | 51.48 | 18.96 | 229.15 | 248.11 |
| 0.60m ³ Backhoe | hrs | 1.72 | 15.85 | 147.41 | 27.24 | 253.32 | 280.56 |
| 11t Dump truck | hrs | 15.96 | 4.86 | 191.07 | 77.58 | 3049.88 | 3127.45 |
| 15t Bulldozer | hrs | 1.56 | 17.19 | 311.59 | 26.90 | 487.59 | 514.49 |
| Foreman | m/d | 0.10 | 75.00 | 0.00 | 7.50 | 0.00 | 7.50 |
| Common labor | m/d | 3.00 | 20.00 | 0.00 | 60.00 | 0.00 | 60.00 |
| Total | | | | | 1318.53 | 5120.17 | 6438.70 |
| Unit price | | | | | 131.85 | 512.02 | 643.87 |
| Unit cost | | | | | 164.82 | 640.02 | 804.84 |
| L/C : F/C | | | | | 0.20 | 0.80 | 1.00 |

| Cuc 7 | | Road Improvement (gravel road) 100 m | | | Estimate | | |
|--------------------|------|--------------------------------------|------------|--------|-----------------|----------------|-----------------|
| Item | Unit | Qty | Unit price | | L/C | F/C | Total |
| | | | L/C | F/C | | | |
| | | | (Lps.) | (Lps.) | (Lps.) | (Lps.) | (Lps.) |
| Motor grader | hrs | 1.60 | 17.53 | 197.44 | 28.04 | 315.77 | 343.80 |
| Pit sand | cu.m | 200.00 | 30.00 | 0 | 6000.00 | 0.00 | 6000.00 |
| Gravel | cu.m | 80.00 | 70.00 | 0 | 5600.00 | 0.00 | 5600.00 |
| 15t Bulldozer | hrs | 6.49 | 17.19 | 311.59 | 111.60 | 2022.84 | 2134.44 |
| 11t Vib. roller | hrs | 4.67 | 18.74 | 517.97 | 87.45 | 2417.19 | 2504.65 |
| 10t Macadam roller | hrs | 5.71 | 16.14 | 174.71 | 92.23 | 998.34 | 1090.57 |
| Foreman | m/d | 0.50 | 75.00 | 0.00 | 37.50 | 0.00 | 37.50 |
| Common labor | m/d | 3.00 | 20.00 | 0.00 | 60.00 | 0.00 | 60.00 |
| Total | | | | | 12016.82 | 5754.14 | 17770.96 |
| Unit price | | | | | 120.17 | 57.54 | 177.71 |
| Unit cost | | | | | 150.21 | 71.93 | 222.14 |
| L/C : F/C | | | | | 0.68 | 0.32 | 1.00 |

**TABLA G.3.10 COSTOS UNITARIOS DE ESTRUCTURAS DE CONTROL
DE ESCOMBROS (7)**

| Cuc 8 | | Road maintenance (gravel road) 100 m | | | | | | |
|--------------|------|--------------------------------------|---------------|---------------|-----------------|----------------|-----------------|--|
| Item | Unit | Qty | Unit price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Motor grader | hrs | 19.19 | 17.53 | 197.44 | 336.43 | 3789.25 | 4125.69 | |
| Gravel | cu.m | 240.00 | 70.00 | 0 | 16800.00 | 0.00 | 16800.00 | |
| Foreman | m/d | 3.00 | 75.00 | 0.00 | 225.00 | 0.00 | 225.00 | |
| Common labor | m/d | 12.00 | 20.00 | 0.00 | 240.00 | 0.00 | 240.00 | |
| Total | | | | | 17601.43 | 3789.25 | 21390.69 | |
| Unit price | | | | | 176.01 | 37.89 | 213.91 | |
| Unit cost | | | | | 220.02 | 47.37 | 267.38 | |
| L/C : F/C | | | | | 0.82 | 0.18 | 1.00 | |

| Cuc 9 | | Bank road(R) (gravel) maintenance 1000 m | | | | | | |
|--------------|------|--|---------------|---------------|-----------------|-----------------|-----------------|--|
| Item | Unit | Qty | Unit price | | Estimate | | Total | |
| | | | L/C (Lps.) | F/C (Lps.) | L/C (Lps.) | F/C (Lps.) | | |
| Motor grader | hrs | 121.70 | 17.53 | 197.44 | 2133.44 | 24028.84 | 26162.28 | |
| Gravel | cu.m | 750.00 | 70.00 | 0 | 52500.00 | 0.00 | 52500.00 | |
| Foreman | m/d | 1.00 | 75.00 | 0.00 | 75.00 | 0.00 | 75.00 | |
| Common labor | m/d | 3.00 | 20.00 | 0.00 | 60.00 | 0.00 | 60.00 | |
| Total | | | | | 54768.44 | 24028.84 | 78797.28 | |
| Unit price | | | | | 54.77 | 24.03 | 78.80 | |
| Unit cost | | | | | 68.46 | 30.04 | 98.50 | |
| L/C : F/C | | | | | 0.70 | 0.30 | 1.00 | |

TABLA G.3.11 COSTO DE CONSTRUCCION DEL RIO CHOLOMA (P/M)

Unit: Lp

| Work Items | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks |
|-------------------------------|--------------------|------|--------|---------------------|-------------------|-----------------|-------------|---------------------|-------------------|-----------------|
| A. RIVER WORKS | | | | | | | | | | |
| 1. PREPARATORY WORK | | | | | | | | | | |
| 2. EMBANKMENT WORK | | | | | | | | | | |
| Excavation | Sandy Soil | m3 | 11 | 94 | 6 | 1,102,000 | 12,122,000 | 11,394,680 | 727,320 | |
| Spilling | | m3 | 28 | 94 | 6 | 621,300 | 17,396,400 | 16,352,616 | 1,043,784 | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 3,600 | 561,600 | 303,264 | 258,336 | |
| Wet Masonry | For Revetment | m2 | 170 | 13 | 87 | 42,576 | 7,237,920 | 940,930 | 6,296,990 | |
| Concrete Structure | Box Culvert | m3 | 2,722 | 44 | 56 | 0 | 0 | 0 | 0 | Incl. form work |
| (for River Structure) | Gate A (Steel) | m2 | 15,000 | 95 | 5 | 0 | 0 | 0 | 0 | excavation, etc |
| | Gate B (Steel) | m2 | 13,000 | 95 | 5 | 0 | 0 | 0 | 0 | |
| | Bridge (Slab, Etc) | m2 | 6,937 | 37 | 63 | 1 | 8,500 | 3,145 | 5,355 | Incl. pier, etc |
| | Weir | m3 | 1,033 | 77 | 23 | 0 | 0 | 0 | 0 | |
| Banking | Consolid. Dam | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 | |
| Sodding | By Machine | m3 | 25 | 92 | 8 | 480,700 | 12,017,500 | 11,056,100 | 961,400 | |
| | | m2 | 8 | 0 | 100 | 237,737 | 1,901,896 | 0 | 1,901,896 | |
| | | | | | | Sub-Total (LP): | 58,933 | 46,058 | 12,874 | |
| | | | | | | %: | 100 | 78 | 22 | |
| B. SABO WORKS | | | | | | | | | | |
| 1. PREPARATORY WORKS | | | | | | | | | | |
| 2. SABO DAM WORKS | | | | | | | | | | |
| Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 102,890 | 113,179,000 | 70,170,980 | 43,008,020 | Incl. form work |
| Gabion (Mat Type) | D=0.45m | m3 | 156 | 54 | 46 | 3,630 | 566,280 | 305,791 | 260,489 | |
| 3. CONSOLIDATION WORKS | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 33,360 | 1,301,040 | 1,222,978 | 78,062 | |
| Debris Control Structure | Concrete Works | m3 | 1,100 | 62 | 38 | 116,880 | 128,568,000 | 79,712,160 | 48,855,840 | Incl. form work |
| Gabion (Mat Type) | 40*120*400 | m3 | 156 | 54 | 46 | 33,360 | 5,204,160 | 2,810,245 | 2,393,914 | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 21,330 | 3,330,600 | 1,798,524 | 1,532,076 | |
| 4. LEVEE | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 0 | 0 | 0 | 0 | |
| Banking | By Machine | m3 | 36 | 92 | 8 | 34,200 | 1,231,200 | 1,132,704 | 98,496 | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 9,215 | 1,437,540 | 776,272 | 661,268 | |
| | | | | | | Sub-Total (LP): | 293,040 | 181,619 | 111,421 | |
| | | | | | | %: | 100 | 62 | 38 | |
| | | | | | | Total(A+B): | 351,973 | 227,677 | 124,296 | |
| | | | | | | %: | 100 | 65 | 35 | |
| SLAND ACQUISITION | | | 0.50 | 0 | 100 | 2,138,568 | 1,069,284 | | 1,069,284 | |

| Item | Total | F/C | L/C | Remarks |
|--------------------------------|----------------|----------------|----------------|------------|
| A Direct Cost | | | | |
| 1) Flood Control Facilities | 58,933 | 46,058 | 12,874 | |
| 2) Sediment Control Facilities | 293,040 | 181,619 | 111,421 | |
| Sub-Total | 351,973 | 227,677 | 124,296 | |
| B Indirect Cost | | | | |
| 1) Land Acquisition | 1,069 | 0 | 1,069 | |
| 2) Administration Cost | 17,599 | 0 | 17,599 | A X5.0 % |
| 3) Engineering Service Cost | 42,237 | 27,321 | 14,915 | (A+C) X10% |
| Sub-Total | 60,905 | 27,321 | 33,583 | |
| C Physical Contingency | | | | |
| | 70,395 | 45,535 | 24,859 | A X20 % |
| Total | 483,273 | 300,534 | 182,738 | |
| | % | 62 | 38 | |

TABLA G.3.12 COSTO DE CONSTRUCCION DEL RIO BLANCO (P/M)

| Unit: Lp | | | | | | | | | | |
|--|--------------------|------|--------|---------------------|-------------------|-----------------|-------------|---------------------|-------------------|------------|
| Work Items | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks |
| A. RIVER WORKS | | | | | | | | | | |
| 1. PREPARATORY WORK | | | | | | | | | | |
| 2. EMBANKMENT WORK | | | | | | | | | | |
| Excavation & Spoiling | Sandy Soil | m3 | 39 | 94 | | 6 | 1,022,856 | 39,891,384 | 37,497,501 | 2,393,443 |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | | 46 | 92,920 | 14,495,520 | 7,827,581 | 6,667,939 |
| Wet Masonry | For Retention | m2 | 178 | 13 | | 87 | 5,692 | 967,640 | 125,793 | 841,847 |
| Concrete Structure (for River Structure) | Box Culvert | m3 | 2,722 | 44 | | 56 | 2,220 | 6,042,840 | 2,638,850 | 3,383,990 |
| | Class A (Steel) | m2 | 15,000 | 95 | | 3 | 64 | 960,000 | 912,000 | 48,000 |
| | Class B (Steel) | m2 | 13,000 | 94 | | 3 | 288 | 3,744,000 | 3,556,800 | 187,200 |
| | Bridge (Slab, Etc) | m2 | 6,937 | 37 | | 63 | 2,250 | 15,608,250 | 5,775,051 | 9,833,198 |
| | Weir | m3 | 1,033 | 77 | | 23 | 0 | 0 | 0 | 0 |
| | Concrete Dam | m3 | 1,100 | 62 | | 38 | 3,024 | 3,326,400 | 2,062,368 | 1,264,032 |
| Face & Banking | By Machine | m3 | 36 | 92 | | 8 | 2,257,128 | 81,256,608 | 74,756,079 | 6,500,529 |
| Sodding | | m2 | 8 | 0 | 100 | 100 | 582,744 | 4,661,952 | 0 | 4,661,952 |
| | | | | | | Sub-Total (Lp): | 196,597,783 | 135,448,288 | 41,149,495 | |
| | | | | | | %: | 100 | 79 | 21 | |
| B. SABO WORKS | | | | | | | | | | |
| 1. PREPARATORY WORKS | | | | | | | | | | |
| 2. SABO DAM WORKS | | | | | | | | | | |
| Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | | 38 | 83,190 | 97,009,000 | 60,145,580 | 36,863,420 |
| Gabion (Mat Type) | D=0.45m | m3 | 156 | 54 | | 46 | 4,155 | 648,180 | 350,017 | 298,163 |
| 3. CONSOLIDATION WORKS | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | | 6 | 35,470 | 1,383,330 | 1,300,230 | 83,000 |
| Debris Control Structure | Concrete Works | m3 | 1,100 | 62 | | 38 | 28,630 | 31,493,000 | 19,325,650 | 11,957,350 |
| Gabion (Mat Type) | 40*120*400 | m3 | 156 | 54 | | 46 | 6,840 | 1,067,040 | 576,202 | 490,838 |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | | 46 | 3,800 | 992,800 | 520,112 | 472,688 |
| 4. LEVEE | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | | 6 | 0 | 0 | 0 | 0 |
| Banking | By Machine | m3 | 36 | 92 | | 8 | 146,160 | 5,261,760 | 4,840,819 | 420,941 |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | | 46 | 39,382 | 6,143,592 | 3,317,540 | 2,826,052 |
| | | | | | | Sub-Total (Lp): | 165,138,207 | 103,932,699 | 61,203,508 | |
| | | | | | | %: | 100 | 63 | 37 | |
| | | | | | | Total(A+B): | 361,736,290 | 239,380,987 | 102,353,303 | |
| | | | | | | %: | 100 | 72 | 28 | |
| 3. LAND ACQUISITION | | | | | | | | | | |
| | | | 0.50 | 0 | 100 | 2,138,568 | 1,069,284 | | 1,069,284 | |

| Unit: Lp(x1000) | | | | |
|--------------------------------|----------------|----------------|----------------|------------|
| Item | Total | F/C | L/C | Remarks |
| A Direct Cost | | | | |
| 1) Flood Control Facilities | 196,598 | 155,448 | 41,150 | |
| 2) Sediment Control Facilities | 165,139 | 103,933 | 61,206 | |
| Sub-Total | 361,737 | 259,381 | 102,356 | |
| B Indirect Cost | | | | |
| 1) Land Acquisition | 1,069 | 0 | 1,069 | |
| 2) Administration Cost | 18,087 | 0 | 18,087 | A X5.0 % |
| 3) Engineering Service Cost | 43,408 | 31,126 | 12,283 | (A+C) X10% |
| Sub-Total | 62,564 | 31,126 | 31,439 | |
| C Physical Contingency | | | | |
| | 72,347 | 51,876 | 20,471 | A X20 % |
| Total | 496,649 | 342,383 | 154,266 | |
| | % | 69 | 31 | |

TABLA G.3.13 COSTO DE CONSTRUCCION DEL RIO EL SAUCE (P/M)

| Unit: Lp | | | | | | | | | | |
|-------------------------------|--------------------------|--------------------|-------|---------------------|-------------------|-----------|-----------------|---------------------|-------------------|------------|
| Work Items | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks |
| A. RIVER WORKS | | | | | | | | | | |
| 1. PREPARATORY WORK | | | | | | | | | | |
| 2. EMBANKMENT WORK | | | | | | | | | | |
| | Excavation & Spilling | Sandy Soil | m3 | 39 | 94 | 6 | 86,340 | 3,367,260 | 3,165,224 | 202,036 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 3,500 | 546,000 | 294,840 | 251,160 |
| | Wet Machinery | For Retreatment | m2 | 170 | 13 | 87 | 43,324 | 7,365,080 | 957,460 | 6,407,620 |
| | Concrete Structure | Box Culvert | m3 | 2,722 | 44 | 56 | 0 | 0 | 0 | 0 |
| | (for River Structure) | Gate A (Steel) | m2 | 13,000 | 95 | 5 | 0 | 0 | 0 | 0 |
| | | Gate B (Steel) | m2 | 13,000 | 95 | 5 | 0 | 0 | 0 | 0 |
| | | Bridge (Slab, Etc) | m2 | 6,937 | 37 | 63 | 1,500 | 10,403,500 | 3,850,033 | 6,553,467 |
| | | Weir | m3 | 1,035 | 77 | 23 | 0 | 0 | 0 | 0 |
| | | Consolid. Dam | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 |
| | Exec. & Banking | By Machine | m3 | 36 | 92 | 8 | 396,340 | 21,468,240 | 19,750,781 | 1,717,459 |
| | Sodding | | m2 | 8 | 0 | 100 | 263,517 | 4,508,136 | 0 | 4,508,136 |
| | | | | | | | Sub-Total (LP): | 34,809,248 | 32,221,092 | 22,588,137 |
| | | | | | | | %: | 100 | 59 | 41 |
| B. SABO WORKS | | | | | | | | | | |
| 1. PREPARATORY WORKS | | | | | | | | | | |
| 2. SABO DAM WORKS | | | | | | | | | | |
| | Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 120,650 | 132,715,000 | 82,283,300 | 50,431,700 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 6,280 | 979,680 | 529,027 | 450,653 |
| 3. CONSOLIDATION WORKS | | | | | | | | | | |
| | Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 13,200 | 514,800 | 483,912 | 30,888 |
| | Debris Control Structure | Concrete Works | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 |
| | Gabion (Mat Type) | 40*120*400 | m3 | 156 | 54 | 46 | 13,200 | 2,099,200 | 1,111,968 | 987,232 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 9,000 | 1,404,000 | 758,160 | 645,840 |
| 4. LEVER | | | | | | | | | | |
| | Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 0 | 0 | 0 | 0 |
| | Banking | By Machine | m3 | 36 | 92 | 8 | 0 | 0 | 0 | 0 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 0 | 0 | 0 | 0 |
| | | | | | | | Sub-Total (LP): | 158,323,582 | 97,941,322 | 60,382,260 |
| | | | | | | | %: | 100 | 62 | 38 |
| | | | | | | | Total(A+B): | 213,132,830 | 130,162,414 | 82,970,416 |
| | | | | | | | %: | 100 | 61 | 39 |
| 5. LAND ACQUISITION | | | | | | | | | | |
| | | | 0.50 | 0 | 100 | 1,143,000 | 572 | | | 572 |

| Unit: Lp(x1000) | | | | |
|--------------------------------|----------------|----------------|----------------|-------------|
| Item | Total | F/C | L/C | Remarks |
| A Direct Cost | | | | |
| 1) Flood Control Facilities | 54,809 | 32,221 | 22,588 | |
| 2) Sediment Control Facilities | 158,324 | 97,941 | 60,382 | |
| Sub-Total | 213,133 | 130,162 | 82,970 | |
| B Indirect Cost | | | | |
| 1) Land Acquisition | 572 | 0 | 572 | |
| 2) Administration Cost | 10,657 | 0 | 10,657 | A X 5.0 % |
| 3) Engineering Service Cost | 25,576 | 15,619 | 9,956 | (A+C) X 10% |
| Sub-Total | 36,805 | 15,619 | 21,185 | |
| C Physical Contingency | | | | |
| | 42,627 | 26,032 | 16,594 | A X 20 % |
| Total | 292,564 | 171,814 | 120,749 | |
| | % | 59 | 41 | |

**TABLA G.3.14 COSTO DE CONSTRUCCION DEL RIO BLANCO
Y EL RIO EL SAUCE (P/M)**

Unit :Lp

| Work Items | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks | |
|-------------------------------|--------------------------|--------------------|-------|---------------------|-------------------|----------|--------------------|---------------------|--------------------|------------------|------------------|
| A. RIVER WORKS | | | | | | | | | | | |
| 1. PREPARATORY WORK | | | | | | | | | | | |
| 2. EMBANKMENT WORK | | | | | | | | | | | |
| | Excavation | Sandy Soil | m3 | 11 | 94 | 6 | 1,327,100 | 14,598,100 | 13,722,214 | 875,886 | |
| | Spilling | | m3 | 28 | 94 | 6 | 348,850 | 9,768,080 | 9,181,993 | 586,085 | |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 7,000 | 1,092,000 | 589,680 | 502,320 | |
| | Wet Masonry | For Retement | m2 | 170 | 13 | 87 | 43,324 | 7,365,080 | 957,460 | 6,407,620 | |
| | Concrete Structure | Box Culvert | m3 | 2,722 | 44 | 56 | 0 | 0 | 0 | Incid. form work | |
| | (for River Structure) | Gate A (Steel) | m2 | 15,000 | 95 | 5 | 0 | 0 | 0 | excavation, etc | |
| | | Gate B (Steel) | m2 | 13,000 | 95 | 5 | 0 | 0 | 0 | 0 | |
| | | Bridge (Slab, Etc) | m2 | 6,937 | 37 | 63 | 2,200 | 15,261,400 | 5,646,718 | 9,614,682 | Incid. pier, etc |
| | | Weir | m3 | 1,035 | 77 | 23 | 4,495 | 4,652,325 | 3,582,290 | 1,070,035 | 0 |
| | Consolid. Dam | By Machine | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 | |
| | Banking | | m3 | 25 | 92 | 8 | 978,240 | 24,456,000 | 22,499,520 | 1,956,480 | 0 |
| | Sodding | | m2 | 8 | 0 | 100 | 690,640 | 5,525,120 | 0 | 5,525,120 | |
| | | | | | | | Sub-Total (LP) | 95,123,821 | 64,608,860 | 30,518,961 | |
| | | | | | | | % | 100 | 68 | 32 | |
| B. SABO WORKS | | | | | | | | | | | |
| 1. PREPARATORY WORKS | | | | | | | | | | | |
| 2. SABO DAM WORKS | | | | | | | | | | | |
| | Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 208,840 | 229,724,000 | 142,428,280 | 87,295,720 | Incid. form work |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 10,395 | 1,621,620 | 875,675 | 745,945 | excavation, etc |
| 3. CONSOLIDATION WORKS | | | | | | | | | | | |
| | Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 48,670 | 1,898,130 | 1,784,242 | 113,888 | 0 |
| | Debris Control Structure | Concrete Works | m3 | 1,100 | 62 | 38 | 28,630 | 31,493,000 | 19,525,660 | 11,967,340 | Incid. form work |
| | Gabion (Flat Type) | 40*120*400 | m3 | 156 | 54 | 46 | 20,040 | 3,125,240 | 1,688,170 | 1,438,070 | 0 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 12,800 | 1,996,800 | 1,078,272 | 918,528 | 0 |
| 4. LEVEE | | | | | | | | | | | |
| | Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 0 | 0 | 0 | 0 | |
| | Banking | By Machine | m3 | 36 | 92 | 8 | 146,160 | 5,261,760 | 4,840,819 | 420,941 | 0 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 39,387 | 6,143,592 | 3,317,540 | 2,826,052 | 0 |
| | | | | | | | Sub-Total (LP) | 323,454,913 | 201,870,145 | 121,584,767 | |
| | | | | | | | % | 100 | 62 | 38 | |
| Total (A+B): | | | | | | | 418,580,734 | 266,477,006 | 152,103,728 | | |
| | | | | | | | % | 100 | 64 | 36 | |
| 5. LAND ACQUISITION | | | | 0.50 | 0 | 100 | 2,143,560 | 1,071,780 | | 1,071,780 | |

| Item | Total | F/C | L/C | Unit: Lp(x1000) |
|--------------------------------|----------------|----------------|----------------|-----------------|
| | | | | Remarks |
| A Direct Cost | | | | |
| 1) Flood Control Facilities | 95,126 | 64,607 | 30,519 | |
| 2) Sediment Control Facilities | 323,455 | 201,870 | 121,585 | |
| Sub-Total | 418,581 | 266,477 | 152,104 | |
| B Indirect Cost | | | | |
| 1) Land Acquisition | 1,072 | 0 | 1,072 | |
| 2) Administration Cost | 20,929 | 0 | 20,929 | A X5.0 % |
| 3) Engineering Service Cost | 50,230 | 31,977 | 18,252 | (A+C) X10% |
| Sub-Total | 72,231 | 31,977 | 40,253 | |
| C Physical Contingency | 83,716 | 53,295 | 30,421 | A X20 % |
| Total | 574,527 | 351,750 | 222,778 | |
| | % | 61 | 39 | |

TABLA G.3.15 COSTO DIRECTO DE CONSTRUCCION PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA (FRECUENCIA DE INUNDACION DE 2 AÑOS)

Unit :L.p

| Work Items | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks | |
|--|--------------------|------|--------|---------------------|-------------------|-----------|-------------------|---------------------|-------------------|-----------------|--|
| A. RIVER WORKS | | | | | | | | | | | |
| 1.PREPARATORY WORK | | | | | | | 1 | 3,573,482 | 1,832,257 | 1,741,226 | |
| 2.EMBANKMENT WORK | | | | | | | | | | | |
| Excavation & Spoiling | Sandy Soil | m3 | 39 | 94 | 6 | 33,820 | 1,318,980 | 1,239,841 | 79,139 | | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 1,806 | 280,800 | 151,632 | 129,168 | | |
| Wet Masonry | For Revetment | m2 | 170 | 13 | 87 | 27,966 | 4,754,220 | 618,049 | 4,136,171 | | |
| Concrete Structure (for River Structure) | Box Culvert | m3 | 2,722 | 44 | 56 | 0 | 0 | 0 | 0 | Incl. form work | |
| | Gate A (Steel) | m2 | 15,000 | 95 | 5 | 0 | 0 | 0 | 0 | excavation, etc | |
| | Gate B (Steel) | m2 | 13,000 | 95 | 5 | 0 | 0 | 0 | 0 | | |
| | Bridge (Slab, Etc) | m2 | 6,937 | 37 | 63 | 1 | 8,500,000 | 3,145,000 | 5,355,000 | Incl. pier, etc | |
| | Weir | m3 | 1,035 | 77 | 23 | 0 | 0 | 0 | 0 | | |
| | Consolid. Dam | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 | | |
| Exca. & Banking | By Machine | m3 | 36 | 92 | 8 | 213,180 | 7,674,480 | 7,060,522 | 613,958 | | |
| Sodding | | m2 | 8 | 0 | 100 | 161,842 | 1,294,736 | 0 | 1,294,736 | | |
| Sub-Total (LP): | | | | | | | 27,386,298 | 14,047,300 | 13,349,998 | | |
| | | | | | | | %: | 100 | 51 | 49 | |
| B. SABO WORKS | | | | | | | | | | | |
| 1.PREPARATORY WORKS | | | | | | | 1 | 4,851,710 | 3,008,862 | 1,842,848 | |
| 2.SABO DAM WORKS | | | | | | | | | | | |
| Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 | Incl. form work | |
| Gabion (Mat Type) | D=0.45m | m3 | 156 | 54 | 46 | 0 | 0 | 0 | 0 | excavation, etc | |
| 3.CONSOLIDATION WORKS | | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 7,673 | 299,247 | 281,292 | 17,955 | | |
| Debris Control Structure | Concrete Works | m3 | 1,100 | 62 | 38 | 26,882 | 29,570,200 | 18,333,324 | 11,236,876 | Incl. form work | |
| Gabion (Mat Type) | 40*120*400 | m3 | 156 | 54 | 46 | 7,673 | 1,195,988 | 646,374 | 550,614 | | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 4,911 | 766,116 | 413,703 | 352,413 | | |
| 4.LEVEE | | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 0 | 0 | 0 | 0 | | |
| Banking | By Machine | m3 | 36 | 92 | 8 | 7,866 | 283,176 | 260,522 | 22,654 | | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 1,468 | 229,008 | 123,664 | 105,344 | | |
| Sub-Total (LP): | | | | | | | 37,196,445 | 23,067,940 | 14,128,505 | | |
| | | | | | | | %: | 100 | 62 | 38 | |
| Total(A+B): | | | | | | | 64,593,144 | 37,115,240 | 27,477,903 | | |
| | | | | | | | %: | 100 | 57 | 43 | |
| 5.LAND ACQUISITION | | | 0.50 | 0 | 100 | 2,138,568 | 1,069,284 | | 1,069,284 | | |

Note : 1) Construction cost of the river improvement is that for 2 year flood frequency.

2) Construction cost of the sediment control is that for 2 year flood frequency. The work quantities of the sediment control of the 2 year flood frequency are 23 % of those of the long term plan.

TABLA G.3.16 COSTO DIRECTO DE CONSTRUCCION PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA (FRECUENCIA DE INUNDACION DE 5 AÑOS)

Unit :L.p

| Work Items | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks | |
|--|--------------------|------|--------|---------------------|-------------------|-----------|--------------------|---------------------|-------------------|-----------------|--|
| A. RIVER WORKS | | | | | | | | | | | |
| 1.PREPARATORY WORK | | | | | | | 1 | 5,432,037 | 3,366,901 | 2,065,136 | |
| 2.EMBANKMENT WORK | | | | | | | | | | | |
| Excavation & Spoiling | Sandy Soil | m3 | 39 | 94 | 6 | 197,600 | 7,706,400 | 7,244,016 | 462,384 | | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 2,400 | 374,800 | 202,176 | 172,624 | | |
| Wet Masonry | For Revetment | m2 | 170 | 13 | 87 | 35,211 | 5,996,076 | 779,489 | 5,216,587 | | |
| Concrete Structure (for River Structure) | Box Culvert | m3 | 2,722 | 44 | 56 | 0 | 0 | 0 | 0 | Incl. form work | |
| | Gate A (Steel) | m2 | 15,000 | 95 | 5 | 0 | 0 | 0 | 0 | excavation, etc | |
| | Gate B (Steel) | m2 | 13,000 | 95 | 5 | 0 | 0 | 0 | 0 | | |
| | Bridge (Slab, Etc) | m2 | 6,937 | 37 | 63 | 1 | 8,500,000 | 3,145,000 | 5,355,000 | Incl. pier, etc | |
| | Weir | m3 | 1,035 | 77 | 23 | 0 | 0 | 0 | 0 | | |
| | Consolid. Dam | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 | | |
| Exca. & Banking | By Machine | m3 | 36 | 92 | 8 | 334,400 | 12,038,400 | 11,075,323 | 963,077 | | |
| Sodding | | m2 | 8 | 0 | 100 | 199,789 | 1,598,312 | 0 | 1,598,312 | | |
| Sub-Total (LP): | | | | | | | 41,643,819 | 25,812,510 | 15,832,709 | | |
| | | | | | | | %: | 100 | 62 | 38 | |
| B. SABO WORKS | | | | | | | | | | | |
| 1.PREPARATORY WORKS | | | | | | | 1 | 7,829,608 | 4,853,654 | 2,975,954 | |
| 2.SABO DAM WORKS | | | | | | | | | | | |
| Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 | Incl. form work | |
| Gabion (Mat Type) | D=0.45m | m3 | 156 | 54 | 46 | 0 | 0 | 0 | 0 | excavation, etc | |
| 3.CONSOLIDATION WORKS | | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 12,343 | 481,577 | 452,494 | 28,883 | | |
| Debris Control Structure | Concrete Works | m3 | 1,100 | 62 | 38 | 43,246 | 47,570,600 | 29,493,772 | 18,076,828 | Incl. form work | |
| Gabion (Mat Type) | 40*120*400 | m3 | 156 | 54 | 46 | 12,343 | 1,925,508 | 1,039,774 | 885,734 | | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 7,900 | 1,232,400 | 663,496 | 568,904 | | |
| 4.LEVEE | | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 0 | 0 | 0 | 0 | | |
| Banking | By Machine | m3 | 36 | 92 | 8 | 12,654 | 455,544 | 419,100 | 36,444 | | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 3,410 | 531,960 | 287,258 | 244,702 | | |
| Sub-Total (LP): | | | | | | | 60,026,997 | 37,311,580 | 22,815,417 | | |
| | | | | | | | %: | 100 | 62 | 38 | |
| Total(A+B): | | | | | | | 101,672,617 | 63,024,490 | 38,648,126 | | |
| | | | | | | | %: | 100 | 62 | 38 | |
| 5.LAND ACQUISITION | | | 0.50 | 0 | 100 | 2,138,568 | 1,069,284 | | 1,069,284 | | |

Note : 1) Construction cost of the river improvement is that for 5 year flood frequency.

2) Construction cost of the sediment control is that for 5 year flood frequency. The work quantities of the sediment control of the 5 year flood frequency are 37 % of those of the long term plan.

TABLA G.3.17 COSTO DIRECTO DE CONSTRUCCION PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA (FRECUENCIA DE INUNDACION DE 30 AÑOS)

Unit :Lp

| Work Items | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks |
|--|--------------------|------|--------|---------------------|-------------------|-----------------|-------------|---------------------|-------------------|-----------------|
| A. RIVER WORKS | | | | | | | | | | |
| 1. PREPARATORY WORK | | | | | | | | | | |
| | | | | | | 1 | 8,547,311 | 5,674,963 | 2,872,348 | |
| 2. EMBANKMENT WORK | | | | | | | | | | |
| Excavation & Spoiling | Sandy Soil | m3 | 39 | 94 | 6 | 431,300 | 16,820,700 | 15,811,458 | 1,009,242 | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 3,200 | 499,200 | 269,568 | 229,632 | |
| Wet Masonry | For Revement | m2 | 170 | 13 | 87 | 42,576 | 7,237,920 | 940,930 | 6,296,990 | |
| Concrete Structure (for River Structure) | Box Culvert | m3 | 2,722 | 44 | 56 | 0 | 0 | 0 | 0 | Incl. form work |
| | Gate A (Steel) | m2 | 15,000 | 95 | 5 | 0 | 0 | 0 | 0 | excavation, etc |
| | Gate B (Steel) | m2 | 13,000 | 95 | 5 | 0 | 0 | 0 | 0 | |
| | Bridge (Slab, Etc) | m2 | 6,937 | 37 | 63 | 1 | 13,217,160 | 4,890,349 | 8,326,811 | Incl. pier, etc |
| | Weir | m3 | 1,035 | 77 | 23 | 0 | 0 | 0 | 0 | |
| | Consolid. Dam | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 | |
| Exca. & Banking | By Machine | m3 | 36 | 92 | 8 | 480,700 | 17,305,200 | 15,920,784 | 1,384,416 | |
| Sodding | | m2 | 8 | 0 | 100 | 237,737 | 1,901,896 | 0 | 1,901,896 | |
| | | | | | | Sub-Total (LP): | 65,529,387 | 43,508,052 | 22,021,335 | |
| | | | | | | %: | 100 | 66 | 34 | |
| B. SABO WORKS | | | | | | | | | | |
| 1. PREPARATORY WORKS | | | | | | | | | | |
| | | | | | | 1 | 22,531,338 | 13,976,749 | 8,574,590 | |
| 2. SABO DAM WORKS | | | | | | | | | | |
| Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 60,705 | 66,775,500 | 41,400,810 | 25,374,690 | Incl. form work |
| Gabion (Mat Type) | D=0.45m | m3 | 156 | 54 | 46 | 2,142 | 334,152 | 180,442 | 153,710 | excavation, etc |
| 3. CONSOLIDATION WORKS | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 19,682 | 767,598 | 721,542 | 46,056 | |
| Debris Control Structure | Concrete Works | m3 | 1,100 | 62 | 38 | 68,959 | 75,854,900 | 47,030,038 | 28,824,862 | Incl. form work |
| Gabion (Mat Type) | 40*120*400 | m3 | 156 | 54 | 46 | 19,682 | 3,070,392 | 1,638,012 | 1,412,380 | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 12,597 | 1,965,133 | 1,061,171 | 903,961 | |
| 4. LEVEE | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 0 | 0 | 0 | 0 | |
| Banking | By Machine | m3 | 36 | 92 | 8 | 20,178 | 726,408 | 668,295 | 58,113 | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 5,437 | 848,172 | 458,013 | 390,159 | |
| | | | | | | Sub-Total (LP): | 172,893,392 | 107,135,072 | 65,758,320 | |
| | | | | | | %: | 100 | 62 | 38 | |
| | | | | | | Total(A+B): | 238,422,980 | 150,663,124 | 87,759,835 | |
| | | | | | | %: | 100 | 63 | 37 | |
| 5. LAND ACQUISITION | | | 0.50 | 0 | 100 | 2,138,568 | 1,069,284 | | 1,069,284 | |

Note : 1) Construction cost of the river improvement is that for 30 year flood frequency.

2) Construction cost of the sediment control is that for 30 year flood frequency. The work quantities of the sediment control of the 30 year flood frequency are 59 % of those of the long term plan.

TABLA G.3.18 COSTO DIRECTO DE CONSTRUCCION PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA (FRECUENCIA DE INUNDACION DE 50 AÑOS)

Unit :Lp

| Work Items | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks |
|--|--------------------|------|--------|---------------------|-------------------|-----------------|-------------|---------------------|-------------------|-----------------|
| A. RIVER WORKS | | | | | | | | | | |
| 1. PREPARATORY WORK | | | | | | | | | | |
| | | | | | | 1 | 9,813,848 | 6,778,728 | 3,035,120 | |
| 2. EMBANKMENT WORK | | | | | | | | | | |
| Excavation & Spoiling | Sandy Soil | m3 | 39 | 94 | 6 | 621,300 | 24,230,700 | 22,776,858 | 1,453,842 | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 3,600 | 561,600 | 303,264 | 258,336 | |
| Wet Masonry | For Revement | m2 | 170 | 13 | 87 | 42,576 | 7,237,920 | 940,930 | 6,296,990 | |
| Concrete Structure (for River Structure) | Box Culvert | m3 | 2,722 | 44 | 56 | 0 | 0 | 0 | 0 | Incl. form work |
| | Gate A (Steel) | m2 | 15,000 | 95 | 5 | 0 | 0 | 0 | 0 | excavation, etc |
| | Gate B (Steel) | m2 | 13,000 | 95 | 5 | 0 | 0 | 0 | 0 | |
| | Bridge (Slab, Etc) | m2 | 6,937 | 37 | 63 | 1 | 14,188,340 | 5,249,686 | 8,938,654 | Incl. pier, etc |
| | Weir | m3 | 1,035 | 77 | 23 | 0 | 0 | 0 | 0 | |
| | Consolid. Dam | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 | |
| Exca. & Banking | By Machine | m3 | 36 | 92 | 8 | 480,700 | 17,305,200 | 15,920,784 | 1,384,416 | |
| Sodding | | m2 | 8 | 0 | 100 | 237,737 | 1,901,896 | 0 | 1,901,896 | |
| | | | | | | Sub-Total (LP): | 75,239,504 | 51,970,250 | 23,269,253 | |
| | | | | | | %: | 100 | 69 | 31 | |
| B. SABO WORKS | | | | | | | | | | |
| 1. PREPARATORY WORKS | | | | | | | | | | |
| | | | | | | 1 | 25,226,950 | 15,635,026 | 9,591,923 | |
| 2. SABO DAM WORKS | | | | | | | | | | |
| Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 67,907 | 74,697,700 | 46,312,574 | 28,385,126 | Incl. form work |
| Gabion (Mat Type) | D=0.45m | m3 | 156 | 54 | 46 | 2,396 | 373,776 | 201,839 | 171,937 | excavation, etc |
| 3. CONSOLIDATION WORKS | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 22,018 | 858,702 | 807,180 | 51,522 | |
| Debris Control Structure | Concrete Works | m3 | 1,100 | 62 | 38 | 77,141 | 84,855,100 | 52,610,162 | 32,244,938 | Incl. form work |
| Gabion (Mat Type) | 40*120*400 | m3 | 156 | 54 | 46 | 22,018 | 3,434,808 | 1,854,796 | 1,580,012 | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 14,091 | 2,198,196 | 1,187,026 | 1,011,170 | |
| 4. LEVEE | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 0 | 0 | 0 | 0 | |
| Banking | By Machine | m3 | 36 | 92 | 8 | 22,572 | 812,592 | 747,585 | 65,007 | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 5,437 | 948,792 | 512,348 | 436,444 | |
| | | | | | | Sub-Total (LP): | 183,406,616 | 119,868,336 | 73,538,080 | |
| | | | | | | %: | 100 | 62 | 38 | |
| | | | | | | Total(A+B): | 266,646,120 | 171,818,785 | 96,807,335 | |
| | | | | | | %: | 100 | 64 | 36 | |
| 5. LAND ACQUISITION | | | 0.50 | 0 | 100 | 1,092,000 | 546,000 | 0 | 546,000 | |

Note : 1) Construction cost of the river improvement is that for 50 year flood frequency.

2) Construction cost of the sediment control is that for 50 year flood frequency. The work quantities of the sediment control of the 50 year flood frequency are 66 % of those of the long term plan.

TABLA G.3.19 COSTO DIRECTO DE CONSTRUCCION PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA (FRECUENCIA DE INUNDACION DE 100 AÑOS)

| Work Items | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks |
|-------------------------------|--|--------------------|-------|---------------------|-------------------|-----------|----------------|---------------------|-------------------|----------------------------------|
| A. RIVER WORKS | | | | | | | | | | |
| 1. PREPARATORY WORK | | | | | | | | | | |
| 2. EMBANKMENT WORK | | | | | | | | | | |
| | Excavation & Spoiling | Sandy Soil | m3 | 39 | 94 | 6 | 811,300 | 31,640,700 | 29,742,258 | 1,898,442 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 4,900 | 624,000 | 336,960 | 287,040 |
| | Wet Masonry | For Retement | m2 | 170 | 13 | 87 | 42,576 | 7,237,920 | 940,930 | 6,296,990 |
| | Concrete Structure (for River Structure) | Box Culvert | m3 | 2,722 | 44 | 56 | 0 | 0 | 0 | 0 |
| | | Gate A (Steel) | m2 | 15,000 | 93 | 3 | 0 | 0 | 0 | Incl. form work, excavation, etc |
| | | Gate B (Steel) | m2 | 13,000 | 93 | 3 | 0 | 0 | 0 | 0 |
| | | Bridges (Slab Etc) | m2 | 6,937 | 37 | 63 | 1 | 15,298,260 | 5,660,356 | 9,637,904 |
| | | Weir | m3 | 1,035 | 77 | 23 | 0 | 0 | 0 | 0 |
| | | Consolid. Dam | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 |
| | Exc. & Banking | By Machine | m3 | 36 | 92 | 8 | 480,700 | 17,305,200 | 15,920,784 | 1,384,416 |
| | Sodding | | m2 | 8 | 0 | 100 | 237,737 | 1,901,896 | 0 | 1,901,896 |
| | | | | | | | Sub-Total (LP) | 83,109,172 | 60,491,481 | 22,617,691 |
| | | | | | | | % | 100 | 71 | 29 |
| B. SABO WORKS | | | | | | | | | | |
| 1. PREPARATORY WORKS | | | | | | | | | | |
| 2. SABO DAM WORKS | | | | | | | | | | |
| | Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 76,139 | 83,752,900 | 51,926,798 | 31,826,102 |
| | Gabion (Mat Type) | D=0.45m | m3 | 156 | 54 | 46 | 2,686 | 419,016 | 226,269 | 192,747 |
| 3. CONSOLIDATION WORKS | | | | | | | | | | |
| | Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 24,686 | 962,754 | 904,985 | 57,769 |
| | Debris Control Structure | Concrete Works | m3 | 1,100 | 62 | 38 | 86,491 | 95,140,100 | 58,986,862 | 36,153,238 |
| | Gabion (Mat Type) | 40° 120° 400 | m3 | 156 | 54 | 46 | 24,686 | 3,831,016 | 2,079,549 | 1,751,467 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 15,799 | 2,464,644 | 1,330,908 | 1,133,736 |
| 4. LEVEE | | | | | | | | | | |
| | Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 0 | 0 | 0 | 0 |
| | Banking | By Machine | m3 | 36 | 92 | 8 | 25,308 | 911,088 | 838,201 | 72,887 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 6,819 | 1,063,764 | 574,433 | 489,331 |
| | | | | | | | Sub-Total (LP) | 216,850,074 | 134,396,208 | 82,453,866 |
| | | | | | | | % | 100 | 62 | 38 |
| | | | | | | | Total (A+B) | 301,939,247 | 194,887,689 | 107,069,557 |
| | | | | | | | % | 100 | 65 | 35 |
| 5. LAND ACQUISITION | | | 0.50 | 0 | 100 | 2,138,568 | 1,069,284 | | 1,069,284 | |

Note : 1) Construction cost of the river improvement is that for 100 year flood frequency.

2) Construction cost of the sediment control is that for 100 year flood frequency. The work quantities of the sediment control of the 100 year flood frequency are 74 % of those of the long term plan.

**TABLA G.3.20 PROGRAMA DE DESEMBOLSOS PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA
I (FRECUENCIA DE INUNDACION DE 2 AÑOS)**

(UNIT:X1000 LP)

| YEAR | TOTAL COS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | REMARKS | |
|---------------------------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|------------|------------|
| 1.CONSTRUCTION+CONTING.) | | | Cost= | 84,593 | F/C= | 37,115 | Contin+= | 1.20 | 10 | | | | |
| TOTAL (A+B) | 77,512 | 7,751 | 7,751 | 7,751 | 7,751 | 7,751 | 7,751 | 7,751 | 7,751 | 7,751 | 7,751 | | |
| F/C | 44,538 | 4,454 | 4,454 | 4,454 | 4,454 | 4,454 | 4,454 | 4,454 | 4,454 | 4,454 | 4,454 | | |
| L/C | 32,974 | 3,297 | 3,297 | 3,297 | 3,297 | 3,297 | 3,297 | 3,297 | 3,297 | 3,297 | 3,297 | | |
| 2.LAND ACQUISITION | | | Cost= | | F/C= | 0 | Contin+= | 1.00 | 10 | | | | |
| TOTAL (A+B) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| F/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 3.ADMINISTRATION | | | Cost= | 3,230 | F/C= | 0 | Contin+= | 1.00 | 10 | | | | |
| TOTAL (A+B) | 3,230 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | | |
| F/C | 3,230 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | | |
| L/C | 3,230 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | | |
| 4.ENGINEERING SERVICES | | | Cost= | 7,751 | F/C= | 3,100 | Contin+= | 1.00 | 10 | | | | |
| TOTAL (A+B) | 7,751 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | 775 | | |
| F/C | 3,100 | 310 | 310 | 310 | 310 | 310 | 310 | 310 | 310 | 310 | 310 | | |
| L/C | 4,651 | 465 | 465 | 465 | 465 | 465 | 465 | 465 | 465 | 465 | 465 | | |
| Sub-Total(1-4) | 88,492 | 8,849 | 8,849 | 8,849 | 8,849 | 8,849 | 8,849 | 8,849 | 8,849 | 8,849 | 8,849 | 0 | |
| F/C | 47,638 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 0 | |
| L/C | 40,854 | 4,085 | 4,085 | 4,085 | 4,085 | 4,085 | 4,085 | 4,085 | 4,085 | 4,085 | 4,085 | 0 | |
| 5.MAINTENANCE/OPERATION | | | | | | | | | | | | | |
| TOTAL (A+B) | 775 | 78 | 155 | 233 | 310 | 388 | 465 | 543 | 620 | 698 | 775 | 775 | |
| F/C | 775 | 78 | 155 | 233 | 310 | 388 | 465 | 543 | 620 | 698 | 775 | 775 | |
| L/C | 775 | 78 | 155 | 233 | 310 | 388 | 465 | 543 | 620 | 698 | 775 | 775 | |
| TOTAL (1-5) | 89,268 | 8,849 | 8,927 | 9,004 | 9,082 | 9,159 | 9,237 | 9,314 | 9,392 | 9,469 | 9,547 | 775 | 775 |
| F/C | 47,638 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 4,764 | 0 | 0 |
| L/C | 41,629 | 4,085 | 4,163 | 4,240 | 4,318 | 4,395 | 4,473 | 4,550 | 4,628 | 4,705 | 4,783 | 775 | 775 |

With Price Contingency.

| | | | | | | | | | | | | | |
|-------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|-----------------------|
| F/C | 59,676 | 5,206 | 5,362 | 5,523 | 5,688 | 5,859 | 6,035 | 6,216 | 6,402 | 6,594 | 6,792 | | x(1+.03) ⁿ |
| L/C | 95,335 | 5,438 | 6,095 | 6,829 | 7,649 | 8,565 | 9,588 | 10,730 | 12,004 | 13,425 | 15,011 | | x(1+.01) ⁿ |
| Total | 155,011 | 10,643 | 11,457 | 12,352 | 13,338 | 14,424 | 15,623 | 16,945 | 18,406 | 20,020 | 21,803 | | |

**TABLA G.3.21 PROGRAMA DE DESEMBOLSOS PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA
(FRECUENCIA DE INUNDACION DE 5 AÑOS)**

(5-YEAR FLOOD FREQUENCY)

(UNIT:X1000 LP)

| YEAR | TOTAL COS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | REMARKS | |
|---------------------------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|--------------|
| 1.CONSTRUCTION+CONTING.) | | | Cost= | 101,672 | F/C= | 63,024 | Contin+= | 1.20 | 10 | | | | |
| TOTAL (A+B) | 122,006 | 12,201 | 12,201 | 12,201 | 12,201 | 12,201 | 12,201 | 12,201 | 12,201 | 12,201 | 12,201 | | |
| F/C | 75,629 | 7,563 | 7,563 | 7,563 | 7,563 | 7,563 | 7,563 | 7,563 | 7,563 | 7,563 | 7,563 | | |
| L/C | 46,378 | 4,638 | 4,638 | 4,638 | 4,638 | 4,638 | 4,638 | 4,638 | 4,638 | 4,638 | 4,638 | | |
| 2.LAND ACQUISITION | | | Cost= | | F/C= | 0 | Contin+= | 1.00 | 10 | | | | |
| TOTAL (A+B) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| F/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 3.ADMINISTRATION | | | Cost= | 5,084 | F/C= | 0 | Contin+= | 1.00 | 10 | | | | |
| TOTAL (A+B) | 5,084 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | | |
| F/C | 5,084 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | | |
| L/C | 5,084 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | | |
| 4.ENGINEERING SERVICES | | | Cost= | 12,201 | F/C= | 4,880 | Contin+= | 1.00 | 10 | | | | |
| TOTAL (A+B) | 12,201 | 1,220 | 1,220 | 1,220 | 1,220 | 1,220 | 1,220 | 1,220 | 1,220 | 1,220 | 1,220 | | |
| F/C | 4,880 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | | |
| L/C | 7,320 | 732 | 732 | 732 | 732 | 732 | 732 | 732 | 732 | 732 | 732 | | |
| Sub-Total(1-4) | 139,291 | 13,929 | 13,929 | 13,929 | 13,929 | 13,929 | 13,929 | 13,929 | 13,929 | 13,929 | 13,929 | 0 | |
| F/C | 80,509 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 0 | |
| L/C | 58,782 | 5,878 | 5,878 | 5,878 | 5,878 | 5,878 | 5,878 | 5,878 | 5,878 | 5,878 | 5,878 | 0 | |
| 5.MAINTENANCE/OPERATION | | | | | | | | | | | | | |
| TOTAL (A+B) | 1,220 | 122 | 244 | 366 | 488 | 610 | 732 | 854 | 976 | 1,098 | 1,220 | 1,220 | |
| F/C | 1,220 | 122 | 244 | 366 | 488 | 610 | 732 | 854 | 976 | 1,098 | 1,220 | 1,220 | |
| L/C | 1,220 | 122 | 244 | 366 | 488 | 610 | 732 | 854 | 976 | 1,098 | 1,220 | 1,220 | |
| TOTAL (1-5) | 140,511 | 13,929 | 14,051 | 14,173 | 14,295 | 14,417 | 14,539 | 14,661 | 14,783 | 14,905 | 15,027 | 1,220 | 1,220 |
| F/C | 80,509 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 8,051 | 0 | 0 |
| L/C | 60,002 | 5,878 | 6,000 | 6,122 | 6,244 | 6,366 | 6,488 | 6,610 | 6,732 | 6,854 | 6,976 | 1,220 | 1,220 |

With Price Contingency.

| | | | | | | | | | | | | | |
|-------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|-----------------------|
| F/C | 100,853 | 8,797 | 9,081 | 9,333 | 9,813 | 9,902 | 10,199 | 10,505 | 10,820 | 11,144 | 11,479 | | x(1+.03) ⁿ |
| L/C | 138,343 | 7,824 | 8,785 | 9,860 | 11,062 | 12,408 | 13,908 | 15,588 | 17,462 | 19,556 | 21,894 | | x(1+.01) ⁿ |
| Total | 239,195 | 16,621 | 17,846 | 19,193 | 20,675 | 22,307 | 24,107 | 26,093 | 28,281 | 30,700 | 33,373 | | |

TABLA G.3.22 PROGRAMA DE DESEMBOLSOS PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA (FRECUENCIA DE INUNDACION DE 30 AÑOS)

| (30-YEAR FLOOD FREQUENCY) | | | | | | | | | | | | (UNIT:X1000 LP) | | REMARKS | | |
|----------------------------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-----------------|--------------|---------|-------|-------|
| YEAR | TOTAL COS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | |
| 1.CONSTRUCTION(+CONTING.) | | | Cost= | 238,422 | F/C= | 150,663 | Conting= | 1.20 | 10 | | | | | | | |
| TOTAL (A+B) | 286,106 | 28,611 | 28,611 | 28,611 | 28,611 | 28,611 | 28,611 | 28,611 | 28,611 | 28,611 | 28,611 | | | | | |
| F/C | 180,798 | 18,080 | 18,080 | 18,080 | 18,080 | 18,080 | 18,080 | 18,080 | 18,080 | 18,080 | 18,080 | | | | | |
| L/C | 105,311 | 10,531 | 10,531 | 10,531 | 10,531 | 10,531 | 10,531 | 10,531 | 10,531 | 10,531 | 10,531 | | | | | |
| 2.LAND ACQUISITION | | | Cost= | | F/C= | 0 | Conting= | 1.00 | 10 | | | | | | | |
| TOTAL (A+B) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| F/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 3.ADMINISTRATION | | | Cost= | 11,921 | F/C= | 0 | Conting= | 1.00 | 10 | | | | | | | |
| TOTAL (A+B) | 11,921 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | | | | | |
| F/C | 11,921 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | | | | | |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 4.ENGINEERING SERVICES | | | Cost= | 28,611 | F/C= | 11,444 | Conting= | 1.00 | 10 | | | | | | | |
| TOTAL (A+B) | 28,611 | 2,861 | 2,861 | 2,861 | 2,861 | 2,861 | 2,861 | 2,861 | 2,861 | 2,861 | 2,861 | | | | | |
| F/C | 11,444 | 1,144 | 1,144 | 1,144 | 1,144 | 1,144 | 1,144 | 1,144 | 1,144 | 1,144 | 1,144 | | | | | |
| L/C | 17,168 | 1,717 | 1,717 | 1,717 | 1,717 | 1,717 | 1,717 | 1,717 | 1,717 | 1,717 | 1,717 | | | | | |
| Sub-Total(1-4) | 326,638 | 32,664 | 32,664 | 32,664 | 32,664 | 32,664 | 32,664 | 32,664 | 32,664 | 32,664 | 32,664 | 0 | 0 | | | |
| F/C | 192,240 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 0 | 0 | | | |
| L/C | 134,398 | 13,440 | 13,440 | 13,440 | 13,440 | 13,440 | 13,440 | 13,440 | 13,440 | 13,440 | 13,440 | 0 | 0 | | | |
| 5.MAINTENANCE/OPERATION | | | Cost= | 286 | F/C= | 572 | Conting= | 859 | 1,144 | 1,431 | 1,717 | 2,003 | 2,289 | 2,575 | 2,861 | 2,861 |
| TOTAL (A+B) | 2,861 | 286 | 286 | 572 | 859 | 1,144 | 1,431 | 1,717 | 2,003 | 2,289 | 2,575 | 2,861 | 2,861 | | | |
| F/C | 2,861 | 286 | 286 | 572 | 859 | 1,144 | 1,431 | 1,717 | 2,003 | 2,289 | 2,575 | 2,861 | 2,861 | | | |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| TOTAL (1-5) | 329,499 | 32,664 | 32,950 | 33,236 | 33,522 | 33,808 | 34,094 | 34,380 | 34,667 | 34,953 | 35,239 | 2,861 | 2,861 | | | |
| F/C | 192,240 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 19,224 | 0 | 0 | | | |
| L/C | 137,259 | 13,440 | 13,726 | 14,012 | 14,298 | 14,584 | 14,870 | 15,156 | 15,443 | 15,729 | 16,015 | 2,861 | 2,861 | | | |

With Price Contingency.

| | | | | | | | | | | | | | | |
|-------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|--|------------|
| F/C | 240,817 | 21,007 | 21,637 | 22,286 | 22,954 | 23,643 | 24,352 | 25,083 | 25,835 | 26,610 | 27,409 | | | x(1+.03)^n |
| L/C | 317,107 | 17,888 | 20,098 | 22,567 | 25,330 | 28,421 | 31,876 | 35,738 | 40,054 | 44,876 | 50,261 | | | x(1+.01)^n |
| Total | 557,924 | 38,895 | 41,733 | 44,852 | 48,284 | 52,064 | 56,228 | 60,821 | 65,889 | 71,486 | 77,670 | | | |

TABLA G.3.23 PROGRAMA DE DESEMBOLSOS PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA (FRECUENCIA DE INUNDACION DE 50 AÑOS)

| (50-YEAR FLOOD FREQUENCY) | | | | | | | | | | | | (UNIT:X1000 LP) | | REMARKS | | |
|----------------------------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-----------------|--------------|---------|-------|-------|
| YEAR | TOTAL COS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | |
| 1.CONSTRUCTION(+CONTING.) | | | Cost= | 268,846 | F/C= | 171,838 | Conting= | 1.20 | 10 | | | | | | | |
| TOTAL (A+B) | 322,375 | 32,238 | 32,238 | 32,238 | 32,238 | 32,238 | 32,238 | 32,238 | 32,238 | 32,238 | 32,238 | | | | | |
| F/C | 206,206 | 20,621 | 20,621 | 20,621 | 20,621 | 20,621 | 20,621 | 20,621 | 20,621 | 20,621 | 20,621 | | | | | |
| L/C | 116,170 | 11,617 | 11,617 | 11,617 | 11,617 | 11,617 | 11,617 | 11,617 | 11,617 | 11,617 | 11,617 | | | | | |
| 2.LAND ACQUISITION | | | Cost= | | F/C= | 0 | Conting= | 1.00 | 10 | | | | | | | |
| TOTAL (A+B) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| F/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 3.ADMINISTRATION | | | Cost= | 1,343 | F/C= | 0 | Conting= | 1.00 | 10 | | | | | | | |
| TOTAL (A+B) | 13,432 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | | | | | |
| F/C | 13,432 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | 1,343 | | | | | |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 4.ENGINEERING SERVICES | | | Cost= | 32,238 | F/C= | 12,895 | Conting= | 1.00 | 10 | | | | | | | |
| TOTAL (A+B) | 32,238 | 3,224 | 3,224 | 3,224 | 3,224 | 3,224 | 3,224 | 3,224 | 3,224 | 3,224 | 3,224 | | | | | |
| F/C | 12,895 | 1,290 | 1,290 | 1,290 | 1,290 | 1,290 | 1,290 | 1,290 | 1,290 | 1,290 | 1,290 | | | | | |
| L/C | 19,343 | 1,934 | 1,934 | 1,934 | 1,934 | 1,934 | 1,934 | 1,934 | 1,934 | 1,934 | 1,934 | | | | | |
| Sub-Total(1-4) | 368,045 | 36,805 | 36,805 | 36,805 | 36,805 | 36,805 | 36,805 | 36,805 | 36,805 | 36,805 | 36,805 | 0 | 0 | | | |
| F/C | 219,101 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 0 | 0 | | | |
| L/C | 148,944 | 14,894 | 14,894 | 14,894 | 14,894 | 14,894 | 14,894 | 14,894 | 14,894 | 14,894 | 14,894 | 0 | 0 | | | |
| 5.MAINTENANCE/OPERATION | | | Cost= | 322 | F/C= | 645 | Conting= | 967 | 1,290 | 1,612 | 1,934 | 2,257 | 2,579 | 2,901 | 3,224 | 3,224 |
| TOTAL (A+B) | 3,224 | 322 | 322 | 645 | 967 | 1,290 | 1,612 | 1,934 | 2,257 | 2,579 | 2,901 | 3,224 | 3,224 | | | |
| F/C | 3,224 | 322 | 322 | 645 | 967 | 1,290 | 1,612 | 1,934 | 2,257 | 2,579 | 2,901 | 3,224 | 3,224 | | | |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| TOTAL (1-5) | 371,269 | 36,805 | 37,127 | 37,449 | 37,772 | 38,094 | 38,416 | 38,739 | 39,061 | 39,384 | 39,706 | 3,224 | 3,224 | | | |
| F/C | 219,101 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 21,910 | 0 | 0 | | | |
| L/C | 152,168 | 14,894 | 15,217 | 15,539 | 15,862 | 16,184 | 16,506 | 16,829 | 17,151 | 17,473 | 17,796 | 3,224 | 3,224 | | | |

With Price Contingency.

| | | | | | | | | | | | | | | |
|-------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|--|------------|
| F/C | 274,465 | 23,942 | 24,680 | 25,400 | 26,162 | 26,947 | 27,755 | 28,588 | 29,445 | 30,329 | 31,239 | | | x(1+.03)^n |
| L/C | 352,021 | 19,825 | 22,279 | 25,026 | 28,100 | 31,538 | 35,383 | 39,681 | 44,485 | 49,854 | 55,851 | | | x(1+.01)^n |
| Total | 626,486 | 43,766 | 46,939 | 50,426 | 54,261 | 58,485 | 63,138 | 68,269 | 73,931 | 80,182 | 87,089 | | | |

TABLA G.3.24 PROGRAMA DE DESEMBOLSOS PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA (FRECUENCIA DE INUNDACION DE 100 AÑOS)

| (100-YEAR FLOOD FREQUENCY) | | (UNIT: X1000 LP) | | | | | | | | | | REMARKS | | |
|---------------------------------|-----------|------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|-------|-------|
| YEAR | TOTAL COS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | |
| 1.CONSTRUCTION+CONTING.) | | | | | | | | | | | | | | |
| | Cost= | 301,959 | | | | | | | | | | | | |
| | F/C= | 194,889 | | | | | | | | | | | | |
| | Conting= | 1,20 | | | | | | | | | | | | |
| TOTAL (A+B) | | 36,235 | 36,235 | 36,235 | 36,235 | 36,235 | 36,235 | 36,235 | 36,235 | 36,235 | 36,235 | | | |
| F/C | | 23,387 | 23,387 | 23,387 | 23,387 | 23,387 | 23,387 | 23,387 | 23,387 | 23,387 | 23,387 | | | |
| L/C | | 12,848 | 12,848 | 12,848 | 12,848 | 12,848 | 12,848 | 12,848 | 12,848 | 12,848 | 12,848 | | | |
| 2.LAND ACQUISITION | | | | | | | | | | | | | | |
| | Cost= | 0 | | | | | | | | | | | | |
| | F/C= | 0 | | | | | | | | | | | | |
| | Conting= | 0 | | | | | | | | | | | | |
| TOTAL (A+B) | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| F/C | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| L/C | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| 3.ADMINISTRATION | | | | | | | | | | | | | | |
| | Cost= | 15,098 | | | | | | | | | | | | |
| | F/C= | 0 | | | | | | | | | | | | |
| | Conting= | 1,00 | | | | | | | | | | | | |
| TOTAL (A+B) | | 15,098 | 1,510 | 1,510 | 1,510 | 1,510 | 1,510 | 1,510 | 1,510 | 1,510 | 1,510 | | | |
| F/C | | 15,098 | 1,510 | 1,510 | 1,510 | 1,510 | 1,510 | 1,510 | 1,510 | 1,510 | 1,510 | | | |
| L/C | | | | | | | | | | | | | | |
| 4.ENGINEERING SERVICES | | | | | | | | | | | | | | |
| | Cost= | 36,235 | | | | | | | | | | | | |
| | F/C= | 14,494 | | | | | | | | | | | | |
| | Conting= | 1,00 | | | | | | | | | | | | |
| TOTAL (A+B) | | 36,235 | 3,624 | 3,624 | 3,624 | 3,624 | 3,624 | 3,624 | 3,624 | 3,624 | 3,624 | | | |
| F/C | | 14,494 | 1,449 | 1,449 | 1,449 | 1,449 | 1,449 | 1,449 | 1,449 | 1,449 | 1,449 | | | |
| L/C | | 21,741 | 2,174 | 2,174 | 2,174 | 2,174 | 2,174 | 2,174 | 2,174 | 2,174 | 2,174 | | | |
| Sub-Total(1-4) | | 413,684 | 41,368 | 41,368 | 41,368 | 41,368 | 41,368 | 41,368 | 41,368 | 41,368 | 41,368 | 0 | 0 | |
| F/C | | 248,361 | 24,836 | 24,836 | 24,836 | 24,836 | 24,836 | 24,836 | 24,836 | 24,836 | 24,836 | 0 | 0 | |
| L/C | | 165,323 | 16,532 | 16,532 | 16,532 | 16,532 | 16,532 | 16,532 | 16,532 | 16,532 | 16,532 | 0 | 0 | |
| 5.MAINTENANCE/OPERATION | | | | | | | | | | | | | | |
| TOTAL (A+B) | | 3,624 | 362 | 725 | 1,087 | 1,449 | 1,812 | 2,174 | 2,536 | 2,899 | 3,261 | 3,624 | 3,624 | |
| L/C | | 3,624 | 362 | 725 | 1,087 | 1,449 | 1,812 | 2,174 | 2,536 | 2,899 | 3,261 | 3,624 | 3,624 | |
| TOTAL (1-5) | | 417,307 | 41,368 | 41,731 | 42,093 | 42,455 | 42,818 | 43,180 | 43,542 | 43,905 | 44,267 | 44,630 | 3,624 | 3,624 |
| F/C | | 248,361 | 24,836 | 24,836 | 24,836 | 24,836 | 24,836 | 24,836 | 24,836 | 24,836 | 24,836 | 24,836 | 0 | 0 |
| L/C | | 168,947 | 16,532 | 16,895 | 17,257 | 17,619 | 17,982 | 18,344 | 18,706 | 19,069 | 19,431 | 19,793 | 3,624 | 3,624 |

With Price Contingency.

| | | | | | | | | | | | | | | |
|-------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|--|-----------------------|
| F/C | 311,119 | 27,139 | 27,953 | 28,792 | 29,656 | 30,545 | 31,462 | 32,405 | 33,378 | 34,379 | 35,410 | | | x(1+.03) ⁿ |
| L/C | 391,237 | 22,004 | 24,735 | 27,793 | 31,214 | 35,041 | 39,322 | 44,109 | 49,459 | 55,439 | 62,120 | | | x(1+.01) ⁿ |
| Total | 702,356 | 49,144 | 52,689 | 56,584 | 60,869 | 65,587 | 70,784 | 76,514 | 82,837 | 89,818 | 97,531 | | | |

TABLA G.3.25 COSTO DIRECTO DE CONSTRUCCION PARA LA EVALUACION ECONOMICA DEL RIO BLANCO (FRECUENCIA DE INUNDACION DE 50 AÑOS)

| Unit: LP | | | | | | | | | | |
|--|---------------------|------|--------|---------------------|-------------------|---------------------|--------------------|---------------------|-------------------|-----------------|
| Work Items | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks |
| A. RIVER WORKS | | | | | | | | | | |
| 1. PREPARATORY WORK | | | | | | | | | | |
| | | | | | | 1 | 25,643,189 | 20,275,864 | 5,367,325 | |
| 2. EMBANKMENT WORK | | | | | | | | | | |
| Excavation & Spotting | Sandy Soil | m3 | 39 | 94 | 6 | 1,022,856 | 39,891,384 | 37,497,901 | 2,393,483 | |
| Gablon (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 92,920 | 14,455,520 | 7,827,581 | 6,627,939 | |
| Wal Masonry | For Retement | m2 | 170 | 13 | 87 | 5,692 | 967,640 | 125,793 | 841,847 | |
| Concrete Structure (for River Structure) | Box Culvert | m3 | 2,722 | 44 | 56 | 2,220 | 6,042,840 | 2,639,836 | 3,403,004 | incl. form work |
| | Gate A (Steel) | m2 | 13,000 | 93 | 7 | 6 | 78 | 950,000 | 912,000 | excavation, etc |
| | Gate B (Steel) | m2 | 13,000 | 93 | 7 | 6 | 78 | 3,744,000 | 3,536,800 | |
| | Bridges (Slab, Box) | m2 | 6,927 | 37 | 63 | 2,250 | 15,608,250 | 5,715,053 | 9,893,197 | incl. pier, etc |
| | Wells | m3 | 1,035 | 77 | 23 | 0 | 0 | 0 | 0 | |
| | Concrete Dam | m3 | 1,100 | 63 | 37 | 3,074 | 3,326,400 | 2,062,368 | 1,264,032 | |
| Esca. & Banking | By Machine | m3 | 36 | 92 | 8 | 2,237,128 | 81,236,608 | 74,756,079 | 6,500,529 | |
| Soilng | | m2 | 8 | 0 | 100 | 582,744 | 4,661,932 | 0 | 4,661,932 | |
| | | | | | | Sub-Total (LP): | 195,597,783 | 155,248,268 | 41,149,515 | |
| | | | | | | %: | 100 | 79 | 21 | |
| B. SAHO WORKS | | | | | | | | | | |
| 1. PREPARATORY WORKS | | | | | | | | | | |
| | | | | | | 1 | 14,104,104 | 8,877,704 | 5,226,398 | |
| 2. SAHO DAM WORKS | | | | | | | | | | |
| Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 58,205 | 64,025,940 | 39,696,083 | 24,329,857 | incl. form work |
| Gablon (Mat Type) | D=0.45m | m3 | 156 | 54 | 46 | 2,742 | 427,799 | 231,011 | 196,787 | excavation, etc |
| 3. CONSOLIDATION WORKS | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 23,410 | 912,998 | 658,218 | 254,780 | |
| Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 18,216 | 20,037,600 | 12,423,312 | 7,614,288 | incl. form work |
| Gablon (Mat Type) | 40"x20"x40" | m3 | 156 | 54 | 46 | 4,314 | 704,246 | 380,293 | 323,953 | |
| Gablon (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 2,508 | 391,248 | 211,274 | 179,974 | |
| 4. LIVER | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 0 | 0 | 0 | 0 | |
| Banking | By Machine | m3 | 36 | 92 | 8 | 8 | 96,466 | 3,472,762 | 3,194,941 | 277,821 |
| Gablon (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 40 | 25,992 | 4,054,711 | 2,189,576 | 1,865,135 |
| | | | | | | Sub-Total (LP): | 108,131,468 | 68,062,414 | 40,069,054 | |
| | | | | | | %: | 100 | 63 | 37 | |
| | | | | | | Total (A+B): | 304,729,251 | 223,510,702 | 81,218,549 | |
| | | | | | | %: | 100 | 73 | 27 | |
| 5. LAND ACQUISITION | | | 0.50 | 0 | 100 | 2,138,568 | 1,669,284 | | 1,669,284 | |

- Note : 1) Construction cost of the river improvement is that for 50 year flood frequency.
 2) Construction cost of the sediment control is that for 50 year flood frequency. The work quantities of the sediment control of the 50 year flood frequency are 66 % of those of the long term plan.

TABLA G.3.26 PROGRAMA DE DESEMBOLSOS PARA LA EVALUACION ECONOMICA DEL RIO BLANCO (FRECUENCIA DE INUNDACION DE 50 AÑOS)

| RIO BLANCO (50-YEAR FLOOD FREQUENCY) | | | | | | | | | | | (UNIT: X1000 LP) | | REMARKS |
|--------------------------------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|------------------|--------------|---------|
| YEAR | TOTAL COS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 1. CONSTRUCTION (+CONTING.) | | | | | | | | | | | | | |
| | | | Cost= | 304,729 | F/C= | 223,510 | Contin= | 1.20 | 10 | | | | |
| TOTAL (A+B) | 365,675 | 36,567 | 36,567 | 36,567 | 36,567 | 36,567 | 36,567 | 36,567 | 36,567 | 36,567 | 36,567 | | |
| F/C | 268,212 | 26,821 | 26,821 | 26,821 | 26,821 | 26,821 | 26,821 | 26,821 | 26,821 | 26,821 | 26,821 | | |
| L/C | 97,463 | 9,746 | 9,746 | 9,746 | 9,746 | 9,746 | 9,746 | 9,746 | 9,746 | 9,746 | 9,746 | | |
| 2. LAND ACQUISITION | | | | | | | | | | | | | |
| | | | Cost= | | F/C= | 0 | Contin= | 1.00 | 10 | | | | |
| TOTAL (A+B) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,089 | |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 3. ADMINISTRATION | | | | | | | | | | | | | |
| | | | Cost= | 15,236 | F/C= | 0 | Contin= | 1.00 | 10 | | | | |
| TOTAL (A+B) | 15,236 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | | |
| L/C | 15,236 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | 1,524 | | |
| 4. ENGINEERING SERVICES | | | | | | | | | | | | | |
| | | | Cost= | 36,567 | F/C= | 14,627 | Contin= | 1.00 | 10 | | | | |
| TOTAL (A+B) | 36,567 | 3,657 | 3,657 | 3,657 | 3,657 | 3,657 | 3,657 | 3,657 | 3,657 | 3,657 | 3,657 | | |
| F/C | 14,627 | 1,463 | 1,463 | 1,463 | 1,463 | 1,463 | 1,463 | 1,463 | 1,463 | 1,463 | 1,463 | | |
| L/C | 21,940 | 2,194 | 2,194 | 2,194 | 2,194 | 2,194 | 2,194 | 2,194 | 2,194 | 2,194 | 2,194 | | |
| Sub-Total(1-4) | 417,479 | 41,748 | 41,748 | 41,748 | 41,748 | 41,748 | 41,748 | 41,748 | 41,748 | 41,748 | 41,748 | 0 | |
| F/C | 282,839 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 0 | |
| L/C | 134,640 | 13,464 | 13,464 | 13,464 | 13,464 | 13,464 | 13,464 | 13,464 | 13,464 | 13,464 | 13,464 | 0 | |
| 5. MAINTENANCE/OPERATION | | | | | | | | | | | | | |
| | | | 366 | 731 | 1,097 | 1,463 | 1,828 | 2,194 | 2,560 | 2,925 | 3,291 | 3,657 | |
| TOTAL (A+B) | 3,657 | | 366 | 731 | 1,097 | 1,463 | 1,828 | 2,194 | 2,560 | 2,925 | 3,291 | 3,657 | |
| L/C | 3,657 | | 366 | 731 | 1,097 | 1,463 | 1,828 | 2,194 | 2,560 | 2,925 | 3,291 | 3,657 | |
| TOTAL (1-5) | 421,135 | 41,748 | 42,114 | 42,479 | 42,845 | 43,211 | 43,576 | 43,942 | 44,308 | 44,673 | 45,039 | 3,657 | |
| F/C | 282,839 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 28,284 | 0 | |
| L/C | 138,296 | 13,464 | 13,830 | 14,195 | 14,561 | 14,927 | 15,292 | 15,658 | 16,024 | 16,389 | 16,755 | 3,657 | |
| With Price Contingency. | | | | | | | | | | | | | |
| F/C | 354,309 | 30,907 | 31,834 | 32,769 | 33,772 | 34,766 | 35,829 | 36,904 | 38,011 | 39,152 | 40,326 | x(1+.03)^n | |
| L/C | 326,522 | 17,921 | 20,248 | 22,862 | 25,796 | 29,088 | 32,781 | 36,921 | 41,561 | 46,761 | 52,585 | x(1+.01)^n | |
| Total | 680,831 | 48,827 | 52,082 | 55,651 | 59,568 | 63,873 | 68,610 | 73,825 | 79,573 | 85,912 | 92,911 | | |

TABLA G.3.27 COSTO DIRECTO DE CONSTRUCCION PARA LA EVALUACION ECONOMICA DEL RIO EL SAUCE (FRECUENCIA DE INUNDACION DE 50 AÑOS)

Unit :lp

| Work Items | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks | |
|--|---------------------|------|--------|---------------------|-------------------|----------|-----------------|---------------------|-------------------|------------------|--|
| A. RIVER WORKS | | | | | | | | | | | |
| 1. PREPARATORY WORK | | | | | | | | | | | |
| | | | | | | | 1 | 7,149,032 | 4,202,751 | 2,946,281 | |
| 2. EMBANKMENT WORK | | | | | | | | | | | |
| Excavation & Spilling | Sandy Soil | m3 | 39 | 94 | 6 | 86,340 | 3,367,260 | 3,165,224 | 202,036 | | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 3,500 | 546,000 | 294,840 | 251,160 | | |
| Wet Masonry | For Revetment | m2 | 170 | 13 | 87 | 43,324 | 7,365,080 | 957,460 | 6,407,620 | | |
| Concrete Structure (for River Structure) | Box Culvert | m3 | 2,722 | 44 | 56 | 0 | 0 | 0 | 0 | Incid form work | |
| | Gate A (Steel) | m2 | 15,000 | 95 | 5 | 0 | 0 | 0 | 0 | excavation, etc | |
| | Gate B (Steel) | m2 | 13,000 | 95 | 5 | 0 | 0 | 0 | 0 | | |
| | Bridge (Slab, Pile) | m2 | 6,937 | 37 | 63 | 1,500 | 10,405,500 | 3,850,035 | 6,555,465 | Incid. pier, etc | |
| | Weir | m3 | 1,035 | 77 | 23 | 0 | 0 | 0 | 0 | | |
| | Consolid. Dam | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 | | |
| Exca. & Banking | By Machine | m3 | 36 | 92 | 8 | 596,340 | 21,468,240 | 19,750,781 | 1,717,459 | | |
| Sodding | | m2 | 8 | 0 | 100 | 563,517 | 4,508,136 | 0 | 4,508,136 | | |
| | | | | | | | Sub-Total (LP): | 54,809,248 | 32,221,092 | 22,588,156 | |
| | | | | | | | %: | 100 | 59 | 41 | |
| B. SABO WORKS | | | | | | | | | | | |
| 1. PREPARATORY WORKS | | | | | | | | | | | |
| | | | | | | | 1 | 13,629,600 | 8,431,473 | 5,198,127 | |
| 2. SABO DAM WORKS | | | | | | | | | | | |
| Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 79,629 | 87,591,900 | 54,306,978 | 33,284,922 | Incid. form work | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 4,145 | 646,620 | 349,175 | 297,445 | excavation, etc | |
| 3. CONSOLIDATION WORKS | | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 8,712 | 339,768 | 319,382 | 20,386 | | |
| Debris Control Structure | Concrete Works | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 | Incid. form work | |
| Gabion (Mat Type) | 40*120*400 | m3 | 156 | 54 | 46 | 8,712 | 1,359,072 | 733,899 | 625,173 | | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 5,940 | 926,640 | 500,386 | 426,254 | | |
| 4. LEVEE | | | | | | | | | | | |
| Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 0 | 0 | 0 | 0 | | |
| Banking | By Machine | m3 | 36 | 92 | 8 | 0 | 0 | 0 | 0 | | |
| Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 0 | 0 | 0 | 0 | | |
| | | | | | | | Sub-Total (LP): | 104,493,600 | 64,641,292 | 39,852,308 | |
| | | | | | | | %: | 100 | 62 | 38 | |
| | | | | | | | Total (A+B): | 159,302,848 | 96,862,384 | 62,440,465 | |
| | | | | | | | %: | 100 | 61 | 39 | |
| 5. LAND ACQUISITION | | | | 0.50 | 0 | 100 | 1,143,000 | 572 | | 572 | |

Note : 1) Construction cost of the river improvevnt is that for 50 year flood frequency.

2) Construction cost of the sediment control is that for 50 year flood frequency. The work quantities of the sediment control of the 50 year flood frequency are 66 % of those of the long term plan.

TABLA G.3.28 PROGRAMA DE DESEMBOLOS PARA LA EVALUACION ECONOMICA DEL RIO EL SAUCE (FRECUENCIA DE INUNDACION DE 50 AÑOS)

| RIO EL SAUCE (50-YEAR FLOOD FREQUENCY) | | | | | | | | | | | (UNIT: X1000 LP) | | REMARKS |
|---|------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------------|-------|---------|
| YEAR | TOTAL COST | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 1. CONSTRUCTION + CONTING. | | | | | | | | | | | | | |
| TOTAL (A+B) | 191,162 | 19,116 | 19,116 | 19,116 | 19,116 | 19,116 | 19,116 | 19,116 | 19,116 | 19,116 | 19,116 | | |
| F/C | 116,234 | 11,623 | 11,623 | 11,623 | 11,623 | 11,623 | 11,623 | 11,623 | 11,623 | 11,623 | 11,623 | | |
| L/C | 74,928 | 7,493 | 7,493 | 7,493 | 7,493 | 7,493 | 7,493 | 7,493 | 7,493 | 7,493 | 7,493 | | |
| 2. LAND ACQUISITION | | | | | | | | | | | | | |
| TOTAL (A+B) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 572 | |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 3. ADMINISTRATION | | | | | | | | | | | | | |
| TOTAL (A+B) | 7,965 | 797 | 797 | 797 | 797 | 797 | 797 | 797 | 797 | 797 | 797 | | |
| L/C | 7,965 | 797 | 797 | 797 | 797 | 797 | 797 | 797 | 797 | 797 | 797 | | |
| 4. ENGINEERING SERVICES | | | | | | | | | | | | | |
| TOTAL (A+B) | 19,116 | 1,912 | 1,912 | 1,912 | 1,912 | 1,912 | 1,912 | 1,912 | 1,912 | 1,912 | 1,912 | | |
| F/C | 7,646 | 765 | 765 | 765 | 765 | 765 | 765 | 765 | 765 | 765 | 765 | | |
| L/C | 11,470 | 1,147 | 1,147 | 1,147 | 1,147 | 1,147 | 1,147 | 1,147 | 1,147 | 1,147 | 1,147 | | |
| Sub-Total(1-4) | 218,244 | 21,824 | 21,824 | 21,824 | 21,824 | 21,824 | 21,824 | 21,824 | 21,824 | 21,824 | 21,824 | 0 | |
| F/C | 123,881 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 0 | |
| L/C | 94,363 | 9,436 | 9,436 | 9,436 | 9,436 | 9,436 | 9,436 | 9,436 | 9,436 | 9,436 | 9,436 | 0 | |
| 5. MAINTENANCE/OPERATION | | | | | | | | | | | | | |
| TOTAL (A+B) | 1,912 | | 191 | 382 | 573 | 765 | 956 | 1,147 | 1,338 | 1,529 | 1,720 | 1,912 | |
| L/C | 1,912 | | 191 | 382 | 573 | 765 | 956 | 1,147 | 1,338 | 1,529 | 1,720 | 1,912 | |
| TOTAL (1-5) | 220,155 | 21,824 | 22,016 | 22,207 | 22,398 | 22,589 | 22,780 | 22,971 | 23,163 | 23,354 | 23,545 | 1,912 | |
| F/C | 123,881 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 12,388 | 0 | |
| L/C | 96,274 | 9,436 | 9,627 | 9,819 | 10,010 | 10,201 | 10,392 | 10,583 | 10,774 | 10,965 | 11,157 | 1,912 | |

With Price Contingency.

| | | | | | | | | | | | | |
|-------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------|
| F/C | 155,184 | 13,537 | 13,943 | 14,361 | 14,792 | 15,236 | 15,693 | 16,164 | 16,649 | 17,148 | 17,662 | x(1+.03) ⁿ |
| L/C | 221,558 | 12,560 | 14,096 | 15,813 | 17,733 | 19,879 | 22,276 | 24,955 | 27,946 | 31,286 | 35,015 | x(1+.01) ⁿ |
| Total | 376,742 | 26,096 | 28,038 | 30,174 | 32,525 | 35,115 | 37,969 | 41,118 | 44,595 | 48,434 | 52,677 | |

TABLA G.3.29 COSTO DIRECTO DE CONSTRUCCION PARA LA EVALUACION ECONOMICA DEL RIO BLANCO Y EL RIO EL SAUCE (FRECUENCIA DE INUNDACION DE 50 AÑOS)

Unit: L.p

| Work Item | Description | Unit | Price | Foreign Portion (%) | Local Portion (%) | Quantity | Cost | Foreign Portion (%) | Local Portion (%) | Remarks |
|-------------------------------|---|--------------------|-------|---------------------|-------------------|-----------|---------------------|---------------------|--------------------|--------------------|
| A. RIVER WORKS | | | | | | | | | | |
| 1. PREPARATORY WORK | | | | | | | | | | |
| 2. EMBANKMENT WORK | | | | | | | | | | |
| | Excavation & Spoiling | Sandy Soil | m3 | 39 | 94 | 6 | 348,850 | 13,605,540 | 12,789,208 | 816,332 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 7,000 | 1,092,000 | 589,680 | 502,320 |
| | Wet Malconsy | For Return | m2 | 170 | 13 | 87 | 43,324 | 7,363,080 | 957,460 | 6,405,620 |
| | Concrete Structures (for River Structure) | Box Culvert | m3 | 2,722 | 44 | 56 | 0 | 0 | 0 | 0 |
| | | Gate A (Steel) | m2 | 15,000 | 95 | 5 | 0 | 0 | 0 | 0 |
| | | Gate B (Steel) | m2 | 13,000 | 95 | 5 | 0 | 0 | 0 | 0 |
| | | Bridge (Slab, Etc) | m2 | 6,937 | 37 | 63 | 2,200 | 15,261,400 | 5,646,718 | 9,614,682 |
| | | Weld | m3 | 1,035 | 77 | 23 | 4,493 | 4,652,325 | 3,582,290 | 1,070,035 |
| | | Consolid. Dam | m3 | 1,100 | 62 | 38 | 0 | 0 | 0 | 0 |
| | Excav. & Banking | By Machine | m3 | 36 | 92 | 8 | 978,240 | 35,216,648 | 32,399,309 | 2,817,339 |
| | Sodding | | m2 | 8 | 0 | 100 | 690,640 | 5,525,120 | 0 | 5,525,120 |
| | | | | | | | Sub-Total (L.P.): | 95,123,821 | 64,339,303 | 30,784,518 |
| | | | | | | | %: | 100 | 68 | 32 |
| B. SABO WORKS | | | | | | | | | | |
| 1. PREPARATORY WORKS | | | | | | | | | | |
| 2. SABO DAM WORKS | | | | | | | | | | |
| | Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 137,834 | 151,617,600 | 94,002,788 | 57,614,812 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 6,861 | 1,070,316 | 577,971 | 492,345 |
| 3. CONSOLIDATION WORKS | | | | | | | | | | |
| | Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 32,122 | 1,252,758 | 1,177,593 | 75,165 |
| | Debris Control Structure | Concrete Work | m3 | 1,100 | 62 | 38 | 18,896 | 20,785,600 | 12,887,072 | 7,898,528 |
| | Gabion (Mat Type) | 40*120*400 | m3 | 156 | 54 | 46 | 13,226 | 2,063,256 | 1,114,158 | 949,098 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 8,448 | 1,317,888 | 711,660 | 606,228 |
| 4. LEVER | | | | | | | | | | |
| | Excavation | Sand/Gravel | m3 | 39 | 94 | 6 | 0 | 0 | 0 | 0 |
| | Banking | By Machine | m3 | 36 | 92 | 8 | 96,466 | 3,472,776 | 3,194,954 | 277,822 |
| | Gabion (Cylinder Type) | D=0.45m | m3 | 156 | 54 | 46 | 25,992 | 4,054,752 | 2,189,565 | 1,865,187 |
| | | | | | | | Sub-Total (L.P.): | 213,479,558 | 133,234,725 | 80,244,833 |
| | | | | | | | %: | 100 | 62 | 38 |
| | | | | | | | Total (A+B): | 308,605,779 | 197,593,490 | 111,012,289 |
| | | | | | | | %: | 100 | 64 | 36 |
| 3. LAND ACQUISITION | | | | | | | | | | |
| | | | 0.50 | 0 | 100 | 2,143,500 | 1,071,780 | | 1,071,780 | |

Note : 1) Construction cost of the river improvement is that for 50 year flood frequency.

2) Construction cost of the sediment control is that for 50 year flood frequency. The work quantities of the sediment control of the 50 year flood frequency are 66 % of those of the long term plan.

TABLA G.3.30 PROGRAMA DE DESEMBOLSOS PARA LA EVALUACION ECONOMICA DEL RIO BLANCO Y EL RIO EL SAUCE (FRECUENCIA DE INUNDACION DE 50 AÑOS)

RIO BLANCO AND RIO EL SAUCE (50-YEAR FLOOD FREQUENCY) (UNIT: X1000 LP)

| YEAR | TOTAL COS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | REMARKS |
|------------------------------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|
| 1. CONSTRUCTION (+CONTING.) | | | | | | | | | | | | |
| TOTAL (A+B) | 370,326 | 37,033 | 37,033 | 37,033 | 37,033 | 37,033 | 37,033 | 37,033 | 37,033 | 37,033 | 37,033 | |
| F/C | 237,112 | 23,711 | 23,711 | 23,711 | 23,711 | 23,711 | 23,711 | 23,711 | 23,711 | 23,711 | 23,711 | |
| L/C | 133,214 | 13,321 | 13,321 | 13,321 | 13,321 | 13,321 | 13,321 | 13,321 | 13,321 | 13,321 | 13,321 | |
| 2. LAND ACQUISITION | | | | | | | | | | | | |
| TOTAL (A+B) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,071 |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3. ADMINISTRATION | | | | | | | | | | | | |
| TOTAL (A+B) | 15,430 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | |
| L/C | 15,430 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | 1,543 | |
| 4. ENGINEERING SERVICES | | | | | | | | | | | | |
| TOTAL (A+B) | 37,033 | 3,703 | 3,703 | 3,703 | 3,703 | 3,703 | 3,703 | 3,703 | 3,703 | 3,703 | 3,703 | |
| F/C | 14,813 | 1,481 | 1,481 | 1,481 | 1,481 | 1,481 | 1,481 | 1,481 | 1,481 | 1,481 | 1,481 | |
| L/C | 22,220 | 2,222 | 2,222 | 2,222 | 2,222 | 2,222 | 2,222 | 2,222 | 2,222 | 2,222 | 2,222 | |
| Sub-Total(1-4) | 422,789 | 42,279 | 42,279 | 42,279 | 42,279 | 42,279 | 42,279 | 42,279 | 42,279 | 42,279 | 42,279 | 0 |
| F/C | 251,925 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 0 |
| L/C | 170,864 | 17,086 | 17,086 | 17,086 | 17,086 | 17,086 | 17,086 | 17,086 | 17,086 | 17,086 | 17,086 | 0 |
| 5. MAINTENANCE/OPERATION | | | | | | | | | | | | |
| TOTAL (A+B) | 3,703 | 370 | 741 | 1,111 | 1,481 | 1,852 | 2,222 | 2,592 | 2,963 | 3,333 | 3,703 | 3,703 |
| L/C | 3,703 | 370 | 741 | 1,111 | 1,481 | 1,852 | 2,222 | 2,592 | 2,963 | 3,333 | 3,703 | 3,703 |
| TOTAL (1-5) | 426,492 | 42,279 | 42,649 | 43,020 | 43,390 | 43,760 | 44,131 | 44,501 | 44,871 | 45,241 | 45,612 | 3,703 |
| F/C | 251,925 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 25,192 | 0 |
| L/C | 174,567 | 17,086 | 17,457 | 17,827 | 18,197 | 18,568 | 18,938 | 19,308 | 19,679 | 20,049 | 20,419 | 3,703 |

With Price Contingency.

| | | | | | | | | | | | | |
|-------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|-----------------------|
| F/C | 315,583 | 27,528 | 28,354 | 29,205 | 30,081 | 30,984 | 31,913 | 32,870 | 33,857 | 34,872 | 35,918 | x(1+.03) ⁿ |
| L/C | 403,884 | 22,742 | 25,558 | 28,711 | 32,238 | 36,163 | 40,595 | 45,528 | 51,041 | 57,202 | 64,085 | x(1+.01) ⁿ |
| Total | 719,467 | 50,271 | 53,913 | 57,916 | 62,319 | 67,167 | 72,508 | 78,399 | 84,898 | 92,074 | 100,003 | |

TABLA G.3.31 COSTO DE CONSTRUCCION DEL RIO CHOLOMA
(E/F - PLAN A LARGO PLAZO)

Exchange Rate : US\$ 1.00=Lps. 6.20=Yen 110

| Item | Unit | Quantity | Foreign Currency | | Local Currency | | Total Cost (Lps. 1000) |
|--|------|------------|---------------------|-----------------------|---------------------|-----------------------|---------------------------|
| | | | Unit Cost (Lps.) | Amount (Lps. 1000) | Unit Cost (Lps.) | Amount (Lps. 1000) | |
| A. DIRECT COST | | | | | | | |
| A-1 River Improvement - 11.250 km to 18.815 km | | | | | | | |
| 1) Preparatory Works :10% of 2) | l.s. | | | 4,422 | | 2,685 | 7,087 |
| 2) Main Works | | | | | | | |
| (1) Excavation common | m3 | 988,400 | 10 | 9,884 | 1 | 988 | 10,872 |
| (2) Embankment | m3 | 476,800 | 23 | 10,966 | 2 | 954 | 11,920 |
| (3) Filling (common) | m3 | 130,300 | 22 | 2,967 | 2 | 261 | 3,128 |
| (4) Spoiling (common) | m3 | 381,300 | 26 | 9,914 | 2 | 763 | 10,677 |
| (5) Revetment(wet masonry) | 10m2 | 44,130 | 221 | 975 | 1,479 | 6,527 | 7,502 |
| (6) Sodding | m2 | 139,000 | 0 | 0 | 8 | 1,112 | 1,112 |
| (7) Bed protection(gablon mat 16,800m2) | m3 | 3,900 | 84 | 328 | 72 | 281 | 609 |
| (8) Extension of N.Road Bridge | l.s. | 90mx 26.5m | - | 6,140 | - | 10,410 | 16,550 |
| (9) Reconst. of Railway Bridge | l.s. | 160mx5.0m | - | 3,150 | - | 5,350 | 8,500 |
| Sub-total of 2) | | | | 44,224 | | 26,646 | 70,870 |
| 3) Total of A-1 | | | | 48,646 | | 29,311 | 77,957 |
| A-2 Sediment Control | | | | | | | |
| 1) Preparatory Works : 10 % of 2) | l.s. | | | 16,288 | | 9,890 | 26,178 |
| 2) Main Works | | | | | | | |
| 2)-1 Check Dam - No.1 to No.10 | | | | | | | |
| (1) Concrete Works | m3 | 103,540 | 682 | 70,614 | 418 | 43,280 | 113,894 |
| (2) Gablon (mat) | m3 | 4,645 | 84 | 390 | 72 | 334 | 724 |
| Sub-total 2)-1 | | | | 71,004 | | 43,614 | 114,618 |
| 2)-2 Consolidation Works - Rio Choloma : No.1 to No.7 - Rio Mejaine : No.1 to No.2 - Rio La Jutosa : No.1 to No.8 | | | | | | | |
| (1) Concrete Works | m3 | 121,030 | 682 | 82,542 | 418 | 50,591 | 133,133 |
| (2) Gablon (mat) | m3 | 59,700 | 84 | 5,015 | 72 | 4,298 | 9,313 |
| (3) Embankment (Rio Choloma No.7) | m3 | 20,240 | 33 | 668 | 3 | 61 | 729 |
| (3) Seepage Protection (steel sheet pila) | m2 | 1,540 | 1,139 | 1,754 | 11 | 17 | 1,771 |
| Sub-total 2)-2 | | | | 89,979 | | 54,967 | 144,946 |
| 2)-3 Training Levee (Rio Choloma) | | | | | | | |
| (1) Embankment | m3 | 51,700 | 33 | 1,706 | 3 | 155 | 1,861 |
| (2) Gablon | m3 | 2,300 | 84 | 193 | 72 | 166 | 359 |
| Sub-total 2)-3 | | | | 1,899 | | 321 | 2,220 |
| Sub-total of 2) | | | | 162,882 | | 98,902 | 261,784 |
| 3) Total of A-2 | | | | 179,170 | | 106,792 | 287,962 |
| Total of A | | | | 227,816 | | 138,103 | 365,919 |
| B. INDIRECT COST | | | | | | | |
| B-1 Land Aquisition | 10m2 | 106,830 | 0 | 0 | 5 | 535 | 535 |
| B-2 Administration (5% of A+(B-1)) | l.s. | | | 0 | | 18,323 | 18,323 |
| B-3 Engineering Service (10 % of A.+C.) | l.s. | | | 27,338 | | 16,572 | 43,910 |
| Total of B. | | | | 27,338 | | 35,430 | 62,768 |
| C. Contingency (20% of A.) | | | | 45,563 | | 27,621 | 73,184 |
| D. GRAND TOTAL (A. + B. + C.) | | | | 300,717 | | 201,154 | 501,871 |

**TABLA G.3.32 COSTO DE CONSTRUCCION DEL RIO CHOLOMA
(E/F - PLAN DE EMERGENCIA)**

Exchange Rate : US\$ 1.00=Lps. 6.20=Yen 110

| Item | Unit | Quantity | Foreign Currency | | Local Currency | | Total Cost (Lps. 1000) |
|--|------|-----------|---------------------|-----------------------|---------------------|-----------------------|---------------------------|
| | | | Unit Cost (Lps.) | Amount (Lps. 1000) | Unit Cost (Lps.) | Amount (Lps. 1000) | |
| A DIRECT COST | | | | | | | |
| A-1 River Improvement - 15.390 km to 18.815 km | | | | | | | |
| 1) Preparatory Works :10% of 2) | I.s. | | | 2,257 | | 1,204 | 3,461 |
| 2) Main Works | | | | | | | |
| (1) Excavation common | m3 | 536,500 | 10 | 5,365 | 1 | 537 | 5,902 |
| (2) Embankment | m3 | 134,400 | 23 | 3,091 | 2 | 269 | 3,360 |
| (3) Filling (common) | m3 | 96,900 | 22 | 2,132 | 2 | 194 | 2,326 |
| (4) Spoiling (common) | m3 | 305,200 | 26 | 7,935 | 2 | 610 | 8,545 |
| (5) Pavement(wet masonry) | 10m2 | 30,420 | 221 | 672 | 1,479 | 4,499 | 5,171 |
| (6) Sodding | m2 | 49,000 | 0 | 0 | 8 | 392 | 392 |
| (7) Bed protection(gabion mat 11,400m2) | m3 | 2,620 | 84 | 220 | 72 | 189 | 409 |
| (8) Extension of N.Road Bridge | I.s. | | | 0 | | 0 | 0 |
| (9) Reconst. of Railway Bridge | I.s. | 160mx5.0m | | 3,150 | | 5,350 | 8,500 |
| Sub-total of 2) | | | | 22,565 | | 12,040 | 34,605 |
| 3) Total of A-1 | | | | 24,822 | | 13,244 | 38,066 |
| A-2 Sediment Control | | | | | | | |
| 1) Preparatory Works : 10 % of 2) | I.s. | | | 3,806 | | 2,128 | 5,934 |
| 2) Main Works | | | | | | | |
| 2)-1 No.1 Check Dam (Majaine Dam) | | | | | | | |
| (1) Concrete Works | m3 | 14,370 | 682 | 9,800 | 418 | 6,007 | 15,807 |
| (2) Gabion (mat) | m3 | 1,120 | 84 | 94 | 72 | 81 | 175 |
| Sub-total 2)-1 | | | | 9,894 | | 6,088 | 15,982 |
| 2)-2 No.9 Check Dam (Jutosa Dam) | | | | | | | |
| (1) Concrete Works | m3 | 15,480 | 682 | 10,557 | 418 | 6,471 | 17,028 |
| (2) Gabion (mat) | m3 | 840 | 84 | 71 | 72 | 60 | 131 |
| Sub-total 2)-2 | | | | 10,628 | | 6,531 | 17,159 |
| 2)-3 No.1 Consolidation Dam (Rio Choloma) | | | | | | | |
| (1) Concrete Works | m3 | 10,660 | 682 | 7,270 | 418 | 4,456 | 11,726 |
| (2) Gabion (mat) | m3 | 2,400 | 84 | 202 | 72 | 173 | 375 |
| (3) Seepage Protection (steel sheet pile) | m2 | 1,540 | 1,139 | 1,754 | 11 | 17 | 1,771 |
| Sub-total 2)-3 | | | | 9,226 | | 4,646 | 13,872 |
| 2)-4 No.7 Consolidation Dam (Rio Choloma) | | | | | | | |
| (1) Concrete Works | m3 | 7,730 | 682 | 5,272 | 418 | 3,231 | 8,503 |
| (2) Gabion (mat) | m3 | 5,590 | 84 | 470 | 72 | 402 | 872 |
| (3) Embankment (Rio Choloma No.7) | m3 | 20,240 | 33 | 668 | 3 | 61 | 729 |
| Sub-total 2)-4 | | | | 6,410 | | 3,694 | 10,104 |
| 2)-5 Training Levee (Rio Choloma) | | | | | | | |
| (1) Embankment | m3 | 51,700 | 33 | 1,706 | 3 | 155 | 1,861 |
| (2) Gabion | m3 | 2,300 | 84 | 193 | 72 | 166 | 359 |
| Sub-total 2)-5 | | | | 1,899 | | 321 | 2,220 |
| Sub-total of 2) | | | | 38,057 | | 21,280 | 59,337 |
| 3) Total of A-2 | | | | 41,663 | | 23,406 | 65,271 |
| Total of A | | | | 66,685 | | 36,652 | 103,337 |
| B. INDIRECT COST | | | | | | | |
| B-1 Land Aquisition | 10m2 | 66,630 | 0 | 0 | 5 | 333 | 333 |
| B-2 Administration (5% of A+(B-1)) | I.s. | | | 0 | | 5,184 | 5,184 |
| B-3 Engineering Service (10 % of (A.+C.)) | I.s. | | | 8,002 | | 4,398 | 12,400 |
| Total of B. | | | | 8,002 | | 9,915 | 17,917 |
| C. Physical Contingency (20% of A.) | | | | 13,337 | | 7,330 | 20,667 |
| D. GRAND TOTAL (A. + B. + C.) | | | | 88,024 | | 53,897 | 141,921 |

TABLA G.3.33 COSTO DE CONSTRUCCION PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA (E/F - FRECUENCIA DE INUNDACION DE 50 AÑOS)

Exchange Rate : US\$ 1.00-Lps. 6.20-Yen 110

| Item | Unit | Quantity | Foreign Currency | | Local Currency | | Total Cost (Lps. 1000) |
|--|------|------------|---------------------|-----------------------|---------------------|-----------------------|---------------------------|
| | | | Unit Cost (Lps.) | Amount (Lps. 1000) | Unit Cost (Lps.) | Amount (Lps. 1000) | |
| A DIRECT COST | | | | | | | |
| A-1 River Improvement - 11.250 km to 18.815 km | | | | | | | |
| 1) Preparatory Works :10% of 2) | l.s. | | | 4,422 | | 2,665 | 7,087 |
| 2) Main Works | | | | | | | |
| (1) Excavation common | m3 | 988,400 | 10 | 9,884 | 1 | 988 | 10,872 |
| (2) Embankment | m3 | 476,800 | 23 | 10,966 | 2 | 954 | 11,920 |
| (3) Filling (common) | m3 | 130,300 | 22 | 2,867 | 2 | 261 | 3,128 |
| (4) Spilling (common) | m3 | 381,300 | 26 | 9,914 | 2 | 783 | 10,677 |
| (5) Revetment(wal masonry) | 10m2 | 4,413 | 221 | 975 | 1,479 | 6,527 | 7,502 |
| (6) Sodding | m2 | 139,000 | 0 | 0 | 8 | 1,112 | 1,112 |
| (7) Bed protection(gablon mat 16,800m2) | m3 | 3,900 | 84 | 328 | 72 | 281 | 609 |
| (8) Extension of N.Road Bridge | l.s. | 90mx 26.5m | - | 6,140 | - | 10,410 | 16,550 |
| (9) Reconst. of Railway Bridge | l.s. | 160mx5.0m | - | 3,150 | - | 5,350 | 8,500 |
| Sub-total of 2) | | | | 44,224 | | 26,648 | 70,870 |
| 3) Total of A-1 | | | | 48,646 | | 29,311 | 77,957 |
| A-2 Sediment Control | | | | | | | |
| 1) Preparatory Works : 10 % of 2) | l.s. | | | 10,750 | | 6,528 | 17,278 |
| 2) Main Works | | | | | | | |
| 2)-1 Check Dam | | | | | | | |
| - No.1 to No.10 | | | | | | | |
| (1) Concrete Works | m3 | 68,336 | 682 | 46,605 | 418 | 28,565 | 75,170 |
| (2) Gablon (mat) | m3 | 3,066 | 84 | 258 | 72 | 221 | 479 |
| Sub-total 2)-1 | | | | 46,863 | | 28,786 | 75,649 |
| 2)-2 Consolidation Works | | | | | | | |
| - Rio Choloma : No.1 to No.7 | | | | | | | |
| - Rio Majaine : No.1 to No.2 | | | | | | | |
| - Rio La Jutosa : No.1 to No.8 | | | | | | | |
| (1) Concrete Works | m3 | 79,880 | 682 | 54,478 | 418 | 33,390 | 87,868 |
| (2) Gablon (mat) | m3 | 39,402 | 84 | 3,310 | 72 | 2,837 | 6,147 |
| (3) Embankment (Rio Choloma No.7) | m3 | 13,358 | 33 | 441 | 3 | 40 | 481 |
| (3) Seepage Protection (steel sheet pile) | m2 | 1,016 | 1,139 | 1,158 | 11 | 11 | 1,169 |
| Sub-total 2)-2 | | | | 59,387 | | 36,278 | 95,665 |
| 2)-3 Training Levee (Rio Choloma) | | | | | | | |
| (1) Embankment | m3 | 34,122 | 33 | 1,128 | 3 | 102 | 1,228 |
| (2) Gablon | m3 | 1,518 | 84 | 128 | 72 | 109 | 237 |
| Sub-total 2)-3 | | | | 1,254 | | 211 | 1,465 |
| Sub-total of 2) | | | | 107,504 | | 65,276 | 172,779 |
| 3) Total of A-2 | | | | 118,254 | | 71,003 | 190,057 |
| Total of A | | | | 156,900 | | 101,114 | 268,014 |
| B. INDIRECT COST | | | | | | | |
| B-1 Land Aquisition | 10m2 | 106,930 | 0 | 0 | 5 | 535 | 535 |
| B-2 Administration (5% of A+(B-1)) | l.s. | | | 0 | | 13,427 | 13,427 |
| B-3 Engineering Service (10 % of A.+C.) | l.s. | | | 20,028 | | 12,134 | 32,162 |
| Total of B. | | | | 20,028 | | 26,096 | 48,124 |
| C. Contingency (20% of A.) | | | | 33,380 | | 20,223 | 53,603 |
| D. GRAND TOTAL (A. + B. + C.) | | | | 220,308 | | 147,433 | 367,741 |

Note : 1) Construction cost of the river improvement is that for 50 year flood frequency.

2) Construction cost of the sediment control is that for 50 year flood frequency. The work quantities of the sediment control of the 50 year flood frequency are 66 % of those of the long term plan.

TABLA G.3.34 PROGRAMA DE DESEMBOLOS DEL RIO CHOLOMA
(E/F - PLAN A LARGO PLAZA)

(UNIT: X1000 LP)

| LONG TERM PLAN YEAR | Year | | | | | | | | | | REMARKS | |
|--------------------------|---|---------|---------|---------|--------|--------|--------|--------|--------|--------|---------|--------|
| | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | | |
| 1. DIRECT COST | A. TOTAL COST | | | | | | | | | | 91 | |
| | Long Term P. (10 Year) Urgent Plan (2 Year) | | | | | | | | | | | |
| | C = A-B | | | | | | | | | | | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| TOTAL | 365,919 | 103,337 | 262,582 | 51,669 | 32,823 | 32,823 | 32,823 | 32,823 | 32,823 | 32,823 | 32,823 | 32,823 |
| F/C | 27,316 | 6,285 | 16,131 | 3,345 | 20,142 | 20,142 | 20,142 | 20,142 | 20,142 | 20,142 | 20,142 | 20,142 |
| L/C | 338,603 | 97,052 | 246,451 | 48,324 | 12,681 | 12,681 | 12,681 | 12,681 | 12,681 | 12,681 | 12,681 | 12,681 |
| 2. INDIRECT COST | B. TOTAL COST | | | | | | | | | | 3 | |
| | Long Term P. (10 Year) Urgent Plan (2 Year) | | | | | | | | | | | |
| | C = A-B | | | | | | | | | | | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| TOTAL | 335 | 333 | 302 | 166 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| F/C | 333 | 333 | 302 | 166 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| L/C | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2-2 ADMINISTRATION | C = A-B | | | | | | | | | | 3 | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| | C = A-B | | | | | | | | | | | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| TOTAL (A+B) | 18,323 | 3,184 | 13,139 | 2,592 | 1,642 | 1,642 | 1,642 | 1,642 | 1,642 | 1,642 | 1,642 | 1,642 |
| F/C | 18,323 | 3,184 | 13,139 | 2,592 | 1,642 | 1,642 | 1,642 | 1,642 | 1,642 | 1,642 | 1,642 | 1,642 |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2-3 ENGINEERING SERVICES | C = A-B | | | | | | | | | | 3 | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| | C = A-B | | | | | | | | | | | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| TOTAL | 33,910 | 12,000 | 31,510 | 6,200 | 3,939 | 3,939 | 3,939 | 3,939 | 3,939 | 3,939 | 3,939 | 3,939 |
| F/C | 27,318 | 8,002 | 19,316 | 4,001 | 2,417 | 2,417 | 2,417 | 2,417 | 2,417 | 2,417 | 2,417 | 2,417 |
| L/C | 16,592 | 4,998 | 12,174 | 2,199 | 1,522 | 1,522 | 1,522 | 1,522 | 1,522 | 1,522 | 1,522 | 1,522 |
| Sub-Total of 2 | C = A-B | | | | | | | | | | 3 | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| | C = A-B | | | | | | | | | | | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| TOTAL | 62,768 | 17,917 | 44,851 | 8,958 | 5,606 | 5,606 | 5,606 | 5,606 | 5,606 | 5,606 | 5,606 | 5,606 |
| F/C | 27,338 | 8,002 | 19,336 | 4,001 | 2,417 | 2,417 | 2,417 | 2,417 | 2,417 | 2,417 | 2,417 | 2,417 |
| L/C | 35,430 | 9,915 | 25,515 | 4,957 | 3,189 | 3,189 | 3,189 | 3,189 | 3,189 | 3,189 | 3,189 | 3,189 |
| 3. PHYSICAL CONTINGENCY | C = A-B | | | | | | | | | | 3 | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| | C = A-B | | | | | | | | | | | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| TOTAL | 73,184 | 20,667 | 52,517 | 10,334 | 6,565 | 6,565 | 6,565 | 6,565 | 6,565 | 6,565 | 6,565 | 6,565 |
| F/C | 35,263 | 13,337 | 21,926 | 6,668 | 4,028 | 4,028 | 4,028 | 4,028 | 4,028 | 4,028 | 4,028 | 4,028 |
| L/C | 37,921 | 7,330 | 30,291 | 3,666 | 2,536 | 2,536 | 2,536 | 2,536 | 2,536 | 2,536 | 2,536 | 2,536 |
| Total (1+2+3) | C = A-B | | | | | | | | | | 94 | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| | C = A-B | | | | | | | | | | | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| TOTAL | 503,871 | 143,921 | 359,950 | 70,961 | 44,994 | 44,994 | 44,994 | 44,994 | 44,994 | 44,994 | 44,994 | 44,994 |
| F/C | 300,717 | 88,024 | 212,693 | 44,012 | 26,587 | 26,587 | 26,587 | 26,587 | 26,587 | 26,587 | 26,587 | 26,587 |
| L/C | 201,154 | 55,897 | 147,257 | 26,949 | 18,407 | 18,407 | 18,407 | 18,407 | 18,407 | 18,407 | 18,407 | 18,407 |
| With Price Contingency | C = A-B | | | | | | | | | | 94 | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| | C = A-B | | | | | | | | | | | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| TOTAL | 371,705 | 97,629 | 274,076 | 48,093 | 30,822 | 30,822 | 30,822 | 30,822 | 30,822 | 30,822 | 30,822 | 30,822 |
| F/C | 414,337 | 75,324 | 339,013 | 35,869 | 29,645 | 29,645 | 29,645 | 29,645 | 29,645 | 29,645 | 29,645 | 29,645 |
| L/C | 786,042 | 172,933 | 613,089 | 83,962 | 60,466 | 60,466 | 60,466 | 60,466 | 60,466 | 60,466 | 60,466 | 60,466 |
| 4. MAINTENANCE/OPERATION | C = A-B | | | | | | | | | | 94 | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| | C = A-B | | | | | | | | | | | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| TOTAL | 4,391 | 1,240 | 3,151 | 620 | 1,240 | 1,240 | 1,240 | 1,240 | 1,240 | 1,240 | 1,240 | 1,240 |
| F/C | 4,391 | 1,240 | 3,151 | 620 | 1,240 | 1,240 | 1,240 | 1,240 | 1,240 | 1,240 | 1,240 | 1,240 |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | C = A-B | | | | | | | | | | 94 | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| | C = A-B | | | | | | | | | | | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| TOTAL | 886,391 | 249,391 | 637,000 | 122,551 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 |
| F/C | 886,391 | 249,391 | 637,000 | 122,551 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | C = A-B | | | | | | | | | | 94 | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| | C = A-B | | | | | | | | | | | |
| | After Urgent P. (8 Year) | | | | | | | | | | | |
| TOTAL | 886,391 | 249,391 | 637,000 | 122,551 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 |
| F/C | 886,391 | 249,391 | 637,000 | 122,551 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 | 77,774 |
| L/C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

TABLA G.3.35 PROGRAMA DE DESEMBOLOSOS PARA LA EVALUACION ECONOMICA DEL RIO CHOLOMA (E/F - FRECUENCIA DE INUNDACION DE 50 AÑOS)

(UNIT: X1000 L.P)

| YEAR | A. TOTAL COST | | B. TOTAL COST | | C. = A+B. | | Year | | | | | | | | | | REMARKS |
|---------------------------------|-----------------------|----------------------|----------------------|----------------------|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------------------------|---------|
| | Long Term P.(10 Year) | Urgent Plan (2 year) | Urgent Plan (2 year) | Urgent Plan (2 year) | After Urgent P.(8 Year) | Year | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | |
| 1. DIRECT COST | | | | | | | | | | | | | | | | | |
| TOTAL | 268,014 | 103,337 | 164,677 | 51,669 | 20,585 | 20,585 | 20,585 | 20,585 | 20,585 | 20,585 | 20,585 | 20,585 | 20,585 | 20,585 | 20,585 | 20,585 | 20,585 |
| F/C | 164,900 | 66,654 | 100,246 | 33,347 | 13,527 | 13,527 | 13,527 | 13,527 | 13,527 | 13,527 | 13,527 | 13,527 | 13,527 | 13,527 | 13,527 | 13,527 | 13,527 |
| L/C | 101,114 | 36,682 | 64,462 | 18,326 | 8,058 | 8,058 | 8,058 | 8,058 | 8,058 | 8,058 | 8,058 | 8,058 | 8,058 | 8,058 | 8,058 | 8,058 | 8,058 |
| 2. INDIRECT COST | | | | | | | | | | | | | | | | | |
| 2-1 LAND ACQUISITION | | | | | | | | | | | | | | | | | |
| TOTAL | 533 | 333 | 202 | 167 | 166 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| L/C | 533 | 333 | 202 | 167 | 166 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| 2-2 ADMINISTRATION | | | | | | | | | | | | | | | | | |
| TOTAL (A+B) | 13,427 | 5,184 | 8,243 | 2,592 | 2,592 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 |
| L/C | 13,427 | 5,184 | 8,243 | 2,592 | 2,592 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 | 1,030 |
| 2-3 ENGINEERING SERVICES | | | | | | | | | | | | | | | | | |
| TOTAL | 32,162 | 12,400 | 19,762 | 6,200 | 2,470 | 2,470 | 2,470 | 2,470 | 2,470 | 2,470 | 2,470 | 2,470 | 2,470 | 2,470 | 2,470 | 2,470 | 2,470 |
| F/C | 20,028 | 8,002 | 12,026 | 4,001 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 |
| L/C | 12,134 | 4,398 | 7,736 | 2,199 | 967 | 967 | 967 | 967 | 967 | 967 | 967 | 967 | 967 | 967 | 967 | 967 | 967 |
| Sub-Total of 2. | 46,124 | 17,917 | 28,207 | 8,958 | 3,526 | 3,526 | 3,526 | 3,526 | 3,526 | 3,526 | 3,526 | 3,526 | 3,526 | 3,526 | 3,526 | 3,526 | 3,526 |
| F/C | 30,028 | 8,002 | 12,026 | 4,001 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 | 1,503 |
| L/C | 26,096 | 9,915 | 16,181 | 4,957 | 2,023 | 2,023 | 2,023 | 2,023 | 2,023 | 2,023 | 2,023 | 2,023 | 2,023 | 2,023 | 2,023 | 2,023 | 2,023 |
| 3. PHYSICAL CONTINGENCY | | | | | | | | | | | | | | | | | |
| TOTAL | 58,603 | 20,667 | 32,936 | 10,334 | 4,117 | 4,117 | 4,117 | 4,117 | 4,117 | 4,117 | 4,117 | 4,117 | 4,117 | 4,117 | 4,117 | 4,117 | 4,117 |
| F/C | 33,380 | 13,337 | 20,043 | 6,669 | 2,505 | 2,505 | 2,505 | 2,505 | 2,505 | 2,505 | 2,505 | 2,505 | 2,505 | 2,505 | 2,505 | 2,505 | 2,505 |
| L/C | 20,223 | 7,330 | 12,893 | 3,665 | 1,612 | 1,612 | 1,612 | 1,612 | 1,612 | 1,612 | 1,612 | 1,612 | 1,612 | 1,612 | 1,612 | 1,612 | 1,612 |
| Total(1+2+3.) | 367,741 | 141,921 | 225,820 | 70,961 | 28,228 | 28,228 | 28,228 | 28,228 | 28,228 | 28,228 | 28,228 | 28,228 | 28,228 | 28,228 | 28,228 | 28,228 | 28,228 |
| F/C | 220,308 | 88,024 | 132,284 | 44,012 | 16,536 | 16,536 | 16,536 | 16,536 | 16,536 | 16,536 | 16,536 | 16,536 | 16,536 | 16,536 | 16,536 | 16,536 | 16,536 |
| L/C | 147,433 | 53,897 | 93,536 | 26,949 | 11,692 | 11,692 | 11,692 | 11,692 | 11,692 | 11,692 | 11,692 | 11,692 | 11,692 | 11,692 | 11,692 | 11,692 | 11,692 |
| With Price Contingency. | | | | | | | | | | | | | | | | | |
| F/C | 268,093 | 97,629 | 170,464 | 48,093 | 19,170 | 19,170 | 19,170 | 19,170 | 19,170 | 19,170 | 19,170 | 19,170 | 19,170 | 19,170 | 19,170 | 19,170 | 19,170 |
| L/C | 290,662 | 75,324 | 215,339 | 35,869 | 18,830 | 18,830 | 18,830 | 18,830 | 18,830 | 18,830 | 18,830 | 18,830 | 18,830 | 18,830 | 18,830 | 18,830 | 18,830 |
| Total | 558,755 | 172,953 | 385,803 | 83,962 | 38,000 | 38,000 | 38,000 | 38,000 | 38,000 | 38,000 | 38,000 | 38,000 | 38,000 | 38,000 | 38,000 | 38,000 | 38,000 |
| 4. MAINTENANCE/OPERATION | | | | | | | | | | | | | | | | | |
| TOTAL | 3,216 | 1,240 | 1,976 | 620 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| L/C | 3,216 | 1,240 | 1,976 | 620 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| | | | | | | | | | | | | | | | | x(1+.03) ⁿ⁽ⁿ⁺²⁾ | |
| | | | | | | | | | | | | | | | | x(1+.10) ⁿ⁽ⁿ⁺²⁾ | |
| | | | | | | | | | | | | | | | | 60,271 | |
| | | | | | | | | | | | | | | | | 23,576 | |
| | | | | | | | | | | | | | | | | 22,223 | |
| | | | | | | | | | | | | | | | | 30,326 | |
| | | | | | | | | | | | | | | | | 33,359 | |
| | | | | | | | | | | | | | | | | 36,695 | |
| | | | | | | | | | | | | | | | | 56,248 | |
| | | | | | | | | | | | | | | | | 2,722 | |
| | | | | | | | | | | | | | | | | 2,475 | |
| | | | | | | | | | | | | | | | | 2,969 | |
| | | | | | | | | | | | | | | | | 3,216 | |

**INFORME SUPLEMENTARIO H
TRABAJOS EN LA LADERA**

INFORME SUPLEMENTARIO H TRABAJOS EN LA LADERA

TABLA DE CONTENIDO

| | | |
|-----|---|------|
| 1 | GENERALIDADES | H-1 |
| 2 | ESTUDIOS PREVIOS | H-2 |
| 3 | INSTITUCIONES RELACIONADAS | H-3 |
| | 3.1 Instituciones Nacionales | H-3 |
| | 3.2 Instituciones Privadas | H-4 |
| | 3.3 Instituciones Internacionales | H-5 |
| 4 | CONDICIONES GENERALES | H-5 |
| | 4.1 Uso de la Tierra | H-5 |
| | 4.2 Gama de Pendiente | H-6 |
| | 4.3 Propiedad de la Tierra | H-6 |
| | 4.4 Erosión del Suelo | H-6 |
| | 4.5 Colapsos de las Pendientes de las Lomas | H-6 |
| 5 | ESTUDIO PILOTO PARA LOS TRABAJOS EN LAS LADERAS | H-7 |
| 5.1 | Condiciones Generales del Area Piloto | H-7 |
| 5.2 | Clasificación del Area Piloto | H-8 |
| 5.3 | Trabajos en las Laderas Propuestos | H-8 |
| | 5.3.1 Terrazas | H-8 |
| | 5.3.2 Trincheras de Contorno | H-9 |
| | 5.3.3 Barreras Vivas | H-12 |
| | 5.3.4 Salidas o Canales de Conducción | H-13 |
| | 5.3.5 Represas de Control de Gavión | H-13 |
| | 5.3.6 Camino en el Terreno | H-14 |
| | 5.3.7 Reforestación | H-14 |

LISTA DE TABLAS

| | | |
|--------------|---|------|
| Tabla H.4.1 | Uso del Suelo en la Cuenca Alta | H-18 |
| Tabla H.4.2 | Comparación del Uso de la Tierra de la Subcuenca del Río Choloma en el período de 1979 - 1992 | H-19 |
| Tabla H.4.3 | Distribución de la Gradiente al lado de la Montaña en el Area de Estudio | H-20 |
| Tabla H.4.4 | Propiedad de las Tierras en la Subcuenca del Río Choloma | H-21 |
| Tabla H.5.1 | Zonas de socavación identificadas en la cuenca Choloma | H-22 |
| Tabla H.5.2 | Clasificación del Uso de la Tierra en el Area de los Trabajos en las Laderas (m ²) | H-22 |
| Tabla H.5.3 | Clasificación de Gradientes en el Area de Pasto (m ²) | H-23 |
| Tabla H.5.4 | Clasificación de los Trabajos Propuestos en las Laderas | H-23 |
| Tabla H.5.5 | Procedimiento de Cálculo de las Presas de las Laderas | H-24 |
| Tabla H.5.6 | Cálculo de las Presas de las Laderas | H-25 |
| Tabla H.5.7 | Cálculo de la Descarga por Unidad de Area de Tributaria | H-26 |
| Tabla H.5.8 | Cálculo de la Sección del Canal mediante la Ecuación Manning | H-27 |
| Tabla H.5.9 | Longitud de Canales por Hectárea | H-28 |
| Tabla H.5.10 | Aplicación de la Fórmula Racional | H-28 |
| Tabla H.5.11 | Cálculo de la Sección del Desembocadero mediante la Ecuación Manning | H-29 |
| Tabla H.5.12 | Producción Unitaria de Especies Comunes de Leña | H-29 |

LISTA DE FIGURAS

| | | |
|------------|---|------|
| Fig. H.3.1 | Cuadro Administrativo de COHDEFOR | H-30 |
| Fig. H.4.1 | Mapa de Uso de la Tierra | H-31 |
| Fig. H.4.2 | Mapa de Gradientes (Cuenca Superior) | H-32 |
| Fig. H.5.1 | Mapa de Localización del Area de Trabajo de Laderas | H-33 |
| Fig. H.5.2 | Condicions Topográficas del Area Piloto de Trabajos | H-34 |
| Fig. H.5.3 | Condicions del Uso de la Tierra en el Area de Trabajos de Laderas Piloto | H-35 |

| | | |
|----------------|--|------|
| Fig. H.5.4 | Sección Transversal de las Presas de las Laderas | H-36 |
| Fig. H.5.5 | Estimación Gráfica del Espaciamiento del Contorno de Canales | H-37 |
| Fig. H.5.6 (a) | Sección Típica del Canal Tipo A (21 - 30%) | H-38 |
| Fig. H.5.6 (b) | Sección Típica del Canal Tipo B (31 - 40%) | H-39 |
| Fig. H.5.6 (c) | Sección Típica del Canal Tipo C (41 - 50%) | H-40 |
| Fig. H.5.7 | Plan General de Acequias y Trincheras de Contorno de Laderas | H-41 |
| Fig. H.5.8 | Sección Típica del Desembocadero | H-42 |
| Fig. H.5.9 | Concepción Gráfica de los Trabajos Propuestos en las Laderas | H-43 |
| Fig. H.5.10 | Sección Típica de la Presa de Control de Gavión | H-44 |
| Fig. H.5.11 | Sección Típica del Camino de Penetración | H-45 |
| Fig. H.5.12 | Plan General de Trabajos de Ladera | H-46 |

INFORME SUPLEMENTARIO H TRABAJOS EN LA LADERA**I GENERALIDADES**

En 1974, el huracán Fifi causó daños catastróficos por sedimentación e inundaciones a las áreas de San Pedro Sula y Choloma. Durante el huracán, hubieron miles de derrumbes de laderas en las montañas Merendon, especialmente en las cuencas del Río Choloma y del Río Blanco. El área de la montaña Merendon fue estudiada en la etapa del plan maestro y la cuenca del Río Choloma fue seleccionada como un área prioritaria para efectuar un Estudio de Factibilidad.

Se ha identificado la cuenca del Río Choloma como la cuenca más deteriorada en el área de estudio. La cuenca alta del Río Choloma estaba cubierta por bosque denso pero en la actualidad está desforestada. En los últimos 13 años, el área de bosques ha sido transformada en área agrícola y en pastizales naturales. El área forestal actual es pequeña, de no más del 10 por ciento del área de la montaña mientras que las tierras con pastizales naturales y las agrícolas cubren el sesenta y cinco por ciento (65%) del área de la montaña. El área montañosa de la cuenca del Río Choloma requerirá de medidas óptimas tanto en el uso de la tierra como en los métodos de desarrollo y explotación.

Sin embargo, el área de la montaña que pertenece a la municipalidad de San Pedro Sula, ha sido bien protegida contra la desforestación. La municipalidad compró 5,554 hectáreas de las montañas Merendon al Gobierno de Honduras en 1917 y ha protegido el área con el nombre de La Protección desde entonces. El área cubre la mayor parte de las cuencas altas del Río Piedras y del Río Santa Ana. De acuerdo con la Municipalidad de San Pedro Sula, la cantidad de habitantes en el área de protección ha aumentado rápidamente desde 300 en 1930 a unos 20,000 en 1979 y a 45,000 en 1990. Ahora, la municipalidad está reubicando a la gente que vive en el área de protección en otras áreas fuera del área protegida para evitar la contaminación del agua y para conservar el suelo y el agua.

Para controlar la erosión y los depósitos de sedimentación de las áreas de la montaña, son indispensables métodos adecuados de uso de la tierra y de desarrollo de ella. En el Plan Maestro se han estudiado los usos existentes de la tierra y las condiciones topográficas de las áreas de la montaña, con el fin de efectuar un buen manejo de la cuenca. En el Estudio de Factibilidad, la cuenca del Río Choloma ha sido investigada y se ha estudiado en detalles un área piloto para efectuar trabajos en la ladera. Los trabajos en la ladera consisten de trabajos en ladera óptimos tales como trincheras de contorno, terrazas, salidas, represas de control y trabajos de reforestación

2 ESTUDIOS PREVIOS

Varios estudios se han efectuado en el área de estudio relacionados con el manejo de la cuenca. Entre ellos, deben destacarse los siguientes:

- (1) Plan de Manejo de la Sierra de Omoa, en 1980, dentro del Programa de Manejo Integral de las Cuencas de Captación, Proyecto PNUD-FAO-HON/77/006.

Este plan cubrió 346 kilómetros cuadrados de los distritos de Omoa, Puerto Cortes, Choloma y San Pedro Sula. Además, en el plan se incluyó el área "La Protección" de la Municipalidad San Pedro Sula.

Basándose en la clasificación de la tierra, se propusieron varias actividades para solucionar los problemas de cada cuenca y para mejorar las condiciones de vida de sus habitantes. En las cuencas que son fuentes de agua se propuso proteger la vegetación existente. En las áreas de agricultura intensiva se propuso aplicar métodos óptimos de técnicas de conservación del suelo. Tomando en consideración la confiabilidad y otros factores, se recomendaron varios tipos de cultivos. Para aumentar la leña se propuso un plan de forestación de corto plazo en la cuenca superior del Río Choloma.

Se recomendó que COHDEFOR, a través de la Unidad de Manejo de la Sierra de Omoa fuese la institución principal en la planeación y la ejecución del manejo de la cuenca del área planeada.

Sin embargo, han sido propuestas varias instituciones, además de COHDEFOR, para tomar parte en el plan. Estas fueron La División de Agricultura Regional Norte del Ministerio de Recursos Naturales, DIMA de la Municipalidad San Pedro Sula, Municipalidad de Choloma y el Servicio Nacional Autónomo de Acueductos y Alcantarillados-SANAA).

- (2) Proyecto de Desarrollo Agroforestal en la Región Nor-Occidental, Cuenca del Río Choloma

Este trabajo fue preparado para COHDEFOR en enero de 1990 por la Agencia de Cooperación Internacional de España, a través del Instituto de la Agencia de Cooperación Iberoamericana. Este proyecto es una cooperación técnica solicitada por el Gobierno de Honduras al Gobierno de España. La duración del proyecto es desde Octubre de 1992 hasta Septiembre de 1995. Los fines del proyecto son promover la protección

y conservación del área forestal y contribuir a la restauración forestal en la cuenca. El área del proyecto cubre toda la cuenca del Río Choloma.

El proyecto incluye trabajos de rehabilitación del camino La Nueva Jutosa-Ocotillo-San Ishidro, con ramales a Majaine y Buenos Aires, para preparar los caminos de acceso a las áreas en las cuales se implementará el proyecto. Los trabajos de rehabilitación incluyen trabajos en los caminos tales como la instalación de desagües, apertura de zanjas, ampliación de ellos y su gravillado.

3 INSTITUCIONES RELACIONADAS

3.1 Instituciones Nacionales

Las instituciones nacionales están representadas principalmente por las siguientes:

- (1) Corporación Hondureña de Desarrollo Forestal-COHDEFOR)

Esta institución fue autorizada para controlar la protección y el desarrollo de las cuencas de los ríos por el Decreto de la Ley Forestal N° 85 de 1972 y el Decreto de Ley N° 103 de 1974.

De acuerdo con el artículo N° 5 de esta ley, el control de todos los bosques públicos y privados y consecuentemente su conservación, reforestación, explotación e industrialización y el comercio de sus productos derivados es responsabilidad del Gobierno de Honduras a través de COHDEFOR.

La organización de COHDEFOR se muestra en la *Fig. H.3.1* El país está dividido en diez (10) regiones forestales. Entre ellas, la región N° VI (región nor-occidental) cubre la provincia de Cortes. La unidad que cubre el área de estudio es la Unidad de Sierra de Omoa.

En 1992, las tareas de COHDEFOR fueron reducidas por el Decreto N° 31-92 (6 de abril de 1992), Ley para la Modernización y Desarrollo de la Agricultura, dejando las tareas de explotación y comercio al sector privado. En el artículo N° 71 de esta ley, se establece que la explotación, industrialización y comercialización de las maderas y de sus productos pueden ser hechos por cualquier persona.

Las funciones específicas de COHDEFOR fueron reducidas a:

- Normalización y control de la forestación en tierras privadas,

- Manejo y administración de los bosques públicos,
- Administración de las áreas protegidas y de la fauna silvestre,
- Aplicación e implementación de incentivos a la reforestación.

(2) Instituto Nacional Agrario INA)

Esta institución proporciona tierras agrícolas cerca de Choloma a los labradores reubicados desde el área de protección de la Municipalidad de San Pedro Sula.

(3) División Municipal de Aguas-DIMA

A través del decreto N° 46-90 de Julio de 1990, este instituto se hizo cargo, en representación de la Municipalidad de San Pedro Sula, de la protección forestal en las cuencas de los ríos usados como fuentes de agua del área urbana de San Pedro Sula, incluyendo al Río Piedras, Río Santa Ana, Río Zaporal y Río Armenta, cubriendo un área de 395 kilómetros cuadrados.

(4) Servicio Nacional de Acueductos y Alcantarillados-SANAA

(5) Junta Regional de Desarrollo-JRD

Este instituto comenzó a funcionar en enero de 1979 y está encargado de la coordinación del desarrollo agrícola. Está integrado por casi todas las instituciones públicas existentes y por algunas instituciones privadas. Entre las instituciones públicas están las Fuerzas de Seguridad Pública, el Ejército, Ministerio de Educación, Ministerio de Salud, Recursos Naturales, SECOPT, ENEE, SANAA, IHCAFE, COHDEFOR, Comité Nacional de Bienestar Público, Banco Nacional de Desarrollo Agrícola y Banco Autónomo Municipal.

3.2 Instituciones Privadas

Hay ciertas instituciones privadas con áreas de inversión definidas que están tomando responsabilidad por la reforestación y los temas ambientales. Entre ellas están las siguientes:

(1) Compañía Azucarera Hondureña S. A.

En 1989 inició un programa de reforestación en las áreas montañosas, habiendo plantado aproximadamente 350,000 árboles de diferentes tipos hasta 1992.

(2) Tabacalera Hondureña S. A.

Esta compañía inició un programa de reforestación en 1983, con un equipo de expertos en agricultura y silvicultura habiendo plantado alrededor de 2,000,000 de árboles hasta 1990. Este programa fue iniciado para compensar los daños provocados por los cultivadores de tabaco los que usan una gran cantidad de leña en el proceso de secado del tabaco.

3.3 Instituciones Internacionales

La Corporación Hondureña-Alemana de Alimentos por Trabajo participó en los proyectos HON/75/109 y HON/77/006 desde agosto de 1976 hasta septiembre de 1979, contribuyendo con más de 140,000 hombres-día en alimentos, como parte de los incentivos para tales proyectos.

4 CONDICIONES GENERALES

4.1 Uso de la Tierra

El mapa del uso de la tierra fue confeccionado usando las ortofotografías tomadas en 1977, las fotografías aéreas tomadas en 1989 y mediante estudios en el sitio. En la *Tabla H.4.1* y *Fig. H.4.1* se muestran los usos de la tierra en las áreas montañosas.

El mapa del uso de la tierra muestra que el área de protección de la Municipalidad de San Pedro Sula está cubierta por bosque denso, como resultado de las actividades de manejo de DIMA. En San Pedro Sula el área forestal cubre 93.3 kilómetros cuadrados, la cual es aproximadamente el 31 por ciento del área de la montaña (304.54 kilómetros cuadrados). Sin embargo, en Choloma, el área forestal cubre sólo 6.13 kilómetros cuadrados del área de la montaña (71.64 kilómetros cuadrados) y la agricultura y los pastizales cubren el 66 por ciento del área de la montaña.

Hay una situación similar en la parte nor-oriental de las áreas montañosas entre Choloma y Campana (Quebrada Seca, Candelaria, La Mina). El área cubierta con bosques cubre tan solo el 12 por ciento del área pero la agricultura y los pastizales cubren el 66 por ciento de ella. Una gran parte de la tierra agrícola se usa para productos agroforestales tales como cítricos y cacao, especialmente en las áreas de pendiente suave.

En la *Tabla H.4.2* se resumen los usos de la tierra en la cuenca del Río Choloma, tanto en 1979 como en 1992. La tabla muestra que las áreas forestales han disminuido un 45

por ciento desde 1979 a 1992 y que tales áreas forestales han pasado a ser tierras agrícolas o zonas de matorrales.

4.2 Gama de Pendiente

La inclinada pendiente de más de 30 grados tiene la tendencia al colapso especialmente en las faldas en las cuales las formaciones geológicas son inestables. La *Tabla H.4.3* y la *Fig. H.4.2* muestran la distribución de la pendiente de las faldas de la montaña en el área de estudio. La zona en la cual la pendiente es de más del 50 por ciento corresponde al bosque de San Pedro Sula. En la cuenca del Río Choloma, la mayoría de las pendientes montañosas son de más del 40 por ciento.

4.3 Propiedad de la Tierra

La *Tabla H.4.4* muestra un resumen de la propiedad de la tierra en la cuenca del Río Choloma, de acuerdo con el registro de propiedad de las tierras, en 1992 (Dirección de Catastro Nacional, 1992). La tabla muestra que la mayor parte de la tierra pertenece a la Municipalidad de Choloma. Las tierras privadas cubren tan solo un 7 por ciento del área.

4.4 Erosión del Suelo

Una gran parte de la erosión del suelo es causada probablemente por las actividades agrícolas en las áreas inclinadas ya que normalmente en tales actividades agrícolas no se usa ningún tipo de medida de conservación del suelo. La erosión formando canales y la erosión laminar son causadas probablemente por los cultivos en las áreas de pendientes elevadas. La actividad agrícola en las pendientes elevadas y la desforestación provocada por el corte de leña o por el cambio de cultivos será una causa principal de colapsos de las pendientes en caso de fuertes precipitaciones.

En la estación seca, en la cuenca se observan con frecuencia incendios forestales y fuegos en los matorrales. Estos fuegos son hechos para preparar la tierra para actividades agrícolas y para obtener pastos naturales. En el comienzo de la época de lluvias, tales áreas de pendientes quemadas están preparadas para que sufran la erosión y para que sufran colapsos, induciendo una fuerte sedimentación en los canales de los ríos aguas abajo.

4.5 Colapsos de las Pendientes de las Lomas

El potencial del colapso de pendientes parece ser muy alto en la cuenca del Río Choloma. De acuerdo con fotografías aéreas recientes, en 650 sitios del área del plan

maestro se pueden identificar colapsos de las pendientes de las lomas. Se ubican principalmente en la cuenca alta del Río Choloma, el Río Blanco y el Río El Sauce. A pesar que la escala de los colapsos identificados es pequeña, siendo la mayoría de ellos de menos de 100 metros cuadrados, y que hay unos pocos casos en los cuales el colapso es de más de 1,000 metros cuadrados la zona muestra un gran potencial de colapsos de pendientes de lomas en tales cuencas. Para controlar la erosión y los depósitos de sedimentos será necesario efectuar un manejo adecuado de las cuencas en el área montañosa.

5 ESTUDIO PILOTO PARA LOS TRABAJOS EN LAS LADERAS

5.1 Condiciones Generales del Area Piloto

Durante el Estudio de Factibilidad se llevó a cabo un estudio piloto sobre trabajos en las laderas en la cuenca del Río Choloma. En el estudio piloto se investigaron cinco (5) zonas. Las condiciones topográficas y las condiciones de uso de la tierra se muestran en la *Tabla H.5.1*. Entre ellas, se seleccionó como área piloto a la zona del Cerro Los Olingos ya que el área es un área típica del Río Choloma que requiere adecuados trabajos de laderas (*Fig. H.5.1*).

El área piloto del Cerro Los Olingos está ubicada en la aldea de El Portillo, con alrededor de 500 habitantes. El Cerro Los Olingos está ubicado en el linde de la granja Buena Vista, a alrededor de 10 km de la ciudad de Choloma, a 5 km de la aldea La Nueva Jutosa y a 100 m de la represa Takemoto. El área piloto cubre 62.4 Ha, incluyendo bosques y área cultivada de 10.2 ha.

En el área existe predominantemente diorita y granodiorita. Mediante la acción de los agentes atmosféricos, las rocas son transformadas en suelos arenosos y propensos a la erosión con pendientes inestables. La profundidad de los suelos arenosos es de normalmente de 20 a 60 cm en las áreas de las laderas.

El área piloto se extiende desde una altitud de 240 metros en el banco del Río La Jurosa hasta 516 metros en la cima del Cerro Los Olingos. El área de la pendiente está dividida en 8 bloques mediante por pequeños arroyos (*Fig. H.5.2*). La gradiente promedio de la pendiente es de alrededor de 35%.

En la *Tabla H.5.2* y en la *Fig. H.5.3* se muestra el uso de la tierra existente, mostrando que el 67% del área se usa como pastizales naturales. El área restante (33%), está

cubierta por bosques, matorrales y pequeños cultivos vegetales tales como caña de azúcar y bananas.

En base a fotografías aéreas anteriores se detecta que el área estaba cubierta por un bosque denso pero ahora persisten tan solo en pocas partes pequeños grupos de árboles a lo largo del Río La Jutosa y por otras pequeñas corrientes de agua. Hay también árboles en hileras separando lotes de terrenos. Los tipos principales de árboles en la zona son Cedros (*Cedrela Odorata*) y Madreado (*gliricidia sepium*).

El área usada para pastos naturales es probablemente la pendiente más erosionada debido a la falta de vegetación permanente. Las agudas pendientes de la zona producen gran cantidad de sedimentos durante las lluvias fuertes. Por lo tanto, el área de pastos naturales debe ser obstinadamente protegida mediante métodos de conservación del suelo.

5.2 Clasificación del Area Piloto

Considerando las condiciones topográficas del área piloto, se la ha clasificado en ocho bloques, desde el bloque A hasta el bloque H. Cada bloque está dividido por arroyos naturales. Los bloques y los usos de sus respectivas tierras está mostrado en la *Tabla H.5.2* y en las *Fig. H.5.3*.

La gradiente de la pendiente es un factor decisivo que restringe los tipos de trabajos en las laderas. De acuerdo con la gradiente de la pendiente, el área piloto está clasificada en seis (6) clases, como lo muestra la *Tabla H.5.3*. Estas clases son: 0-20%, 21-30%, 31-40%, 41-50% y más de 50%

5.3 Trabajos en las Laderas Propuestos

Los trabajos en las laderas se proponen basándose en las gradientes de las pendientes y el uso existente de la tierra, lo cual fue identificado mediante el mapa topográfico (1:2,000), las fotografías aéreas (1:10,000) tomadas en 1987 e investigaciones en el terreno. Los conceptos básicos se resumen y muestran en la *Tabla H.5.4*. A continuación se explican los trabajos que se propone efectuar en las laderas.

5.3.1 Terrazas

1) Generalidades

Las terrazas (zanjas en la ladera) corresponden a una terraza angosta de ancho constante, de alrededor de 2 metros. La pendiente ha de estar protegido con pastos

corrientes (*Paspalum notatum* o *Axonopus compressus*). La distancia entre las terrazas será de aproximadamente 12 metros. Su función principal es cortar el flujo superficial que corre pendiente abajo, antes que dañe más la ladera provocando mayor erosión. Otra ventaja de la terraza (zanjas en la ladera) es que puede ser usada como vía de acceso.

2) Diseño

Para facilitar el drenaje de la terraza, normalmente se utiliza una gradiente inversa de alrededor del 10%. En las regiones húmedas, la gradiente es de un 0.5 a un 1%. La gradiente en los terraplenes será de 0.75:1 en los trabajos hechos a mano y de 1.0:1.0 en los trabajos hechos con máquinas.

En la *Tabla H.5.4* se ilustra el procedimiento de diseño de la terraza, tomando la *Fig. H.5.5* como referencia.

En la *Tabla H.5.6* se muestran los resultados de los cálculos de los movimientos de tierra por hectárea para gradientes de la pendiente entre 1 y 50%. De acuerdo con los resultados, se concluye que para gradientes de hasta alrededor del 20%, el movimiento de tierra es menor en zanjas en la ladera que el requerido con trincheras de contorno, sin embargo, desde ese límite hasta el 50%, el movimiento de tierra es considerablemente mayor en zanjas en la ladera que en las trincheras de contorno. En general, las pendientes clasificadas entre 1 y 20%, se protegerán con zanjas de laderas. Las pendientes clasificadas entre 21% y 50% se protegerán con trincheras de contorno.

5.3.2 Trincheras de Contorno

1) Generalidades

La trinchera de contorno tiene por fin retener temporalmente el agua de lluvia y disminuir la velocidad del flujo de ella en la ladera, regulando la descarga durante lluvias fuertes. El agua de lluvia almacenada en la ladera mejora las condiciones de humedad del suelo lo que en consecuencia puede conducir a mejores condiciones para la vegetación circundante.

La trinchera de contorno protege directamente la ladera contra la erosión mediante la regulación de los flujos superficiales y del flujo de sedimentos. Aun si la trinchera se llena de sedimentos, la vegetación aumentará a lo largo de la trinchera y el propósito de estabilización se cumplirá naturalmente.

Este es un método usado en regiones que tienen abundantes precipitaciones anuales y pendientes agudas de entre el 20% al 50%. Cuando la pendiente es mayor del 50%, al hacer las excavaciones se dañará la ladera. Además, el costo de construcción de los trabajos en la ladera serían muy elevados.

Para evitar daños a la superficie de la ladera, la profundidad de la trinchera será de 20 a 40 cm desde la superficie del terreno. A lo largo de la trinchera, es necesario efectuar algunas particiones como terraplenes para disminuir la velocidad del flujo en la trinchera.

Las particiones están espaciadas aproximadamente 10 a 15 metros unas de las otras y el área de su sección debe ser más del 20% del total del área de la sección, teniendo una altura de 10 a 20 cm menos que los bordes de las trincheras. Por lo tanto, la trinchera actuará como un pequeño estanque a lo largo de las particiones. Sin embargo, para evitar el sobrepaso del flujo de la trinchera es necesario decidir cuidadosamente las cantidades de precipitaciones de diseño y el espacio de las particiones.

3) Diseño

Las trincheras de contorno, cubriendo la gama de gradientes de la pendiente desde 20% hasta 50%, están diseñadas para ser capaces de descargar dentro del 50% de la sección de diseño.

La forma y dimensiones de la trinchera de contorno depende de factores tales como las cantidades de precipitaciones, condiciones de la superficie, gradiente de la ladera, geología, etc. Puede ser diseñada de la manera siguiente.

Para estimar la descarga de diseño se utiliza la fórmula racional, de la manera siguiente:

$$Q=C \times I \times A / 360$$

Donde:

Q : Descarga en m³/seg

C : Coeficiente de correntía

I : Intensidad de las precipitaciones en mm/hora

A : Área de la cuenca en Has.

Las áreas unitarias fueron calculadas usando una distribución de gradientes desde el 21% hasta el 50%, gama que es la más adecuada para los trabajos de trinchera. Como se observa en la Fig. H.5.5, para obtener el espaciamiento horizontal y vertical óptimos, debieron efectuarse varios ensayos. Los resultados dan las siguientes rela-

ciones: espaciamiento vertical de 4.5, 4.5 y 8.0 para espaciamiento horizontal correspondiente de 18.5, 13.0 y 18.0 respectivamente, para trincheras de los tipos A, B y C. Además, definiendo una unidad de longitud para la trinchera de contorno (10 metros), encontramos áreas unitarias de 185, 130 y 180 m² para las gradientes correspondientes. Las descargas estimadas mediante la Fórmula Racional se muestran en la *Tabla H.5.7*.

La sección de trinchera se diseña mediante la fórmula de Manning, de la manera siguiente:

$$V = (1/n) \times R^{2/3} \times S^{1/2}$$

Donde:

- n : Coeficiente de aspereza de Manning,
- V : Velocidad en m/seg,
- R : Radio hidráulico en m,
- S : Gradiente del canal

Por lo tanto, en una sección dada de trinchera "A", la descarga "Q" en m³/seg será:

$$Q = A \times V$$

Los resultados de los cálculos se muestran en la *Tabla H.5.8*.

Las velocidades de flujo obtenidas están dentro de las gamas especificadas (0.30 a 0.90 m/s) para los materiales arenosos, los cuales son los más normales en el área, originados por rocas de diorita sometidas a los elementos atmosféricos. Estas velocidades son lo suficientemente bajas como para evitar la socavación del lecho de la trinchera. Secciones típicas se muestran en las *Figs. H.5.6*.

La descarga de la cuenca de cada trinchera se compara con la capacidad de descarga de cada sección. Las descargas calculadas previamente corresponden a las de secciones de 10 metros. La comparación entre las descargas da un número de veces que puede descargar la sección de trinchera propuesta. El largo de la trinchera es el valor del cociente multiplicado por diez veces. Los resultados son iguales o mayores que el largo máximo de las líneas de contorno (desde la cresta) para cada tipo y ellas son 183 > 180 (bloque "E"), 162 > 160 (bloque "E") y 80 = 80 (bloque "A"), respectivamente.

Además, mediante cálculo regresivo a partir desde el largo máximo establecido de las líneas de contorno, con el cociente de las descargas, las áreas unitarias pueden ser obtenidas optimizando el espaciado vertical y horizontal de las trincheras.

En la sección calculada previamente de trincheras, el largo de la trinchera es obtenido en cada hectárea, como puede verse en la *Tabla H.5.9*.

5.3.3 Barreras Vivas

1) Generalidades

Las barreras vivas corresponden a una estrecha cinta de plantas perennes, colocadas con un espaciado horizontal definido a lo largo de la línea de contorno y/o es usada como protección del borde de la terraza o de la zanja. Las plantas usadas como barrera viva deben tener fuertes tallos y producir una gran cantidad de macollas, dando algún beneficio a los labradores al mismo tiempo.

2) Diseño

Las barreras vivas serán usadas para la protección de las trincheras de contorno y de las terrazas y estarán alineadas a lo largo de las facilidades, a alrededor de 15 a 20 cm del borde superior en una o dos líneas.

De acuerdo con los largos de diseño de las trincheras de contorno y de las zanjas de ladera, el largo total de las barreras vivas será de 3,509 metros en las zanjas de ladera y de 13,123 metros en las trincheras de contorno.

Las especies recomendadas son las siguientes:

- Yerba Guinea (*panicum maximun*)
- Yerba Paez (*panicum purpureum*)
- Yerba Elefante (*Pannisetum purpureum*)
- Limoncillo de Té (*Cymbopogar citratus*)
- Pachulí (*Vativeria Zizaniodes*)
- Sorgo Forrajero (*Sorghum vulgare*)

La *Fig. H.5.7* muestra los trabajos de ladera propuestos, tales como terrazas, diferentes tipos de trincheras y barreras vivas.

5.3.4 Salidas o Canales de Conducción

1) Generalidades

Las salidas son canales en los cuales fluyen las descargas de las laderas de contorno y de las terrazas. La pendiente de estos canales es elevada y es necesario usar algún tipo de forro. Se propone efectuar un forro de piedras ya que tiene el efecto de disminuir la energía del flujo. En el área piloto, el área total de las corrientes de agua o arroyos es de 4,850 m de los cuales 3,350 m están protegidos por vegetación natural (árboles, matorrales, pasto) y 1,500 m están sin protección.

2) Diseño

La salida se diseña usando la misma metodología que la trinchera de contorno, de la manera expresada a continuación.

En las zonas corriente abajo y de media corriente, se estima que el tiempo de concentración es de 15 minutos, y que la intensidad de las precipitaciones es de 100 mm con un período de retorno de 10 años en la zona corriente arriba y que es de 150 mm en la cuenca pequeña. Los resultados se muestran en las *Tablas* H.5.10 y H.5.11.

Como la velocidad del flujo en ambos casos es un poco mayor que el máximo permisible en las condiciones supuestas (hasta 4.5 m/seg), se propone la colocación de represas de control de gavión en los sitios en los cuales predominan las pendientes elevadas y el suelo está descubierto, con el fin de retener el flujo de sedimentos y al mismo tiempo, disminuir la inclinación de las pendientes. En la *Fig. H.5.8* se muestran las secciones típicas de las 3 zonas a lo largo del área piloto. En la *Fig. H.5.9* se muestra gráficamente el concepto de estos trabajos en las laderas.

5.3.5 Represas de Control de Gavión

1) Generalidades

Las represas de control tienen la función de reducir las inclinaciones de las pendientes y la velocidad del flujo mediante la retención de sedimentos. Pueden ser hechas de concreto, gavión o simplemente apilando piedras sueltas.

Considerando las fuertes pendientes del área piloto se propone la confección de represas de control de gavión. Estas represas de gavión pueden ser planeadas en las corrientes de agua relativamente grandes. Una sección típica se muestra en la *Fig. H.5.10*.

2) Diseño

Las represas de control de gavión destinadas a la retención de sedimentos, están diseñadas considerando factores de seguridad contra el vuelco y el deslizamiento y mediante la comprobación de la estabilidad de la fundación.

5.3.6 Camino en el Terreno

1) Generalidades

En el área piloto es necesario efectuar la construcción de un camino a usar en los trabajos de construcción y durante la operación y el mantenimiento de los trabajos propuestos.

2) Diseño

Las especificaciones de diseño son las siguientes:

- Ancho: 4 m
- Espesor del empedrado: 15 cm.

Capa inferior de 10 cm : piedras trituradas o de río de 0 a 40 mm

Capa superior de 5 cm : piedras trituradas o de río de 0 a 25 mm

La *Fig. H.5.11* muestra una sección típica del camino. La ruta del camino se muestra en la *Fig. H.5.12*.

5.3.7 Reforestación

Para proteger el área piloto, junto con los trabajos en la ladera propuestos, se recomienda efectuar trabajos de reforestación. Se recomienda efectuar la plantación de árboles, especialmente en los terraplenes para reforzar la parte, además, se recomienda plantar árboles en las áreas entre las trincheras para tener una protección adicional de la pendiente mediante las ramas y hojas que absorberán el impacto de las gotas de lluvia, antes que esta llegue a la superficie del terreno, ayudando a disminuir la erosión y la producción de sedimentos.

Es necesario tener una limpieza regular de las plantaciones, especialmente durante los primeros dos años, con una frecuencia regular de una vez cada dos o tres meses al comienzo y luego disminuyéndola a una vez cada tres a cinco meses, de acuerdo con las necesidades (Bauer J., 1980)

De acuerdo con las gradientes de las pendientes y el uso de la tierra, se proponen 3 alternativas de reforestación, correspondiendo a cítricos, leña y protección permanente.

1) Cítricos

Se propone la plantación de cítricos en el área piloto que tenga gradientes de entre el 21 al 50%, es decir, la misma área en la cual se diseñan las trincheras. El propósito es tener una producción considerable en una tierra mejorada. La producción por cosecha por hectárea es de 2,195 kg/ha (Bauer J. 1980).

2) Leña

Es bien conocido que una de las causas principales de la deforestación es un elevado consumo de leña, el cual es de aproximadamente del orden de 1.5 m³/ persona/año (Bauer J. 1980). En la *Tabla H.5.12* también se muestran las producciones de algunos tipos de árboles para leña.

El precio de la leña es de 60 Lps/m³ en caso de Encina y de 35 Lps/m³ en caso de madreado (*Gliricidia sepium*) en el área rural. En las ciudades tales como San Pedro Sula el precio alcanza los 100 Lps/m³ y 60 Lps/m³, respectivamente.

3) Plan de Reforestación Propuesto

En este estudio se combinan la producción de leña junto con la protección de las laderas para cubrir las áreas que actualmente están recubiertas de matorrales, la cual corresponde a 10.60 has. La especie más común en el área es el Madrecacao (*Gliricidia sepium*), que se usa para verjas vivas y para leña. Se reproduce mediante estacas hechas de sus ramas.

a) Beneficios Económicos Esperados

La producción esperada en el área de 10.60 has. se estima en alrededor de 159 m³/turno en plantaciones de Madreado, con un período de retorno de 4 a 5 años. Esto corresponde a una producción de Lps 5,565 con los precios actuales en el sitio.

b) Beneficios Sociales Esperados

Aunque la producción muestra relativamente bajos beneficios económicos, la protección de la ladera y la implementación de áreas permanentes definidas para la producción de leña en bloques pequeños para consumo local, puede ser considerado como el mejor beneficio obtenido, un beneficio social.

c) Leyes Relacionadas

De acuerdo con la Ley del Medio Ambiente (La Gaceta, 30 de junio de 1993), Art. 50, el suelo que queda en pendientes con gran inclinación, y cuya explotación pueda acelerar la erosión o las avalanchas de tierra, debe mantenerse permanentemente con vegetación y por lo tanto no estará afecto a lo previsto en la Ley de la Tierra. La Administración Estatal Forestal promoverá programas para su forestación o reforestación.

La Ley de la Tierra considera una gradiente límite del 30% para la tierra que será afectada por los proyectos del Instituto Agrario Nacional (I.N.A.)

La Ley Forestal, Art. 64, establece un cinturón de protección de 250 metros en torno a cualquier fuente de agua y también establece un cinturón de protección de 150 m a cada lado de una corriente de agua permanente.

d) Especies Existentes

Se considera que en el pasado, el área piloto estaba cubierto de bosque denso, pero fue limpiado y cortado para efectuar cultivos o con fines ganaderos. Hay ciertas variedades de árboles, tales como:

- Cedro (*Cedrela odorata*),
- Teca (*Tectona grandis*),
- San Juan Primavera (*Cybistax donnellsmithii*),
- Guarumo (*Cecropia spp*),
- Macuelizo (*Tabebuia pentaphyla*),
- Guano,
- Chepel,
- Higo,
- Quebracho,
- Jobo,
- Chichipare.

Y en menor proporción:

- Laurel (*Cordia alliodora*),
- Pino Caribe (*pinus caribaea var. hondurensis*),
- Sauce.

Los períodos adecuados de reforestación en la parte Nor-occidental de Honduras es desde mediados de mayo hasta mediados de julio y entre mediados de septiembre hasta finales de noviembre.

Con respecto al suministro de semillas para la reforestación, será necesario efectuar un esfuerzo de coordinación entre la agencia encargada y el Departamento de Semillas de COHDEFOR, en Siguatepeque, donde se producen semillas de excelente calidad en el Nivel Latinoamericano.

La *Fig. H.5.12* muestra el plan general de los trabajos en las laderas.

TABLAS

TABLA H.4.1 USO DEL SUELO EN LA CUENCA ALTA

(Unit : sq.km)

| SUB-BASIN | FOREST (Q) | BRUSHWOOD (M) | AGRICULTU- RE+PASTURE (G) | POPULATED RIVERS (U) | TOTAL |
|---|---------------|------------------|---------------------------------|-------------------------|----------------|
| Queb.La Cumbre, Between Queb.La Cumbre and Queb. La Puerta % | 9.07 34% | 2.04 8% | 2.32 9% | 12.93 49% | 26.36 100% |
| Rio de Piedras, Between Rio de Piedras and Queb.Santa Ana Queb.Santa Ana Miramelinda % | 23.49 77% | 1.02 3% | 5.99 20% | 30.50 100% | |
| Rio Santa Ana Between Rio Santa Ana and Queb. Armenta and Rio Zapotal % | 24.03 67% | 1.67 5% | 5.71 16% | 4.46 12% | 35.87 100% |
| Rio Zapotal, Rio Chiquito % | 23.52 29% | 12.54 15% | 37.17 45% | 8.32 10% | 81.88 100% |
| Rio Choloma % | 6.13 9% | 8.13 11% | 47.17 66% | 5.11 7% | 71.64 100% |
| North-eastern % | 7.06 12% | 5.17 9% | 38.59 66% | 7.47 13% | 58.29 100% |
| TOTAL (KM2) % | 93.30 31% | 30.57 10% | 130.96 43% | 44.28 15% | 304.54 100% |

TABLA H.4.2 COMPARACION DEL USO DE LA TIERRA
DE LA SUBCUENCA DEL RIO CHOLOMA
EN EL PERIODO DE 1979 - 1992

| LAND USE | 1979 | 1992 | DIFFERENCE(%) |
|---------------------|-------|-------|---------------|
| Forest | 1,120 | 613 | -45% |
| Brushwood | 744 | 813 | + 9% |
| Agriculture+Pasture | 4,279 | 4,717 | +10% |
| Rivers | 510 | 510 | -- |
| Populated | 511 | 511 | -- |
| TOTAL | 7,164 | 7,164 | |

TABLA H.4.3 DISTRIBUCION DE LA GRADIENTE AL LADO DE LA MONTAÑA EN EL AREA DE ESTUDIO

| Basin | TOTAL | | 0-20 | | 21-30 | | 31-40 | | 41-50 | | Over 50 | |
|---|-------|-----|------|-----|-------|----|-------|----|-------|----|---------|----|
| | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % |
| 1. Cerro Azul | 425 | 100 | 25 | 6 | 25 | 6 | 56 | 13 | 138 | 32 | 181 | 43 |
| 2. Quebrada La Cumbre | 93 | 100 | 0 | 0 | 12 | 13 | 50 | 54 | 31 | 33 | 0 | 0 |
| 3. Between La Cumbre and La Puerta | 88 | 100 | 0 | 0 | 13 | 15 | 25 | 28 | 50 | 57 | 0 | 0 |
| 4. Quebrada La Puerta | 244 | 100 | 0 | 0 | 25 | 10 | 75 | 31 | 94 | 39 | 50 | 20 |
| 5. Between La Puerta and Las Mesetas | 144 | 100 | 0 | 0 | 19 | 13 | 63 | 44 | 56 | 39 | 6 | 4 |
| 6. Quebrada Las Mesetas/ Primavera | 412 | 100 | 0 | 0 | 6 | 1 | 106 | 26 | 131 | 32 | 169 | 41 |
| 7. Between Las Mesetas and Rio Piedras | 94 | 100 | 0 | 0 | 6 | 6 | 25 | 27 | 38 | 40 | 25 | 27 |
| 8. Rio Piedras | 1993 | 100 | 0 | 0 | 31 | 1 | 200 | 10 | 331 | 17 | 1431 | 72 |
| 9. Between Rio Piedras and Quebrada Santa Ana | 239 | 100 | 0 | 0 | 12 | 5 | 31 | 13 | 75 | 31 | 121 | 51 |
| 10. Quebrada Santa Ana/ Miramelinda | 381 | 100 | 0 | 0 | 0 | 0 | 12 | 3 | 81 | 21 | 288 | 76 |
| 11. Rio Santa Ana | 2225 | 100 | 0 | 0 | 19 | 1 | 100 | 4 | 312 | 14 | 1794 | 81 |
| 12. Between Rio Santa Ana and Armenta | 556 | 100 | 0 | 0 | 31 | 6 | 50 | 9 | 119 | 21 | 356 | 64 |
| 13. Quebrada Armenta | 918 | 100 | 0 | 0 | 6 | 1 | 19 | 2 | 87 | 9 | 806 | 88 |
| 14. Between Quebrada Armenta and Rio Zapotal | 267 | 100 | 0 | 0 | 6 | 2 | 68 | 25 | 50 | 19 | 143 | 54 |
| 15. Rio Zapotal | 1793 | 100 | 6 | 0 | 37 | 2 | 106 | 2 | 138 | 8 | 1506 | 84 |
| 16. Rio Chiquito | 806 | 100 | 100 | 13 | 181 | 22 | 169 | 21 | 137 | 17 | 219 | 27 |
| 17. Rio Choloma | 7164 | 100 | 900 | 12 | 795 | 11 | 1447 | 20 | 1831 | 26 | 2192 | 31 |
| 18. North-Eastern | 5646 | 100 | 556 | 10 | 719 | 13 | 1232 | 22 | 1482 | 26 | 1657 | 29 |
| 19. Plain | 6966 | 100 | 6966 | 100 | | | | | | | | |

Source: Plan de Manejo Sierra de Omoa, Jan Bauer, 1980

TABLA H.4.4 PROPIEDAD DE LAS TIERRAS EN LA SUBCUENCA DEL RIO CHOLOMA

| OWNERSHIP (Propiedad) | No. LOTS (No. Lotes) | % | AREA (Has.) | % |
|----------------------------------|---------------------------------|----------|--------------------|----------|
| National | 6 | 1 | 286.4 | 4 |
| Municipal | 394 | 90 | 6,347.2 | 89 |
| Private | 40 | 9 | 530.4 | 7 |
| Total | 440 | 100 | 7,164.0 | 100 |

TABLA H.5.1 ZONAS DE SOCAVACION IDENTIFICADAS EN LA CUENCA CHOLOMA

| ZONE | AREA (HAS) | AVERAGE GRADIENT (%) | PAS-TURE (%) | BRUSH-WOOD (%) | FOREST (%) | OTHERS (%) |
|-------------------|------------|----------------------|--------------|----------------|------------|------------|
| CERRO LOS OLINGOS | 62.4 | 35 | 67 | 17 | 15 | 1 |
| CERRO LA PAVOSA | 189.3 | 30 | 73 | 2 | 9 | 16 |
| CERRO WILL | 179.2 | 13 | 80 | 8 | 2 | 10 |
| CERRO LOS CABROS | 193.3 | 32 | 74 | -- | 16 | 10 |
| CERRO DE LA UVA | 163.5 | 23 | 90 | -- | -- | 10 |

TABLA H.5.2 CLASIFICACION DEL USO DE LA TIERRA EN EL AREA DE LOS TRABAJOS EN LAS LADERAS (M²)

| BLOCK | NATURAL PASTURE | BRUSHWOOD | FOREST | OTHERS | TOTAL | % |
|-----------------|-----------------|-----------|--------|--------|---------|-----|
| A | 66,063 | 28,037 | 9,666 | 8,219 | 111,985 | 18 |
| B | 55,358 | -- | -- | -- | 55,358 | 9 |
| C | 63,762 | 15,919 | -- | -- | 79,681 | 13 |
| D | 16,929 | -- | 6,890 | -- | 23,819 | 4 |
| E | 103,391 | 12,827 | 25,517 | -- | 141,735 | 23 |
| F | 35,787 | 7,150 | -- | -- | 42,937 | 7 |
| G | 35,484 | 42,022 | 18,439 | -- | 95,945 | 15 |
| H | 39,757 | -- | 32,890 | -- | 72,647 | 12 |
| TOTAL | 416,531 | 105,955 | 93,402 | 8,219 | 624,107 | 100 |
| % | 67 | 17 | 15 | 1 | 100 | |
| Choloma Basin % | 66(*) | 11 | 9 | 14(**) | 100 | |

(*) Includes agriculture, (**) Includes populated/river areas

TABLA H.5.3 CLASIFICACION DE GRADIENTES EN EL AREA DE PASTO (M²)

| BLOCK | 0-20% (T) | 21-30% (A) | 31-40% (B) | 41-50% (C) | >50% (R) | TOTAL | % |
|---------------|--------------|---------------|---------------|---------------|-------------|---------|-----|
| A | 8,214 | 36,554 | 13,267 | 8,029 | -- | 66,064 | 16 |
| B | -- | 7,783 | 4,727 | 20,651 | 22,198 | 55,359 | 13 |
| C | 12,159 | -- | 24,899 | -- | 26,704 | 63,762 | 15 |
| D | 2,545 | 4,210 | 1,200 | 7,385 | 1,590 | 16,930 | 4 |
| E | 27,109 | 3,555 | 34,837 | 19,849 | 18,041 | 103,391 | 25 |
| F | -- | 7,532 | -- | 8,232 | 20,023 | 35,787 | 9 |
| G | -- | 4,875 | -- | -- | 30,608 | 35,483 | 9 |
| H | -- | -- | -- | -- | 39,757 | 39,757 | 10 |
| TOTAL | 50,027 | 64,509 | 78,930 | 64,146 | 158,921 | 416,533 | 100 |
| % | 12 | 15 | 19 | 15 | 38 | 100 | |
| Chol. Basin % | 12 | 11 | 20 | 26 | 31 | 100 | |

TABLA H.5.4 CLASIFICACION DE LOS TRABAJOS PROPUESTOS EN LAS LADERAS

| GRADIENT RANGE AND LAND USE | SYMBOL | PROPOSED HILLSIDE WORK |
|-----------------------------|--------|--|
| 0-20%, Pasture | T | Terraces, Living Barriers, Cultivation of Basic Grains |
| 21-30%, Pasture | A | Contour Trench, Living Barriers and Cultivation of Citrics |
| 31-40%, Pasture | B | Contour Trench, Living Barriers and Cultivation of Citrics |
| 41-50%, Pasture | C | Contour Trench, Living Barriers and Cultivation of Citrics |
| 51% or more, Pasture | Rp | Reforestation for Protection |
| Brushwood | Rfw | Reforestation for Firewood |

TABLA H.5.5 PROCEDIMIENTO DE CALCULO DE LAS PRESAS DE LAS LADERAS

| STEP | CONCEPT | SYMBOL | FORMULA |
|------|--|---------------|------------------------------------|
| 1 | GIVEN DATA: Platform width (m) Embankment Inclination Reverse Gradient | Wb U RG | 2 m 0.75 10% |
| 2 | Theoretical Vertical Interval (m) | TVI | $S \times Wb / (100 - S \times U)$ |
| 3 | Reverse Gradient Height (m) | RH | $Wb \times RG$ |
| 4 | Slope Height (m) | Hr | $(TVI + RH) / 2$ |
| 5 | Width of Slope (m) | Wr | $Hr \times U$ |
| 6 | Width of Terrace (m) | Wt | $Wb + 2Wr$ |
| 7 | Vertical Interval Between Ditches (m) | VI | $(S + 4) / 10$ |
| 8 | Horizontal Interval Between Ditches (m) | HI | $(VI / S) \times 100$ |
| 9 | Inclined Distance (m) | D | $VI / \sin \text{Angle}$ |
| 10 | Length per Hectare (m) | L | $10,000 / HI$ |
| 11 | Platform Area per Hectare (m ²) | A | $L \times Wb$ |
| 12 | % of Platform Area per Ha. | Pb | $(A / 10,000) \times 100$ |
| 13 | Ditch Cross Section per Ha. (m ²) | C | $Wb \times 2Hr / 8$ |
| 14 | Cut and Fill Volume per Ha. (m ³) | V | $L \times C$ |

Source: Fao, 1989

TABLA H.5.6 CALCULO DE LAS PRESAS DE LAS LADERAS

| S (%) | U | Wb (m) | TVI (m) | RH (m) | Hr (m) | Wr (m) | Wt (m) | VI (m) | HI (m) | D (m) | L (m/ha) | A (m ² /ha) | C (m ² /ha) | V m ³ /ha |
|-------|------|--------|---------|--------|--------|--------|--------|--------|--------|-------|----------|------------------------|------------------------|----------------------|
| 1 | 0.75 | 2 | 0.02 | 0.2 | 0.11 | 0.08 | 2.17 | 0.5 | 50 | 50 | 200 | 400 | 0.06 | 11 |
| 2 | 0.75 | 2 | 0.04 | 0.2 | 0.12 | 0.09 | 2.18 | 0.6 | 30 | 30 | 333 | 667 | 0.06 | 20 |
| 3 | 0.75 | 2 | 0.06 | 0.2 | 0.13 | 0.10 | 2.20 | 0.7 | 23 | 23 | 429 | 857 | 0.07 | 28 |
| 4 | 0.75 | 2 | 0.08 | 0.2 | 0.14 | 0.11 | 2.21 | 0.8 | 20 | 20 | 500 | 1,000 | 0.07 | 35 |
| 5 | 0.75 | 2 | 0.10 | 0.2 | 0.15 | 0.11 | 2.23 | 0.9 | 18 | 18 | 556 | 1,111 | 0.08 | 42 |
| 6 | 0.75 | 2 | 0.13 | 0.2 | 0.16 | 0.12 | 2.24 | 1 | 16 | 17 | 600 | 1,200 | 0.08 | 49 |
| 7 | 0.75 | 2 | 0.15 | 0.2 | 0.17 | 0.13 | 2.26 | 1.1 | 15 | 16 | 636 | 1,273 | 0.09 | 55 |
| 8 | 0.75 | 2 | 0.17 | 0.2 | 0.19 | 0.14 | 2.28 | 1.2 | 15 | 15 | 667 | 1,333 | 0.09 | 62 |
| 9 | 0.75 | 2 | 0.19 | 0.2 | 0.20 | 0.15 | 2.29 | 1.3 | 14 | 15 | 692 | 1,385 | 0.10 | 68 |
| 10 | 0.75 | 2 | 0.22 | 0.2 | 0.21 | 0.16 | 2.31 | 1.4 | 14 | 14 | 714 | 1,429 | 0.10 | 74 |
| 11 | 0.75 | 2 | 0.24 | 0.2 | 0.22 | 0.16 | 2.33 | 1.5 | 13 | 14 | 733 | 1,467 | 0.11 | 81 |
| 12 | 0.75 | 2 | 0.26 | 0.2 | 0.23 | 0.17 | 2.35 | 1.6 | 13 | 13 | 750 | 1,500 | 0.12 | 87 |
| 13 | 0.75 | 2 | 0.29 | 0.2 | 0.24 | 0.18 | 2.37 | 1.7 | 13 | 13 | 765 | 1,529 | 0.12 | 93 |
| 14 | 0.75 | 2 | 0.31 | 0.2 | 0.26 | 0.19 | 2.38 | 1.8 | 12 | 13 | 778 | 1,556 | 0.13 | 100 |
| 15 | 0.75 | 2 | 0.34 | 0.2 | 0.27 | 0.20 | 2.40 | 1.9 | 12 | 13 | 789 | 1,579 | 0.13 | 106 |
| 16 | 0.75 | 2 | 0.36 | 0.2 | 0.28 | 0.21 | 2.42 | 2 | 12 | 13 | 800 | 1,600 | 0.14 | 113 |
| 17 | 0.75 | 2 | 0.39 | 0.2 | 0.29 | 0.22 | 2.44 | 2.1 | 12 | 13 | 810 | 1,619 | 0.15 | 119 |
| 18 | 0.75 | 2 | 0.42 | 0.2 | 0.31 | 0.23 | 2.46 | 2.2 | 12 | 12 | 818 | 1,636 | 0.15 | 126 |
| 19 | 0.75 | 2 | 0.44 | 0.2 | 0.32 | 0.24 | 2.48 | 2.3 | 12 | 12 | 826 | 1,652 | 0.16 | 133 |
| 20 | 0.75 | 2 | 0.47 | 0.2 | 0.34 | 0.25 | 2.50 | 2.4 | 12 | 12 | 833 | 1,667 | 0.17 | 140 |
| 21 | 0.75 | 2 | 0.50 | 0.2 | 0.35 | 0.26 | 2.52 | 2.5 | 11 | 12 | 840 | 1,680 | 0.17 | 147 |
| 22 | 0.75 | 2 | 0.53 | 0.2 | 0.36 | 0.27 | 2.55 | 2.6 | 11 | 12 | 846 | 1,692 | 0.18 | 154 |
| 23 | 0.75 | 2 | 0.56 | 0.2 | 0.38 | 0.28 | 2.57 | 2.7 | 11 | 12 | 852 | 1,704 | 0.19 | 161 |
| 24 | 0.75 | 2 | 0.59 | 0.2 | 0.39 | 0.29 | 2.59 | 2.8 | 11 | 12 | 857 | 1,714 | 0.20 | 168 |
| 25 | 0.75 | 2 | 0.62 | 0.2 | 0.41 | 0.31 | 2.61 | 2.9 | 11 | 12 | 862 | 1,724 | 0.20 | 176 |
| 26 | 0.75 | 2 | 0.65 | 0.2 | 0.42 | 0.32 | 2.63 | 3 | 11 | 12 | 867 | 1,733 | 0.21 | 183 |
| 27 | 0.75 | 2 | 0.68 | 0.2 | 0.44 | 0.33 | 2.66 | 3.1 | 11 | 12 | 871 | 1,742 | 0.22 | 191 |
| 28 | 0.75 | 2 | 0.71 | 0.2 | 0.45 | 0.34 | 2.68 | 3.2 | 11 | 12 | 875 | 1,750 | 0.23 | 199 |
| 29 | 0.75 | 2 | 0.74 | 0.2 | 0.47 | 0.35 | 2.71 | 3.3 | 11 | 12 | 879 | 1,758 | 0.24 | 207 |
| 30 | 0.75 | 2 | 0.77 | 0.2 | 0.49 | 0.37 | 2.73 | 3.4 | 11 | 12 | 882 | 1,765 | 0.24 | 215 |
| 31 | 0.75 | 2 | 0.81 | 0.2 | 0.50 | 0.38 | 2.76 | 3.5 | 11 | 12 | 886 | 1,771 | 0.25 | 223 |
| 32 | 0.75 | 2 | 0.84 | 0.2 | 0.52 | 0.39 | 2.78 | 3.6 | 11 | 12 | 889 | 1,778 | 0.26 | 232 |
| 33 | 0.75 | 2 | 0.88 | 0.2 | 0.54 | 0.40 | 2.81 | 3.7 | 11 | 12 | 892 | 1,784 | 0.27 | 240 |
| 34 | 0.75 | 2 | 0.91 | 0.2 | 0.56 | 0.42 | 2.83 | 3.8 | 11 | 12 | 895 | 1,789 | 0.28 | 249 |
| 35 | 0.75 | 2 | 0.95 | 0.2 | 0.57 | 0.43 | 2.86 | 3.9 | 11 | 12 | 897 | 1,795 | 0.29 | 258 |
| 36 | 0.75 | 2 | 0.99 | 0.2 | 0.59 | 0.44 | 2.89 | 4 | 11 | 12 | 900 | 1,800 | 0.30 | 267 |
| 37 | 0.75 | 2 | 1.02 | 0.2 | 0.61 | 0.46 | 2.92 | 4.1 | 11 | 12 | 902 | 1,805 | 0.31 | 276 |
| 38 | 0.75 | 2 | 1.06 | 0.2 | 0.63 | 0.47 | 2.95 | 4.2 | 11 | 12 | 905 | 1,810 | 0.32 | 286 |
| 39 | 0.75 | 2 | 1.10 | 0.2 | 0.65 | 0.49 | 2.98 | 4.3 | 11 | 12 | 907 | 1,814 | 0.33 | 295 |
| 40 | 0.75 | 2 | 1.14 | 0.2 | 0.67 | 0.50 | 3.01 | 4.4 | 11 | 12 | 909 | 1,818 | 0.34 | 305 |
| 41 | 0.75 | 2 | 1.18 | 0.2 | 0.69 | 0.52 | 3.04 | 4.5 | 10 | 12 | 911 | 1,822 | 0.35 | 315 |
| 42 | 0.75 | 2 | 1.23 | 0.2 | 0.71 | 0.53 | 3.07 | 4.6 | 10 | 12 | 913 | 1,826 | 0.36 | 326 |
| 43 | 0.75 | 2 | 1.27 | 0.2 | 0.73 | 0.55 | 3.10 | 4.7 | 10 | 12 | 915 | 1,830 | 0.37 | 336 |
| 44 | 0.75 | 2 | 1.31 | 0.2 | 0.76 | 0.57 | 3.14 | 4.8 | 10 | 12 | 917 | 1,833 | 0.38 | 347 |
| 45 | 0.75 | 2 | 1.36 | 0.2 | 0.78 | 0.58 | 3.17 | 4.9 | 10 | 12 | 918 | 1,837 | 0.39 | 358 |
| 46 | 0.75 | 2 | 1.40 | 0.2 | 0.80 | 0.60 | 3.20 | 5 | 10 | 12 | 920 | 1,840 | 0.40 | 369 |
| 47 | 0.75 | 2 | 1.45 | 0.2 | 0.83 | 0.62 | 3.24 | 5.1 | 10 | 12 | 922 | 1,843 | 0.41 | 381 |
| 48 | 0.75 | 2 | 1.50 | 0.2 | 0.85 | 0.64 | 3.28 | 5.2 | 10 | 12 | 923 | 1,846 | 0.43 | 392 |
| 49 | 0.75 | 2 | 1.55 | 0.2 | 0.87 | 0.66 | 3.31 | 5.3 | 10 | 12 | 925 | 1,849 | 0.44 | 404 |
| 50 | 0.75 | 2 | 1.60 | 0.2 | 0.90 | 0.68 | 3.35 | 5.4 | 10 | 12 | 926 | 1,852 | 0.45 | 417 |

TABLA H.5.7 CALCULO DE LA DESCARGA POR UNIDAD DE AREA DE TRIBUTARIA

1) C Values

| Basin Classification | "C" Value |
|--------------------------|-----------|
| Populated area | 0.9 |
| Street | 0.8 |
| Field, uncultivated land | 0.6 |
| Rice field | 0.7 |
| Mountain area | 0.7 |

Source: Takemoto, Y., 1981

2) Discharge

| GRADIENT TYPE | C | I (mm/hour) | A (m ²) | Q (m ³ /sec) |
|---------------|-----|-------------|---------------------|-------------------------|
| A (21-30%) | 0.6 | 150 | 185 | 0.0046 |
| B (31-40%) | 0.6 | 150 | 130 | 0.0033 |
| C (41-50%) | 0.6 | 150 | 180 | 0.0045 |

TABLA H.5.8 CALCULO DE LA SECCION DEL CANAL MEDIANTE LA ECUACION MANNING

1) Roughness Coefficient

| Description of Earth Channels | Range of n | Average |
|---|-------------|---------|
| Clayish soil; straight and uniform | 0.016-0.022 | 0.020 |
| Clayish sandy or sandy clayish soils; straight and uniform | -- | 0.020 |
| Slightly covered by pasture | 0.035-0.045 | 0.040 |
| Densely covered by pasture | 0.040-0.060 | 0.050 |
| Covered with stones of several sizes, 1 to 3 cm of diameter | -- | 0.022 |
| Covered with stones of several sizes, 2 to 6 cm of diameter | -- | 0.025 |
| Bed of smooth stones and homogeneous | 0.030-0.035 | 0.033 |
| Bed of rough stones | 0.035-0.045 | 0.040 |

Source: FAO, 1989, Guía FAO No. 13/3
Also refer to Takemoto, Y. 1981

2) Trench Section

| SLOPE TYPE | Bt (m) | Bb (m) | H (m) | Area (m ²) | R (m) | S | v m/sec | Q m ³ /sec |
|------------|--------|--------|-------|------------------------|-------|-------|---------|-----------------------|
| A(25%) | 1.50 | 0.90 | 0.20 | 0.24 | 0.15 | 1/400 | 0.35 | 0.0840 |
| B(35%) | 1.10 | 0.65 | 0.15 | 0.13 | 0.11 | 1/200 | 0.41 | 0.0533 |
| C(45%) | 0.70 | 0.45 | 0.10 | 0.06 | 0.07 | 1/50 | 0.63 | 0.0360 |

TABLA H.5.9 LONGITUD DE CANALES POR HECTAREA

| GRADIENT TYPE | UNIT WIDTH (m) | TOTAL AREA (m ²) | TRENCH LENGTH (m) | TRENCH LENGTH PER HA. (m/ha) |
|---------------|----------------|------------------------------|-------------------|------------------------------|
| A (21-30%) | 18.5 | 64,509 | 3,487 | 540.62 |
| B (31-40%) | 13.0 | 78,930 | 6,072 | 769.58 |
| C (41-50%) | 18.0 | 64,146 | 3,564 | 556.01 |

TABLA H.5.10 APLICACION DE LA FORMULA RACIONAL

| ZONE (Channel Length) | C | I (mm/hour) | A (m ²) | Q (m ³ /sec) |
|-----------------------|-----|-------------|---------------------|-------------------------|
| Downstream (100m) | 0.6 | 100 | 261,796 | 4.36 |
| Midstream (300m) | 0.6 | 100 | 226,300 | 3.77 |
| Upstream (1,100m) | 0.6 | 150 | 30,000 | 0.79 |

TABLA H.5.11 CALCULO DE LA SECCION DEL DESEMBOCADERO
MEDIANTE LA ECUACION MANNING

| n | Bt (m) | Bb (m) | H (m) | Area (m ²) | R (m) | S (%) | V m/sec | Q m ³ /sec |
|------|-----------|-----------|----------|---------------------------|----------|----------|------------|--------------------------|
| 0.04 | 2.50 | 1.00 | 0.50 | 0.88 | 0.31 | 19* | 5.04 | 4.41 |
| 0.04 | 2.35 | 1.00 | 0.45 | 0.75 | 0.29 | 25* | 5.49 | 4.14 |
| 0.04 | 1.45 | 1.00 | 0.15 | 0.18 | 0.12 | 50 | 4.28 | 0.79 |

(*) Weighted average

TABLA H.5.12 PRODUCCION UNITARIA DE ESPECIOS COMUNES DE LEÑA

| PLANTATION TYPE | PRODUCTION (m ³ /ha) | TURN PERIOD (year) |
|--|------------------------------------|-----------------------|
| Madreado (<i>Gliricidia sepium</i>) | 15 | 4 to 5 |
| Guaje (<i>Leucaena leucocephala</i>) | 15 | 4 to 5 |
| Eucalipto (<i>Eucalyptus deglupta</i>) | 14 | 8 to 10 |

Source: Bauer, J. 1980

FIGURAS

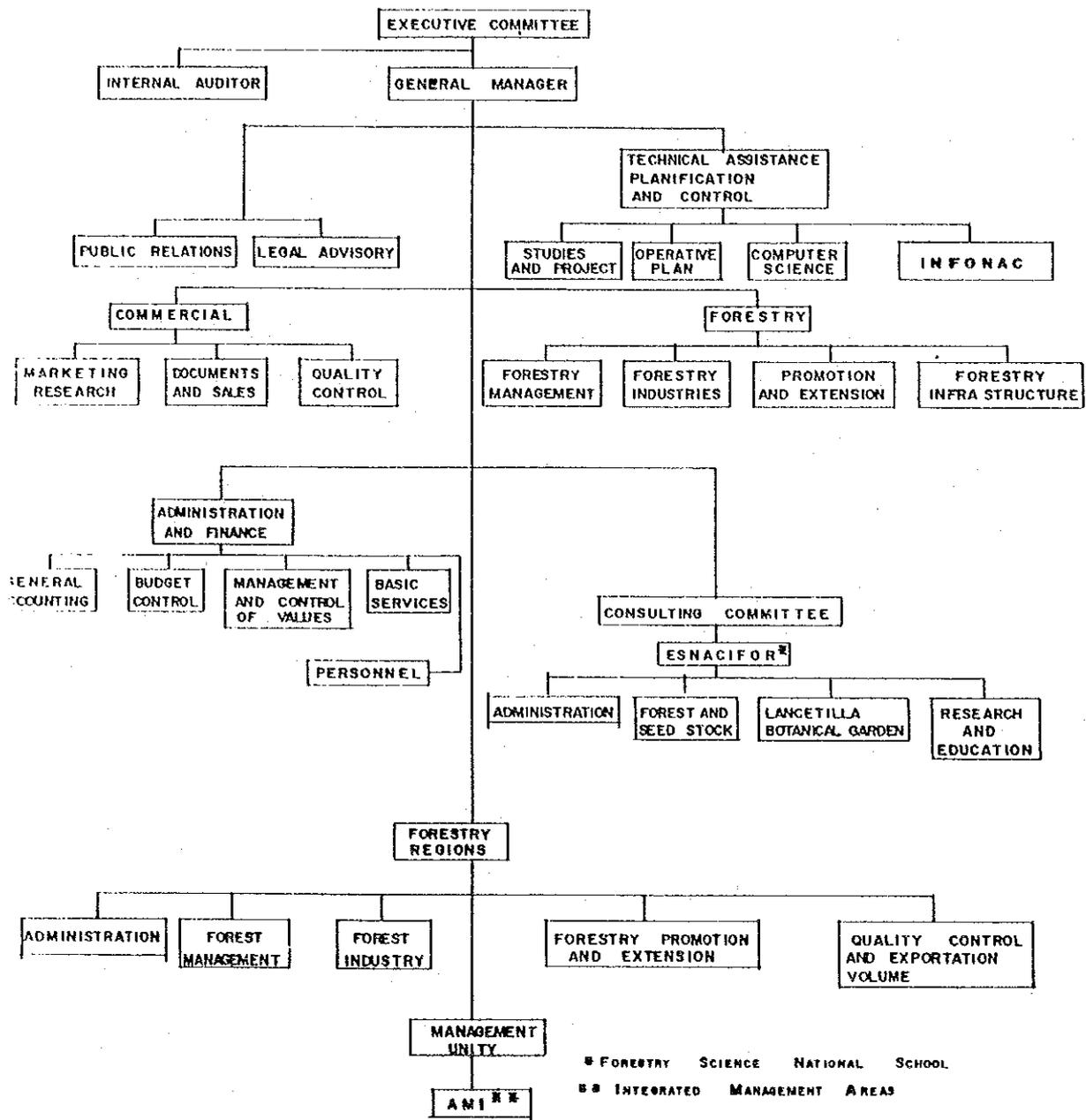


FIG. H.3.1 CUADRO ADMINISTRATIVO DE COHDEFOR

| LEGEND (LEYENDA) | |
|------------------|---|
| A | BANANO (BANANO) |
| B | RICE, MAIZÉ (ARROZ, MAIZ) |
| | VEGETABLES, CITRICS, SUGAR CANE (VEGETALES, CITRICOS, CAÑA AZUCAR) |
| | CULTIVATED PASTURE (PASTO CULTIVADO) |
| | NATURAL PASTURE (PASTO NATURAL) |
| C | AGRICULTURE AND PASTURE IN GENERAL (AGRICULTURA Y PASTO EN GENERAL) |
| | BRUSHWOOD (MATORRAL) |
| | FOREST (BOSQUE) |
| | RIVERS AND LAGOONS (RIOS Y LAGUNAS) |
| | POPULATED AREA (AREA HABITADA) |
| | OTHERS (OTROS) |

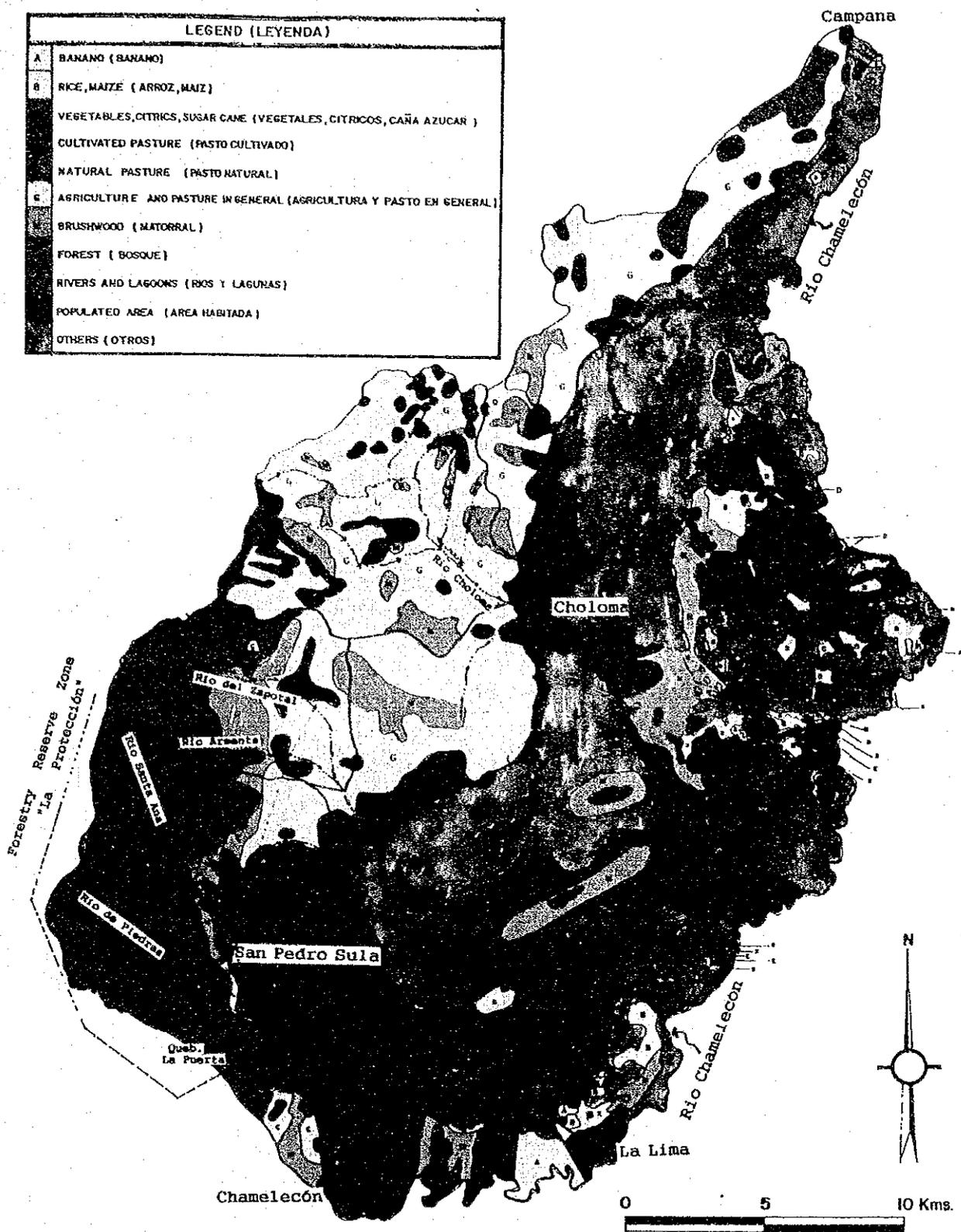


FIG. H.4.1 MAPA DE USO DE LA TIERRA

| LEGEND (LEYENDA) | |
|------------------|---|
| A | BANANO (BANANO) |
| B | RICE, MAIZE (ARROZ, MAIZ) |
| | VEGETABLES, CITRUS, SUGAR CANE (VEGETALES, CITRICOS, CAÑA AZUCAR) |
| | CULTIVATED PASTURE (PASTO CULTIVADO) |
| | NATURAL PASTURE (PASTO NATURAL) |
| C | AGRICULTURE AND PASTURE IN GENERAL (AGRICULTURA Y PASTO EN GENERAL) |
| D | BRUSHWOOD (MATORRAL) |
| | FOREST (BOSQUE) |
| | RIVERS AND LAGOONS (RIOS Y LAGUNAS) |
| | POPULATED AREA (AREA HABITADA) |
| | OTHERS (OTROS) |

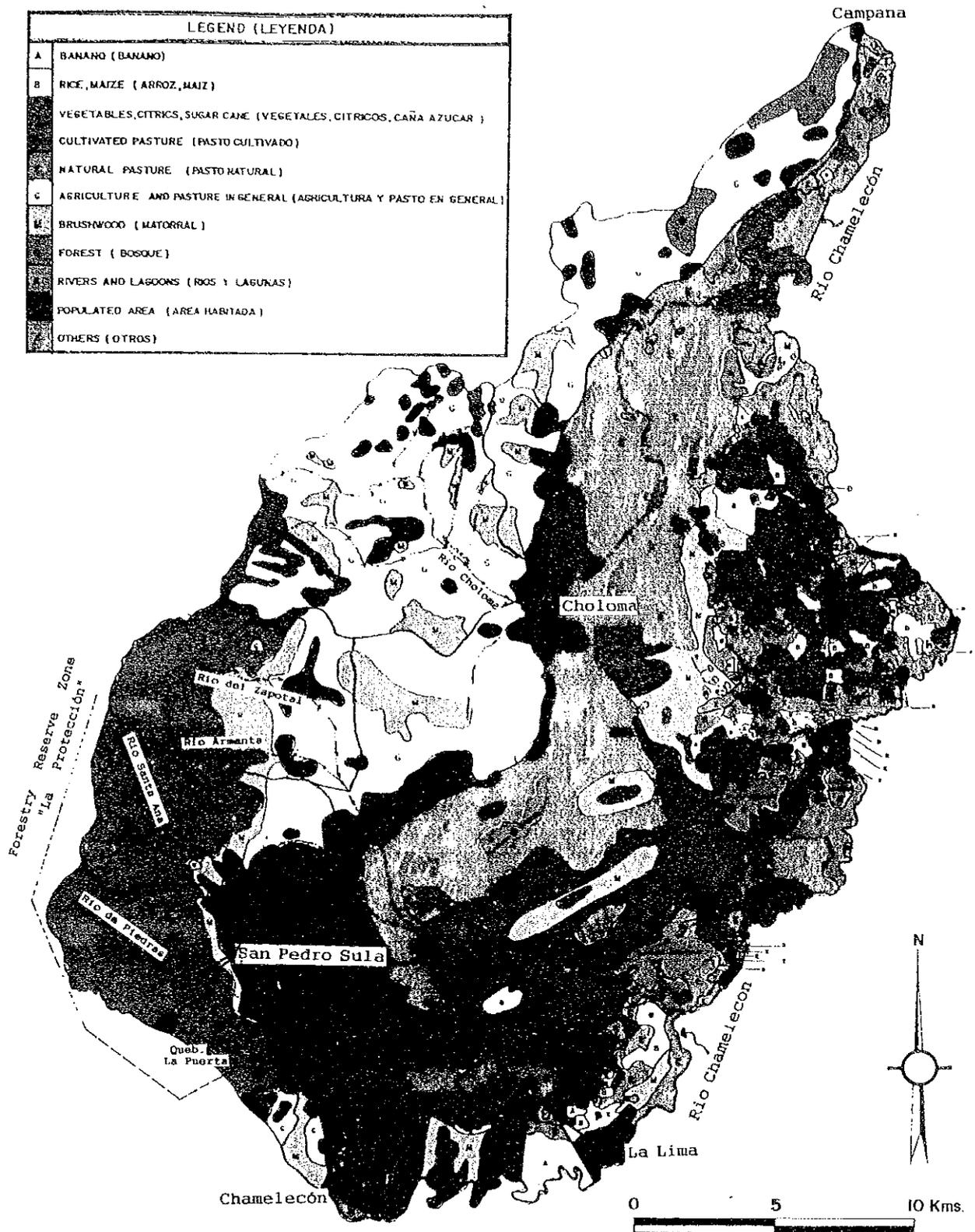


FIG. H.4.1 MAPA DE USO DE LA TIERRA

LEGENDA (LEYENDA)

| | |
|---|--|
| A | BANANO (BANANA) |
| B | ARIZ, MAIZE (ARROZ, MAIZ) |
| C | VEGETALES DIVERSOS, SUCAS COM. (VEGETALES DIFERENTES, CANA AZÚCAR) |
| D | CULTIVATED PASTURE (PASTO CULTIVADO) |
| E | NATURAL PASTURE (PASTO NATURAL) |
| F | AGRICULTURE AND PASTURE (AGRICULTURA Y PASTO EN GENERAL) |
| M | BRUSHWOOD (MATONNA) |
| P | FOREST (BOSQUE) |
| R | RIVERS AND LAGOONS (RIOS Y LAGUNAS) |
| S | SWAMPY AREAS (ÁREAS HÚMIDAS) |
| X | OTHERS (OTROS) |

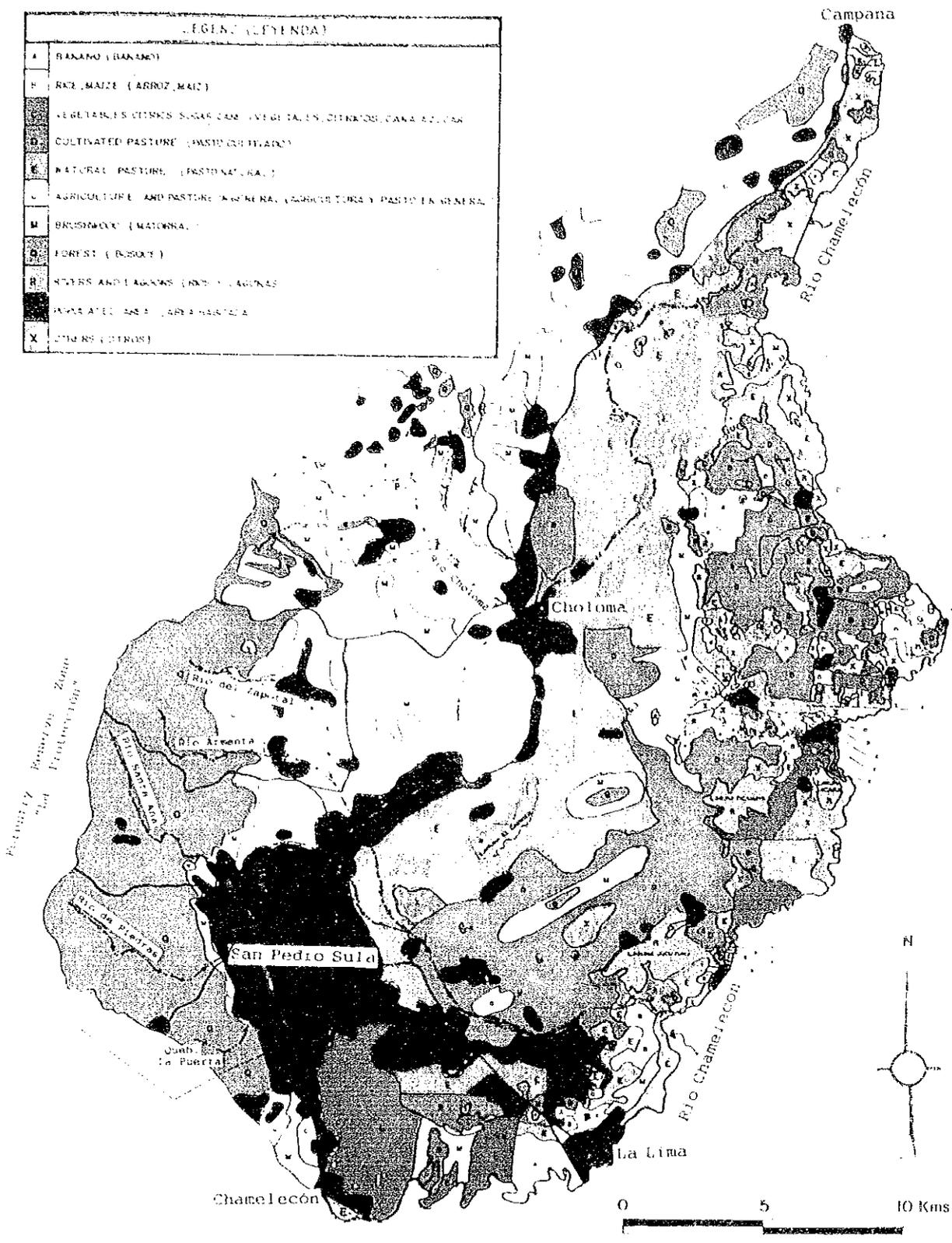


FIG. II.4.1 MAPA DE USO DE LA TIERRA

LEGEND

| CLASS | GRADIENT (%) |
|-------|--------------|
| | 0 - 20 |
| | 21 - 30 |
| | 31 - 40 |
| | 41 - 50 |
| | > 50 |

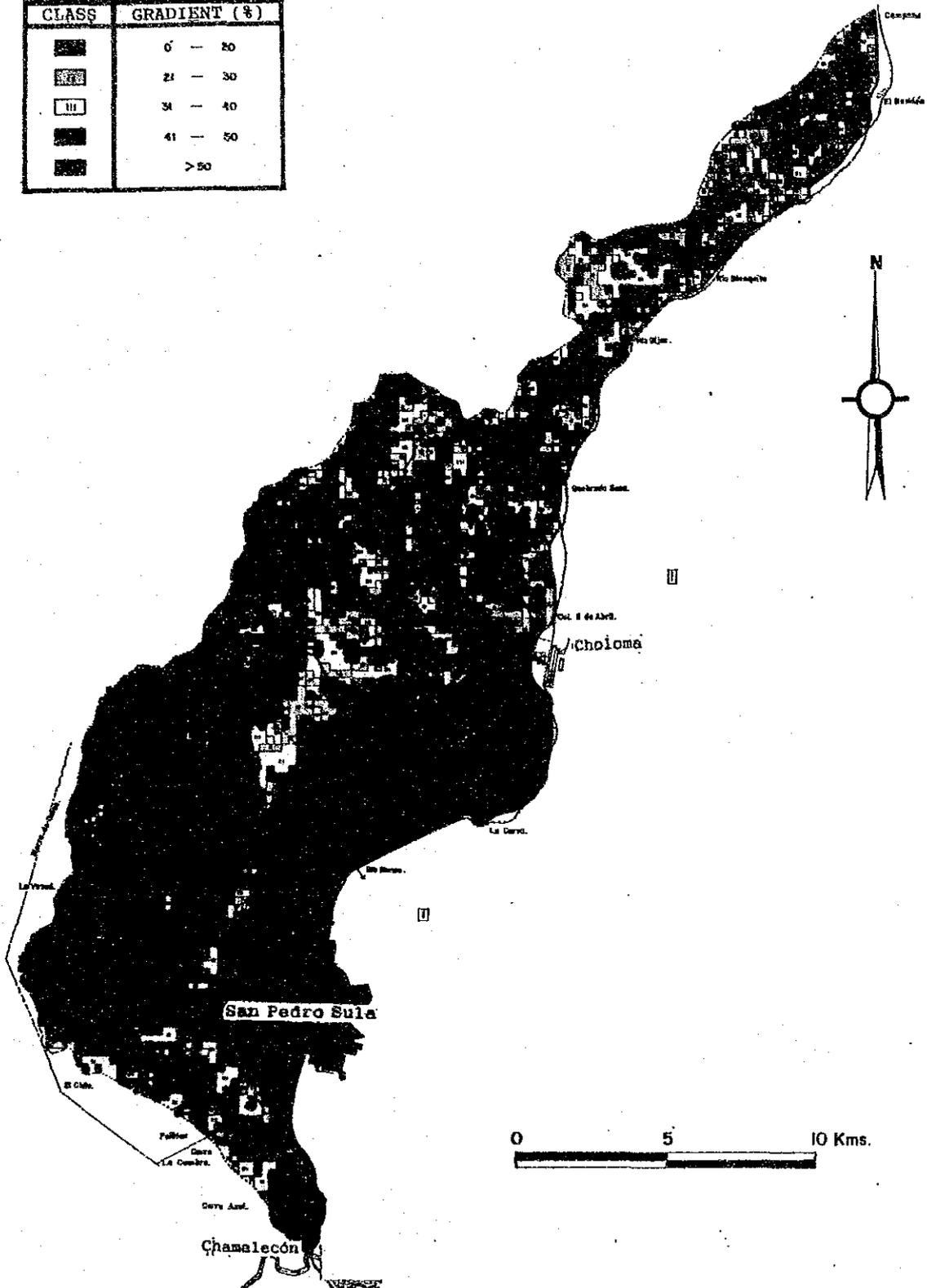
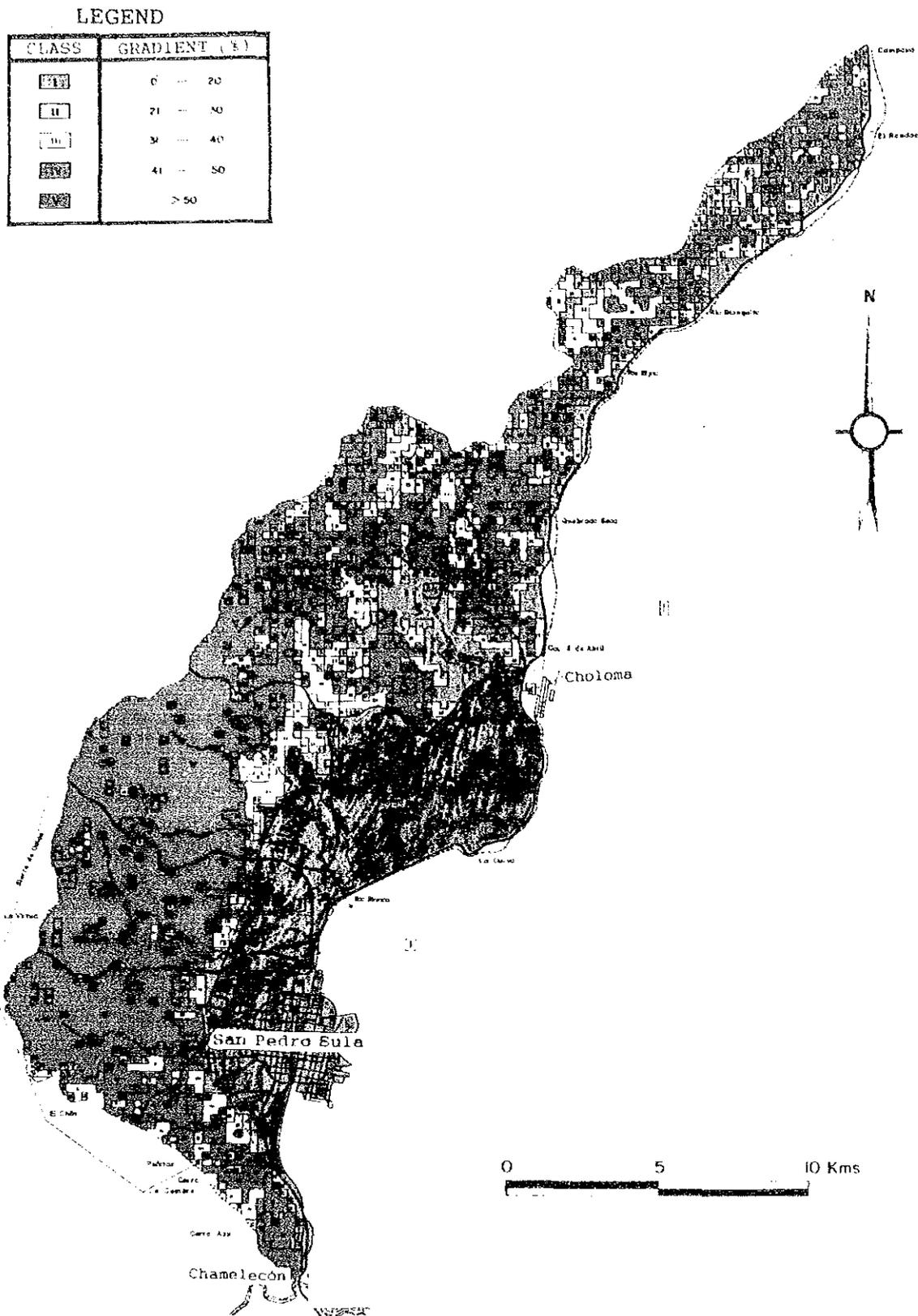


FIG. H.4.2 MAPA DE GRADIENTES (CUENCA SUPERIOR)



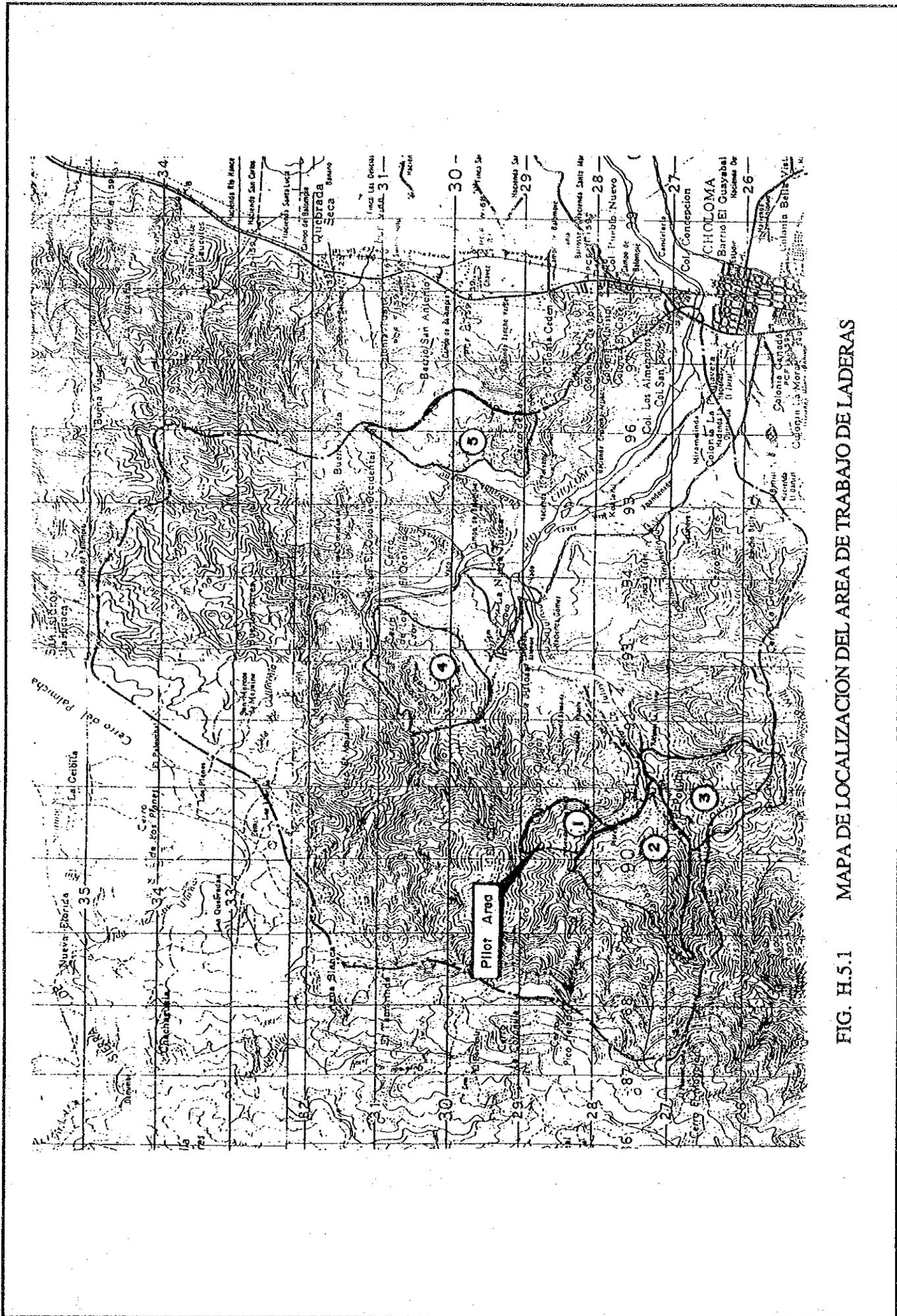


FIG. H.5.1 MAPA DE LOCALIZACION DEL AREA DE TRABAJO DE LADERAS

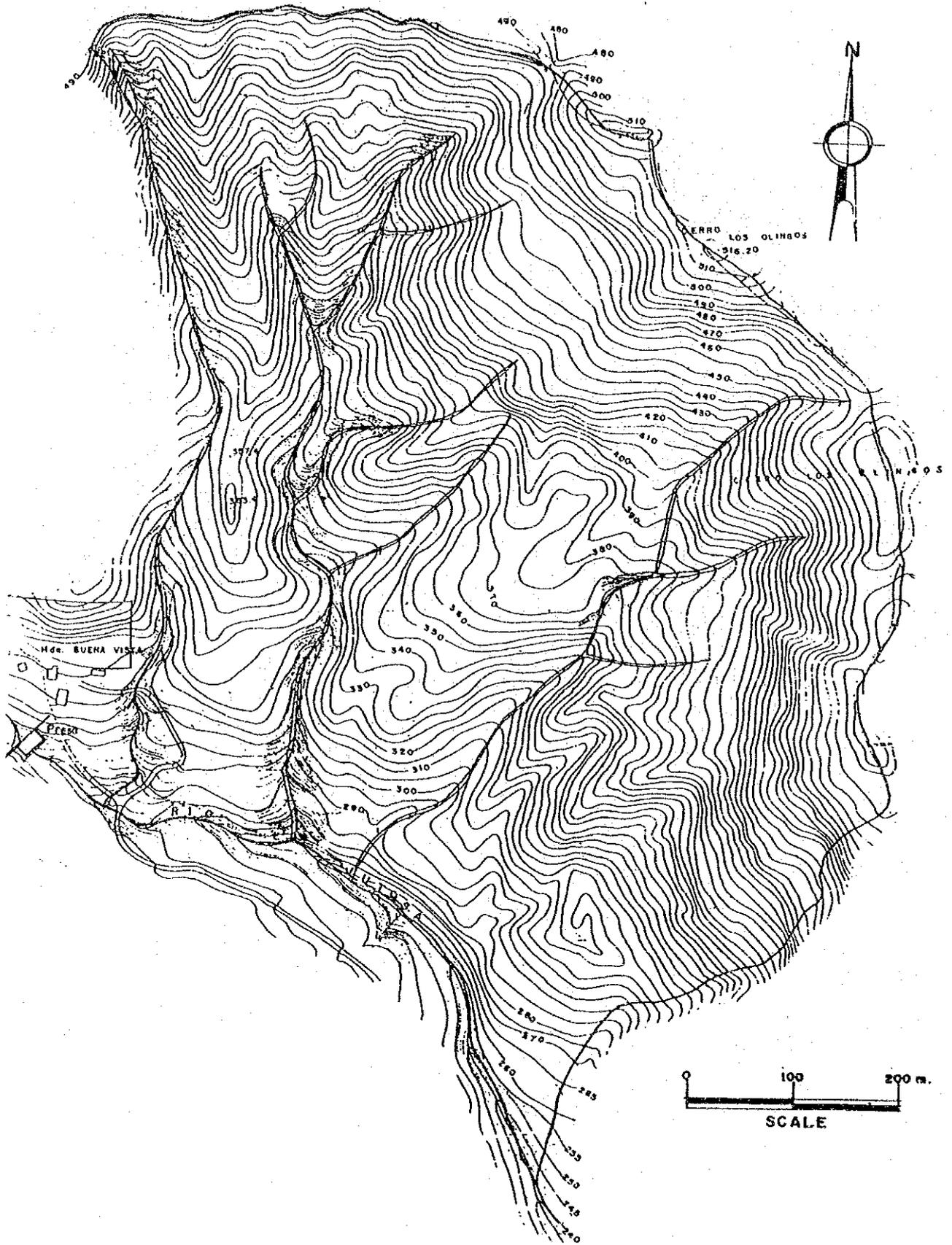


FIG. H.5.2 CONDICIONES TOPOGRAFICAS DEL AREA PILOTO DE TRABAJO

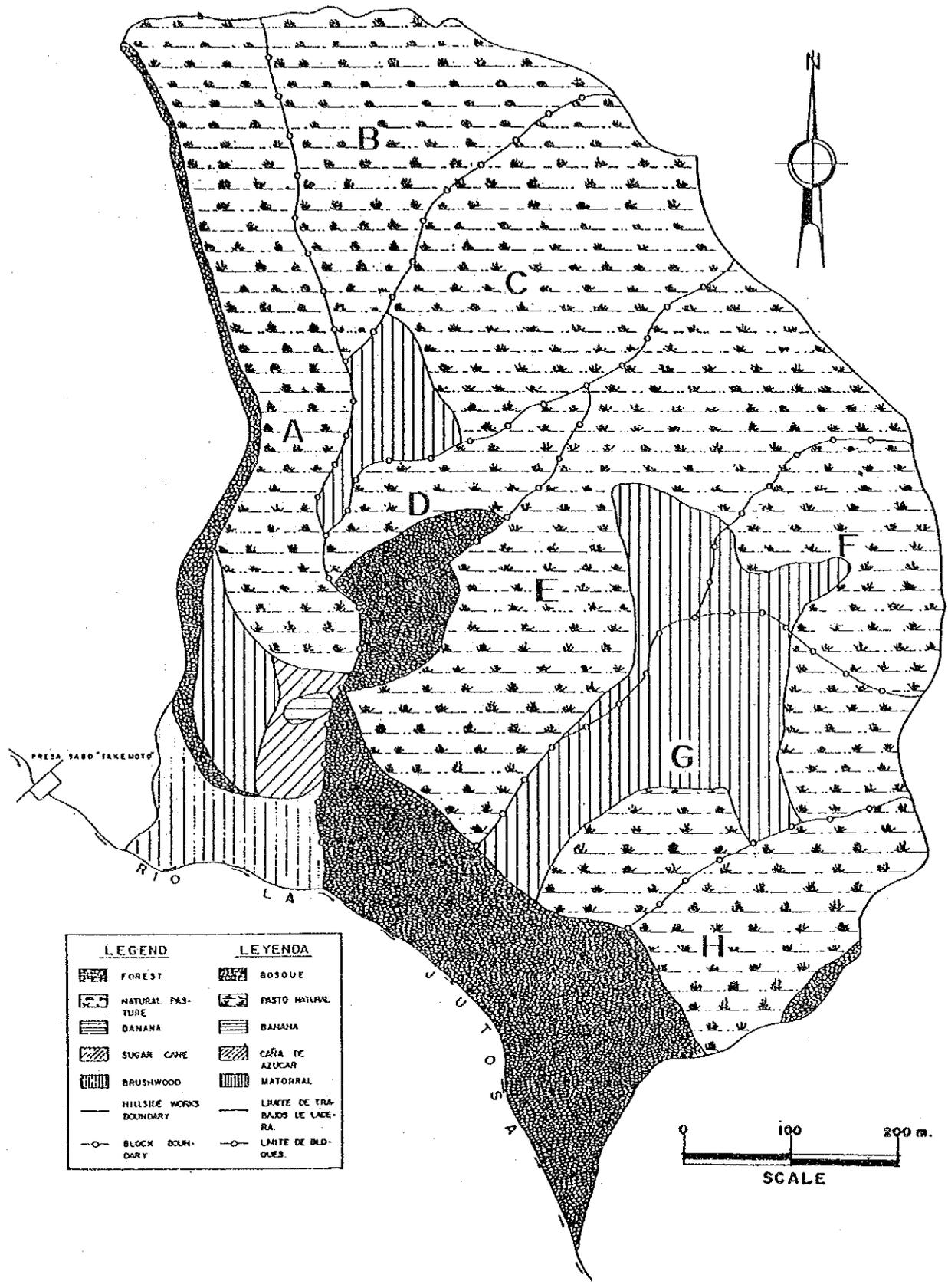


FIG. H.5.3 CONDICIONES DEL USO DE LA TIERRA EN EL AREA DE TRABAJOS DE LADERAS PILOTO