## 8.3. Operation, Maintenance and Replacement Cost.

The maintenance cost for the flood control facilities after the completion of the project, including clearing works on the major beds, maintenance of low water channel by dredging and operation and maintenance of sluice, was assumed at Rp 25,000,000 per year at the 1977-price.

The operation and maintenance cost for the irrigation and drainage facilities after the completion of construction was assumed at Rp 88,000,000 at the 1977-price including those for operation and maintenance of the intakes, maintenance of the approach canals and settling basins by dredging, maintenance of the irrigation canals, operation and maintenance of the related irrigation structures, maintenance of the drainage canals, operation and maintenance of related drainage structures, and maintenance of the farm ditches, the farm drains and the farm roads.

The amount of operation and maintenance cost in the irrigation and drainage sector during the construction period was assumed to be proportional to the area developed. The annual disbursement schedule of the operation and maintenance cost for the irrigation and drainage facilities is shown below.

Annual Disbursement Schedule of Operation and Maintenance Cost for Irrigation and Drainage Facilities

Unit: Million Rp

| | 1980/81 | 1981/82 | 1982/83 | after 1983/84 |
|---|---|---|---|---|
| O.M. cost | 35 | 68 | 88 | 88 |

The cost required for replacing the facilities for irrigation and drainage within the period of project life was assumed mainly for gates. Their life year was assumed at 30 years. Since the civil works for the irrigation/drainage improvement are planned to be carried out for the period of 1980/81 through 1982/83 as shown in Fig.8-2-10, replacement will be carried out over the five years extending from 2010/11 to 2012/13. The total amount of the cost required for replacement was estimated at Rp 90,000,000. As there is no necessity for counting the second replacement by reason that it is beyond the period of project life, the annual disbursement schedule of the replacement cost during the said five years will be as follows.

Annual Disbursement Schedule of Replacement Cost

Unit: Million Rp

| | 2010/11 | 2011/12 | 2012/13 |
|---|---|---|---|
| Replacement cost | 33 | 28 | 29 |

Table 8-2-1 Construction Cost for Flood Control Component (1)
(Full-contracting System; 5-year Plan)

1977-price

| Work item | Q'ty of work | | Unit price | | Amount | | |
|---|---|---|---|---|---|---|---|
| | Unit | Q'ty | L.C. (Rp.) | F.C. ($) | L.C. ($10^3$Rp.) | F.C. ($) | Total ($10^3$Rp.) |
| 1. Land acquisition | $m^2$ | | | | 193,000 | - | 193,000 |
| 2. Civil works | - | - | - | - | 1,052,802 | 4,515,057 | 2,926,551 |
| a. Preparation | l.s. | - | - | - | 237,565 | 496,033 | 443,418 |
| b. Dredging | $m^3$ | 73,300 | (1,658 | 21.38) | 121,551 | 1,567,231 | 771,952 |
| c. Excavation | $m^3$ | 934,700 | ( 134 | 1.15) | 124,901 | 1,077,619 | 572,114 |
| d. Embankment | $m^3$ | 1,338,600 | ( 254 | 0.64) | 339,500 | 863,312 | 697,774 |
| e. Revetment | m | 1,800 | (26,600 | 6.77) | 47,880 | 12,193 | 52,940 |
| f. Drains | $m^3$ | 135,000 | ( 490 | 0.27) | 66,147 | 35,781 | 80,996 |
| g. Sluice | l.s. | - | - | - | 22,800 | 53,354 | 44,942 |
| h. Miscellaneous | l.s. | - | - | - | 92,458 | 409,534 | 262,415 |
| 3. Engineering and administration | l.s. | - | - | - | 193,348 | 1,114,383 | 655,817 |
| 4. Contingency (15%) | l.S. | - | - | - | 215,873 | 844,416 | 566,305 |
| 5. Total | - | - | - | - | 1,655,023 | 6,473,856 | 4,341,673 |

Note: The cost does not include price escalation during the construction period.

Table 8-2-2 Construction Cost for Flood Control Component (2)
(Full-contracting System; 5-year Plan)

1977-price

| Description | Local currency ($10^3$Rp) | Foreign currency (US$) | Total ($10^3$Rp) |
|---|---|---|---|
| 1. Land | 193,000 | - | 193,000 |
| 2. Civil work | 1,052,802 | 4,515,057 | 2,926,551 |
| a. Equipment (in depreciation) | - | 2,847,542 | 1,181,730 |
| b. Spareparts | | 1,306,373 | 542,145 |
| c. Materials | 655,497 | 128,631 | 708,879 |
| d. Labor etc. & technicians | 397,305 | 232,511 | 493,797 |
| 3. Engineering & administration | 193,348 | 1,114,383 | 655,817 |
| 4. Contingency | 215,873 | 844,416 | 566,305 |
| 5. Total | 1,655,203 | 6,473,856 | 4,341,673 |

Note: The cost does not include price escalation during the construction period.

Table 8-2-3 Construction Cost for Irrigation/Drainage Component (1)
(Full-contracting System; 5-year Plan)

1977-price

| Description | Local currency ($10^3$Rp) | Foreign currency (US$) | Total ($10^3$Rp) |
|---|---|---|---|
| 1. Land acquisition & compensation | 417,000 | - | 417,000 |
| 2. Civil Work | 4,551,030 | 2,947,350 | 5,774,180 |
| a, Preparatory work | 195,000 | 180,000 | 269,700 |
| b. Irrigation work | 1,480,060 | 356,320 | 1,627,933 |
| c. Drainage work | 1,103,340 | 2,069,590 | 1,962,220 |
| d. On-farm work | 1,387,500 | - | 1,387,500 |
| 4. Miscellaneous work | 385,130 | 341,440 | 526,827 |
| 3. Engineering and administration | 629,470 | 1,372,510 | 1,199,062 |
| 4. Contingency | 839,630 | 647,980 | 1,108,542 |
| 5. Total | 6,847,130 | 4,967,840 | 8,498,784 |

Note: The cost does not include price escalation during the construction period.

Table 8-2-4 Construction Cost for Irrigation/Drainage Component (2)
(Full-contracting System; 5-year Plan)

1977-price

| Description | Local currency ($10^3$Rp) | Foreign currency (US$) | Total ($10^3$Rp) |
|---|---|---|---|
| 1. Land acquisition & compensation | 417,000 | - | 417,000 |
| 2. Civil work | 4,551,030 | 2,947,350 | 5,774,180 |
| a. Equipment | - | 1,554,447 | 645,095 |
| b. Spareparts | - | 914,783 | 379,635 |
| c. Material | 2,153,180 | - | 2,153,180 |
| d. Labor etc. & technicians | 2,397,850 | 478,120 | 2,596,270 |
| 3. Engineering & administration | 629,470 | 1,372,510 | 1,199,062 |
| 4. Contingency | 839,630 | 647,980 | 1,108,542 |
| 5. Total | 6,437,130 | 4,967,840 | 8,498,784 |

Note: The cost does not include price escalation during the construction period.

Table 8-2-5 Breakdown of Construction Cost for Flood Control (Full-contracting System; 5-year Plan)

1977-price

| Section and type of work | Quantity Unit | Quantity Q'ty | L.C. Unit cost (Rp.) | L.C. Cost (100Rp.) | F.C. Unit cost ($) | F.C. Cost ($) | Remarks |
|---|---|---|---|---|---|---|---|
| 1. Dredging works | | | | | | | |
| -12.25K∿-11.25K | $m^3$ | 46,400 | | 5,058 | | 81,244 | |
| 1-a | " | 46,400 | 109 | 5,058 | 1.751 | 81,244 | |
| -11.25K∿-7.5K | $m^3$ | 146,100 | | 16,258 | | 253,211 | |
| 1-a | " | 96,100 | 109 | 10,458 | 1.751 | 168,311 | |
| 1-f | " | 50,000 | 116 | 5,800 | 1.698 | 84,900 | |
| -7.5K ∿-2.5K | $m^3$ | 309,800 | | 65,908 | | 778,767 | |
| 1-a | " | 96,200 | 109 | 10,486 | 1.751 | 168,446 | |
| 1-b | " | 102,200 | 399 | 40,829 | 3.721 | 380,169 | |
| 1-e | " | 111,400 | 131 | 14,593 | 2.066 | 230,152 | |
| -2.5K ∿ 0.0K | $m^3$ | 76,100 | | 11,556 | | 152,706 | |
| 1-a | " | 58,000 | 109 | 6,326 | 1.751 | 101,548 | |
| 1-d | " | 3,100 | 337 | 1,045 | 3,651 | 11,318 | |
| 1-g | " | 15,000 | 279 | 4,185 | 2.656 | 39,840 | |
| 0.0K ∿ 10.0K | $m^3$ | 0 | | 0 | | 0 | |
| 10.0K ∼ 15.0K | $m^3$ | 104,400 | | 17,231 | | 213,927 | |
| 1-a | " | 70,000 | 109 | 7,630 | 1.751 | 122,561 | |
| 1-g | " | 34,400 | 279 | 9,601 | 2.656 | 91,366 | |
| 15.0K ∿ 19.0K | $m^3$ | 44,600 | | 4,929 | | 77,572 | |
| 1-a | " | 34,600 | 109 | 3,771 | 1.751 | 60,592 | |
| 1-f | " | 10,000 | 116 | 1,160 | 1.698 | 16,980 | |
| 19.0K ∿ 22.65K | $m^3$ | 0 | | 0 | | 0 | |
| Pulau Gamber | $m^3$ | 5,600 | | 611 | | 9,804 | |
| 1-a | " | 5,600 | 109 | 610 | 1.751 | 9,804 | |
| Total | $m^3$ | 733,000 | - | 121,551 | - | 1,567,231 | |
| 2. Excavation | | | | | | | |
| -12.25K∿-11.25K | $m^3$ | 0 | | 0 | | 0 | |
| -11.25K∿-7.5K | $m^3$ | 99,700 | | 4,279 | | 62,532 | |
| 2-a | " | 99,700 | 43 | 4,279 | 0.627 | 62,532 | |
| -7.5K ∿-2.5K | $m^3$ | 180,000 | | 17,241 | | 162,276 | |
| 2-a | " | 152,300 | 43 | 6,549 | 0.627 | 95,491 | |
| 2-d | " | 27,700 | 386 | 10,692 | 2.411 | 66,785 | |
| -2.5K ∿ 0.0K | $m^3$ | 68,700 | | 4,080 | | 50,845 | |
| 2-a | " | 62,600 | 43 | 2,689 | 0.627 | 39,255 | |
| 2-f | " | 6,100 | 228 | 1,391 | 1.900 | 11,590 | |
| 0.0K ∿ 10.0K | $m^3$ | 202,400 | | 29,778 | | 258,435 | |
| 2-a | " | 79,200 | 43 | 3,406 | 0.627 | 49,658 | |
| 2-b | " | 80,000 | 206 | 16,522 | 1.585 | 126,697 | |
| 2-f | " | 43,200 | 228 | 9,850 | 1.900 | 82,080 | |
| 10.0K ∿ 15.0K | $m^3$ | 320,800 | | 53,387 | | 429,282 | |
| 2-a | " | 155,400 | 43 | 6,682 | 0.627 | 97,436 | |
| 2-c | " | 99,100 | 290 | 28,786 | 1.970 | 195,116 | |
| 2-e | " | 9,800 | 514 | 5,037 | 2.998 | 29,380 | |
| 2-f | " | 56,500 | 228 | 12,882 | 1.900 | 107,350 | |

| Section and type work | Quantity Unit | Quantity Q'ty | L.C. Unit cost (Rp.) | L.C. Cost (1000Rp.) | F.C. Unit cost ($) | F.C. Cost ($) | Remarks |
|---|---|---|---|---|---|---|---|
| 15.0K ∿ 19.0K | $m^3$ | 63,100 | | 16,136 | | 114,249 | |
| 2-b | " | 26,000 | 206 | 5,356 | 1.585 | 41,210 | |
| 2-c | " | 37,100 | 290 | 10,780 | 1.970 | 73,039 | |
| 19.0K ∿ 22.65K | $m^3$ | 0 | | 0 | | 0 | |
| Pualu Gambar | $m^3$ | 0 | | 0 | | 0 | |
| Total | $m^3$ | 934,700 | - | 124,901 | - | 1,077,619 | |
| 3. Embankment | | | | | | | |
| -12.25K∿-11.25K | $m^3$ | 203,800 | | 63,462 | | 319,264 | |
| 3-a | " | 6,900 | 228 | 1,573 | 0.285 | 1,967 | |
| 3-b | " | 42,200 | 240 | 10,128 | 0.443 | 18,695 | |
| 3-c | " | 25,200 | 250 | 6,300 | 0.600 | 15,120 | |
| 3-d | " | 129,500 | 349 | 45,461 | 2.194 | 283,482 | |
| -11.25K∿-7.5K | $m^3$ | 316,400 | | 75,623 | | 132,302 | |
| 3-a | " | 136,100 | 228 | 31,031 | 0.285 | 38,789 | |
| 3-b | " | 87,400 | 240 | 20,976 | 0.443 | 38,718 | |
| 3-c | " | 92,900 | 250 | 23,616 | 0.600 | 54,795 | |
| -7.5K ∿-2.5K | $m^3$ | 195,900 | | 45,591 | | 64,349 | |
| 3-a | " | 138,400 | 228 | 31,791 | 0.285 | 38,876 | |
| 3-b | " | 57,500 | 240 | 13,800 | 0.443 | 25,473 | |
| -2.5K ∿ 0.0K | $m^3$ | 70,500 | | 17,717 | | 42,082 | |
| 3-c | " | 70,500 | 250 | 17,717 | 0.600 | 42,082 | |
| 0.0K ∿ 10.0K | $m^3$ | 144,700 | | 36,361 | | 86,371 | |
| 3-c | " | 144,700 | 250 | 36,361 | 0.600 | 86,371 | |
| 10.0K ∿ 15.0K | $m^3$ | 205,300 | | 50,553 | | 107,338 | |
| 3-a | " | 32,700 | 228 | 7,456 | 0.285 | 9,320 | |
| 3-b | " | 31,300 | 240 | 7,512 | 0.443 | 13,866 | |
| 3-c | " | 141,300 | 250 | 35,585 | 0.600 | 84,152 | |
| 15.0K ∿ 19.0K | $m^3$ | 64,200 | | 15,617 | | 30,513 | |
| 3-a | " | 9,100 | 228 | 2,075 | 0.285 | 2,594 | |
| 3-b | " | 31,500 | 240 | 7,560 | 0.443 | 13,955 | |
| 3-c | " | 23,600 | 250 | 5,982 | 0.600 | 13,964 | |
| 19.0K ∿ 22.65K | $m^3$ | 42,600 | | 10,705 | | 25,428 | |
| 3-c | " | 42,600 | 250 | 10,705 | 0.600 | 25,428 | |
| Pulau Gambar | $m^3$ | 95,200 | | 23,871 | | 55,665 | |
| 3-b | " | 5,100 | 240 | 1,224 | 0.443 | 2,259 | |
| 3-c | " | 90,100 | 250 | 22,647 | 0.600 | 53,406 | |
| Total | $m^3$ | 1,338,600 | - | 339,500 | - | 863,312 | |
| 4. Revetment | | | | | | | |
| -12.25K∿-11.25K | m | 0 | 26,600 | 0 | 6.774 | 0 | |
| -11.25K∿-7.5K | m | 0 | 26,600 | 0 | 6.774 | 0 | |
| -7.5K ∿-2.5K | m | 600 | 26,600 | 15,960 | 6.774 | 4,065 | |
| -2.5K ∿ 0.0K | m | 600 | 26,600 | 15,960 | 6.774 | 4,064 | |
| 0.0K ∿ 10.0K | m | 0 | 26,600 | 0 | 6.774 | 0 | |
| 10.0K ∿ 15.0K | m | 300 | 26,600 | 7,980 | 6.774 | 2,032 | |
| 15.0K ∿ 19.0K | m | 0 | 26,600 | 0 | 6.774 | 0 | |
| 19.0K ∿ 22.65K | m | 300 | 26,600 | 7,980 | 6.774 | 2,032 | |
| Pulau Gambar | m | 0 | 26,600 | 0 | 6.774 | 0 | |
| Total | m | 1,800 | - | 47,880 | | 12,193 | |

| Section and type of work | Quantity Unit | Quantity Q'ty | L.C. Unit cost (Rp.) | L.C. Cost (1000Rp.) | F.C. Unit cost ($) | F.C. Cost ($) | Remarks |
|---|---|---|---|---|---|---|---|
| 5. Drainage channel | | | | | | | |
| -12.25K∿-11.25K | $m^3$ | 7,600 | 490 | 3,724 | 0.265 | 2,014 | |
| -11.25K∿-7.5K | $m^3$ | 22,800 | 490 | 11,171 | 0.265 | 6,043 | |
| -7.5K ∿-2.5K | $m^3$ | 29,200 | 490 | 14,307 | 0.265 | 7,739 | |
| -2.5K ∿ 0.0K | $m^3$ | 16,400 | 490 | 8,036 | 0.265 | 4,347 | |
| 0.0K ∿ 10.0K | $m^3$ | 59,000 | 490 | 28,909 | 0.265 | 15,638 | |
| 10.0K ∿ 15.0K | $m^3$ | 0 | 490 | 0 | 0.265 | 0 | |
| 15.0K ∿ 19.0K | $m^3$ | 0 | 490 | 0 | 0.265 | 0 | |
| 19.0K ∿ 22.65K | $m^3$ | 0 | 490 | 0 | 0.265 | 0 | |
| Pulau Gambar | $m^3$ | 0 | 490 | 0 | 0.265 | 0 | |
| Total | $m^3$ | 135,000 | - | 66,147 | - | 35,781 | |
| 6. Sluice | | | | | | | |
| -12.25K∿-11.25K | | | | 0 | | 0 | |
| -11.25K∿-7.5K | | | | 0 | | 0 | |
| -7.5K ∿-2.5K | | | | 0 | | 0 | |
| -2.5K ∿ 0.0K | | | | 0 | | 0 | |
| 0.0K ∿ 10.0K | | | | 0 | | 0 | |
| 10.0K ∿ 15.0K | | | | 0 | | 0 | |
| 15.0K ∿ 19.0K | | | | 0 | | 0 | |
| 19.0K ∿ 22.65 | | | | 0 | | 0 | |
| Pulau Gambar | ℓ.s. | | | 22,800 | | 53,354 | |
| Total | | | - | 22,800 | - | 53,354 | |

Table 8-2-6 Construction Cost for Flood Control for Divided Sections
(Full-contracting System; 5-year Plan)

1977-price

| Work item | Q'ty of work Unit | Q'ty | Unit price L.C. (Rp.) | F.C. ($) | Amount L.C. ($10^3$Rp.) | F.C. ($) | Total ($10^3$Rp.) |
|---|---|---|---|---|---|---|---|
| Section: -12.25K to -11.25K | | | | | | | |
| 1. Land acquisition & compen. | - | - | - | - | 13,275 | 0 | |
| 2. Civil works | - | - | - | - | 105,859 | 507,143 | |
| a. Preparation | l.s. | - | - | - | 24,318 | 58,622 | |
| b. Dredging | $m^3$ | 46,400 | 109 | 1.75 | 5,058 | 81,244 | |
| c. Excavation | $m^3$ | 0 | 0 | 0 | 0 | 0 | |
| d. Embankment | $m^3$ | 203,800 | 311 | 1.57 | 63,462 | 319,263 | |
| e. Revetment | m | 0 | 0 | 0 | 0 | 0 | |
| f. Drains | $m^3$ | 7,600 | 490 | 0.27 | 3,724 | 2,014 | |
| g. Sluice | l.s. | - | - | - | 0 | 0 | |
| h. Miscellaneous | l.s. | - | - | - | 9,297 | 46,000 | |
| 3. Engineering and administration | l.s. | - | - | - | 18,490 | 125,170 | |
| 4. Contingency (15%) | l.s. | - | - | - | 20,644 | 94,847 | |
| 5. Total | - | - | - | - | 158,268 | 727,160 | |
| Section: -11.25K to -7.5K | | | | | | | |
| 1. Land acquisition & compen. | - | - | - | - | 42,889 | 0 | |
| 2. Civil works | - | - | - | - | 156,627 | 588,652 | |
| a. Preparation | l.s. | - | - | - | 35,541 | 81,170 | |
| b. Dredging | $m^3$ | 146,100 | 111 | 1.73 | 16,258 | 253,211 | |
| c. Excavation | $m^3$ | 99,700 | 43 | 0.63 | 4,279 | 62,532 | |
| d. Embankment | $m^3$ | 316,400 | 239 | 0.42 | 75,623 | 132,303 | |
| e. Revetment | m | 0 | 0 | 0 | 0 | 0 | |
| f. Drains | $m^3$ | 22,800 | 490 | 0.27 | 11,171 | 6,043 | |
| g. Sluice | l.s. | - | - | - | 0 | 0 | |
| h. Miscellaneous | l.s. | - | - | - | 13,755 | 53,393 | |
| 3. Engineering and administration | l.s. | - | - | - | 30,965 | 145,288 | |
| 4. Contingency (15%) | l.s. | - | - | - | 34,572 | 110,091 | |
| 5. Total | - | - | - | - | 265,053 | 844,031 | |
| Section: -7.5K to -2.5K | | | | | | | |
| 1. Land acquisition & compen. | - | - | - | - | 47,995 | 0 | |
| 2. Civil works | - | - | - | - | 236,862 | 1,272,400 | |
| a. Preparation | l.s. | - | - | - | 57,053 | 139,792 | |
| b. Dredging | $m^3$ | 309,800 | 213 | 2.51 | 65,908 | 778,767 | |
| c. Excavation | $m^3$ | 180,000 | 96 | 0.90 | 17,241 | 162,276 | |
| d. Embankment | $m^3$ | 195,900 | 232 | 0.33 | 45,591 | 64,349 | |
| e. Revetment | m | 600 | 26,600 | 6.78 | 15,960 | 4,065 | |
| f. Drains | $m^3$ | 29,200 | 490 | 0.27 | 14,307 | 7,739 | |
| g. Sluice | l.s. | - | - | - | 0 | 0 | |
| h. Miscellaneous | l.s. | - | - | - | 20,802 | 115,412 | |
| 3. Engineering and administration | l.s. | - | - | - | 44,209 | 314,048 | |
| 4. Contingency (15%) | l.s. | - | - | - | 49,361 | 237,966 | |
| 5. Total | - | - | - | - | 378,427 | 1,824,414 | |
| Section: -2.5K to 0.0K | | | | | | | |
| 1. Land acquisition & compen. | - | - | - | - | 0 | 0 | |
| 2. Civil works | - | - | - | - | 87,478 | 328,978 | |
| a. Preparation | l.s. | - | - | - | 22,447 | 45,094 | |
| b. Dredging | $m^3$ | 76,100 | 152 | 2.01 | 11,556 | 152,706 | |
| c. Excavation | $m^3$ | 68,700 | 59 | 0.74 | 4,080 | 50,845 | |
| d. Embankment | $m^3$ | 70,500 | 251 | 0.60 | 17,717 | 42,082 | |
| e. Revetment | m | 600 | 26,600 | 6.77 | 15,960 | 4,064 | |
| f. Drains | $m^3$ | 16,400 | 490 | 0.27 | 8,036 | 4,347 | |
| g. Sluice | l.s. | - | - | - | 0 | 0 | |
| h. Miscellaneous | l.s. | - | - | - | 7,682 | 29,840 | |
| 3. Engineering and administration | l.s. | - | - | - | 13,577 | 81,197 | |
| 4. Contingency (15%) | l.s. | - | - | - | 15,158 | 61,526 | |
| 5. Total | - | - | - | - | 116,213 | 471,701 | |
| Section: 0.0K to 10.0K | | | | | | | |
| 1. Land acquisition & compen. | - | - | - | - | 0 | 0 | |
| 2. Civil works | - | - | - | - | 134,959 | 441,032 | |
| a. Preparation | l.s. | - | - | - | 28,059 | 40,585 | |
| b. Dredging | $m^3$ | 0 | 0 | 0 | 0 | 0 | |
| c. Excavation | $m^3$ | 202,400 | 147 | 1.28 | 29,778 | 258,435 | |
| d. Embankment | $m^3$ | 144,700 | 251 | 0.60 | 36,361 | 86,371 | |
| e. Revetment | m | 0 | 0 | 0 | 0 | 0 | |
| f. Drains | $m^3$ | 59,000 | 490 | 0.27 | 28,909 | 15,638 | |
| g. Sluice | l.s. | - | - | - | 0 | 0 | |
| h. Miscellaneous | l.s. | - | - | - | 11,852 | 40,003 | |

(to be continued)

| Work item | Q'ty of work | | Unit price | | Amount | | |
|---|---|---|---|---|---|---|---|
| | Unit | Q'ty | L.C. (Rp.) | F.C. ($) | L.C. ($10^3$Rp.) | F.C. ($) | Total ($10^3$Rp.) |
| 3. Engineering and administration | l.s. | - | - | - | 20,946 | 108,853 | |
| 4. Contingency (15%) | l.s. | - | - | - | 23,386 | 82,483 | |
| 5. Total | - | - | - | - | 179,291 | 632,368 | |
| Section: 10.0K to 15.0K | | | | | | | |
| 1. Land acquisition & compen. | - | - | - | - | 49,016 | 0 | |
| 2. Civil works | - | - | - | - | 170,295 | 897,080 | |
| a. Preparation | l.s. | - | - | - | 26,188 | 63,132 | |
| b. Dredging | $m^3$ | 104,400 | 165 | 2.05 | 17,231 | 213,927 | |
| c. Excavation | $m^3$ | 320,800 | 166 | 1.34 | 53,387 | 429,282 | |
| d. Embankment | $m^3$ | 205,300 | 246 | 0.52 | 50,553 | 107,338 | |
| e. Revetment | m | 300 | 26,600 | 6.77 | 7,980 | 2,032 | |
| f. Drains | $m^3$ | 0 | 0 | 0 | 0 | 0 | |
| g. Sluice | l.s. | - | - | - | 0 | 0 | |
| h. Miscellaneous | l.s. | - | - | - | 14,956 | 81,369 | |
| 3. Engineering and administration | l.s. | - | - | - | 34,036 | 221,413 | |
| 4. Contingency (15%) | l.s. | - | - | - | 38,002 | 167,774 | |
| 5. Total | - | - | - | - | 291,349 | 1,286,267 | |
| Section: 15.0K to 19.0K | | | | | | | |
| 1. Land acquisition & compen. | - | - | - | - | 27,571 | 0 | |
| 2. Civil works | - | - | - | - | 50,467 | 269,308 | |
| a. Preparation | l.s. | - | - | - | 9,353 | 22,547 | |
| b. Dredging | $m^3$ | 44,600 | 111 | 1.74 | 4,929 | 77,572 | |
| c. Excavation | $m^3$ | 63,100 | 256 | 1.81 | 16,136 | 114,249 | |
| d. Embankment | $m^3$ | 64,200 | 243 | 0.48 | 15,617 | 30,513 | |
| e. Revetment | m | 0 | 0 | 0 | 0 | 0 | |
| f. Drains | $m^3$ | 0 | 0 | 0 | 0 | 0 | |
| g. Sluice | l.s. | - | - | - | 0 | 0 | |
| h. Miscellaneous | l.s. | - | - | - | 4,432 | 24,427 | |
| 3. Engineering and administration | l.s. | - | - | - | 12,111 | 66,469 | |
| 4. Contingency (15%) | l.s. | - | - | - | 13,522 | 50,367 | |
| 5. Total | - | - | - | - | 103,671 | 386,144 | |
| Section: 19.0K to 22.65K | | | | | | | |
| 1. Land acquisition & compen. | - | - | - | - | 7,148 | 0 | |
| 2. Civil works | - | - | - | - | 31,762 | 50,035 | |
| a. Preparation | l.s. | - | - | - | 10,288 | 18,037 | |
| b. Dredging | $m^3$ | 0 | 0 | 0 | 0 | 0 | |
| c. Excavation | $m^3$ | 0 | 0 | 0 | 0 | 0 | |
| d. Embankment | $m^3$ | 42,600 | 252 | 0.60 | 10,705 | 25,428 | |
| e. Revetment | m | 300 | 27 | 6.77 | 7,980 | 2,032 | |
| f. Drains | $m^3$ | 0 | 0 | 0 | 0 | 0 | |
| g. Sluice | l.s. | - | - | - | 0 | 0 | |
| h. Miscellaneous | l.s. | - | - | - | 2,789 | 4,538 | |
| 3. Engineering and administration | l.s. | - | - | - | 6,039 | 12,349 | |
| 4. Contingency (15%) | l.s. | - | - | - | 6,742 | 9,358 | |
| 5. Total | - | - | - | - | 51,691 | 71,742 | |
| Section: Pualu Gambar | | | | | | | |
| 1. Land acquisition & compen. | - | - | - | - | 5,106 | 0 | |
| 2. Civil works | - | - | - | - | 78,493 | 160,429 | |
| a. Preparation | l.s. | - | - | - | 24,318 | 27,054 | |
| b. Dredging | $m^3$ | 5,600 | 109 | 1.75 | 611 | 9,804 | |
| c. Excavation | $m^3$ | 0 | 0 | 0 | 0 | 0 | |
| d. Embankment | $m^3$ | 95,200 | 251 | 0.58 | 23,871 | 55,665 | |
| e. Revetment | m | 0 | 0 | 0 | 0 | 0 | |
| f. Drains | $m^3$ | 0 | 0 | 0 | 0 | 0 | |
| g. Sluice | l.s. | - | - | - | 22,800 | 53,354 | |
| h. Miscellaneous | l.s. | - | - | - | 6,893 | 14,552 | |
| 3. Engineering and administration | l.s. | - | - | - | 12,975 | 39,596 | |
| 4. Contingency (15%) | l.s. | - | - | - | 14,486 | 30,004 | |
| 5. Total | - | - | - | - | 111,060 | 230,029 | |

Table 8-2-7 Annual Construction Cost for Flood Control Component (1)
(Full-contracting System; 5-year Plan)

1977-price

| Work item | 1st (1978/79) | | 2nd (1979/80) | | 3rd (1980/81) | | 4th (1981/82) | | 5th (1982/83) | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C. ($10^3$Rp) | F.C. ($) | L.C. ($10^3$Rp) | F.C. ($) | L.C. ($10^3$Rp) | F.C. ($) | L.C. ($10^3$Rp) | F.C. ($) | L.C. ($10^3$Rp) | F.C. ($) | L.C. ($10^3$Rp) | F.C. ($) |
| 1. Land acquisition | 0 | 0 | 47,995 | 0 | 42,889 | 0 | 102,116 | 0 | 0 | 0 | 193,000 | 0 |
| 2. Civil work | 0 | 0 | 0 | 0 | 220,889 | 1,358,707 | 363,350 | 1,317,541 | 468,563 | 1,838,809 | 1,052,802 | 4,515,057 |
| a. Preparatory | 0 | 0 | 0 | 0 | 57,249 | 137,670 | 85,926 | 168,165 | 94,390 | 190,198 | 237,565 | 496,033 |
| b. Dredging | 0 | 0 | 0 | 0 | 65,908 | 778,766 | 27,814 | 405,918 | 27,829 | 382,547 | 121,551 | 1,567,231 |
| c. Excavation | 0 | 0 | 0 | 0 | 17,241 | 162,276 | 38,136 | 371,813 | 69,524 | 543,530 | 124,901 | 1,077,619 |
| d. Embankment | 0 | 0 | 0 | 0 | 45,591 | 64,349 | 129,701 | 260,756 | 164,208 | 538,207 | 339,500 | 863,312 |
| e. Revetment | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47,880 | 12,193 | 47,880 | 12,193 |
| f. Drains | 0 | 0 | 0 | 0 | 14,307 | 7,739 | 48,116 | 26,028 | 3,724 | 2,014 | 66,147 | 35,781 |
| g. Sluice | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22,800 | 53,354 | 22,800 | 53,354 |
| h. Miscellaneous | 0 | 0 | 0 | 0 | 20,593 | 207,907 | 33,657 | 84,861 | 38,208 | 116,766 | 93,458 | 409,534 |
| 3. Engineering and administration | 16,559 | 238,723 | 66,236 | 315,360 | 36,851 | 186,766 | 36,851 | 186,767 | 36,851 | 186,767 | 193,348 | 1,114,383 |
| 4. Contingency | 2,484 | 35,808 | 17,135 | 47,304 | 45,094 | 231,821 | 75,348 | 225,646 | 75,812 | 303,837 | 215,873 | 844,416 |
| 5. Total | 19,043 | 274,531 | 131,366 | 362,664 | 345,723 | 1,777,294 | 577,665 | 1,729,954 | 581,226 | 2,329,413 | 1,655,023 | 6,473,856 |

Note: The cost does not include price escalation during the construction period.

Table 8-2-8 Annual Construction Cost for Flood Control Component (2)
(Full-contracting System; 5-year Plan)

1977-price

| Work item | 1st 1978/79 | | 2nd 1979/80 | | 3rd 1980/81 | | 4th 1981/82 | | 5th 1982/83 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C. ($10^3$Rp) | F.C. ($) | L.C. ($10^3$Rp) | F.C. ($) | L.C. ($10^3$Rp) | F.C. ($) | L.C. ($10^3$Rp) | F.C. ($) | L.C. ($10^3$Rp) | F.C. ($) | L.C. ($10^3$Rp) | F.C. ($) |
| 1. Land acquisition | 0 | 0 | 47,995 | 0 | 42,889 | 0 | 102,116 | 0 | 0 | 0 | 193,000 | 0 |
| 2. Civil works | 0 | 0 | 0 | 0 | 220,889 | 1,358,707 | 363,350 | 1,317,541 | 468,563 | 1,838,809 | 1,052,802 | 4,515,057 |
| a. Equipment | 0 | 0 | 0 | 0 | 0 | 811,293 | 0 | 838,970 | 0 | 1,197,279 | 0 | 2,847,542 |
| b. Spare part | 0 | 0 | 0 | 0 | 0 | 372,198 | 0 | 384,897 | 0 | 549,278 | 0 | 1,306,373 |
| c. Material | 0 | 0 | 0 | 0 | 141,225 | 128,631 | 203,044 | 0 | 311,228 | 0 | 655,497 | 128,631 |
| d. Labor | 0 | 0 | 0 | 0 | 79,664 | 46,585 | 160,306 | 93,674 | 157,335 | 92,252 | 397,305 | 232,511 |
| 3. Engineering & administration | 16,559 | 238,723 | 66,236 | 315,360 | 36,851 | 186,766 | 36,851 | 186,767 | 36,851 | 186,767 | 193,348 | 1,114,383 |
| 4. Contingency | 2,484 | 35,808 | 17,135 | 47,304 | 45,094 | 231,821 | 75,348 | 225,646 | 75,814 | 303,837 | 215,873 | 844,416 |
| 5. Total | 19,043 | 274,531 | 131,366 | 362,664 | 345,723 | 1,777,294 | 577,665 | 1,729,954 | 581,226 | 2,329,413 | 1,655,023 | 6,473,856 |

Note: The cost does not include price escalation during the construction period.

Table 8-2-9 Annual Construction Cost for Irrigation/Drainage Component (1)
(Full-contracting System; 5-year Plan)

1977-price

| Description | 1 1978/79 | | 2 1979/80 | | 3 1980/81 | | 4 1981/82 | | 5 1982/83 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C. ($10^3$Rp) | F.C. (US$) | L.C. ($10^3$Rp) | F.C. (US$) | L.C. ($10^3$Rp) | F.C. (US$) | L.C. ($10^3$Rp) | F.C (US$) | L.C. ($10^3$Rp) | F.C. (US$) | L.C. ($10^3$Rp) | F.C. (US$) |
| 1. Land acquisition and compensation expenses | - | - | 156,520 | - | 176,570 | - | 83,910 | - | - | - | 417,000 | - |
| 2. Civil work | | | | | | | | | | | | |
| a. Preparatory work | - | - | 19,500 | 18,000 | 102,500 | 96,000 | 36,500 | 33,000 | 36,500 | 33,000 | 195,000 | 180,000 |
| b. Irrigation work | - | - | - | - | 420,550 | 75,770 | 593,780 | 150,980 | 465,730 | 129,570 | 1,480,060 | 356,320 |
| c. Drainage work | - | - | - | - | 302,529 | 715,814 | 307,848 | 725,639 | 492,963 | 628,137 | 1,103,340 | 2,069,590 |
| d. On-farm work | - | - | - | - | 486,000 | - | 554,330 | - | 347,170 | - | 1,387,500 | - |
| e. Miscellaneous work | - | - | 997 | 4,600 | 121,496 | 115,666 | 138,251 | 118,537 | 124,386 | 102,637 | 385,130 | 341,440 |
| Sub-total | - | - | 20,497 | 22,600 | 1,433,075 | 1,003,250 | 1,630,709 | 1,028,156 | 1,466,749 | 893,344 | 4,551,030 | 2,947,350 |
| 3. Engineering and administrative expenses | 39,220 | 211,591 | 91,500 | 467,199 | 166,250 | 231,240 | 166,250 | 231,240 | 166,250 | 231,240 | 629,470 | 1,372,510 |
| 4. Contingency | 5,883 | 31,739 | 40,280 | 73,470 | 266,385 | 185,174 | 282,131 | 188,909 | 244,951 | 168,688 | 839,630 | 647,980 |
| Total | 45,103 | 243,330 | 308,797 | 563,269 | 2,042,280 | 1,419,664 | 2,163,000 | 1,448,305 | 1,877,950 | 1,293,272 | 6,437,130 | 4,967,840 |

Note: The cost does not include price escalation during the construction period.

Table 8-2-10 Annual Construction Cost for Irrigation/Drainage Component (2)
(Full-contracting System; 5-year Plan)

1977-price

| Description | 1978/79 | | 1979/80 | | 1980/81 | | 1981/82 | | 1982/83 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C. ($10^3$Rp) | F.C. (US$) | L.C. ($10^3$Rp) | F.C. (US$) | L.C. ($10^3$Rp) | F.C. (US$) | L.C. ($10^3$Rp) | F.C. (US$) | L.C. ($10^3$Rp) | F.C. (US$) | L.C. ($10^3$Rp) | F.C. (US$) |
| 1. Land acquisition & compensation | - | - | 156,520 | - | 176,570 | - | 83,910 | - | - | - | 417,000 | - |
| 2. Civil work | | - | 20,497 | 22,600 | 1,433,075 | 1,003,250 | 1,630,709 | 1,028,156 | 1,466,749 | 893,344 | 4,551,030 | 2,947,350 |
| a. Equipment & spare part | | | - | 22,600 | - | 863,748 | - | 893,352 | - | 689,530 | - | 2,469,230 |
| b. Material | | - | 7,691 | - | 623,727 | - | 795,157 | - | 726,605 | - | 2,153,180 | - |
| c. Labor etc & technician | | - | 12,806 | - | 809,348 | 139,502 | 835,552 | 134,804 | 740,144 | 203,814 | 2,397,850 | 478,120 |
| 3. Engineering & administration | 39,220 | 211,591 | 91,500 | 467,199 | 166,250 | 231,240 | 166,250 | 231,240 | 166,250 | 231,240 | 629,470 | 1,372,510 |
| 4. Contingency | 5,883 | 31,739 | 40,280 | 73,470 | 266,385 | 185,174 | 282,131 | 188,909 | 244,951 | 168,688 | 839,630 | 647,980 |
| 5. Total | 45,103 | 243,330 | 308,797 | 563,269 | 2,042,280 | 1,419,664 | 2,163,000 | 1,448,305 | 1,877,950 | 1,293,272 | 6,437,130 | 4,967,840 |
| | 146,085 | | 542,554 | | 2,631,441 | | 2,764,047 | | 2,414,657 | | 8,498,784 | |

$10^3$Rp

Notes: The cost does not include price escalation during the construction period.

The cost for the engineering and administration includes an amount of US$ 94,791 as the cost for procuring instruments and cars.

# CHAPTER IX

# ECONOMIC EVALUATION

## 9.1. General.

The project is composed of the two components of flood control and irrigation/drainage improvement. The following four alternative plans were studied on the way of implementation of the project.

(1) Seven-year construction plan on full-contracting system.

(2) Seven-year construction plan on equipment-lending system.

(3) Five-year construction plan on full-contracting system.

(4) Five-year construction plan on equipment-lending system.

The economic evaluation was made on each alternative plan classifying it into three categories of flood control component, irrigation/drainage component and the entire project.

Benefit of the project consists of two kinds; one is benefit of the flood control and the other is benefit of the irrigation/drainage improvement.

Benefit that will arise from the flood control is represented as effect of decrease in damages to be caused by floods. In the present study, the flood damage was estimated based on historical four floods in 1954, Dec. 1973, 1969 and Jan. 1973. In estimating the flood damage, the economic data in the present were applied though data available for forecasting, should be used for the estimation. The economic data mean properties, agricultural crops and economic activities.

In the case of "with irrigation/drainage improvement", the increase in flood damage due to the improvement was estimated and the amount was added to the flood damage in case of "without irrigation/drainage improvement". This increase in flood damage was estimated in regard to three items; increase in flood damage to paddy due to alternation in the yield, damages to agricultural facilities and decrease in production of paddy due to damages to the agricultural facilities.

Further, for estimating the flood damages, it was assumed that the flood damages corresponding to a discharge of 600 $m^3/s$ and below were reduced to half, taking account of the effect of the Urgent Flood Control Project.

Benefit of the irrigation/drainage improvement is defined as a difference between both profits of agricultural crops produced with and without the project conditions.

The economic cost and benefit were given at the 1977-price level excluding such transfer costs as tax, duty, subsidy and interest. The rate of tax was assumed as shown below based on the Tax Ordinance of Indonesia.

i. Rate of income tax: 10% of income.
This rate was applied to wage and salary of local staff and employee.

ii. Rate of sales tax: 5% of market price.
This rate was applied to equipment, materials, spare parts and other goods to be procured in the country.

In the present study, it was planned that the project would be commenced at the beginning of the 1978/79 fiscal year as a base year and its construction work would be completed at the end of 1982/83 for the five-year plan and at the end of 1984/85 for the seven-year plan. Economic life of the project was assumed at 50 years after completing the construction work.

First of all, general economic outline of the project area will be described for clarifying the economic significance of the project.

## 9.2. Economic Outline of the Project Area and Its Neighborhood.

The project area stretches over 7 subdistricts (Kecamatan) of Galang, Lubuk Pakam, Perbaungan, Pantai Cermin, Sei Rampah, Teluk Mengkudu and Tanjung Beringin administratively included in Deli/Serdang District.

The total area of the seven districts is about 1,100 $km^2$ or 18 percent of the area of Deli/Serdan District. The population in 1976 was estimated at approximately 400,000 or 36 percent of that of Deli/Serdan District. The rate of population increase was about 0.6 percent per year on the average during the period of 1970 to 1976, which is equal to about 1/4 of the rate (2.4 percent) of the whole country for the same period (Table 9-2-1).

The seven subdistricts have a comparatively high density of population of 360 souls per $km^2$ in 1976. These figure exceeds those of North Sumatra Province and Deli/Serdan District (Table 9-2-2). Among the seven subdistricts, Lubuk Pakam has the highest population density of 669 per $km^2$ in 1976, which exceeds that of Java Island populated most densely among the islands in Indonesia.

In 1976, the seven subdistricts had about 70,000 houses or 63.5 houses per $km^2$. Average number of family in North Sumatra Province and in Deli/Serdan District was 4.8 and 2.9 persons per household respectively, whereas the number of family in the seven subdistricts was 5.7 persons per household exceeding any of the above (Table 9-2-2).

Table 9-2-3 shows number of houses in the seven subdistricts in each year from 1970 to 1976. Excepting Lubuk Pakam and Perbaungan, houses had almost no change in number during the said period. However, number of houses of Lubuk Pakam and Perbaungan had an increase at rates of 2.3% and 2.4% respectively. Those increases seem to be caused by the fact that both the subdistricts are located near Medan and hold an important position in regard to transportation on the national highway and the national railway.

Among the above-mentioned subdistricts, the four of Lubuk Pakam, Perbaungan, Pantai Cermin and Galang are the most important ones from the viewpoint of flood control of the Ular river. The statistics in 1976 show that farm houses, dwelling houses, and shop houses and others in these four subdistricts accounted for 65%, 32% and 3% respectively.

Agriculture in the subdistricts is roughly divided into two categories; estate plantation and farming by inhabitants.

Most of the plantations in the downstream area of the Ular, except a few owned by foreign capital and small-sized private enterprises, have been operated as national plantations called PNP's (Map of Project Area given at the beginning of the report). Recently, however, in order to expand their activities, they are going to be handed over gradually to private hands called PTP's. The major agricultural products in the plantations are palm oil, rubber, tobacco, coffee and tea. The downstream area of the Ular mainly produces palm oil and rubber. Palm oil is a very important agricultural product for export and has a great contribution to the earning of foreign currencies (Table 9-2-4). On the other hand, in recent years, some of rubber plantations have been replaced to those of palm oil because of the instability of rubber price in the international market and lower value compared with that of palm oil. The project area has an estate field of 17,800 ha, among which about 10,000 ha are oil palm plantations and about 4,300 ha are rubber plantations. Most of them belong to PNP VI and PTP II, V and IX.

Among agricultural products exported from Indonesia, rubber and palm oil are the most important goods for acquisition of foreign currencies holding the highest in volume as shown in Table 9-2-4. Therefore, implementation of the flood control project has a great significance to maintain the products of rubber and palm oil.

Besides the estate plantations mentioned above, the project area is characterized by well-developed farming by inhabitants and various kinds of crops are produced. Major products are rice, cassava, sweet potatoes, soya beans and small green peas. The rice field of 18,500 ha included in the project area consists of technical irrigation area of 3,000 ha, semi-technical irrigation area of 1,500 ha, non-technical irrigation area of 2,500 ha and rain-fed area of 11,500 ha. Though water is being taken from the Ular to some part of the irrigated area, it does not reach sufficiently to all the area due to insufficiency of irrigation facilities. However, owing to positive investments by the Government, the irrigation facilities in

the project area are gradually being improved. At present, yield of paddy is estimated at about 2.9 tons per ha in rain-fed field and 3.6 tons per ha in irrigated field.

In North Sumatra as a whole, however, supply of rice does not meet its own demand because of large consumption in Medan, high density of population and increase in demand of rice per capita. This shortage of rice, which seems to continue for a period of time, will have to be supplemented by importation from abroad as well as from other domestic area. The problem of supply and demand of rice was discussed in detail in Chapter II.

Livestock in the seven subdistricts numbers about 500,000 heads including cattle, buffalo, goat, pig, duck, sheep and fowl (Table 9-2-5). Fowl, that is important for inhabitants as albuminous food of animal origin, amounted to about 300,000 heads in 1976 or accounted for 60% of number of the whole livestock. All of these livestock are available as edible meat, and further cattle and buffalo are also used for tilling. Statistics indicate that an average farmer has 8.8 heads of fowl or duck, 0.3 heads of cattle or buffalo and 0.5 heads of goat or sheep.

The largest-scale factory in the project area is a refinery of palm oil belonging to PNP VI in Perbaungan. This factory holds a plottage of about 15 ha and produced palm oil of about 680,000 tons in 1976. With the exception of this factory, the project area has no noteworthy industry but some small-scale factories such as rice mills.

Fishery is being operated on small scale in the subdistricts of Tanjung Beringin, Teluk Mengkudu, Pantai Cermin and Lubuk Pakam facing the Strait of Malacca. The hauls are estimated at about 4,000 tons or about 700 million Rupiah per annum and most of them are consumed locally.

Among the seven subdistricts, Lubuk Pakam and Perbaungan have commercial zones on a larger scale compared with those of the other subdistricts. Shops in both zones are estimated to number about 1,000 and 300 respectively and mainly deal in commodities for daily use. According to the property survey carried out in November 1976, the amount of stored goods was estimated at about 2 million Rupiah per shop on the average.

The railway which runs through the project area has a single track. Passenger trains make two return trips a day, and freight trains make six return trips a day. The statistics obtained by the Railway Authority in Medan indicate that the railway transports about 2,000 passengers a day and freight of about 2,000 tons per day. On the other hand, the highway transports about 300 passenger cars, about 200 buses and about 350 trucks respectively per day. The transport volume per day is estimated at about 15,000 passengers and about 8,000 tons in freight.

GDP of Indonesia in the 1973/74 fiscal year was about US$15 Billion or about US$120 per capita. According to PELITA II, the GDP in 1978/79 is estimated at US$22 Billion at the 1973 constant prices and at an average growth rate of 7.5% per annum. As for the related agricultural sector, GDP is planned to be raised by 36% during the period of PELITA II at an annual growth rate of 4.6%.

Statistical record of Galang and Perbaungan Subdistricts* indicate that the average annual income per household in 1976 was about Rp 325,000 at the annual growth rate of 7.0% during the period of 1970 to 1976 (Table 9-2-6). The breakdowns of them were Rp 235,000 and 1.0% for farmer, Rp 513,000 and 12.0% for shop's owner, Rp 330,000 and 8% for officer, and Rp 220,000 and 3.5% for laborer. It is seen here that the income of shop's owner and its rate of annual increase are the highest and the farmer's are the lowest. This low increase of farmer's income was mainly caused by damages to agricultural crops due to noxious insects and submergences by floodings in 1973 and 1974.

On the other hand, prices of commodities in Medan in 1976 raised nearly three times as much as those in 1970 at the average annual increase rate of about 20% (Table 9-2-7). This fact indicates that the rate of increase in prices was approximately three times as much as the rate of increase in household's income during the period of 1970 to 1976.

This situation of the project area will give an expectation for increase in agricultural productions and accordingly increase in farmer's income, if the present project is implemented and the targets are achieved.

## 9.3. Flood Damage.

### 9.3.1. Flood Damage Survey.

As mentioned previously, it is recorded that the Ular river had big floods in the past, whose discharges were estimated at 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$ in order of magnitude.

The amounts of damages caused by these floods were surveyed first in the Feasibility Study for the Urgent Flood Control Project in 1970/71 and, after that, in the Overall Plan Study in 1976/77. In the former study, the survey was made mainly of the damages to estate crops, paddy and public facilities based on the information collected by the DPU and data on submergence depth obtained in the inundated area. In the latter study, the damages to buildings and household effects were newly surveyed in addition to those to public facilities and agricultural crops based on the information collected by Subdistricts and the data on the properties obtained by the Team.

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* Subdistricts other than Galang and Perbaungan have no available data for estimation of household income.

Based on a newly drawn topographical map of 1/10,000, a partial revision was made of the amounts of the damages which were surveyed in the Overall Plan Study. To estimate flood damages, the economic data in the present were applied by reason of lack of data available for forecasting. The area of inundation caused by the biggest flood discharge in the past, 865 $m^3/s$ in 1954, was estimated at approximately 25,000 ha stretching over about 100 villages in 4 Subdistricts.

Table 9-3-1 shows the breakdown of inundated area estimated with regard to each flood discharge of 865 $m^3/s$, 610 $m^3/s$ and 540 $m^3/s$. The inundated area on the occasion of the 1973-Jan-Flood of 430 $m^3/s$ could not be estimated owing to lack of data though the area of inundated paddy fields was found to be about 1,000 ha and the amount of damage to public facilities was estimated. In the case of the flood of 430 $m^3/s$, therefore, the damages to other items were estimated on the assumption that a proportional relation holds between damages to paddy or public facilities and damages to items other than the said two.

9.3.2. Flood Damage in the Present Situation.

In order to estimate average annual flood damage, flood damages by discharge were calculated on condition that the Urgent Project has been completed. The average annual flood damage was calculated by integrating the flood damages obtained by discharge.

Flood damages by discharge were first calculated with regard to the four cases of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$ on the assumption that the Urgent Project is not implemented but the inundated area has the present economic potential. In calculating them, the flood damages were considered to consist of those to public facilities, buildings and household effects, paddy, palm oil and rubber, facilities in the plantation, upland crops and losses due to suspension of business activities and interruption of transport.

Next, flood damages corresponding to flood discharge of 800 $m^3/s$, 600 $m^3/s$, 400 $m^3/s$ and 200 $m^3/s$ were estimated by interpolation of the four values obtained above. In this case, the discharge of 200 $m^3/s$ and below was regarded as innocuous discharge in accordance with the study mentioned in Chapter II.

The flood damages by discharge of 800 $m^3/s$, 600 $m^3/s$ and 400 $m^3/s$ were estimated by reducing the flood damages due to 600 $m^3/s$ and below to half because the Urgent Project was implemented for protecting the land from floods due to 600 $m^3/s$ and below.

For estimating flood damage in case irrigation/drainage improvement is implemented on condition that the Urgent Project has already been completed, the increase in flood damage due to the improvement is estimated, and this amount has only to be added to the damage obtained above. But in this case too, similar adjustment must be done for taking the effect of the Urgent Project into consideration. In calculating the increase in flood damage, such

items as increase in flood damage to paddy due to alteration in yield, damages to agricultural facilities and decrease in production of paddy due to damages to agricultural facilities were taken into consideration.

(1) Estimation of flood damage by discharge.

(a) Damages to public facilities.

Damages to public facilities such as national road, provincial roads, canals, intakes, levees and bridges were estimated on each case of discharges of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$ based on the flood record obtained by the DPU. The estimated amounts of flood damages are respectively Rp 277.5 million, Rp 87.5 million, Rp 194.4 million and Rp 67.3 million, the breakdown of which is shown in Table 9-3-2.

(b) Damages to buildings and household effects.

According to the population statistics given in Table 9-2-1, the rate of population increase of four subdistricts of Galang, Lubuk Pakam, Perbaungan and Pantai Cermin which have suffered from floods of the Ular was about 0.6% per year during the period from 1970 to 1976 on the weighted mean by population. This rate is very low compared with 2.4% of the whole country for the same period.

In Lubuk Pakam and Perbaungan, as seen in Table 9-2-3, the increase rate of number of houses was about 2.4% per year during the period from 1970 to 1976, but almost no change is seen in Galang and Pantai Cermin. It is difficult to estimate number of houses in the future only by use of these data, and further, the project area has no such plan that gives data on future increase in number of houses. In the present study, therefore, number of houses as of 1976 was used for estimating flood damages to buildings and household effects.

The number of submerged houses which were surveyed on the occasion of the Overall Plan Study was reviewed by use of the topographical maps on the scale of 1/10,000. This was estimated at about 20,000, about 13,000 and about 5,000 respectively on the occasion of 865 $m^3/s$, 610 $m^3/s$ and 540 $m^3/s$. These are shown in Table 9-3-3.

The flood damages to buildings and household effects in an inundated area are calculated as follows.

$$D = A \cdot R \cdot N$$

where D : flood damage to buildings and household effects in an inundated area,

A : appraisement of property per house,

R : rate of damage of property per house, and

N : number of submerged houses.

The property of a house consists of buildings and household effects (including goods stored in shop and factory). Their appraisements are given in Table 9-3-4 on the average of the values of properties surveyed in the said four subdistricts. Further, based on the result of field survey, household effects were appraised by kinds of houses and by height above the floor level. These are shown in Table 9-3-5.

In appraising the damage of property, a difference must be considered between damage rate of building and that of household effects or stored goods. In general, the damage rate of building will be considered by water depth of submergence and a damage rate of the submerged household effects must be considered by their kinds of properties included within the water depth of submergence. In this study too, this conception was adopted; but since there are no available data in Indonesia, those damage rates which are used in Japan were applied to this study. Those rates are shown in Tables 9-3-6 and 9-3-7.

Table 9-3-8 shows the flood damages to buildings and household effects on each occasion of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$. These were estimated at Rp 4,469 million, Rp 3,054 million, Rp 1,090 million and Rp 455 million respectively.

(c) Damage to paddy.

The flood damage to paddy is given by the following formula.

$$D = P \cdot Y \cdot A \cdot R$$

where D : flood damage to paddy,

P : unit price,

Y : unit yield,

A : inundated area, and

R : rate of decrease in yield due to inundation.

The unit price of paddy was, as mentioned in Chapter II, estimated at Rp 65 per kg at the farm gate at the 1977 price level. The price does not include any transfer cost such as tax and subsidy.

For estimating the flood damage in rain-fed and irrigated paddy field, 3.6 tons per ha was used as the average unit yield in the case

of "without irrigation/drainage improvement", while 4.5 tons per ha was used in the case of "with irrigation/drainage improvement".

The rate of decrease in yield of submerged paddy is generally related to height of planted paddy and depth and duration of submergence. As no survey of this relation is found in Indonesia, a relation obtained in Japan based on experiments conducted by the Agricultural Experiment Station of the Ministry of Agriculture and Forestry was applied to this study. This relation is shown in Table 9-3-9 and Fig. 9-3-1.

Based on this condition, amount of damage to paddy per ha was obtained by submergence depth in consideration of cropping patterns of "without and with irrigation/drainage improvement". These are shown in Table 9-3-10. By use of the amount of damage per ha shown in Table 9-3-10 and inundated area shown in Table 9-3-1, the flood damage to paddy was estimated by discharge and on condition of "without and with irrigation/drainage improvement". These are shown in Table 9-3-11.

(d) Damages to palm oil and rubber.

Recently, drainage facilities of the plantation in the project area have remarkably been improved. Therefore, they will scarecely be damaged due to submergence though roots of oil palm and rubber are not so strong against water. It is supposed, however, that the yield of palm oil and rubber will decrease due to flood because production activities will be suspended not only during the flood but also for a period required for restoring the production facilities after the flood has subsided. In order to estimate those damages, it was assumed that the period for restoration of the production facilities is nearly equal to the duration of the flood and the production is carried out uniformly every day.

Unit prices and unit yields of palm oil, palm kernel and rubber are given in Table 9-3-12, of which the former were given based on *Price Prospects for Major Primary Commodities* published by the World Bank in 1977 and the latter were given based on the production in PNP's and PTP's in the project area these last five years.

Based on the conditions mentioned above, the rates of decrease in yield per ha of palm oil (including palm kernel) and rubber due to suspension of production were calculated by inundation depth. These are shown in Table 9-3-13. The damages to palm oil (including palm kernel) and rubber were estimated as shown in Table 9-3-14.

(e) Damages to facilities in the plantation.

Damages to facilities in the plantation are not included in the damages to public facilities which were mentioned in (a). In order to estimate those damages, it was assumed that the rate of flood damage to such facilities as small-size roads (except the national and

provincial roads), canals and bridges is uniform over the inundated area or proportional to the inundated area. On this assumption, damages were calculated by the following formula.

$$D_2 = (D_1 - d_1) \frac{A_2}{A_1}$$

where $D_1$ : damages to public facilities,

$D_2$ : damages to facilities in the plantation,

$d_1$ : damages to national and provincial roads,

$A_1$ : inundated area except plantation area, and

$A_2$ : inundated area in the plantation.

The flood damages to facilities in the plantation were thus estimated Rp 55 million, Rp 55 million, Rp 21 million and Rp 10 million respectively corresponding to each flood discharge of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$. These are shown in Table 9-3-15.

(f) Damages to upland crops.

The damages to major upland crops such as cassava, sweet potato, peanuts, soya beans and small green peas can be estimated by use of the same formula as that for paddy. Harvested area and yields of upland crops in the project area are given in Table 9-3-16 based on the statistics of the subdistricts of Galang, Lubuk Pakam, Perbaungan and Pantai Cermin, and also unit prices per kg of upland crops are given in the same table at the 1977-price level at farm gate. By use of these data, the average production of upland crops in the project area was estimated at Rp 129,200 per ha.

The damage rate of submerged crops in the field was assumed by depth and duration of inundation following those which are usually used in Japan for economic study of flood control. These are given in Table 9-3-17.

The flood damages to upland crops were thus estimated at Rp 32 million, Rp 22 million, Rp 19 million and Rp 4 million respectively corresponding to each flood discharge of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$. These are shown in Table 9-3-18.

(g) Losses due to suspension of business activities.

All or a part of business activities of persons and corporations in an inundated area will be suspended during the period of inundation. It is, however, very hard to exactly grasp the losses that will arise from such suspension of business. The survey conducted by the Ministry of Construction of Japan indicates that the losses

account for about 6% of flood damages to buildings and household effects. It was assumed that this rate is applicable to the present study, because no data on this rate are found in Indonesia. The losses to business activities due to flood were thus estimated at Rp 268 million, Rp 183 million, Rp 63 million and Rp 27 million respectively corresponding to each flood discharge of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$. These are shown in Table 9-3-19.

(h) Loss due to interruption of transport.

A national railway and a national highway run east and west in the project area through Medan. The volume of the traffic and transport on the railway and the highway was estimated based on the statistical data obtained by the offices of Railway Authority and the Highway Department of North Sumatra Province as well as the transportation survey that was carried out by the Team on the highway on December 13 and 14, 1976. These are shown in Table 9-3-20.

A flood will inflict a loss due to interruption of traffic to persons and corporations concerned. The loss will mainly consist of decrease in income of passenger, loss due to accumulation of freight and losses due to suspension of bus, truck and railway businesses.

a. Decrease in income of passenger.

The decrease in income of passenger per day due to interruption of traffic will be obtained by the following formula.

$$D = I \cdot P \cdot R$$

where D : amount of decrease in income of passenger (Rp/day),

I : income of passenger (Rp/day),

P : number of passengers per day, and

R : ratio of working persons to the entire passengers.

Based on the survey mentioned above, it was assumed that the income of passenger and the ratio of working persons to the entire passengers would be Rp 500 per day and 80% respectively. The decrease in income of passenger was thus estimated at Rp 12.04 million per day.

b. Loss due to accumulation of freight.

The accumulation of freight due to interruption of traffic means a suspension of working of capital, as the freight under transportation itself is a capital. This loss can be measured by the interest to the capital.

Price of transport goods was estimated at about Rp 100,000 per ton on the average based on the transport record of goods on the railway and the transport survey of freight on the highway. Assuming

the interest rate to be 10% per annum, the loss due to accumulation of freight was estimated at Rp 0.32 million per day. This is shown in Table 9-3-22.

c. Losses due to suspension of business of bus, truck and railway.

The losses due to suspension of business activities of persons and corporations in the inundated area were already estimated in (g). Such losses will also arise in an area other than the inundated one. However, it is very difficult to estimate all of such losses. Therefore, in the present study, the estimation of losses due to suspension of business activities in noninundated area was limited to such transport business as bus, truck and railway transportations whose losses are relatively easy to estimate.

Fare of passenger, transportation charge and range of freight, ratio of business truck to the entire trucks and profit ratio of transport business activities to be required to estimate the losses were assumed as shown in Table 9-3-21 on the basis of the railway transport record and the transport survey on the highway. The losses due to suspension of the businesses were thus estimated at about Rp 13.28 million per day. The breakdown is shown in Table 9-3-22.

The loss due to interruption of traffic was in total estimated at about 25 million Rupiah per day as the sum of the losses stated in the above items of a, b and c.

The records of the past floods indicate that the duration of interruption of traffic on the railway and highway was 3 days in the 1954-Sept-flood, 2 days in the 1969-Oct-flood, 2 days in the 1973-Dec-flood and 1 day in the 1973-Jan-flood.

The losses due to interruption of traffic were thus estimated at Rp 75 million, Rp 50 million, Rp 50 million and Rp 25 million respectively corresponding to each flood discharge of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$. These are shown in Table 9-3-23.

(i) Total flood damages in the present situation.

The total of the flood damages obtained in (a) through (h) worked out at Rp 6,196 million, Rp 4,017 million, Rp 1,853 million and Rp 695 million corresponding to each flood discharge of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$. These are shown in Table 9-3-24.

By use of these four values, the flood damages corresponding to each discharge of 800 $m^3/s$, 600 $m^3/s$ and 400 $m^3/s$ were estimated by interpolation. The discharge of 200 $m^3/s$ was regarded as innocuous discharge as mentioned above. For taking the effect of the Urgent Project into consideration, the flood damages corresponding to discharge of 600 $m^3/s$ and below obtained above were reduced to half. After all, the flood damages corresponding to each discharge of 800 $m^3/s$, 600 $m^3/s$, 400 $m^3/s$ and 200 $m^3/s$ in the present situation were estimated at Rp 6,050 million, Rp 1,840 million, Rp 255 million and Rp 0 respectively. These are shown in Table 9-3-25.

(2) Estimation of increase in flood damage in the case of irrigation/drainage improvement without flood control.

(a) Increase in flood damage to paddy due to alteration in yield.

An unit yield of 3.6 t/ha was applied to the estimation of flood damage to paddy on condition of the present situation. But in the case of implementation of irrigation/drainage improvement, another unit yield of 4.5 t/ha must be used because the yield is expected to increase to 4.5 t/ha by the improvement.

The flood damages to paddy in the latter case were estimated at Rp 721 million, Rp 290 million, Rp 314 million and Rp 68 million respectively corresponding to each flood discharge of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$. These are shown in Table 9-3-11. Therefore, the increase in flood damage in case of "with irrigation/drainage improvement and without flood control" works out at Rp 144 million, Rp 58 million, Rp 63 million and Rp 14 million respectively corresponding to each flood discharge mentioned above. However, if the effect of the Urgent Project is taken into consideration, the damage increase of Rp 63 million and Rp 14 million corresponding to 540 $m^3/s$ and 430 $m^3/s$ must be reduced to half. The flood damages to paddy in case of "with irrigation/drainage improvement and without flood control" are thus shown in Table 9-3-26.

(b) Increase in flood damage to such agricultural facilities as intakes and canals to be constructed newly.

a. Intakes.

It was planned to newly construct two intakes and improve one intake. In estimating the increase in flood damage to intakes, it was assumed that the three intakes suffer flood damage from a discharge of 865 $m^3/s$ but do not suffer from smaller discharges of 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$. This was based on the consideration of the effect of the Urgent Flood Control Project. The flood damage to the three intakes was thus estimated at Rp 19 million, as shown in Table 9-3-26.

b. Canals.

The rate of past flood damage to canals was about 14% of the total length of canals in the flooded area. Based on this rate, it was assumed that the new canals would suffer flood damage over a length of about 12 km, about 5 km and about 4 km respectively corresponding to each flood discharge of 865 $m^3/s$, 610 $m^3/s$ and 540 $m^3/s$. The estimation on this assumption worked out at Rp 36 million, Rp 16 million and Rp 13 million corresponding to the said three discharges. These are shown in Table 9-3-26.

(c) Decrease in production of paddy due to damages to canals and intakes.

It was assumed in consideration of the effect of the Urgent Flood Control Project that six intakes including the three new intakes would suffer damages from the flood discharge of 865 $m^3/s$ but no damages from the discharge of 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$. The area in which the production of paddy is affected by damages to the intakes was estimated at about 12,700 ha on the occasion of flood discharge of 865 $m^3/s$ based on the proposed irrigation system.

The area in which the production of paddy is affected by damages to canals was estimated at about 13,100 ha, about 5,300 ha, about 3,700 ha and about 700 ha respectively corresponding to flood discharge of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$ in consideration of the proposed canal systems for irrigation and drainage and the past flooded area corresponding to each of the said four discharges.

Decrease in production of paddy due to damages to intakes and canals was estimated on the following assumption.

a. Owing to damages to canals, paddy fields which are irrigated by the canals will return to rain-fed fields for one year.

b. Owing to damages to intakes, paddy fields which are irrigated by the intakes will return to rain-fed fields. It will take 3 years for restoration. The annual rate of restoration will be constant.

The amount of production decrease was estimated at Rp 5,351 million, Rp 899 million, Rp 628 million and Rp 119 million respectively corresponding to flood discharge of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$. These are shown in Table 9-3-26.

(d) Increase in flood damage to paddy in the case of irrigation/drainage improvement and without flood control.

The total of increase in flood damage to paddy obtained in (a) and (c) on condition of "with irrigation/drainage improvement and without flood control" worked out at Rp 9,561 million, Rp 957 million, Rp 659 million and Rp 126 million respectively corresponding to flood discharge of 865 $m^3/s$, 610 $m^3/s$, 540 $m^3/s$ and 430 $m^3/s$. These are shown in Table 9-3-26.

By use of these four values, the flood damage corresponding to each flood discharge of 1,200 $m^3/s$, 1,000 $m^3/s$, 800 $m^3/s$, 600 $m^3/s$ and 400 $m^3/s$ were estimated by interpolation and extrapolation. These values are shown in Table 9-3-27. In this case too, the discharge of 200 $m^3/s$ and below was regarded as innocuous discharge.

9.3.3. Average Annual Flood Damage.

(1) Estimation of average annual flood damage on the present condition.

The average annual flood damage is generally given by the following formula.

$$d = \int_{\underline{Q}}^{\bar{Q}} D(Q) \cdot P(Q) \cdot dQ$$

where d : average annual flood damage,

Q : flood discharge,

D(Q): damage caused by flood discharge Q,

P(Q): probability of occurrence of flood discharge Q,

$\bar{Q}$ : design flood discharge, and

$\underline{Q}$ : innocuous discharge.

This integration was performed based on the flood damages by discharge given in Table 9-3-25 and on condition that $\bar{Q}$ = 800 $m^3/s$ and $\underline{Q}$ = 200 $m^3/s$. The calculated average annual flood damage worked out at Rp 830 million. This is shown in Table 9-3-29. This value will be used later as average annual economic benefit by flood control.

(2) Estimation of average annual flood damage in the case of irrigation/drainage improvement without flood control.

Similar integration was performed with regard to flood damage to paddy based on the flood damages given in Table 9-3-27 dividing it into two parts of "below 800 $m^3/s$" and "above 800 $m^3/s$". It worked out at Rp 856 million consisting of production decrease by Rp 832 million due to flood damage to intakes and canals and damage increase by Rp 24 million due to alteration in yield. These are shown in Table 9-3-28.

Increase in the average annual damage to intakes and canals to be newly constructed was calculated in a similar way with regard to two cases of discharge of 800 $m^3/s$ and below and above 800 $m^3/s$. It worked out at Rp 6 million and Rp 1 million respectively. These are shown in Table 9-3-28.

The increase in average annual flood damage to paddy and to intakes and canals to be newly constructed in the case of "with irrigation/drainage improvement and without flood control" was thus estimated at Rp 863 million consisting of Rp 616 million for discharge of 800 $m^3/s$ and below and Rp 247 million for discharge of above 800 $m^3/s$.

Therefore, the average annual flood damage in the case of "with irrigation/drainage improvement and without flood control" was thus estimated at Rp 1,446 million by adding Rp 830 million given in Table 9-3-29 to Rp 616 million given in Table 9-3-28.

## 9.4. Cost-Benefit Analysis.

### 9.4.1. Economic Cost.

In Chapters V to VIII, the foreign currency portion of construction cost was given in the CIF price at Belawan Harbor. Namely, it shows economic cost which does not include any import duty, sales tax and other transfer cost. While, since the local currency portion of the construction cost was given in the market price, it should be given in the economic cost by deducting taxes included in it.

To estimate the economic cost of the local currency portion, the civil work cost was first classified into equipment, spare parts, materials, labor and others instead of kind of works. Next, by deducting taxes included in the above cost, the construction cost was given in the economic price as shown in Table 9-4-1 to 9-4-8. The economic construction cost of the project is summarized in Tables 9-4-9 and 9-4-10.

The above tables show that the minimum construction cost among the four alternatives is about Rp 12,300 million for the five-year plan on the full-contracting system and the maximum cost is about Rp 13,000 million for the five-year plan on the equipment-lending system. The difference between both costs is less than 6% of the construction cost.

In the same way, annual operation and maintenance costs (hereinafter referred to as the "OM costs") are given in economic price. The OM costs of the flood control component were estimated at Rp 22 million per annum in economic price throughout the project life after the completion of construction. The OM costs for the construction period were estimated assuming that they would be given in ratio of the invested partial construction cost to the total construction cost (Table 9-4-11).

The OM costs of the irrigation and drainage component were estimated at 76 million Rupiah per annum throughout the period of project life after the completion of construction. The OM costs for the construction period were also estimated on the same assumption as that of the flood control component.

The OM costs of the entire project were thus estimated at 98 million Rupiah per annum as a total sum of the above two components.

Besides, the replacement costs for gates of intakes are given in economic price in Table 9-4-12.

9.4.2. Economic Benefit.

(1) Definition of Benefit.

Benefit of the project was estimated classifying the project, for convenience' sake, into three categories of flood control component, irrigation/drainage improvement component and the project.

Benefit that will arise from the flood control is mainly given as effects of decrease in damages caused by flood. In the present study, such effects will be evaluated in the monetary term regarding public facilities, buildings, household effects, paddy, plantation and upland crops, business activities and transportation. On the other hand, the benefit of irrigation and drainage improvement is defined as a difference between with and without project conditions concerning primary profits to be produced from crops.

Benefit of the project will accrue immediately after implementation of the construction. As for the flood control component, the benefit will increase in proportion to the degree of completion of the construction and is expected to attain to its maximum in the 1983/84 fiscal year in the case of the five-year plan and the 1985/86 fiscal year in the case of the seven-year plan. On the other hand, the benefit of the irrigation and drainage component is expected to increase linearly year by year after implementation of the construction and to attain to its maximum in the 7th year after completion of the construction.

Besides, salvage value of construction equipment will be given as a benefit of the project in the final year of construction period in case of the equipment-lending system. In case of the full-contracting system, the salvage value of equipment need not be counted into benefit of the project, because the equipment cost is included in the construction cost as a depreciation.

(2) Benefit of Flood Control.

As stated in Paragraph 9.3.3, in case of "without irrigation and drainage improvement", the average annual damage due to flood discharge of 800 $m^3/s$ and below has been estimated at Rp 830 x million. If the flood control with design discharge of 800 $m^3/s$ is implemented, this flood damage will be eliminated, namely, it will be given as the average annual benefit of the flood control component. This benefit will accrue every year throughout the project life of 50 years after completion of the construction. Partial benefits that will accrue during the construction were estimated assuming that they may be given in a ratio of the invested construction cost to the total construction cost (Tables 9-4-18 and 9-4-19).

The salvage value of construction equipment was estimated at about 247 million Rupiah for the five-year plan and about 409 million Rupiah for the seven-year plan. This value is given as a benefit in 1982/83 and in 1984/85 respectively.

(3) Benefit of Irrigation and Drainage Improvement.

Most of the paddy field in the project area is at present under insufficient seasonal irrigation and rainfed. Consequently the percentage of paddy cropping in dry season is restricted to less than 25%. Furthermore unit yield of paddy crop remains in low level due to improper water control as well as insufficient farm management.

The project will provide perennial irrigation water throughout the year and proper drainage of excess water to the entire project area and will thereby promise to provide the basis for a major increase in rice yield and production.

The benefit of irrigation/drainage improvement will come out immediately after the implementation of the construction of irrigation and drainage facilities and is expected to increase linearly year by year and attains to its maximum of Rp 3,139 million in and after the 7th year after completion of irrigation and drainage facilities. This is shown in Tables 9-4-14 and 9-4-15.

The above-mentioned benefit has been estimated leaving the flood damage as stated in previous Section out of consideration. Taking into account the flood damage, the net annual benefit of the irrigation and drainage improvement was estimated at Rp 2,276 million by subtracting the flood damage of Rp 863 million from Rp 3,139 million. Further, the benefits expected for each year during the building period were given as shown in Tables 9-4-16, 9-4-18 and 9-4-19 assuming that the benefit after deduction of the flood damage will be given by multiplying 0.725 ($=2,276 \times 10^6/3,139 \times 10^6$) by the benefit before deduction of the flood damage.

In the case of the equipment-lending system, the salvage value of equipment, after completion of the construction, was estimated at Rp 242 million for the seven-year plan and Rp 324 million for the five-year plan. This is given as a benefit in 1982/83 and 1984/85 respectively.

(4) Benefit of the Project.

As mentioned in the previous paragraph, the net annual benefit of the irrigation and drainage improvement was given by subtracting the average annual flood damage amounting to Rp 863 million from the production benefit due to the irrigation and drainage improvement. Of the above flood damage, the damage due to flood discharge of 800 $m^3/s$ and below was estimated at about Rp 616 million as shown in Table 9-3-28 of Section 9.3. Such a damage is to be eliminated in case the flood control work is executed. The eliminated damage will be given as an increase in benefit by the implementation of flood control work.

Accordingly, the average annual benefit of the present project, which has been planed to implement both the flood control and the irrigation/drainage improvement at the same time, amounts to Rp 3,722

million in total, adding the increase in benefit of Rp 616 million to the sum of the flood control benefit of Rp 830 million and the irrigation/drainage benefit of Rp 2,276 million.

Benefits expected in each year during the building period of the above increase in benefit were given using jointly two ways; one is the way of estimation of benefit expected during the building period for the irrigation/drainage improvement, and the other is the way of estimation of benefit expected during the construction period for the flood control (Tables 9-4-17, 9-4-18 and 9-4-19).

In the case of the equipment-lending system, the salvage value amounts to Rp 489 million at the end of 1984/85 for the seven-year plan and Rp 733 million at the end of 1982/83, combining the two salvage values for the flood control and the irrigation/drainage improvement. This is given as a benefit of the project in 1984/85 and in 1982/83 respectively.

(5) Intangible Benefit.

The benefits described in the previous paragraphs 9.4.2,(2) and 9.4.2,(4) are tangible benefits which are comparatively easy to count in monetary term. Besides these, the following benefits will have to be taken into consideration as intangible ones.

In the flood control sector, the implementation of the project will produce such good results as decrease in diseases due to improvement of the environment and stabilization of the people's livelihood due to protection from menace of flood. In the sector of irrigation/drainage improvement, the intensive and extensive farming planned in the project will foster trade in agricultural inputs and the production increase in rice will encourage commercial millings and improvement of the distribution system of rice.

As a result, the impact of the project will lead to expansion of commercial activities, increase in opportunity of employment, improvement of living conditions of inhabitants and increase in incomes of the people in the project area and its neighborhood.

9.4.3. Comparison of Cost and Benefit.

The streams of the economic costs and benefits of the four alternative plans of the project are summarized in Tables 9-4-20 to 9-4-31 classifying them into the three categories. Based on these streams, cost-benefit analysis was made for each of the four alternatives. The calculated internal rate of return (IRR), benefit-cost ratio (B/C) and net present value (B - C) are given in Tables 9-4-32 to 9-4-35.

It is easily seen from the tables that the benefit exceeds the cost in all the alternatives in case the discount rate is assumed at 12% and the value of IRR indicates a good rate as high as 19% or 20%. It may be said from these results that any of the four alternative plans is economically feasible.

Comparing the full-contracting system with the equipment-lending system, it is found that the former a little surpasses the latter in the three economic indices. This is by reason that the disbursement on the full-contracting system is almost constantly distributed over the construction period mainly owing to the depreciation system taken for the equipment, while the disbursement on the equipment-lending system appears at the early stage of the construction period owing to the procurement of equipment. Furthermore, the problem of disposal of equipment left behind the project at the time of completion of the works will not occur in the system of full-contracting. This is also another benefit of the full-contracting system. Therefore, the plan of full-contracting system is recommendable.

Next, the comparison of the two plans of 7-year and 5-year indicates no significant difference between them. But the 7-year plan is recommendable from the viewpoint of finance and others.

In conclusion, the 7-year plan on the full-contracting system is recommendable from the viewpoint of economic evaluation.

### 9.4.4. Sensitivity Analysis.

Sensitivity has been examined only in regard to IRR because the sensitivity analyses of benefit-cost ratio and net present value are expected to give the same result as that of IRR. For examining the sensitivity, increase and/or reduction in cost and/or benefit were adopted as variables. Tables 9-4-36 to 9-4-39 show the increase and/or decrease in IRR corresponding to the increase and/or reduction in cost and/or benefit by 10%, 20% and 30% in each of the four alternative plans.

It is found from the results given in the above tables that the value of IRR of the project exceeds 12% even if the cost should go up by 20% or the benefit should come down by 20%. Further, even in case of the most pessimistic assumption that the cost should go up by 20% and at the same time the benefit should come down by 20%, IRR of the project attains to a pretty good value as high as 14%. This means that the project is economically sound. The similar tendency will be seen in the two components of the project. This is also shown in the above-mentioned tables for reference.

Furthermore, some examinations must be made on the sensitivity of two major elements of price of paddy and yield of paddy which may have an influence upon the value of IRR.

(1) Price of Paddy.

In the present study, Rp 65 per kg has been applied as the price of paddy. This is the farm-gate price which has been derived from the international price of paddy at the 1977-price. This price of paddy has however varied between about Rp 35 and about Rp 130 per kg since 1970. Such a fluctuation in the price may also be expected in the future.

If the price of paddy is assumed at Rp 35 per kg as a pessimistic condition, the benefit of the project will be reduced by about 35% and IRR will work out at 12%. This result indicates that there is no room for doubt of economic viability of the project.

On the contrary, if the price of paddy is assumed at Rp 130 per kg as an optimistic condition, the benefit of the project will be increased by about 75% and IRR will work out at 25%.

International price of paddy has generally taken an upward tendency for the long period of time. It seems therefore that the price of paddy will be an optimistic element rather than a pessimistic element.

(2) Yield of Paddy.

In the present study, the yield of paddy per ha in the dry season has been assumed to be the same as the wet season paddy. However, if the yield of paddy per ha in the dry season is assumed at 80% of that in the wet season as assumed in the Overall Plan Study, the benefit of the irrigation/drainage component will be reduced by about 25% which will reduce the value of IRR of the project to 15 or 16%. However, all the values of IRR exceed 12% even if the above-mentioned pessimistic assumption should be applied. The economic feasibility of the project is therefore justifiable from the viewpoint of fluctuation of yield of paddy.

## 9.5. Farm Budget.

From the farmer's point of view, the economic evaluation was made through the analysis of two tipical types of owner farmers in the project area. Type I is the representative of non-technical irrigated paddy field area and Type II is that of technical irrigated paddy field area.

In future, on the condition of without project and on the condition of full development stage after completion of construction works of the project, the gross farm income, the gross farm expenses, net farm income and reserve or capacity to pay worked out as shown in Table 9-5-1.

The reserve of the farmer under with project condition would amount about 17 times in case of Type I and more than 6 times in case of Type II of that of without project condition respectively.

According to these analyses, it can be said that the project is quite beneficial for the farmers in the project area.

Table 9-2-1 Population (1970 to 1976)

| | Year | | | | | | | Rate of population increase per year |
|---|---|---|---|---|---|---|---|---|
| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | |
| Indonesia | 117,469,000 | 120,148,856 | 123,115,083 | 126,088,473 | 129,082,642 | 132,110,359 | 135,190,468 | 2.4 |
| North Sumatra | 6,413,270 | 6,620,811 | 6,893,248 | 6,920,330 | 7,083,124 | 7,231, 295 | 7,249,275 /1 | 2.4 |
| Kab. Deli Serdang | 1,409,628 | 1,430,637 | 1,451,670 | 1,458,111 | 1,105,764 | 1,138,955 | 1,119,549 /1 | 1.6 |
| Kec. Galang | 54,105 | 54,356 | 55,609 | 53,500 | 53,959 | 54,281 | 54,533 | 0.1 |
| " Lubuk Pakam | - | 114,652 | - | - | 115,038 | 118,598 | 115,777 | 0.2 |
| " Perbaungan | 70,304 | 71,466 | 72,665 | 74,046 | 74,096 | 75,484 | 75,582 | 1.2 |
| " Pantai Cermin | - | - | - | 21,376 | 22,593 | 23,157 | 23,090 | 2.6 |
| " Sei-Rampah | - | 80,691 | 81,910 | 82,329 | 82,332 | 85,040 | 84,462 | 0.9 |
| " Teluk Mengkudu | 23,364 | 23,785 | 24,029 | 24,353 | 24,795 | 25,107 | 24,173 /2 | 0.6 |
| " Tanjung Beringin | 23,406 | 23,214 | 23,228 | 23,158 | 23,158 | 23,365 | 22,522 /2 | 0.6 |

/1 : as of June 1976.

/2 : Decrease in population by migration of laborers to other Kecamatans in 1976.

Table 9-2-2 Area, Population, Population Density, Number of Houses in 1976

| | Area ($Km^2$) | Number of village | Population | | Houses | | |
|---|---|---|---|---|---|---|---|
| | | | Number | Density (per $Km^2$) | Number | Number of family per house | Number of houses per $Km^2$ |
| North Sumatra | 72,513.0 | 5,550 | 7,249,275 | 100 | - | - | - |
| Kab. Deli Serdang | 6,240.0 | 854 | 1,119,549 /1 | 179 | - | - | - |
| Kec. Galang | 167.9 | 38 | 54,533 | 325 | 9,762 | 5.59 | 58.1 |
| " Lubuk Pakam | 173.1 | 59 | 115,777 | 669 | 21,495 | 5.39 | 124.2 |
| " Perbaungan | 203.1 | 41 | 75,582 | 372 | 13,953 | 5.42 | 68.7 |
| " Pantai Cermin | 63.2 | 12 | 23,090 | 365 | 4,185 | 5.52 | 66.2 |
| " Sei-Rampah | 336.6 | 27 | 84,462 | 251 | 13,724 | 6.15 | 40.8 |
| " Teluk Mengkudu | 91.0 | 12 | 24,173 | 266 | 3,803 | 6.36 | 41.8 |
| " Tanjung Beringin | 76.2 | 8 | 22,522 | 296 | 3,666 | 6.14 | 48.1 |
| Total of 7 Kecamatans | 1,111.1 | 197 | 400,139 | 360 | 70,588 | 5.67 | 63.5 |

Source: Statistical year Book 1976, North Sumatra.
Statistical Records of Kabupaten and Kecamatans, 1976.

/1 : June 1976.

Table 9-2-3 Number of Houses

| Kecamatan | Item | Year 1970 Number | % | 1971 Number | % | 1972 Number | % | 1973 Number | % | 1974 Number | % | 1975 Number | % | 1976 Number | % | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Galang | Farm house | 4,373 | 44.1 | 4,415 | 44.2 | 4,450 | 44.5 | 4,128 | 44.4 | 4,642 | 47.3 | 4,761 | 47.9 | 4,358 | 44.6 | |
| | Residence | 5,484 | 55.3 | 5,524 | 55.2 | 5,499 | 54.9 | 5,112 | 54.9 | 5,106 | 52.0 | 5,124 | 51.5 | 5,200 | 53.3 | |
| | Shop, etc. | 63 | 0.6 | 63 | 0.6 | 63 | 0.6 | 63 | 0.7 | 63 | 0.7 | 64 | 0.6 | 204 | 2.1 | |
| | Total | 9,920 | 100 | 10,002 | 100 | 10,012 | 100 | 9,303 | 100 | 9,811 | 100 | 9,949 | 100 | 9,762 | 100 | |
| Perbaungan | Farm house | 8,504 | 70.2 | 8,766 | 70.6 | 8,902 | 70.2 | 9,088 | 70.4 | 9,206 | 69.5 | 9,485 | 69.3 | 9,676 | 69.4 | Average annual rate of increase in number of houses:2.4% |
| | Residence | 3,480 | 28.8 | 3,529 | 28.4 | 3,660 | 28.8 | 3,705 | 28.7 | 3,922 | 29.6 | 4,061 | 29.7 | 3,952 | 28.3 | |
| | Shop, etc. | 122 | 1.0 | 125 | 1.0 | 127 | 1.0 | 122 | 0.9 | 125 | 0.9 | 135 | 1.0 | 325 | 2.3 | |
| | Total | 12,106 | 100 | 12,420 | 100 | 12,689 | 100 | 12,915 | 100 | 13,253 | 100 | 13,681 | 100 | 13,953 | 100 | |
| Pantai Cermin | Farm house | - | - | - | - | - | - | 3,087 | 73.0 | 3,154 | 73.0 | 3,086 | 73.3 | 3,054 | 73.0 | |
| | Residence | - | - | - | - | - | - | 1,144 | 27.0 | 1,168 | 27.0 | 1,124 | 26.7 | 1,131 | 27.0 | |
| | Shop, etc. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| | Total | - | - | - | - | - | - | 4,231 | 100 | 4,322 | 100 | 4,210 | 100 | 4,185 | 100 | |
| Sei-Rampah | Farm house | - | - | 11,781 | 78.0 | 11,786 | 78.0 | 11,791 | 78.6 | 10,965 | 78.2 | 10,861 | 79.1 | 10,861 | 79.1 | |
| | Residence | - | - | 3,211 | 21.3 | 3,211 | 21.3 | 3,106 | 20.7 | 2,948 | 21.0 | 2,757 | 20.1 | 2,757 | 20.1 | |
| | Shop, etc. | - | - | 105 | 0.7 | 106 | 0.7 | 106 | 0.7 | 106 | 0.8 | 106 | 0.8 | 106 | 0.8 | |
| | Total | - | - | 15,097 | 100 | 15,103 | 100 | 15,003 | 100 | 14,019 | 100 | 13,724 | 100 | 13,724 | 100 | |
| Teluk Mengkudu | Farm house<br>Residence | 4,367 | 98.9 | 4,434 | 98.8 | 4,343 | 98.7 | 4,110 | 98.7 | 3,993 | 98.5 | 3,951 | 98.6 | 3,754 | 98.7 | Total of farm house and residence |
| | Shop, etc. | 52 | 1.1 | 52 | 1.2 | 57 | 1.3 | 56 | 1.3 | 59 | 1.5 | 58 | 1.4 | 49 | 1.3 | |
| | Total | 4,419 | 100 | 4,486 | 100 | 4,400 | 100 | 4,166 | 100 | 4,052 | 100 | 4,009 | 100 | 3,803 | 100 | |

Table 9-2-3 Number of Houses (Continued)

| Kecamatan | Item | Year 1970 Number | % | 1971 Number | % | 1972 Number | % | 1973 Number | % | 1974 Number | % | 1975 Number | % | 1976 Number | % | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lubuk Pakam | Farm house | 16,769 | 89.6 | 18,781 | 89.2 | - | - | - | - | 16,637 | 78.2 | 16,588 | 73.7 | 14,877 | 68.5 | Average annual rate of increase in number of houses 23% |
| | Residence | 1,852 | 9.9 | 2,139 | 10.2 | - | - | - | - | 3,738 | 17.6 | 4,891 | 21.7 | 5,581 | 25.7 | |
| | Shop, etc. | 99 | 0.5 | 124 | 0.6 | 136 | - | 379 | - | 895 | 4.2 | 1,027 | 4.6 | 1,037 | 4.8 | |
| | Total | 18,720 | 100 | 21,044 | 100 | - | - | - | - | 21,270 | 100 | 22,506 | 100 | 21,495 | 100 | |
| Tanjung Beringin | Farm house | 2,267 | 51.4 | 2,332 | 52.0 | 2,206 | 50.8 | 2,179 | 50.5 | 2,154 | 50.6 | 2,102 | 49.9 | 1,867 | 49.9 | |
| | Residence | 2,086 | 47.3 | 2,095 | 46.7 | 2,078 | 47.8 | 2,077 | 48.1 | 2,043 | 48.0 | 2,045 | 48.6 | 1,813 | 48.4 | |
| | Shop, etc. | 60 | 1.3 | 59 | 1.3 | 59 | 1.4 | 59 | 1.4 | 61 | 1.4 | 63 | 1.5 | 64 | 1.7 | |
| | Total | 4,413 | 100 | 4,486 | 100 | 4,343 | 100 | 4,315 | 100 | 4,258 | 100 | 4,210 | 100 | 3,744 | 100 | |

Table 9-2-4 Export of Major Agricultural Products in Indonesia

Unit: Thousand Ton

| Kind of products | Year | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 |
| Rubber | 790.2 | 789.3 | 774.6 | 990.2 | 840.4 | 788.3 | 811.5 |
| Copra | 185.1 | 77.5 | 42.4 | 44.6 | - | 33.0 | 3.9 |
| Coffee | 104.3 | 74.3 | 107.0 | 100.9 | 111.9 | 128.4 | 136.3 |
| Palm oil | 159.2 | 209.0 | 236.5 | 262.7 | 281.2 | 386.6 | 405.6 |
| Palm kennel | 42.4 | 48.6 | 51.4 | 39.2 | 28.5 | 21.0 | 25.6 |
| Tobacco | 11.0 | 18.3 | 26.2 | 33.3 | 28.1 | 19.6 | 20.5 |
| Peper | 2.6 | 24.2 | 25.7 | 25.6 | 15.7 | 14.5 | 28.8 |
| Tea | 41.1 | 44.8 | 44.0 | 39.6 | 55.7 | 45.9 | 47.5 |

Source: Monthly Statistical Bulletin, August 1977,
Biro Pusat Statistik, Jakarta, Indonesia.

Table 9-2-5 Number of Livestook in 1976

| Kecamatan | Kind of livestook | | | | | | | Total number |
|---|---|---|---|---|---|---|---|---|
| | Cattle | Buffalo | Goat | Pig | Duck | Sheep | Fowl | |
| Galang | 1,860 | 260 | 3,020 | 2,580 | 1,500 | 415 | 71,700 | 81,335 |
| Lubuk Pakam | 300 | 100 | 800 | 7,800 | 6,500 | - | 118,000 | 133,500 |
| Perbaungan | 1,826 | 631 | 2,358 | 754 | 13,712 | 192 | 45,748 | 65,221 |
| Pantai Cermin | 150 | 21 | 400 | 850 | 2,000 | 80 | 4,000 | 7,501 |
| Sei Rampah | 2,200 | 3,700 | 12,300 | 40,050 | 82,400 | 560 | 43,000 | 184,210 |
| Teluk Mengkudu | 350 | 110 | 2,300 | 1,600 | 4,200 | 750 | 12,509 | 21,819 |
| Tanjung Beringin | 86 | 24 | 150 | 750 | 3,250 | - | 7,250 | 11,510 |
| T o t a l | 6,772 | 4,846 | 21,328 | 54,384 | 113,562 | 1,997 | 302,207 | 505,096 |

Table 9-2-6 Annual Income

Unit: $10^3$ Rp

| Occupation | Year | | | | | | | Average annual rate of increase in income |
|---|---|---|---|---|---|---|---|---|
| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | |
| Farmer | 222 | 258 | 275 | 184 | 104 | 236 | 235 | 1.0 (%) |
| Shop owner | 260 | 283 | 323 | 278 | 260 | 363 | 513 | 12.0 |
| Officer | 208 | 227 | 256 | 264 | 311 | 345 | 330 | 8.0 |
| Laborer | 179 | 189 | 194 | 200 | 219 | 239 | 220 | 3.5 |
| Mean | 217 | 239 | 262 | 231 | 224 | 296 | 325 | 7.0 |

Source: Statistics of Galang and Perbaungan.

Table 9-2-7 Price Index in Medan

| Description | Year | | | | | | | Average of annual rate of increase in Price Index |
|---|---|---|---|---|---|---|---|---|
| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | |
| General | 100 | 103 | 111 | 171 | 210 | 242 | 279 | 18.6 (%) |
| Food | 100 | 105 | 116 | 206 | 245 | 272 | 310 | 20.8 |

Source: Monthly Statistical Bulletin, August 1977, Biro Pusat Statistik, Jakarta, Indonesia.

Table 9-3-1 Inundated Area

(A) Flood Discharge: 540 $m^3/s$.

Unit: Ha

| Land use \ Inundated depth | 0.00 - 0.49 | 0.50 - 0.99 | 1.00 - 1.49 | 1.50 - 1.99 | over 2.00 | Total |
|---|---|---|---|---|---|---|
| Oil palm | 950 | 500 | 400 | 430 | 140 | 2,420 |
| Rubber | 130 | 130 | 10 | 0 | 0 | 270 |
| Paddy | 1,420 | 1,340 | 870 | 630 | 400 | 4,660 |
| Upland crops | 240 | 70 | 30 | 0 | 0 | 340 |
| Town | 40 | 40 | 10 | 0 | 0 | 90 |
| Others | 600 | 450 | 400 | 360 | 110 | 1,920 |
| Total | 3,380 | 2,530 | 1,720 | 1,420 | 650 | 9,700 |

(B) Flood Discharge: 610 $m^3/s$.

Unit: Ha

| Land use \ Inundated depth | 0.00 - 0.49 | 0.50 - 0.99 | 1.00 - 1.49 | 1.50 - 1.99 | over 2.00 | Total |
|---|---|---|---|---|---|---|
| Oil palm | 1,950 | 1,700 | 1,400 | 840 | 440 | 6,330 |
| Rubber | 150 | 110 | 50 | 10 | 0 | 320 |
| Paddy | 1,550 | 1,190 | 770 | 660 | 300 | 4,470 |
| Upland crops | 220 | 110 | 30 | 0 | 0 | 360 |
| Town | 200 | 130 | 50 | 10 | 0 | 390 |
| Others | 690 | 530 | 300 | 300 | 210 | 2,030 |
| Total | 4,760 | 3,770 | 2,600 | 1,820 | 950 | 13,900 |

(C) Flood Discharge: 865 $m^3/s$.

Unit: Ha

| Land use \ Inundated depth | 0.00 - 0.49 | 0.50 - 0.99 | 1.00 - 1.49 | 1.50 - 1.99 | over 2.00 | Total |
|---|---|---|---|---|---|---|
| Oil palm | 2,100 | 1,900 | 1,750 | 1,310 | 550 | 7,610 |
| Rubber | 330 | 350 | 190 | 100 | 0 | 970 |
| Paddy | 2,670 | 2,770 | 2,310 | 1,650 | 800 | 10,200 |
| Upland crops | 230 | 220 | 30 | 0 | 0 | 480 |
| Town | 210 | 130 | 50 | 10 | 0 | 400 |
| Others | 1,550 | 1,750 | 1,930 | 590 | 490 | 5,210 |
| Total | 7,090 | 7,120 | 5,260 | 3,660 | 1,820 | 24,950 |

Table 9-3-2 Flood Damages to Public Facilities

Unit: $10^3$ Rp.

| Description \ Flood discharges ($m^3/s$) | 865 | | 610 | | 540 | | 430 | |
|---|---|---|---|---|---|---|---|---|
| | Quantity | Amount | Quantity | Amount | Quantity | Amount | Quantity | Amount |
| | (km) | | (km) | | (km) | | (km) | |
| National Roads | 15.6 | 101,000 | 0.5 | 3,200 | 13.2 | 85,600 | 0.5 | 1,200 |
| Provincial Roads | 7.5 | 24,200 | 3.5 | 11,400 | 2.6 | 8,400 | 5.0 | 6,000 |
| Canals | 13.0 | 42,100 | 3.0 | 9,700 | 2.0 | 6,500 | - | - |
| Intakes | 5.0 | 32,400 | 3.0 | 19,400 | 3.0 | 19,400 | 1.0 | 30,000 |
| Dikes | 5.4 | 38,900 | 0.3 | 4,900 | 6.2 | 35,600 | 0.6 | 20,400 |
| Bridges | 4.0 | 38,900 | 4.0 | 38,900 | 4.0 | 38,900 | 1.0 | 9,700 |
| T o t a l | | 277,500 | | 87,500 | | 194,400 | | 67,300 |

Amounts shown in the table are given at the 1977 price level.

Table 9-3-3 Number of Houses Submerged

(A) Flood Discharge: 540 $m^3/s$.

| Houses \ Inundated depth | 0.00 – 0.49 | 0.50 – 0.99 | 1.00 – 1.49 | 1.50 – 1.99 | over 2.00 | Total |
|---|---|---|---|---|---|---|
| Farm houses | 1,610 | 1,010 | 490 | 60 | 0 | 3,170 |
| Residence | 680 | 440 | 180 | 0 | 0 | 1,300 |
| Shop | 230 | 140 | 70 | 0 | 0 | 440 |
| Others /1 | 140 | 90 | 30 | 0 | 0 | 260 |
| T o t a l | 2,660 | 1,680 | 770 | 60 | 0 | 5,170 |

(B) Flood Discharge: 610 $m^3/s$.

| Houses \ Inundated depth | 0.00 – 0.49 | 0.50 – 0.99 | 1.00 – 1.49 | 1.50 – 1.99 | over 2.00 | Total |
|---|---|---|---|---|---|---|
| Farm houses | 3,170 | 1,900 | 770 | 120 | 0 | 5,960 |
| Residence | 2,760 | 1,620 | 550 | 80 | 10 | 5,020 |
| Shop | 790 | 520 | 200 | 30 | 0 | 1,540 |
| Others /1 | 300 | 170 | 60 | 10 | 0 | 540 |
| T o t a l | 7,020 | 4,210 | 1,580 | 240 | 10 | 13,060 |

(C) Flood Discharge: 865 $m^3/s$.

| Houses \ Inundated depth | 0.00 – 0.49 | 0.50 – 0.99 | 1.00 – 1.49 | 1.50 – 1.99 | over 2.00 | Total |
|---|---|---|---|---|---|---|
| Farm houses | 5,450 | 3,350 | 1,350 | 200 | 30 | 10,380 |
| Residence | 3,480 | 2,130 | 690 | 90 | 10 | 6,400 |
| Shop | 1,120 | 720 | 290 | 40 | 0 | 2,170 |
| Others /1 | 470 | 260 | 90 | 10 | 0 | 830 |
| T o t a l | 10,520 | 6,460 | 2,420 | 340 | 40 | 19,780 |

/1: includes office, school, hospital, factory, mosque, church and kiosk.

Table 9-3-4 Appraisements of Buildings and Household Effects or Stored Goods (at the 1977 Price Level)

| Kind of houses | Appraisements | | |
|---|---|---|---|
| | Buildings | Household effects or stored goods | Total |
| 1. Farm house | 300 | 210 | 510 |
| 2. Residence | 300 | 350 (3 | 650 |
| 3. Shop | 1,120 | 1,640 (4 | 2,760 |
| 4. Others (1 | 1,850 (4 | 780 | 2,630 (4 |
| . Office (2 | 11,160 | 10,280 | 21,440 |
| . School | 6,320 | 1,200 | 7,520 |
| . Hospital | 4,420 | 1,560 | 5,980 |
| . Factory | 4,370 | 3,310 | 7,680 |
| . Mosque & church | 3,070 | 590 | 3,660 |
| . Kiosk | 120 | 40 | 160 |

(1 : Office, school, hospital, factory, mosque, church and kiosk.

(2 : Public office, meeting hall, post office, bank and scouting house.

(3 : Price after sales tax of 5%.

(4 : Average appraisement of office, school, hospital, factory, mosque and church and kiosk at the ratio of 1;3;1;2;5;21 in number, respectively.

Table 9-3-5 Rate of Appraisement of Household Effects by Height above Floor Level

Unit : %

| Kind of houses | Height above flood level ( in meter ) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0-0.5 | 0-1.0 | 0-1.5 | 0-2.0 | 0-2.5 | 0-3.0 | over 3.0 |
| Farm house | 65 | 90 | 95 | 98 | 100 | 100 | 100 |
| Residence | 56 | 79 | 89 | 94 | 99 | 100 | 100 |
| Shop | 38 | 63 | 77 | 88 | 96 | 99 | 100 |
| Office, etc. (1 | 54 | 87 | 97 | 99 | 100 | 100 | 100 |

(1 : Office, school, hospital, factory, mosque, chruch and kiosk.

Table 9-3-6 Rate of Damage to Building Submerged

| Water level above floor ( m ) | Rate of damage |
|---|---|
| 0 - 0.49 | 0.037 |
| 0.50 - 0.99 | 0.064 |
| 1.00 - 1.49 | 0.099 |
| 1.50 - 1.99 | 0.137 |
| 2.00 - 2.49 | 0.179 |

Source : Ministry of Construction, Japan.

Table 9-3-7 Rates of Damages to Properties Submerged
( Except Buildings )

| | Kind of properties | Rate of damage to submerged goods |
|---|---|---|
| (A) | Household effects of residence and farm house | 0.690 |
| (B) | Stored goods of shop | 0.597 |
| (C) | Properties of office, school, hospital, mosque, church and kiosk | 0.632 |

Source : Ministry of Construction, Japan.

Table 9-3-8 Damages to Properties by Flood Discharge

| Flood discharge ( $m^3/S$ ) | Damages to properties ( $10^6$ Rp ) |
|---|---|
| 865 | 4,469 |
| 610 | 3,054 |
| 540 | 1,090 |
| 430 | 455 |

Table 9-3-9 Rate of decrease in Yield of Paddy due to Submergence (%)

| Submergence depth | duration (days) | Tillering stage 0 - 70 th day (0-54 %) | Booling St. 71 - 87 th (55-67 %) | Heading St. 88 - 100 (68-77 %) | Ripaning St. 101 - 130 th (78 - 100 %) |
|---|---|---|---|---|---|
| Case(1) | 1 to 2 | 10 % | 70 % | 30 % | 5 % |
| Over | 3 to 4 | 20 | 80 | 80 | 20 |
| Plant | 5 to 6 | 30 | 85 | 90 | 30 |
| Height | Over 7 | 35 | 95 | 100 | 30 |
| Case(2) | 1 to 2 | 6 | 40 | 10 | 4 |
| 75% of | 3 to 4 | 9 | 46 | 23 | 15 |
| Plant | 5 to 6 | 14 | 49 | 26 | 23 |
| Height | Over 7 | 16 | 55 | 30 | 23 |
| Case(3) | 1 to 2 | 4 | 37 | 8 | 2 |
| 50% of | 3 to 4 | 9 | 42 | 22 | 4 |
| Plant | 5 to 6 | 13 | 45 | 25 | 6 |
| Height | Over 7 | 15 | 50 | 28 | 6 |

Table 9-3-10 Ammount of Damage per ha to Paddy by Submergence

| Submergence Depth (m) | Amount of damage (Rp/ha) | |
|---|---|---|
| | (1) | (2) |
| 0.0 - 0.49 | 20,300 | 25,400 |
| 0.50 - 0.99 | 57,500 | 71,800 |
| 1.00 - 1.49 | 75,700 | 94,600 |
| 1.50 - 1.99 | 77,000 | 96,200 |
| over - 2.00 | 77,000 | 96,200 |

(1) : without irrigation and drainage improvement.
(2) : with irrigation and drainage improvement.

Table 9-3-11 Damage to Paddy by Flood Discharge

| Flood discharge ($m^3/S$) | Damages to paddy ($10^6$ Rp) | |
|---|---|---|
| | (1) | (2) |
| 865 | 577 | 721 |
| 610 | 232 | 290 |
| 540 | 251 | 314 |
| 430 | 54 | 68 |

(1) : without irrigation and drainage improvement.
(2) : with irrigation and drainage improvement.

Table 9-3-12 Prices and Yields of Palm Oil, Palm Kennel and Rubber

| Kind of Crops | Price (Rp/Kg) | Yield (Kg/ha) |
|---|---|---|
| Palm oil | 200 | 2,400 |
| Palm kennel | 130 | 600 |
| R u b b e r | 250 | 1,000 |

Table 9-3-13 Rates of Decrease in Yield of Palm Oil and Rubber (Rp/ha)

| Inundation depth | Suspended period of production (1 ( days ) | Rate of decrease in yield(Rp/ha) | |
|---|---|---|---|
| | | Palm oil (includes palm kennel) | Rubber |
| 0.0 - 0.49 | 10 | 15,300 | 6,900 |
| 0.50 - 0.99 | 26 | 39,700 | 17,800 |
| 1.00 - 1.49 | 45 | 68.800 | 30,800 |
| 1.50 - 1.99 | 64 | 97,800 | 43,800 |
| 2.00 - 2.49 | 80 | 122,300 | 54,800 |

(1 : Suspended period of production was calculated using a relation between depth and duration of inundation in the Feasibility Study Report of the Urgent Flood Control Project.

Table 9-3-14 Damages to Palm Oil and Rubber by Flood Discharge

| Flood discharge ($m^3/S$) | Amount of damages ( $10^6$ Rp ) | |
|---|---|---|
| | Palm oil (1 | R u b b e r |
| 865 | 423 | 19 |
| 610 | 330 | 5 |
| 540 | 161 | 4 |
| 430 | 52 | 1 |

(1 : includes palm kernel.

Table 9-3-15 Damages to Facilities in the Plantation by Flood Discharge

| Flood discharge ($m^3/S$) | Damages to facilities in the plantation ($10^6$ Rp) |
|---|---|
| 865 | 55 |
| 610 | 55 |
| 540 | 21 |
| 430 | 10 |

Table 9-3-16 Harvested Area, Yield and Unit Price of Crops

| Kind of crops | harvested Area(1 (Ha) | (%) | Yield(2 (ton/Ha) | Price(3 (Rp/kg) |
|---|---|---|---|---|
| Cassava | 270 | 49 | 11.9 | 12.25 |
| Sweet potatoes | 94 | 17 | 11.9 | 12.25 |
| Peanuts | 16 | 3 | 1.09 | 127.23 |
| Soya beans | 103 | 19 | 0.95 | 97.91 |
| Small green peas | 64 | 12 | 0.95 | 97.91 |
| T o t a l | 547 | 100 | | |

(1 : Average harvested area of 4 Kecamatan (Galang, L.Pakam, Perbaungan and P.Cermin for 3 years 1974-76).

(2 : Average yield in the project area for 6 years (1970-1976).

(3 : 1977 price level.

Table 9-3-17 Rate of damage to Upland Crops

| Inundation | | Rate of damage |
|---|---|---|
| Depth (m) | Duration (days) | |
| 0.00 - 0.49 | 3 - 5 | 0.35 |
| 0.50 - 0.99 | 4 - 6 | 0.67 |
| 1.00 - 1.49 | 5 - 7 | 0.85 |
| 1.50 - 1.99 | 5 - 7 | 0.95 |
| 2.00 - 2.49 | over- 7 | 0.99 |

Table 9-3-18 Damages to Upland Crops by Flood Discharge

| Flood discharge ( $m^3/S$ ) | Damages to crops ( $10^6$ Rp ) |
|---|---|
| 865 | 32 |
| 610 | 22 |
| 540 | 19 |
| 430 | 4 |

Table 9-3-19 Losses due to Suspernsion of Business Activities

| Flood discharge ($m^3/S$) | Losses due to suspension of Business Activities ($10^6$ Rp) |
|---|---|
| 865 | 268 |
| 610 | 183 |
| 540 | 63 |
| 430 | 27 |

Table 9-3-20 Traffic and Transport Volumes on the Railway and Highway Passing in the Project Area

| Made of transport | Passenger car (car/day) | Passenger (person/day) | Freight car or truck (car/day) | Freight (ton/day) |
|---|---|---|---|---|
| Railway | 24 (1 | 2,100 (2 | 40 | 1,900 |
| Highway | 3,000 (1 | 28,000 (2 | 1,400 | 9,800 |

(1 : Includes buses of 600.
(2 : Includes passenger of 14,000 by buses.

Table 9-3-21 Matters to be Required to Estimate the Losses due to Suspension of Business Activities

| I t e m | Unit | Railway | Highway |
|---|---|---|---|
| 1. Average fare per passen er | Rp | 500 | 250 |
| 2. Average transportation range or freight | km | 200 | 150 |
| 3. Transportation charge of freight per ton. km | Rp | 8 | 100 |
| 4. Ratio of business truck to entire truck | % | - | 40 |
| 5. Rate of profit to transportation fare or charge | % | 20 | 20 |

Table 9-3-22 Loss due to Interruption of Traffic per Day

| Description | Calculation |
|---|---|
| A. Accumulation of freight | Rp 100,000 x (1,900 + 9,800) ton x 0.1 ÷ 365 = 0.32 million Rp |
| B. Suspension of business | |
| a. Railway business for passenger | Rp500 x 2,100 persons x 0.2 = 0.21 million Rp. |
| b. Railway business for freight | Rp8 x 1,900 ton x 200 km x 0.2 = 0.16 million Rp. |
| c. Bus business on the highway | Rp250 x 14,000 persons x 0.2 = 0.70 million Rp. |
| d. Truck business on the highway | Rp100 x 9,800 ton x 150 km x 0.4 x 0.2 = 11.76 million Rp. |

Table 9-3-23 Losses due to Interruption of Traffic by Flood Discharge

| Flood discharge ( $m^3/S$ ) | Losses due to interruption of traffic ( $10^6$ Rp ) |
|---|---|
| 865 | 75 |
| 610 | 50 |
| 540 | 50 |
| 430 | 25 |

Table 9-3-24 Flood Damage by Discharge without Urgent Project and Irrigation/Drainage Improvement

| Item | Flood discharges ($m^3/S$) | | | |
|---|---|---|---|---|
| | 865 | 610 | 540 | 430 |
| (1) Public facilities | 278 | 88 | 194 | 67 |
| (2) Houses and household effects | 4,469 | 3,053 | 1,090 | 455 |
| (3) P a d d y | 577 | 232 | 251 | 54 |
| (4) Palm oil and rubber | 442 | 334 | 165 | 53 |
| (5) Facilities in plantation | 55 | 55 | 21 | 10 |
| (6) Upland crops | 32 | 22 | 19 | 4 |
| (7) Suspension of business activities | 268 | 183 | 63 | 27 |
| (8) Interruption of traffic | 75 | 50 | 50 | 25 |
| T o t a l | 6,196 | 4,017 | 1,853 | 695 |

Table 9-3-25 Flood Damages by Discharge in the Present Situation

Unit: Million Rp

| Discharge ( $m^3/S$ ) | Return period (year) | Flood damage ($10^6$ Rp) |
|---|---|---|
| 200 | 1 | 0 |
| 400 | 2 | 255 |
| 600 | 8 | 1,840 |
| 800 | 33 | 6,050 |

Table 9-3-26 Increase in Flood Damage in Case of "with Irrigation/Drainage Improvement and without Flood Control"

Unit: Million Rp

| Item | Flood discharge ($m^3/S$) | | | |
|---|---|---|---|---|
| | 865 | 610 | 540 | 430 |
| A. Public facilities | | | | |
| a. Intakes | 19 | 0 | 0 | 0 |
| b. Canals | 36 | 16 | 13 | 0 |
| c. Sub-total | 55 | 16 | 13 | 0 |
| B. Paddy | | | | |
| a. Due to increase in yield | 144 | 58 | 31 | 7 |
| b. Due to damages agricultural facilities | 9,417 | 899 | 628 | 119 |
| c. Sub-total | 9,561 | 957 | 659 | 126 |
| C. T o t a l | 9,616 | 973 | 672 | 126 |

Table 9-3-27 Increase in Flood Damages to Paddy and to Intakes and Canals to be Constructed newly in Case of "with Irrigation/Drainage Improvement and without Flood Control"

Unit: Million Rp

| Flood discharge ($m^3/s$) | Flood damages to paddy | | Flood damages to intakes and canals |
|---|---|---|---|
| | Due to alternation in yield (3.6 ton/ha 4.5 ton/ha) (1) | Due to damages of intakes and Canals (2) | |
| 200 | 0 | 0 | 0 |
| 400 | 3 | 103 | 0 |
| 600 | 54 | 860 | 16 |
| 800 | 128 | 7,246 | 43 |
| 1,000 | 165 | 9,417 | 47 |
| 1,200 | 183 | 9,417 | 48 |

Table 9-3-28 Increase in Average Annual Flood Damage to Paddy and Intakes and Canals to be Constructed newly in Case of "with Irrigation/Drainage Improvement and without Flood Control"

Unit: Million Rp

| Flood discharge ($m^3/s$) | Average annual flood damage | | | | |
|---|---|---|---|---|---|
| | To paddy | | | To intakes & canals | Total |
| | (1) | (2) | Sub total | | |
| 200 to 800 | 20 | 590 | 610 | 6 | 616 |
| over 800 | 4 | 242 | 246 | 1 | 247 |
| Total | 24 | 832 | 856 | 7 | 863 |

(1): Flood damage to paddy to difference between 4.5 ton/ha and 3.6 ton/ha.

(2): Decrease in production of paddy due to flood damages to intakes and canals.

Table 9-3-29 Average Annual Flood Damage without Flood Control

Unit: Million Rp

| Description | Average annual benefit |
|---|---|
| (1) without irrigation & drainage project conditions | 830 |
| (2) with irrigation & drainage project conditions | 1,446 |

Table 9-4-1 Economic Construction Cost of Flood Control Component;
Alternative 1: 7-Year Plan on Full-contructing System

| Fiscal year | Equipment | | Spare parts | | Materials | | Labor | | Land acquisition | | Personnel in E/A | | Contingency | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | Total ($10^3$Rp) |
| 1978/79 | - | 76,883 | - | - | 2,366 | 83,000 | 2,258 | - | - | - | 10,537 | 78,840 | 2,274 | 35,809 | 17,435 | 274,532 | 131,366 |
| 1979/80 | - | - | - | - | 9,462 | - | 9,033 | - | 47,995 | - | 42,150 | 315,360 | 16,296 | 47,304 | 124,936 | 362,664 | 275,442 |
| 1980/81 | - | 398,102 | - | 195,457 | 65,353 | 128,631 | 38,478 | 22,851 | 49,016 | - | 14,070 | 142,340 | 25,038 | 133,107 | 191,955 | 1,020,488 | 615,457 |
| 1981/82 | - | 594,949 | - | 292,104 | 105,152 | - | 55,492 | 33,816 | - | - | 14,070 | 142,340 | 26,207 | 159,481 | 200,921 | 1,222,690 | 708,337 |
| 1982/83 | - | 586,860 | - | 288,133 | 112,505 | - | 61,587 | 37,743 | 42,889 | - | 14,071 | 142,340 | 34,658 | 158,261 | 265,710 | 1,213,337 | 769,245 |
| 1983/84 | - | 610,060 | - | 299,522 | 146,451 | - | 124,393 | 78,209 | 53,100 | - | 14,071 | 142,340 | 50,702 | 169,520 | 388,717 | 1,299,652 | 928,073 |
| 1984/85 | - | 596,093 | - | 292,665 | 210,840 | - | 96,061 | 59,955 | - | - | 14,071 | 142,340 | 48,146 | 163,658 | 369,118 | 1,254,711 | 899,823 |
| Total | - | 2,862,948 | | 1,367,881 | 652,129 | - | 387,302 | 232,574 | 193,000 | - | 123,040 | 1,105,900 | 203,321 | 867,140 | 1,558,792 | 6,648,074 | 4,317,743 |

Note : E/A means Engineering and Administration.

Table 9-4-2 Economic Construction Cost of Irrigation/Drainage Component;
Alternative 1: 7-Year Plan on Full-contracting System

| Fiscal year | Equipment | | Spare parts | | Materials | | Labor | | Land acquisition | | Personnel in E/A | | Contingency | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | Total ($10^3$Rp) |
| 1978/79 | - | 56,381 | - | - | 5,603 | 38,410 | 5,348 | - | - | - | 24,958 | 116,800 | 5,386 | 31,739 | 41,295 | 243,330 | 142,277 |
| 1979/80 | - | 9,959 | - | 5,861 | 18,195 | - | 20,630 | - | 86,080 | - | 58,227 | 467,199 | 27,470 | 72,453 | 210,602 | 555,472 | 441,123 |
| 1980/81 | - | 320,614 | - | 188,679 | 411,355 | - | 460,134 | 57,736 | 106,020 | - | 63,476 | 158,700 | 156,148 | 108,860 | 1,197,133 | 834,589 | 1,543,487 |
| 1981/82 | - | 299,546 | - | 176,281 | 356,719 | - | 434,573 | 81,703 | 73,780 | - | 63,477 | 158,700 | 139,282 | 107,435 | 1,067,831 | 823,665 | 1,409,652 |
| 1982/83 | - | 297,951 | - | 175,343 | 365,287 | - | 407,671 | 72,685 | 98,060 | - | 63,477 | 158,700 | 140,174 | 105,703 | 1,074,669 | 810,382 | 1,410,978 |
| 1983/84 | - | 376,560 | - | 221,604 | 505,031 | - | 498,027 | 133,918 | 53,060 | - | 63,476 | 158,700 | 167,939 | 133,618 | 1,287,533 | 1,024,400 | 1,712,659 |
| 1984/85 | - | 249,817 | - | 147,015 | 478,384 | - | 439,320 | 132,078 | - | - | 63,476 | 158,700 | 147,177 | 103,142 | 1,128,357 | 790,752 | 1,456,519 |
| Total | - | 1,610,828 | - | 914,783 | 2,140,574 | 38,410 | 2,265,703 | 478,120 | 417,000 | - | 400,567 | 1,377,499 | 783,576 | 662,950 | 6,007,420 | 5,082,590 | 8,116,695 |

Note : E/A means Engineering and Administration.

Table 9-4-3 Economic Construction Cost of Flood Control Component;
Alternative 2: 7-Year Plan on Equipment-lending System

| Fiscal year | Equipment | | Spare parts | | Materials | | Labor | | Land acquisition | | Personnel in E/A | | Contingency | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | Total ($10^3$Rp) |
| 1978/89 | - | 76,883 | - | - | 2,369 | 83,000 | 2,261 | - | - | - | 10,552 | 78,840 | 2,277 | 35,808 | 17,459 | 274,531 | 131,389 |
| 1979/80 | - | 341,872 | - | - | 9,474 | - | 9,044 | - | 47,995 | - | 42,206 | 315,360 | 16,308 | 98,585 | 125,027 | 755,817 | 438,691 |
| 1980/81 | - | 1,533,849 | - | - | 65,349 | 128,631 | 47,373 | - | 49,016 | - | 14,088 | 142,340 | 26,374 | 270,723 | 202,200 | 2,075,543 | 1,063,550 |
| 1981/82 | - | 817,659 | 37,391 | 246,921 | 105,142 | - | 68,649 | - | - | - | 14,088 | 142,340 | 33,791 | 181,038 | 259,061 | 1,387,958 | 835,064 |
| 1982/83 | | 608,889 | 37,391 | 246,921 | 112,494 | - | 76,272 | - | 42,889 | - | 14,089 | 142,340 | 42,470 | 149,722 | 325,604 | 1,147,872 | 801,971 |
| 1983/84 | - | - | 37,391 | 246,921 | 146,436 | - | 154,817 | - | 53,100 | - | 14,089 | 142,340 | 60,875 | 58,389 | 466,708 | 447,650 | 652,483 |
| 1984/85 | - | - | 37,392 | 246,921 | 210,815 | - | 119,385 | - | - | - | 14,089 | 142,340 | 57,252 | 58,390 | 438,933 | 447,651 | 624,708 |
| Total | - | - | 149,565 | 987,684 | 652,079 | 211,631 | 477,801 | - | 193,000 | - | 123,200 | 1,105,900 | 239,347 | 852,655 | 1,834,992 | 6,537,022 | 4,547,856 |

Note : E/A means Engineering and Administration.

Table 9-4-4 Economic Cost of Irrigation/Drainage Component;
Alternative 2: 7-Year Plan on Equipment-lending System

| Fiscal year | Equipment | | Spare parts | | Materials | | Labor | | Land acquisition | | Personnel in E/A | | Contingency | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | Total ($10^3$Rp) |
| 1978/79 | - | 56,381 | - | - | 5,603 | 38,410 | 5,348 | - | - | - | 24,958 | 116,800 | 5,386 | 31,739 | 41,295 | 243,330 | 142,277 |
| 1979/80 | - | 355,426 | 512 | - | 18,195 | - | 20,631 | - | 86,080 | - | 58,227 | 467,199 | 27,547 | 123,394 | 211,192 | 946,019 | 603,790 |
| 1980/81 | - | 1,090,480 | 15,031 | 147,248 | 411,355 | - | 482,608 | - | 106,020 | - | 63,476 | 158,700 | 161,773 | 209,464 | 1,240,263 | 1,605,892 | 1,906,708 |
| 1981/82 | - | 497,153 | 14,188 | 179,969 | 356,719 | - | 465,702 | - | 73,780 | - | 63,477 | 158,700 | 146,080 | 125,373 | 1,119,946 | 961,195 | 1,518,842 |
| 1982/83 | - | - | 14,485 | 217,188 | 365,287 | - | 435,539 | - | 98,060 | - | 63,477 | 158,700 | 146,512 | 56,383 | 1,123,260 | 432,271 | 1,302,653 |
| 1983/84 | - | - | 17,020 | 173,751 | 505,031 | - | 548,302 | - | 53,060 | - | 63,476 | 158,700 | 178,033 | 49,867 | 1,364,922 | 382,318 | 1,523,584 |
| 1984/85 | - | - | 11,587 | 130,313 | 478,384 | - | 488,078 | - | - | - | 63,476 | 158,700 | 156,229 | 43,352 | 1,197,754 | 332,365 | 1,335,685 |
| Total | - | 1,999,440 | 72,823 | 848,469 | 2,140,574 | 38,410 | 2,446,108 | - | 417,000 | - | 400,567 | 1,377,499 | 821,560 | 639,572 | 6,298,632 | 4,903,390 | 8,333,539 |

Note : E/A means Engineering and Administration.

Table 9-4-5 Economic Construction Cost of Flood Control Component;
Alternative 3: 5-Year Plan on Full-contracting System

| Fiscal year | Equipment | | Spare parts | | Materials | | Labor | | Land acquisition | | Personnel in E/A | | Contingency | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | Total ($10^3$Rp) |
| 1978/79 | - | 76,883 | - | - | 2,366 | 83,000 | 2,258 | - | - | - | 10,537 | 78,840 | 2,274 | 35,808 | 17,435 | 274,531 | 131,365 |
| 1979/80 | - | - | - | - | 9,462 | 0 | 9,033 | - | 47,995 | - | 42,150 | 315,360 | 16,296 | 47,304 | 124,936 | 362,664 | 275,442 |
| 1980/81 | - | 811,293 | - | 372,198 | 139,765 | 128,631 | 77,446 | 46,585 | 42,889 | - | 23,451 | 186,766 | 42,533 | 231,821 | 326,084 | 1,777,294 | 1,063,661 |
| 1981/82 | - | 838,970 | - | 384,897 | 198,639 | - | 150,758 | 93,674 | 102,116 | - | 23,451 | 186,767 | 71,244 | 225,646 | 546,208 | 1,729,954 | 1,264,139 |
| 1982/83 | - | 1,197,279 | - | 549,278 | 301,672 | - | 148,056 | 92,252 | - | - | 23,451 | 186,767 | 70,977 | 303,837 | 544,156 | 2,329,413 | 1,510,862 |
| Total | - | 2,924,425 | - | 1,306,373 | 651,904 | 211,631 | 387,551 | 232,511 | 193,000 | - | 123,040 | 954,500 | 203,324 | 844,416 | 1,558,819 | 6,473,856 | 4,245,469 |

Note : E/A means Engineering and Administration.

Table 9-4-6 Economic Construction Cost of Irrigation/Drainage Component;
Alternative 3: 5-Year Plan on Full-contracting System

| Fiscal year | Equipment | | Spare parts | | Materials | | Labor | | Land acquisition | | Personnel in E/A | | Contingency | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | Total ($10^3$Rp) |
| 1978/79 | - | 56,381 | - | - | 5,603 | 38,410 | 5,348 | - | - | - | 24,958 | 116,800 | 5,386 | 31,739 | 41,295 | 243,330 | 142,277 |
| 1979/80 | - | 14,227 | - | 8,373 | 20,396 | - | 24,119 | - | 156,520 | - | 58,227 | 467,199 | 38,889 | 73,470 | 298,151 | 563,269 | 531,908 |
| 1980/81 | - | 543,753 | - | 319,995 | 617,776 | - | 758,442 | 139,502 | 176,570 | - | 105,794 | 231,240 | 248,787 | 185,174 | 1,907,369 | 1,419,664 | 2,496,529 |
| 1981/82 | - | 562,389 | - | 330,963 | 781,043 | - | 782,265 | 134,804 | 83,910 | - | 105,794 | 231,240 | 262,952 | 188,909 | 2,015,964 | 1,448,305 | 2,617,011 |
| 1982/83 | - | 434,078 | - | 255,452 | 715,756 | - | 695,529 | 203,814 | - | - | 105,794 | 231,240 | 227,562 | 168,688 | 1,744,641 | 1,293,272 | 2,281,349 |
| Total | - | 1,610,828 | - | 914,783 | 2,140,574 | 38,410 | 2,265,703 | 478,120 | 417,000 | - | 400,567 | 1,277,719 | 783,576 | 647,980 | 6,007,420 | 4,967,840 | 8,069,074 |

Note : E/A means Engineering and Administration.

Table 9-4-7 Economic Construction Cost of Flood Control Component;
Alternative 4: 5-Year Plan on Equipment-lending System

| Fiscal year | Equipment | | Spare parts | | Materials | | Labor | | Land acquisition | | Personnel in E/A | | Contingency | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | Total ($10^3$Rp) |
| 1978/79 | - | 76,883 | - | - | 2,369 | 83,000 | 2,261 | - | - | - | 10,552 | 78,840 | 2,277 | 35,808 | 17,459 | 274,531 | 131,389 |
| 1979/80 | - | 740,396 | - | - | 9,474 | - | 9,044 | - | 47,995 | - | 42,206 | 315,360 | 16,308 | 158,363 | 125,027 | 1,214,119 | 628,887 |
| 1980/81 | - | 2,961,584 | - | - | 139,738 | 128,631 | 95,503 | - | 42,889 | - | 23,481 | 186,766 | 45,242 | 491,547 | 346,853 | 3,768,528 | 1,910,792 |
| 1981/82 | - | - | 74,677 | 463,229 | 198,640 | - | 187,095 | - | 102,116 | - | 23,481 | 186,767 | 87,901 | 97,500 | 673,910 | 147,496 | 984,121 |
| 1982/83 | - | - | 74,678 | 463,230 | 301,823 | - | 184,155 | - | - | - | 23,481 | 186,767 | 87,620 | 97,500 | 671,757 | 747,497 | 981,968 |
| Total | | 3,778,863 | 149,355 | 926,459 | 652,044 | 211,631 | 478,058 | - | 193,000 | - | 123,201 | 954,500 | 239,348 | 880,718 | 1,835,006 | 6,752,171 | 4,637,157 |

Note : E/A means Engineering and Administration.

Table 9-4-8 Economic Construction Cost of Irrigation/Drainage Component;
Alternative 4: 5-Year Plan on Equipment-lending System

| Fiscal year | Equipment | | Spare parts | | Materials | | Labor | | Land acquisition | | Personnel in E/A | | Contingency | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | L.C ($10^3$Rp) | F.C (US$) | Total ($10^3$Rp) |
| 1978/79 | - | 56,381 | - | - | 5,603 | 38,410 | 5,348 | - | - | - | 24,958 | 116,800 | 5,386 | 31,739 | 41,295 | 243,330 | 142,277 |
| 1979/80 | - | 764,952 | 731 | - | 20,396 | - | 24,121 | - | 156,520 | - | 58,227 | 467,199 | 38,999 | 184,821 | 298,994 | 1,416,972 | 887,037 |
| 1980/81 | - | 1,290,899 | 25,305 | 317,830 | 617,776 | - | 811,656 | - | 176,570 | - | 105,794 | 231,240 | 260,565 | 275,994 | 1,997,666 | 2,115,963 | 2,875,791 |
| 1981/82 | - | - | 26,949 | 363,235 | 781,043 | - | 833,605 | - | 83,910 | - | 105,794 | 231,240 | 274,695 | 89,170 | 2,105,996 | 683,645 | 2,389,709 |
| 1982/83 | - | - | 19,838 | 227,022 | 715,756 | - | 771,378 | - | - | - | 105,794 | 231,240 | 241,915 | 68,738 | 1,854,681 | 527,000 | 2,073,386 |
| Total | - | 2,112,232 | 72,823 | 908,087 | 2,140,574 | 38,410 | 2,446,108 | - | 417,000 | - | 400,567 | 1,227,719 | 821,560 | 650,462 | 6,298,632 | 4,986,910 | 8,368,200 |

Note : E/A means Engineering and Administration.

Table 9-4-9 Economic Construction Cost of the Project in 7-year Plan

Unit: Million Rp

| Year after base year | Fiscal year | Full-contracting system | | | Equipment-lending system | | |
|---|---|---|---|---|---|---|---|
| | | Flood control | Irrigation & drainage | Total | Flood control | Irrigation & drainage | Total |
| 1 | 1978/79 | 131 | 142 | 273 | 131 | 142 | 273 |
| 2 | 1979/80 | 276 | 441 | 717 | 439 | 604 | 1,043 |
| 3 | 1980/81 | 616 | 1,543 | 2,159 | 1,064 | 1,907 | 2,971 |
| 4 | 1981/82 | 708 | 1,410 | 2,118 | 835 | 1,519 | 2,354 |
| 5 | 1982/83 | 769 | 1,411 | 2,180 | 802 | 1,303 | 2,105 |
| 6 | 1983/84 | 928 | 1,713 | 2,641 | 652 | 1,523 | 2,175 |
| 7 | 1984/85 | 890 | 1,456 | 2,346 | 625 | 1,336 | 1,961 |
| T o t a l | | 4,318 | 8,116 | 12,434 | 4,548 | 8,334 | 12,882 |

Table 9-4-10 Economic Construction Cost of the Project in 5-year Plan

Unit: Million Rp

| Year after base year | Fiscal year | Full-contracting system | | | Equipment-lending system | | |
|---|---|---|---|---|---|---|---|
| | | Flood control | Irrigation & drainage | Total | Flood control | Irrigation & drainage | Total |
| 1 | 1978/79 | 131 | 142 | 273 | 131 | 142 | 273 |
| 2 | 1979/80 | 276 | 532 | 808 | 629 | 887 | 1,516 |
| 3 | 1980/81 | 1,064 | 2,497 | 3,561 | 1,911 | 2,876 | 4,787 |
| 4 | 1981/82 | 1,264 | 2,617 | 3,881 | 984 | 2,390 | 3,374 |
| 5 | 1982/83 | 1,511 | 2,281 | 3,792 | 982 | 2,073 | 3,055 |
| T o t a l | | 4,246 | 8,069 | 12,315 | 4,637 | 8,368 | 13,005 |

Table 9-4-11 Economic Operation and Maintenance Cost of the Project

Unit: Million Rp

| Year after base year | Fiscal year | 7-year plan | | | 5-year plan | | |
|---|---|---|---|---|---|---|---|
| | | Flood control | Irrigation & drainage | Total | Flood control | Irrigation & drainage | Total |
| 4 | 1981/82 | 5 | 18 | 23 | 8 | 30 | 38 |
| 5 | 1982/83 | 9 | 37 | 46 | 14 | 59 | 73 |
| 6 | 1983/84 | 13 | 52 | 65 | 22 | 76 | 98 |
| 7 | 1984/85 | 17 | 65 | 82 | 22 | 76 | 98 |
| 8 | 1985/86 | 22 | 76 | 98 | 22 | 76 | 98 |
| : | : | : | : | : | : | : | : |
| : | : | : | : | : | : | : | : |
| : | : | : | : | : | : | : | : |
| 55 | 2032/33 | 22 | 76 | 98 | 22 | 76 | 98 |
| 56 | 2033/34 | 22 | 76 | 98 | - | - | - |
| 57 | 2034/35 | 22 | 76 | 98 | - | - | - |
| T o t a l | | 1,144 | 3,972 | 5,116 | 1,122 | 3,889 | 5,011 |

Table 9-4-12 Economic Replacement Cost for Gates of Irrigation Facilities

Unit: Million Rp

| Year after base year | Fiscal year | Replacement cost | |
|---|---|---|---|
| | | 7-year plan | 5-year plan |
| 33 | 2010/11 | 28 | 31 |
| 34 | 2011/12 | 13 | 26 |
| 35 | 2012/13 | 12 | 27 |
| 36 | 2013/14 | 12 | - |
| 37 | 2014/15 | 19 | - |

Table 9-4-13 Annual Economic Irrigation Benefit in the Full Stage

| | | Area ( ha ) | Unit yield (t/ha) | Total production (ton) | Unit price (Rp/t) | Gross income ($10^6$Rp) | Input area ( ha ) | Unit production cost(Rp) | Gross out go ($10^6$Rp) | Primary profit ($10^6$Rp) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5)=3x4 | (6) | (7) | (8)=6x7 | (9)=5 - 8 |
| Without I/D impr. without flood control | Paddy | | | | | 5,343 | | | 2,084 | 3,259 |
| | Rainfed | 14,000(w) | 3.3 | 46,200 | 65,000 | 3,003 | 14,000 | 82,000 | 1,148 | 1,855 |
| | Irrigated | 4,500(w) | 4.0 | 18,000 | 65,000 | 1,170 | 4,500 | 104,000 | 468 | 702 |
| | area | 4,500(D) | 4.0 | 18,000 | 65,000 | 1,170 | 4,500 | 104,000 | 468 | 702 |
| | Other Crops (1 | | | | | 127 | | | 33 | 94 |
| | Cassava | 654 | 11.9 | 7,800 | 12,250 | 95 | 654 | 35,000 | 23 | 72 |
| | Peanuts | 170 | 1.09 | 190 | 127,230 | 24 | 170 | 47,000 | 8 | 16 |
| | Soybeans | 80 | 0.95 | 80 | 97,910 | | 80 | 30,000 | 2 | 6 |
| | T o t a l | | | | | 5,470 | | | 2,117 | 3,353 |
| With I/D impr. without flood control | Paddy | | | | | 10,822 | | | 4,330 | 6,492 |
| | Irrigated | 18,500(w) | 4.5 | 83,250 | 65,000 | 5,411 | 18,500 | 117,000 | 2,165 | 3,246 |
| | area | 18,500(D) | 4.5 | 83,250 | 65,000 | 5,411 | 18,500 | 117,000 | 2,165 | 3,246 |
| | Other crops | | | | | 0 | | | 0 | 0 |
| | Cassava | - | - | - | - | - | - | - | - | - |
| | Peanuts | - | - | - | - | - | - | - | - | - |
| | Soybeans | - | - | - | - | - | - | - | - | - |
| | T o t a l | | | | | 10,822 | | | 4,330 | 6,492 |
| | Benefit | | | | | | | | | 3,139 (2 |

Notes: (1 2nd crops to be cultivated in the rain-fed area after harvesting of 1st paddy (west season paddy).
(2 $6,492 \times 10^6 - 3,353 \times 10^6$
I/D means irrigation and drainage.

Table 9-4-14 Economic Irrigation and Drainage Benefit in Building-up Period in the Project Area in 7-year Plan

Unit: Million Rp

| 1st(1 | 2nd(2 | 3rd(3 | 4th | 5th | 6th | 7th | 8th | 9th |
|---|---|---|---|---|---|---|---|---|
| 0 | 119 | 327 | 608 | 939 | 1,438 | 1,887 | 2,335 | 2,665 |

| 10th | 11th | in and after 12th |
|---|---|---|
| 2,908 | 3,070 | 3,139 |

Table 9-4-15 Economic Irrigation and Drainage Benefit in Building-up Period in the Project Area in 5-year Plan

Unit: Million Rp

| 1st(1 | 2nd(2 | 3rd(3 | 4th | 5th | 6th | 7th | 8th | 9th | 10th |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 167 | 496 | 946 | 1,395 | 1,845 | 2,294 | 2,742 | 3,024 | 3,139 |

Notes: (1 At the end of 1st year, implementation of 7,300 ha for Sumber Rejo, Ramonia, Bendang and Pulau Gambar areas will be finished.

(2 At the end of 2nd year, implementation of 7,000 ha for Perbaungan and Buluh (1/3) area will be finished.

(3 At the end of 3rd year, implementation of 4,200 ha for Buluh (2/3), Singosari and Timbang Deli areas will be finished.

Table 9-4-16 Annual Economic Benefit of Irrigation and Drainage Improvement without Flood Control

A. 7-year plan

Unit: Million Rp

| Description year | Fiscal year 1981/82 | 1982/83 | 1983/84 | 1984/85 | 1985/86 | 1986/87 | 1987/88 | 1988/89 | 1989/90 | 1990/91 | 1991/92 | .... | 2034/35 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Irrigation/ drainage benefit, flood damage excluded | 119 | 327 | 608 | 989 | 1,438 | 1,887 | 2,335 | 2,665 | 2,908 | 3,070 | 3,139 | ..... | 3,139 |
| " (%) | (3.79) | (10.42) | (19.37) | (31.51) | (45.81) | (60.11) | (74.39) | (84.90) | (92.64) | (97.80) | (100) | .... | (100) |
| 2. Flood damage | 33 | 90 | 167 | 272 | 395 | 519 | 642 | 733 | 799 | 844 | 863 | .... | 863 |
| 3. Irrigation/ drainage benefit without flood control | 86 | 237 | 441 | 717 | 1,043 | 1,368 | 1,693 | 1,932 | 2,109 | 2,226 | 2,276 | .... | 2,276 |

B. 5-year plan

Unit: Million Rp

| Description | Fiscal year 1981/82 | 1982/83 | 1983/84 | 1984/85 | 1985/86 | 1986/87 | 1987/88 | 1988/89 | 1989/90 | .... | 2032/33 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Irrigation/ drainage benefit, flood damage excluded | 167 | 496 | 946 | 1,395 | 1,845 | 2,294 | 2,742 | 3,024 | 3,139 | ..... | 3,139 |
| " (%) | (5.32) | (15.80) | (30.14) | (44.44) | (58.78) | (73.08) | (87.35) | (96.34) | (100) | ..... | (100) |
| 2. Flood damage | 46 | 136 | 260 | 384 | 507 | 631 | 754 | 831 | 863 | ..... | 863 |
| 3. Irrigation/ drainage benefit without flood control | 121 | 360 | 686 | 1,011 | 1,338 | 1,663 | 1,988 | 2,193 | 2,276 | ..... | 2,276 |

Table 9-4-17 Increase in Average Annual Economic Benefit of Flood Control in Building-up Period of Irrigation and Drainage Improvement

A. 7-year plan

Unit: Million Rp

| Description | Fiscal year 1981/82 | 1982/83 | 1983/84 | 1984/85 | 1985/86 | 1986/87 | 1987/88 | 1988/89 | 1989/90 | 1990/91 | 1991/92 | .... | 2034/35 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Irrigation/ drainage benefit | 119 | 327 | 608 | 989 | 1,438 | 1,887 | 2,335 | 2,665 | 2,908 | 3,070 | 3,139 | .... | 3,139 |
| " (%) | (3.79) | (10.42) | (19.37) | (31.51) | (45.81) | (60.11) | (74.39) | (84.90) | (92.64) | (97.80) | (100) | .... | (100) |
| 2. Increase in flood damage | 23 | 64 | 119 | 194 | 282 | 370 | 458 | 523 | 571 | 602 | 616 | .... | 616 |
| 3. Completion rate of flood control works(%) | 23.56 | 39.93 | 57.70 | 79.28 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | .... | 100 |
| 4. Increase in benefit of flood control | 5 | 26 | 69 | 154 | 282 | 370 | 458 | 523 | 571 | 602 | 616 | .... | 616 |

B. 5-year plan

Unit: Million Rp

| Description | Fiscal year 1981/82 | 1982/83 | 1983/84 | 1984/85 | 1985/86 | 1986/87 | 1987/88 | 1988/89 | 1989/90 | ..... | 2032/33 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Irrigation/ drainage benefit | 167 | 496 | 946 | 1,395 | 1,845 | 2,294 | 2,742 | 3,024 | 3,139 | ..... | 3,139 |
| " (%) | (5.32) | (15.80) | (30.14) | (44.44) | (58.78) | (73.08) | (87.35) | (96.34) | (100) | ..... | (100) |
| 2. Increase in flood damage | 33 | 97 | 186 | 274 | 362 | 450 | 538 | 593 | 616 | ..... | 616 |
| 3. Completion rate of flood control works(%) | 34.51 | 64.35 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | ..... | 100 |
| 4. Increase in benefit of flood control | 11 | 62 | 186 | 274 | 362 | 450 | 538 | 593 | 616 | ..... | 616 |

Table 9-4-18 Average Annual Economic Benefit of the Project in 7-year Plan

Unit: Million Rp

| Year after base year | Fiscal year | Flood control | | | Irrigation/Drainage Improvement | | | Increase in benefit (1 | Project | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Benefit | Salvage value | Total | Benefit | Salvage value | Total | | Benefit | Salvage value | Total |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8)=(1)+(4)+(7) | (9)=(2)+(5) | (10) |
| 4 | 1981/82 | 196 | - | 196 | 86 | - | 86 | 5 | 287 | - | 287 |
| 5 | 1982/83 | 331 | - | 331 | 237 | - | 237 | 26 | 594 | - | 594 |
| 6 | 1983/84 | 479 | - | 479 | 441 | - | 441 | 69 | 989 | - | 989 |
| 7 | 1984/85 | 658 | 247 | 905 | 717 | 242 | 959 | 154 | 1,529 | 489 | 2,018 |
| 8 | 1985/86 | 830 | - | 830 | 1,043 | - | 1,043 | 282 | 2,155 | - | 2,155 |
| 9 | 1986/87 | 830 | - | 830 | 1,368 | - | 1,368 | 370 | 1,368 | - | 1,368 |
| 10 | 1987/88 | 830 | - | 830 | 1,693 | - | 1,693 | 458 | 2,981 | - | 2,981 |
| 11 | 1988/89 | 830 | - | 830 | 1,932 | - | 1,932 | 523 | 3,285 | - | 3,285 |
| 12 | 1989/90 | 830 | - | 830 | 2,109 | - | 2,109 | 571 | 3,510 | - | 3,510 |
| 13 | 1990/91 | 830 | - | 830 | 2,226 | - | 2,226 | 602 | 3,658 | - | 3,658 |
| 14 | 1991/92 | 830 | - | 830 | 2,276 | - | 2,276 | 616 | 3,722 | - | 3,722 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 57 | 2034/35 | 830 | - | 830 | 2,276 | - | 2,276 | 616 | 3,722 | - | 3,722 |
| | Total | 43,164 | 247 | 43,411 | 111,996 | 242 | 112,238 | 30,164 | 185,326 | 489 | 185,813 |

(1: Increase in benefit means decrease in flood damage to be deducted from benefit of the irrigation/drainage improvement.

Table 9-4-19 Average Annual Economic Benefit of the Project in 5-year Plan

Unit: Million Rp

| Year after base year | Fiscal year | Flood control | | | Irrigation/drainage improvement | | | Increase(1 in benefit | Project | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Benefit (1) | Salvage value (2) | Total (3) | Benefit (4) | Salvage value (5) | Total (6) | (7) | Benefit (8)=(1)+(4)+(7) | Salvage value (9)=(2)+(5) | Total (10) |
| 4 | 1981/82 | 286 | 229 | 286 | 121 | - | 121 | 11 | 418 | - | 418 |
| 5 | 1982/83 | 534 | 409 | 943 | 360 | 324 | 684 | 62 | 956 | 733 | 1,689 |
| 6 | 1983/84 | 830 | - | 830 | 686 | - | 686 | 186 | 1,702 | - | 1,702 |
| 7 | 1984/85 | 830 | - | 830 | 1,011 | - | 1,011 | 274 | 2,115 | - | 2,115 |
| 8 | 1985/86 | 830 | - | 830 | 1,338 | - | 1,338 | 362 | 2,530 | - | 2,530 |
| 9 | 1986/87 | 830 | - | 830 | 1,663 | - | 1,663 | 450 | 2,943 | - | 2,943 |
| 10 | 1987/88 | 830 | - | 830 | 1,988 | - | 1,988 | 538 | 3,356 | - | 3,356 |
| 11 | 1988/89 | 830 | - | 830 | 2,193 | - | 2,193 | 593 | 3,616 | - | 3,616 |
| 12 | 1989/90 | 830 | - | 830 | 2,276 | - | 2,276 | 616 | 3,722 | - | 3,722 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 55 | 2032/33 | 830 | - | 830 | 2,276 | - | 2,276 | 616 | 3,722 | - | 3,722 |
| | Total | 42,320 | 409 | 42,729 | 109,504 | 324 | 109,828 | 29,580 | 181,404 | 733 | 182,137 |

(1: Increase in benefit means decrease in flood damage to be deducted from benefit of the irrigation/drainage improvement.

Table 9-4-20 Economic Cost and Benefit of Flood Control Component of 7-year Plan on Full-contracting System

Unit: Million Rp

| | Year | Cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | Maintenance cost | |
| 1. | 1978/79 | 131 | | |
| 2. | 1979/80 | 276 | | |
| 3. | 1980/81 | 616 | | |
| 4. | 1981/82 | 708 | 5 | 196 |
| 5. | 1982/83 | 769 | 9 | 331 |
| 6. | 1983/84 | 928 | 13 | 479 |
| 7. | 1984/85 | 890 | 17 | 658 |
| 8. | 1985/86 | | 22 | 830 |
| 9. | 1986/87 | | 22 | 830 |
| 10. | 1987/88 | | 22 | 830 |
| 11. | 1988/89 | | 22 | 830 |
| 12. | 1989/90 | | 22 | 830 |
| 13. | 1990/91 | | 22 | 830 |
| 14. | 1991/92 | | 22 | 830 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 32. | 2009/10 | | 22 | 830 |
| 33. | 2010/11 | | 22 | 830 |
| 34. | 2011/12 | | 22 | 830 |
| 35. | 2012/13 | | 22 | 830 |
| 36. | 2013/14 | | 22 | 830 |
| 37. | 2014/15 | | 22 | 830 |
| 38. | 2015/16 | | 22 | 830 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 57. | 2034/35 | | 22 | 830 |
| | Total | 4,318 | 1,144 | 43,164 |

Table 9-4-21 Economic Cost and Benefit of Irrigation/Drainage Component of 7-year Plan on Full-contracting System

Unit: Million Rp

| | Year | Cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | OMR[1] cost | |
| 1. | 1978/79 | 142 | | |
| 2. | 1979/80 | 441 | | |
| 3. | 1980/81 | 1,543 | | |
| 4. | 1981/82 | 1,410 | 18 | 86 |
| 5. | 1982/83 | 1,411 | 37 | 237 |
| 6. | 1983/84 | 1,713 | 52 | 441 |
| 7. | 1984/85 | 1,456 | 65 | 717 |
| 8. | 1985/86 | | 76 | 1,043 |
| 9. | 1986/87 | | 76 | 1,368 |
| 10. | 1987/88 | | 76 | 1,693 |
| 11. | 1988/89 | | 76 | 1,932 |
| 12. | 1989/90 | | 76 | 2,109 |
| 13. | 1990/91 | | 76 | 2,226 |
| 14. | 1991/92 | | 76 | 2,276 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 32. | 2009/10 | | 76 | 2,276 |
| 33. | 2010/11 | | 104 | 2,276 |
| 34. | 2011/12 | | 89 | 2,276 |
| 35. | 2012/13 | | 88 | 2,276 |
| 36. | 2013/14 | | 88 | 2,276 |
| 37. | 2014/15 | | 95 | 2,276 |
| 38. | 2015/16 | | 76 | 2,276 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 57. | 2034/35 | | 76 | 2,276 |
| | Total | 8,116 | 4,056 | 111,996 |

1): OMR means operation, maintenance and replacement.

Table 9-4-22 Economic Cost and Benefit of the Project in 7-year plan on Full-contracting System

Unit: Million Rp

| | Year | Cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | OMR[1] cost | |
| 1. | 1978/79 | 273 | | |
| 2. | 1979/80 | 717 | | |
| 3. | 1980/81 | 2,159 | | |
| 4. | 1981/82 | 2,118 | 23 | 287 |
| 5. | 1982/83 | 2,180 | 46 | 594 |
| 6. | 1983/84 | 2,641 | 65 | 989 |
| 7. | 1984/85 | 2,346 | 82 | 1,529 |
| 8. | 1985/86 | | 98 | 2,155 |
| 9. | 1986/87 | | 98 | 2,568 |
| 10. | 1987/88 | | 98 | 2,981 |
| 11. | 1988/89 | | 98 | 3,285 |
| 12. | 1989/90 | | 98 | 3,510 |
| 13. | 1990/91 | | 98 | 3,658 |
| 14. | 1991/92 | | 98 | 3,722 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 32. | 2009/10 | | 98 | 3,722 |
| 33. | 2010/11 | | 126 | 3,722 |
| 34. | 2011/12 | | 111 | 3,722 |
| 35. | 2012/13 | | 110 | 3,722 |
| 36. | 2013/14 | | 110 | 3,722 |
| 37. | 2014/15 | | 117 | 3,722 |
| 38. | 2015/16 | | 98 | 3,722 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 57. | 2034/35 | | 98 | 3,722 |
| | Total | 12,434 | 5,200 | 185,324 |

1): OMR means operation, maintenance and replacement.

Table 9-4-23 Economic Cost and Benefit of Flood Control Component of 7-year Plan on Equipment-lending System

Unit: Million Rp

| | Year | Cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | Maintenance cost | |
| 1. | 1978/79 | 131 | | |
| 2. | 1979/80 | 439 | | |
| 3. | 1980/81 | 1,064 | | |
| 4. | 1981/82 | 835 | 5 | 196 |
| 5. | 1982/83 | 802 | 9 | 331 |
| 6. | 1983/84 | 652 | 13 | 479 |
| 7. | 1984/85 | 625 | 17 | 905 |
| 8. | 1985/86 | | 22 | 830 |
| 9. | 1986/87 | | 22 | 830 |
| 10. | 1987/88 | | 22 | 830 |
| 11. | 1988/89 | | 22 | 830 |
| 12. | 1989/90 | | 22 | 830 |
| 13. | 1990/91 | | 22 | 820 |
| 14. | 1991/92 | | 22 | 830 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 32. | 2009/10 | | 22 | 830 |
| 33. | 2010/11 | | 22 | 830 |
| 34. | 2011/12 | | 22 | 830 |
| 35. | 2012/13 | | 22 | 830 |
| 36. | 2013/14 | | 22 | 830 |
| 37. | 2014/15 | | 22 | 830 |
| 38. | 2015/16 | | 22 | 830 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 57. | 2034/35 | | 22 | 830 |
| | Total | 4,548 | 1,144 | 43,411 |

Table 9-4-24 Economic Cost and Benefit of Irrigation/Drainage Component of 7-year Plan on Equipment-lending System

Unit: Million Rp

| | Year | Cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | OMR[1] cost | |
| 1. | 1978/79 | 142 | | |
| 2. | 1979/80 | 604 | | |
| 3. | 1980/81 | 1,907 | | |
| 4. | 1981/82 | 1,519 | 18 | 86 |
| 5. | 1982/83 | 1,303 | 37 | 237 |
| 6. | 1983/84 | 1,523 | 52 | 441 |
| 7. | 1984/85 | 1,336 | 65 | 959 |
| 8. | 1985/86 | | 76 | 1,043 |
| 9. | 1986/87 | | 76 | 1,368 |
| 10. | 1987/88 | | 76 | 1,693 |
| 11. | 1988/89 | | 76 | 1,932 |
| 12. | 1989/90 | | 76 | 2,109 |
| 13. | 1990/91 | | 76 | 2,226 |
| 14. | 1991/92 | | 76 | 2,276 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 32. | 2009/10 | | 76 | 2,276 |
| 33. | 2010/11 | | 104 | 2,276 |
| 34. | 2011/12 | | 89 | 2,276 |
| 35. | 2012/13 | | 88 | 2,276 |
| 36. | 2013/14 | | 88 | 2,276 |
| 37. | 2014/15 | | 95 | 2,276 |
| 38. | 2015/16 | | 76 | 2,276 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 57. | 2034/35 | | 76 | 2,276 |
| | Total | 8,334 | 4,056 | 112,238 |

1): OMR means operation, maintenance and replacement.

Table 9-4-25 Economic Cost and Benefit of the Project in 7-year Plan on Equipment-lending System

Unit: Million Rp

| | Year | Cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | OMR[1] cost | |
| 1. | 1978/79 | 273 | | |
| 2. | 1979/80 | 1,043 | | |
| 3. | 1980/81 | 2,971 | | |
| 4. | 1981/82 | 2,354 | 23 | 287 |
| 5. | 1982/83 | 2,105 | 46 | 594 |
| 6. | 1983/84 | 2,175 | 65 | 989 |
| 7. | 1984/85 | 1,961 | 82 | 2,018 |
| 8. | 1985/86 | | 98 | 2,155 |
| 9. | 1986/87 | | 98 | 2,568 |
| 10. | 1987/88 | | 98 | 2,981 |
| 11. | 1988/89 | | 98 | 3,285 |
| 12. | 1989/90 | | 98 | 3,510 |
| 13. | 1990/91 | | 98 | 3,658 |
| 14. | 1991/92 | | 98 | 3,722 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 32. | 2009/10 | | 98 | 3,722 |
| 33. | 2010/11 | | 126 | 3,722 |
| 34. | 2011/12 | | 111 | 3,722 |
| 35. | 2012/13 | | 110 | 3,722 |
| 36. | 2013/14 | | 110 | 3,722 |
| 37. | 2014/15 | | 117 | 3,722 |
| 38. | 2015/16 | | 98 | 3,722 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 57. | 2034/35 | | 98 | 3,722 |
| | Total | 12,882 | 5,200 | 185,813 |

1): OMR means operation, maintenance and replacement.

Table 9-4-26 Economic Cost and Benefit of Flood Control Component of 5-year Plan on Full-Contracting System

Unit: Million Rp

| | Year | Cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | Maintenance cost | |
| 1. | 1978/79 | 131 | | |
| 2. | 1979/80 | 276 | | |
| 3. | 1980/81 | 1,064 | | |
| 4. | 1981/82 | 1,264 | 8 | 286 |
| 5. | 1982/83 | 1,511 | 14 | 534 |
| 6. | 1983/84 | | 22 | 830 |
| 7. | 1984/85 | | 22 | 830 |
| 8. | 1985/86 | | 22 | 830 |
| 9. | 1986/87 | | 22 | 830 |
| 10. | 1987/88 | | 22 | 830 |
| 11. | 1988/89 | | 22 | 830 |
| 12. | 1989/90 | | 22 | 830 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 32. | 2009/10 | | 22 | 830 |
| 33. | 2010/11 | | 22 | 830 |
| 34. | 2011/12 | | 22 | 830 |
| 35. | 2012/13 | | 22 | 830 |
| 36. | 2013/14 | | 22 | 830 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 55. | 2032/33 | | 22 | 830 |
| | Total | 4,246 | 1,122 | 42,320 |

Table 9-4-27 Economic Cost and Benefit of Irrigation/Drainage Component of 5-year Plan on Full-contracting System

Unit: Million Rp

| | Year | Cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | OMR[1] cost | |
| 1. | 1978/79 | 142 | | |
| 2. | 1979/80 | 532 | | |
| 3. | 1980/81 | 2,497 | | |
| 4. | 1981/82 | 2,617 | 30 | 121 |
| 5. | 1982/83 | 2,281 | 59 | 360 |
| 6. | 1983/84 | | 76 | 686 |
| 7. | 1984/85 | | 76 | 1,011 |
| 8. | 1985/86 | | 76 | 1,338 |
| 9. | 1986/87 | | 76 | 1,663 |
| 10. | 1987/88 | | 76 | 1,988 |
| 11. | 1988/89 | | 76 | 2,193 |
| 12. | 1989/90 | | 76 | 2,276 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 32. | 2009/10 | | 76 | 2,276 |
| 33. | 2010/11 | | 107 | 2,276 |
| 34. | 2011/12 | | 102 | 2,276 |
| 35. | 2012/13 | | 103 | 2,276 |
| 36. | 2013/14 | | 76 | 2,276 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 55. | 2032/33 | | 76 | 2,276 |
| | Total | 8,069 | 3,973 | 109,504 |

1): OMR means operation, maintenance and replacement.

Table 9-4-28 Economic Cost and Benefit of the Project in 5-year Plan on Full-contracting System

Unit: Million Rp

| | Year | Cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | OMR[1] cost | |
| 1. | 1978/79 | 273 | | |
| 2. | 1979/80 | 808 | | |
| 3. | 1980/81 | 3,561 | | |
| 4. | 1981/82 | 3,881 | 38 | 418 |
| 5. | 1982/83 | 3,792 | 73 | 956 |
| 6. | 1983/84 | | 98 | 1,702 |
| 7. | 1984/85 | | 98 | 2,115 |
| 8. | 1985/86 | | 98 | 2,530 |
| 9. | 1986/87 | | 98 | 2,943 |
| 10. | 1987/88 | | 98 | 3,356 |
| 11. | 1988/89 | | 98 | 3,616 |
| 12. | 1989/90 | | 98 | 3,722 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 32. | 2009/10 | | 98 | 3,722 |
| 33. | 2010/11 | | 129 | 3,722 |
| 34. | 2011/12 | | 124 | 3,722 |
| 35. | 2012/13 | | 125 | 3,722 |
| 36. | 2013/14 | | 98 | 3,722 |
| ⋮ | ⋮ | | ⋮ | ⋮ |
| 55. | 2032/33 | | 98 | 3,722 |
| | Total | 12,315 | 5,095 | 181,404 |

1): OMR means operation, maintenance and replacement.

Table 9-4-29 Economic Cost and Benefit of Flood Control Component of 5-year Plan on Equipment-lending System

Unit: Million Rp

| | Year | Cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | Maintenance cost | |
| 1. | 1978/79 | 131 | | |
| 2. | 1979/80 | 629 | | |
| 3. | 1980/81 | 1,911 | | |
| 4. | 1981/82 | 984 | 8 | 286 |
| 5. | 1982/83 | 982 | 14 | 943 |
| 6. | 1983/84 | | 22 | 830 |
| 7. | 1984/85 | | 22 | 830 |
| 8. | 1985/86 | | 22 | 830 |
| 9. | 1986/87 | | 22 | 830 |
| 10. | 1987/88 | | 22 | 830 |
| 11. | 1988/89 | | 22 | 830 |
| 12. | 1989/90 | | 22 | 830 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 32. | 2009/10 | | 22 | 830 |
| 33. | 2010/11 | | 22 | 830 |
| 34. | 2011/12 | | 22 | 830 |
| 35. | 2012/13 | | 22 | 830 |
| 36. | 2013/14 | | 22 | 830 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 55. | 2032/33 | | 22 | 830 |
| | Total | 4,637 | 1,122 | 42,729 |

Table 9-4-30 Economic Cost and Benefit of Irrigation/Drainage Component of 5-year Plan on Equipment-lending System

Unit: Million Rp

| | Year | cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | OMR[1)] cost | |
| 1. | 1978/79 | 142 | | |
| 2. | 1979/80 | 887 | | |
| 3. | 1980/81 | 2,876 | | |
| 4. | 1981/82 | 2,390 | 30 | 121 |
| 5. | 1982/83 | 2,073 | 59 | 684 |
| 6. | 1983/84 | | 76 | 686 |
| 7. | 1984/85 | | 76 | 1,011 |
| 8. | 1985/86 | | 76 | 1,338 |
| 9. | 1986/87 | | 76 | 1,663 |
| 10. | 1987/88 | | 76 | 1,988 |
| 11. | 1988/89 | | 76 | 2,193 |
| 12. | 1989/90 | | 76 | 2,276 |
| : | : | | : | : |
| 32. | 2009/10 | | 76 | 2,276 |
| 33. | 2010/11 | | 108 | 2,276 |
| 34. | 2011/12 | | 102 | 2,276 |
| 35. | 2012/13 | | 103 | 2,276 |
| 36. | 2013/14 | | 76 | 2,276 |
| : | : | | : | : |
| 55. | 2032/33 | | 76 | 2,276 |
| | Total | 8,368 | 3,973 | 109,828 |

1): OMR means operation, maintenance and replacement.

Table 9-4-31 Economic Cost and Benefit of the Project in 5-year Plan on Equipment-lending System

Unit: Million Rp

| | Year | Cost | | Benefit |
|---|---|---|---|---|
| | | Construction cost | OMR[1)] cost | |
| 1. | 1978/79 | 273 | | |
| 2. | 1979/80 | 1,516 | | |
| 3. | 1980/81 | 4,787 | | |
| 4. | 1981/82 | 3,374 | 38 | 418 |
| 5. | 1982/83 | 3,055 | 73 | 1,689 |
| 6. | 1983/84 | | 98 | 1,702 |
| 7. | 1984/85 | | 98 | 2,115 |
| 8. | 1985/86 | | 98 | 2,530 |
| 9. | 1986/87 | | 98 | 2,943 |
| 10. | 1987/88 | | 98 | 3,356 |
| 11. | 1988/89 | | 98 | 3,616 |
| 12. | 1989/90 | | 98 | 3,722 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 32. | 2009/10 | | 98 | 3,722 |
| 33. | 2010/11 | | 129 | 3,722 |
| 34. | 2011/12 | | 124 | 3,722 |
| 35. | 2012/13 | | 125 | 3,722 |
| 36. | 2013/14 | | 98 | 3,722 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 55. | 2032/33 | | 98 | 3,722 |
| | Total | 13,005 | 5,095 | 182,137 |

1): OMR means operation, maintenance and replacement.

Table 9-4-32 Cost-benefit Analysis of 7-year Plan on Full-contracting System

| Description | IRR (%) | Benefit-cost ratio (B/C) Discount rate 10% | 12% | 15% | 20% | Net present value (B-C) Discount rate 10% ($10^6$Rp) | 12% ($10^6$Rp) | 15% ($10^6$Rp) | 20% ($10^6$Rp) |
|---|---|---|---|---|---|---|---|---|---|
| Project | 20 | 2.23 | 1.82 | 1.40 | 0.98 | 10,518 | 6,398 | 2,756 | - 90 |
| Flood control | 18 | 1.79 | 1.50 | 1.21 | 0.90 | 2,282 | 1,331 | 484 | -183 |
| Irrigation/drainage | 17 | 1.94 | 1.57 | 1.19 | 0.82 | 5,336 | 2,946 | 874 | -676 |

Table 9-4-33 Cost-benefit Analysis of 7-year Plan on Equipment-lending System

| Description | IRR (%) | Benefit-cost ratio (B/C) Discount rate 10% | 12% | 15% | 20% | Net present value (B-C) Discount rate 10% ($10^6$Rp) | 12% ($10^6$Rp) | 15% ($10^6$Rp) | 20% ($10^6$Rp) |
|---|---|---|---|---|---|---|---|---|---|
| Project | 19 | 2.12 | 1.73 | 1.33 | 0.92 | 10,235 | 6,084 | 2,408 | -470 |
| Flood control | 17 | 1.67 | 1.39 | 1.11 | 0.82 | 2,122 | 1,154 | 289 | -395 |
| Irrigation/drainage | 17 | 1.88 | 1.52 | 1.15 | 0.79 | 5,214 | 2,809 | 721 | -844 |

Table 9-4-34 Cost-benefit Analysis of 5-year Plan on Full-contracting System

| Description | IRR (%) | Benefit-cost ratio (B/C) Discount rate 10% | 12% | 15% | 20% | Net present value (B-C) Discount rate 10% ($10^6$Rp) | 12% ($10^6$Rp) | 15% ($10^6$Rp) | 20% ($10^6$Rp) |
|---|---|---|---|---|---|---|---|---|---|
| Project | 20 | 2.24 | 1.83 | 1.41 | 0.99 | 11,489 | 7,116 | 3,160 | - 52 |
| Flood control | 18 | 1.82 | 1.53 | 1.23 | 0.92 | 2,539 | 1,524 | 597 | -167 |
| Irrigation/drainage | 17 | 1.93 | 1.56 | 1.19 | 0.81 | 5,757 | 3,214 | 955 | -807 |

Table 9-4-35 Cost-benefit Analysis of 5-year Plan on Equipment-lending System

| Description | IRR (%) | Benefit-cost ratio (B/C) Discount rate 10% | 12% | 15% | 20% | Net present value (B-C) Discount rate 10% ($10^6$Rp) | 12% ($10^6$Rp) | 15% ($10^6$Rp) | 20% ($10^6$Rp) |
|---|---|---|---|---|---|---|---|---|---|
| Project | 19 | 2.13 | 1.74 | 1.34 | 0.94 | 11,242 | 6,835 | 2,840 | -418 |
| Flood control | 17 | 1.68 | 1.41 | 1.13 | 0.85 | 2,385 | 1,350 | 400 | -390 |
| Irrigation/drainage | 17 | 1.88 | 1.52 | 1.15 | 0.79 | 5,664 | 3,107 | 832 | -949 |

Table 9-4-36 Sensitivity of IRR of 7-year Plan on Full-contracting System

(A) Project

Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 20 | 18 | 16 | 15 | 14 | 13 | 12 |
| | -20 | 22 | 20 | 18 | 17 | 15 | 14 | 13 |
| | -10 | 24 | 22 | 20 | 18 | 17 | 16 | 15 |
| | 0 | (over 25) | 24 | 21 | 20 | 18 | 17 | 16 |
| Increase (%) | 10 | (over 25) | 25 | 23 | 21 | 20 | 18 | 17 |
| | 20 | | (over 25) | 25 | 23 | 21 | 20 | 19 |
| | 30 | | | (over 25) | 24 | 23 | 21 | 20 |

(B) Flood control

Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 18 | 16 | 14 | 13 | 12 | 11 | 10 |
| | -20 | 21 | 18 | 16 | 15 | 13 | 12 | 11 |
| | -10 | 23 | 20 | 18 | 16 | 15 | 14 | 13 |
| | 0 | (over 25) | 23 | 20 | 18 | 17 | 15 | 14 |
| Increase (%) | 10 | (over 25) | 25 | 22 | 20 | 18 | 17 | 15 |
| | 20 | | (over 25) | 24 | 22 | 20 | 18 | 17 |
| | 30 | | | (over 25) | 23 | 21 | 20 | 18 |

(C) Irrigation and drainage

Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 17 | 16 | 14 | 13 | 12 | 11 | 10 |
| | -20 | 19 | 17 | 16 | 14 | 13 | 12 | 12 |
| | -10 | 21 | 19 | 17 | 16 | 15 | 14 | 13 |
| | 0 | 22 | 20 | 19 | 17 | 16 | 15 | 14 |
| Increase (%) | 10 | 24 | 22 | 20 | 19 | 17 | 16 | 15 |
| | 20 | (over 25) | 23 | 21 | 20 | 18 | 17 | 16 |
| | 30 | (over 25) | 25 | 23 | 21 | 20 | 18 | 17 |

Table 9-4-37 Sensitivity of IRR of 7-year Plan on Equipment-lending System

(A) Project

Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 19 | 17 | 15 | 14 | 13 | 12 | 11 |
| | -20 | 21 | 19 | 17 | 16 | 15 | 14 | 13 |
| | -10 | 23 | 21 | 19 | 17 | 16 | 15 | 14 |
| | 0 | 25 | 22 | 20 | 19 | 17 | 16 | 15 |
| Increase (%) | 10 | (over 25) | 24 | 22 | 20 | 19 | 18 | 16 |
| | 20 | (over 25) | 23 | 22 | 20 | 19 | 18 | |
| | 30 | (over 25) | 25 | 23 | 21 | 20 | 19 | |

(B) Flood control

Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 17 | 15 | 13 | 12 | 11 | 10 | 9 |
| | -20 | 19 | 17 | 15 | 13 | 12 | 11 | 10 |
| | -10 | 21 | 19 | 17 | 15 | 14 | 13 | 12 |
| | 0 | 23 | 20 | 18 | 17 | 15 | 14 | 13 |
| Increase (%) | 10 | 25 | 22 | 20 | 18 | 17 | 15 | 14 |
| | 20 | (over 25) | 24 | 22 | 20 | 18 | 17 | 15 |
| | 30 | (over 25) | 23 | 21 | 19 | 18 | 17 | |

(C) Irrigation and drainage

Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 17 | 15 | 14 | 13 | 12 | 11 | 10 |
| | -20 | 19 | 17 | 15 | 14 | 13 | 12 | 11 |
| | -10 | 20 | 18 | 17 | 15 | 14 | 13 | 13 |
| | 0 | 22 | 20 | 18 | 17 | 16 | 15 | 14 |
| Increase (%) | 10 | 23 | 21 | 19 | 18 | 17 | 16 | 15 |
| | 20 | 25 | 23 | 21 | 19 | 18 | 17 | 16 |
| | 30 | (over 25) | 24 | 22 | 20 | 19 | 18 | 17 |

Table 9-4-38 Sensitivity of IRR of 5-year Plan on Full-contracting System

(A) Project

Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 20 | 18 | 16 | 15 | 14 | 13 | 12 |
| | -20 | 22 | 20 | 18 | 17 | 15 | 14 | 13 |
| | -10 | 24 | 22 | 20 | 18 | 17 | 16 | 15 |
| | 0 | (over 25) | 24 | 22 | 20 | 18 | 17 | 16 |
| Increase (%) | 10 | (over 25) | | 23 | 21 | 20 | 19 | 17 |
| | 20 | (over 25) | | 25 | 23 | 21 | 20 | 19 |
| | 30 | | (over 25) | | 24 | 23 | 21 | 20 |

(B) Flood control

Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 18 | 16 | 14 | 13 | 12 | 11 | 10 |
| | -20 | 21 | 18 | 16 | 15 | 13 | 12 | 11 |
| | -10 | 24 | 21 | 18 | 17 | 15 | 14 | 13 |
| | 0 | (over 25) | 23 | 21 | 18 | 17 | 15 | 14 |
| Increase (%) | 10 | (over 25) | 25 | 23 | 20 | 18 | 17 | 16 |
| | 20 | (over 25) | | 25 | 22 | 20 | 18 | 17 |
| | 30 | | (over 25) | | 24 | 22 | 20 | 18 |

(C) Irrigation and drainage

Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 17 | 15 | 14 | 13 | 12 | 11 | 10 |
| | -20 | 19 | 17 | 16 | 14 | 13 | 12 | 12 |
| | -10 | 21 | 19 | 17 | 16 | 15 | 14 | 13 |
| | 0 | 22 | 20 | 19 | 17 | 16 | 15 | 14 |
| Increase (%) | 10 | 24 | 22 | 20 | 18 | 17 | 16 | 15 |
| | 20 | (over 25) | 23 | 21 | 20 | 18 | 17 | 16 |
| | 30 | (over 25) | 24 | 22 | 21 | 19 | 18 | 17 |

Table 9-4-39 Sensitivity of IRR of 5-year Plan on Equipment-lending System

(A) Project

Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 19 | 17 | 16 | 14 | 13 | 12 | 11 |
| | -20 | 21 | 19 | 17 | 16 | 15 | 14 | 13 |
| | -10 | 23 | 21 | 19 | 18 | 16 | 15 | 14 |
| | 0 | (over 25) | 23 | 21 | 19 | 18 | 16 | 15 |
| Increase (%) | 10 | (over 25) | 25 | 22 | 21 | 19 | 18 | 17 |
| | 20 | | (over 25) | 24 | 22 | 20 | 19 | 18 |
| | 30 | | | (over 25) | 23 | 22 | 20 | 19 |

(B) Flood control

Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 17 | 15 | 13 | 12 | 11 | 10 | 9 |
| | -20 | 19 | 17 | 15 | 14 | 12 | 11 | 10 |
| | -10 | 22 | 19 | 17 | 15 | 14 | 13 | 12 |
| | 0 | 23 | 21 | 19 | 17 | 15 | 14 | 13 |
| Increase (%) | 10 | (over 25) | 23 | 21 | 19 | 17 | 16 | 14 |
| | 20 | | (over 25) | 23 | 20 | 19 | 17 | 16 |
| | 30 | | (over 25) | 24 | 22 | 20 | 18 | 17 |

(C) Irrigation and drainage

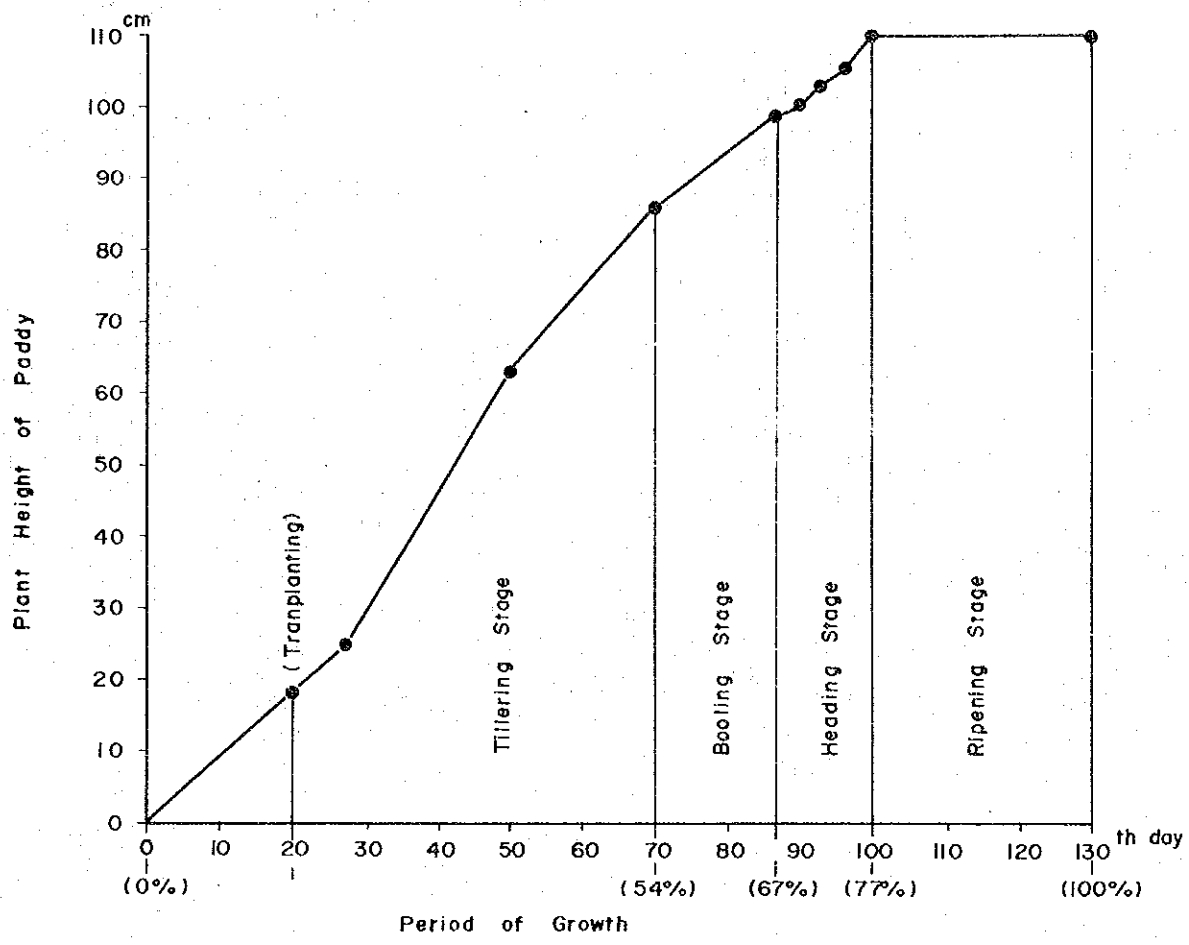
Unit: %

| Benefit \ Cost | | Reduction (%) | | | | Increase (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | -30 | -20 | -10 | 0 | 10 | 20 | 30 |
| Reduction (%) | -30 | 17 | 15 | 14 | 13 | 12 | 11 | 10 |
| | -20 | 19 | 17 | 15 | 14 | 13 | 12 | 11 |
| | -10 | 20 | 18 | 17 | 15 | 14 | 13 | 13 |
| | 0 | 22 | 20 | 18 | 17 | 16 | 15 | 14 |
| Increase (%) | 10 | 23 | 21 | 20 | 18 | 17 | 16 | 15 |
| | 20 | 25 | 23 | 21 | 19 | 18 | 17 | 16 |
| | 30 | (Over 25) | 24 | 22 | 20 | 19 | 18 | 17 |

Table 9-5-1 Future Annual Budget on Typical Owner Farmer

| Description | Type I (1.45 ha) Without project | Type I (1.45 ha) With project | Type II (1.00 ha) Without project | Type II (1.00 ha) With project |
|---|---|---|---|---|
| Farm size description (ha) | | | | |
| Irrigated paddy field | - | 1.34 | 0.45 | 0.95 |
| Rainfed paddy field | 1.34 | - | 0.5 | - |
| Upland | 0.11 | 0.11 | 0.05 | 0.05 |
| Family size (person) | 5.55 | | 5.25 | |
| Gross farm income (Rp) | 354,290 | 858,040 | 387,830 | 604,790 |
| Intensive paddy (Wet season) | - | 422,100 | 126,000 | 299,250 |
| Intensive paddy (Dry season) | - | 422,100 | 126,000 | 299,250 |
| Non-intensive paddy | 331,650 | - | 123,750 | - |
| Upland crops | 22,640 | 13,840 | 12,080 | 6,290 |
| Farming expense (Rp) | 45,330 | 132,260 | 54,890 | 93,470 |
| Hired labours & cows | 9,230 | 24,030 | 10,800 | 16,950 |
| Seeds | 6,560 | 10,790 | 6,020 | 7,470 |
| Fertilizers | 18,760 | 65,660 | 24,330 | 46,550 |
| Agrichemicals | 3,030 | 12,730 | 4,320 | 9,030 |
| Miscellaneous | 7,750 | 19,050 | 9,420 | 13,470 |
| Other expense (Rp) | 5,370 | 16,280 | 6,900 | 11,210 |
| Tax | 5,080 | 9,570 | 4,900 | 6,450 |
| Interest of credit | - | 5,900 | 1,710 | 4,180 |
| Other fees | 290 | 810 | 290 | 580 |
| Net farm income (Rp) | 303,590 | 709,500 | 326,040 | 500,110 |
| Non farm income (Rp) | 31,000 | - | - | - |
| Family living expense (Rp) | 310,580 | 310,580 | 293,790 | 293,790 |
| Payment capacity (Rp) | 24,010 | 398,920 | 32,250 | 206,320 |

Fig. 9-3-1 Relation Between Plant Height and Period of Growth of Paddy



# CHAPTER X

# FINANCIAL ASPECTS

## 10.1. Required Fund.

The fund to be required for the implementation of the project was estimated for each of the four alternative plans at the 1977-price and are shown in Tables 10-1-1 to 10-1-4. The estimation was made on the following assumptions.

(a) The escalation in price was assumed at 18% per year for the local currency portion and 10% per year for the foreign currency portion taking account of the rate of rise in prices for the last five years.

(b) The annual interest during the construction period was assumed at 3% of capital to be invested in foreign currency and assumed to be disbursed in local currency.

The economic evaluation has concluded that the 7-year plan on the full-contracting system is the most recommendable plan among the four alternatives. The fund of this alternative plan was estimated at Rp 27,270 million in total consisting of Rp 19,589 million in the local currency portion and US$18,508,000 (equivalent to Rp 7,681 million) in the foreign currency portion including price escalation and annual interest during the construction period. Among this amount, the fund to be required for the flood control component is Rp 8,754 million consisting of Rp 4,359 million in the local currency portion and US$10,590,000 (equivalent to Rp 4,395 million) in the foreign currency portion, and the fund required for the irrigation/drainage component is Rp 18,516 million consisting of Rp 15,230 million in the local currency portion and US$7,918,000 (equivalent to Rp 3,286 million) in the foreign currency portion.

## 10.2. Disbursement Schedule.

The annual disbursement schedule of the funds for the four alternative plans are shown in Tables 10-2-1 through 10-2-4.

Table 10-1-1 Fund Required for 7-Year Plan on Full-Contracting System

| Description | Flood control | | | Irrigation & drainage | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) |
| Construction cost | 1,655 | 6,648 | 4,414 | 6,437 | 5,082 | 8,546 | 8,092 | 11,730 | 12,960 |
| Land acquisition | 193 | - | 193 | 417 | - | 417 | 610 | - | 610 |
| Labor | 397 | 233 | 494 | 2,492 | 478 | 2,690 | 2,889 | 711 | 3,184 |
| Equipment | - | 2,786 | 1,156 | - | 1,554 | 645 | - | 4,340 | 1,801 |
| Spare parts | - | 1,368 | 568 | - | 915 | 380 | - | 2,283 | 948 |
| Materials | 656 | 129 | 709 | 2,247 | - | 2,247 | 2,903 | 129 | 2,956 |
| Administration | 193 | 1,265 | 718 | 441 | 1,472 | 1,052 | 634 | 2,737 | 1,770 |
| Contingency | 216 | 867 | 576 | 840 | 663 | 1,115 | 1,056 | 1,530 | 1,691 |
| Price escalation | 2,311 | 3,942 | 3,947 | 8,476 | 2,836 | 9,653 | 10,787 | 6,778 | 13,600 |
| Interest /1 | 393 | - | 393 | 317 | - | 317 | 710 | - | 710 |
| T o t a l | 4,359 | 10,590 | 8,754 | 15,230 | 7,918 | 18,516 | 19,589 | 18,508 | 27,270 |

/1 : Interest for foreign currency portion during the construction period.

Table 10-1-2 Fund Required for 7-Year Plan on Equipment-Lending System

| Description | Flood control | | | Irrigation & drainage | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) |
| Construction cost | 1,950 | 6,537 | 4,663 | 6,753 | 4,903 | 8,788 | 8,703 | 11,440 | 13,451 |
| Land acquisition | 193 | - | 193 | 417 | - | 417 | 610 | - | 610 |
| Labor | 496 | - | 496 | 2,691 | - | 2,691 | 3,187 | - | 3,187 |
| Equipment | - | 3,302 | 1,371 | - | 1,943 | 806 | - | 5,245 | 2,177 |
| Spare parts | 157 | 988 | 567 | 76 | 848 | 428 | 233 | 1,836 | 995 |
| Materials | 656 | 129 | 709 | 2,247 | - | 2,247 | 2,903 | 129 | 2,956 |
| Administration | 194 | 1,265 | 719 | 441 | 1,472 | 1,052 | 635 | 2,737 | 1,771 |
| Contingency | 254 | 853 | 608 | 881 | 640 | 1,147 | 1,135 | 1,493 | 1,755 |
| Price escalation | 2,763 | 2,991 | 4,004 | 8,933 | 2,075 | 9,794 | 11,696 | 5,066 | 13,798 |
| Interest /1 | 469 | - | 469 | 363 | - | 363 | 832 | - | 832 |
| T o t a l | 5,182 | 9,528 | 9,136 | 16,049 | 6,978 | 18,945 | 21,231 | 16,506 | 28,081 |

/1 : Interest for foreign currency portion during the construction peirod.

Table 10-1-3 Fund Required for 5-Year Plan on Full-Contracting System

| Description | Flood control | | | Irrigation & drainage | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) |
| Construction cost | 1,655 | 6,474 | 4,342 | 6,437 | 4,968 | 8,499 | 8,092 | 11,442 | 12,841 |
| Land acquisition | 193 | - | 193 | 417 | - | 417 | 610 | - | 610 |
| Labor | 397 | 233 | 494 | 2,492 | 478 | 2,690 | 2,889 | 711 | 3,184 |
| Equipment | - | 2,848 | 1,182 | - | 1,554 | 645 | - | 4,402 | 1,827 |
| Spare parts | - | 1,306 | 542 | - | 915 | 380 | - | 2,221 | 922 |
| Materials | 656 | 129 | 709 | 2,247 | - | 2,247 | 2,903 | 129 | 2,956 |
| Administration | 193 | 1,114 | 656 | 441 | 1,373 | 1,011 | 634 | 2,487 | 1,667 |
| Contingency | 216 | 844 | 566 | 840 | 648 | 1,109 | 1,056 | 1,492 | 1,675 |
| Price escalation | 1,567 | 2,919 | 2,778 | 5,892 | 2,075 | 6,753 | 7,459 | 4,994 | 9,531 |
| Interest /1 | 239 | - | 239 | 200 | - | 200 | 439 | - | 439 |
| T o t a l | 3,461 | 9,393 | 7,359 | 12,529 | 7,043 | 15,452 | 15,990 | 16,436 | 22,811 |

/1 : Interest for foreign currency portion during the construction period.

Table 10-1-4 Fund Required for 5-Year Plan on Equipment-Lending System

| Description | Flood control | | | Irrigation & drainage | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) | LC ($10^6$Rp) | FC ($10^3$\$) | Total ($10^6$Rp) |
| Construction cost | 1,950 | 6,752 | 4,752 | 6,753 | 4,987 | 8,823 | 8,703 | 11,739 | 13,575 |
| Land acquisition | 193 | - | 193 | 417 | - | 417 | 610 | - | 610 |
| Labor | 497 | - | 497 | 2,691 | - | 2,691 | 3,188 | - | 3,188 |
| Equipment | - | 3,702 | 1,536 | - | 2,056 | 853 | - | 5,758 | 2,389 |
| Spare parts | 157 | 926 | 541 | 76 | 908 | 453 | 233 | 1,834 | 994 |
| Materials | 656 | 129 | 709 | 2,247 | - | 2,247 | 2,903 | 129 | 2,956 |
| Administration | 193 | 1,114 | 656 | 441 | 1,373 | 1,011 | 634 | 2,487 | 1,667 |
| Contingency | 254 | 881 | 620 | 881 | 650 | 1,151 | 1,135 | 1,531 | 1,771 |
| Price escalation | 1,884 | 2,332 | 2,852 | 6,201 | 1,663 | 6,891 | 8,085 | 3,995 | 9,743 |
| Interest /1 | 322 | - | 322 | 243 | - | 243 | 565 | - | 565 |
| T o t a l | 4,156 | 9,084 | 7,926 | 13,197 | 6,650 | 15,957 | 17,353 | 15,734 | 23,883 |

/1 : Interest for foreign currency portion during the construction period.

Table 10-2-1 Disbursement Schedule for 7-Year Plan on Full Contracting System

| Description | 1978/79 | | | 1979/80 | | | 1980/81 | | | 1981/82 | | | 1982/83 | | | 1983/84 | | | 1984/85 | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total |
| | ($10^6$ Rp) | ($10^3$ $) | ($10^6$Rp) | ($10^6$ Rp) | ($10^3$ $) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) |
| Flood control | 26 | 302 | 151 | 191 | 441 | 374 | 358 | 1,357 | 921 | 465 | 1,788 | 1,207 | 716 | 1,955 | 1,528 | 1,216 | 2,301 | 2,171 | 1,387 | 2,446 | 2,402 | 4,359 | 10,590 | 8,754 |
| Construction cost | 19 | 275 | 133 | 131 | 363 | 282 | 202 | 1,020 | 625 | 215 | 1,222 | 722 | 281 | 1,213 | 785 | 413 | 1,300 | 952 | 394 | 1,255 | 915 | 1,655 | 6,648 | 4,414 |
| Price escalation | 3 | 27 | 14 | 51 | 78 | 83 | 130 | 337 | 270 | 202 | 566 | 437 | 362 | 742 | 670 | 702 | 1,001 | 1,118 | 861 | 1,191 | 1,355 | 2,311 | 3,942 | 3,947 |
| Interest /1 | 4 | - | 4 | 9 | - | 9 | 26 | | 26 | 48 | - | 48 | 73 | - | 73 | 101 | - | 101 | 132 | - | 132 | 393 | - | 393 |
| Irrigation & drainage | 56 | 267 | 167 | 320 | 674 | 600 | 2,131 | 1,110 | 2,592 | 2,261 | 1,207 | 2,762 | 2,688 | 1,305 | 3,229 | 3,808 | 1,815 | 4,561 | 3,966 | 1,540 | 4,605 | 15,230 | 7,918 | 18,516 |
| Construction cost | 45 | 243 | 146 | 221 | 556 | 452 | 1,281 | 834 | 1,627 | 1,145 | 824 | 1,487 | 1,150 | 810 | 1,486 | 1,381 | 1,024 | 1,806 | 1,214 | 791 | 1,542 | 6,437 | 5,082 | 8,546 |
| Price escalation | 8 | 24 | 18 | 87 | 118 | 136 | 824 | 276 | 935 | 1,075 | 383 | 1,234 | 1,481 | 495 | 1,686 | 2,348 | 791 | 2,676 | 2,653 | 749 | 2,964 | 8,476 | 2,836 | 9,653 |
| Interest /1 | 3 | - | 3 | 12 | | 12 | 26 | | 26 | 41 | - | 41 | 57 | - | 57 | 79 | - | 79 | 99 | - | 99 | 317 | - | 317 |
| T o t a l | 82 | 569 | 318 | 511 | 1,115 | 974 | 2,489 | 2,467 | 3,513 | 2,726 | 2,995 | 3,969 | 3,404 | 3,260 | 4,757 | 5,024 | 4,116 | 6,732 | 5,353 | 3,986 | 7,007 | 19,589 | 18,508 | 27,270 |

/1 : Interest for foreign currency portion during the construction period.

Table 10-2-2 Disbursement Schedule for 7-Year Plan on Equipment-Lending System

| Description | 1978/79 | | | 1979/80 | | | 1980/81 | | | 1981/82 | | | 1982/83 | | | 1983/84 | | | 1984/85 | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total |
| | ($10^6$ Rp) | ($10^3$ $) | ($10^6$Rp) | ($10^6$ Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) |
| Flood control | 26 | 302 | 151 | 197 | 916 | 577 | 400 | 2,761 | 1,546 | 612 | 2,031 | 1,455 | 887 | 1,848 | 1,654 | 1,450 | 795 | 1,780 | 1,610 | 875 | 1,973 | 5,182 | 9,528 | 9,136 |
| Construction cost | 19 | 275 | 133 | 131 | 756 | 445 | 213 | 2,075 | 1,074 | 277 | 1,388 | 853 | 345 | 1,147 | 821 | 497 | 448 | 683 | 468 | 448 | 654 | 1,950 | 6,537 | 4,663 |
| Price escalation | 3 | 27 | 14 | 51 | 160 | 117 | 137 | 688 | 422 | 260 | 643 | 527 | 444 | 701 | 735 | 845 | 347 | 989 | 1,023 | 427 | 1,200 | 2,763 | 2,991 | 4,004 |
| Interest /1 | 4 | - | 4 | 15 | - | 15 | 50 | - | 50 | 75 | - | 75 | 98 | - | 98 | 108 | - | 108 | 119 | - | 119 | 469 | - | 469 |
| Irrigation & drainage | 56 | 267 | 167 | 326 | 1,146 | 802 | 2,226 | 2,136 | 3,112 | 2,393 | 1,407 | 2,977 | 2,822 | 695 | 3,110 | 4,034 | 679 | 4,316 | 4,192 | 648 | 4,461 | 16,049 | 6,978 | 18,945 |
| Construction cost | 45 | 243 | 146 | 221 | 946 | 614 | 1,328 | 1,606 | 1,994 | 1,202 | 961 | 1,601 | 1,203 | 432 | 1,382 | 1,465 | 383 | 1,624 | 1,289 | 332 | 1,427 | 6,753 | 4,903 | 8,788 |
| Price escalation | 8 | 24 | 18 | 87 | 200 | 170 | 854 | 530 | 1,074 | 1,129 | 446 | 1,314 | 1,549 | 263 | 1,658 | 2,490 | 296 | 2,613 | 2,816 | 316 | 2,947 | 8,933 | 2,075 | 9,794 |
| Interest /1 | 3 | - | 3 | 18 | - | 18 | 44 | - | 44 | 62 | - | 62 | 70 | - | 70 | 79 | - | 79 | 87 | - | 87 | 363 | - | 363 |
| T o t a l | 82 | 569 | 318 | 523 | 2,062 | 1,379 | 2,626 | 4,897 | 4,658 | 3,005 | 3,438 | 4,432 | 3,709 | 2,543 | 4,764 | 5,484 | 1,474 | 6,096 | 5,802 | 1,523 | 6,434 | 21,231 | 16,506 | 28,081 |

/1: Interest for foreign currency portion during the construction period.

Table 10-2-3 Disbursement Schedule for 5-Year Plan on Full-Contracting System

| Description | 1978/79 | | | 1979/80 | | | 1980/81 | | | 1981/82 | | | 1982/82 | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total |
| | ($10^6$ Rp) | ($10^3$ $) | ($10^6$ Rp) | ($10^6$ Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) |
| Flood control | 26 | 302 | 151 | 191 | 441 | 374 | 607 | 2,364 | 1,588 | 1,191 | 2,532 | 2,242 | 1,446 | 3,754 | 3,004 | 3,461 | 9,393 | 7,359 |
| Construction cost | 19 | 275 | 133 | 131 | 363 | 282 | 346 | 1,777 | 1,083 | 578 | 1,730 | 1,296 | 581 | 2,329 | 1,548 | 1,655 | 6,474 | 4,342 |
| Price escalation | 3 | 27 | 14 | 51 | 78 | 83 | 222 | 587 | 466 | 543 | 802 | 876 | 748 | 1,425 | 1,339 | 1,567 | 2,919 | 2,778 |
| Interest /1 | 4 | - | 4 | 9 | - | 9 | 39 | - | 39 | 70 | - | 70 | 117 | - | 117 | 239 | - | 239 |
| Irrigation & drainage | 56 | 267 | 167 | 442 | 681 | 725 | 3,390 | 1,890 | 4,174 | 4,256 | 2,122 | 5,136 | 4,385 | 2,083 | 5,250 | 12,529 | 7,043 | 15,452 |
| Construction cost | 45 | 243 | 146 | 309 | 563 | 543 | 2,042 | 1,420 | 2,631 | 2,163 | 1,449 | 2,764 | 1,878 | 1,293 | 2,415 | 6,437 | 4,968 | 8,499 |
| Price escalation | 8 | 24 | 18 | 121 | 118 | 170 | 1,313 | 470 | 1,508 | 2,031 | 673 | 2,310 | 2,419 | 790 | 2,747 | 5,892 | 2,075 | 6,753 |
| Interest /1 | 3 | - | 3 | 12 | - | 12 | 35 | - | 35 | 62 | - | 62 | 88 | - | 88 | 200 | - | 200 |
| T o t a l | 82 | 569 | 318 | 633 | 1,122 | 1,099 | 3,997 | 4,254 | 5,762 | 5,447 | 4,654 | 7,378 | 5,831 | 5,837 | 8,254 | 15,990 | 16,436 | 22,811 |

/1 : Interest for foreign currency portion during the construction period.

Table 10-2-4 Disbursement Schedule for 5-Year Plan on Equipment-Lending System

| Description | 1978/79 | | | 1979/80 | | | 1980/81 | | | 1981/82 | | | 1982/83 | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total | LC | FC | Total |
| | ($10^6$ Rp) | ($10^3$ $) | ($10^6$ Rp) | ($10^6$ Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) | ($10^6$Rp) | ($10^3$$) | ($10^6$Rp) |
| Flood control | 26 | 302 | 151 | 204 | 1,470 | 814 | 691 | 5,016 | 2,773 | 1,482 | 1,094 | 1,936 | 1,753 | 1,202 | 2,252 | 4,156 | 9,084 | 7,926 |
| Construction cost | 19 | 275 | 133 | 131 | 1,214 | 635 | 369 | 3,769 | 1,933 | 714 | 741 | 1,024 | 717 | 747 | 1,027 | 1,950 | 6,752 | 4,752 |
| Price escalation | 3 | 27 | 14 | 51 | 256 | 157 | 237 | 1,247 | 755 | 670 | 347 | 814 | 923 | 455 | 1,112 | 1,884 | 2,332 | 2,852 |
| Interest /1 | 4 | - | 4 | 22 | - | 22 | 85 | - | 85 | 98 | - | 98 | 113 | - | 113 | 322 | - | 322 |
| Irrigation & drainage | 56 | 267 | 167 | 457 | 1,713 | 1,168 | 3,576 | 2,818 | 4,745 | 4,454 | 1,002 | 4,870 | 4,654 | 850 | 5,007 | 13,197 | 6,650 | 15,957 |
| Construction cost | 45 | 243 | 146 | 310 | 1,417 | 898 | 2,140 | 2,116 | 3,018 | 2,260 | 684 | 2,544 | 1,998 | 527 | 2,217 | 6,753 | 4,987 | 8,823 |
| Price escalation | 8 | 24 | 18 | 122 | 296 | 245 | 1,376 | 702 | 1,667 | 2,122 | 318 | 2,254 | 2,573 | 323 | 2,707 | 6,201 | 1,663 | 6,891 |
| Interest /1 | 3 | - | 3 | 25 | - | 25 | 60 | - | 60 | 72 | - | 72 | 83 | - | 83 | 243 | - | 243 |
| T o t a l | 82 | 569 | 318 | 661 | 3,183 | 1,982 | 4,267 | 7,834 | 7,518 | 5,936 | 2,096 | 6,806 | 6,407 | 2,052 | 7,259 | 17,353 | 15,734 | 23,883 |

/1 : Interest for foreign currency portion during the construction period.

LIST OF APPENDICES INCLUDED IN VOLUME III SUPPORTING REPORT