7)	Beach Vegetation			Coastal		
8)	Peat Swamp	waterable	High-water	Fresh	Peat	
9)	Freshwater Swamp Forest		Fresh	Muck water		
10)	Brackish water Forest			Brackish water	Saline clays	
11)	Mangrove Forest			Salt water clays	Saline	
12)	Lowland Monsoon seasonal	Clear	Dry land	Inland	Zonal	Lowland
13)	Monsoon Forest on Ultra basic	shortage of rain			Ultra basic	Mainly lowland
14)	Monsoon Forest on Limestone				Limestone	Mainly lowland

1.8 Flora in the Ecological Boundary Area

Vegetation structure of natural forest, rivarian forest, production forest, bush area, grassland and mixed garden in upersteam rolling area and central plain area were studied. The location and number of plot studied were as follows.

Lange Forest Group (north of Paselloreng village)	6 plots
Dulang Forest Group (east of Paselloreng village)	4 plots
Karakati Labusta Forest Area (west of Paselloreng village)	5 plots
Natural forest (flood plain area)	1 plot
Teak forest (flood plain area)	1 plot
Mixed garden (flood plain area)	2 plot
Natural forest (main stream rivarian forest)	2 plots
People production forest (main stream revarian forest)	4 plots
Bush area (main stream rivarian forest)	3 plots

Sixty one (61) tree and grass species were observed in the primary forest, secondary forest / bush, forest plantation (roboisari), people production forest, mixed garden, and grassland. There are 16 commercial tree species were included in the 61 species.

	Local Name	Botanical Name
1. Primary forest		
a. Top canopy (20-30 m height)	Sipate	*Alstonia sp.*
	Bajo	*Pterospermum sp.*
	Serra	*Dillenia sp.*
	Daubawi	*Santiria sp.*
	Dama-dama	*Santiria laevigata*
	Sugimanai	*Anthocepalus cadamba*
	Bunu	*Colona sp.*
	Ganjeng-ganjeng	*Celtis sp.*
	Jalapao	*Buchanania arborescens*
	Uri	*Aglaria sp.*
	Lelatang	*Laportea sp.*
	Terra	*Anthocarpus sp.*
	Tiro langi	*Tabarnaemontana sp.*
	Pangi	*Pangium odule*
b. Second Stratum (5-20 m height)	Palia	*Clenhovia hosvita*
	Sampi	*Schleichera oleosa*
	Bitti	*Vitex cofassus*
	- - -	*Buchanania arborescens*

	- - -	*Celtis sp.*
	Kani	*Erythrina pusca*
	- - -	*Alstonia sp.*
	Laru-laru	*Myristica sp.*
	- - -	*Santiria laevigata*
	Settung	*Sandoricum koetjape*
	Langi	*Phitecellebium sp.*
	Enau	*Arenga seccarifera*
c. Ground Cover	Manggis hutan	*Garcinia sp.*
(less than 5 m hight)	Lumpiwi	*Tetracera sp.*
	Bampeng	*Zingiberaceae*
	- - -	*Myristica sp.*
	Lambang	*Santiria sp.*
	Mali-mali	*Leea indica*
	Ballo	*Pandanus sp.*
	Bunnepadung	*Antidesma sp.*
	- - -	*Pterospermum sp.*
2. Secondary forest / Bush		
a. Top canopy	- - -	*Santilia sp.*
	- - -	*Santilia laevi-gata*
	Siretong	*Arallia sp.*
	Aruale	*Ficus sp.*
	- - -	*Buchanania arborescens*
	Kaili	*Dracontomelon dao*
	- - -	*Anthocepalus cadamba*
	Bunga	*Cananga odoratum*
	Kecci	*Spondias sp.*
	Cuco	*Ficus sp.*
	Cundekke	*Ficus sp.*
	- - -	*Pterospermum sp.*
	- - -	*Myristica sp.*
	Bance	*Nauclea orientalis*
	Sampi	*Schleichere oleosa*
b. Ground cover	Talise	*Terminalia sp.*
	Pejje-pejje	*Mallotus sp.*
	- - -	*Leea indica*
	Buanging	*Ficus sp.*
	- - -	*Buchanania arborescen*
3. Forest Plantation	Jati	*Tectona grandis*
(reboisasi)	- - -	*Eucalyptus sp.*
4. Peaple Forest	Jati	*Tectonia gradis*
Production	- - -	*Alleurites moluccana*
	- - -	*Anthocepalus cadamba*
	- - -	*Cananga odoratum*
5. Mixed Garden	Coklat	*Teobroma cacao*
	Kapi	*Coffea robusta*
	Kelor	*Moringa sp.*
	Jeruk	*Citrus sp.*
	- - -	*Alleurites moluccana*
	- - -	*Vitex cofassus*
6. Grassland	Dea / Alang-alang	*Imperata silindrica*
	Seri minyak	*Panicum malabricum*
	Padang-padang	*Andropogon aciculatus*
	Seri panca	- - -
	Seri billa	- - -
	Seri lila manuk	- - -
	Bekko	- - -

Kelling-kelling	- - -
Awareng	- - -

Commercial species in the ecological boundary area are *Tectonia grandis, Vitex cofassus, Pterospermum celebium, P. javanicum, Sondericum koetjape, Alstonia sp. Anthocepalus cadamba, Buchanania arborescens, Colona sp., Myristica sp. Dracontomelon dao, D. mangiferum, Dillenia sp., Koordersiodenrum pinnatum, Cananga odoratu, and Calophyllum sp.*.

1.9 Lowland Monsoon Forest in Uperstream Rolling Area

The land use of inundated area in Desa Paselloreng is 32 % of bush, 24 % of paddy field, 13 % of orchard, 11 % of grassland, and 3 % of village. According to vegetation survey, forest and bush in inundated area is mostly rivarain forest of main stream and tributaries of Gilirang river, especially lower portion of the inundated area. Hills are used as grassland for grazing animals. Forest area increase more in upper portion of the area. Primary forest around the inundated area are located at the northern hill (Lange forest group), east hill (Dulung forest group), and west hill (Karakari Labusa forest area) of Desa Paselloreng. Tropical primary forest is very valuable from the viewpoint of bio-diversity and wildlife conservation. Because of higher elevation than the expected normal water level of Gilirang dam (51.5 m above sea level), these primary forest will not be so much influenced by negative impact by the dam construction. According to the Forest Office in Wajo, reforestation in government forest land is carried on yearly in the northern most of Gilirang river. The tree species of high quality like Teak, Akasia, Albisia, Kemiri, Mahoni, and Johar are being planted for timber production and environmental conservation.

1.10 Mangrove Forest in Down Stream Coastal Area

South Sulawesi formerly had about 110,000 ha of mangrove, but 70 % had been converted to brackish water fishpond (tambak) and only 34,000 ha remained in 1991. There is mangrove forest in the downstream coastal area facing to Bone Bay. Vegetation structure of mangrove forest is a complex ecosystem composed by more than thirty species of trees and bushes adapted to high salinity condition. The forest is rich in wildlife, and important for protecting coastal erosion and river-bank erosion.

Mangrove is observed on the river bank of Gilirang river at Cappabalatue, Desa Akkajeng, Kec. Sojoeging, 7 km from outlet of the river, showing incursion of sea water. Water quality analysis shows high salinity contents. Mangrove is a bio-indicator of sea water intrusion, and contributing as the protection from river-bank erosion. There are the experimental forest of Center for Environmental Studies, Hassanuddin University at outlet of Gilirang river. Dominant species of mangrove forest complex are changed by the condition of flood (high, low), salinity (high, low), and subtracted (sand, clay, coral). Impact to mangrove forest by the dam construction will be the external factors to disturb the mangrove ecosystem through decrease of water, sedimentation, and mineral supply.

Presently, Green Belt Plan is going on in South Sulawesi. The plan aims to develop 200 m wide mangrove belt along sea coast and river-bank for environmental conservation. Forest Office in Wajo have been practising 370 ha of mangrove re plantation at nine (9) location from 1990 to 1994.

1.11 Fauna and Endangered Species in Sulawesi

The fauna of Sulawesi is one of the most distinctive in all Indonesia, particularly among

animals. Of the 127 indigenous mammal species, 79 (62%) are endemic, and the percentage rises to 98% if bat are excluded. The mammal fauna is also characterized by its primitive characters. Indonesia registered 16 animal species considered to be at risk in Sulawesi to Red Data Book of International Union for the Conservation of Nature (IUCN).

Common Name	Zoological Name	Statue
Sulawesi tarsier	*Tarsius spectrum*	I
Sulawesi civet	*Macrogalidia musschenbroeckii*	R
Dugong	*Dugong dugon*	V
Babirusa	*Babyrousa babirussa*	V
Lowland anoa	*Bubalus depressicornis*	E
Mountain anoa	*Bubalus quarlesi*	E
Chinese egret	*Egretta eulophotes*	V
Milky stork	*Ibis cinereus*	V
Maleo	*Macrocephalon maleo*	V
Estuarine crocodile	*Crocodylus porosus*	E
Leatherback turtle	*Dermochelys coriacca*	E
Hawksbill turtle	*Eretochelys imbricata*	E
Foresten's tortoise	*Indotestudo forsteni*	R
Talaud black birdwing	*Troides dohertyi*	V
Palu swallow tail	*Atrophaneura palu*	I
Tambusisi wood nymph	*Idea tambusisiana*	I

Note : E; endangered, V; vulnerable, R; rare, I; insufficiently known

1.12 Fauna and Endangered Species in Ecological Boundary Area

Seventy three (73) animal species were found in the ecological boundary area by the field survey and interviewing to villigers by EIA Team. They are 7 species of mammal, 32 of bird, 13 of reptilia, 13 of fish, 5 of crustacea, and 3 of mollusca.

Local Name	Indonesian Name	Zoological Name
Mammal		
1. Bawi	Babi hutan	*Sus celebansis*
2. Junga	Rusa	*Cevus timorensis*
3. Tengkaleng	Musang	*Macrogalidia musschenbroeckii*
4. Balaomappa	Tupai	- - -
5. Kusa	Trenggiling	- - -
6. Lanceng	Kera tonkeana	*Macaca tonkeana*
7. Balao ale	Tikus hutan	*Paruromys dominator*
Bird		
8. Alo	Enggang sulawesi	*Rhyticeras cassidix*
9. Turutele	Engang kecil	*Penelopides exarhatus*
10. Capili	- - -	- - -
11. Cakkurra	- - -	- - -
12. Petung	- - -	- - -
13. Bekku	Tekukur	*Streptopelia chinensis*
14. Cabe-cabeng	- - -	- - -
15. Dakkoro	Kt. Punggung biru	*Tanygnathus sumatranus*
16. Cakkale	Kt. Jambul kuning	*Cacatua sulphurea*
17. Dora	Nuri permai	*Trichoglossus ornatus*
18. Deling	Nuri kuning hijau	*Trichoglossus flavoviridis*
19 Serra	Burung hantu	*Tyto sp.*
20. Picing	- - -	- - -

21. Dongi	Pipit	*Passer montanus*
22. Pune	Punai hijau	*Duculus aenea*
23. Uro	Puyu	*Coturnix sp.*
24. Cawiwi	Belibis kecil	*Dendrocycna sp.*
25. Unreng	Belibis besar	*Dendrocycna sp.*
26. Cappalali	- - -	- - -
27. Kao-kao	Gagak	*Corvus sp.*
28. Jana	Elang abu	- - -
29. Tarru	Elang coklt	- - -
30. Balitoto	Pelatuk	- - -
31. Paniki	Kelelawar buah	- - -
32. Campong pute	- - -	- - -
33. Campong bolong	- - -	- - -
34. Doko	- - -	- - -
35. Lairung	- - -	- - -
36. Tampalairung	- - -	- - -
37. Dunrung	- - -	- - -
38. Kulu-kulu	- - -	- - -
39. Manu ale	Ayam hutan	*Gallus gallus*
Reptilia		
40. Ula sawa	Ular sanca	*Phyton sp.*
41. Ula daun-daun	- - -	- - -
42. Ula kaleke	- - -	- - -
43. Ula bolong	- - -	- - -
44. Ula laputeng	- - -	- - -
45. Ula makuluwali	- - -	- - -
46. Pararang	- - -	- - -
47. Biccoro	Kadal sirip	*Hydrosaurus sp.*
48. Buaja	Buaya sungai	*Crocodylus sp.*
49. Kiobatang	Tokke hutan	*Gekko sp.*
50. Buccili	- - -	- - -
51. Lipanbolong	- - -	- - -
52. Tuppang	Katak	*Rana sp.*
Fish		
53. Masapi	Paling / sidat	*Anguilla sp.*
54. Lendong	Belut	*Monopterus sp.*
55. Kandea	Tawes	*Puntius goniotus*
56. Cappi	Lele	*Clarius batrachus*
57. Bolong	Gabus	*Channa striata*
58. Ceppa	Gurami	*Osphronemus gurami*
59. Ulaweng	Mas	*Cyprinus carpio*
60. Bunti	Belanak	*Liza sp.*
61. Aro-aro	- - -	- - -
62. Anai	- - -	- - -
63. Bolu	Bandeng	*Chanos chanos*
64. Bungo pute	- - -	- - -
65. Cakke	- - -	- - -
Crustaceae		
66. Urang batu	- - -	- - -
67. Urang pute	- - -	- - -
68. Urang sawe	- - -	- - -
69. Urang takka	- - -	- - -
70. Urang sura	- - -	- - -
Mollusca		
71. Gelling	- - -	- - -
72. Bojo	- - -	- - -
73. Cuco	- - -	- - -

There are four (4) endangered and law protected species in the 73 animal species, namely Musang (civil cat), Kera tonkeana (monkey), Enggang sulawesi (sulawesi horn bill), and Enggang kecil (small horn bill). During field survey on Nov. 12, 1994, about 35 head of black monkey was observed at the dam site. According to information from villagers, Anoa, which is the endemic mammal in Sulawesi and the one of IUCN Red Book registered important species, could be still found in this area, especially in Forest Deraga Complex.

Endangered species of fauna will be protected by the prohibition of hunting by local people. However, the only small of primary forest area as habitats will be influenced by the permanent pool, so their habitats will not be really affected.

1.13 Major Ethnic Group, Religion and Traditional Economy in Sulawesi

Despite the relatively small size area and population of Sulawesi, the number and make-up of the ethnic groups is extremely complex. Seven (7) major groups are recognized in Sulawesi. The Sulawesi people themselves use region, religion and style of farming as the major criteria for determining ethnic groups. In Wajo District, the population majority are basically of Malay heritage and are mostly the Buggies ethnic group. There is no report of inhabitation of ethnic minority or nomad in and around the project area.

Major Ethnic Group	Inhabitation	Dominant Religion	Traditional Economy
1) Manahasa	N.Sul.	Christianity	Plantation and mixed agriculture
2) Gorontalo-Tomini	N. & C.Sul.	Islam	Mixed agriculture(slash and burn)
3) Traja			
- Kaili	C.Sul.	Islam	Mixed agriculture
- Upland Kaili and Pamosa	C. & S. Sul.	Christianity	Upland slash and burn
- Toraja	S. Sul.	Christianity	Mixed agriculture
4) Bugis-Makassar			
- Bugis	S. Sul.	Islam	Lowland agriculture, commerce, seafaring
- Makassarese	S. Sul.	Islam	Lowland agriculture, seafaring
- Mandarese	S. Sul.	Islam	Lowland agriculture, seafaring
5) Luwuk-Banggai	C. Sul.	Mixed	Slash and burn, fishing
6) Bunku-Mori	NE. Sul.	Mixed	Slash and burn, fishing
7) Muna-Buton	NE. Sul.	Islam	Slash and burn, fishing

1.14 Ethnic Group and Religion in the Project Area

In Kab. Wajo, Bugis ethnic group, which belongs to Maley heritage, is of majority in the population. There is no inhabitant of ethnic minority or nomad in and around the study area. All person in Kec. Majauleng and Sojoanging are Islam as their religion. However, 96 % of population of Kec. Maniangpajo are Islam while the rest is Hindu.

1.15 Historical Remains and Archaeological Assets in South Sulawesi and Wajo

There are several historic remains and archaeological assets in South Sulawesi. Maros Caves located near Ujung Pandung is a remains of pre-historic age, and ship-shaped houses of Toraja village are famous historical properties. There are historical remains of old palace and the kings and brave soldiers of Wajo Dynasty (1476-1946) at Desa Tosora, Kec.

Majauleng, 10 km east from Sengkang. Tosora was the capital of Wajo Dynasty until the capital transferred to Sengkang in 1966. The location is out of the study area.

1.16 Fishing Right and Water Right in Gilirang River

Indonesian Water Right stated that Government shall control water and land for all the prosperity of all Indonesian people. There is no fishing right in the Gilirang river. Every one can catch fish without any payment. Also, There is no clear water use right in the Gilirang river. Every farmer can traditionally use surface water for their paddy field. Likewise in downstream, pisculture fisherman can use water for their fish pond. Therefore minimum supply of surface water in dry season will be needed for their traditional water use.

1.17 Non-Spontaneous Removal of Inhabitants from Reservoir

Desa Paselloreng in Kec. Maniangpajo is located in the expected reservoir area of proposed dam. In this context, the Study Team obtained a report titled "policy statement of local government of South Sulawesi Province on resettlement from reservoir area of Gilirang dam". The report was prepared by Bupati (Chief of Kabupaten) based on discussion meeting held between Land Control Office, Kab. Wajo and 58 representatives of 315 families in Desa Paselloreng, and sent to DGWRD on Sept. 20, 1993. The report summarises the results of discussion as follows :

1)In principal, the inhabitants of Desa Paselloreng agree to removal from the reservoir and dam construction to be implemented under the Gilirang Irrigation Project.

2)Location of new land for the inhabitants and amount of compensation shall be arranged and decided by the Government.

An interview of 25 person of Paselloreng villagers was carried out on September 23-25, 1994, along with economic survey. Most of villagers wished the need of feasible compensation and move together in one location. Villagers were willing to cooperate with the local authority to move another area. However, their willingness to move and resettle have to be compensated by the Project or Government. This consist of the following three items proposed by them.

1)New resettlement should be located in Lakabatua which now inside area of PT Bina Muria Ternak (State Livestock Range Company).

2)The amount of compensation and payment procedure have to be negotiate between villagers and the Government. Compensation should be directed to villagers.

3)All graves should be resettled on the side that they easy to visit by the relatives. Mosque, school, health center, and other public facilities should be rebuilt by the Project or Government on the new resettlement site.

Topics of questionnaire and respondent answer, and basic information of Paselloreng village are tabled as follows .

Topic of Questionnaire	Percentage of respondent answer	
	No.	%
Expectation to Gilirang Irrigation Project.		
If resettlement is agreed, then		
1. Need feasible compensation	8	32
2. Will be move together in one location	6	24
3. Will be discussed and agreed between family members	3	12
4. Guarantee for better live	4	16
5. Possibility of working in the Project	2	8
6. No comment	2	8

According to the order of Ministry of Public Works, preparation of resettlement program is needed for a project under which resettlement of inhabitants more than 200 households is envisaged (Menurut Peraturan Menteri PU No. 46/PRT/1990). Following this order, DGWRD requested DINAS PU Pengairan, South Sulawesi Province on September 14, 1994 to formulate the resettlement program for the Project. In practice, the preparation of resettlement program was carried out by the working team organized in Bupati Office, Kab. Wajo. The JICA Study Team provided relevant data and information to the working team for the program preparation, and explained the outline of the Project in the meeting held among the members of working team on November 19, 1994 in the Bupati Office.

In the draft of resettlement program prepared by the working team on December 2, 1994, the resettlement of inhabitants in Desa Paselloreng is programmed to be carried out within the following three options:

a) New employment in private sector plantations planned to be developed in Kab. Wajo,
b) New development of state-owned land nearby submerged areas, and
c) Resettlement under a local transmigration program.

In addition, the further steps to be taken by the working team and the Government mentioned in the draft of resettlement program are as follows:

a) To conduct extension and explanation to the inhabitants in Desa Paselloreng on the planned irrigation project and the resettlement program.
b) To make physical inventory of Paselloreng village, covering area by land use categories, number of houses and public facilities.
c) To determine a new resettlement site under a decree of Bupati of Wajo.
d) To conduct an arrangement with the Ministry of Agriculture, BPN, Ministry of Forestry, PT. Bina Mulia Ternak and other related parties for the conversion of land status where the proposed site is to be located.
e) To set up a team of the related agencies for the implementation of the planned resettlement.
f) To determine a proper compensation to the concerned inhabitants.
g) To prepare a site plan for proposed site so that it will function similarly with that in the former settlement.
h) To provide the necessary infrastructures and facilities such as roads, power line, water supply, mosque, school, health service, administration office, and village-based institution office.
i) To carry out the resettlement plan in stages.

2. INITIAL ENVIRONMENT EXAMINATION (IEE)

In cooperation with the parties concerned of DGWRD, the initial environmental examination was carried out on 47 social and natural environmental components. The results are shown

as follows.

I. Environmental components which are unquestionably induced significant impact by the project
   1. Social environment
      - Planed residential settlement
      - Involuntary resettlement
      - Change in basis of economic activity
      - Occupation change and loss of job
   2. Natural environment
      - Change in vegetation
      - Encroachment into tropical rain forest and wild land
      - Changes in surface water hydrology
      - Sedimentation

II. Environmental components which are likely to be induced significant impact by the project
   1. Social environment
      - Population increase
      - Drastic change in population consideration
      - Increase in income disparities
      - Increase use of agrochemical
      - Residual toxicity of agrochemical
      - Increase in domestic and other human waste
   2. Natural environment
      - Soil erosion
      - Soil contamination by agrochemical and others
      - Change in ground water hydrology
      - Water eutrophication

III. Environmental components which are not fully known to be induced significant impact by the project
   1. Social environment
      - Substantial change in way of life
      - Conflict among communities and way of life
      - Adjustment and regulation of water and fishing right
      - Change in social and institutional structure
      - Change in existing institutions and custom
      - Spreading of endemic disease
      - Impairment of historic remains and cultural assets
      - Damage to aesthetic site
      - Impairment of buried assets
   2. Natural environment
      - Negative impact on important or indigenous diversity
      - Degeneration of ecosystems with biological diversity
      - Destruction or degeneration of mangrove forest
      - Water contamination and deterioration of water quality
      - Sea water intrusion

3. ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

3.1 General

The Project is formulated paying much attention to minimizing expected adverse impacts on environment by employing mitigation measures, e.g. determination of river maintenance flow considering water demand in the downstream reach of the Gilirang river, drainage planning taking the existing brackish water ponds into account, and introduction of farming

practice which utilize small amount of agro-chemical. However, it is predicted that the Project would cause various impacts on various environment components due mainly to the construction of dam with 132 MCM of maximum storage capacity and conversion of 7,000 ha of rainfed paddy field into irrigated paddy field. These impacts are assessed based on the study result of the JICA Study Team hereinafter in this Section. Environmental management plan and monitoring plan formulated following the impacts assessment are also presented in this Section.

3.2 Environmental Impact Assessment

The result of identification and evaluation of the impacts caused by the different project activities at different project stages is as shown in matrix form in Table A.9.2. Environmental components in the matrix table are 7 physical-chemical components, 5 flora and fauna components, and 11 social, economical, and cultural components. The different project activities at different project stages are 3 activities at pre-construction stage, 10 activities at construction stage and 5 activities at operation stage. The predicted locations of the impacts are also indicated in the matrix table.

1) Pre-construction Stage

   Environmental impacts related to involuntary resettlement of inhabitants in the submerged area of Paselloreng dam are predicted to be significant at pre-construction stage, i.e. inhabitants would have expectation and anxiety about new resettlement site, resettlement activity itself and compensation. They would lose present job and lose their village.

2) Construction Stage

   At construction stage, the Project would cause significant impacts on the environmental components of physiography and topography, soil erosion, water quality, etc. These would further cause changes in mangrove forest in downstream areas.

3) Operation Stage

   At this stage, significant impacts are predicted on changes in surface water hydrology due to the construction of dam, increase of salinity in downstream area and decrease of sedimentation due to decrease of water flow and change in groundwater level. These impacts would further cause impacts on mangrove forest and fishes. Positive impact is expected on water supply to the inhabitants in the project area after operation of irrigation system. Contamination of water quality is predicted due to introduction of 229% of cropping intensity, although farming with small amount of agro-chemical is to be practiced under the Project. Accordingly, the drainage canal layout of the Project is programmed that drainage water would not enter into brackish water ponds directly. Through the introduction of irrigated agriculture, the positive impact is also expected on increase of job opportunity, increase of income and activation of regional economy.

3.3 Environmental Management Plan

Based on the above result of environmental impact assessment, mitigation measures are examined as an environmental management plan for the environmental components which are evaluated to be induced significant impact by the Project. The environmental management plan is as shown in Table A.9.3.

3.4 Environmental Monitoring Plan

Environmental monitoring plan is formulated through the clarification of source of impact, monitoring objective, monitoring methodology, monitoring execution agency, etc. The environmental monitoring plan is as shown in Table A.9.4.

3.5 Environmental Impact Assessment of DGWRD

All the results of the above mentioned environmental impact assessment including environmental management and monitoring plans were handed over to DGWRD on middle of December 1994. Based on this result, DGWRD is going to prepare the report on environmental impact assessment according to the Indonesian lows and regulations through explanation and discussion with the committee for environmental assessment which is organized both at provincial level and national level.

4. METHOD AND PROCEDURE OF ENVIRONMENT IMPACT ASSESSMENT IN INDONESIA

4.1 Aims of Environment Impact Assessment (EIA)

Environment Impact Assessment (Analysis of Environmental Impact or AMDAL in Indonesian) is an integrated review process to coordinate the planning and review of development activities, particularly their ecological, socio-economical and cultural components, as complement to the technical and economical feasibility.

4.2 Goal of EIA Process

The goal of EIA is to facilitate and expedite economically sound, environmentally and socially acceptable development venture. Essentially, it involves the following steps :

a) To identify the potential environmental impacts of a project proposal.
b) Predict the extent of impacts if a project is implemented.
c) Evaluate impacts, including:
   - Identifying which can be mitigated or managed and how that management will be done, for example, through changes in project design or location.
   - Identifying and assessing the significance of those impact which can not be mitigated or managed (residual impact).

4.3 EIA Documentation

The EIA documentation for proposed projects is comprised of the following documents.

a) Initial Environment Examination (Preliminary Environmental Information or PIL).
b) Terms of Reference (TOR) for EIA (KA-ANDAL).
c) Environment Impact Assessment (ANDAL).
d) Environmental Management Plan (RKL).
e) Environmental Monitoring Plan (RPL).

4.4 Selection of EIA Process

It is important to note that not all projects will need to enter the whole process of EIA. Projects are selected according to the scale and the contents of a project concerned as following :

a) Project which impact is obviously significant and need whole process of EIA (Category 1, ANDAL).
b) Project which impact is not instantly determined and need either EIA or IEE (Category 2, ANDAL/PIL).
c) Project which impact is not so significant and may need only IEE (Category 3, PIL/NO AMDAL).
d) Project which impact is obviously not significant and not need whole process of EIA (Category 4, NO AMDAL).

4.5 General Relationship Between EIA and Project Cycle Phase

EIA (AMDAL) Stage	Project Cycle Phase
1) Initial screening of project	Planning and program development
2) Initial Environment Examination (PIL)	Pre-feasibility study
3) Term of reference for EIA (KA-ANDAL)	Feasibility study
4) Environment impact assessment (ANDAL) Conceptual outline of Environmental management plan (RKL) Environmental monitoring plan (RPL)	Feasibility study
5) Project approval in principle	
6) Detail of Environmental management plan (RKL) Environmental monitoring plan (RPL)	Detailed design and permit
7) Implementation of Environmental management plan (RKL) Environmental monitoring plan (RPL) (Modification, if any)	Pre-construction Construction operation Post project evaluation

4.6 Purpose and Contents of Document in each EIA Process

Initial Environment Examination (PIL)

Purpose :

- To determine if the project requires EIA study.
  (note : if the project is known to have important impact, it may go straight to EIA)
- To determine, if possible with secondary information, if the proposed project should be reject because it will result in significant, adverse impact which can not be mitigated, or if the project should be relocated because the proposed location is not suitable.
- To determine if the project should be accepted as proposed, or with specified mitigation and management programs.

Contents :

- Brief description of the activity, the environmental setting of activity location, and the potential or actual environmental impact resulting from the activity.
- A plan of action to manage the predicted impact.
- Identification and evaluation of the significance of residual impact (those that can not be mitigated).

Terms of Reference for Environment Impact Assessment (KA-ANDAL)

Purpose :

- To clearly identify the scope of the study, the selection of relevant data and information so that only directly related factors are considered.

Contents :

- Specification of data requirements and report components to include in the EIA report.

Environmental Impact Assessment (ANDAL)

Purpose :

- To identify the anticipated environmental impacts of a proposed project, and determine if they are mitigable.
- To determine if a proposed project should be rejected because it will result in significant, adverse impacts which cannot be mitigated.

Contents :

- An elaborate and in-depth study of an activity.
- A plan of action to manage the predicted impacts (conceptual environmental management plan and environmental monitoring plan).
- Identification and evaluation of residual impacts.

Environmental Management Plan (RKL)

Purpose :

- To set out the design and operating requirements for mitigating environmental effects by potential or existing projects.

Contents :

- Detailed description of all design change, construction and operating procedures and site rehabilitation measures undertaken to mitigate identified impacts.
- Specification of, among other things, compliance standards and activity responsibilities and schedules.
- Compensation plan for unmitigable or residual impacts.

Environmental Monitoring Plan (RPL)

Purpose :

-To ensure that mitigative measures suggested in initial information or environment impact assessment and environmental management plan documents are effective, and to detect unanticipated change to the environment.

Contents :

- Type of impacts and/or environmental factors being observed.
- Location, frequency and accuracy of data collection.
- Responsibilities for conducting, analyzing, reporting, managing and utilizing monitoring results.

4.7 Member and Task of Central Committee for EIA in the Ministry of Public Works

The Central Committee for EIA in the Ministry of Public Works consist of Committee Forum, Secretariat, Technical Team and Working Team.

Central Committee (Central Forum)

Chairman	Director General of Research and Development
Deputy-chairman	Inspector General
Permanent Member	Senior of Officials of Public Works
	Representative of Ministry of Population and Environment
	Environmental expert from a university
Non-Permanent Member	Regional Commission stuff
	Representative from communities affected by project under

	view Representative from NGOs (Non Government Organizations)
Task	- Evaluation of EIA, recommendation on EIA Document, and TOR of EIA for the decision of the Minister - Provision of guidance and preparation of regulations concerning environmental affairs such as preparation of guidance and technical guidelines for the decision of the minister
Secretariat	
Member	Officials from Research and Development Agency and Secretariat General
Task	A part of the Committee and as the agency of committee in charge of administrative of the committee
Technical Team	
Chairman	
Member	Environmental experts based with the Research and Development Agency, Secretariat General, Inspectorate General, and Directorate General
Task	A part of the Committee and as an agent of the Committee in evaluating technical document of the Committee
Working Team	
Chairman	Director of Planning
Member	- Expert environmental staff from the Directorate of Planning and Programming - Representative from Technical Directorate
Task	A part of the Committee and as an agent of the Committee for a certain Directorate General, in charge of evaluating EIA document and recommending the presented document in the Committee's meeting

4.8 Member and Task of Regional Commission for EIA in Provincial Government

Regional Commission for EIA is organized by Provincial Government. The Commission carry out the project financed by the following.

a) Provincial budget (APBD).
b) National budget (APBN) but the implementation of which has been formally transferred to the provincial government.
c) Foreign or domestic investment projects and community or private enterprises whose operating license have been issued by an agency with regional authority.

Regional Commission

Chairman	Chair of Provincial Development Planning Board (BAPPEDAL)
Deputy-chairman	Assistant Secretary, Provincial Government Administration
Secretary	Chief, Provincial Population and Environment Office (BKLH)
Permanent Member	- Provincial Development Planning Office - Provincial Population and Environment Office - Provincial Legal Office - Environment study center (PLS) in the Province
Non-permanent	- Chair, Regional Investment Coordination Board

Member	- District-level Secretary for Administration - Line Development Regional Office - Representative from Provincial Technical Service - Representative from the affected community and/or from a "Community self-reliance institution" / NGO - An expert on specific types of environmental impact (varies with project)
Task	Essentially same as National Government Central Committee

Technical Team

Chairman	
Member	Representative from Provincial Government, Technical Agencies and "Central Agencies" (these representatives must possess a certificate of ANDAL A course)
Task	Assistance to Regional Commission

4.9 EIA Training and Certification

EIA training is coordinate by Environment Impact Management Agency (BAPEDAL). Information on course may be obtained from the Agency. Presently, the following course are offered :

Basic EIA (Type A)

The basic EIA course is an introductory course which provides information on environmental management and the EIA process. It is ten days duration. The target group degree or within minimum 3 years experience in related field.

EIA for Practitioner (Type B)

The six weeks EIA B course is designated primary for those individuals wishing to write EIA report. The basic EIA course is a prerequisite for this course. The target groups are consultants and those interested in preparing EIA report.

EIA Evaluator

This is five days course which focused on case study to demonstrate how to evaluate EIA technical team) and non-government organizations. As a prerequisite, course participants requested to have completed the basic EIA course.

Certification

There is currently no certification of EIA practitioners or evaluators. However, Environment Impact Management Agency strongly recommends that people wishing to write EIA reports be graduates of EIA B coarse or have equivalent professional training, that EIA evaluators have a minimum of EIA A qualifications.

Table A.9.1 (1/4) Laws, Regulations, Guidelines, Case Studies and Literature Related to Environmental Matters

I. Environmental Laws, Government Regulations, Ministerial Decrees, Guidelines and Environmental Quality Standards

1. Act. No.4, 1974, regarding Principal Government ship in the Regional Government Administration.
2. Act. No. 5, 1974, regarding Principal Government ship in the Rural Government Administration.
3. Act. No. 11, 1974, regarding Water Resources.
4. Act. No. 4, 1982, regarding Basic Provision for the Living Environmental Management.
5. Government Regulation No. 21, 1982, regarding Water Regulation.
6. Government Regulation No. 23, 1982, regarding Irrigation.
7. Government Regulation No. 29, 1986, regarding Analysis on Environmental Impact.
8. Minister of Population and Environment Decree KEP-49 / MENKLH / 6 / 1987, regarding Guidelines for Determination of Important Impact and the Related Attachment.
9. Minister of Population and Environment Decree KEP-50 / MENKLH / 6 / 1987, regarding Guidelines for Analysis on Environmental Impact and the Related Attachments.
10. Minister of Population and Environment Decree KEP-51 / MENKLH / 6 / 1987, regarding Guidelines for Preparation of Evaluation Study on Environment Impact and Related Attachments.
11. Minister of Population and Environment Decree KEP-52 / MENKLH / 6 / 1987, regarding Time Limit for Preparation of Evaluation Study on Environmental Impact and related Attachments.
12. Minister of Population and Environment Decree KEP-53 / MEMKLH / 6 / 1987, regarding Procedure for Resolution against Pollution Problem and Environmental Damage.
13. Ministry of Public Works Decree No. 2 / MENKLH / 1988, regarding Environmental Standard of Sea Water Quality.
14. Government Regulation No. 49, 1989, regarding Environmental Impact Analysis.
15. Ministry of Public Works Decree No. 531 / KPTS / 1989, regarding Guidelines for the Arrangement of Environmental Impact Analysis Management within the Ministry of Public Works.
16. Ministry of Public Works Decree No. 557 / KPTS / 1989, regarding Guidelines for Selecting Environmental Impact Analysis (AMDAL) Procedure for Ministry of Works.
17. Act No. 5, 1990, regarding Natural Resource Conservation.

Table A.9.1 (2/4) Laws, Regulations, Guidelines, Case Studies and Literature Related to Environmental Matters

18. Government Regulation No. 20, 1990, regarding Guidance for Water Pollution Control.

19. Agency for Environmental Impact Management (BAPEDAL) Decree of Head of the Agency for Environmental Impact Management / No. KEP-1 / 1990, regarding Organization and Work Procedures of Agency for Environmental Impact Management.

20. Ministry of Public Works Decree No. 779 / KPTS / 1990, regarding Technical Guidelines for Analysis of Impacts on the Environment of Surface Water Irrigation Project.

21. Ministry of Public Works Regulation No. 46 / PRT / 1990, regarding Technical Guidance for Environmental Impact Analysis of Public Works.

22. Government Regulation No. 20, 1990, regarding Guidance for Control of Water Pollution.

23. Ministry of Public Works Technical Guidance, 1990, regarding Analysis on Environmental Impact of Surface Water Irrigation Control.

24. Ministry of Public Works Technical Guidance, 1990, regarding Analysis on Environmental Impact of Swamp Irrigation Project.

25. Ministry of Public Works Technical Guidance, 1990, regarding Analysis on Environmental Impact of Public Works Sector Projects.

26. Government Regulation No. 35, 1991, regarding River.

27. State Ministry of Population and Environment / Decree of the State Ministry of Population and the Environment No. KEP-03 / MEHKLH / 2 / 1991, regarding Liquid Water Quality Standard for Activities Already in Operation. (Continued from Water CAFI No. 63, Dated May 27, 1991).

28. State Ministry of Population and the Environment / Decree of the State Minister of Population and the Environment No. KEP-3 / MENKLH / 2 / 1991, regarding Liquid Water Quality Standard for Activities Already in Operation.

29. Ministry of Public Works Decree No. 506 / KPTS / 1991, regarding Guideline for Management of Environmental Impact Analysis and Attachments.

30. Ministry of Public Works Decree No. 506 / KPTS / 1991, regarding Technical Guidance for Regulation of Preparation of Public Works Environmental Impact Analysis (Revised).

31. Ministry of Public Works Technical Guidance on Analysis on Environmental Impact of Flood Control Project and River Regulation.

32. Act No. 24, 1992, regarding Spatial Use Regulation and Management.

33. Ministry of Public Works Decree No. 184 / KPTS / 1992, regarding Technical Guidance for Dam Construction Environmental Impact Analysis.

Table A.9.1 (3/4) Laws, Regulations, Guidelines, Case Studies and Literature Related to Environmental Matters

34. Presidential Decree No. 35, 1993, regarding Land Acquisition.

35. Government Regulation No. 51, 1993, regarding Analysis of Impacts on Environment.

36. Government Regulation No. 51, 1993, regarding Analysis of Impacts on Environment (Continued from WARTA CAFI No. 134, 1993).

37. Government Regulation No. 51, 1993, regarding Analysis of Impacts on Environment (Continued from WARTA CAFI No. 136, 1993).

38. State Ministerial Decree of Environment No. KEP-12 / MENCH / 3 / 1994, regarding Guidelines for Environmental Management Plan and Monitoring Plan.

39. State Ministerial Decree of Environment No. KEP-14 / MENCH / 3 / 1994, regarding General Guidelines for Preparation of Environmental Impact Assessment.

40. HEAO Agency of Environmental Impact Management Decree No. KEP-056 / 1994, regarding Guideline for Potential Impact Value.

II. Case Study Reports on IEE, EIA and Resettlement Study

1. Final Report, Resettlement Study of the Kedungombo Dam, Vol. 2 Main Report, Jratunsaluna River Basin Development, Jratunsaluna Irrigation Project of Prasida, 1984.

2. Supporting Report, Environment Assessment Study, Bila Irrigation Project, Directorate General of Water Resources Development, 1988.

3. Final Report, Environmental Impact Assessment, Tiu Kulit Dam Project, Executive Summary, Small-scale Irrigation Management Project (SSIMP), 1989.

4. Salomekko Irrigation Project , Environmental Assessment, Vol. 1 Main Report, Small-Scale Irrigation Management Project (SSIMP), 1990.

5. Survey and Detailed Design for Klambu Barrage Retention Basin, Design Report, Appendix 8, Environmental Impact Assessment, Jratunsaluna River Basin Development Project, 1990.

6. Duriangkan Dam Water Supply Project, Batam Island, Environmental Information Presentation Study (EIP), Batam Industrial Development Authority, 1991.

7. Environmental Impact Analysis for Duringkang Dam Water Supply Project, Batam Island, Batam Industrial Development Authority, 1992.

III. Reference Literature on Environmental Matters

1. Koesnadi Hardjasoemantri : Environmental Legislation in Indonesia, 1987.

2. Ir. Suryatin Sastromijoyo : Implementation on the Environmental Impact Assessment Process in the Ministry of Public Works, 1990.

Table A.9.1 (4/4) Laws, Regulations, Guidelines, Case Studies and Literature Related to Environmental Matters

3. Ir. Suryatin Sastromijoyo : Methodologies and Procedures for Implementing the Environmental Impact Assessment Process in the Ministry of Public Works, Republic of Indonesia, 1991.

4. Environmental Impact Management Agency (BAPEDAL) with Environment Management Development in Indonesia (EMDI) : AMDAL. A Guide to Environmental Assessment in Indonesia, 1992.

5. Wim Giesen, Michael Balzer, Rudin Baruadi : Integrating Conservation with Land Use Develpoment in Wetland of Sulawesi. 1991.

6. Baharudddin Nurkin : Degradation Mangrove Forests in South Sulawesi, Indonesia. Hydrobiology, 285 : 271-276, 1994.

7. Wolf Donner : Land Use and Environment in Indonesia. Univ. Hawaii Press, Honolulu, 1987.

Table A.9.2 Matrix of Impact Identification and Evaluation

Activities / Environmental Component	Pre-Construction Stage			Construction Stage										Operation Stage					Location of Impact		
	Location survey and stake out	Land acquisition	Resettlement	Land clearing	Heavy equipment mobilization	Labour mobilization	Construction of access and construction road	Base camp erection	Transportation of building material	Sand and gravel mining	Construction of dam and Diversion weir	Construction of Irrigation network and farm road	Reservoir impounding	Reservoir operation	Reservoir maintenance	Operation of irrigation network	Operation of farm and inspection path	Distribution of irrigation water	Upstream rolling area	Central plain area	Downstream coastal area
I.Physical-Chemical																					
a.Climate				B	B		B		B					B	B	B	B	B	*	*	*
b.Physiography and										B	A	B							*	*	*
Topography																					
c.Land use										B	A		B						*	*	*
d.Water quantity				A			B			B	A		B	B	B	B		B	*	*	*
e.Soil erosion				A			A	A	B	A	A	B	A	A	B	B	B	B	*	*	*
f.Ground water				B						B			B	B	B	A		B		*	*
g.Water quality				B			B	B	B	B	A	B	B	A	B	A		B	*	*	*
h.Domestic water utilization														A		A				*	*
II.Flora and Fauna																					
a.Vegetation				B			B	B		B	B	B	B						*	*	*
b.Mangrove													A	A	B						*
c.Fish										B	B	B	B	A	B				*	*	*
d.Plankton										B	B	B	B	B	B						
e.Wild life				B							B		B	B					*		
III.Social, Economic, and Culture																					
a.People perception	B	A	B			B								B				B	*	*	*
b.People anxiety		A	A			B		B						B				B	*	*	
c.Social jealousy				B		B		B						B				A	*	*	
d.Job opportunity			A	B		B			B	B	B	B		A		A				*	*
e.Income			A						B	B	B	B		A		A				*	*
f.Regional economics										B	B			A		A				*	*
g.Public health			B	B	B				B	B	B	B	B							*	*
h.Inhabitant mobility			B									B		B			B		*	*	*
i.Safety and social security			B					B			B		B				B		*	*	*
j.Culture			A					B											*	*	*
h.Public facilities			A		B				B		B								*		

Note) A : Important impact
B : Less important impact

Table A.9.3 (1/2) Environment Management Plan of the Gilirang Irrigation Project

Stage	Description of Impact	Source of Impact	Objective of Env. Management	Environment Management Plan	Location of Environment Manag.	Timing of Env. Management	Executor of Env. Management	Supervision Institution	Related Institution
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
I. PRECONSTRUCTION 1. Land acquisition	a. People expectation b. People anxiety c. Disturbances of safety and public order	Unsatisfactory of resettlement and the amount of compensation	a. To avoid unsatisfactory and negative perception of people b. For smooth execution of project	a. To carry out extension service and intensive approach to people b. To decide amount of compensation based on agreed figures c. To decide amount of compensation according to types and functions of people d. To disburse compensation directry to inhabitants e. To compensate relocation of remainings and provide new cemetery in new area	a. Villagers in Paselloreng b. People in irrigation area	Before and during Land acquisition	a. Gilirang Irrigation Project b. Committee for Land acquisition	a. Pemda Tk.II Wajo b. Kanwil Pekerjaan Umum	a. Pemda Tk.I b. Kepolisian c. Dirjen Pengairan
2. Resettlement of Paselloreng Villager	a. People complaint b. People anxiety and disturbances to safety and Public order c. Decrement of income d. Decrement of occupation	a. Lack of project attention during resettlement b. Lack of public facilities and road infrastructure c. Lack of farmer occupation in the new area	a. To avoid people complaint and anxiety b. To improve quality of life and prosperity in the new area	a. To avoid help to people moving their building b. To provide new location with public facilities an they have in Paselloreng c. To construct access road between new area and surrounding village	a. Paselloreng village b. New resettlement area	a. During resettlement b. Before and after resettlement	a. The gilirang Irrigation Project b. Contractor awarded the job	a. Pemda Tk.II Wajo b. Kanwil Pekerjaan Umum c. Dinas Kesehatan d. Kanwil Transmigrasi dan perambah hutan	a. Bappeda Tk.II Wajo b. Dinas Sosial c. Dinas Pertanian d. Aparat Keamanan e. Dirjen Pengairan
II. CONSTRUCTION 1. Land clearing, fill and soil compaction	a. Decrement of plantation b. Increment of dust c Endanger to Labour healthy and safety	a. Cutting trees in reservoir area b. Utilization of heavy equipment c. Soil compaction d. Lack of worker's safety device	a. To avoid plant destroy around dam site b. To avoid fugitive dust c. To avoid accident	a. To provide safty facilities and management b. To provide location for residue of trees and shrubs c. To conduct watering d. Extension to workers e. To provide safety device to workers	a. Dam location b. Workers c. Irrigation network location	Anytime during construction	a. The Gilirang Irrigation Project b. Contractor	a. Pemda Tk.II Wajo b. Kanwil Pekerjaan Umum c. Dinas Kesehatan D. Kanwil Transmigrasi dan perambah hutan	a. Bappeda Tk.II Wajo b. Dinas Sosial c. Dinas Pertanian d. Aparat Keamanan e. Dirjen Pengairan
2. Mobilization of heavy equipment and bridge material	a. Road damages b Disturbances to people mobility and economics c. Disturbances to people confortability and health d. Increment of dust and noise	a. Utilization of heavy equipments and truck b. Increment of truck and motor vehicle c. Lack of transportation vehicle maintenance	a. To reduce road damage and dust b. To avoid complaint and nosy c. To avoid traffic jam	a. To controll operation during night b. To improve and reinforce of road and bridge	a. Along road within project area b. Road junction	During construction	a. The gilirang Irrigation Project b. Contractor	a. Pemda Tk.II Wajo b. Kanwil Pekerjaan Umum c. Dinas Kesehatan d. Kanwil Transmigrasi dan perambah hutan	a. Bappeda Tk.II Wajo b. Dinas Sosial c. Dinas Pertanian d. Aparat Keamanan e. Dirjen Pengairan
3. Mobilization and worker's recruitment	a. Negative perception of local people b. People jealousy c. Disturbances to safety and public order d. Increment of job opportunity	a. Lack of priority to local people b. Workers from the outside area	a. To avoid conflict between local and incoming people b. To increase job opportunity to local people c. To improve local people income during project implementation	a. To give priority to local people base on their capability b. To provide extension and intensive approach c. To provide guidance to workers	a. Villagers of Arajang, Gilirang and Paselloreng b. Base camp and workers	a. During recruitment b. Anytime during construction	a. The Gilirang Irrigation Project b. Contractor	a. Kecamatan and village government b. Kanwil Pekerjaan Umum c. Kanwil Transmigrasi dan perambah hutan	a. Bappeda Tk.II Wajo b. Dinas Sosial c. Dinas Pertanian d. Aparat Keamanan e. Dirjen Pengairan
4. Base camp, storage and temporary shed	e. Environment pollution around base camp b. Water, pollutant caused by oil, grease and solid waste/liquid waste generated by workers	a. Solid and liquid waste generated by workers b. Oil drops from garage and workshop	a. To avoid pollution around base camp b. To avoid degradation	a. To provide facilities for solid and liquid waste collection b. To provide sufficient sanitary facilities in base camp c. Collect waste oil and grease	a. Base camp and surrounding air b. Workshop	During construction	a. The Gilirang Irrigation Project b. Contractor	a. Kanwil Pekerjaan Umum b. Kanwil Tenaga kerja	a. Bappeda Tk.II Wajo b. Dinas Sosial c. Dinas Pertanian d. Pemda Tk.I Sul-Sel e. Dirjen Pengairan
5. Sand, rock and gravel excavation	a. Modification of physicgraphy and topography b. Increment of erosion c. Decrement of river water quality	a. Excavation of rock sand & gravel b. Soil erosion transported into river	a. To avoid stagnant water b. To avoid soil erosion	a. To controll excavation along river bank b. To carry out replantation in excavation area	a. Excavation area	Before and During excavation activities	a. The Gilirang Irrigation Project b. Contractor	a. Dinas Pertam bangan b. Kanwil Pekerjaan Umum c. Pemda Tk.II Wajo d. Kanwil Tenaga Kerja	a. Dinas Kehutanan b. Dinas Perikanan c. Kanwil Pertam bangan d. Dinas Pertanian

Table A.9.3 (2/2) Environment Management Plan of the Gilirang Irrigation Project

Stage	Description of Impact	Source of Impact	Objective of Env. Management	Environment Management Plan	Location of Environment Manag.	Timing of Env. Management	Executor of Env. Management	Supervision Institution	Related Institution
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
6. Dam and weir construction	a. Change of physiography and topography b. Increment solid waste c. Increment of dust and noise d. Water quality degradation e. Degradation of aquatic biota f. Disturbance to wild life	a. Utilization of heavy equipments b. Increment of washout and mud c. Decrement of water flow in the river	To avoid degradation of water quality and quantity	a. To backfill excavated soil shall be property piled b. To provide sufficient equipment to workers c. To provide guidance to workers	Dam and weir location	Before and during construction	a. The Gilirang Irrigation Project b. Contractor	a. Pemda Tk.II Wajo b. Kanwil Pekerjaan Umum c. Kanwil Tenaga Kerja	a. Dinas Kehutanan b. Dinas Pekerjaan Umum c. Dinas Perikanan d. Dinas Kesehatan
7. Construction Irrigation networks and farm road	a. Increment of dust noisy b. Disturbances to people comfort and health	a. Soil Excavation and compaction b. Transport-ation of fill materials c. Spoiling of embankment soil	a. To reduce dust fugitive b. To reduce spoiling of embankment soil c. To reduce traffic jam and noisy	a. To carry out routine watering b. To reduce frequency of transportation during night and rainy season c. To provide sufficient traffic sign in the entry of project area	a. At irrigation network location b. Along the road passed by Project Truck	During construction	a. The Gilirang Irrigation Project b. Contractor	a. LLAJR b. Lalulintas c. Kanwil PU	a. Dinas Pekerja an Umum b. Dinas Tanaman Pangan c. Dinas Perikanan d. Pemda Tk.II Wajo
8. Reservoir inundation	a. Decrement of water quantity and quality b. Decrement of population and growth of aquatic biota (fish, plankton) c. Decrement of soil fertility d. Disturbance to migration of sidat fish (anguilla sp)	a. Water stagnant in Reservoir b. Decrease of sediment transport to downstream c. Lack of organic matter transported to downstream	a. To reduce complain fishpond farmers b. To keep water quality and quantity in the river c. To avoid decrement of mangrove in estuary d. To keep water fertility sediment transformed to downstream	a. To regulate water released into river	a. Dam location b. Diversion gate c. Upstream area of dam	a. During construction b. During operation	a. The Gilirang Irrigation Project b. Contractor c. Dinas Kehutanan untuk pengamanan daerah hulu	a. Pemda Tk.II Wajo b. Kanwil Pekerjaan Umum c. Dinas Perikanan d. Dirjen Pengairan	
III.OPERATION STAGE 1. Operation of Reservoir	a. Decrement of water quantity and quality b. Decrement of aquatic biota growth c. Disturbances to fish migration d. Support fertility of water body e. Disturbance to mangrove growth f. Decrement of fishpond production g. Decrement of water quality within reservoir	a. Dammed-up of river water b. Decrement of river debit c. Disturbances to inundated catchment area d. Increment of tourists	a. To avoid salinity, decrement sediment and fertility b. To keep aquatic ecosystem stability c. To avoid complaint by fish pond farmers d. To keep environment that fish environment not disturb	a. To regulated water released into river b. To cleaning of gate routinely, at least four times year c. To carry out replantation in the upstream of dam d. To provide signboard to forbid people litter in reservoir	a. Water gate b. Dam reservoir and surrounding area c. Upstream of Gilirang river	During operation stage	a. Dinas Pengairan b. Dinas Kehutanan c. Dinas Pertanian	a. Pemda Tk.II Wajo b. Pemda Tk.I Sul-Sel c. Kanwil PU	a. Dinas Perikanan b. Dinas Parawisata c. Dirjen Pengairan
2. Reservoir maintenance	a. Increment of turbidity b. Decrement of water quantity in reservoir c. Increment of solid waste in reservoir	a. Cleaning of intake gate b. Degradation of upstream part of the Gilirang river c. Tourism	a. To keep water quality b. To keep reservoir sustainable c. To protect forest upstream of Gilirang river d. Provision of sign not to litter in and around reservoir	a. To carry out periodec cleaning b. To keep replantation trees around dam	a. Gilirang Dam b. Reservoir c. Upstream area	During operation area	a. Dinas Pengairan b. Dinas Kehutanan c. Dinas Pertanian d. Pemda Tk.II Wajo	a. Pemda Tk.I Sul-sel b. Dinas Pariwisate	a. Dinas Perikanan b. Kanwil Pekerjaan Umum c. Dirjen Pengairan
3. Operation of irrigation network	a. Increment of farmer's income and prosperity b. Increment of national rice stock c. Degradation of river water quality d. Complaint of fishpond farmers e. Increment of aquatic plant in irrigation networks	a. Increment of crop intencity b. Increment of utilization of fertilizer and pesticide c. Decrement of fishpond production	a. To increase farmer's income and prosperity b. To keep river water quality c. Extension and train farmer in using water and organic fertilizer	a. To optimized water utilization b. To reduce utilization of fertilizer and pesticide	a. Irrigated area b. Primary secondary and tertiary canal c. Water user association	Along operation period	a. Dinas Pertanian b. Dinas Pengairan	a. Pemda Tk.II Wajo	a. Pemda Tk.I Sul-Sel b. Dinas Perikanan c. Kanwil PU d. Dirjen Pengairan
4. Water distribution	a. Conflict between water user	a. Water not distributed properly b. Disturbance to irrigation network c. Increment of aquatic plant in irrigation network	a. To avoid conflict b. To keep irrigation network sustainable	a. To establish water user association b. Regulate member responsibility and obligation c. Regular cleaning of irrigation network	a. Water user association b. Irrigation networks	Any time during operation stage	a. Dinas Pertanian b. Dinas Pengairan	a. Pemda Tk.II Wajo	a. Kanwil PU b. Kanwil Pertanian c. Pemda Tk.I Sul-Sel d. Dirjen Pengairan

Table A.9.4 (1/2) Environment Monitoring Plan of the Gilirang Irrigation Project

Important Impact	Sources of Impact	Monitoring Objective	Monitoring Methodology	Analyses Methodology	Time and Frequency of Monitoring	Monitoring Execution Agency	Monitoring Supervision Agency	Related Institution Responsible
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I. PRECONSTRUCTION STAGE 1. People expectation, anxiety and disturbance of safety and public order	a. Unsatisfactory process of resettlement and amount of compensation b. Resettlement	a. To monitor perception of people to project	Interview	Tabulation of interview result	After land acquisition	Gilirang Irrigation Project Management	a. Pemda Tk.II Wajo b. Kanwil PU	a. Pemda Tk.I Sul-Sel b. Dirjen Pengairan
2 Decrement of people income health condition and complaint	Resettlement to new area	a. To Monitor people income and property b. To Monitor livelihood source c. To Monitor public facilities	a. Direct observation b. Interview	Tabulation of interview result	After resettlement 2 times a year	a. Gilirang Irrigation Project Management b. Dinas Pengairan	a. Pemda Tk.II Wajo b. Kanwil PU c. Pemda Tk.I Sul-Sel	a. Pemda Tk.I Sul-Sel b. Dirjen Pengairan
II. CONSTRUCTION STAGE 1. Air quality	a. Mobilization of heavy equipment b. Land clearing compaction and fill c. Excavation of rock, sand and gravel	a. To Monitor fugitive dust b. To monitor degree and radius of noisy	Sampling collection and direct measurement	- Gravimetri - NDIR - Pararosamlin - Saltman	3 times a year during construction	a. Gilirang Irrigation Project Management or contractor or appointed institution	a. Pemda Tk.II Wajo b. Kanwil PU c. Pemda Tk.I Sul-Sel	a. Pemda Tk.I Sul-Sel b. Dirjen Pengairan c. Pemda Tk.II Wajo d. Dinas Kehutanan e. Dinas Pertanian
2. Physiography and topography modification	a. Excavation of rock, sand and gravel b. Land clearing c. Dam and irrigation system construction	a. To Monitor Utilized quarry b. To monitor replantation activities	Direct observation	Descriptive	During and after construction two times a year	a. Gilirang Irrigation Project Management or contractor or appointed institution b. Dinas Pengairan	a. Pemda Tk.II Wajo b. Kanwil PU c. Pemda Tk.I Sul-Sel d. Kanwil Pertambangan	a. Dirjen Pengairan Sel b. Dinas Pertambangan c. Dinas Kehutanan
3. River and ground water quantity and quality (total flow, turdibity and salinity)	a. Reservoir impounding b. Excavation of rock, sand and gravel c. Land clearing d. Workshop and base camp	a. To monitor flow b. To monitor turbidity, and suspended load c. To monitor salinity d. To monitor sediment rate	Direct observation and sampling	Laboratory analyses and descriptive	During construction, minimum 3 times a year	a. Gilirang Irrigation Project Management or contractor or appointed institution b. Dinas Pengairan	a. Pemda Tk.II Wajo b. Kanwil PU c. Pemda Tk.I Sul-Sel	a. Dinas Perikanan b. Dinas Kehutanan c. Dirjen Pengairan
4. Land flora & fauna (species, density, growth and wild life)	a. Land clearing b. Excavation of rock, sand and gravel c. Dam construction d. Utilization of heavy equipment	a. To monitor species, density and plantation growth b. To monitor species and population of wild life	Direct data collection and interview	Laboratory analyses and descriptive	During and after construction (two times a year)	a. Gilirang Irrigation Project Management or contractor or appointed institution b. Dinas Pengairan	a. Pemda Tk.II Wajo b. Kanwil PU c. Pemda Tk.I Sul-sel d. Dinas Kehutanan	a. Dirjen Pengairan b. Kanwil Kehutanan c. Balai Penelitian Kehutanan d. Pemda Tk.I Sul-Sel e. Pemda Tk.II Wajo
5. Aquatic biota (Diversity index similarity, growth and migration)	a. Utilization of reservoir b. Increased of turbidity and solid waste	a. To monitor mangrove growth b. To monitor species, growth of fish plankton and benches	Direct data collector and interview	Laboratory analyses and descriptive	During construction (3 times a year)	a. Gilirang Irrigation Project Management or contractor or appointed institution b. Dinas Pengairan	a. Pemda Tk.II Wajo b. Kanwil PU c. Pemda Tk.I Sul-Sel d. Dinas Kehutanan	a. Dirjen Pengairan b. Kanwil Kehutanan c. Balai Penelitian Kehutanan d. Pemda Tk.I Sul-Sel e. Pemda Tk.II Wajo f. Dinas Perikanan
6. People perception, jealousy (social behavior changes of people residing around project)	a. Restriction to local people recruitment b. Incoming Labourer	a. To monitor social behavior changes of local people to project	Interview	Data and descriptive	During construction	a. Gilirang Irrigation Project Management or contractor or appointed institution b. Dinas Pengairan	a. Pemda Tk.II Wajo b. Kanwil PU c. Pemda Tk.I Sul-Sel	a. Dirjen Pengairan b. Pemda Tk.I Sul-Sel c. Pemda Tk.II Wajo
7. Job opportunity and income	a. Total of local people involved in project activity b. Total of local business involved in project activity	a. To monitor local people involved in project b. To monitor worker income	Interview	Data and descriptive	During construction	a. Gilirang Irrigation Project Management or contractor or appointed institution b. Dinas Pengairan	a. Pemda Tk.II Wajo b. Kanwil PU c. Pemda Tk.I Sul-Sel	a. Dirjin Pengairan b. Pemda Tk.I Sul-Sel c. Pemda Tk.II Wajo
8. Health and comfort of people (complaint, type of disease)	Increase of dust and noisy	a. To monitor people complaint b. To monitor type of disease	Interview	Data and descriptive	During construction	a. Gilirang Irrigation Project Management or contractor or appointed institution b. Dinas Pengairan	a. Pemda Tk.II Wajo b. Kanwil PU c. Pemda Tk.I Sul-Sel	a. Dirjin Pengairan b. Pemda Tk.I Sul-Sel c. Pemda Tk.II Wajo
9. Health and worker safety	a. Increased of mosquito in Base camp b. Lack of health facility and safety device c. Lack of worker discipline and capability	a. To monitor worker complaint and degree of safety b. To monitor worker health and safety facilities c. To monitor workers degree of health	Interview	Diagnosis and descriptive	During construction	a. Gilirang Irrigation Project Management or contractor or appointed institution b. Dinas Pengairan	a. Pemda Tk.II Wajo b. Kanwil PU c. Pemda Tk.I Sul-Sel d. Kanwil Tenaga	a. Dirjin Pengairan b. Pemda Tk.I Sul-Sel c. Pemda Tk.II Wajo

Table A.9.4 (2/2) Environment Monitoring Plan of the Gilirang Irrigation Project

Important Impact	Sources of Impact	Monitoring Objective	Monitoring Methodology	Analyses Methodology	Time and Frequency of Monitoring	Monitoring Execution Agency	Monitoring Supervision Agency	Related Institution Responsible
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
III. OPERATION STAGE 1. River water quantity and quality	a. Dam operation b. Irrigation networks operation c. Utilization of fertilizer and pesticide d. Maintenance of intake gate	a. To monitor water debit b. To Monitor water quality) c. to monitor water salinity d. To monitor water body fertility	Direct observation and sampling	Laboratory analyses and descriptive	Operation stage, 2 times a year	a. Dinas Pengairan b. Dinas Pertanian	a. Pemda Tk.II Wajo b. Pemda Tk.I Sul-Sel c. Kanwil PU	a. Dirjen Pengairan b. Dinas Perikanan c. Dinas Kehutanan
2. Aquatic biota (fish, plankton, benches and mangrove)	a. Increased of water aquatic plant in reservoir and irrigation canal b. Change of water quality because of reservoir operation	a. To monitor species and growth of fish, plankton and benches b. To monitor fish migration c. To monitor mangrove growth	Direct observation and sampling	Laboratory analyses and descriptive	Operation stage, 2 times a year	a. Dinas Pengairan b. Dinas Pertanian	a. Pemda Tk.II Wajo b. Pemda Tk.I Sul-Sel c. Kanwil PU	a. Dirjen Pengairan b. Dinas Perikanan c. Dinas Kehutanan
3. Conflict between water user	a. Water not distributed properly b. Disturbance to irrigation networks c. Lack of guidance to water user	a. To monitor farmer complaint b. To monitor water user activity c. To monitor irrigation network condition	Direct observation and interview	Descriptive	Operation stage, 2 times a year	a. Dinas Pengairan b. Dinas Pertanian	a. Pemda Tk.II Wajo b. Pemda Tk.I Sul-Sel c. Kanwil PU d. Kanwil Pertanian	a. Dirjen Pengairan b. Dinas Perikanan c. Dinas Kehutanan

ANNEX 10

PROJECT EVALUATION

ANNEX 10 PROJECT EVALUATION

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ANNEX 10. PROJECT EVALUATION

1. GENERAL

The objective of the project evaluation is to assess the economic and financial feasibility of the Gilirang Irrigation Project. For the economic evaluation, three measures of project worth, namely, economic internal rate of return (EIRR), benefit-cost ratio (B/C) and benefit minus cost (B-C) were examined. In addition, a sensitivity analysis in terms of EIRR was made to evaluate the economic viability of the Project against possible changes in project costs, benefits and build-up period. For the financial evaluation, the repayment capability of the Project and the capacity to pay of the farmers were analyzed. The indirect benefits and socio-economic effects, which would impact on the regional and national economy, were also studied briefly.

The project evaluation was based on the following basic assumptions:

a) The useful life of the Project was taken as 50 years from project implementation;
b) For the calculation of EIRR, only direct benefits were counted, and no indirect and intangible benefits were taken into account;
c) The exchange rate of Indonesian Rupiah (Rp.) to US. Dollar (US$) was taken to be Rp.2,160 equivalent to US$ 1.00 (as of August, 1994);
d) Constant prices at 1994 level were used in the economic evaluation; and
e) The economic conversion factors, which were estimated in the Guideline for Water Resources Projects PU, are used to convert financial to economic values in the economic evaluation.

2. ECONOMIC EVALUATION

2.1 Project Costs

The project costs for economic evaluation would consist of construction cost, annual operation and maintenance (O&M) cost, replacement cost and resettlement cost, and these economic costs can be obtained by applying standard conversion factors (SCF) to the financial costs. The SCFs used to convert financial into economic costs are presented in Table A.10.1.

The construction cost for implementation of the Project includes the costs for (1) preparatory works, (2) construction of project facilities such as dam, intake weir, irrigation and drainage canals and farm road, (3) procurement of O&M equipment (4) resettlement of people living reservoir area, (5) administration expenses, (6) engineering services, and 7) physical contingency. These total costs would amount to Rp. 98.6 billion as shown in Table A.10.2, and its annual disbursement is scheduled as shown in Table A.10.3. Of the total cost, the preparatory works and civil works accounts for 62% (Rp.61.6 billion).

The annual O&M cost for project facilities was estimated at Rp.643 million on the basis of the figures of similar irrigation project. The O&M cost would be initially disbursed in 1999 when partial operation would be commenced, and would reach the full amount in 2001 when full operation would start. Regarding the replacement cost, the steel gates, pump and O&M equipment installed in the project facilities would be replaced several times during the entire period of the project life. Their useful lives were estimated to be 25, 15 and 10 years, respectively (see Table A.10.4). The resettlement cost would amounts to Rp.1.81 billion (see Table A.10.6).

Land acquisition costs and price contingency were excluded from the project economic costs. Production foregone earmarked for negative benefits was evaluated, instead of the land acquisition cost. Since EIRR of the Project is measured at constant prices, provision

for price contingency was excluded from the project costs.

2.2 Project Benefits

2.2.1 Economic Prices of Farm Inputs and Outputs

Economic prices of farm inputs and outputs were estimated in order to evaluate the expected project benefits. Economic prices of trade goods such as rice, maize, mungbeans, soybeans, groundnuts and fertilizers were estimated on the basis of the projected world market prices of these commodities forecast by the World Bank in the long term range for the period from 2000 to 2005. The details are shown in Table A.10.7. Non-trade goods such as, chillies, seeds and animal power were valued at financial prices which were estimated on the basis of current market or farm gate prices prevailing in the Project area in November 1994. As for farm labor, it was valued at a shadow wage rate, based on the SCF of 0.75 (see Table A.10.1). Economic and financial prices of farm inputs and outputs used for project evaluation are summarized in Table A.10.8.

2.2.2 Project Benefits

The project benefits consist of irrigation benefits and negative benefits. The irrigation benefits will accrue primarily from increased crop production owing to stable irrigation water supply. Negative benefits will occur on lands to be occupied by the project facilities.

(1) Irrigation Benefits

The irrigation benefits are defined as the difference in net return from crops between the future with and the future without project conditions. The net return per ha for each crop under the future with and the future without project conditions was estimated as shown in Tables A.10.9 and A.10.10. Applying the net return per ha for each crop to those harvested area, the total net return to accrue from crop production was calculated on both the future with and without project conditions. Annual irrigation benefit at full development stage was estimated at Rp 18.8 billion, as shown below. The details are shown in Table A.10.11. The benefits would start to accrue from 2001, and would gradually increase up to the full benefit in 2006.

	Without Project		With Project		
	Harvested Area (ha)	Total value (Rp.Million)	Harvested Area (ha)	Total value (Rp.Million)	Incremental Benefit (Rp.Million)
Rainfed Area					
Paddy (Wet Season)	7,220	3,841	-	-	-3,841
Palawija*1	720	138	-	-	-138
Irrigated Area					
Paddy (Wet Season)	-	-	7,000	10,806	10,806
Paddy (Dry Season)	480 *2	408	7,000	10,958	10,550
Palawija*1	-	-	1,800	1,044	1,044
Vegetables (Chillies)	-	-	200	339	339
Total	8,420	4,387	16,000	23,147	18,760

*1 Average value of mungbeans, soybeans and groundnuts.
*2 Pump irrigation.

As shown in the above table, it was estimated that total net return under the future without project condition would remain at present level. The reasons of present low yields are due mainly to water shortage. This problem in the area can't be solved radically without the implementation of the irrigation project. Moreover, almost no change in cultivation area of

crops would be expected under the future without project condition. At present, about 640 ha of paddy field are irrigated by pumping facilities in the dry season, however it would be difficult to expand more its area from the present level, without exploitation of new water resources.

(2) Negative Benefits

For the economic assessment, the opportunity cost of the lands to be newly installed project facilities is evaluated in distinction from the land acquisition cost which is used in the financial assessment. In the Project area, the production foregone was evaluated to the farm land to be used for the installed facilities and covered by reservoir area, instead of its land acquisition cost, and was earmarked for the negative benefit.

After completion of the Project, 420 ha of existing farm land in the reservoir area will be submerged under the water. These production foregone amount to Rp. 368 million per annum, as shown below. The details are presented in Table A.10.5. Regarding the forest and grass lands, no opportunity cost in a national economic sense was evaluated, since there were no potential alternative.

	Area (ha)	Total Net Return (Rp.million)
1) Paddy - Rainfed (Wet Season)*1	240	128
2) Paddy - Irrigated (Dry Season)*2	160	136
3) Upland*1	50	10
4) Orchard*3	130	94
5) Grass Land/Bush/Forest	530	-
Total		368

*1 See Tables A.10.9 and A.10.10. *2 Pump irrigation
*3 As cacao. Planting numbers are estimated at 52,000 trees.

The losses of farm lands for project facilities total about 220 ha. These production foregone are already counted in the estimate of irrigation benefit by deducting these areas from the paddy field under the future with project condition.

2.3 Economic Evaluation

2.3.1 EIRR, B/C and B-C

In order to compute the EIRR, B/C and B-C, the annual economic costs and benefits flows were firstly prepared as shown in Table A.10.12. From this table, the EIRR was estimated to be 13.3%. In addition, the B/C and B-C at the discount rate of 10% were also estimated as follows. The result indicates that the Project is economically viable.

		Whole Project	Gravity Irrigation	Pump Irrigation
Area	(ha)	7,000	5,880	1,120
EIRR	(%)	13.3	13.5	11.9
B/C		1.37	1.40	1.21
B-C	(Rp.billion)	26.2	23.9	2.4

The project consists of 5,880 ha of gravity irrigation area and 1,120 ha of pump irrigation area. Those EIRRs were estimated to be 13.5 and 11.9 %, respectively. The details of this

analysis are shown in Table A.10.13.

2.3.2 Sensitivity Analysis

Project sensitivity in terms of the EIRR was analyzed in respect of changes in project costs and benefits. The result of analysis is summarized below.

(EIRR: %)

Project costs increased	Benefits Decreased 0%	Benefits Decreased -10%	Benefits Delay in 1 Year
0%	13.3	12.1	12.0
+10%	12.3	11.2	11.1

3. FINANCIAL EVALUATION

3.1 Repayment Capability

The repayment capability of the Project was studied by preparing cash flow statements on the basis of an annual disbursement schedule of the construction cost, fund requirement and anticipated project revenue. The study was made in relation to the project executing agency which construct the irrigation facilities.

The annual disbursement schedule of the construction cost was prepared as shown in Table A.10.14. The price contingency shown in this table was estimated on the basis of the world manufacturing unit value index forecast by the World Bank and recent trends of consumer price index in South Sulawesi Province (see Table A.10.15). The total project cost including price contingency was estimated to be Rp.160.7 billion, as shown below.

Financial Project Cost

(Unit: Rp. Million)

	F.C.*1	L.C.*1	Total
1) Preparatory Works	2,583	1,547	4,130
2) Civil Works			
- Weir	4,252	4,732	8,984
- Dam	25,423	10,478	35,901
- Main System	15,588	7,441	23,029
- Secondary System	3,919	2,612	6,531
- Tertiary System	0	4,453	4,453
- Drainage System	1,389	584	1,973
- Farm Road Network	1,018	476	1,494
- Pump Station	70	164	234
3) O&M Facilities and Equipment	741	317	1,058
4) Land Acquisition and Compensation	0	3,741	3,741
5) Administration	1,354	810	2,164
6) Engineering services	23,009	2,779	25,788
7) Physical Contingency	7,931	4,010	11,941
Sub-Total	87,277	44,144	131,421
8) Price Contingency	12,344	16,922	29,266
Total	99,621	61,066	160,687

Remarks: *1 F.C. = Foreign Currency L.C. = Local Currency

For the estimation of funding requirements, it was assumed that the capital required for

project implementation would be arranged in terms of the following financial conditions.

Foreign Loan (International Fund)

The capital will be financed by an international organization with the following loan conditions:

- Interest rate : 2.6 % per year
- Grace period : 10 years
- Repayment period : 30 years (including grace period)

Items not eligible for financing are as shown below.

a) General administration expense
b) Taxes and duties
c) Purchase of land and other real property
d) Compensation
e) Other indirect items

Government Budget

The capital is arranged by budget allocation of the Government with no interest and no repayment.

Based on the above assumptions, the total fund requirement for construction of the Project was estimated at about Rp.152.8 billion, and its yearly breakdown area as shown below. The details are presented in Table A.10.16.

(Unit: Rp.Million)

	Total Cost			International Fund			Government Budget		
Year	F.C.	L.C.		F.C.	L.C.		F.C.	L.C.	
1996	4,367	1,387	5,754	4,367	0	4,367	0	1,387	1,387
1997	5,894	1,960	7,854	5,894	0	5,894	0	1,960	1,960
1998	11,185	6,673	17,858	11,014	5,520	16,534	171	1,153	1,324
1999	23,840	13,164	37,004	23,383	12,339	35,722	457	825	1,282
2000	30,588	23,813	54,401	29,962	23,266	53,228	626	547	1,173
2001	23,747	14,069	37,816	23,289	13,762	37,051	458	307	765
Total	99,621	61,066	160,687	97,909	54,887	152,796	1,712	6,179	7,891

As for the anticipated project revenue, this will accrue from irrigation service fees. In general, it is understood that irrigation service fee will be imposed on water users (farmers), and the collected fees will be spent for payment of O&M expenditure. The Government policy will now be to collect irrigation service fees (IPAIR) and recover all O&M costs in main and secondary systems from the fees.

The prospective fee is estimated to be Rp.144,000/ha/annum in 2001 prices, referring the Government regulations for calculating of IPAIR amount. The annual project revenue which accrue from the fees would amount to Rp.1,009 million.

	(Rp. Million)	(Rp./ha/year)
Direct Operation and Maintenance Cost	583.5	83,000
Collecting Fee (15%)	87.5	13,000
IPAIR in 1994 Prices	671.0	96,000
Price Contingency in 2001 (150.4%)	338.2	
IPAIR in 2001 Prices	1009.2	144,000

The cash flow statement of the Project executing agency is presented in Table A.10.17. The annual repayment of the fund is estimated to be Rp.9 -14 billion during the repayment period. Repayment of the fund will have to be made by subsidy from the Government.

3.2 Capacity to Pay of the Farmers

In order to assess the capacity to pay of farmers, the analysis of their farm budget was made under the future with project condition.

(Unit: Rp 1,000/year)

		Without Project		With Project	
		Rainfed Area	Pump Area	Gravity Area	Pump Area
1	Gross Income	3,037	5,840	10,199	10,199
	- Farm Income	2,624	5,427	9,904	9,904
	- Off-Farm Income	237	237	119	119*1
	- Others	176	176	176	176
2	Gross Outgoing	2,804	4,348	6,336	6,663
	- Production Cost	1,564	3,108	4,477	4,804
	- Living Expenses	1,240	1,240	1,859	1,859*2
4.	Net Reserve (Capacity to Pay)	233	1,492	3,863	3,536
3.	Irrigation Service Fees*3			218	218

*1 50% of present condition.
*2 150% up from present condition.
*3 1994 Prices
Rp.96,000/ha/year x 2.27 ha = Rp.218,000

The net reserve or capacity to pay of farmers would increase remarkably from Rp.0.2 - 1.5 million under the future without project condition to Rp 3.5 - 3.9 million under the future with project condition. The increase in net reserve would enable farmers to pay the irrigation service fee.

4. INDIRECT BENEFITS AND SOCIO-ECONOMIC IMPACTS

After implementation of the Project, various indirect benefits and socio-economic impacts are expected as mentioned below.

(1) Employment Opportunities

The Project would create a demand for farm labors due to the increased farming activity, more intensive use of land and higher agricultural production. In addition, the construction of the Project would increase employment opportunities in the area. During the construction stage, the majority of workers would be unskilled laborers, and most of whom would come from farmers and ordinary laborers in and around the Project area. The labor employment under the construction stage will be expected to reach over 140,000 man-days in total. All these would contribute to activate regional economy.

(2) Farmers' Income

After implementation of the Project, income of farmers estimated at 3,000 households is expected to increase considerably as a direct result of the increase in crop production. Such increase in income would contribute to improving farmers' living standards. Moreover, it is expected that farmers' purchasing power would increase along with improvement of their living standards, and this increased purchasing power would benefit the development of the regional economy.

(3) Marketing of Farm Inputs and Outputs

Future marketing in the area is likely expand as compared with the present condition. With anticipated higher agricultural production, more farm products could be marketed by the farmers and the proportion of sales would also increase relative to consumption. The merchants would have a larger turnover which could increase their incomes.

Marketing functions would not only be influenced by agricultural outputs. It is estimated that when agricultural production develops as a result of the Project, the Project area would be a good market for farm supplies. The farmers need to operate with farm supplies such as tools, equipment and bags. Both ends of marketing channels could, therefore, expect substantial beneficial impacts from the Project.

(4) Food Supply

A result of demand and supply forecast indicate that the Indonesia will increase annual domestic demand over its paddy production by about 4.6 million tons in 2003 and 7.8 million tons in 2008. It is expected to increase paddy production to meet the domestic demand increasing along with population growth. The project will support it, which will produce about 80,000 tons/year of marketable surplus.

(5) Mitigation of Water Shortage

The Project area has a serious problem on water shortage for not only agricultural production but also people's living in the dry season. After completion of the irrigation facilities, the Project would provide irrigation water to the fields through the canals spread over the area and during the 4 months in the dry season. People can utilize this irrigation water for their living during the serious period, and it means that the Project would mitigate the water shortage.

(6) Other Effects

Implementation of the Project would certainly lead to changes in rural socio-economy in the area. By the construction of inspection roads along the canals, the local transportation system would also be improved, which will contribute to the improvement of rural socio-economic activities.

Table A.10.1 Standard Conversion Factors (SCF)

	Coefficient used to convert financial into economic values (SCF)
1) Preparatory Works	0.71
2) Weir	0.71
3) Irrigation System	0.71
4) Drainage System	0.71
5) Land Clearing	0.80
6) On-farm Development (Sawah Formation)	0.80
7) O&M Equipment	1.00
8) Design and Survey	0.90
9) Administration	0.90
10) Operation and Maintenance Cost	0.80
11) Replacement Cost	1.00
12) Unskilled Off-farm Labor	0.75
13) Farm Labor*1	0.75

Source: Pedoman Pengamatan dan Evaluasi Proyek-Proyek Pengairan, Direktorato Jenderal Pengairan, 1985.

*1 Estimated on the basis of unskilled off-farm labor.

Table A.10.2 Economic Construction Cost

(Unit: Rp. Million)

	Financial Cost	SCF	Economic Cost
1) Preparatory Works	4,131	0.71	2,933
2) Civil Works			
- Weir	8,984	0.71	6,379
- Dam	35,901	0.71	25,490
- Main System	23,029	0.71	16,351
- Secondary System	6,531	0.71	4,637
- Tertiary System	4,453	0.71	3,162
- Drainage System	1,973	0.71	1,401
- Farm Road Network*1	1,494	0.71	1,061
- Pump Station	234	1.00	234
3) O&M Facilities and Equipment	1,058	1.00	1,058
4) Resettlement Cost*2	2,721 *2		1,815
5) Administration	2,164	0.90	1,948
6) Engineering services	25,788	0.90	23,209
7) Physical Contingency	11,846		8,968
Total	130,307		98,645

*1 Including maintenance roads.

Note: US$ 1.00 = Rp.2,160 (August, 1994)

*2 Changed from land aquisition and compensation to resettlement costs. (See Table A.10.6)

Table A.10.3 (1/4) Annual Disbursement Schedule of Economic Construction Cost (Rp. Million) - Whole Project

	Total Cost		*3					
	F/C*1	E/C*2	1996	1997	1998	1999	2000	2001
1) Preparatory Works	4,130	2,932	0	0	2,932	0	0	0
2) Civil Works								
- Weir	8,984	6,379	0	0	713	1,676	2,166	1,824
- Dam	35,901	25,490	0	0	2,153	4,338	7,759	11,240
- Main System	23,029	16,351	0	0	655	8,993	6,703	0
- Secondary System	6,531	4,637	0	0	0	835	3,293	509
- Tertiary System	4,453	3,162	0	0	0	0	2,245	917
- Drainage System	1,973	1,401	0	0	0	0	995	406
- Farm Road Network	1,494	1,061	0	0	0	0	754	307
- Pump Station	234	234	0	0	0	0	117	117
3) O&M Facilities and Equipment	1,058	1,058	0	0	741	317	0	0
4) Resettlement Cost	2,721	1,815	545	726	363	181	0	0
5) Administration	2,164	1,948	0	0	204	501	760	483
6) Engineering services	25,788	23,209	3,418	4,497	2,928	4,122	4,122	4,122
7) Physical Contingency	11,846	8,968	396	522	1,069	2,096	2,892	1,993
Sub-Total	130,306	98,645	4,359	5,745	11,758	23,059	31,806	21,918
8) Price Contingency	0	0	0	0	0	0	0	0
Total	130,306	98,645	4,359	5,745	11,758	23,059	31,806	21,918

Remarks: *1 F/C = Financial Cost *2 E/C = Economic Cost
*3 Year is assumption in order to estimate the price contingency and dose not indicate its real year.

Table A.10.3 (2/4) Annual Disbursement Schedule of Economic Construction Cost (US$ Million) - Whole Project

	Total Cost		*3					
	F/C*1	E/C*2	1996	1997	1998	1999	2000	2001
1) Preparatory Works	1,912	1,358	0	0	1,357	0	0	0
2) Civil Works								
- Weir	4,159	2,953	0	0	330	776	1,003	844
- Dam	16,621	11,801	0	0	997	2,008	3,592	5,204
- Main System	10,662	7,570	0	0	303	4,163	3,102	0
- Secondary System	3,024	2,147	0	0	0	387	1,525	236
- Tertiary System	2,062	1,464	0	0	0	0	1,039	425
- Drainage System	913	648	0	0	0	0	461	188
- Farm Road Network	692	491	0	0	0	0	349	142
- Pump Station	108	108	0	0	0	0	54	54
3) O&M Facilities and Equipment	490	490	0	0	343	147	0	0
4) Resettlement Cost	1,260	840	252	336	168	84	0	0
5) Administration	1,002	902	0	0	94	232	352	224
6) Engineering services	11,939	10,745	1,581	2,082	1,356	1,908	1,908	1,908
7) Physical Contingency	5,484	4,152	183	242	495	971	1,339	923
Sub-Total	60,328	45,669	2,016	2,660	5,443	10,676	14,724	10,148
8) Price Contingency	0	0	0	0	0	0	0	0
Total	60,328	45,669	2,016	2,660	5,443	10,676	14,724	10,148

Remarks: *1 F/C = Financial Cost *2 E/C = Economic Cost
*3 Year is assumption in order to estimate the price contingency and dose not indicate its real year.
Note: US$ 1.00 = Rp. 2,160

Table A.10.3 (3/4) Annual Disbursement Schedule of Economic Construction Cost (Rp. Million) - Gravity Irrigation

	Total Economic Construction Cost	*1 1996	1997	1998	1999	2000	2001
1) Preparatory Works	2,463	0	0	2,463	0	0	0
2) Civil Works							
- Weir	5,360	0	0	599	1,408	1,819	1,532
- Dam	21,413	0	0	1,809	3,644	6,518	9,442
- Main System	13,737	0	0	550	7,554	5,631	0
- Secondary System	3,896	0	0	0	701	2,766	428
- Tertiary System	2,656	0	0	0	0	1,886	770
- Drainage System	1,177	0	0	0	0	836	341
- Farm Road Network	891	0	0	0	0	633	258
- Pump Station							
3) O&M Facilities and Equipment	890	0	0	622	266	0	0
4) Resettlement Cost	1,525	458	610	305	152	0	0
5) Administration	1,639	0	0	171	421	638	406
6) Engineering services	19,499	2,871	3,777	2,460	3,462	3,462	3,462
7) Physical Contingency	7,515	333	439	898	1,761	2,419	1,665
Sub-Total	82,661	3,662	4,826	9,877	19,370	26,608	18,304
8) Price Contingency	0	0	0	0	0	0	0
Total	82,661	3,662	4,826	9,877	19,370	26,608	18,304

Remarks: *1 Year is assumption in order to estimate the price contingency and dose not indicate its real year.

Table A.10.3 (4/4) Annual Disbursement Schedule of Economic Construction Cost (Rp. Million) - Pump Irrigation

	Total Economic Construction Cost	*1 1996	1997	1998	1999	2000	2001
1) Preparatory Works	469	0	0	469	0	0	0
2) Civil Works							
- Weir	1,021	0	0	114	268	347	292
- Dam	4,079	0	0	344	694	1,241	1,798
- Main System	2,616	0	0	105	1,439	1,072	0
- Secondary System	742	0	0	0	134	527	81
- Tertiary System	506	0	0	0	0	359	147
- Drainage System	224	0	0	0	0	159	65
- Farm Road Network	170	0	0	0	0	121	49
- Pump Station	234	0	0	0	0	117	117
3) O&M Facilities and Equipment	170	0	0	119	51	0	0
4) Resettlement Cost	290	87	116	58	29	0	0
5) Administration	312	0	0	33	80	122	77
6) Engineering services	3,714	547	720	468	660	660	660
7) Physical Contingency	1,454	63	83	171	335	473	328
Sub-Total	16,001	697	919	1,881	3,689	5,198	3,614
8) Price Contingency	0	0	0	0	0	0	0
Total	16,001	697	919	1,881	3,689	5,198	3,614

Remarks: *1 Year is assumption in order to estimate the price contingency and dose not indicate its real year.

Table A.10.4 O&M and Replacement Costs

			Financial Cost (Rp. million)	SCF	Economic Cost (Rp. million)
1.	Annual O&M Cost		804	0.8	643
2.	Replacement Cost *2	(Useful Life)			
	1) O&M Equipment				
	- Vehicle and Equipment	10	963	1.0	963
	- Wireless Communication Equipment	10	97	1.0	97
	2) Project facilities				
	a) Weir				
	- Gate, Trush, Racks, Stoplog	25	1,487	1.0	1,487
	- Electrical Equipment and Accessaries, etc.	10	555	1.0	555
	b) Dam				
	- Gate, Trush, Racks	25	5,402	1.0	5,402
	- Electrical Equipment and Accessaries, etc.	10	580	1.0	580
	c) Irrigation canal				
	- Sluce Gate	25	2,071	1.0	2,071
	- Crump-De Gruyter Gate	25	1,114	1.0	1,114
	- Pumping Facilities	15	235	1.0	235

Table A.10.5 Production Foregone

		Area (ha)	Net Return per Hectare (Rp.1000/ha)	Total Net Return (Rp.million)
1)	Paddy Field - Rainfed*1	240	532	128
	Paddy Field - Irrigated*2	160	850	136
2)	Upland*1	50	192	10
3)	Orchard	130	*3	94
4)	Grass Land/Bush/Forest*4	530	-	-
	Total			368

*1 See Tables A.10.9 and A.10.10. *2 Pump irrigation

*3 As cacao. Planting numbers are estimated at 52,000 trees in 130 ha.

Annual Production	3 lit./tree x 52,000 trees	156,000 lit.
Gross Income	156,000 lit. x Rp.1,000	156,000,000 Rp.
Production Cost	40% of the above	62,400,000 Rp.
Annual Net return		93,600,000 Rp.

*4 For the grass land, bush and forest in the reservoir area, no opportunity cost in a national economic sense was evaluated, since there were no potential alternative.

Table A.10.6 Resettlement Cost

		Q'ty	Unit Price (Rp1,000.)	Financial Cost (Rp. million)	SCF	Economic Cost (Rp. million)
1. Public Facilities						
Village Office						
Land	m2	1,000	2	2	0.71	1.4
Building	m2	140	300	42	0.71	29.8
Village Office						
Land	m2	2,000	2	4	0.71	2.8
Barracks	m2	400	25	10	0.71	7.1
Elementary School						
Land	ha	2	20,000	40	0.71	28.4
Buildings	m2	1,200	400	480	0.71	340.8
Furniture	L.S.	1	120,000	120	0.71	85.2
Junior High School						
Land	ha	2	20,000	40	0.71	28.4
Buildings	m2	1,000	400	400	0.71	284.0
Furniture	L.S.	1	300,000	300	0.71	213.0
Houses for School Principal						
Land	m2	3,000	2	6	0.71	4.3
Buildings	m2	600	300	180	0.71	127.8
Mosque						
Land	m2	6,000	2	12	0.71	8.5
Buildings	m2	500	500	250	0.71	177.5
Health Facilities						
Land	m2	2,000	2	4	0.71	2.8
Buildings	m2	200	300	60	0.71	42.6
Furniture	L.S.	1	40,000	40	0.71	28.4
Water Supply System	L.S.	1	300,000	300	0.71	213.0
Micro Hydro Electric	L.S.	1	250,000	250	0.71	177.5
Farmer Meeting Facilities	m2	150	40	6	0.71	4.3
Cemetery	m2	5,000	2	10	0.71	7.1
2. Residential Land	m2	300,000	0.3			*1
3. Houses	no.	220	750	165	1.00	165.0
4. Paddy field	ha	240	0.15			*2
5. Trees	no.	52,000	4.50			*2
6. Land Acquisition for Dam, Weir and Irrigation Facilities						*3
Total				2,721		1,814.7

*1 No economic value was evaluated to land to be acquired for settlers.

*2 Evaluated as production foregone

*3 The right of way for project facilities total about 220 ha. These production foregone are counted in the estimate of irrigation benefit by deducting these areas from the paddy field under the future with project condition.

Table A.10.7 (1/3) Economic Price Structure

Items	Import Parity			Export Parity		
	Operation	US$/ton	Rp./kg	Operation	US$/ton	Rp./kg
Rice						
1) Thai 5% broken, FOB Bangkok, 2005 (Constant 1990 price)*1*3		267			267	
2) Adjusted to 1994 constant price	106.03%	283		106.03%	283	
3) Quality adjustment	90%	255		90%	255	
4) Freight and insurance (Bangkok-Ujung Pandang)	+	35				
5) CIF Ujung Pandang		290			255	
6) Conversion to Rupiah *2			626.4			550.8
7) Port handling, storage and losses	5% +		31.3	5% -		27.5
8) Transportation (port to wholesaler)	+		10.0	-		10.0
9) Ex-wholesaler			667.7			513.3
10) Handling and transportation (wholesaler to project area)	-		20.0	-		20.0
11) Ex-mill price			647.7			493.3
12) Conversion to paddy	68%		440.4	68%		335.4
13) By-products (Rice bran: 20% of paddy x Rs.100/kg)	+		20.0	+		20.0
14) Milling cost	-		15.0	-		15.0
15) Transportation (farm to mill)	-		5.0	-		5.0
16) Economic farm gate price			440.4			335.4
(Rounded)			440.0			335.0
17) Average economic farm gate price of import and export parity						388.0
Maize						
1) Export price, FOB Gulf ports, 2005 (Constant 1990 price)*1*4		90			90	
2) Adjusted to 1994 constant price	106.03%	95		106.03%	95	
3) Freight and insurance (Gulf ports-Ujung Pandang)	+	40				
4) CIF Ujung Pandang		135			95	
5) Conversion to Rupiah *2			292.5			206.1
6) Port handling, storage and losses	5% +		14.6	5% -		10.3
7) Transportation (port to wholesaler)	+		5.5	-		5.5
8) Ex-wholesaler (Ujung Pandang)			312.6			190.3
9) Handling and transportation (wholesaler to project area)	-		20.0	-		20.0
10) Ex-wholesaler prices			292.6			170.3
11) Local transportation and handling losses	-		12.0	-		12.0
12) Economic farm gate price			280.6			158.3
(Rounded)			281.0			158.0
13) Average economic farm gate price of import and export parity						220.0

Remarks: *1 Projected price in 2005 at constant 1990 price
Source: The World Bank, Commodity Markets and the Developing Countries - A World Bank Quarterly, August 1994.
*2 Exchange rate: US$ 1.00 = Rp. 2,160
*3 Thai, white, milled, 5% broken, government standard, Board of Trade-posted price, FOB Bangkok.
*4 US, No. 2, yellow, FOB Gulf ports.

Table A.10.7 (2/3) Economic Price Structure

	Operation		US$/ton	Rp./kg
Mungbeans				
1) Import price, CIF Jakarta (1994) *1			427	
2) Adjusted to 1994 constant price	100.00%		427	
3) Conversion to Rupiah *2				922.3
4) Port handling, storage and losses	5%	+		46.1
5) Transportation (port to wholesaler at Jakarta)		+		5.5
6) Ex-wholesaler price (Jakarta)				973.9
7) Transportation cost (Jakarta to Ujung Pandang)		-		10.0
8) Port handling and storage (Ujung Pandang)		-		22.0
9) Handling and transportation costs to project site		-		20.0
10) Local transportation and handling losses		-		12.0
11) Economic farm gate price				909.9
(Rounded)				910.0
Soybeans				
1) Export price, CIF Rotterdam *3*4			247	
2) Adjusted to 1994 constant price	106.03%		262	
3) Freight and insurance (Rotterdam-Ujung Pandang)		+	35	
4) CIF Ujung Pandang			297	
5) Conversion to Rupiah *2				641.3
6) Port handling, storage and losses	5%	+		32.1
7) Transportation (port to wholesaler at Ujung Pandang)		+		5.5
8) Ex-wholesaler price (Ujung Pandang)				678.9
9) Handling and transportation costs to project site		-		20
10) Local transportation and handling losses		-		12
11) Economic farm gate price				646.9
(Rounded)				647.0
Groundnuts				
1) Export price, groundnut oil CIF Rotterdam *3*5			448	
2) Conversion to price of shelled groundnuts	63%		282	
3) Adjusted to 1994 constant price	106.03%		299	
4) Freight and insurance		+	35	
5) Import price, shelled groundnuts, CIF Ujung Pandang			334	
6) Conversion to Rupiah *2				721.4
7) Port handling, storage and losses	5%	+		36.1
8) Transportation (port to wholesaler at Ujung Pandang)		+		5.5
9) Ex-wholesaler price (Ujung Pandang)				763.0
10) Handling and transportation costs to project site		-		20.0
11) Local transportation and handling losses		-		12.0
12) Economic farm gate price				731.0
(Rounded)				731.0

Remarks: *1 Estimated on the basis of CIF Jakarta prices for the last 5 years.
*2 US$ 1.00 = Rp. 2,160
*3 Projected price in 2005 at constant 1990 price
Source: The World Bank, Commodity Markets and the Developing Countries - A World Bank Quarterly, August 1994.
*4 US, CIF Rotterdam .
*5 Nigerian/West Africa, bulk, CIF UK, through January1977, subsequently (any origin), CIF Rotterdam

Table A.10.7 (3/3) Economic Price Structure

	Operation		US$/ton	Rp./kg
Urea				
1) Export price FOB Europe, bagged *1			140	
2) Adjusted to 1994 constant price	106.03%		148	
3) Transport premium		+	15	
4) FOB Palembang			163	
5) Conversion to Rupiah *2				353.0
6) Cost of shipping to Ujung Pandang		+		10.0
7) Port handling, storage and losses		+		23.0
8) Handling and transportation costs to project site		+		30.0
9) Economic price of bagged urea at farm gate				416.0
(Rounded)				416.0
TSP				
1) Export price, FOB US Gulf, bulk *1			129	
2) Adjusted to 1994 constant price	106.03%		137	
3) Freight and insurance (US Gulf-Ujung Pandang)		+	55	
4) Import price, CIF Ujung Pandang			192	
5) Conversion to Rupiah *2				414.2
6) Port handling charge		+		30.0
7) Bagging cost		+		12.0
8) Handling and transportation costs to project site		+		30.0
9) Economic price of bagged TSP at farm gate				486.2
(Rounded)				486.0
Potassium Chloride (KCl)				
1) Export price, FOB Vancouver, bulk *1			103	
2) Adjusted to 1994 constant price	106.03%		109	
3) Freight and insurance (US Gulf-Ujung Pandang)		+	50	
4) Import price, CIF Ujung Pandang			159	
5) Conversion to Rupiah *2				343.9
6) Port handling charge		+		30.0
7) Bagging cost		+		12.0
8) Handling and transportation costs to project site		+		30.0
9) Economic price of bagged KCl at farm gate				415.9
(Rounded)				416.0

Remarks: *1 Projected price in 2005 at constant 1990 price
Source: The World Bank, Commodity Markets and the Developing Countries - A World Bank Quarterly, August 1994.
*2 US$ 1.00 = Rp. 2,160

Table A.10.8 Financial and Economic Prices of Farm Inputs and Outputs

(Unit: Rp.)

		Financial Price*1	Economic Price*2
1) Farm Products			
Paddy *3	(Rp./kg)	320	388
Maize *3	(Rp./kg)	250	220
Mungbeans *3	(Rp./kg)	690	910
Soybeans *3	(Rp./kg)	950	647
Groundnuts *3	(Rp./kg)	1,000	731
Chillies	(Rp./kg)	1,100	1,100
2) Seeds			
Paddy	(Rp./kg)	600	600
Maize	(Rp./kg)	300	300
Mungbeans	(Rp./kg)	690	690
Soybeans	(Rp./kg)	1,200	1,200
Groundnuts	(Rp./kg)	1,800	1,800
Chillies	(Rp./kg)	112,500	112,500
3) Fertilizers			
Urea	(Rp./kg)	260	416
TSP	(Rp./kg)	480	486
KCl	(Rp./kg)	350	416
ZA	(Rp./kg)	295	472
4) Agro-chemicals			
Insecticides - Liquid type	(Rp./liter)	13,200	13,200
- Powder type	(Rp./kg)	3,000	3,000
Rodenticides	(Rp./kg)	3,000	3,000
5) Hired Labor *6			
Land preparation	(Rp./man-day)	5,400	4,050
Nursery preparation	(Rp./man-day)	3,400	2,550
Transplanting	(Rp./man-day)	5,400	4,050
Fertilizing	(Rp./man-day)	3,400	2,550
Weeding	(Rp./man-day)	3,400	2,550
Spraying	(Rp./man-day)	3,400	2,550
Harvesting	(Rp./man-day)	7,300	5,475
Other farm work	(Rp./man-day)	3,400	2,550
6) Hired Animal	(Rp./day)	23,000	23,000
7) Hired Machinery (2-wheel Tractor)	(Rp./day)	29,000	29,000
8) Transportation of Products (Paddy)	(Rp./ton)	13,000	13,000

Remarks: *1 As of 1994
*2 Projected prices in 2005 at 1994 constant.
*3 Dry grain
*4 Fresh roots
*5 Economic price of ZA is estimated on the basis of ratio of financial and economic prices of urea. (Economic Price of ZA = Economic Price of urea / Financial Price of Urea x Financial Price of ZA) = Rp.416/kg / Rp.260/kg x Rp.295/kg = Rp.472/kg
*6 Including cost for two meals
Economic conversion factor is estimated on the basis of unskilled off-farm labor (see Table A.10.1).

Table A.10.9 (1/2) Economic Net Return per Hectare for Crops (Without Project)

			Rainfed Paddy		Irrigated Paddy*1	
1. Gross Income						
- Unit Yield	(t)			3.0		4.0
- Unit Price	(Rp./kg)			388		388
- Gross Income	(Rp.)			1,164,000		1,552,000
2. Production Cost		Unit Price (Rp.)	Q'ty	Value (Rp.)	Q'ty	Value (Rp.)
1) Seed	(kg)	600	30	18,000	30	18,000
2) Fertilizers						
- Urea	(kg)	416	183	76,128	183	76,128
- TSP	(kg)	486	32	15,552	32	15,552
- KCl	(kg)	416	3	1,248	3	1,248
- ZA	(kg)	472	54	25,488	54	25,488
3) Agro-chemicals						
- Liquid type	(lit.)	13,200	0.48	6,336	0.48	6,336
- Powder type	(kg)	3,000	1.1	3,300	1.1	3,300
4) Labor						
- Nursery	(man-day)	2,550	3.2	8,160	3.2	8,160
- Land Preparation	(man-day)	4,050	15.8	63,990	15.8	63,990
- Transplanting	(man-day)	4,050	18.6	75,330	18.6	75,330
- Fertilizing	(man-day)	2,550	2.5	6,375	2.5	6,375
- Spraying	(man-day)	2,550	2.0	5,100	2.0	5,100
- Weeding	(man-day)	2,550	20.1	51,255	20.1	51,255
- Irrigating	(man-day)	2,550	-	-	2.0	5,100
- Harvesting	(man-day)	5,475	17.0	93,075	17.0	93,075
- Drying	(man-day)	2,550	3.0	7,650	4.0	10,200
5) Transportation of Products				39,000		52,000
6) Animal Power	(day)	23,000	2.04	46,920	2.04	46,920
7) Mech. Power	(day)	29,000	2.03	58,870	2.03	58,870
8) Operation Cost of Pump*2			-	-		46,600
9) Others (5%)				30,089		33,451
Total				631,866		702,478
3. Net Return				532,134		849,522

*1 Pump irrigation.

*2 Operation cost of pump per one season is estimated to be Rp.46,600/season/ha, based on the existing pump irrigation system.

Table A.10.9 (2/2) Economic Net Return per Hectare for Crops (Without Project)

		Unit Price (Rp.)	Maize Q'ty	Maize Value (Rp.)	Mungbeans Q'ty	Mungbeans Value (Rp.)	Soybeans Q'ty	Soybeans Value (Rp.)	Groundnuts Q'ty	Groundnuts Value (Rp.)
1. Gross Income										
- Unit Yield	(t)		2.0		0.8		0.9		1.1	
- Unit Price	(Rp./t)		220		910		647		731	
- Gross Income	(Rp.)		440,000		728,000		582,300		804,100	
2. Production Cost										
1) Seed	(kg)		20	6,000	20	13,800	40	48,000	120	216,000
2) Fertilizers										
- Urea	(kg)	416	-	-	-	-	25	10,400	40	16,640
- TSP	(kg)	486	-	-	-	-	100	48,600	60	29,160
- KCl	(kg)	416	-	-	-	-	25	10,400	-	-
- ZA	(kg)	472	-	-	-	-	-	-	-	-
3) Agro-chemicals										
- Insecticides	(lit.)	13,200	-	-	-	-	1.5	19,800	-	-
4) Labor	(man-day)									
- Family Labor		2,550	76	193,800	36.0	91,800	45.0	114,750	49	124,950
- Hired Labor		2,550	-	-	19.6	49,980	24.5	62,475	32	81,600
5) Animal Power	(day)	23,000	4.35	100,000	5.22	120,000	5.22	120,000	12.43	286,000
6) Mech. Power	(day)		-	-			-	-	-	-
7) Others (5%)				14,990		13,779		21,721		37,718
Total				314,790		289,359		456,146		792,068
3. Net Return				125,210		438,641		126,154		12,032

*1 Unit prices of seeds (Rp./kg):

Maize	300
Mungbeans	690
Soybeans	1,200
Groundnuts	1,800

Note: Production costs of palawija were estimated on the basis of the Household Survey (JICA Survey Team, 1994) and the "Laporan Analisa Usahatani Padi, Palawija dan Hortikultura 1993/94 (Dinas Pertanian Tanaman Pangan, Propinsi Sulawesi Sulatan).

Table A.10.10 (1/2) Economic Net Return per Hectare for Crops (With Project)

			Gravity Irrigation				Pump Irrigation			
			Paddy				Paddy			
			Wet Season		Dry Season		Wet Season		Dry Season	
1. Gross Income										
- Unit Yield	(t)			6.0		6.0		6.0		6.0
- Unit Price	(Rp./kg)			388		388		388		388
- Gross Income	(Rp.)			2,328,000		2,328,000		2,328,000		2,328,000
2. Production Cost		Unit Price (Rp.)	Q'ty	Value (Rp.)	Q'ty	Value (Rp.)	Q'ty	Value (Rp.)	Q'ty	Value (Rp.)
1) Seed	(kg)	600	30	18,000	30	18,000	30	18,000	30	18,000
2) Fertilizers										
- Urea	(kg)	416	250	104,000	200	83,200	250	104,000	200	83,200
- TSP	(kg)	486	50	24,300	50	24,300	50	24,300	50	24,300
- KCl	(kg)	416	100	41,600	100	41,600	100	41,600	100	41,600
- ZA	(kg)	472	25	11,800	25	11,800	25	11,800	25	11,800
3) Agro-chemicals										
- Insecticides	(lit.)	13,200	1.0	13,200	1.0	13,200	1.0	13,200	1.0	13,200
- Herbicides	(lit.)		-	-	-	-	-	-	-	-
- Rodenticides	(kg)	12,000	0.5	6,000	0.5	6,000	0.5	6,000	0.5	6,000
4) Labor	(man-day)									
- Nursery		2,550	3.2	8,160	3.2	8,160	3.2	8,160	3.2	8,160
- Land Preparation		4,050	15.8	63,990	15.8	63,990	15.8	63,990	15.8	63,990
- Transplanting		4,050	20.0	81,000	20.0	81,000	20.0	81,000	20.0	81,000
- Fertilizing		2,550	2.5	6,375	2.5	6,375	2.5	6,375	2.5	6,375
- Spraying		2,550	3.0	7,650	3.0	7,650	3.0	7,650	3.0	7,650
- Weeding		2,550	30.0	76,500	30.0	76,500	30.0	76,500	30.0	76,500
- Irrigating		2,550	2.0	5,100	2.0	5,100	2.0	5,100	2.0	5,100
- Harvesting		5,475	20.0	109,500	20.0	109,500	20.0	109,500	20.0	109,500
- Drying		2,550	6.0	15,300	6.0	15,300	6.0	15,300	6.0	15,300
5) Transportation of Products				39,000		39,000		39,000		39,000
6) Animal Power	(day)	23,000	2.04	46,920	2.04	46,920	2.04	46,920	2.04	46,920
7) Mech. Power	(day)	29,000	2.03	58,870	2.03	58,870	2.03	58,870	2.03	58,870
8) Operation Cost of Pump *1			-	-	-	-		62,123		62,123
9) Others (5%)				36,863		35,823		39,969		38,929
Total		103		774,128		752,288		839,357		817,517
3. Net Return				1,553,872		1,575,712		1,488,643		1,510,483

Remarks: *1 Operation cost of pump is estimated as follows.

			Type 3	Type 4	Type 5	Total
HP of Engine		(HP)	10	18	27	
No. of Pump Units		(No.)	6	22	13	41
Operation Hour per Year		(hr/year)	3,112	3,112	3,112	
Fuel Cost						
- Unit Fuel Consumption		(Lit./hr)	1.17	2.11	3.16	
- Total Fuel Consumption		(lit.)	21,846	144,459	127,841	294,146
- Unit price of Diesel		(Rp./lit)	389.6	389.6	389.6	389.6
- Total Fuel Cost		(Rp.)	8,511,202	56,281,226	49,806,854	114,599,282
- Lubricant (20%)		(Rp.)	1,702,240	11,256,245	9,961,371	22,919,856
Annual Repair and Maintenance Cost		(Rp.)	5% of procurement cost			11,731,200
Annual Depreciation Cost*		(Rp.)				-
Total Cost		(Rp.)				149,250,338
Irrigation Area	Cropping Area		Double cropping of paddy and			2,403
- Wet S. Paddy	1,120	(ha)	palawija (29%)			(1,120)
- Dry S. Paddy	1,120	(ha)	Operation hour of palawija is			(1,120)
- Palawija	325	(ha)	estimated to be 50% of its paddy.			(163)
Operation cost per ha						
- Paddy		(Rp./ha)				62,123
- Palawija		(Rp./ha)				31,062

* Earmarked as replacement cost.

Note: Proposed farm inputs were estimated on the basis of the recommendation of BIMAS package technology in 1994/1995 and 1995. (Rekomendasi, Paket Teknorogy Tanaman Pangan Propinsi Sulawesi Selatan - MT 1994/1995 dan 1995, Tim Teknis BIMAS Propinsi Sulawesi Sulatan, Agustus 1994)

Table A.10.10 (2/2) Economic Net Return per Hectare for Crops (With Project)

		Unit Price (Rp.)	Gravity Irrigation								Pump Irrigation							
			Mungbeans		Soybeans		Groundnuts		Chillies (Large)		Mungbeans		Soybeans		Groundnuts		Chillies (Large)	
1. Gross Income																		
- Unit Yield	(t)			1.50		1.50		1.50		3.00		1.50		1.50		1.50		3.00
- Unit Price	(Rp./t)			910		647		731		1,100		910		647		731		1,100
- Gross Income	(Rp.)			1,365,000		970,500		1,096,500		3,300,000		1,365,000		970,500		1,096,500		3,300,000
2. Production Cost			Q'ty	Value (Rp.)	Q'ty	Value (Rp.)	Q'ty	Value (Rp.)	Q'ty	Value (Rp.)	Q'ty	Value (Rp.)	Q'ty	Value (Rp.)	Q'ty	Value (Rp.)	Q'ty	Value (Rp.)
1) Seed*1	(kg)		25	17,250	45	54,000	60	108,000	0.4	45,000	25	17,250	45	54,000	60	108,000	0.4	45,000
2) Fertilizers																		
- Urea	(kg)	416	50	20,800	50	20,800	30	12,480	300	124,800	50	20,800	50	20,800	30	12,480	300	124,800
- TSP	(kg)	486	50	24,300	100	48,600	50	24,300	250	121,500	50	24,300	100	48,600	50	24,300	250	121,500
- KCl	(kg)	416	50	20,800	50	20,800	50	20,800	250	104,000	50	20,800	50	20,800	50	20,800	250	104,000
- ZA	(kg)	472	-	-	-	-	-	-	150	70,800	-	-	-	-	-	-	150	70,800
3) Agro-chemicals																		
- Insecticides	(lit.)	13,200	1	13,200	1.5	19,800	1	13,200	2.5	33,000	1	13,200	1.5	19,800	1	13,200	2.5	33,000
4) Labor	(man-day)																	
- Family Labor		2,550	43.2	110,160	54.0	137,700	58.8	149,940	199.5	508,725	43.2	110,160	54.0	137,700	59	149,940	199.5	508,725
- Hired Labor		2,550	23.5	59,925	29.4	74,970	38.4	97,920	85.5	218,025	23.5	59,925	29.4	74,970	38	97,920	85.5	218,025
5) Animal Power	(day)	23,000	5.22	120,000	5.22	120,000	12.43	286,000	13.04	300,000	5.22	120,000	5.22	120,000	12.43	286,000	13.04	300,000
6) Mech. Power	(day)	29,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7) Operation Cost of Pump*2			-	-	-	-	-	-	-	-		31,062		31,062		31,062		31,062
8) Others (5%)				19,322		24,834		35,632		76,293		19,322		24,834		35,632		76,293
Total				405,757		521,504		748,272		1,602,143		436,819		552,566		779,334		1,633,205
3. Net Return				959,243		448,996		348,228		1,697,857		928,181		417,934		317,166		1,666,795

*1 Unit prices of seeds (Rp./kg):

Maize	300	Groundnuts	1,800
Mungbeans	690	Chillies	112,500
Soybeans	1,200		

*2 50% of operation cost for paddy = Rp.62,123 x 50% = Rp. 31,062 /ha

Note: Production costs of palawija were estimated on the basis of the Household Survey (JICA Survey Team, 1994) and the "Laporan Analisa Usahatani Padi, Palawija dan Hortikultura 1993/94 (Dinas Pertanian Tanaman Pangan, Propinsi Sulawesi Sulatan).

Table A.10.11 Project Benefits under Full Development Stage

	Without Project			With Project			
	Harvested Area (ha)	Net Return per Hectare (Rp.1,000/ha)	Total value (Rp.Million)	Harvested Area (ha)	Net Return per Hectare (Rp.1,000/ha)	Total value (Rp.Million)	Incremental Benefit (Rp.Million)
Rainfed							
Paddy (Wet Season)	7,220	532	3,841	0	0	0	-3,841
Palawija*1	720	192	138	0	0	0	-138
Vegetables (Chillies)	0	0	0	0	0	0	0
Gravity Irrigation							
Paddy (Wet Season)	0	0	0	5,880	1,554	9,138	9,138
Paddy (Dry Season)	0	0	0	5,880	1,576	9,267	9,267
Palawija*2	0	0	0	1,510	585	883	883
Vegetables (Chillies)	0	0	0	170	1,698	289	289
Pump Irrigation							
Paddy (Wet Season)	0	0	0	1,120	1,489	1,668	1,668
Paddy (Dry Season)	480	850	408	1,120	1,510	1,691	1,283
Palawija*2	0	0	0	290	554	161	161
Vegetables (Chillies)	0	0	0	30	1,667	50	50
Total	8,420		4,387	16,000		23,147	18,760

*1 Average value of mungbeans, soybeans and groundnuts.
= (Rp.438,641+Rp.126,154+Rp.12,032)/3
= Rp.192,276

*2 Average value of mungbeans, soybeans and groundnuts.
Gravity Irrigation
= (Rp.959,243+Rp.448,996+Rp.348,228)/3
= Rp.585,489
Pump Irrigation
= (Rp.928,181+Rp.417,934+Rp.317,166)/3
= Rp.554,427

Table A.10.12 (1/3) Economic Internal Rate of Return - Whole Project

(Unit: Rp. Million)

Year	Year in Order	Project Costs				Project Benefits			Balance
		Construction	Replace-ment	O&M	Total	Benefits	Negative Benefits	Total	
1996	1	4,359			4,359			0	-4,359
1997	2	5,745			5,745			0	-5,745
1998	3	11,758			11,758			0	-11,758
1999	4	23,059		64	23,123			0	-23,123
2000	5	31,806		322	32,128			0	-32,128
2001	6	21,918		514	22,432	4,690	-368	4,322	-18,110
2002	7		0	643	643	11,256	-368	10,888	10,245
2003	8		0	643	643	14,070	-368	13,702	13,059
2004	9		0	643	643	15,946	-368	15,578	14,935
2005	10		0	643	643	17,822	-368	17,454	16,811
2006	11		0	643	643	18,760	-368	18,392	17,749
2007	12		0	643	643	18,760	-368	18,392	17,749
2008	13		0	643	643	18,760	-368	18,392	17,749
2009	14		0	643	643	18,760	-368	18,392	17,749
2010	15		0	643	643	18,760	-368	18,392	17,749
2011	16		2,196	643	2,839	18,760	-368	18,392	15,553
2012	17		0	643	643	18,760	-368	18,392	17,749
2013	18		0	643	643	18,760	-368	18,392	17,749
2014	19		0	643	643	18,760	-368	18,392	17,749
2015	20		0	643	643	18,760	-368	18,392	17,749
2016	21		235	643	878	18,760	-368	18,392	17,514
2017	22		0	643	643	18,760	-368	18,392	17,749
2018	23		0	643	643	18,760	-368	18,392	17,749
2019	24		0	643	643	18,760	-368	18,392	17,749
2020	25		0	643	643	18,760	-368	18,392	17,749
2021	26		2,196	643	2,839	18,760	-368	18,392	15,553
2022	27		0	643	643	18,760	-368	18,392	17,749
2023	28		0	643	643	18,760	-368	18,392	17,749
2024	29		0	643	643	18,760	-368	18,392	17,749
2025	30		0	643	643	18,760	-368	18,392	17,749
2026	31		10,075	643	10,718	18,760	-368	18,392	7,674
2027	32		0	643	643	18,760	-368	18,392	17,749
2028	33		0	643	643	18,760	-368	18,392	17,749
2029	34		0	643	643	18,760	-368	18,392	17,749
2030	35		0	643	643	18,760	-368	18,392	17,749
2031	36		2,431	643	3,074	18,760	-368	18,392	15,318
2032	37		0	643	643	18,760	-368	18,392	17,749
2033	38		0	643	643	18,760	-368	18,392	17,749
2034	39		0	643	643	18,760	-368	18,392	17,749
2035	40		0	643	643	18,760	-368	18,392	17,749
2036	41		0	643	643	18,760	-368	18,392	17,749
2037	42		0	643	643	18,760	-368	18,392	17,749
2038	43		0	643	643	18,760	-368	18,392	17,749
2039	44		0	643	643	18,760	-368	18,392	17,749
2040	45		0	643	643	18,760	-368	18,392	17,749
2041	46		2,196	643	2,839	18,760	-368	18,392	15,553
2042	47		0	643	643	18,760	-368	18,392	17,749
2043	48		0	643	643	18,760	-368	18,392	17,749
2044	49		0	643	643	18,760	-368	18,392	17,749
2045	50		0	643	643	18,760	-368	18,392	17,749

EIRR (%) =	13.3	
B/C (Discount Rate 10%) =	1.37	B-C (Discount Rate 10%, Rp. Million) = 26,248

Table A.10.12 (2/3) Economic Internal Rate of Return - Gravity Irrigation

(Unit: Rp. Million)

Year	Year in Order	Project Costs				Project Benefits			Balance
		Construction	Replace-ment	O&M	Total	Benefits	Negative Benefits	Total	
1996	1	3,662			3,662			0	-3,662
1997	2	4,826			4,826			0	-4,826
1998	3	9,877			9,877			0	-9,877
1999	4	19,370		54	19,424			0	-19,424
2000	5	26,608		270	26,878			0	-26,878
2001	6	18,304		432	18,736	4,017	-309	3,708	-15,028
2002	7		0	540	540	9,641	-309	9,332	8,792
2003	8		0	540	540	12,051	-309	11,742	11,202
2004	9		0	540	540	13,658	-309	13,349	12,809
2005	10		0	540	540	15,265	-309	14,956	14,416
2006	11		0	540	540	16,068	-309	15,759	15,219
2007	12		0	540	540	16,068	-309	15,759	15,219
2008	13		0	540	540	16,068	-309	15,759	15,219
2009	14		0	540	540	16,068	-309	15,759	15,219
2010	15		0	540	540	16,068	-309	15,759	15,219
2011	16		1,845	540	2,385	16,068	-309	15,759	13,374
2012	17		0	540	540	16,068	-309	15,759	15,219
2013	18		0	540	540	16,068	-309	15,759	15,219
2014	19		0	540	540	16,068	-309	15,759	15,219
2015	20		0	540	540	16,068	-309	15,759	15,219
2016	21		0	540	540	16,068	-309	15,759	15,219
2017	22		0	540	540	16,068	-309	15,759	15,219
2018	23		0	540	540	16,068	-309	15,759	15,219
2019	24		0	540	540	16,068	-309	15,759	15,219
2020	25		0	540	540	16,068	-309	15,759	15,219
2021	26		1,845	540	2,385	16,068	-309	15,759	13,374
2022	27		0	540	540	16,068	-309	15,759	15,219
2023	28		0	540	540	16,068	-309	15,759	15,219
2024	29		0	540	540	16,068	-309	15,759	15,219
2025	30		0	540	540	16,068	-309	15,759	15,219
2026	31		8,463	540	9,003	16,068	-309	15,759	6,756
2027	32		0	540	540	16,068	-309	15,759	15,219
2028	33		0	540	540	16,068	-309	15,759	15,219
2029	34		0	540	540	16,068	-309	15,759	15,219
2030	35		0	540	540	16,068	-309	15,759	15,219
2031	36		1,845	540	2,385	16,068	-309	15,759	13,374
2032	37		0	540	540	16,068	-309	15,759	15,219
2033	38		0	540	540	16,068	-309	15,759	15,219
2034	39		0	540	540	16,068	-309	15,759	15,219
2035	40		0	540	540	16,068	-309	15,759	15,219
2036	41		0	540	540	16,068	-309	15,759	15,219
2037	42		0	540	540	16,068	-309	15,759	15,219
2038	43		0	540	540	16,068	-309	15,759	15,219
2039	44		0	540	540	16,068	-309	15,759	15,219
2040	45		0	540	540	16,068	-309	15,759	15,219
2041	46		1,845	540	2,385	16,068	-309	15,759	13,374
2042	47		0	540	540	16,068	-309	15,759	15,219
2043	48		0	540	540	16,068	-309	15,759	15,219
2044	49		0	540	540	16,068	-309	15,759	15,219
2045	50		0	540	540	16,068	-309	15,759	15,219

EIRR (%) =	13.5		
B/C (Discount Rate 10%) =	1.40	B-C (Discount Rate 10%, Rp. Million) =	23,850

Table A.10.12 (3/3) Economic Internal Rate of Return - Pump Irrigation

(Unit: Rp. Million)

Year	Year in Order	Project Costs				Project Benefits			Balance
		Construction	Replace-ment	O&M	Total	Benefits	Negative Benefits	Total	
1996	1	697			697			0	-697
1997	2	919			919			0	-919
1998	3	1,881			1,881			0	-1,881
1999	4	3,689		10	3,699			0	-3,699
2000	5	5,198		52	5,250			0	-5,250
2001	6	3,614		82	3,696	673	-59	614	-3,082
2002	7		0	103	103	1,615	-59	1,556	1,453
2003	8		0	103	103	2,019	-59	1,960	1,857
2004	9		0	103	103	2,288	-59	2,229	2,126
2005	10		0	103	103	2,557	-59	2,498	2,395
2006	11		0	103	103	2,692	-59	2,633	2,530
2007	12		0	103	103	2,692	-59	2,633	2,530
2008	13		0	103	103	2,692	-59	2,633	2,530
2009	14		0	103	103	2,692	-59	2,633	2,530
2010	15		0	103	103	2,692	-59	2,633	2,530
2011	16		351	103	454	2,692	-59	2,633	2,179
2012	17		0	103	103	2,692	-59	2,633	2,530
2013	18		0	103	103	2,692	-59	2,633	2,530
2014	19		0	103	103	2,692	-59	2,633	2,530
2015	20		0	103	103	2,692	-59	2,633	2,530
2016	21		235	103	338	2,692	-59	2,633	2,295
2017	22		0	103	103	2,692	-59	2,633	2,530
2018	23		0	103	103	2,692	-59	2,633	2,530
2019	24		0	103	103	2,692	-59	2,633	2,530
2020	25		0	103	103	2,692	-59	2,633	2,530
2021	26		351	103	454	2,692	-59	2,633	2,179
2022	27		0	103	103	2,692	-59	2,633	2,530
2023	28		0	103	103	2,692	-59	2,633	2,530
2024	29		0	103	103	2,692	-59	2,633	2,530
2025	30		0	103	103	2,692	-59	2,633	2,530
2026	31		1,612	103	1,715	2,692	-59	2,633	918
2027	32		0	103	103	2,692	-59	2,633	2,530
2028	33		0	103	103	2,692	-59	2,633	2,530
2029	34		0	103	103	2,692	-59	2,633	2,530
2030	35		0	103	103	2,692	-59	2,633	2,530
2031	36		586	103	689	2,692	-59	2,633	1,944
2032	37		0	103	103	2,692	-59	2,633	2,530
2033	38		0	103	103	2,692	-59	2,633	2,530
2034	39		0	103	103	2,692	-59	2,633	2,530
2035	40		0	103	103	2,692	-59	2,633	2,530
2036	41		0	103	103	2,692	-59	2,633	2,530
2037	42		0	103	103	2,692	-59	2,633	2,530
2038	43		0	103	103	2,692	-59	2,633	2,530
2039	44		0	103	103	2,692	-59	2,633	2,530
2040	45		0	103	103	2,692	-59	2,633	2,530
2041	46		351	103	454	2,692	-59	2,633	2,179
2042	47		0	103	103	2,692	-59	2,633	2,530
2043	48		0	103	103	2,692	-59	2,633	2,530
2044	49		0	103	103	2,692	-59	2,633	2,530
2045	50		0	103	103	2,692	-59	2,633	2,530

EIRR (%) =	11.9		
B/C (Discount Rate 10%) =	1.21	B-C (Discount Rate 10%, Rp. Million) =	2,398

Table A.10.13 Economic Analysis for Gravity and Pump Irrigations

		Whole Project	Gravity Irrigation	Pump Irrigation
1) Irrigation Area	(ha)	7,000	5,880	1,120
2) Net Field Water Requirement*1	(MCM/year)	83.0	69.7	13.3
		100.0%	84.0%	16.0%
3) Project Costs				
Common costs of Gravity and Pump Irrigations*2				
- Construction Cost *3	(Rp.Million)	94,910	79,724	15,186
- O&M Cost *4	(Rp.Million)	643	540	103
- Replacement Cost *5				
10 years depreciation	(Rp.Million)	2,196	1,845	351
25 years depreciation	(Rp.Million)	10,075	8,463	1,612
- Production Foregone	(Rp.Million)	368	309	59
Separate Costs				
- Construction Cost of Tertiary System *6	(Rp.Million)	3,478	2,922	556
- Construction cost of Pump	(Rp.Million)	257	0	257
- Replacement Cost *7				
15 years depreciation	(Rp.Million)	235	0	235

6) Project Benefits	Area (ha)	Total Value (Rp. Million)	Area (ha)	Net Return per ha (Rp.1,000)	Total Value (Rp. Million)	Area (ha)	Net Return per ha (Rp.1,000)	Total Value (Rp. Million)
Without Project								
- Paddy - Rainfed	7,220	3,841	6,060	532	3,224	1,160	532	617
- Paddy - Irrigated (Pump) *8	480	408	200	850	170	280	850	238
- Palawija	720	138	600	192	115	120	192	23
Total		4,387			3,509			878
With Project								
- Paddy	7,000	21,764	5,880	3,130	18,405	1,120	2,999	3,359
- Palawija	1,800	1,044	1,510	585	883	290	554	161
- Vegetables	200	339	170	1,698	289	30	1,667	50
Total		23,147			19,577			3,570
Incremental Benefits (Rp.1,000/ha)		18,760			16,068			2,692
Benefits per Hectare (US$/ha)		1,241			1,265			1,113

7) Economic Evaluation				
EIRR	(%)	13.3	13.5	11.9
B-C (10% Discount Rate)		1.37	1.40	1.21
B/C (10% Discount Rate)	(Rp.Million)	26,248	23,850	2,398

*1 Annual total requirement.
*2 Costs for common facilities of gravity and pump irrigation facilities. Costs are divided by the ratio of those annual field irrigation water requirement.
*3 Excluding construction costs of tertiary block and pumping facilities which are earmarked in "Separate Costs."
*4 Excluding operation and maintenance costs of pumping facilities. These are earmarked in the production cost of crops.
*5 Including O&M equipment and steel gate.
*6 Divided by gravity and pump irrigation areas.
*7 Replacement of pumping facilities.
*8 Existing irrigation system is located in the area to be covered by the gravity irrigation.

Table A.10.14 (1/2) Annual Disbursement Schedule of Financial Construction Cost (Rp. Million)

	Total Cost *1			1996 *2		1997		1998		1999		2000		2001	
	F.C.	L.C.	Total	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
1) Preparatory Works	2,583	1,547	4,130	0	0	0	0	2,583	1,547	0	0	0	0	0	0
2) Civil Works															
- Weir	4,252	4,732	8,984	0	0	0	0	390	613	1,171	1,190	1,836	1,216	855	1,713
- Dam	25,423	10,478	35,901	0	0	0	0	2,095	936	4,380	1,730	6,949	3,980	11,999	3,832
- Main System	15,588	7,441	23,029	0	0	0	0	623	297	8,574	4,093	6,391	3,051	0	0
- Secondary System	3,919	2,612	6,531	0	0	0	0	0	0	705	470	2,783	1,855	431	287
- Tertiary System	0	4,453	4,453	0	0	0	0	0	0	0	0	0	3,162	0	1,291
- Drainage System	1,389	584	1,973	0	0	0	0	0	0	0	0	986	415	403	169
- Farm Road Network	1,018	476	1,494	0	0	0	0	0	0	0	0	723	338	295	138
- Pump Station	70	164	234	0	0	0	0	0	0	0	0	35	82	35	82
3) O&M Facilities and Equipment	741	317	1,058	0	0	0	0	519	222	222	95	0	0	0	0
4) Land Acquisition and Compensation	0	3,741	3,741	0	1,122	0	1,497	0	748	0	374	0	0	0	0
5) Administration	1,354	810	2,164	0	0	0	0	142	84	370	187	492	352	350	187
6) Engineering services	23,009	2,779	25,788	3,798	0	4,998	0	2,891	361	3,774	806	3,774	806	3,774	806
7) Physical Contingency	7,931	4,010	11,941	379	112	499	149	924	480	1,919	894	2,396	1,525	1,814	850
Sub-Total	87,277	44,144	131,421	4,177	1,234	5,497	1,646	10,167	5,288	21,115	9,839	26,365	16,782	19,956	9,355
8) Price Contingency	12,344	16,922	29,266	190	153	397	314	1,018	1,385	2,725	3,325	4,223	7,031	3,791	4,714
Total	99,621	61,066	160,687	4,367	1,387	5,894	1,960	11,185	6,673	23,840	13,164	30,588	23,813	23,747	14,069

Remarks: *1 F.C. = Foreign Currency L.C. = Local Currency
*2 Year is assumption in order to estimate the price contingency and dose not indicate its real year.

Table A.10.14 (2/2) Annual Disbursement Schedule of Financial Construction Cost (US$ Thousand)

	Total Cost *1			1996 *2		1997		1998		1999		2000		2001	
	F.C.	L.C.	Total	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
1) Preparatory Works	1,196	716	1,912	0	0	0	0	1,196	716	0	0	0	0	0	0
2) Civil Works															
- Weir	1,969	2,191	4,160	0	0	0	0	181	284	542	551	850	563	396	793
- Dam	11,770	4,851	16,621	0	0	0	0	970	433	2,028	801	3,217	1,843	5,555	1,774
- Main System	7,217	3,445	10,662	0	0	0	0	288	138	3,969	1,895	2,959	1,413	0	0
- Secondary System	1,814	1,209	3,023	0	0	0	0	0	0	326	218	1,288	859	200	133
- Tertiary System	0	2,062	2,062	0	0	0	0	0	0	0	0	0	1,464	0	598
- Drainage System	643	270	913	0	0	0	0	0	0	0	0	456	192	187	78
- Farm Road Network	471	220	691	0	0	0	0	0	0	0	0	335	156	137	64
- Pump Station	32	76	108	0	0	0	0	0	0	0	0	16	38	16	38
3) O&M Facilities and Equipment	343	147	490	0	0	0	0	240	103	103	44	0	0	0	0
4) Land Acquisition and Compensation	0	1,732	1,732	0	519	0	693	0	346	0	173	0	0	0	0
5) Administration	627	375	1,002	0	0	0	0	66	39	171	87	228	163	162	87
6) Engineering services	10,652	1,287	11,939	1,758	0	2,314	0	1,338	167	1,747	373	1,747	373	1,747	373
7) Physical Contingency	3,672	1,856	5,528	175	52	231	69	428	222	888	414	1,109	706	840	394
Sub-Total	40,406	20,437	60,843	1,933	571	2,545	762	4,707	2,448	9,774	4,556	12,205	7,770	9,240	4,332
8) Price Contingency	5,715	7,834	13,549	88	71	184	145	471	641	1,262	1,539	1,955	3,255	1,755	2,182
Total	46,121	28,271	74,392	2,021	642	2,729	907	5,178	3,089	11,036	6,095	14,160	11,025	10,995	6,514

Remarks: *1 F.C. = Foreign Currency L.C. = Local Currency
*2 Year is assumption in order to estimate the price contingency and dose not indicate its real year.
Note: US$ 1.00 = Rp. 2,160

Table A.10.15 Price Contingency

Year	G-5 Manufacturing Unit Value Index *1 (1985=100)	(%)	Price Contingency for Foreign Currency *2 (1994=100)	(%)	Combined Consumer Price Index of 17 Cities*3 (%)	Consumer Price Index Ujung Pandang*4 (%)	Price Contingency for Local Currency *5 (1994=100)	(%)
1985	68.61	0.81	-	-	-	-	-	-
1986	80.89	17.91	-	-	-	-	-	-
1987	88.84	9.84	-	-	-	-	-	-
1988	95.31	7.28	-	-	5.47	3.08	-	-
1989	94.65	-0.70	-	-	5.97	5.40	-	-
1990	100.00	5.65	-	-	9.53	7.37	-	-
1991	102.23	2.23	-	-	9.52	8.21	-	-
1992	106.64	4.31	-	-	4.94	3.66	-	-
1993	106.05	-0.55	-	-	-	-	-	-
1994	106.03	-0.02	100.00	-	-	-	100.0	-
1995	108.14	1.99	101.99	2.0	-	-	106.0	6.0
1996	110.87	2.52	104.56	2.5	-	-	112.4	6.0
1997	113.71	2.56 *6	107.24	2.6	-	-	119.1	6.0
1998	116.65	2.59 *6	110.02	2.6	-	-	126.2	6.0
1999	119.71	2.63 *6	112.91	2.6	-	-	133.8	6.0
2000	123.02	2.66	116.02	2.7	-	-	141.9	6.0
2001	126.18	2.57 *6	119.00	2.6	-	-	150.4	6.0
2002	129.31	2.48 *6	121.95	2.5	-	-	159.4	6.0
2003	132.40	2.39 *6	124.87	2.4	-	-	168.9	6.0
2004	135.46	2.31 *6	127.76	2.3	-	-	179.1	6.0
2005	138.32	2.23	130.45	2.2	-	-	189.8	6.0

*1 Unit value index of manufactured exports from developed to developing countries.
Source: Commodity Markets and the Developing Countries, A World Bank Quarterly, August 1994.

*2 Apply the manufacturing unit value index to the price contingency for foreign currency (F.C.).

*3 Source: Statistik Indonesia - 1992, Biro Pusat Statistik.

*4 Source: Sulawesi Selatan Dalam Angka - 1992, Kantor Statistik, Ujung Pandang

*5 Price contingency for local currency (L.C.) was estimated at 10% per annum on the basis of an average consumer price index of Ujung Pandang from 1988 to 1992.

*6 Estimated figures based on the % change in 1996, 2000 and 2005.

Table A.10.16 (1/2) Annual Loan Requirement (Rp. Million)

	Total Cost *1			1996 *2		1997		1998		1999		2000		2001	
	F.C.	L.C.	Total	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
1) Preparatory Works	2,583	1,547	4,130	0	0	0	0	2,583	1,547	0	0	0	0	0	0
2) Civil Works															
- Weir	4,252	4,732	8,984	0	0	0	0	390	613	1,171	1,190	1,836	1,216	855	1,713
- Dam	25,423	10,478	35,901	0	0	0	0	2,095	936	4,380	1,730	6,949	3,980	11,999	3,832
- Main System	15,588	7,441	23,029	0	0	0	0	623	297	8,574	4,093	6,391	3,051	0	0
- Secondary System	3,919	2,612	6,531	0	0	0	0	0	0	705	470	2,783	1,855	431	287
- Tertiary System	0	4,453	4,453	0	0	0	0	0	0	0	0	0	3,162	0	1,291
- Drainage System	1,389	584	1,973	0	0	0	0	0	0	0	0	986	415	403	169
- Farm Road Network	1,018	476	1,494	0	0	0	0	0	0	0	0	723	338	295	138
- Pump Station	70	164	234	0	0	0	0	0	0	0	0	35	82	35	82
3) O&M Facilities and Equipment	741	317	1,058	0	0	0	0	519	222	222	95	0	0	0	0
4) Land Acquisition and Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5) Administration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6) Engineering services	23,009	2,779	25,788	3,798	0	4,998	0	2,891	361	3,774	806	3,774	806	3,774	806
7) Physical Contingency	7,798	3,559	11,357	379	0	499	0	910	398	1,883	838	2,348	1,491	1,779	832
Sub-Total	85,790	39,142	124,932	4,177	0	5,497	0	10,011	4,374	20,709	9,222	25,825	16,396	19,571	9,150
8) Price Contingency	12,119	15,745	27,864	190	0	397	0	1,003	1,146	2,674	3,117	4,137	6,870	3,718	4,612
Total	97,909	54,887	152,796	4,367	0	5,894	0	11,014	5,520	23,383	12,339	29,962	23,266	23,289	13,762

Remarks: *1 F.C. = Foreign Currency L.C. = Local Currency
*2 Year is assumption in order to estimate the price contingency and dose not indicate its real year.

Table A.10.16 (2/2) Annual Loan Requirement (US$ Thousand)

	Total Cost *1			1996 *2		1997		1998		1999		2000		2001	
	F.C.	L.C.	Total	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
1) Preparatory Works	1,196	716	1,912	0	0	0	0	1,196	716	0	0	0	0	0	0
2) Civil Works															
- Weir	1,969	2,191	4,160	0	0	0	0	181	284	542	551	850	563	396	793
- Dam	11,770	4,851	16,621	0	0	0	0	970	433	2,028	801	3,217	1,843	5,555	1,774
- Main System	7,217	3,445	10,662	0	0	0	0	288	138	3,969	1,895	2,959	1,413	0	0
- Secondary System	1,814	1,209	3,023	0	0	0	0	0	0	326	218	1,288	859	200	133
- Tertiary System	0	2,062	2,062	0	0	0	0	0	0	0	0	0	1,464	0	598
- Drainage System	643	270	913	0	0	0	0	0	0	0	0	456	192	187	78
- Farm Road Network	471	220	691	0	0	0	0	0	0	0	0	335	156	137	64
- Pump Station	32	76	108	0	0	0	0	0	0	0	0	16	38	16	38
3) O&M Facilities and Equipment	343	147	490	0	0	0	0	240	103	103	44	0	0	0	0
4) Land Acquisition and Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5) Administration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6) Engineering services	10,652	1,287	11,939	1,758	0	2,314	0	1,338	167	1,747	373	1,747	373	1,747	373
7) Physical Contingency	3,610	1,648	5,258	175	0	231	0	421	184	872	388	1,087	690	824	385
Sub-Total	39,717	18,122	57,839	1,933	0	2,545	0	4,634	2,025	9,587	4,270	11,955	7,591	9,062	4,236
8) Price Contingency	5,611	7,289	12,900	88	0	184	0	464	531	1,238	1,443	1,915	3,181	1,721	2,135
Total	45,328	25,411	70,739	2,021	0	2,729	0	5,098	2,556	10,825	5,713	13,870	10,772	10,783	6,371

Remarks: *1 F.C. = Foreign Currency L.C. = Local Currency
*2 Year is assumption in order to estimate the price contingency and dose not indicate its real year.
Note: US$ 1.00 = Rp. 2,160

Table A.10.17 Cash Flow Statement

(Unit: Rp. Million)

Year	Year in Order	Cash Outflow							Cash Inflow				Balance
		Capital Cost *1		Loan Repayment*2		Total O&M Cost*3	Replace-ment Cost *3	Total	Const-ruction Fund	*3*4 Re-venue	Govern-ment Budget	Total	
		Interna-tional Fund	Government Budget	Interest	Principal								
1996	1	4,367	1,387	-				5,754	5,754		0	5,754	0
1997	2	5,894	1,960	114				7,968	7,854		114	7,968	0
1998	3	16,534	1,324	267				18,125	17,858		267	18,125	0
1999	4	35,722	1,282	697		359		38,060	37,004		1,056	38,060	0
2000	5	53,228	1,173	1,625		760		56,786	54,401		2,385	56,786	0
2001	6	37,051	765	3,009		1,209		42,034	37,816	504	3,714	42,034	0
2002	7			3,973		1,209	0	5,182	0	1,009	4,173	5,182	0
2003	8			3,973		1,209	0	5,182	0	1,009	4,173	5,182	0
2004	9			3,973		1,209	0	5,182	0	1,009	4,173	5,182	0
2005	10			3,973		1,209	0	5,182	0	1,009	4,173	5,182	0
2006	11			3,973	7,640	1,209	0	12,821	0	1,009	11,812	12,821	0
2007	12			3,774	7,640	1,209	0	12,623	0	1,009	11,614	12,623	0
2008	13			3,575	7,640	1,209	0	12,424	0	1,009	11,415	12,424	0
2009	14			3,377	7,640	1,209	0	12,226	0	1,009	11,217	12,226	0
2010	15			3,178	7,640	1,209	0	12,027	0	1,009	11,018	12,027	0
2011	16			2,980	7,640	1,209	2,613	14,441	0	1,009	13,432	14,441	0
2012	17			2,781	7,640	1,209	0	11,630	0	1,009	10,621	11,630	0
2013	18			2,582	7,640	1,209	0	11,431	0	1,009	10,422	11,431	0
2014	19			2,384	7,640	1,209	0	11,232	0	1,009	10,223	11,232	0
2015	20			2,185	7,640	1,209	0	11,034	0	1,009	10,025	11,034	0
2016	21			1,986	7,640	1,209	280	11,115	0	1,009	10,106	11,115	0
2017	22			1,788	7,640	1,209	0	10,637	0	1,009	9,628	10,637	0
2018	23			1,589	7,640	1,209	0	10,438	0	1,009	9,429	10,438	0
2019	24			1,390	7,640	1,209	0	10,239	0	1,009	9,230	10,239	0
2020	25			1,192	7,640	1,209	0	10,041	0	1,009	9,032	10,041	0
2021	26			993	7,640	1,209	2,613	12,455	0	1,009	11,446	12,455	0
2022	27			795	7,640	1,209	0	9,643	0	1,009	8,634	9,643	0
2023	28			596	7,640	1,209	0	9,445	0	1,009	8,436	9,445	0
2024	29			397	7,640	1,209	0	9,246	0	1,009	8,237	9,246	0
2025	30			199	7,640	1,209	0	9,047	0	1,009	8,038	9,047	0
2026	31					1,209	11,989	13,198	0	1,009	12,189	13,198	0
2027	32					1,209	0	1,209	0	1,009	200	1,209	0
2028	33					1,209	0	1,209	0	1,009	200	1,209	0

Remarks: *1 F.C. = Foreign Currency Portion, L.C. = Local Currency Portion
*2 Interest: 2.6% per year. Grace Period: 10 years. Repayment Period: 30 years (including grace period).
*3 Prices in 2001.
*4 Revenue from irrigation service fees to be collected from the beneficiaries.

Note: The cash flow statement was prepared for the project executing agency of the Gilirang Irrigation Project.