Directorate General of
Water Resources Development
Ministry of Public Works
Republic of Indonesia

United States
Agency for
International
Development

Small-Scale Irrigation Management Project (SSIMP)

FINAL REPORT
ENVIRONMENTAL ASSESSMENT
KALIMANTONG II PROJECT

MAIN REPORT
including
MITIGATION PLAN and MONITORING PLAN

October 1989

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October 1989

Prepared by

HARZA ENGINEERING COMPANY

in association with

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Glossary and Acronyms

Agraria/Pertanahan	Directorate General of Land Affairs
AID	Agency for International Development
AMDAL-Analisa Mengenai Dampak Lingkungan	Environmental Impact Assessment
ANDAL-Analisa Dampak Lingkungan	Environmental Impact Study
BangDes-Pembangunan Desa	Directorate of Village Development, under the Department of Home Affairs
BAPPEDA Tk.II-Badan Perencanaan Pembangunan Daerah	District level of the Regional Development Planning Board, under the Department of Home Affairs
Beras	Milled rice, uncooked
Bibit	Seed
BIMAS-Bimbingan Massal Swasembada Bahan Makanan	Mass Guidance for self-sufficiency in foodstuffs, a farm input-credit package program
BKLH-Biro Kependudukan dan Lingkungan Hidup	BPE-Bureau of Population and Environment
Buin Aik Panas	Hot water spring
BULOG-Badan Urusan Logistik	National food logistics body
Bupati	Head of a District, i.e. a Regency (Kabupaten)
Cabang	Branch office
Camat	Sub-District head
Cipta Karya	Part of GOI Department of Public Works
DA	Drainage (catchment) area
Dalam Negeri	Ministry of Home Affairs
Demplot	A demonstration plot by Agricultural Extension Services

Desa	A village
DGWRD	Directorate General of Water Resources Development
DOLOG/SUB-DOLOG-Depot Logistik	Provincial food logistics body
DPUP-Dinas Pekerjaan Umum Propinsi	Provincial Public Works Services
Dusun	A village administrative sub-area
EA	Environmental Assessment
EMP	Environmental Management Plan or Environmental Monitoring Plan
E & P-Exploitasi dan Pemeliharaan	O & M - Operation and Maintenance
Embung	Local term for a small dam/reservoir
Fenco	An engineering company (Canada)
FY	Fiscal Year (from 1 April to the following 31 March)
Gabah	Rice in husk after threshing
Gabah Kering	Dry gabah
GeoSurvey Swasti Sarana	An engineering company (Bandung)
Giliran	To go around, as in rotational supply of irrigation water
Gogo-rancah	Dry/upland rice
GOI	Government of Indonesia
Golongan	A class/division, as in a subdivision of irrigation area for rotating and spreading planting dates
Gotong Royong	Cooperative work effort by villagers; mutual self-help
Harza	An engineering company (US)
HHS	Household Survey
HYV	High Yielding Variety (rice)

Hutan Lindung	Protected forest status
IBRD	International Bank for Reconstruction and Development - World Bank
INMAS-Intensifikasi Massal	Massive Intensification, a farm input program
INPRES-Instruksi Presiden	Presidential Instruction, a general program for rural development
INSUS-Intensifikasi Khusus	Special Intensification, a farm input credit program for groups of farmers with improved infrastructure facilities
IR-36	Paddy seed variety
Juru Pengairan	Irrigation Sub-foreman for O & M in the Sub-district (Ranting Dinas)
Kabupaten	Regency
Kandang	A cattle corral
KanWil-Kantor Wilayah	Regional Office of a Ministry
Kecamatan	Administrative Sub-district within a kabupaten
Kejuron	Administrative area of the juru pengairan (mantri pengairan) from the branch office (ranting dinas) for O & M
Kelompok	A group, as in a quaternary irrigation unit
Kelompok Tani	A farmers' group
Kepala	Head of an organization
Kepala Desa	Head of a village
Kesehatan	Department of Public Health
Kerbau	Water buffalo
Ketua	Head, senior officer
Ketua P3A	Head of the Water Users' Association
kg/ha	Kilograms per hectare
Kios	Small shop

KK-Kepala Keluarga	Household head
Kontak Tani	Leader of a farmer group who is in contact with extension service; a key farmer
KSDA-Konservasi Sumber Daya Alam	Agency for the conservation of natural resources
KUD-Koperasi Unit Desa	A village cooperative
KUPPEDES-Kredit Umum Pedesaan	A village credit cooperative unit
KUT-Koperasi Usaha Tani	A Farmer Cooperative
Ladang	Dry fields, not used for wet rice production
Lebe	Well-respected community leader
LKMD-Lembaga Ketahanan Masyarakat Desa	Organization for Self-Reliance of the village community (Village community development committee)
LP3ES-Lembaga Penelitian Pendidikan dan Penerangan Ekonomi dan Sosial	Indonesian non-governmental organization with expertise in organizing water users' associations (Institute for Social and Economic Research, Education and Information)
LMD-Lembaga Masyarakat Desa	Village Development Council
Lurah	Head of kelurahan (large village)
m3/s	Cubic meters per second
mg/l	Milligrams per liter
Malar/Pekasih/Ulu-ulu	Irrigation foreman appointed by village
Mantri	Local official in charge of a specific service, kejuron or kemantren in his administrative service region
MCM	Million cubic meters
Muara Ema	An engineering company (Mataram)
NEPA	(US) National Environmental Policy Act
NTB-Nusa Tenggara Barat	A province

O & M	Operation and Maintenance
Orong	A group of contiguous rice fields relying on the same water source and some shared work tasks
Padi	Stalk rice, unthreshed rice which is harvested and can be tied into bundless with part of the stalk
Padi gabah	Unhusked rice (1 ton gabah = 630 kg dried rice)
Padi Gadu	Dry season rice
Padi Rendeng	Wet season rice
Palawija	Non-rice food crops, secondary crop, such as maize, cassava, soybeans
Pamong Desa	Village administrative officer
Panggung	A house usually made of wood with its floor elevated one or two meters above the ground
Panitia Irigasi	Irrigation Committee
Pantai Grazing Area	Beach grazing area
PELITA V	Indonesia's Fourth Five-Year Development Plan
PEMDA-Pemerintah Daerah	Regional Government (District, Sub-District)
Pengairan	Irrigation; generally used in reference to the irrigation division of DGWRD-Directorate General Water Resources Development
Pengamat	Water distribution supervisor
Pengurus P3A	Executive board of the Water Users' Association
Perkebunan	Horticulture; estate (usually tree) crops services
P3A-Perkumpulan Petani Pemakai Air	Water Users' Association
P & K - Pendidikan dan Kebudayaan	Directorate of Education and Culture

Pertanian	Ministry of Agriculture
PKK-Program Kesejahteraan Keluarga	Women's Group for Family Prosperity Program
Petak	Individual bunded rice field
Pagar Hidup	A living fence; row of trees forming a fence
PPL-Penyuluh Pertanian Lapangan	Field extension agent
PPM-Penyuluh Pertanian Madya	Field extension manager of PPL
PPS-Penyuluh Pertanian Specialis	Extension subject matter specialist
P3SA-Proyek Perencanaan Pengembangan Sumber Air	Water Resources Development Planning Project
PIL-Penyajian Informasi Lingkungan	Preliminary Environmental Information
PP 29-Peraturan Pemerintah 29	Indonesia's environmental law
PSL-Pusat Studi Lingkungan	Environmental Studies Center
PU-Pekerjaan Umum	Ministry of Public Works
Pusat	Center; usually central office
PU Seksi	Administrative area for irrigation management within the province
PU Wilayah	Administrative area for irrigation management within the province
PUSKESMAS-Pusat Kesehatan Masyarakat	Public Health Clinics; government sponsored health program
Ranting/Ranting Cabang	Twig; smaller than sub-district (village or irrigation system level)
Residen	Assistant Governor for the coordination of five kabupaten
RH	Relative Humidity

RKL-Rencana Pengelolaan Lingkungan	Environmental Mitigation Plan
Rp	Rupiah
RPL-Rencana Pemantauan Lingkungan	Environmental Monitoring Plan
RRIA	Rapid Rural Irrigation Appraisal
RT-Rukun Tetangga	A village sub-unit of about 25 households, usually living together in one hamlet
RT-Rumah Tangga	A household
Sawah	Wet rice bunded field
Sederhana	Non-technical (simple) irrigation
SSIMP	Small-Scale Irrigation Management Project
TA	Technical Assistance
t/ha	ton per hectare
Tambak	Fish pond
Tani Maju	Progressive farmer
Tani Teladan	Expert, leading farmer
Tegalan	Dryland fields for growing upland crops
Tingkat I-Tk I	First level of government administration (usually Provincial)
Tingkat II-Tk II	Second level of government administration (usually Kabupaten and Kotamadya)
Tri Tunggal	An engineering company (Mataram)
Ulu-ulu Desa	Water master within the staff of the Kantor Desa
Ulu-ulu P3A	Water master of P3A
US	United States
USAID	United States Agency for International Development

Wilayah	Subdivision of provincial DPUP
Wikel	Sub-area of the Wilud
Wilud-Wilayah Unit Desa	A village unit for agricultural extension

Chapter I

INTRODUCTION

Background

This report has been prepared in conformance with the laws and regulations of the governments of the Republic of Indonesia and the United States of America, as administered by the appropriate agencies in terms of guidelines and decrees.

Indonesian Requirements

The basis for the Indonesian environmental assessment process is Government Regulation No. 29, 1986 (PP 29), as implemented through a series of decrees by the Ministry of Population and Environment. These decrees establish the process whereby a new project is the subject of a Preliminary Environmental Information (PIL) Report (Ministerial Decree No. 49/MENKLH, 1987) and, should the PIL commission so decide, a complete Environmental Impact Assessment (AMDAL) Report (Ministerial Decree No. 50/MENKLH, 1987). In addition to the ANDAL Report, Ministerial Decree No. 50/MENKLH establishes guidelines for the Environmental Management Plan (RKL) and the Environmental Monitoring Plan (RPL).

USAID Requirements

The US Government requirements on environmental planning were first set forth in the National Environmental Policy Act of 1969, extended to US-funded overseas projects by the Foreign Assistance Act Amendments of 1986. The details of the process are set forth in USAID Regulation No. 16. The USAID regulations establish a process similar to the Indonesian PIL process, whereby a project is determined to have potential for significant environmental impact, in which case an environmental assessment (EA) is required, or to lack such potential, in which case a declaration of "no significant impact" is made and no further environmental study is required.

Combined Process

Environmental specialists from the ministry of Population and Environment, the Ministry of Public Works, USAID, and the engineering consultant firm, Harza Engineering Company, conferred in April 1988 to evaluate the need for an environmental study for each of the ten proposed surface water projects under the USAID-funded Small-Scale Irrigation Management Project (SSIMP). It was decided that most of the projects had potential for significant environmental impacts. It was further decided that a combined team of Indonesian and American consultants would prepare a single environmental report for each project, structured so as to satisfy both government's

requirements and prepared in both Indonesian and English. It was agreed that although the Indonesian "AMDAL" is best translated into English as "Environmental Impact Assessment", that the ANDAL was most similar in intent of meaning to what is known in America as an "Environmental Assessment."

This report has been prepared by the SSIMP Technical Assistance Team and the University of Mataram Environmental Studies Center, with the support and assistance of the NTB Public Works Water Resources Division.

Environmental Policy

The governments of Indonesia and the United States have similar policies regarding environmental management. Their attitudes are effectively stated in the preamble to Indonesia's Government Regulation No. 29 as requiring "within the framework of implementing development with an environmental outlook therein resources rationally for sustainable development aimed at enhancing the living standard. Any activity as a rule has its impact on the environment, which shall be predicted at the initial stage of planning, in order ... to cope with any negative impacts and to enhance any positive impacts..." (translation by Canadian International Development Agency). The US National Environmental Policy Act (NEPA) contains similar language, mandating the inclusion of environmental planning in any action of the federal government that may exert significant environmental effects.

Objective of the Environmental Assessment

The major objective of this environmental assessment is to inquire whether there are any probable major negative impacts of this irrigation project on the environment. Conversely, this report also assesses possible negative impacts of the environment on the functioning and efficiency of the project. Once harmful effects are identified, a plan is provided to mitigate these major negative impacts.

Scope of Report

As a result of an Environmental Scoping Session held in Mataram in July 1986, and in subsequent visits to the site by environmental experts a list of priority issues was developed. This list has been reorganized into four basic categories to reflect the requirements of PP 29. These are: water resources, land resources, biological resources, and socioeconomic and cultural resources. Information on climate and physiography is also presented, as required by PP 29. An account of the 1986 session is found in Appendix D to this report.

The methodology for each of the four main areas of assessment followed standard research procedures common to the respective disciplines. In brief, they were:

- **Water Resources.** Streamflow estimates were developed from simulation studies that relied on records of staff gauge readings, discharge measurements and rainfall records. Water quality was based on standard laboratory analyses done at the Water Quality Laboratory of Mataram University. Water use estimates were based on household interviewa.

- **Land Resources.** Land use definition relied on visual assessment of the study area in conjunction with available maps and aerial photographs. Details on soils were obtained from soil maps available from the National Board of Land Titles (Pertanahan). The agriculture analysis was based on a series of interviews with farmers and government officials in provincial, district, sub-district and village offices.

- **Biological Resources.** The primary method of investigation of the biological resources in the study area were to visually review local conditions, and to interview villagers and officials from relevant sectoral agencies (Departments of Agriculture, Livestock and Forestry).

- **Socioeconomic and Cultural Resources.** This assessment relied on primary and secondary data that included quantitative characteristics of the study area population. These data included results of the various "Rapid Rural Irrigation Appraisals" (RRIA), the Household Survey (HHS), and a number of in-depth interviews with study area villagers and officials.

Sponsoring Agencies

This project is jointly sponsored by the Ministry of Public Works of the Government of Indonesia and the Agency for International Development of the Government of the United States.

Chapter II

DESCRIPTION OF THE PROPOSED PROJECT

Type of Project

The Kalimantong II Project is one of ten surface water schemes being implemented under the Small-Scale Irrigation Management Project. It will complete some structures left unfinished by previous lack of funding, provide additional main and secondary canals, and extend the tertiary delivery system.

Location of Project

The project is located within eight villages in Sub-district Taliwang, Sumbawa District, NTB Province, Indonesia. It is 120 km southwest of the district town of Sumbawa Besar and 35 km from the ferry port of Poto Tano, near the western end of the island of Sumbawa. The project headworks is located on the Tepas River (also called the Brang Rea) about five kilometers upstream of Tepas Village. The service area of 2,850 ha extends downstream from that point approximately 10 km, much of it near the village of Taliwang. (See Figure II-1, Project Location Map.)

Limits of the Study Area

The study area for this environmental assessment consists of the Brang Rea river basin, extending from the headwaters above the weir site to the downstream service area, Lake Taliwang, and the town of Taliwang. As this project is located within eight villages in Sub-district Taliwang, the study area includes the entire land area and population of these eight villages. All borrow areas are located near the weir site; there are no areas located outside the river basin that are directly affected by the project.

Project Life

For planning purposes, the life of the project is taken as 60 years, but there is no reason to believe that the structures, properly maintained, will not function for a much longer time.

4'

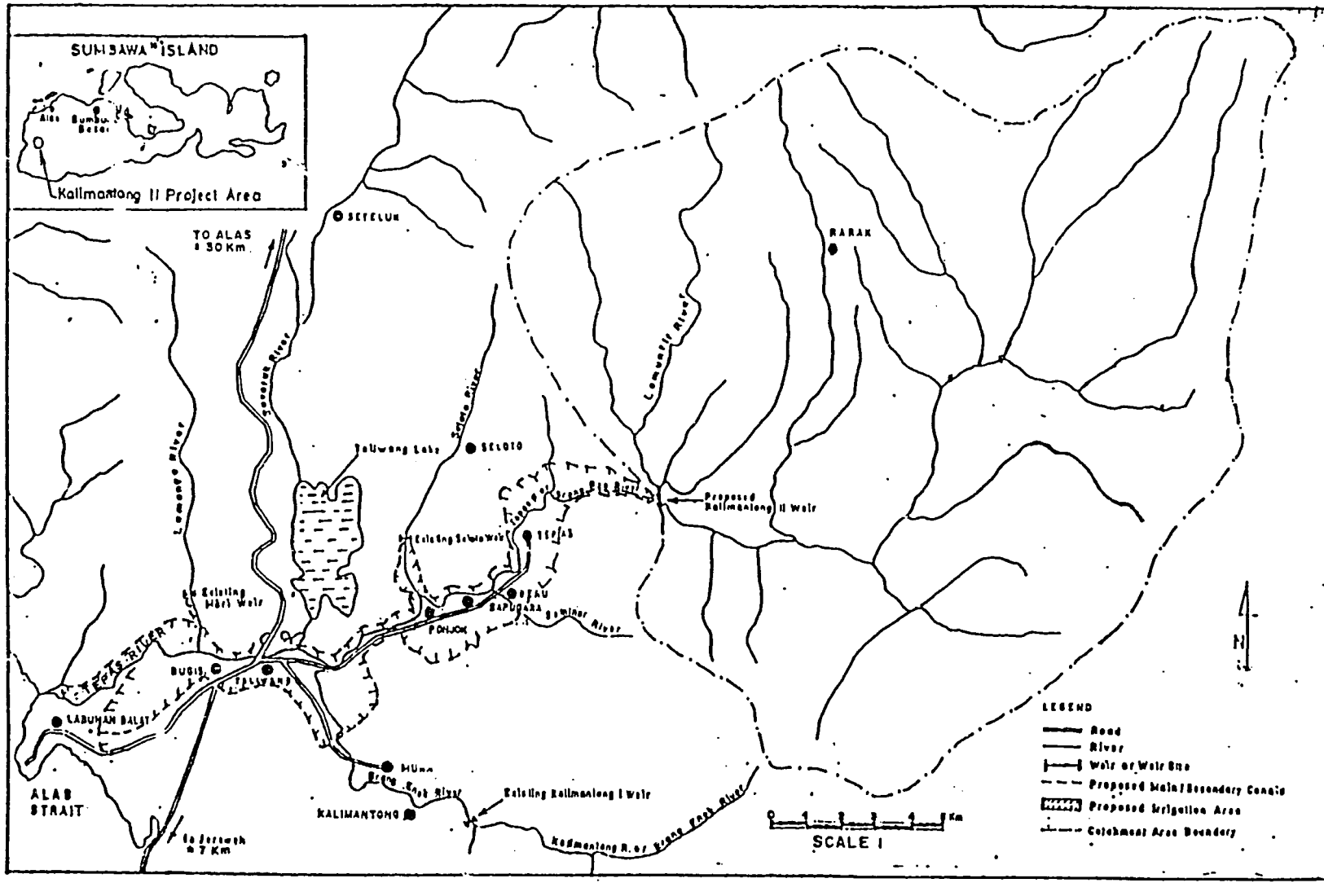

Figure II-1
Kalimantong II Project
Location Map

Description of the Project

Pre-Construction Period

Design of the Kalimantong II Project, and in fact, partial construction of the diversion weir, has previously been undertaken under the direction of Provincial Public Works. In Fiscal Year (FY) 1981/82, PT Geosurvey Swasti Sarana, Bandung, performed the initial work. The scope of the initial work included topographic mapping, materials survey, geotechnical studies, survey of the main and secondary canals, design of the diversion weir and design of other major structures in the scheme, including model testing of the weir. In FY 1984/85, the design of the tertiary scheme was carried out by BPP Tri Tunggal, Mataram.

Construction of the Kalimantong II weir commenced in FY 1984/85, and continued in FY 1985/86. The contractor was PT Muara Ema of Mataram.

In December 1986, a "Rapid Rural Irrigation Appraisal (RRIA) was conducted at the Kalimantong II site by several USAID SSIMP social scientists and engineers (Duewel, 1987). A Household Survey (HHS) was then conducted in 1987 by this same USAID team, working with a Site Profile survey team from NTB PU staff assigned to SSIMP. Information from these surveys has been incorporated into sections of this Environmental Assessment, particularly in Chapter IV, "Existing Environmental Conditions," and in the proposed Mitigation Plan.

In 1987, construction funds were not available in the GOI budget, and work has been halted since 1986. The construction funds spent to date amount to about Rp 600 million.

The weir stands approximately 20 percent complete. The completed works remain in good repair.

Construction Period

Major Structures: Diversion Weir. The major structural component of the project is the partially constructed weir, called Kalimantong II. The weir will be completed and placed in service by this project.

The Kalimantong II weir is designed as a stone masonry structure 4 m high and 70 m long. The weir spills water over a semi-circular crest into a roller bucket-type stilling basin. There are separate left and right intakes, and sediment sluiceways. The approach walls, wing walls, and closure dike are designed to an elevation of 30.5 m, or 5.5 m higher than the weir.

The completed portion of the weir consists of the left abutment walls, upstream training dike and intake, and a 15 m

long section of the weir body, upstream apron, and stilling basin. The upstream apron and stilling basin will be modified according to proposed hydraulic design changes.

Conveyance System. The project will construct two main canals, on the right and left sides of the Tepas River, to transport water to the service area. Their capacity will be approximately 2.8 m3/s at the weir, decreasing as water is removed along their length. These canals will be trapezoidal with approximately 2.3 m bottom width (4.5 to 5.0 m top width), and unlined, except at erosion-prone points. The depth of the water in them will vary from 0.9 to 1.2 meters.

The right main canal will require a flume over the Seloto River, and the same at the outlet of Taliwang Lake. Consideration has been given to using project water to raise the level of Taliwang Lake (at present 90 percent weed covered) and irrigating an area near the mouth of the Seteluk River. For reasons discussed below (see Chapter III, "Alternatives to the Proposed Project"), that proposal probably is not feasible, at least until measures have been implemented to improve the nutrient level in the lake.

The right main canal will be tied into existing canal systems that take water from the Lamonga River (at the Mari weir) and the Seloto River, irrigating 509 ha and 210 ha, respectively.

The left main canal will require siphons under the Seminar and Kalimantong Rivers. It will be operated integrally with the system fed by Kalimantong I, a weir located on the Kalimantong River, just upstream of the village of that name. The left main canal will supply supplemental irrigation water for 450 ha in the Kalimantong I service area. Hill streams intersected by the main canals will be passed under the canals.

Delivery System. A system of secondary and tertiary canals will provide water to the farm fields. The secondary canals will be 1.5 to 2.0 m wide and unlined. The tertiary canals will be about 1.0 m wide and unlined. In most parts of the system, water will be delivered to the sawah by quaternary canals, beyond which are the small on-farm canals.

Drainage System. Excess irrigation water and rainfall runoff will be collected in a system of surface drains and returned to the main stem of the river via drainage channels and, in some cases, tributary streams.

Support Facilities. The access road to the partially constructed weir will be upgraded to handle increased vehicle traffic during construction. The flat area on the left bank at the weir site will be developed as the construction yards and workers' village. The workers are expected to live in tents, with water and sanitation provided by the contractor.

Borrow Areas. Materials (rock, gravel, sand and clay) for the weir, intake structures, cofferdams and left bank closure dike will be obtained from borrow areas in the immediate vicinity of the weir site, located with the river basin. Excavation for borrow areas will be prohibited within 50 m of the closure dike to protect against seepage. The contractor may exercise his option to obtain materials from other locations subject to the Engineer's approval.

Materials for access road embankments will be obtained within the designated right-of-way for excavated sections that are within the nominal haul distances specified in the contract. Canal embankment materials are expected to be obtained from drains that are excavated immediately above the main canals to intercept run-off from the higher adjacent lands.

In isolated cases, where the required embankment material from normal sources as described above is insufficient, local borrow sites will be designated. In this event, the contractor will be required to restore these sites by providing drainage and reducing the cut slopes so as to make the site useful for other non-agricultural pursuits.

Equipment Use. Other than heavy equipment provided by the contractor, no special equipment will be required for this project. The laborers will use hand tools (spades and mattocks) for moving earth in shaping the canals. Drilling equipment will be used when blasting is necessary.

Resource Use. Completion of the weir will require mostly rock and concrete, with steel reinforcing bar in some structures. Bridges, siphons and flumes will require reinforced concrete. Lumber and plywood will be needed for concrete forms.

Small amounts of concrete and lumber will be required for service buildings and management residences near the project site.

Energy requirements for construction are relatively low, due to the labor intensive construction methods. Diesel fuel and gasoline will be required for transportation and heavy equipment. Electricity for lights and hand tools probably will be provided by a diesel generator provided by the contractor, unless a decision is made to extend the transmission line, which now ends at Tepas. In any case, the electric demand will be minimal.

Work Force. The total work force for the completion of the weir is expected to number 200. About 150 will be laborers, 35 heavy equipment operators and other skilled workers, and 15 technical and management personnel. Construction of the main, secondary and tertiary systems will be done under two separate contracts, requiring a total work force of about 700. Six hundred will be laborers, 70 skilled, and 30 technical and management personnel.

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Source. Most contractors operating in Sumbawa use work crews recruited in Lombok, even when local labor is available. During the 1986 Scoping Session for this project a request was made that the construction utilize local labor. The possibility of imposing on the contractor some sort of requirement favoring local labor is under investigation.

Construction Camp. The weir contractor is expected to use the same area for construction shops and workers' camp as was used in the earlier construction period, a level area of pasture and brush, several hectares in extent, located just south of the weir site. The irrigation system contractors will establish base camps and offices near the canal alignments.

Training Program. No special training program for construction workers on this project is being contemplated, since the contractor is expected to base hiring on prior experience.

Construction Schedule. Construction of the weir is expected to be resumed in early 1990 and be completed in about 18 months. If contractual services and labor are available, construction of the irrigation system will overlap with the weir construction and also be completed in about 18 months.

Operation Period

Irrigation: Method of Operation. The project will provide water to fields on an as-needed basis as determined by the head of the water users' association, or irrigation foreman (malar), in each tertiary area. The malar will regularly report his tertiary block water needs to the PU irrigation inspector (juru pengairan) who is responsible for regulating canal discharges in the main and secondary system. Flow in the main and secondary canals will be on a continuous basis with diversions rotating from block to block to meet each area's crop water requirements. The malar will direct the irrigation diversion rates and periods of application to the sub-tertiary blocks under his supervision.

Equipment Use. No special equipment will be required for this project, beyond that installed for controlling and monitoring water distribution.

The PU irrigation inspector, responsible for the operation of the weir and the canals, will be provided with a motorbike (or bicycle) to enable him to check on the irrigation system, to observe and record discharge at each control structure, and to coordinate with the malar on water management activities.

Resource Use: Water. The project is dependent, of course, on the water resource, and will consume, through crop evapotranspiration an estimated 32 million cubic meters (MCM) per year at full development. Most of the irrigation water which is lost to canal seepage and deep percolation in the

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fields will enter the surface drainage system and return to the river further downstream.

Energy Resources. Consumption of energy in direct connection to project operation will be small, since most of the actual energy of the cropping system is human or animal energy. Fossil fuels (oil and gasoline) will be required for the irrigation inspector's motorbike and that of his supervisor (PU sub-district head, or pengamat).

Chemicals. An increase in fertilizer application is expected with the project, exceeding the 230 kg/ha average that farmers now use in irrigated sawah areas. Fertilizer amounts applied at rates recommended by the agricultural extension service (about 300 kg/ha) to 2,850 ha for two crops of rice, would result in 1,700 tons of fertilizer per year.

On-farm Water Management. The functioning of local water users' associations (P3A), will be examined, and strengthened where necessary. The relative roles of the locally elected malar and the PU operations and maintenance staff will be examined in terms of the effectiveness and reliability of the water distribution system. PU will receive assistance in on-farm water management from the Indonesian non-governmental organization, LP3ES (Lembaga Penelitian Pendidikan dan Penerangan Ekonomi dan Sosial).

Public Bathing and Livestock Watering. Public bathing and laundry steps for the use of local villagers will be built by the project. Once built, there will be some monitoring of the structures to see that they remain in good condition.

The project will construct livestock bathing and drinking sites to minimize damage to canal banks. PU will monitor the condition of these sites to see they remain in good condition.

Community education and community-led enforcement programs through the joint efforts of Public Works, LP3ES, and the Departments of Agriculture and Livestock will be required if the canals are to be effectively protected from violation of the no livestock regulations. In fact, the entire target population would benefit from a program to instill respect for the irrigation system. Maintenance of the livestock watering holes could be incorporated into an overall community livestock management program.

If begun before the system is installed, and continued vigorously, the education program could reduce the amount of plant matter and domestic trash thrown into canals and drains, illegal taps and other abuses of the system.

Waste Water Management. Waste water created by this project, consisting of irrigation return flows and rainfall runoff, will be returned to the nearest part of the river system through a system of surface drains.

Project Outputs. The project outputs will be a reliable supply of irrigation water, and provision of sites along the canals for public bathing, laundry washing, and livestock watering.

Institutional Development and Training

The SSIMP consultant on the transfer of technical knowledge has prepared guidelines for a program of training of full-time Public Works SSIMP staff in the planning, construction and management of these irrigation systems. It is to be a four-year program, centrally administered in Jakarta, but focusing on the three provincial PU offices where these projects are located. Individuals would receive up to three months of intensive training.

The training program is in its formative stage, and the administrator has not yet been appointed. Scheduling, identification of training needs, course identification, planning, logistic support, and identification of follow-up activities have not been undertaken. The training program should have the following general objectives:

1. To upgrade the English language capabilities of local personnel to enable them to communicate more effectively with expatriate specialists and to read technical literature not available in Indonesian.

2. To improve staff understanding of computer use, both for problem solving and for word processing, and provide hands-on training.

3. To develop skills in project management and supervision.

4. To improve staff knowledge of basic planning and design.

These objectives will be met through a variety of formal and informal means: short courses (local), long courses (overseas), workshops, symposia, guest lectures, and field courses.

SSIMP will also work to improve operations and maintenance of the Kalimantong II system by training PU staff at the levels of wilayah, cabang and ranting dinas. Special attention will be given to joint training of the local malar, alongside the PU staff responsible for working at the Kalimantong II site. These local activities will occur under the coordination of LP3ES, who will be hired to organize the water users' associations.

Project Cost

Capital Costs

Funding for completion of the Kalimantong II Project will be provided by direct financing from GOI and loan funds from USAID. Construction of the project will be performed under a number of separate contracts. The project headworks (including the weir, dike and intake structures), left bank irrigation system, and right bank irrigation system will be let as three separate contracts under international competitive bidding. The left and right irrigation system contracts will include the main and secondary canals, inspection roads, and tertiary works construction. Two locally bid contracts will be let for upgrading 5 km of access road from Tepas Village to the weir site and for permanent buildings for PU NTB.

Table II-1 below summarizes the estimated project costs. A January 1989 price level has been adopted with an exchange rate of Rp 1,730 per US dollar. The cost estimate for the weir and irrigation system packages is based on the latest (April 1989) Engineer's Estimate prepared by P.T. GeoSurvey.

The headworks construction contract is estimated at Rp 2,342 million including GOI tax. The sum of the irrigation system construction packages is estimated at Rp 8,080 million including main and tertiary systems. Capital financing will also be required for engineering services and owner's overhead during construction, which includes construction supervision by PU staff. The cost of engineering services and owner's overhead is estimated at 12 percent of the construction cost, or Rp 1,173 million for the project.

Foreign and Local Cost Components. To estimate financing requirements, the project cost can be separated into foreign and local cost components. The foreign currency component mainly consists of costs for heavy equipment. General experience guidelines indicate a breakdown for the various components as follows: 75 percent to 25 percent local to foreign for the main irrigation system, 90 percent to 10 percent for tertiary, 70 percent to 30 percent for roads, and 60 percent to 40 percent for the weir. Table II-1 presents the resulting breakdown in foreign and local cost components.

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Table II-1

PROJECT COST ESTIMATE
(in million Rupiah)

Item	Local Currency	Foreign Currency	Total Amount
1. Access Road	140	60	200
2. Permanent Buildings	90	10	100
3. Headworks	1,277	852	2,129
4. Left Irrigation System:	2,536	720	3,256
Main/Secondary (22 km)	(1,972)	(657)	(2,629)
Tertiary (962 ha)	(564)	(63)	(627)
5. Right Irrigation System:	3,182	907	4,089
Main/Secondary (30 km)	(2,492)	(830)	(3,322)
Tertiary (1,374 ha)	(690)	(77)	(767)
Total Direct Cost	7,225	2,549	9,774
Engineering/Administration (12%)	704	469	1,173
Contract Tax (10%)	977	0	977
Land Acquisition	204 *	0	204
TOTAL ESTIMATED COST	9,110	3,018	12,128

* Rp 151 million of this total has already been spent.
Source: P.T. GeoSurvey Draft Engineer's Cost Estimate, April 1989

Operation and Maintenance Costs

Operation and maintenance costs for Kalimantong II project, including headworks and irrigation system, are estimated at Rp 30,000 per hectare, or Rp 70 million per year.

Chapter III

ALTERNATIVES TO THE PROPOSED PROJECT

No Action Alternative

In the event that this project were not implemented, trends seen in the past could be expected to continue. The Kalimantong II weir would stand unfinished, since it is unlikely that the local government, at the district level, could generate enough capital to finish it. The Kalimantong I weir would continue to operate as it now does.

Alternative Irrigation Technologies

Ground Water Utilization

The possibility of economically using ground water in the Kalimantong project area has been investigated. Ground water is the major source of domestic water in this area. Its use in irrigation would deplete the resource for domestic use (for which the relative purity of ground water is a major asset) and the combined use of the resource could not be sustained.

The presence of the partially completed Kalimantong II weir is the dominant factor in favor of the selected project plan, but even without it, ground water would not provide sufficient advantage.

Improved Water Management

The project will improve water conservation and on-farm management to the maximum extent possible under social and technological constraints. This organizing will be accomplished by the Department of Public Works and the non-governmental organization LP3ES.

Siting Alternatives

Structures

Diversion Weir. For the purposes of this project, the selection of the weir site had already been made, with the design initiated in FY 1981/1982 by P.T. GeoSurvey Swasti Sarana, Bandung and construction undertaken from FY 1984/85 to 1985/86. Geotechnical, topographic, and hydrologic data gathered in those studies have been reviewed and supplemented with new data. Subject to minor design changes, the choice of site is confirmed by the latest studies.

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Secondary Structures: Roads. Study for he placement of the access road indicates that there are few alternatives to upgrading the existing road, whose position is firmly dictated by topography and land use. In its present routing, it provides access for construction and maintenance of the left main canal and headworks.

Construction Camp. There are few alternatives in siting the construction work area in the vicinity of the weir. The flat area of river floodplain at the terminus of the access road, just downstream of the existing partial weir structure is the only logical alternative and uses land now in brushy pasture. That area served the work force in the 1984-1985 construction period.

Canals. Placement of irrigation canals is largely governed by the location of the service area relative to the water source (in the case of the main canal), the configuration of the service area (in the case of secondary and tertiary canals), existing irrigation systems, and local topography. These factors are interrelated and combine to restrict the alternatives available for the project layout.

In the final analysis, canal design, routing, and sizing decisions are made on the basis of economic criteria, within internationally established guidelines for the design of reliable irrigation systems, but with local constraints always taken into account in matters such as control structures and system maintenance.

Service Area

Selection of the service area has been based on water availability, existing cropping patterns, soils, topography, and the areas currently served by the Kalimantong I, Mari and Seloto systems. Other than the Seteluk River area, upstream of Lake Taliwang (see below), no additional areas have emerged as candidates for alternative use of the available water.

Lake Taliwang

The question of using water from the Kalimantong II right main canal to raise the water level in Lake Taliwang has been reviewed several times, notably in the USAID Project Paper (1985), at the Environmental Scoping Session (1986), and in the meeting with local agencies on environmental matters (1988). While the concept superficially appears to have merit, and has been examined as part of these studies, the disadvantages greatly outweigh the purported advantages, for the following reasons:

1. Raising the lake level by a meter or two would, as argued, increase the surface area and immediately create large areas

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problem remains, namely eutrophication, the excess of nutrients (see Fenco, 1981), the weed problem will persist.

2. Raising the lake level more than a meter would inundate sections of the main road into the area, necessitating elevating the roadway.

3. Raising the lake level also would inundate some sections of Meraran Bawah and Meraran Atas villages that lie on the east side of the main road, and the villages of Seran and Joroldiang, at the northeast corner of the lake.

4. Maintaining a higher lake level would necessitate modifications in the existing but apparently inoperative control weir, located in the sawah downstream of the lake exit.

5. It seems likely that a substantial rise in lake level would inundate many hectares of low-lying sawah along the lake shore.

Of the above arguments, the strongest is that the increase in lake level would be a costly, temporary solution to Lake Taliwang's weed problem. The deeper lake would be weed-covered again within a decade, with the deeper water utilized by water hyacinth, following the example shown in Lake Batujai. The more logical approach to the problem, recognized by Fenco in their 1981 report, would be to balance the high nutrient input with high economic returns, through effective fisheries management.

A plan recently put forth would raise the level of Lake Taliwang by 10 m with a long dike near the present control weir. This would more than double the area of the lake and would increase its volume manyfold. The water to fill the enlarged lake would be taken from the Tepas River at the Kalimantong II weir and from the Seteluk River. The objective would be to irrigate about 12,000 new hectares of sugar cane in the upper Seteluk catchment and along the coast, and provide water for coastal aquaculture facilities.

This grand scheme, if put into effect, certainly would solve the weed problem in Lake Taliwang, in the near term, at least. Its socioeconomic effects would be enormous, however, including the inundation of several villages and thousands of hectares of sawah and relocation of a substantial stretch of highway. The right bank canal of Kalimantong II would have to be greatly enlarged, since the reservoir could only be filled by diverting wet season flows of the Tepas. A thorough feasibility study is required for this proposal.

Scheduling Alternatives

In a sense, this project is the culminating phase of a series of smaller earlier developments that already use part of the available surface water of the catchment, by unifying the application of water from the two Kalimantong weirs and from the two subsidiary weirs.

Little would be gained by further phasing this development, since completion of the Kalimantong II weir will make available the entire flow of the Tepas River (less the downstream release) during the drier months. Studies of the local social and economic conditions indicate that the additional irrigation water will return immediate benefits, so no advantage would occur from further delaying completion of the project.

Chapter IV

EXISTING ENVIRONMENTAL CONDITIONS

Climate

The Kalimantong project area climatic stations provide only rainfall data. Wind velocity and direction, ambient humidity, temperature, and solar radiation measurements are not available.

During 23 years of record (1955-1977) there was one rainfall gauge in Taliwang, belonging to the Agriculture Department. In 1976 P3SA installed four new stations, which have operated since 1977. They are located in Tepas (at 20 m above sea level), Sapugara (15 m asl), Mura (20 m asl), and Rarak (650 m asl); the last only operated for three years (July 1980 to June 1983) and sometimes the data were not recorded.

Monthly and annual rainfall data from these stations, presented in Table IV-1, indicate that in the upper catchments of the Tepas River (Brang Rea) and Kalimantong River, rainfall is greater and rainy days more frequent than in the middle and downstream areas. The project area experiences a wet season generally from October to April and a dry season from May to September.

Table IV-1

AVERAGE MONTHLY RAINFALL IN THE KALIMANTONG II PROJECT AREA

Station (m)	Elevation (number)	Year of Records	Rainfall	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Taliwang	+ 15	1955-1967	mm	234	200	168	101	73	51	23	16	39	69	153	243	1,370
		(32)	days	27	10	9	6	5	3	2	1	3	5	9	13	78
Sapugara	+ 15	1976-1983	mm	206	243	142	161	97	57	51	10	67	138	400	490	2,064
		(8)	days	9	9	7	7	4	3	2	1	1	5	11	13	72
Tepas	+ 20	1977-1967	mm	287	227	245	185	79	85	50	21	55	141	317	272	1,964
		(11)	days	14	13	12	9	6	5	3	2	4	8	17	16	109
Mura	+ 20	1976-1967	mm	295	281	262	152	93	95	29	21	59	120	297	364	2,068
		(10)	days	15	13	13	10	7	5	3	2	3	6	14	15	106
Rarak	+650	1980-1983	mm	362	269	252	277	136	23	10	27	47	104	307	367	2,211
		(3)	days	22	15	20	17	17	6	5	6	7	13	16	24	159

Source: Agriculture Department and P3SA, NTB.

During the period of record, average annual rainfall at Taliwang was 1,370 mm and at Mura 2,068 mm. Average rainy days varied from 78 per year at Taliwang to 109 at Tepas. Monthly rainfall of less than 60 mm occurred in July, August and September, and monthly rainfall of more than 200 mm in November, December, January, February and March. The area may be considered to have a wet season of seven months and a dry season of three months, the other two months being intermediate.

Regional climatic data were obtained from the meteorological station of Brang Biji Airport, Sumbawa Besar. Those data provide the following general picture: average temperature is 26.4 degrees C, with an average daily maximum of 31.9 degrees and an average minimum of 22.1 degrees. Relative humidity averages 77 percent, with an average daily maximum of 87 percent and an average minimum of 59 percent. Wind direction shifts from the northwest during the wet season to southeast during the dry season; average wind velocity is 12 km per hour.

Geology and Physiography

The uplands of the Tepas and Kalimantong catchment areas consist of volcanic and sedimentary rocks of the Tertiary age, andesitic breccia with sandy tuffs, pumaceous tuffs, and tuffaceous sandstones. In some locations, there are lahars, andesitic and basaltic lava flows.

Alluvium of the Quaternary age is found throughout the lowlands in the villages of Taliwang, Tepas, and Kalimantong. Some alluvium near the coast shows a marine influence. Alluviums in the region consist of stone-free sands, silts and clays, making them among the most desirable soils in the area for agricultural development.

Geomorphic features in the project area, according to Fenco Consultants (1981), consist of Recent alluvial plains, Recent alluvial terrace, alluvio-marine plains, alluvio-colluvial foot slopes and interhill valleys, volcanic hills and plains, river channels, and steep eroded lands.

Taliwang and other population centers are generally less than 20 m above sea level. The major drainage systems of the area trend westward (see "Surface Water," below).

Water Resources

Surface Water

The Tepas River drains an area of 838 km2, of which 344 km2 is upstream of the Kalimantong II weir site. Its headwaters lie at an elevation of about 1,500 m in the center of the western land mass of Sumbawa Island. The river flows generally

westward, receiving many tributaries upstream of the weir site. Approximately 7.5 river kilometers below the weir, it is joined from the south by the Seminar River and about 2 km farther by the Seloto River, from the north. The next major tributary, the Kalimantong River, flows from the south, joining the Tepas River approximately 3 km from the Seloto and just upstream of the town of Taliwang. As the largest tributary of the Tepas, it drains an area of 210 km2. One kilometer downstream of the Kalimantong, the Tepas is joined from the north by the Seteluk River, which drains an interior catchment separated from the coast by a low line of hills. The Seteluk River flows into the north end of Taliwang Lake, and the lake then drains into the Tepas River. The only significant remaining tributary is the Lamonga, which flows in from the north to join the Tepas some 3 km downstream of the town of Taliwang.

Taliwang Lake is a shallow, weed-covered lake of 860 ha. It receives Seteluk River water primarily in the form of agricultural runoff. As a result of irrigation diversion, the dry season inflow is practically zero and the wet season flow is much lower than that of the Seteluk. When the Tepas River is in flood (usually in February) the lake receives some backwater from that river (Fenco, 1981).

Streamflow

Direct measurements of streamflow in the vicinity of the Kalimantong II site are available for only several years. Staff gauge readings were made near Tepas, approximately 2 km downstream of the weir site, from August 1979 to December 1981 (when the gauge was destroyed by flood) and from May 1983 to present. Discharge measurements at the gauging section were performed only during the earlier period. Based on these years of streamflow records and longer periods of station rainfall records in and around the catchment, a time series of monthly streamflow (1972-1987) was generated for the Kalimantong II site by P.T. GeoSurvey (1988). Figure IV-1 plots the average, minimum, and maximum monthly flows for the period; Table IV-2 lists the monthly data.

On the average, August is the lowest flow month (3.1 m3/s), but in many years, September and October have lower flows. Near-zero monthly flows have been recorded twice in the 1972-1987 period, both times in October. The river rises rapidly in November and December and usually peaks around February. Average monthly flows in January-February-March are normally 20 to 40 m3/s. The river flow then diminishes through the April to August (or September-October) period.

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ESTIMATED MONTHLY DISCHARGE AT WEIR

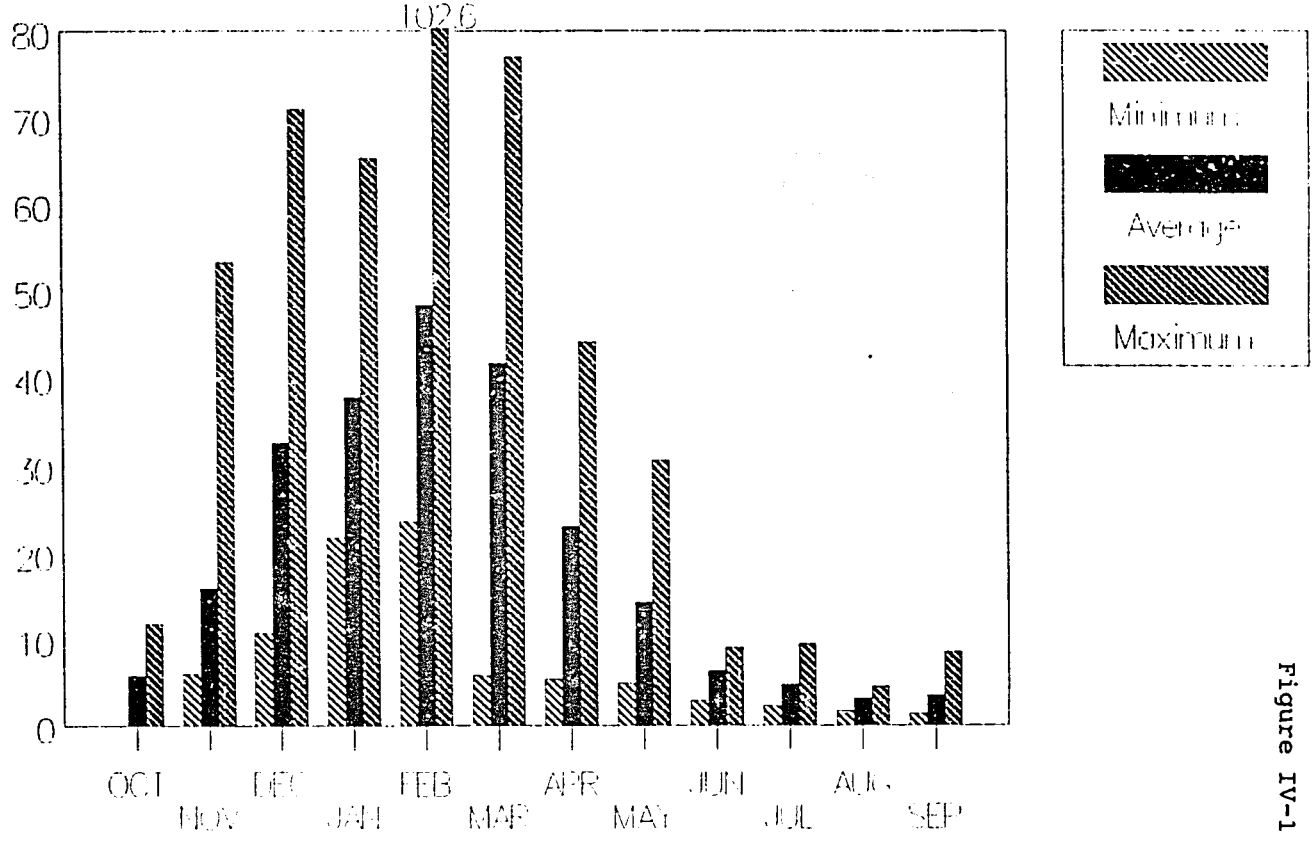

Figure IV-1

Table IV-2

MONTHLY DISCHARGE AT WEIR SITE
(in m3/s)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1972/73	0.4	6.5	40.1	44.9	25.1	14.5	37.5	27.9	5.5	5.2	3.1	5.1	15.3
1973/74	5.9	12.5	23.2	34.2	54.5	64.5	20.4	10.5	5.3	4.5	2.9	3.5	20.5
1974/75	7.5	11.7	47.5	25.5	64.6	53.6	26.6	30.7	7.9	3.9	2.7	1.0	23.9
1975/76	10.0	16.2	43.9	27.5	24.6	5.6	6.5	5.0	4.3	4.9	2.9	1.9	13.0
1976/77	5.7	15.9	39.4	51.9	102.6	77.1	5.4	5.7	4.4	3.3	2.5	1.9	26.6
1977/78	0.0	6.6	71.1	38.7	35.7	43.9	23.2	15.4	5.7	6.5	4.5	4.3	22.1
1978/79	11.6	20.6	20.6	32.3	34.9	63.7	14.1	13.5	5.1	3.3	2.4	2.0	21.4
1979/80	2.4	6.0	10.5	21.9	25.4	19.1	15.7	4.9	2.9	2.3	1.7	1.4	9.5
1980/81	1.7	6.4	23.1	36.2	23.7	36.3	34.0	19.8	5.5	9.5	4.4	5.7	17.4
1981/82	11.6	21.0	22.9	46.9	25.6	7.7	21.4	5.2	3.9	3.5	2.6	1.9	14.6
1982/83	0.1	6.5	53.5	38.4	54.9	29.8	7.2	21.1	9.1	4.4	4.4	4.2	19.6
1983/84	10.6	53.2	32.6	37.1	69.7	54.2	40.5	25.3	5.9	4.5	3.5	5.6	28.8
1984/85	6.3	16.1	32.6	22.6	75.6	70.3	14.9	7.6	6.4	5.0	3.4	2.7	22.4
1985/86	2.6	10.3	14.2	43.1	42.2	49.1	35.6	5.1	7.2	5.9	3.3	2.5	18.7
1986/87	6.4	23.2	13.5	65.4	60.5	35.2	13.5	9.3	4.3	3.5	2.6	2.5	20.0
Average	5.6	16.0	32.6	37.5	45.4	41.7	23.1	14.4	6.4	4.7	3.1	3.5	19.6

Source: P.T. GeoSurvey, October 1985, Draft Hydrology Appendix

Table IV-3 shows estimated wet season (October-May) and dry season (June-September) water yields for the periods of 1972/73 through 1986/87 and average annual flows for the given years. Total annual yield at the weir varied from 300 MCM, in the exceedingly dry year, 1979/80, to just over 900 MCM in the wettest year of the period, 1983/84.

While the catchment area above the weir represents only one-third of the Tepas River basin, it contributes roughly one-half of the total yield. This is due to the rainfall in the interior mountains being substantially higher than that of the coastal plain. The total annual yield of the Tepas River, therefore, ignoring consumptive use, varied from 600 MCM to 1,800 MCM during the period of rainfall record.

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Table IV-3

ESTIMATED FLOW AND YIELD OF THE TEPAS RIVER
AT THE KALIMANTONG II WEIR SITE

Year	Avg Annual Flow (m3/s)	Water Yield (MCM) Oct-May	Jun-Sep	Total
1972/73	18.3	518	58	576
1973/74	20.5	603	43	646
1974/75	23.9	704	49	753
1975/76	13.0	374	37	411
1976/77	26.6	805	32	837
1977/78	22.1	631	64	695
1978/79	21.4	634	42	675
1979/80	9.5	279	22	301
1980/81	17.4	476	74	550
1981/82	14.6	427	31	458
1982/83	19.6	560	58	618
1983/84	28.8	847	59	906
1984/85	22.4	660	46	706
1985/86	18.7	539	51	589
1986/87	20.0	597	34	631
Average	19.8	577	46	623

Source: P.T. GeoSurvey, October 1988, Draft Hydrology Appendix

Maximum average daily flows estimated at the Tepas staff gauge during the wet seasons of 1979/80 through 1986/87 are shown in Table IV-4.

Table IV-4

MAXIMUM RECORDED DAILY FLOWS AT TEPAS STAFF GAUGE
(in m3/sec)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1979/80	5.7	28.5	25.2	74.2	100.9	78.4	67.7	9.0
1980/81	3.8	26.0	78.4	151.9	52.2	132.3	97.4	46.8
1981/82	40.8	60.1	103.8	-------- No flow record -------				
1982/83	---------- No flow record ----------							54.8
1983/84	-	412.0	119.8	84.0	193.4	260.8	103.2	297.8
1984/85	13.4	-	-	52.9	625.0	291.8	60.6	16.5
1985/86	4.7	62.6	67.7	356.4	93.4	112.0	95.8	12.7
1986/87	14.1	91.0	51.1	398.8	262.7	120.0	25.4	30.3

Source: Streamflow records of P3SA, NTB.

Water Quality

Water samples were taken at eleven locations in the project area river system and in Lake Taliwang on 7 July 1988. Analyses were performed at the Water Quality Laboratory of Mataram University, in addition to certain measurements (pH, temperature) taken in the field. The results (Table IV-5) indicate a fairly clean, silt-free stream, neutral or slightly alkaline, low in chemical oxygen demand (but higher downstream of Taliwang) and in fecal coliform bacteria (again, higher downstream of Taliwang, but lower than might be expected of a dry season river receiving the waste of a town of 5,000).

The sampling locations were as follows (see Figure IV-2):

B1. Tepas River at the Kalimantong II weir site.
B2. Tepas River at Sapugara.
B3. Tepas River immediately upstream of the junction with the Kalimantong River.
B4. Kalimantong River, approximately 1 km upstream of the junction with the Tepas River.
B5. Kalimantong River near Mura.
B6. At the Kalimantong weir.
B7. Tepas River immediately downstream of its confluence with the Kalimantong River.
B8. About 50 m downstream of the bridge at Taliwang.
D1. Lake Taliwang, at the mouth of the Seteluk River
D2. Lake Taliwang, approximately in the middle of the lake
D3. Lake Taliwang, at the outlet channel

Table IV-5

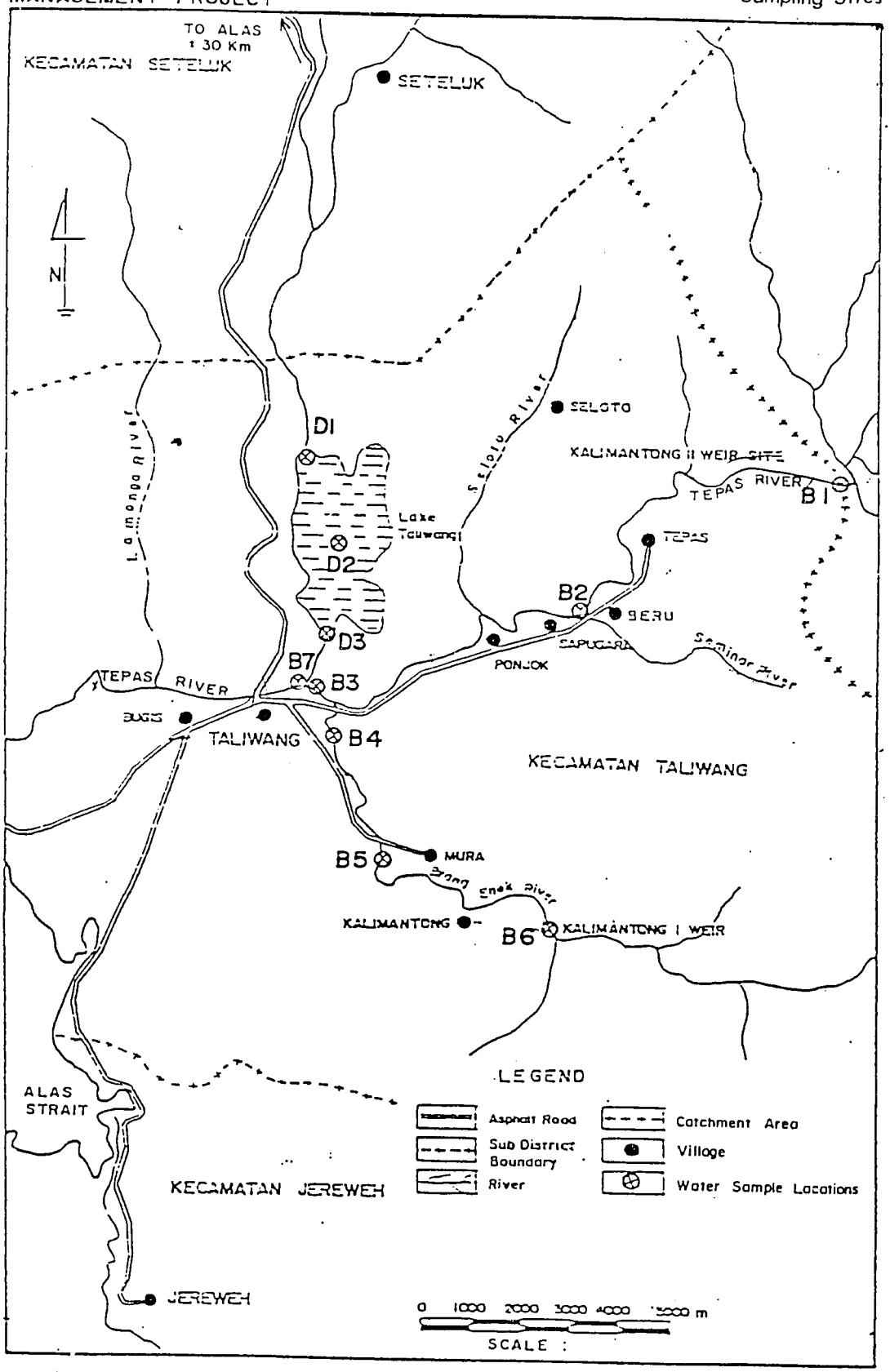
WATER QUALITY IN THE KALIMANTONG II PROJECT AREA

Sample	pH	Total Suspended Solids	SO_4	NO_3	Cl	NH_4	Alkalinity as $CaCO_3$	Fecal Coliform Bacteria	Chemical Oxygen Demand	Temperature
		(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(MPN/l)	(mg/l O_2)	(°C)
River System:										
B1	7.5	177	29.8	0.36	0.39	0.09	175.11	17	1.89	28
B2	7.3	198	19.5	1.42	0.39	0.09	125.50	23.5	3.53	28
B3	7.3	181	35.5	0.51	0.35	0.084	126.50	21.5	1.32	28
B4	7.4	357	125.8	0	0.47	0.09	189.25	150	22.42	28.5
B5	7.4	370	112.3	0	0.50	0.09	177.00	125	5.05	22
B6	7.6	260	136.2	0.15	0.54	0.08	111.84	13	5.37	28
B7	7.3	269	77.8	0.97	0.49	0.09	160.52	190	2.53	27
B8	7.4	305	80.9	0.95	0.40	0.05	142.14	17	2.84	29
Lake Taliwang:										
D1	7.6	755	73.3	0.84	5.07	0.06	439.99		15.48	26
D3	7.1	412	35.4	0.57	1.72	0.10	237.84	129.5	9.79	29

Source: Laboratory tests and field measurements, July 1988.

SMALL - SCALE IRRIGATION
MANAGEMENT PROJECT

Figure IV-2
Water Quality
Sampling Sites



Dry season sediment loads were measured by Fenco (1981) at the Kalimantong II weir as 112 mg/l in July (at 2.86 m3/s flow) and 49 mg/l in September (at 1.95 m3/s). A recent (July, 1988) measurement by the project field team of 177 mg/l is substantially higher, but the differences may be due to the sampling method. Wet season sediment load undoubtedly is higher; probably in excess of 300 mg/l. In the agricultural area farther downstream, the field team measured sediment loads mostly above 200 mg/l.

Ground Water

Wells in the project area generally provide water at depths of 4 to 5 m in the wet season and 6 to 7 m in the dry season. Many wells, however, are not dug below 5 m and cease to provide water during the dry season.

Water Use

Domestic Demand. The domestic consumption of water was estimated by the field team as 5.4 liters per capita per day (l/cap/da) for drinking and cooking. The requirement for bathing, laundry, and sanitation is approximately 20 l/cap/da. For the area population of 30,000, therefore, the total domestic water demand may be taken as 762,000 l/da or 9 l/s. If all of the water were obtained from the river system, it would require a total flow of slightly less than 0.01 m3/s. Actually, about 80 percent of the households draw their domestic water from wells, with some turning to the rivers and the irrigation system during the dry season.

Taliwang Village has a water treatment and distribution system with a capacity of 20 l/s. The water is pumped from a pool in the Tepas River, filtered and chlorinated, and delivered through a pipe system to some residences (which pay for it), and to municipal, state, and religious buildings (which do not). Average monthly delivery is 15,000 to 16,000 m3 or about 33 percent of system capacity. About 35 percent of the output is sold; the rest is provided free.

Agricultural Demand. The only significant agricultural water use in this area is for irrigation. At present, this is accomplished by several small irrigation systems, the largest of which is the Kalimantong I weir, which serves an area of 1,560 ha, with a demand of approximately 2.3 m3/s of water (about 1.5 l/s/ha). Two smaller systems, at the Seloto and Mari weirs, distribute approximately 0.3 and 0.75 m3/s, respectively. In addition, some 15 pumps, owned by villages, cooperatives, and private individuals and located at various points along the river banks, distribute a total of about 0.15 m3/s.

Land Resources

Land Use

Land use in the project area is shown in Figure IV-3 and summarized in Table IV-6. In general, the more mountainous parts of the catchment are forested with mature tropical mixed forest, covering about 94 percent of the weir catchment area. Another 4.5 percent, mostly near settlements, is brushy secondary forest, grading into scrub woodland. There are few settlements in the catchment area, and they use only about 1.7 percent of the area for living space and agriculture.

Downstream there are scattered areas of lowland forest but most undeveloped land is on the hill slopes. The dominant land use is agriculture, mostly under some form of irrigation, but some 80 percent of the lower catchment is essentially undeveloped, being unsuitable, by virtue of topography or soils, for irrigated agriculture.

Table IV-6

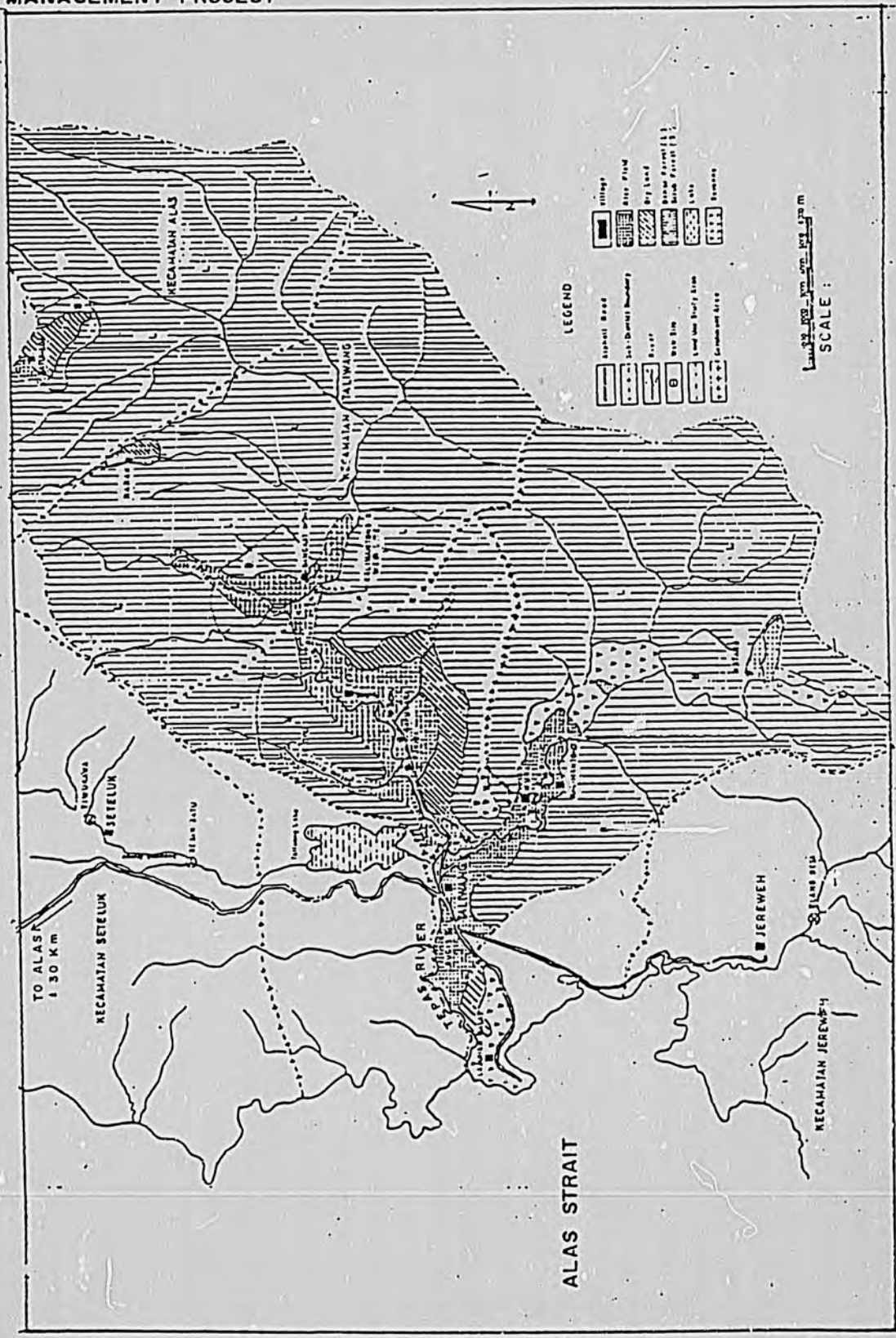
LAND USE IN THE KALIMANTONG II WEIR CATCHMENT AND DOWNSTREAM CATCHMENT AREA

Land Use Type	Weir Catchment Area(ha)	Weir Catchment Percent	Downstream Catchment * Area(ha)	Downstream Catchment * Percent
Irrigated Agriculture	480	1.4	1,803	18.0
Rainfed Agriculture	40	0.1	38	0.4
Plantation	25	<0.1	63	0.6
Subtotal Developed Land:	545	(1.6)	1,904	(19.0)
Dense Forest	32,260	93.9	3,490	34.8
Secondary Forest & Brush	1,550	4.5	4,239	42.2
Savannah	10	<0.1	318	3.2
Teak Forest	-	-	61	0.6
Bamboo Forest	-	-	18	0.2
Subtotal Undeveloped Land:	33,820	(98.4)	8,126	(81.0)
Total:	34,365	100.0	10,030	100.0

* Refers to the catchment area between a point on the Tepas River just upstream of Taliwang village and the Kalimantong II weir catchment.

Source: Pertanahan (formerly Agraria) Directorate, NTB, Land Use Map, Scale 1:250,000.

Figure IV-3
Land Use in
Kalimantong Area



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Soils

Alluvial Soils. Within the Taliwang soils, there are four alluvial soil units (Fenco, 1981):

1. Taliwang 1 - Moderately well to well drained, with 30 to 70 cm of silt loam to fine sandy loam, overlying silty clay loam to clays.

2. Taliwang 2 - Well drained to somewhat excessively drained, with more than 70 cm of silt loam to fine sandy loam, overlying finer textured silty clay loams to clays.

3. Taliwang 3 - Well to moderately well drained, with 30 to 70 cm of silty clay loam to loam overlying coarser-textured silt loams and fine sands.

4. Taliwang 4 - Moderately well to somewhat poorly drained, with more than 70 cm of loam to clay at the surface.

All of the Taliwang soil units represent the more desirable soils of the area. They are relatively fertile, nonsaline, and neutral to mildly alkaline, but low in nitrogen and sometimes in phosphorus. They generally have a high cation exchange capacity (CEC), except for Taliwang 2 soils, which have a low CEC due to their low clay content.

These soils range from marginally to highly suitable for irrigation. Taliwang 2 soils tend to be more suitable under irrigation for diversified cropping than for rice, due to the depth of coarser textures. Taliwang 3 and 4 soils are the most suited to irrigated rice cultivation.

Regosols. These are young soils, lacking horizon development, on volcanic sands, ash, tuff and coastal beach deposits. Two units are recognized in the project area (Fenco, 1981):

1. Kalimantong 1 - Well drained, slightly acid to neutral, slightly to moderately stony, deep soils on alluvio-colluvial footslopes and interhill valleys.

2. Tepas 1 - Well drained, mildly alkaline, stone-free to slightly stony, moderately deep to deep soils on gently undulating to undulating alluvio-colluvial footslopes and interhill valleys.

The Kalimantong 1 soils contain silty clay loam to loam overlying a silty clay loam, clay loam, or clay subsoil. They are nonsaline and slightly acid to neutral, relatively fertile with medium to high CEC values, and high levels of available potassium and nitrogen, but sometimes low in phosphorus. They are marginally suitable for irrigated rice and moderately suitable for other crops, when located in areas of less than two percent slope. Their main limitation is a high water

requirement, due to the coarser textures. They generally are not intensively cultivated and most frequently are covered by forest or brush. The Tepas 1 soils contain 20 to 50 cm of silt loam to loam overlying a very firm silty clay loam to clay subsoil. They are nonsaline and mildly alkaline, and relatively fertile with a high

CEC value. Available potassium is high, but nitrogen and phosphorus are low, especially, in the lower subsoils. These soils are marginally suited for irrigation, due to topography and high water requirements. They are often left in forest or brush, but in the northern part of the project area are cleared for maize and cassava.

Mediterranean Soils. Formed mainly on limestone and the less acid volcanic materials, Mediterranean soils are neutral to mildly alkaline, with high base saturation. Their distinguishing characteristics are dark red color and the presence of an argillic (clay) B horizon. Fenco (1981) recognizes two units in the project area:

1. Kalimantong 2 - Well to moderately well drained soils on gently undulating to moderately rolling alluvio-colluvial footslopes or interhill valleys. Subsurface of 20 to 50 cm of friable to firm silt loam to loam, brown to dark brown, underlain by dark brown silty clay loam to clay, very firm in consistency. They may be neutral or slightly acid in reaction.

2. Tepas 2 - Similar to Tepas 1 unit, but surface soil not so deep and with a pedogenic B horizon in the upper subsoil.

Kalimantong 2 soils may be irrigated when found on slopes of less than two percent, but being shallow, are better suited for rice than for deep-rooted crops. Usually, they are left in brush or forest, but sometimes in benign topography are cleared for secondary food crops.

Tepas 2 soils are considered to have severe limitations for nonirrigated cropping because of the firm subsoil which restricts root development. On suitable slopes, they may be irrigated for rice, but most soils of this unit are left in brush or grass. Some landowners attempt wet season maize or cassava on Tepas 2 soils.

Erosion

Erosion hazard in the project area was mapped by Fenco Consultants (1981) and by the NTB Department of Agriculture in 1987. Both maps present three categories of erosion hazard:

E-0 No tendency toward erosion. Alluvial soils with slopes of less than one percent; usually used for irrigated sawah. Frequently found in Taliwang, Sapugara, and Tepas Villages.

E-1 Slight erosion hazard. Mostly on slopes of 2 to 7 percent, in forested areas. Within the project area, these soils are mostly in the west, in the Taliwang-Seteluk River drainage areas.

E-2 Moderate erosion hazard. Mostly on slopes of 7 to 30 percent, but on less sloping terrain where the soils are younger, especially from volcanic, coral, or limestone parent materials.

The two map sets do not indicate areas of erosion hazard higher than E-2 within the Tepas catchment, but the field team found that most soils in the steeper alluvial valleys have high erosion hazard (E-3) when subject to intensive removal of vegetation for firewood, timber, or agriculture.

Farming Patterns

Farm Size. The project Household Survey (HHS) indicates farmers own and/or rent an average of 1.7 ha, ranging from 0.35 to 6.0 ha, some of which may be irrigated. Typically, the farmed area consists of 0.3 ha irrigated paddy, 1.0 ha rainfed paddy, 0.3 ha dry land (tegalan or ladang), and 0.1 ha orchard (coconut trees, often mixed with banana and other fruit trees).

Cropping Patterns. The overall intensity of cropping in the project area is about 170 percent. Nearly 100 percent of the available land is planted in the wet season in rice or palawija (vegetable crop). Toward the end of the wet season, when rainfall is not reliable, some 250 ha are planted in a second rice crop, using pumped irrigation from the river. In addition, approximately 1,300 ha of palawija are planted consisting mostly of soybeans and some mungbeans.

During the latter months of the dry season, farmers with access to pump irrigation put in a second palawija crop, usually soybeans. This covers about 200 ha of the project service area.

Livestock. Data on livestock numbers were derived from the HHS and from the Taliwang Sub-district Department of Livestock. The latter figures (Table IV-7) are somewhat lower than those from the HHS, but the proportions are similar. The HHS indicates that water buffalo are the most numerous large animals in the project area, outnumbering both cows and horses by more than five to one. Goats are slightly more numerous than cows but there are relatively few sheep. The project HHS indicated that 70 percent of the farmers are outright owners of draft livestock. The average ownership rate per survey household was 4.2 animals.

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Table IV-7

LIVESTOCK NUMBERS IN THE KALIMANTONG II PROJECT AREA

Region	Buffalo	Cattle	Horses	Goats	Sheep
Upstream	1,555	97	227	223	44
Middle	2,147	554	210	391	122
Downstream	1,945	590	590	684	92
Totals	5,647	1,241	1,027	1,298	258

Source: Taliwang Sub-district Department of Livestock.

Production Levels. Rice yields in the region are strongly affected by water availability, irrigated sawah yielding one-and-a-half times as much (3.3 t/ha) as rainfed (2.2 t/ha). Soybean yields are approximately 600 kg/ha and mungbean yields approximately 350 kg/ha.

Marketing Produce

About 60 percent of harvested paddy goes to home consumption, 25 percent is sold, 25 percent goes towards wages and 5 percent is kept as seed stock. Most of the paddy that is sold goes to private middlemen, with the residual (about 15 percent) purchased by the local farm cooperative (KUD). There are sufficient middlemen to ensure a competitive local market. Prices offered at farmgate are often superior to those of the KUD. Other incentives to sell to middlemen are: (1) middlemen purchase at farmgate, whereas farmers must arrange their own delivery of crops they sell to a KUD buying center; (2) private middlemen are said to accommodate a wider range of quality in their purchase; and, (3) private middlemen pay cash at the time of purchase.

Production of palawija crops is almost totally commercially oriented. Ninety percent of these crops are sold to private middlemen. Most middlemen come from the town of Sumbawa Besar and a few from the town of Alas.

Biological Resources

Habitat

Terrestrial. Two types of habitat are found in the upper Tepas River catchment: tropical evergreen forest on the upper slopes, and scrub savannah where land clearing has taken place and fields have been fallow for several years. Where extensive logging has occurred, a second growth forest is found. Rensch

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(1931) referred to it as "deciduous monsoon forest," because many trees are not truly evergreen but shed their leaves in the dry season.

The long dry season has produced a woodland composed of trees resistant to water loss, a condition achieved by leaf adaptations, leaf shedding, or root structure. The thorny Zizyphus is typical of the lower slopes. At higher elevations some unspoiled forest is reported to remain, but many parts of the catchment area have been heavily logged, despite protective regulations.

The forest is one of two-layered discontinuous canopy, with frequent clearings. Tamarind (Tamarindus indicus) is a prevalent tree species, with species of Barringtonia and Corypha also common. Having little timber value, these trees tend to survive logging. The most important timber trees are teak (Tectona grandis), kolaka (Parina corymbosa), bungur (Lagerstromia speciosa), ketapang (Terminalia catappa), and laban (Vitex pubescens). The shrub layer is less well known than the canopy. In openings, alang-alang grass (Imperata cylindrica) may take control and inhibit the growth of tree seedlings. Other important grasses are species of Paspallum, Pennisetum, and Chloris.

Above 700 m elevation, one frequently finds an understory of bamboo, figs (Ficus spp), and pandanus (Freycinetia sp).

The unspoiled forest of the upper catchment provides good habitat diversity for the terrestrial fauna. The density of the vegetation gives good water-holding capability, providing more even runoff than that found in heavily cleared catchments.

The estuary of the Tepas River consists of extensive mudflats with salt tolerant trees, such as tamarisk (Tamarix sp) in areas with ground water. There are scattered fingers of mangrove (Rhizophora, Avicennia, and Bruguera) but they are scarcely extensive enough for ecological importance.

The service area provides a variety of manmade habitats, based largely on agricultural plants and a few ornamentals or shade trees, such as kapok (Ceiba pentandra) and frangipani (Plumeria sp).

Aquatic. Intermittent streamflow conditions have restricted the diversity of the aquatic habitat, so that the true riverine habitat is sparse and does not support a significant fishery.

Lake Taliwang, according to the study by Fenco (1981) is an intricate wetland with more than 20 species of fish (some introduced) and a strong food chain supporting them. The lake lies outside the weir catchment and also outside the project service area, so will not be considered in detail here.

Fauna

The forests of the Tepas River catchment are reported to support rich game populations, despite some illegal hunting. There is a species of deer (*Cervus timorensis*), a muntjac (*Muntiacus muntjak*), a wild pig (*Sus vittatus*), and a macaque monkey (*Macaca iris*). Carnivores are represented by a fox (*Acanthyon brachyurum*) and a mongoose (*Viverricula malaccensis*). The fauna also contains numerous bats, marsupials, and small rodents.

The bird fauna of Sumbawa has been enumerated by White and Bruce (1986), who list 121 species of land birds. All of them could occur in the Tepas River catchment, but certainly not all of them do. Casual observations made in the project service area by the Project Environmental Scientist indicate a diverse avifauna, with many species, such as herons and munias, well adapted to agriculture-based habitats.

The reptile and amphibian faunas of Sumbawa are also well known, but which species are found in the project area has not been determined. Python (*Python molurus*) are reported (by the Forestry Department) to be present, but are usually killed on sight by rural people, who view these large snakes as threats to children and livestock.

Socioeconomic and Cultural Resources

Population Profile

Age Structure and Work Force. The population of the project area is a young one, with 46 percent of all individuals less than 15 years of age. The 15 to 54 year age group, considered the working cohort, contains 47 percent of the population, the remaining 7 percent being 55 years and older. Strict application of these figures would suggest a dependent cohort 12 percent larger than the working cohort, but the boundaries of the various divisions are not sharp. Much farm labor is performed by children, even as young as ages 7 or 8, freeing older family members for more arduous tasks. Healthy adults often continue to do field labor well past the age of 55, and even those unable to work in the fields perform useful work around the home.

Household Size. Households in the project area usually consist of a nuclear family, as is true throughout most of Indonesia. Household size averages slightly more than five persons, with somewhat larger families, averaging seven members, in the upstream villages.

Population Growth. Sub-district Taliwang records indicate a 1987 crude birth rate of 12.4 births per thousand population. The figure suggests that many births in the Sub-district went

unreported. The 1987 death rate, derived from 263 reported deaths among 29,566 people, appears to be 8.9 deaths per thousand population, but this figure also must be accepted cautiously. If the two figures are accepted at face value the neutral population growth in the area is 0.36 percent, varying from minus 1.34 percent (a net population decrease) in the downstream villages to plus 1.30 percent in the more upstream villages.

Education and Literacy. Among the area population as a whole, despite school attendance laws, education is spotty, but gradually improving. Approximately 5 percent of adults have never attended school and another 26 percent dropped out of primary school without finishing. The records indicate that approximately 51 percent of the population have completed primary school or are now in attendance. The majority of these may be presumed literate.

Religion. Islam is the religion of the region, embraced by 99.97 percent of the population. The remainder, numbering only ten individuals, is comprised of four Christians and six Hindus.

Income. Agriculture is the economic base of the region, with 71 percent of the adult workers employed as farmers. Fishing (marine only) is the primary occupation of 3.8 percent and wood cutting that of another 0.8 percent. The remaining 24.4 percent work in the service sector of the farm-based economy: industry, 6.4 percent; commerce, 4.6 percent; transportation, 1,6 percent; public service, 4.5 percent; and all another occupation, 7,3 percent.

Gross farm income varies with family size and land holdings. The project Household Survey indicated average annual farm incomes of approximately Rp. 600,000 to 700,00 per household. These figures are derived, not from actual reported income, but from yield estimates and market values of crops and inputs.

After the expenses of family maintenance are considered, medium and smaller farms are left with little or no cash reserve, and in fact, can hardly sustain even a small family. Such farmers probably supplement their own farm incomes by labor off the farm, either for wages or for a share of produce.

Kinship and Marriage Many young farming couples settlel near a parents' homestead, when land is available. Marriage partners are sought from eligible individuals in the same village or hamlet.

Health and Disease

Formal health facilities consist of a clinic and four-bed hospital at Taliwang, regional clinics at Sampir and Bugis villages, and smaller clinics ("PUSKESMAS") at Beru and Kuang

villages. The Taliwang clinic is staffed by two doctors, five nurses, and a laboratory technician.

The major reported diseases of the region are those of the skin, respiratory system, and digestive system. Malaria, almost entirely Plasmodium falciparum, is the most prevalent disease of the region and no suppressant drugs are employed in the area. Gastroenteric conditions, caused by water-borne bacteria and viruses, are widespread. Leprosy also is common in the area and an increasing number of patients are coming to the Taliwang clinic for treatment. Tuberculosis, influenza, and skin diseasses, such as scabies, also are prevalent. Measles and poliomyelitis, major killers of children in many rural regions, are gradually decreasing through an aggressive vaccination program, but the program has yet to affect the more remote areas of the catchment.

Attitudes toward the Project

Farmers in the region are strongly in favor of improved irrigation, recognizing that the lack of water is a frequent cause of crop failure. Those in the Kalimantong II service area have examples of irrigaiton on all sides of them, so are strongly desirous of obtaining irrigation themselves.

Regional Infrastructure

The project area is traversed by a two-lane paved road form the town of Sumbawa Besar via Alas and Seteluk. A network of asphalt paved roads connects the various hamlets but these roads become dirt tracks farther from Taliwang.

Electricity is provided at Taliwang and in villages along the main roads to Tepas and Kalimantong.

Settlement Pattern and Administrative System

Settlement Pattern. The settlement pattern reflects the administrative system, or vice versa. Within the village, are a number of sub-areas (dusun), each with up to several hundred people. The dusun is composed of hamlets with one or more administrative units (rukun tetangga, or 'RT') of 25 to 50 families.

In the smaller hamlets most dwellings are made of local materials: timber, bamboo and palm thatch. House floors often are woven bamboo and wood platforms, elevated one or two meters above the ground. Greater prosperity, generally found in larger villages along main roads such as the villages of Taliwang and Tepas, is reflected in concrete or brick walls, concrete floors, corrugated or even tile roofs and glass windows.

There do not appear to be major population movements in or out of the project area. Some seasonal wage labor enters the area, mostly from Lombok, but the urban out-migration that has occurred in many agricultural regions does not appear to have taken place here.

Administrative System. Village heads (kepala desa) are appointed by the sub-district government. Village administrative officers (pamong desa), including secretary and office staff, are responsible for handling administration, development, welfare, finances, and miscellaneous administrative and record-keeping duties. The kepala desa is advised by the LKMD (Lembaga Ketahanan Masyarakat Desa), a kind of planning council at village level. Members of this council are local key persons and representatives of semi-governmental organizations like the rural women's group (Program Kesejahteraan Keluarga, or 'PKK'), key, or contact farmers (kontak tani), the malar, or water users association leaders (P3A), and leaders of village unit cooperatives (KUD). Proposals are made by the village advisory body, known as the 'LMD' (Lembaga Masyarakat Desa), that finally make recommendations to the kepala desa. In practice, the quality of the village administration strongly depends on the capabilities of the village head.

Farmer Organization

In addition to the village and hamlet organizations, the farmer has an opportunity to receive support and assistance from three farm-oriented systems, described below.

Kelompok Tani. Farmers groups have been organized under the existing extension system in accordance with the Training and Visit system model. There are 16 groups under each field extension agent (Penyuluh Pertanian Lapangan, or 'PPL'). These farmer groups are headed by a contact farmer who is assisted by five leading farmers (petani teladan), who are each supposed to guide another twenty farmers in their surrounding areas.

Koperasi Unit Desa (KUD). Farmers cooperative KUD have been in the general area for some time, but have been largely non-functional. The scope for growth and increased activity with the arrival of irrigation is substantial. Farmers could benefit from combined processing, storage and marketing of crop outputs, and from bulk input purchases, transport and storage.

Pooling of resources would also enhance access to credit through lending programs (e.g., KUT and KUPPEDES credit programs). But without improved management, training and active farmer participation, KUD realization of these benefits is not likely. The general record of farm cooperatives in developing countries has not been favorable.

The Malar System. The current simple irrigation schemes are organized around malar, who are agriculture and water distribution managers from the villages in charge of distinct agricultural subcommand areas. They are active in seeing that fences and simple irrigation facilities are maintained, and fences and simple irrigation facilities are maintained, and supervise distribution of water supplies during wet season periods when river water is available for diversion into canals. Each system is headed by a chief malar, assisted by other malar responsible for subsections of the command areas. The malar sometimes receives compensation on the order of 0.5 to 1.0 percent of farmer yields.

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Chapter V

POTENTIAL ENVIRONMENTAL IMPACTS

There are three major phases to the Kalimantong II Irrigation Project: preconstruction, construction, and post-construction, otherwise known as the operation and maintenance period. Within the preconstruction phase are several subcomponents, including this Environmental Assessment, the feasibility study that results in the Project Justification Report, and completion of the final design and tender documents. The subcomponents of the preconstruction phase are now nearly complete as the Environmental Assessment has been submitted and the Project Justification Report, the final design, and the tender documents are about to be submitted for review by the Department of Public Works and USAID.

As noted in Chapter I of this Environmental Assessment, the focus of this study is the result of an early Scoping Session, held in Mataram in July 1986. The information contained in this report is also based on subsequent field visits to the site by environmental experts who prepared this report.

Virtually all the Potential Environmental Impacts that have been identified, refer to post-construction/operational impacts. The Kalimantong II Irrigation Project preconstruction phase had some minor physical impacts where test bores were made and where a water level measuring recorder was installed. The work accomplished during the feasibility assessment by contractors also resulted in wood and cement markers being installed during surveys. Work during the pre-construction phase produced generally positive social impacts among the local population, and raised public interest in the likelihood of receiving irrigation. The only negative social impact of the preconstruction work has been where some farmers had to give up some agriculturally productive land to be used as borrow areas, and for primary and secondary canal routes. This project remains relatively uncontroversial in the area since it does not entail any resettlement. In general, the preconstruction phase was viewed enthusiastically by the local population.

Potential environmental impacts during the construction phase will be mostly temporary ones. The local population will positively benefit from increased employment apportunities and from increased demand for locally procured goods and services while construction crews build the system. The local population will probably be somewhat inconvenienced by increased noise and dust, and there will be some limited disruption to agricultural production along canal routes, as they are built.

The following details the potential environmental impacts that are likely to be more long term, occurring mostly in the post construction phase of the project.

Water Resources

Streamflow Characteristics and Flow Distribution

The Kalimantong II Project will divert water from the Tepas River to the canal system, the sawah, the drains, and back to the river. The effect of this will be a reduction in the flow of the river by approximately 3 to 5 m3/s when the project is in full operation. During most of the year, from November through May, this diminution will not be significant, since flows usually are well above 10 m3/s during that period.

During July through October, when the Tepas River flows at 3 to 6 m3/s on the average, the diversion of irrigation water of up to 1.9 m3/s for the palawija crop will sharply reduce the water downstream of the weir. This will effectively extend the existing period of extreme low flow, now usually limited to the month of October, to three months' duration, August to October.

Figure V-1 shows the effect of project irrigation diversions on the Tepas River streamflow pattern, using data for one of the driest years on record. For extreme conditions such as this, the project irrigation diversions would need to be reduced during the brief critical periods (early June and early September, in this case).

A detailed review of the 16 dry seasons (June-October) of generated Tepas River monthly flows reveals the impact of the project on streamflows:

- Under pre-project conditions, only October exhibited flows of less than 0.5 m3/s (3 times) and twice had zero flow.

- Under post-project conditions, during the 16 years, flows would fall below 0.5 m3/s once in June, once in August, six times in September, and three times in October. Zero flow would occur once in June, once in August, once in September, and twice in October.

The effect of project diversions will be moderated to some extent by irrigation return flows (water satisfactory for bathing and livestock but not for domestic use) and by flows from several tributary rivers. The most upstream of these, the Seminar River, contributes a flow equal to about 5 percent of that of the Tepas, and the Seloto River about 7 percent. Table V-1 shows anticipated flows at various points downstream.

During October, usually the month of lowest flow, the irrigation system will be out of operation, so without-project conditions will prevail below the weir.

PROJECT IMPACT ON STREAMFLOW REGIME

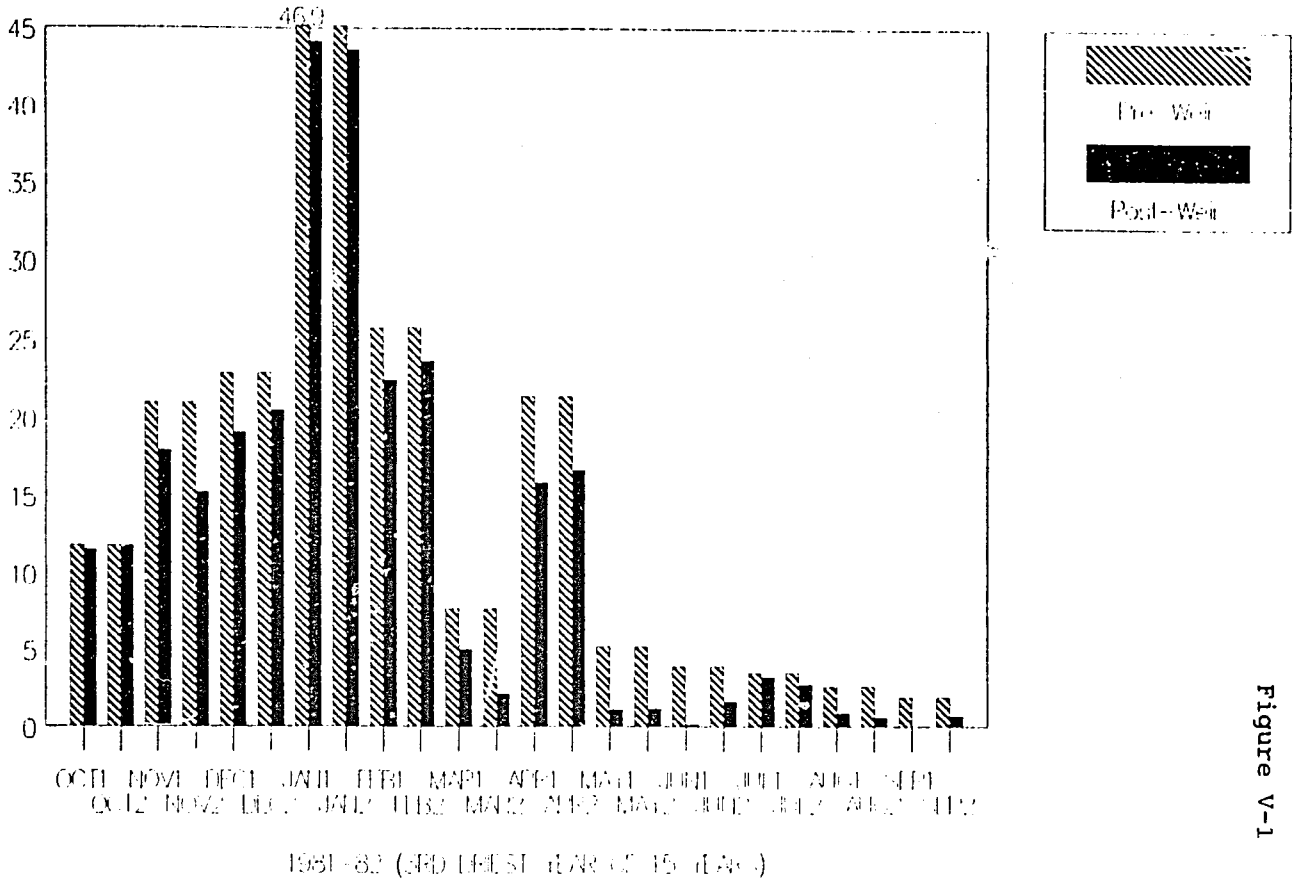

Figure V-1

Table V-1

ESTIMATED WITH-PROJECT DRY SEASON FLOWS IN THE TEPAS RIVER IN A DRY YEAR (1980 RAINFALL) AND A WET YEAR (1981 RAINFALL)

Location (Moving Downstream)	Descrip.	As % of weir inflow[1]	Dry Year (1980) Jun	Jul	Aug	Sep	Oct	Wet Year (1981) Jun	Jul	Aug	Sep	Oct
			(m3/s)					(m3/s)				
1. Weir	inflow	--	2.9	2.3	1.7	1.4	1.7	5.5	3.5	4.4	5.7	11.8
	diversion[2]		3.0	0.5	1.9	1.6	0.1	3.0	0.5	1.9	1.6	0.1
	outflow	--	0.0	1.8	0.0	0.0	1.6	5.5	3.0	2.8	4.1	11.7
2. Unnamed tributaries	incr. 1-2	6.7%	0.2	0.2	0.1	0.1	0.1	0.6	0.6	0.3	0.4	0.8
	cumulative	--	0.2	2.0	0.1	0.1	1.7	6.1	9.6	2.8	4.5	12.5
3. Seloto/ Seminar	incr. 2-3	11.8%	0.3	0.3	0.2	0.2	0.2	1.0	1.1	0.5	0.7	1.4
	cumulative	--	0.5	2.3	0.3	0.3	1.9	7.1	10.7	3.3	5.2	13.9
4. Kalimantong	incr. 3-4	49.8%	0.0	0.9	0.0	0.0	0.7	2.6	4.3	1.3	2.0	5.7
	cumulative[3]	--	0.5	3.1	0.3	0.3	2.6	9.7	15.0	4.6	7.2	19.6
5. Taliwang	incr. 4-5	0.2%	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1
	cumulative	--	0.5	3.1	0.3	0.3	2.6	9.8	15.1	4.6	7.3	19.7
6. Lamonga	incr. 5-6	10.0%	0.3	0.2	0.2	0.1	0.2	0.9	1.0	0.4	0.6	1.2
	cumulative	--	0.8	3.3	0.5	0.4	2.8	10.7	16.1	5.0	7.9	20.9

Notes: Incremental inflows to the river between locations are estimated based on catchment area proportion relative to weir site.

1. The contribution of irrigation return flow is ignored in these calculations.
2. Average monthly irrigation diversion at the weir for assumed cropping pattern of rice-rice-palawija.
3. Assumes irrigation diversion at Kalimantong I weir equal to 50 percent of rate shown above for Kalimantong II.

Runoff and Drainage

Increased application of irrigation water, in a system with properly planned, constructed, and maintained drainage canals, inevitably leads to increased drainage flow. In the proposed Kalimantong II system, drainage will be returned to the Tepas River through new and existing drains, some of which feed into natural tributaries.

Ground Water

Quantity. Extended application of irrigation water may be expected to improve the availability of ground water during the drier parts of the year, especially in areas away from the rivers. This prediction is made cautiously, because the origins

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and rates of ground water recharge have not been studied. The relatively impermeable soils of the rice fields, well suited for surface irrigation, have an estimated deep percolation rate of 3 mm per day based on field tests by Fenco (1981). The effect on ground water, if any, is likely to be beneficial.

Quality. To the extent that aquifers do receive water by percolation from irrigated fields and seepage from canals, the effect on water quality may be slightly detrimental, due to the possibility of contamination by agricultural chemicals. The risk of serious contamination of the aquifers through normal chemical use appears to be small, but a major chemical spill could cause substantial contamination that would persist much longer than the surface water contamination from the same spill.

Water Quality

Upstream. No significant water quality changes are expected to occur upstream of the weir. The pool will settle out what silt arrives at its upstream end and it will be sluiced out during the high flow period. During October, when the river is at minimum flow and the irrigation system out of service, the pool may acquire additional organic material and experience an oxygen deficit due to high temperatures and elevated Biochemical Oxygen Demand (BOD). Such conditions probably occur to an even greater extent under pre-project conditions in years of extreme low flow, when the pools in the river are smaller than the project weir pool will be.

Water quality in the river upstream of the weir pool will not be affected by the project.

Service Area. Surface water in the service area will be of two types: water in the canals, and in the fields and drains. The water in the canals will be of approximately the same quality as that of the river at the weir, minus much of the silt, which will settle out in the weir pool. Minor increases in fecal coliforms, phosphorus, and nitrates may be expected due to human use of the canals for bathing and laundry, but this has remained low in existing systems. Water quality samples taken in August 1985 at the Kalimantong I weir and below Taliwang (Table IV-5, Sites B7 and B8) show only slight increases in fecal coliforms, phosphate phosphorus, and nitrate nitrogen from samples at the Kalimantong II weir or elsewhere in the river system. These samples represent water that has been through various parts of the total irrigation flow, and not simply the canals.

Water in the fields and drains is expected to acquire additional nutrients (phosphorus, nitrogen, and ammonia) through the increased use of fertilizer and to acquire some pesticide residues as these are applied in increasing amounts. The relatively high cost of pesticides will restrict their use somewhat. Moreover, application during the period of maximum

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runoff will mean that the amounts in the return flows will be well diluted by the river.

Downstream. Entry of pesticides into the river ecosystem could become a problem some years hence, in the event that residual chemicals such as the chlorinated hydrocarbons or phenolic herbicides are used in large quantities. Those compounds in the river water would cause problems in fish or shrimp ponds downstream. At present, however, no such aquaculture facilities exist in the Tepas catchment area and no development plans have been announced.

Continued use of short-lived organophosphates and carbamates will keep residues at a minimum. Moreover, water quality analyses indicate that levels of persistent compounds in use in 1988 were not sufficient to provide residues in water high enough for concern.

The main danger of pesticide contamination would be through careless storage or use, or an accidental spill. Such an event could cause a sudden increase in the level of contamination and pose a risk to human health.

Land Resources

Land Use and Capability

The project will result in increased cropping of lands already in agriculture, but will not bring lands into cultivation that are now used for other purposes.

Soil Chemistry and Moisture

The heavy soils of the project area are not expected to undergo any significant change in composition with multi-crop cultivation. Soil moisture will increase generally, but the surface drainage system will ensure that waterlogging and salinization do not occur. Experience with similar irrigation schemes in NTB has been good in this regard.

Erosion and Soil Movement

The possibility always exists that an unlined canal will be operated at water velocities that produce erosion of the canal walls. The project canals will be lined at any curves likely to experience excessive wear. Erosion of canal walls is not a serious problem at Kalimantong I or other projects in the region, except where livestock use of the canals is heavy.

Slides are not now a serious problem in the region, since the steeper slopes are vegetation-stabilized. The project roads and canals will not create new slopes that would slide.

Biological Resources

Habitat Quality and Distribution

The natural habitat of the Tepas River catchment is mostly rain forest in the northern upper elevations. This forest is continually at risk from illegal loggers, who are extremely difficult for the provincial Forestry Department to control. In the lower catchment, most wood cutting, legal and illegal, is for fuelwood.

Increasing population in the project area, some of which is natural, but which may be augmented by migrants attracted by the benefits of the project, will put greater pressure on the timber and fuelwood resources. As demand increases and male heads of household devote more time to cash cropping, the incentive for entrepreneurs to enter the fuelwood market will increase. Improved roads will facilitate transporting cut wood from the more remote parts of the catchment. In particular, the improved access road to the Kalimantong II weir may also provide access to forested areas.

The illegal cutting of forest in the catchment is merely a small part of the broader problem of forest management on Sumbawa. Viewed in that light, the catchment forests are in jeopardy with or without the project. An increase in agricultural intensity anywhere, with its increased specialization of the farmer, must be expected to produce support industries, among them the supplying of fuel. A further extension of this is the shift to kerosene or gas, but by the time that occurs the forest resource usually is severely depleted.

The converse of this problem is that, over several decades, deforestation in the catchment may well be extensive enough to increase runoff and erosion rates. These increases would work to the detriment of project operation.

This network of interactions underscores the need for integrated resource planning and management, since the development of one resource, such as water, invariably carries implications for others, such as forests and fisheries.

Species and Ecosystems of Special Importance

Of the three sectors of the biological system considered "of special importance", only one, that of the pest species, is present in the immediate project area. The possibility of effects on forest resources, discussed above, also could be considered in the "special importance" category.

Whenever an agricultural area shifts toward longer cropping periods or toward monoculture, one must expect an increase in pest populations. Fallow periods, when preferred or obligate foods or breeding sites are denied, are hard on crop pests.

When able to move smoothly from one growing season to another, pests obtain higher population densities than when forced to endure an adverse period between crops. It is especially true of insects, which tend to be crop-specific, but it also applies to birds and rodents, whose tastes apply to grains generally.

The usual countermeasure to increased pest risk is more intensive chemical use, but some more traditional measures, such as burning old stalks and dried weeds, are useful in destroying weed seeds and insect eggs and larvae.

Other pest species, such as aquatic weeds, are likely to flourish in the Kalimantong II weir pool, from which they can be expected to colonize canals and drains. Although not a severe problem in most parts of the project area (except in Lake Taliwang), aquatic weeds could be more of a burden in a system with nearly year-round water. Some vigilance will be required, especially with respect to drains.

Inclusion of disease vectors as "pests" is unorthodox, but these are ecologically responsive species and appropriately treated as part of the biological system. The most serious vector in the Kalimantong region is the mosquito, of which some species transmit human disease. An increase in mosquito populations frequently accompanies the application of additional irrigation water, and with the increase in mosquitoes almost invariably comes an elevated incidence of malaria, dengue, and other mosquito-borne diseases.

Fisheries

There being no important fishery in the catchment other than that of Lake Taliwang, irrigation development is hardly likely to affect a fishery resource.

The pool of water behind the weir, approximately 4 ha in area and 4 m deep near the weir, could develop a small fishery, with local benefits. No matter how effectively managed, however, such a small area is not likely to develop a significant fishery.

Socioeconomic and Cultural Resources

Economic change, resulting from increased agricultural production, is the primary objective of this project. As such, economic benefits are not considered environmental effects. Secondary social effects may be expected from most resource development projects, due in part to social, geographic, and economic divisions of the population. For the purposes of predicting secondary effects, the local population may be considered in several categories (USAID, 1980):

1. Target Population. These are the group to whom the project benefits are directed, in this case, farmers who will receive additional irrigation water.

2. At-risk Population. This group is outside the area of direct project benefits, due to location, occupation, economic status, or whatever reason, but vulnerable to some adverse secondary effect, such as loss of resource, deprivation of an amenity, or even some minor inconvenience.

3. Migrant Population. This category includes both immigrants to the area, attracted by labor opportunities or potential markets for goods, and emigrants, whether officially resettled or driven out of the area by other factors.

4. Host Population. This broad group includes most members of the other three, being defined as all persons "living within the area of project influence."

By the above definitions, the groups of greatest interest in a consideration of secondary project effects are the target population, which, in addition to receiving the primary benefits of the project, is likely to experience other effects, and the at-risk population, which, while not in line for primary benefit, may experience positive and/or negative secondary effects.

In general, the secondary effects of an irrigation project fall into several categories:

1. Secondary benefits arising from the primary benefits of increased crop production and disposable income.

2. Opportunities to enhance the use of a resource through secondary applications of the project facilities, e.g., reservoir, canals, roads, drainage canals.

3. Potential adverse effects of project construction or normal operation, e.g., demand by the construction work force for scarce local resources, resource contamination, or conflicting demand for the water.

4. Failure of the project to live up to expectations, due to over-optimism of planners, inadequacies of maintenance, or misuse by the local population.

Of the above, the fourth is the most distasteful for project planners, because it arises from a fundamental weakness in the planning system: the tendency of technical people to foresee a project as operating in a trouble-free, idealized situation, as opposed to a worst-case condition involving misuse, neglect, and unplanned modifications of the system. To adopt the latter approach would be unnecessarily pessimistic, and irrigation planners increasingly stress combining structural

improvements with upgraded management, user education, and periodic review of the project, in an attempt to achieve a more foolproof system. In actuality, however, despite continuing efforts toward more effective operation, rural irrigation systems in many parts of Indonesia, as elsewhere, continue to be plagued by abuses at many levels of the system: control gates left open instead of releasing water on schedule, damage to canal banks by livestock, insufficient removal of trash from channels and control structures, and a variety of other factors.

This section on socioeconomic effects deals with both the effects of the project on living conditions and the potential effects of local society on the project. Both sets of effects, especially the latter, form feedback loops: if the practices of the local population compromise the effective operation of the irrigation system, that in turn may have effects on the health or economic status of local people.

Settlement Patterns and Movements

The demand for additional labor in the project area may be expected to lead to some settlement by individuals who now enter the area only to provide temporary labor. The increase in disposable income that is the primary benefit of the project probably will lead to more rapid development of Taliwang, Tepas, and the smaller villages as entrepreneurs respond to the increased purchasing power of the farmers. This could lead to some completely new commercial enterprises being started in the region, but more likely the expansion will occur in existing businesses.

There being little undeveloped land for sale, it is unlikely that outsiders will buy into the area. Concern was voiced at the 1986 Scoping Session that the project will elevate land prices in the service area, making it more difficult for tenant farmers and small landowners, to acquire property. This, in turn, would favor the larger landowners, who have more disposable income, and would lead to increasingly larger holdings by that group. The scenario is not unrealistic, but it overlooks the fact the smaller farmer, who now has little surplus income in the average year and none in the dry year (even going into debt), will experience a greater percentage increase than the larger farmer.

Services, Infrastructure and Social Organization

Improved living standards and more economic opportunity in the target population probably will result in some of the younger farmers remaining in the area rather than out-migrating. Other farmers will move into the area because of irrigation development. Traders and middlemen will establish more shops and services as trade increase. Demand, in general, will increase for services and infrastructure (schools, health clinics, roads, transport, markets and extension services), and

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with this increased demand, and diversified population, the local social structure will become more complex.

Farming Systems

Cropping Patterns. The usual response of the Indonesian farmer to the availability of additional irrigation water is to add a second crop of paddy, which is then marketed. Economic studies have shown that growing other crops instead of rice can provide a higher rate of return, and farmers in some areas with irrigation have adopted onions, melons, tobacco, groundnuts, pineapple, lettuce, and other vegetable crops. In the Kalimantong project area, the farmers are expected to add a second rice crop initially, but shift to other crops after a decade or two of irrigation experience.

It is likely that one effect of increased intensity of cropping will be a substantial change in the disposable time of the farmer in the target population. The demands of two or more crops per year will leave him less time for house repairs, wage labor, and other activities that now occupy him during the dry season. With less time and more disposable cash, he will pay to have work done that he now does himself.

Land Use. The major foreseeable land use change expected to result from increased rice cropping is that fields now used for grazing livestock will no longer be available. Since it is unlikely that farmers will readily give up the security of livestock ownership, new grazing and fodder sources will be sought. If pressure on grazing and fodder resources becomes too intense, some herd reduction may occur. This might be desirable as the present herd, averaging 4.2 water buffalo per household, probably exceeds the number required for draft purposes. Moreover, it represents a considerable burden on the vegetative production of the area, a substantial demand for custodial time (often that of younger family members), and a strain on surface water resources during the drier parts of the year.

The gradual increase in prosperity among the target population also may reduce the value of the buffalo as a financial reserve, to be sold in time of crisis. Coupled with the gradual mechanization of field preparation, the reduced need for water buffalo or cattle as a buffer against crisis could result in substantially reducing livestock numbers over the next few decades.

Agricultural Chemicals. The increased use of agricultural chemicals, both fertilizers and pesticides, is an integral part of intensive cropping. Indonesia appears to have an excellent safety record in the rural use of pesticides, although the application of fertilizer has had some deleterious side effects in some parts of the system, notably in surface waters. Whenever chemical use is increased or new chemicals are introduced to a region, additional vigilance by health

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authorities and training of farmers in chemical use should be strengthened.

Adverse impacts may arise from many aspects of pesticide use, and not all effects are attributed to the correct source. Some aspects of pesticide use that require special attention are:

1. Storage and Handling. Storage of toxic chemicals near exposed foodstuffs, such as grain, may result in poisoning of consumers, that is often unrecognized or blamed on disease. Exposure of water soluble chemicals to rain or flooding results in contamination of soils, surface water, and ground water. Again, without testing, these results pass unnoticed or are blamed on other actions.

2. Careless Mixing or Improper Formulation. The failure of even experienced operators to exercise proper caution against spills or skin contact has cost lives in several countries.

3. Excessive Application. One might expect farmers to be parsimonious in applying compounds for which they have paid hard-earned money, but there is a tendency to err on the side of excess, just to be sure of effectiveness. HHS data indicate, however, that farmers in the project area now apply pesticides at below recommended levels.

4. Improper Disposal of Containers. Containers in which liquid chemicals are supplied frequently are reused, sometimes sold, and often with only cursory washing.

Regional Economics

Target Population. Disposable income among farmers practicing multicrop irrigated agriculture is expected to rise sharply; this is one of the primary benefits of the project (the other is the contribution toward national self-sufficiency in food). This increase in disposable income, potentially two- or threefold, will result in increased purchasing of consumer goods, improved nutrition, and a greater interest in nonfarm matters.

While the last does not necessarily follow merely from increased income, world experience shows that as rural societies become more affluent school attendance increases, health services experience more demand, and greater attention is paid to quality of life. Some of these changes can be achieved in other ways, such as through government education programs.

At-Risk Population. Farmers and others who do not have access to irrigation will, nevertheless, receive some secondary benefits. As the demand for goods and services rises, these fringe families will see their labor increase in value when they

hire out to assist the target farmers. Moreover, the poorer farmer may find that the market for fuelwood, woven mats, thatch and other natural products increases as the target population has less time for gathering and processing natural plants.

Public Health

Vector-borne Diseases. Irrigation projects in the tropics usually carry the risk of increasing certain vector-borne diseases, especially malaria, dengue and other diseases transmitted by mosquitoes. The risk is especially great when pools of standing water are allowed to exist in poorly maintained drains or canals. These conditions occur today in many areas with irrigation systems, although there are many other breeding sites for mosquitoes not connected with irrigation.

Other Water-related Diseases. There are several possible scenarios of water use in the project area, depending on rainfall, project operation, and the actions of local authorities. In general, the decreases in dry season flow in the Tepas River will cause the few families that use river water to turn to other sources, probably canals. Since that water will be of no poorer quality than the river is at present (possibly better, having received no drain water) there should be no deleterious effects on the incidence of intestinal and parasitic diseases, typhoid and other water-related diseases.

Resource Use

Water: Quantity. A major effect of the project is the diversion of water from the main stem of the Tepas River into the irrigation system. The effect of the removal will be seen mainly in the reach of the river between the weir and the mouth of the Seloto River. The contribution of runoff in that stretch is only about 7 percent of the flow at the weir, or as little as 0.1 or 0.2 m3/s during the months of June through October in a dry year (see Table V-1). If there was no excess flow over the weir, the river could be nearly dry for several months.

Drying the river will not cause widespread hardship, since the use of river water in that reach is rather limited at present, but watering livestock will be made more difficult. Farmers that now water buffalo in the river will excavate deeper pools or use the canals. The municipal water system of Taliwang, which draws its water from the Tepas River, will not suffer from the removal of water, since the contribution of tributaries between the weir and Taliwang is two-thirds of the flow at the weir. Thus, even in a dry year, the town will be able to find the 0.02 m3/s that its system requires. The effect will be felt at Tepas village, however, where there is no municipal water system and little tributary addition in the reach between the weir and the village.

The shift of water from river to canal must be expected to lead to the use of canals for many purposes now served by the river: bathing, laundry, and livestock watering. All of these activities are detrimental to the canal banks, but livestock watering is by far the most serious. Extensive use of unlined main and secondary canals by buffalo seriously damages the canal banks and compromises the effectiveness of the system.

The widespread application of irrigation water is expected to increase ground water recharge, due to percolation from fields, canals, and drains. This will improve the availability of water in some domestic wells that dry up in some years of low rainfall.

Quality. There are two potential sources of water quality degradation with this project: reduction of flow in the main stem and agrochemicals in the irrigation return flows. The reduction of river flow, which will be greatest in reaches nearest the weir, means that the river will have less capacity to assimilate the increasing waste water flows from the towns on its banks. At present, dry season water quality at Tepas and Taliwang is quite good and human contamination, indicated by rather low fecal coliform levels, is low. With a reduction in flow of up to 80 percent or more at Tepas, the levels of contaminants will increase five- or sixfold. The risk of disease for persons bathing and, particularly, for children swimming, will be increased. In all probability, however, much of the swimming and bathing now practiced in the river will move to the canals.

Agricultural runoff degrades water quality by its content of pesticides and, to a lesser extent, fertilizers. It is unlikely that pesticide use will reach high enough levels in the Kalimantong area to pose a serious threat to human health. The risk would be to downstream water users such as shrimp farmers, since crustaceans are quite sensitive to chlorinated hydrocarbons. The preferred insecticides in the region being carbamates and organophosphates, this risk appears negligible.

Other Resources. The expanding population of the project area will demand increasing supplies of forest resources, especially firewood, but also bamboo, palm leaves, and timber. Some enterprising area residents may be counted upon to meet that demand, partly by illegal cutting.

Effects of Project Alternatives

No Action Alternative

The pressure of a gradually increasing population, dependent on a land resource with limited irrigation and an unreliable water supply, would lead to greater poverty and lower living standards. These would induce the younger members of the

communities to emigrate in search of wage labor or better farming conditions. Some might turn to exploitation of different resources, such as the forest of the wild fauna.

Alternatives Technologies

There being no viable technical solutions to the need for more water, speculation on the environmental effects of other systems would be meaningless.

Design Alternatives

Siting. There being no downstream diversion sites in the catchment that offer the possibilities of the selected one, no environmental effects will be postulated for such alternatives.

Selection of the service area on other than topographic, soils, and geographic bases really is not possible if the project is to function. The environmental effects of alternative service area selections would be about the same as those of the proposed area.

Scheduling Alternatives

The effects of scheduling the project so as to stretch it out over a longer period would resemble those of the no action alternative, i.e., continued poverty for the part of the target population not receiving water and, possible, shifts of people within the area to take advantage of irrigation water.

Chapter VI

EVALUATION OF SIGNIFICANT IMPACTS

This chapter summarizes the probable major positive and negative effects of this irrigation project on the environment. It also points out possible negative impacts of the environment on the functioning and efficiency of the project. Virtually all of the likely significant effects will occur during post-construction, that is, during the operation and maintenance phase.

A primary impact of this project will be to increase incomes and raise the standard of living. This is considered to be a positive, long-term effect. Other significant effects are likely to be negative and long-term, and require that mitigating measures be put into effect. Thus, a Mitigation Plan has been prepared to deal with these potential negative effects of the project on the environment, and of the environment on the project.

Water Resources

Streamflow Characteristics and Flow

Distribution. The Kalimantong II Project will divert water from the Tepas River into the irrigation system. The effect will be a reduction in the flow of the river by approximately 3 to 5 m3/s when the project in full operation during the months from November through May.

During the dry season (July through October), the diversion of irrigation water for the palawija crop will sharply reduce the water downstream of the weir, particularly during the driest period, August through October.

The effect of the project diversions on the downstream flow will be moderated by irrigation return flows and by flows from several tributary rivers.

Water Quality: Downstream. Pesticides in the river ecosystem could become a problem in the future if chemicals such as the chlorinated hydrocarbons or phenolic herbicides are used in large quantities.

Land Resources

The main significant impact will be increased cropping of land already in agricultural production.

Biological Resources

Habitat Quality and Distribution. Any increased cutting of forest in the catchment area may lead to eventual deforestation. Deforestation would lead to increased runoff and erosion rates. These increases would act negatively against the operation of the project and lead to increased maintenance problems.

Species and Ecosystems of Special Importance. Crop pests (insects, birds and rodents) are likely to increase with intensification of cropping. Aquatic weeds are likely to flourish in the weir pool and in some canals and drains. An increase in the mosquito populations is likely to occur, and with them, increases in mosquito-borne diseases, such as malaria and dengue fever.

Socioeconomic and Cultural Resources

Increases in agricultural production will lead to increases in income and an improved living standard. This will directly affect the target population, and secondarily benefit the at-risk and migrant population through increases in wage labor and increased demand for goods and services.

Other socioeconomic and cultural effects include effects of the project on living conditions and the potential effects of local society on the project.

Settlement Patterns and Movement

The demand for additional labor can be expected to lead to increases in the population as some people who temporarily enter the area will decide to permanently settle here.

Services, Infrastructure and Social Organization

Improved living standards and more economic opportunity in the area will probably lead to increased trade and demand for services. There should also be an increased demand for more infrastructure (schools, health clinics, roads, transport, markets, and extension services).

Farming Systems

Land Use. The major foreseeable land use change is that fields now used form grazing livestock will no longer be available. New grazing and fodder will be sought.

Regional Economics

Target Population. Disposable income among farmers practicing multicrop irrigated agriculture is expected to rise sharply. This is one of the primary benefits of the project (the other is

to contribute to national self-sufficiency in food production). Purchasing of consumer goods should increase, as well as improved nutrition, and a greater interest in nonfarm matters.

At-Risk Population. The value of labor should increase among those who hire out to assist target farmers.

Public Health

Vector-borne Diseases. The project will probably bring with it an increase in mosquito-borne diseases, particularly malaria and dengue fever.

Resource Use

Water: Quantity. A major effect of the project will be the diversion of water from the Tepas River into the irrigation system. The effect of the removal of water from the river will be seen mainly in the reach of the river between the weir and mouth of the Seloto River.

Watering water buffalo will be made more difficult in this reach of the river. Tepas Village will experience shortages of river water during the dry season as there is little tributary addition in the reach between the weir and the village. Shortage of water in the river is expected to lead to the use of canals for many purposes now served by the river. Extensive use of unlined canals, particularly by livestock, can be expected to damage the canals.

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Chapter VII

CONCLUSIONS

The Kalimantong II Project is a simple diversion scheme to provide irrigation water to 2,850 ha, (including 450 ha in the Kalimantong I area). Virtually all of the area is already planted in rice for one or two seasons. The project will boost the service area's cropping intensity, currently 170 percent, to 290 percent.

The Kalimantong II weir will divert water from the Tepas River to the canal system, the sawah, the drains, and then back into the river. The effect of this will be a reduction in the river flow of approximately 3 to 5 m3/s when the project is in full operation. During most of the year, from November through May, this diminution will not be significant, since flows usually are well above 10 m3/s during that period.

During the period July through October, when the average flows of the Tepas River are 3 to 6 m3/s, the diversion of irrigation water of up to 1.9 m3/s for the palawija crop will sharply reduce the water downstream of the weir. This will effectively extend the existing period of extreme low flow, now usually limited to the month of October, to three month's duration, August to October.

In some years, the month of June, which will have a high irrigation diversion demand (3.0 m3/s), may also have low river flows. The effect will be moderated to some extent by irrigation return flows (water satisfactory for bathing and livestock but not for domestic use) and by flows from several tributary rivers.

During October, usually the month of lowest flow, the irrigation system will be out of operation, so without-project conditions will prevail below the weir.

The municipal water system of Taliwang, which draws its water from the Tepas River, will not suffer from the removal of water, since the contribution of tributaries between the weir and Taliwang is two-thirds of the flow at the weir. Thus, even in a dry year, the town will be able to find the 0.02 m3/s that its system requires.

Low river flows will be felt at Tepas Village where there is no municipal water system and little tributary addition in the reach between the weir and the village. However, the left main canal will pass alongside Tepas hamlet and it is expected that the canal will be used for many purposes now served by the river.

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KALIMANTONG II PROJECT

MITIGATION PLAN

The objective of an environmental study is to develop the information necessary for assessing project effects and then to develop a plan to minimize the adverse effects and enhance benefits. Environmental impacts can be considered as falling in two general categories:

1. Unavoidable Adverse Impacts. These are effects, such as the partial loss of river water to downstream users due to diverting water into a canal system, that are inevitable with project implementation and do not lend themselves to remedial actions without compromising the project.

2. Manageable Effects. These are direct or indirect effects, adverse or beneficial, that lend themselves to some sort of actions to improve the situation. Such actions may lessen the severity of adverse impacts or enhance secondary benefits of the project.

Types of Actions

The approach to managing an environmental effect varies with the type and degree of effect, its time and place of occurrence, and the stage of project development at which it is recognized. Ideally, the process of environmental impact assessment is a continuous one that permits midcourse corrections in project planning. More often, an environmental assessment is a one-shot affair, conducted during a prefeasibility or feasibility study, at a time in project development when only superficial changes in project design are possible. In this project, however, sufficient latitude exists to permit planners to address all of the major environmental concerns.

Mitigation actions may be divided into those directed at changing some aspect of the project, such as design, construction method, or operation, and those directed at changing the environment so as to avoid or lessen a project effect or to increase a benefit. Within these two groups of actions, a further distinction may be made between those that must be implemented during project construction, in order to be effective, and those that take place during project operation.

Impacts to be Mitigated

The most serious potential environmental problems associated with this project involve conflicting demands on the limited water resource, especially during the dry season. The

problems are not new to area residents; under present conditions they find it difficult to find water of good quality for domestic purposes during the dry season.

Other potential impacts involve the displacement of livestock, especially water buffalo, from water and grazing, and potential impacts on human health due to increases in disease vectors.

Proposed Mitigation Plan

Overall responsibility for coordinating the proposed Mitigation Plan will be shared by the NTB Provincial Public Works, Water Resources Division, and the Regional Development Planning Board (BAPPEDA). It is recommended that other government agencies be involved in the Mitigation Plan of the project. These agencies include the Extension Services of the Departments of Food Crops and of Livestock, the Departments of Forestry and Health, the National Board of Lands (Badan Pertanahan Nasional, formerly Agraria), the Agrarian Taxation Office (IPEDA/PBB), that part of Public Works responsible for village water supply (Cipta Karya), and regional government (PEMDA) at and below the district level, including the Bupati and Camat, and their delegated staff.

Water Resources

Downstream Water Use: Washing and Bathing. Care must be taken that loss of water in the reach of the river between the weir and the inflow of the Seminar River (a reach that includes the hamlets of Tepas and Beru Villages), does not adversely affect families that are dependent on the river for domestic water during the dry season. Project planners have considered this problem and propose to provide washing/bathing/livestock watering places at locations on the secondary canals near each of the two villages mentioned above. As a matter of coordination, the village residents will be asked to cooperate with the water master to ensure that these facilities are used properly and not abused.

The water provided by the these secondary canals will be of better overall quality than that currently in the river pools at times of extreme low flow, but it will not be pure enough for drinking without boiling. In appearance, it will be clearer than what people are used to (if canal bank abuses are effectively controlled) since the weir pool and conveyance canals will have removed most of the suspended sediments.

Livestock Watering. Even when this alternate water supply is provided for river users of the Tepas and Beru area, the secondary canals, flowing like a new river up to 100 meters from the nearly dry river bed will attract those seeking water for bathing

livestock. Two actions will be required if degradation of the canal is to be avoided:

1. A vigorous program of education must be undertaken, aimed at both adults and young, to instill respect for the canal system and realization that degrading the system is counter to the farmers' own interest. This program must be backed up by strong enforcement, with penalties (probably in the form of labor) for miscreants.

2. A series of pools should be provided to ensure that adequate water is available for livestock under conditions that will not damage the canals. These pools must be more than a token effort; they must be adequate in number, location, and volume to handle the demand for livestock water. Otherwise it will be impossible enforce the ban on canal use.

Quality of Runoff. Speakers at the 1986 and 1988 meetings mentioned the problem of water quality in irrigation return flows, one even going so far as to recommend "treatment". It is technically difficult to remove dissolved solids from water (requiring an energy-intensive distillation process) and the application of a treatment process to irrigation return flows is economically unthinkable. The usual practice, where a river is subject to downstream irrigation demand, is to capture the upstream drainage flow and bypass downstream intakes with a long drainage canal. Since the canal system in the Kalimantong II area will serve the entire irrigable area, there is no economic justification for preventing irrigation return flows from reaching the river.

The argument was raised that downstream water should be kept salt-free so that tambak (fish ponds) could be developed in the estuary area. The argument would have validity if there were aquaculture facilities in existence or under construction, but there are none. Moreover, most of the fertilizer residues in return flows are not salts but nitrates and phosphates, which are beneficial to fish ponds.

We recommend, therefore, that no action be taken to intercept or treat drainage flows, but that long-term water quality monitoring be undertaken (see Part 4 - Monitoring Plan).

Land Resources

Livestock Management. Concern over pre-emption of grazing land by intensified cropping was voiced at the 1986 and 1988 meetings. The problem is, in a sense, insoluble, being a very direct conflict between two uses of limited land resources, both of them providing economic and social returns. Several approaches are possible:

1. Laissez-faire. By letting the grazing problem "solve itself," the government would force livestock owners to seek new fodder sources, legal or illegal, or perhaps to reduce their holdings. Probably some illicit clearing and burning would take place in the catchment nearest the settlements. Some farmers might elect to avoid intensified cropping in order to maintain grazing.

2. Laissez-faire with Enforcement. Under this alternative, farmers would be left on their own to find new grazing lands in the catchment area. This would saddle the Forestry Department with a difficult enforcement program, for which they do not at present have the resources.

3. Development of New Grazing Sources. The provincial or the subdistrict government could develop grasslands on public property and manage them for grazing. To be effective, this program would have to involve the farmers and the local Livestock Department. Users of such land could be charged modest users' fees, which could be used to pay the costs of pasture management.

4. Comprehensive Livestock Management Program. Obviously, the most desirable alternative is a program that will integrate livestock maintenance with the overall agricultural and forestry program. This would require a joint effort by several departments to evaluate the farmers' changing needs for livestock, the economic, social and ecological burden imposed by the animals, and the means of obtaining new fodder sources (or enhancing existing ones) and of achieving voluntary herd reduction, if the latter is found to be needed.

The last alternative, is the most desirable from a long-term planning viewpoint. The Livestock Department should have inputs to project planning beyond its functions of monitoring livestock numbers and providing extension assistance. Community education and development of a community enforced grazing land and livestock watering policy should be the responsibility of LP3ES and Public Works, and assisted by the Departments of Agriculture (Food Crops) and Livestock.

Biological Resources

Catchment Management. Despite remarks by the PU spokesman (at the 1986 Scoping Session) that the management of the catchment area is not a responsibility of the irrigation managers, there are cogent reasons for those managing the project to be interested in the upper catchment. Foremost among these is that extensive forest clearing would result in a sharp increase in erosion and therefore in siltation of the weir pool and canals.

There probably are few actions that PU alone can take to regulate deforestation of the catchment area, other than preventing the use of the project access road by illegal woodcutters.

The NTB Forestry Department and the Bupati of Sumbawa District should be alerted to the need for protecting the Kalimantong II catchment area, so that serious deforestation can be detected and corrective measures taken.

Socioeconomic and Cultural Resources

Hiring of Local Labor. The hope was expressed at the 1988 meeting of agencies that the construction of project facilities would utilize local laborers, rather than bringing in construction labor from Lombok, as is the prevailing practice. There are certain advantages to hiring local farmers to build the irrigation system:

1. By working on the weir and canals, farmers gain an understanding of the system. Some of them may subsequently be hired to maintain or operate the system.

2. Working on a project develops a sense of possession in the worker, a sense of pride of accomplishment that is reflected in respect for the completed systems. This helps to reduce abuses to the system that are more apt to occur when the project is simply installed from "outside".

3. Hiring locally provides an economic boost to the area, often through members of the at-risk population, who are more likely than the target population to have labor time available.

The difficulty with utilizing local labor is that many of the farmers are unskilled in stone masonry or concrete construction and contractors are unwilling to train new crews. Nevertheless, we recommend that the project specifications require bidders to utilize local labor for unskilled tasks, such as excavating and shaping canals, and the resident engineer be instructed to assist the contractor in seeking out local laborers.

Services and Infrastructure. Improved living standards, more economic opportunity and a larger population will increase demand for services and infrastructure (schools, health clinics, roads, transport and markets). Some medium- and long-term planning activities are needed if services and infrastructure are to keep pace with irrigation components of the project.

BAPPEDA, Tk II should work together with the Departments of Education, Health and District Public Works to develop local medium- and long-term plans. The Bupati of Sumbawa District and area government (PEMDA) would play an important role in

ascertaining the need and timing for any increases in services and infrastructure, and coordinating various development plans in the Kalimantong II area.

Farming Systems. Improvements in irrigation of the Kalimantong II service area will lead to increased demand for agricultural extension services. The Department of Agriculture (Food Crops) will work together with Public Works, PEMDA, LP3ES and local farmers to shift to cropping patterns that maximize returns with the secure agricultural water supply. The Department of Agriculture should incorporate the need for increased agricultural extension services into its new five-year plan (PELITA V). This whole process is likely to require several decades. During this time it is likely there will be increased demand for cooperatives and extension of credit for technical inputs.

Land Classification, Land Values, and Land Ownership. With the advent of agricultural intensification upon completion of irrigation construction, it is expected that the irrigated service area land will be reclassified to a higher value. Land values will probably increase even before the irrigation system is completed. It is expected that some farmers will seek to acquire certificate title to their land. It may be that the government will organize a special land survey so that the whole service area will be converted to the modern land title system.

Land Taxes and Water User's Fees. The government should expect to receive an increase from land taxes once the value of the irrigated area has been increased. If water users' fees are eventually initiated, the government can expect to receive an increase in operation and maintenance funds from this source.

Organizing Water Users' Associations and Irrigation Committees. Conversion of the service area to operation under one irrigation system will require a higher level of organization than currently exists among local water users' associations. Local farmers will also have to work more closely with local government to operate and maintain the system. The Department of Public Works has contracted the non-governmental organization, LP3ES to assist in this process.

Public Health. Changes in surface water distribution and the attendant possibility of increases in mosquitoes will require a program of malaria and dengue prevention on the part of health authorities, if increases in the incidence of the diseases are to be avoided. Any such program should be tied in with a program of public education and local mosquito control. When informed about malaria and dengue and given the impetus for action, many rural people respond positively. The additional cash flow in the service area should enhance the ability of people to purchase the inexpensive chemicals needed for mosquito control.

In addition to increased risk of mosquito-borne diseases, the risk of an increase in other water-related diseases will depend on how the population uses water from the canal system. The Department of Health, through its regular PUSKESMAS clinics and its various infant-child health programs should educate mothers, in particular, about the importance of boiling water and inoculating children against preventable water-borne diseases.

Post-Construction Report

A report should be prepared after construction of the project is completed. The report should be a detailed description of the monitoring and mitigation measures recommended, and a designation of the responsible agencies for each task. The report should be distributed to the agencies involved, and should be reviewed after a year or two of operating experience, and revised as may be necessary.

Mitigation Plan Components: Timing and Costs

While Public Works will construct the "water resources" mitigating structures as well as provide any possible clearing of vegetation from the reservoir site, other government agencies, as mentioned above, will be principally responsible for their own extension programs and ongoing activities. In most cases programs and extension services (see Figure MI-1) should commence about the time the irrigation system is constructed (beginning about November, 1990). It is expected that construction of the irrigation system will take about 18 months to complete (May 1992). By this time there should be a livestock management plan, a catchment area management plan, and a public health plan in place.

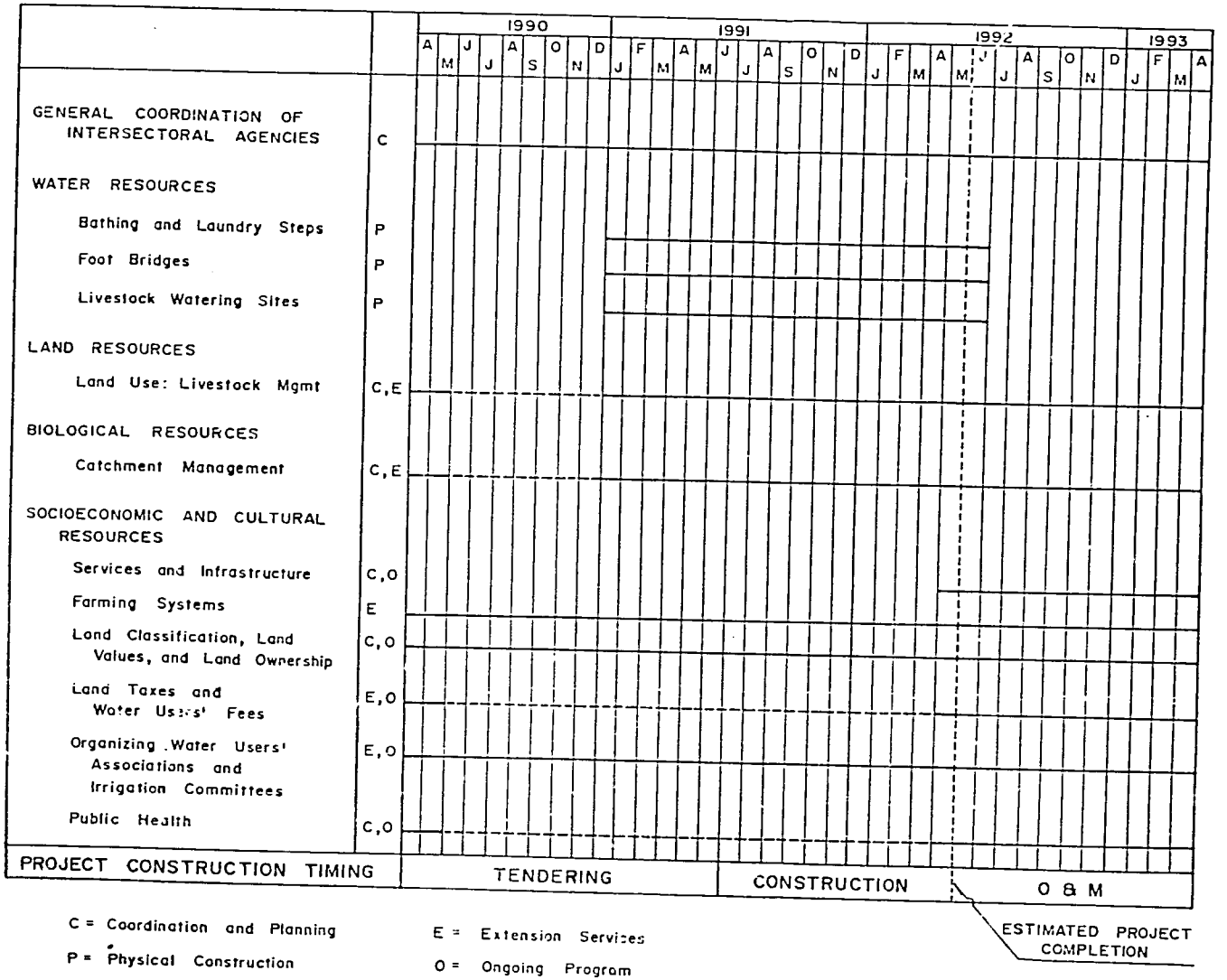
It is expected that any increases in services and infrastructure will be gradual, and probably occur after 1992. It is expected that changes in land classification, land values, land ownership, land taxes and possibly an initiation of water users' fees will occur after farmers have had several harvests to adapt to intensification.

The organizing of water users' associations and irrigation committees will probabl commence in the first quarter of 1990 when the non-governmental organization, LP3ES, works with PU staff, local government, and the existing water users'. associations.

Table MI-1 summarizes the estimated costs of the mitigating activities. Those costs borne b the Department of Public Works have been factored into the costs of construction of the project. In the cases of costs for other government agencies, most of the recommended mitigating activities should incur no special costs and should come under regular operating costs.

The exception to this is the case of catchment management, where it is anticipated that Rp 5 million be spent every year. Also, is the National Board of Lands decides to commence a land titling program, there will be special costs, only part of which will be borne by the farmers themselves.

Figure MI - 1



C = Coordination and Planning

P = Physical Construction

E = Extension Services

O = Ongoing Program

SSIMP - KALIMANTONG II
MITIGATION PLAN COMPONENTS
AND ESTIMATED TIMING

Table MI-1

MITIGATION PLAN COMPONENTS AND ESTIMATED COSTS

Item	Participating Entities	Estimated Cost (Rp)
General Coordination of Sectoral Agencies	BAPPEDA, Tk II and district government	No Special Cost
Water Resources:		
Bathing and Laundry Steps in Canals (Rp 50,000/unit x 21)	Public Works, NTB Province	1,050,000
Livestock Watering Sites in Canals Rp 2,307,336/unit x 10)	Public Works, NTB Province, and Extension Services of Agriculture (Food Crops) and Livestock	23,073,360
Foot Bridges Over Canals (Rp 1,391,215/unit x 14)	Public Works, NTB Province	19,477,010
Land Resources:		
Land Use: Livestock Management for establishing pastures/ fodder sources, and number of cattle	Departments of Livestock and Forestry, assisted by Public Works and LP3ES	No Special Cost (1)
Biological Resources:		
Catchment Management	Bupati and Camat, Public Works, NTB Province, Department of Forestry, and assisted by LP3ES	5,000,000 every year (2)
Socioeconomic and Cultural Resources:		
Services and Infrastructure	BAPPEDA TK II, and district government	No Immediate Costs (3)
Farming Systems	Department of	Regular

	Agriculture (Food Crops), with Public Works assisting	Operating Costs (4)
Land Classification, Land Values, and Land Ownership	National Board of Lands (Badan Pertanahan Nasional) and Agrarian Taxation Office (IPEDA/PBB), with district government	Special Costs (5)
Land Taxes and Water Users' Fees	Agrarian Taxation Office, National Board of Lands, district government, and Public Works	No Special Costs (6)
Organizing Water Users' Associations, and the Irrigation Committee	Public Works, NTB Province, Agricultural Extension Services, and assisted by LP3ES	No Special Costs (7)
Public Health	Department of Health	Regular Operating Costs (8)

Notes to Table MI-1:

(1) This assumes establishing a land use and grazing policy, and controlling the number of livestock, as part of the community development program. This would occur while the water users' associations are being organized. Inputs from the Departments of Livestock and Forestry would consist of their normal field staff attending village meetings.

(2) This assumes a cost of Rp 1 M for satellite photographs every year; 1 month salary of Rp 2 M for a watershed management specialist to interpret photographs, make a visual inspection of test sites, and prepare a report. Rp 2 M reserved for miscellaneous expenses (travel, report preparation, etc.).

(3) Regional government is expected to follow development and to increase numbers of schools, health clinics and other services as the population increases. No immediate costs are envisaged.

(4) Development of new irrigation is usually accompanied by an intensification of agricultural extension services. Increased extension services staffing should occur.

(5) Survey of the land and the necessary administrative costs of providing certificated title to land would partially be borne by the farmers and partiall by the respective agencies involved in this task.

(6) Increased revenues from land tax collection would result, but the system for collecting land taxes is already in place. Collection of water users' fees would presumably be shared by the water users' associations and existing tax collecting systems.

(7) Costs for the LP3ES contract with Public Works is covered by GOI/USAID project costs.

(8) The Department of Health should monitor development and adjust their programs and services accordingly.

PART 4

MONITORING PLAN

KALIMANTONG II PROJECT

MONITORING PROGRAM

General Considerations

Environmental monitoring is one of the most difficult components of project development to accomplish. Although continued data gathering is a logical follow-on to the environmental program during planning, design, and construction, and may be mandated by law (as it is Indonesia), operating agencies seldom are receptive to the idea of further studies. The reasons for this reluctance are not difficult to identify:

1. Whereas project design and construction often are funded from exterior sources, the local government bears the burden of operating costs. The local agency rarely is able or willing to allocate funds to what its managers see as an unproductive program.

2. The operating agency usually has its expertise concentrated in the area of its primary responsibility (e.g., agriculture) and lacks expertise in some of the areas required for environmental monitoring.

3. Administrators tend to dislike "open-ended" programs that do not relate directly to the primary mission of their agency.

4. Environmental monitoring programs tend to impinge on the spheres of responsibility of several agencies (e.g., livestock, forestry, fisheries, public health), and so tend to inflame interagency jurisdictional disputes.

Some of the above factors may be absent in NTB Province and Sumbawa District, but one must anticipate that some parts of the proposed monitoring program will encounter resistance on the part of responsible agencies. The program proposed is a minimal one, however, that will provide data useful for integrated resource management in the project area.

Proposed Program

Water Quality

Program Objective. The purpose of the water quality monitoring program will be to ensure that project-induced changes in flow, land use, and agriculture patterns are not causing water quality changes that would operate to the detriment of human health or pre-empt other water uses.

Location. Nine to ten sample sites should suffice for this, including at least the following:

1. At the headworks of one of the main canals (the right and left main canals are assumed to receive the same water).

2. In the canal immediately above the hamlet of Tepas Village.

3. In the Tepas River 50 m downstream of Tepas.

4. At the headworks of the Kalimantong I weir.

5. In the Tepas River immediately upstream of its confluence with the Kalimantong River.

6. At the intake of the Taliwang water system (not to be sampled if the Taliwang water authority already has a regular water testing program).

7. In the Tepas River immediately upstream of the inflow from Taliwang Lake.

8. In the Tepas River immediately downstream of the Lamonga River.

9. At the outfall of the largest drainage canal of the Kalimantong II service area.

Methods and Equipment. A competent water quality laboratory, such as that of the University of Mataram, will be needed for analyses. Field meters should be used to measure electrical conductivity, pH, and dissolved oxygen. A hand thermometer will suffice for temperature readings. It would be advisable to establish a staff gauge at each site, in order to obtain flow measurements.

Standardized data sheets must be used for recording all field data, including conditions at each site, flow, and personnel, as well as, the analytical data for the sample. Parameters to be analyzed should include total suspended solids, sulfate, nitrate nitrogen, ammonia, phosphate phosphorus, salinity (expressed as chloride ion), alkalinity (expressed as calcium carbonate), and fecal coliform bacteria. We do not advise analyzing for pesticide residues, unless there is known use in the area of a chemical that leaves significant residue in runoff, or there is some clinical manifestation of pesticide poisoning.

An attempt always should be made to determine flow at each site, even if it is only a general estimate. If a staff gauge is present at the site, its reading should be recorded at the time of sampling.

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Schedule. Water quality should be tested during the wet season and the dry season of every third year. The sampling should be coordinated with other environmental monitoring (e.g., land use), in order to establish linkages in the system.

Implementing Agency. It is recommended that the Department of Public Works assume primary responsibility for water quality testing, although it may wish to contract out the required testing of water samples.

Land Use

Program Objective. Monitoring land use changes in the project area will serve to alert planners to adverse impacts of the project on the resources of the catchment and changes in the catchment, not caused by the project, which may affect the success of the irrigation system.

Location. Land use should be monitored throughout the catchment area, but especially in the catchment above the Kalimantong II weir. A parallel study may be undertaken in connection with the management of the Seteluk River-Lake Taliwang system. If so, it should be combined with project area studies, in order to achieve economies of scale and comparability of results.

Methods and Equipment. Aerial photography and satellite imagery are the usual tools for land use studies, and the latter is the only economical means of repeated study unless the catchment is being flown for other reasons. Satellite imagery is available as computer data and, in time, processing facilities may become available in Mataram.

It will be necessary to establish 10 to 12 study plots (a total of about 25 ha) that can be visited periodically on foot in order to verify the reflectance patterns of land use types. The plots should be thoroughly photographed on the ground at each visit, for comparison with the satellite images.

Equipment for this program will depend on the data source and what facilities are available. If prints of the satellite images are used (usually in false color infrared), most of the plotting of land use can be done by hand.

Schedule. The survey should be conducted annually, with field checking at least every third year. The frequency of field checking will depend largely on the degree of personnel continuity achieved.

Personnel. A trained remote sensing specialist with expertise in watershed management should plan and supervise this program. As the value of these data in land management and agricultural planning becomes more appreciated, Indonesian agencies are likely to acquire trained specialists in this field.

Implementing Agency. It is recommended that the Planning Section (P#SA, NTB) of Public Works in NTB Province be principally responsible for overall coordination of watershed protection, but that it work closely with the Department of Forestry, and local government (PEMDA).

Biological Resources

Objectives. Monitoring of biological resources will be performed on an as-needed basis, i.e., when a problem of an ecological nature, such as an outbreak of insect, rodent, or bird pests, occurs or there is reason to believe that project activities are affecting biological resources. The objective of such a study program would be to evaluate the problem, identify causes, and develop solutions.

Location. Biological resources in any part of the catchment could interact with the irrigation project, but those of the upper catchment are of greater interest from a conservation viewpoint. Pest problems may be expected anywhere in the agricultural production system, from planting to storage and marketing.

Methods and Equipment. Each sort of ecological monitoring problem will require its own methods and equipment. When a problem arises that requires surveillance, the program must be tailored to that problem.

Schedule. Care should be taken that monitoring of a biological resource is not terminated too soon to evaluate the effectiveness of solutions applied to the particular problem.

Personnel. Some ecological problems that may arise will require highly specialized knowledge. Assistance for such problems should be sought elsewhere in Indonesia, or outside the country if no expertise can be found in Indonesia.

Socioeconomic Resources

Integration of Local and Regional Planning. Any program of environmental monitoring of socioeconomic conditions would serve only to supplement the analysis of project effectiveness which will accompany this development on a long-term basis. It is assumed that the sub-district Agriculture Department will monitor agricultural production and support systems so as to ensure project effectiveness and correct any shortcomings that may arise. The project staff also should be aware of peripheral problems arising from water use, land use changes, or economic changes. The effects of upgrading the agricultural system will be so profound, in terms of income and lifestyle of the target population, that adjustment may have to be made in another sector of the local economy. The sub-district, district and provincial government must be alert to increased demand for health services, schools, transportation system changes, and the

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need for electricity at the local level, in order to integrate the irrigation project into regional development. Presumably BAPPEDA will act as lead agency in this regard.

No special studies are envisioned to monitor the socioeconomic conditions, beyond those already in place among local agencies, but it is hoped that the accumulated data will be examined periodically to evaluate cause-effect relationships among the complex network of social and economic elements.

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A P P E N D I C E S

APPENDIX A

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APPENDIX B

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APPENDIX C

RECORD OF SSIMP ENVIRONMENTAL SCOPING SESSIONS HELD IN MATARAM IN JULY 1986

Note: This record was prepared by USAID/Jakarta shortly after the July 1986 scoping session. Some rearrangement of responses to questions has been done, in order to bring similar topics together. In addition, the editor, who is also the Project Environmental Scientist, has added his own comments on some of the statements made by the meeting participants.

Introduction

In general, the purpose of an environmental scoping session is to sensitize the project participants to environmental concerns and to identify potential environmental problems that should be studied in greater depth. The results of the scoping sessions and the follow-up studies are then used throughout the project cycle for planning and management purposes, particularly with regard to efforts to ensure project sustainability. From 21 through 25 July 1986, USAID/Jakarta held its first joint USAID/GOI environmental scoping session. The session was for two SSIMP sites, Kalimantong II and Tiu Kulit, in NTB Province. Because neither USAID nor the Indonesian agencies involved had any prior experience with environmental scoping sessions, a major goal of the session was to make the scoping process familiar to all the planning agencies involved.

The NTB session was attended by representatives from several Indonesian agencies, including the provincial PU, BAPPEDA Tk. I NTB, Agricultural services, Education & Culture, Agraria (now called Pertanahan), Forestry, Fisheries, Transmigration, Rural Development ("Bangdes"), PSL-UNRAM, BKSA, Health, and Husbandry. At the national level, there were representatives from PU.

The official session began on Thursday, 24 July, with Mr. Hamid, from Ketua BAPPEDA, giving the opening ceremonies. Next, Mr. Newman, from USAID, talked about current SSIMP program activities and gave a brief introduction on environmental problems in irrigated agriculture. Following Mr. Newman was Mr. Suhartono, from PU/Pusat, who explained the new GOI policy regulations (AMDAL), a policy change that requires project analysis of environmental, as well as technical, economic, and management issues. Next, Mr. Philley, from USAID/W, explained the rationale, goals, and procedures for the environmental scoping session. Finally, Mr. Karta briefly described the key features of the projects, such as the total area to be irrigated, the size of the affected population, etc.

After a short break, Mr. Fauzi from BAPPEDA Tk. I, read the agenda, and Mr. Rustam, from PU/Pusat, led the discussion of topics.

I. Land Resources

A. Soils and Land Capability
B. Salinity/Alkalinity and Waterlogging
C. Soil Erosion in Catchments
D. Sedimentation in Irrigation Reservoirs
E. Construction and Land Clearing

Questions/Statements and Answers

1. Education & Culture: What will be the impact of flooding?
Will it decrease salinity?

Response: The impact of a reservoir is on the shallow water table. Through the capillarity of the soil, the salt will reach the root zone area and cause salinity problems. (Mr. Rustam, PU/Pusat).

2. PSL-UNRAM: Erosion may be a problem, especially at the embung (reservoir). We need to mitigate it. Have we planned the actions?

Response: Erosion in Tiu Kulit is estimated at 0.5 mm/yr. In 25 years, it will be 600,000 m3. In the reservoir design, there is 600,000 m3 of dead storage to trap this sediment. Monitoring the system will be important in the future. (Mr. Karta, P.U./NTB).

3. Agraria: Land acquisition: public interest sometimes becomes a problem for us (Agraria).

- We hope to have enough time, 6 to 12 months, for land acquisition before construction starts.

- Land compensation is not always money; sometimes it is other lands or other houses.

- Site permit and other permit problems should be handled far in advance.

Response: There will be no land acquisition for the Tiu Kulit reservoir, just for the (support) systems. (Mr. Karta).

4. Transmigration: There will be a resettlement program in 1986/87 for 1,000 families in the Tiu Kulit area. Can they get benefits from this project? The site is in Labangka, in Sub-district Plampang.

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Response: The location of the resettlement (Labangka) is about 20 to 25 km away from the project site, so they will not get any benefit, except for increased employment opportunities as farm laborers.

5. Health: Sumbawa is proposed for livestock development. What kind of structures are suitable for this proposal so that cattle will not damage the structures?

Response: Not answered.

6. Agriculture: Soil conditions: At the beginning of the project, evaporation is high, so the water requirement is around 2.2 l/sec/ha, up to 4 l/sec/ha. Has PU planned the tertiary system? If the soil is porous, it (the tertiary system) will need lining. The goal is for the farmers to start benefiting as soon as possible.

Response: Not answered.

7. In PELITA IV there is 3,375 ha of critical land; 2,700 ha will be conserved in Sub-district Plampang. Tiu Kulit is located in the Moyo catchment.

Efforts to mitigate erosion:

- Use multicrop system.

- For conservation, build debris-dams and farmers dams.

Response: Information only (NAN). (What does this mean? Presumably that no response is required - Ed.)

8. Forestry: In the upstream area of the reservoir there are three kinds of forest:

- Forest preserve.

- Unanimous (?) forest, part for preserve, part for production.

- Limited production forest.

9. PSL-UNRAM: We need special techniques for land clearing in order to preserve water quality.

Response: Only selective clearing will be done, due to funding limitations.

II. Water Resources

A. Streamflow Characteristics

B. Drainage

C. Water Losses and System O & M

D. Water Quality

Questions/Statements and Answers:

1. Fisheries: Regarding water quality, it is hoped that the Tiu Kulit reservoir will not be like Lake Taliwang, where long ago the flooded area was thousands of hectares, but now only 800 ha.

   (Editorial note: The statement that Lake Taliwang once covered "thousands of hectares" is incorrect. The drainage basin of the lake is only about 8,000 ha, and the lake level was controlled by an natural sill until the installation of the present control weir. The water surface probably never has greatly exceeded 900 ha. (See the 1981 FENCO report.)

   - For development of fishponds along the seashore of 1,200 ha, we need fresh water to neutralize the salinity of water that comes from the drains.

   - Regarding pesticide impact, since the distance from the seashore is large enough, the impact is small. Moreover, because the supply of fresh water is not needed often and the amount of seawater is large, the fisheries will not be affected.

   Response: See following statement and comments following.

2. Agriculture: The concern that pesticides and fertilizers will contaminate water used for fishponds is small; the use of fertilizer is only 300 kg/ha, or 30 gm/m2. Furthermore, because farmers dry the rice fields for three days after applying fertilizer, the fertilizer has already been absorbed into the soil by the time it is irrigated.

   Response: None. (Editorial comment: If this were true, the presence of fertilizer in agricultural runoff would be rare, but such is not the case. Lake Taliwang is a striking example of the effects of nutrients derived from irrigation return flows.)

Concerning pesticides, the Department of Agriculture uses an integrated system where pesticide is used as a last resort only. (The question of pesticides is a valid one. The amount used ofter exceeds the "correct amount". Moreover, pesticides often enter the ecosystem by means other than spraying, eg. spills, washing of equipment, etc.)

3. PU/Pusat: Regarding salinity, we need a monitoring program to detect whether or not there is a problem.

   Response: None.

4. PSL-UNRAM: We need a system to treat drainage water, especially during the dry season, when salinity is high, because the flow is too low. Furthermore, crops planted during the dry season use less water, causing the salt concentration to rise.

   Response: None.

Comments by project staff: Although there were no specific responses to the remarks above, some explanations were offered.

1. Mr. Karta: The functions of the reservoir are:

   - To ensure the water supply during the first growing season.

   - To irrigate only, not to be involved in upstream water management. (Editorial comment: This statement suggests a belief that the reservoir operates in isolation from the basin that provides its water.)

   - If there is enough water during the dry season, it can be used to grow second crops and to provide domestic water.

2. Mr. Menninger: There will be enough water to grow secondary crops and for domestic water, because to grow two crops of paddy there need only be 5 million m3 when 70 ha is flooded. Previously, when 100 ha was to be flooded, we needed 6.6 million m3.

   We need to protect Simu village, located on the Tiu Kulit River, from flooding during the rainy season, considering that the dam is 23 m high. (Editorial comment: This concern over flooding at Simu is misplaced, unless he is speaking of a failure of the dam. Simu is located just downstream of the junction of the Tiu Kulit and Maronge Rivers. The dam and its reservoir, upstream of the village, will alleviate the flooding problem somewhat, storing some flood water and reducing the flood peak. There is no practical way to

protect the village from a dam failure other than a warning system.)

3. Mr. Karta: Regarding the O&M system, there is none yet, but the operation will be the same as the regular irrigation system, combined with gogo-rancah. No maintenance problem has been foreseen so far, but the reservoir will require further study.

III. Biological Resources

A. Critical Habitat for Threatened or Endangered Species

B. Fisheries

C. Biomass in the Impoundment

D. Water Weeds and Pests

Questions/Statements and Answers:

1. Agriculture:

- If the system is for dry-paddy (gogo-rancah), it does not need irrigation.

- Water Weeds: During the dry season there is no water, so it is not necessary to worry about water weeds.

- Pests: With the increase in cropping intensity, there will of course be an increase in pests.

Response (PSL-UNRAM): We disagree. Gulma (water weeds) and grazing land still need to be considered.

2. Education & Culture: Agriculture and farming systems in Sumbawa are closely related. For instance, buffalo are used for working in the fields and for transportation. Therefore, we should take into account the following:

- We need to gather data on farming and environmental patterns.

- We need new grazing land to substitute for land lost to irrigation, in order to protect the watershed from cattle.

- Animals that live in the reservoirs/dams/canals, such as crabs, can damage the structures.

Response: None.

KSDA (Konservasi Sumberdaya Alam):

- Deer and pythons should be protected from the villagers.

- The project development will invite other types of birds to the project. Please protect the birds.

- Specifically protected trees: Sawo kecik and gaharu.

Response (PSL-UNRAM): There is no problem with deer or python in the project area.

4. BKLH:

- With project development, grazing land will be lost.

- When land clearing, do not burn the trees; it can disturb the area around it.

- Deer need to be protected, especially during the implementation stage.

Response: See response to 3, above.

5. PU/Pusat: We need to take into account the migration of people into the watershed area.

Response: None.

6. PSL-UNRAM: Responses to 1, 3, and 4, above.

7. Agriculture: We need to identify critical lands and give guidance to farmers on how to use such lands, including grazing land.

IV. Environmental and Public Health

A. Water-borne Diseases

B. Agro-chemicals

C. Livestock Diseases

Questions/Statements and Answers:

1. Health:

- The prevalence of malaria will increase and must be considered.

- Endemic (Enteric? Ed.) diseases also will increase.

- There is no schistosomiasis in the project area.

Response: None.

V. Socioeconomic Factors

A. Settlement

B. Social Organization

C. Farming Systems

D. Community Participation

Questions/Statements and Answers:

1. PU/Pusat:

- Regarding cropping patterns, we need to give the farmers guidance in changing the system from dry/ rainfed paddy to an irrigated system.

- Land-farming (?) for dry-land area.

- Is land ownership spread equally?

Response: None

2. Fisheries:

- We need a constant water supply to grow fish in the rice fields (three months).

- Fishponds need a freshwater supply for 1,200 hectares.

Response: None.

3. PSL-UNRAM: (Important) activities during project construction:

a. Before construction:

- Land acquisition. We need to confirm with Agraria that the land belongs to the government.

b. During construction:

- Labor/workers: availability and absorption

- Communication.

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c. After construction:

- Resettlement, due to: labor; development of the project area; good roads.

- To stimulate the farmers' sense of belonging:

- Make a demonstration plot for water management at the tertiary level.

- Prohibit land speculation during land acquisition.

- Minimize the impact on the farmers' way of life.

Response (Agraria): There will be no problem with land acquisition, because it will be used in the public interest and there are land laws and records that show peoples' rights to the land.

4. Bangdes: We need to develop the settlement area.

Response: None.

5. Agraria:

- There are no problems for the development project.

- The camat prohibits the shifting cultivation system.

- We need to carefully examine land status, due to the tanah; after 2-5 years of cultivation, it is left fallow.

Response: None.

VI. Cultural Property

A. Archaeological, Historical, or Religious Sites

B. Esthetic or Natural Values

Questions/Statements and Answers:

1. Education & Cultural: So far, there is no problem at these sites, except for a cemetary that must be protected from negative impact.

Response: None.

2. PSL-UNRAM: There is one small lake in the upstream area of the Tiu Kulit project that is used by a horse-healer for a ceremony. Horseracing is a common sport in Sumbawa, and to make a horse the winner, people use a horse-healer.

Response: None.

VII. Conclusions: Tiu Kulit. (Refer to the ESS check-list)

1. Land Resources

   A. We may need further detailed soil analysis.

   B. Do not need analysis, only monitoring.

   C. Do not need analysis, only monitoring, management, and mitigation.

   D. Need only monitoring.

   E. We need analysis to determine where to get borrow material for construction. We need to be selective in cutting for land clearing.

2. Water Resources

   A. We need an environment l assessment.

   B. We need an environmental assessment, including flood control.

   C. We need an environmental assessment, an O&M manual for the reservoir, and a plan for the use of water over time.

   D. We need an environmental assessment and an analysis of the impact of drainage water on the seashore and mangrove.

3. Biological Resources

   A. No conclusion.

   B. We need an analysis with inventory.

   C. No conclusion.

   D. We need an analysis with inventory, as well as a monitoring plan and mitigation of water weeds.

4. Environmental and Public Health

   A. No conclusion.

   B. Need analysis.

   C. No conclusion.

5. Socioeconomic Factors

A. No conclusion.

B. No conclusion.

C. Integrated with site profiles.

D. Integrated with Co-Management system.

6. Cultural Property

A. Do not need analysis, only inventory.

B. Monitoring is necessary during construction, whether there is cultural property or not.

VIII Conclusions: Kalimantong II

1. Land Resources

A. No conclusion.

B. No conclusion.

C. Need analysis.

D. No conclusion.

E. For construction period, need analysis; for land clearing, no problem.

2. Water Resources

A. We need an analysis of forest status, because part of the watershed forest is designated limited production forest.

B. We need an environmental assessment, including flood control.

C. We need an environmental assessment.

D. No conclusion.

3. Biological Resources

A. No conclusion.

B. No conclusion.

C. We need an environmental assessment.

D. No conclusion.

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4. Environmental and Public Health

A. We need an environmental assessment.

B. No conclusion.

C. No analysis needed; only monitoring. Wait for information about animal diseases from Animal Husbandry Service.

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APPENDIX D

RECORD OF SSIMP ENVIRONMENTAL BRIEFING HELD IN SUMBAWA BESAR ON 26 MAY 1988

Background

In April-May 1988, the Project Environmental Scientist visited NTB to assess needs and propose methods and schedules for conducting the environmental studies for two SSIMP projects: Kalimantong II Weir and Tiu Kulit Dam. A draft outline was prepared for the Environmental Assessment Reports. Discussions were held with the University of Mataram Environmental Studies Center (PSL), which agreed to participate in the environmental baseline studies.

In early May, the Project Environmental Scientist, the head of PSL, and a USAID Program Specialist traveled to Sumbawa to visit the two project areas. They were unable to arrange a meeting with representatives of the locally concerned agencies, as hoped, so the meeting was delayed until 26 May 1988. A record of the meeting is presented below.

Introduction

The purpose of the environmental briefing in Sumbawa Besar was first to inform the local agencies of the plans and progress on the Kalimantong II and Tiu Kulit projects, and then to identify any environmentally sensitive topics which should be addressed during the course of the SSIMP studies. The scoping session for these projects was held in Mataram in July 1986, with limited participation by the local Sumbawa agencies.

A copy of the environmental briefing agenda is given in Appendix E; the list of participants is shown in Appendix F. After the introduction and overview of the projects, the discussion followed the checklist topics as shown on the agenda. Questions or comments on each topic were made by the local agency representatives followed by response from the P.U. NTB Project Managers, head of PSL, and SSIMP NTB Team Leader. The discussion first covered the Tiu Kulit Project and then the Kalimantong II Project. A summary of the discussion follows.

Discussion on Tiu Kulit Project

I and II. Land and Water Resources

- From Tax Office (IPEDA Dinas Luar):

  Will the Tiu Kulit Dam Project supply an area of 3000 hectares?

  Response from Project:

  The Tiu Kulit Dam Project capability is just calculated for a maximum 1600 hectares.

- From Agricultural Department Office:

  The existing local weirs on Tiu Kulit River irrigate an area of 815 hectares with a planting intensity of 200 percent. Will the planting intensity be raised to 300 percent?

  Response from Project:

  The Tiu Kulit dam is planned to supply irrigation water for an area of 1520 hectares with a plant intensity of 200 percent.

- From Local Development Office:

  How will the balance of available water be used in the dry season?

  Response from Project:

  The available water during dry season is expected to be used for palawija cultivation.

III. Biological Resource

- From Fisheries Office:

  Fresh water supply is needed for a fish pond in tidal area. Fresh water should be used not only for irrigation but also other forms of food production such as fish culture. Will the project supply water to existing fish pond?

  Response from Project:

  The Tiu Kulit Dam Project is designed to sustain paddy in the first planting season and, if possible, to support palawija in the second planting season. Calculation of water requirements for the fish pond has

not yet been undertaken, but the possibility will be studied.

IV. Environmental and Public Health

- From the Head of PU, West Sumbawa:

  Excessively detailed environmental assessments are not necessary for these projects.

V. Socioeconomic Factors

- From the Head of Plampang Sub-district:

  The people in Plampang look forward to receiving the benefits of the embung as soon as possible. We must developed the awareness of the people about the embung construction. Are all land acquisition costs paid in the water storage area?

  Response from Project:

  There will be no land acquisition costs for government land, nor the tertiary canal system.

- From District Government Office:

  No free land can be used for the project area, especially for water storage, without land acquisition.

  Why did not the project get money for land acquisition while for the Kalimantong II project and Mamak water storage project there are land acquisition (allocations)?

VI. Cultural Property

- No discussion.

Discussion on Kalimantong II Project

I and II. Land and Water Resources

- From Head of PU, West Sumbawa:

  There has been some information concerning the Kalimantong II project supplying water to the Taliwang Lake, which when raised could supply water to land in Seteluk District for use by a sugar cane plantation. If the lake is raised, what would be the impact to the existing road?

  Response from Project:

  The plan to raise the level of Taliwang Lake is still in the feasibility study.

III. Biological Resources

- No discussion.

IV. Environmental and Public Health

- From Forestry Office:

  The project location (and catchment area) lies in Preserve Forest, limited Production Forest, and Social Forest. The weir site is located in Social Forest area but is not expected to have negative impact on forest productivity.

  The catchment area should be protected against wood cutting to save water resources. The Forestry Office has some programs to reduce erosion in the upstream areas, i.e., the Reforestation Program

V. Socioeconomic Factors

- From Local Planning and Development Board (BAPPEDA):

  Will local labor be used in project construction, and if so, we hope the project will propose some training.

  Response from Project:

  The project will principally use the local labor force.

  Response from Head of PU, West Sumbawa:

  It would be better to use local labor.

From Lands Office (Agraria):

We have some problems with land acquisition because private land and ownership data are not available. A schedule for land acquisition should be made.

VI. Cultural Property

- No discussion.

Summary by Ir. Kartabrata:

Some project matters should be studied in detail, examples:

Conflicting interests for water and land resources.
Land acquisition.
Erosion and Sedimentation.
Labor, qualifications, and resources.
Socioeconomic issues.
Resettlement.
Diversified water use; example: electric power generation.

LIST OF SCOPING SESSION PARTICIPANTS
TIU KULIT AND KALIMANTONG II WEIR

Sumbawa, May 26, 1988

Name	Profession/position	Organization
Provincial		
01. Kartabrata	Irrigation	PU. NTB
02. Wahju Djoko M.	Irrigation	PU. NTB
03. Sudanta	Embung Project	PU. NTB
04. Djoko Prakoso	Kalimantong Project	PU. NTB
05. Abdullah MT.	Head of Environmental Center (PSL)	Mataram University
Harza NTB		
06. Jeffery Frey	NTB Team Leader	Harza
07. Robin B. Erickson	Agro Econ. Consult.	Harza
Regency		
08. M. Rabil	--	Village Development
09. L. Mudahan	--	Village Development
10. Alimuddin Nur	Head District	Plampang
11. Agil Husein	--	Food Crop Services
12. Sustomo	Acting Head of Agrarian	Agrarian
13. Soedirman	--	Forestry Services
14. Gufranuddin H.	--	Plantation Services
15. M. Noer Tala	--	Health Services
16. Arman A. Hamid	--	Fishery Services
17. Edy Mokhtar	--	Sumbawa Office
18. P.M. Loilewen	--	BAPPEDA
19. Mahfud Johari	--	BAPPEDA
20. Usman	--	BAPPEDA
21. Idris	--	BAPPEDA
22. Agus Sutisna	Irrigation	West Sumbawa, PU
23. Slamet Sumardjo	--	West Sumbawa, PU
24. M. Soewadji	Head of PU	Sumbawa Besar
25. Djalaludin R.	Head of PU	East Sumbawa
26. Lunar	--	--

APPENDIX E

AGENDA OF SSIMP ENVIRONMENTAL BRIEFING

Sumbawa, 26 May 1988

I. Opening

II. Introduction

1. Small-Scale Irrigation Management Project

- DGWRD/USAID
- Provincial PU/Technical Assistance Consultant/Local Consultants

2. Environmental Regulations, Scoping Sessions, and Purpose of Meeting

3. ANDAL and PIL

III. Overview of Kalimantong II and Tiu Kulit Projects

IV. Discussion

1. Explanation of Checklist.

2. Land Resources

- Soils and Land Capability
- Salinity/Alkalinity and Waterlogging
- Soil Erosion in Catchments
- Sedimentation in Reservoirs and Downstream Irrigation Works
- Construction and Land Clearing

3. Water Resources

- Streamflow Characteristics and Water Availability
- Water Retention and Drainage Potential
- Water Losses through Operations and Maintenance
- Water Quality

4. Biological Resources

- Critical Habitat for Rare and/or Endangered Species
- Livestock and Pasture Land
- Fisheries
- Biomass, Water Weeda and Pests

5. Environmental and Public Health

- Water-related Disease and Insect Vectors
- Agrochemicals

6. Socioeconomic Factors

- Settlement
- Social Organization
- Farming Systems
- Community Participation

7. Cultural Property

- Archeological, Historic or Religious Sites
- Aesthetic or Natural Values

IV. Conclusion and Recommendations

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APPENDIX F

LIST OF SSIMP ENVIRONMENTAL BRIEFING PARTICIPANTS

Sumbawa, 26 May 1988

Name	Profession/position	Organization
NTB Province		
1. Kartabrata	Irrigation	PU NTB
2. Wahju Djoko M.	Irrigation	PU NTB
3. Sudanta	Embung Project	PU NTB
4. Djoko Prakoso	Kalimantong Project	PU NTB
5. Abdullah MT.	Head of Environmental Center (PSL)	Mataram University
Harza, NTB		
6. Jeffery Frey	NTB TA Team Leader	Harza
7. Robin B. Erickson	Agricultural Economist	Harza
Regency		
8. M. Rabil	--	Village Development
9. L. Mudahan	--	Village Development
10. Alimuddin Nur	Head District	Plampang
11. Agil Husein	--	Food Crop Services
12. Sustomo	Acting Head of Agraria	Agraria
13. Soedirman	--	Forestry Services
14. Gufranuddin H.	--	Plantation Services
15. M. Noer Tala	--	Health Services
16. Arman A. Hamid	--	Fishery Services
17. Edy Mokhtar	--	Sumbawa Office
18. P.M. Loilewen	--	BAPPEDA
19. Mahfud Johari	--	BAPPEDA
20. Usman	--	BAPPEDA
21. Idris	--	BAPPEDA
22. Agus Sutisna	Irrigation	West Sumbawa, PU
23. Slamet Sumardjo	--	West Sumbawa, PU
24. M. Soewadji	Head of PU	Sumbawa Besar
25. Djalaludin R.	Head of PU	East Sumbawa
26. Lunar	--	--

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APPENDIX G

LIST OF PERSONS CONSULTED

No.	Name	Status
1.	Drs. Umar Yasin	Head of Taliwang Sub-district
2.	Dr. A. A. Kosala	Doctor at Taliwang Medical Clinic
3.	H. M. Saad	Staff at Taliwang Clinic
4.	Abdullah	Staff at Beru Clinic (PUSKESMAS)
5.	Amnah Sari	Head of Tepas Village
6.	M. Saleh A. R.	Secretary of Beru Village
7.	Hasyim	Head of Sampir Village
8.	Abdullah	Head of Menala Village
9.	Jafar Amadi	Head of Kuang Village
10.	A. Rahman A. R.	Head of Dalam Village
11.	Daeng Muhi	Head of Bugis Village
12.	Abubakar	Farmer, Tepas Village
13.	Ayang H. Abdullah	Farmer, Tepas Village
14.	Junaedi Siddiq	Farmer, Tepas Village
15.	M. Saleh H. A.	Farmer, Beru Village
16.	Ahmad Z.	Farmer, Beru Village
17.	A. Rachim	Farmer, Sampir Village
18.	Moch. Cha	Farmer, Sampir Village
19.	A. Madjis	Farmer, Sampir Village
20.	Alwi Ahmad	Farmer, Kuang Village
21.	M. Nur Sandrang	Farmer, Kuang Village
22.	Baruk Zainuddin	Farmer, Kuang Village
23.	Ahmad	Farmer, Menala Village
24.	M. Husain	Farmer, Menala Village
25.	M. Zain Nur	Farmer, Dalam Village
26.	Fatrawi	Farmer, Dalam Village
27.	Makarani	Farmer, Dalam Village
28.	Dr. Robert G. Morrison	Environmental Management Development in Indonesian (EMDI), Canadian International Development Agency (CIDA), Jakarta
29.	Dr. George Green	Environmental Management Development in Indonesia, Canadian International Development Agency, Jakarta
30.	Mr. Nabiel Makerim	Deputy Assistant Minister, Ministry of Population and Environment, Jakarta
31.	Mr. Gempur Adiyan	Staff Deputy Assistant Minister, Ministry of Population and Environment, Jakarta
32.	Mr. Hensri Reichart	World Wildlife Fund, Jakarta
33.	Dr. Peter Neame	Environmental Consultant, Ujung Pandang
34.	Ir. Mardjono Notodihardjo	Department of Public Works, Jakarta

APPENDIX H

RECORD OF REVIEW MEETING ON DRAFT ENVIRONMENTAL ASSESSMENT REPORTS

Introduction:

The meeting was held on 17 March 1989 in response to a request by Harza Engineering Company to have all interested parties review the draft Environmental Impact Assessment reports for the Tiu Kulit and Kalimantong II projects.

The location of the meeting was the conference room of BAPPEDA TK I, Mataram. Participants included representatives of the following:

1. BAPPEDA TK I
2. Public Works - Jakarta and Provincial NTB
3. Agriculture
4. Forestry
5. Livestock
6. Fisheries
7. Bangdes
8. PSL-UNRAM
9. Small Industry
10. USAID
11. Consultants: P.T. GeoSurvey (Kalimantong II Project)
12. Consultants: P.T. Mettana (Tiu Kulit Project)
13. Harza Engineering Co., Technical Assistance (TA) Team

The session was opened by Drs. H. L. Parka Mahardan, Head of BAPPEDA Tk I. The second speaker was Ir. Koesdaryono, Ministry of Public Works, Jakarta, who explained that each new project was required to have an Environmental Impact Assessment study (AMDAL). This study should be prepared in conformance with the laws and regulations of the participating governments of the Republic of Indonesia and the United States of America.

The third speaker was the SSIMP NTB TA Team Leader, Mr. Jeff Frey, who gave a general briefing of the major components of each individual project. Following this, Drs. Abdullah MT of the PSL-UNRAM, gave a detailed description of the methodology and results of the impact study for each project. He also invited comments or questions from the participating body in order to ensure that they understood the study or had their queries addressed.

The following notes are a record of the questions (Q) or statements (S), together with the responses (R), plus the name of the speaker whenever that individual could be identified:

Q - Drs. Fauzi Gani, from BAPPEDA, stated he understood this was a study based upon the laws and regulations of the governments of the Republic of Indonesia and the United States, but what about the report status - was it a PIL or ANDAL?

R - Drs. Abdullah MT, PSL-UNRAM, responded that this draft report was an ANDAL although it still had to be revised to conform with this format.

S - A PU Jakarta staff member from Project Evaluation, indicated, that the Tiu Kulit project costs were too high compared with similar projects, although the EIRR was favorable.

R - Tiu Kulit is a new project, not on-going. The initial construction cost is high because of the dam. The large irrigation area will support the project costs.

Q - What was being planned to prevent livestock from destroying the canal embankments? What about grazing land that was now to become agricultural land? What plans were being made to mitigate the effects of construction, i.e., cut areas, borrow pits, embankments, etc.

S - A PU Jakarta staff member stated that the prices and costs of production were in the socioeconomic section of the draft report.

Q - Were there any beneficial or negative factors regarding aquatic plants in the proposed projects?

Q - The construction program was to attract about 400 laborers from other regions. How about the negative impact of these incoming laborers in terms of crime? What has been planned to overcome this negative aspect?

R - No specific response to the above.

S - Public Health stated that construction of the dam and reservoir would increase the population of mosquitoes.

Q - Are there any plans to overcome this potential problem?

Q - Interrelated with the village water supply, if the water level in the reservoir falls sharply, how can water be delivered to the household users?

R - The above problems are primarily the responsibility of the Department of Health and it is their duty (with the help of BAPPEDA) to provide possible solutions.

S - A Provincial PU staff member stated that the water quality (based on the sampling done in this study) was considered adequate for the purposes intended, but this did not include the standards necessary for fisheries.

Q - How about the quality of return flows (drainage) from the service area?

R - no specific response

S - Construction workers need water for their daily use.

Q - What water were they expected to use?

Q - Check with the Forestry Department on the relationship between slope and degree of erosion.

R - Since much of the catchment of the proposed reservoir is forested, there is not expected to be erosion problems.

Q - How far was the seepage (from the canals, etc.) expected to influence public (domestic) water supplies?

Q - Did the Tiu Kulit project expect to increase farm mechanization?

R - There is expected to be selective increases in farm mechanization due to the higher cropping intensities requiring faster tillage methods between cropping seasons. There may also be mechanical tillage equipment used in the heavier clay soils (gromosols) during the dry season.

Q - What would be the impact caused by the maximum discharge (flood)?

Q - Was there a pilot project being proposed?

R - Parameter data for water quality for irrigation and/or water supply requires future monitoring and is being planned to be done each two to three years.

S - Changes in discharge volumes could cause changes in aquatic plant infestations so that this aspect needs to be investigated.

S - A Jakarta PU technical staff member stated that with the present yield of rice at 2 t/ha being increased to 5 t/ha under improved irrigated conditions, then this is already considered to be a high level of technology.

Q - A PU Jakarta staff member asked the following:

- Requested clarification of ANDAL?

- How about operations and maintenance?

- How about operations and management during wet or dry season and the impact downstream?

- What is the future use of livestock (draft or consumption)?

- What about water supply (domestic)?
- Has there been any investigation into the possibility of a landslide into the reservoir from the adjacent steep slopes?

R - All these questions were answered previously.

Q - Should ANDAL be processed in Jakarta or NTB Provincial level?

Q - What about the safety in storing the ten million cubic meters of water in the 100 ha reservoir behind the dam?

Q - Clarification is required to explain how and where the borrow areas are to produce the immense quantity of embankment material required to build the dams?

Q - What about the cost/benefit ratio computations for the economic analysis?

Q - The USAID staff member asked about the RKL (Environmental Management Plan) and the RPL (Environmental Monitoring Plan) in relation to the discussion about high project development costs? What about the real costs?

S - A BAPPEDA staff member stated that land use data was given in sufficient detail, but there was no data on ownership status so that this could be a problem in implementation.

S - Bpk. Wijaya, from the Department of Small Industry, made the following statements:

- PIL or ANDAL should be reported to the AMDAL commission. Erosion and landslide problems in the Tiu Kulit report should be supported by analyses and investigations.

- On the subject of public health - give information concerning nutrition and sanitation.

- The report should have included oceanography and the study based on a matrix evaluation.

- Bpk. Nasri, from PU Jakarta, stated that the questions concerning Tiu Kulit and Kalimantong II projects were almost identical.

- Drs. Fauzi Gani, from Provincial BAPPEDA, stated that this report was not yet a final ANDAL. When the revisions have been finalized, it should be discussed by the NTB Provincial Environmental Commission (Komisi Daerah) and then reviewed and approved by the PU Central Environmental Commission in Jakarta. There should be a systematic analysis of the various components of the environmental impact study such as biology, physics, socioeconomics and public health. The NTB Provincial Environmental Commission (Komisi Daerah) is responsible for this study because the projects are located within this one province.

S - A PU, Jakarta staff member stated that since these projects were both located within NTB province, the first step in approval would be at this level. When a revision is accomplished, final approval would be done at the PU Jakarta head office.

S - A USAID staff member stated that in 1986, the ANDAL was already prepared, but since the Jakarta office was very busy it was handed down to the provincial level again for final approval. This report is still in the draft stage and after revision it will be changed into a final report using USAID format.

S - Bpk. Danu, PU, Jakarta, stated this report format does not fit the ANDAL model since it does not use the matrix method. The report is still in the draft stage and the matter of fitting the proper format is not paramount now, but in the final revision the appropriate governmental regulations should apply.

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Borrow Areas. Materials (rock, gravel, sand and clay) for the weir, cofferdams and left bank canal protection dike will be obtained from borrow in the immediate vicinity of the weir site. There is a restriction that borrow for the dike can not be excavated within fifty meters upstream thereof as a protection against underseepage. The contractor may exercise his option to obtain theses materials from other locations subject to the contract provisions and the Supervising Engineers' approval.

Materials for access road embankments are expected to be obtained within the designated right-of-way from excavated sections that are within the nominal haul distances as specified in the contract. Canal embankment materials are expected to be obtained from drains that are excavated immediately above the main canals to intercept run-off from the higher adjacent lands.

In some isolated cases, there will be borrow sites designated where the calculated embankment material is in short supply from the normal sources as described above. In the event that borrow sites are designated, the contractor will be required to restore such sites by providing drainage and reducing the cut slopes so as to make the site useful for other non-agricultural pursuits.

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NOTULEN RAPAT PEMBAHASAN

LAPORAN ANDAL PROYEK TIU KULIT DAN KALIMANTONG DI MATARAM TGL. 17 MARET 1989

1. Bahwa pada hari Jum'at tanggal 7 Maret 1989, telah diadakan pembahasan laporan ANDAL proyek irigasi beserta waduk Tiu Kulit dan Proyek Irigasi Kalimantong, Nusa Tenggara Barat di Mataram, yang dipimpin oleh Ketua Bappeda Dati I NTB yang dihadiri oleh :
   I. Dari Jakarta.
      - Staf Ahli Menteri PU Bidang Pengairan.
      - Kepala Biro perencanaan Dep. PU beserta Ir. Dana A. Kartakesuma.
      - Kasubdit K2S, Dit. Bina Program Pengairan.
      - Kasubdit Evaluasi Proyek Dit. Bina Program Pengairan beserta Ir. Ngajiono.
      - Wakil Direktorat Irigasi I Ir. Achmad dan Ibnu Sudarman.
   II. Dari Daerah.
      - Ketua Bappeda Dati I NTB beserta Staff.
      - Kakanwil Dep. PU NTB beserta Staff.
      - Kasubdin Pengairan beserta Pemimpin Proyek-proyeknya.
      - Wakil-wakil dari Dinas dan Instansi terkait Dati NTB
   III. Pihak USAID
   IV. Konsultan Harza dan Konsultan Lokal

2. Pada pembukaan diskusi telah memberi pengarahan Ketua Bappeda Dati I NTB dan Staff Ahli Menteri PU Bidang Pengairan

3. Setelah presentasi laporan-laporan oleh Konsultan PSL Universitas Mataram, para peserta rapat dari Pusat dan Propinsi telah menyampaikan tanggapan yang umumnya sangat berguna sebagai input bagi perbaikan laporan-laporan Andal tersebut.

4. Berdasarkan pengarahan-pengarahan dan diskusi yang berlangsung dapat diambil beberapa kesimpulan :
   4.1. Judul laporan-laporan perlu disesuaikan dengan ketentuan-ketentuan yang ada.
   4.2. Andal Proyek Tiu Kulit adalah Andal (E.I.A), perlu dilengkapi dengan metoda dan evaluasi dampak penting, jadi perlu dilengkapi sistematika atau kerangka laporan yang berlaku.
   4.3. Andal Proyek Kalimantong adalah Andal yang perlu dilengkapi dengan metoda flowchart dan evaluasi dampak penting.

4.4. Uraian komponen proyek agar diuraikan lebih rinci lagi, termasuk pada tahap operasi dan pemeliharaan mengenai pengaturan alokasi air.

4.5. Uraian Rona Awal dan dengan dampak agar didukung oleh data kwantitatif yang dikumpulkan dilapangan (sekunder dan primer).

4.6. R.P.L dan R.K.L akan disusun lebih rinci setelah laporan Andal ini tidak sesuai dengan ketentuan yang ada.

Dengan demikian dari studi Andal ini, yang laporan Akhir akan diperbaiki sesuai dengan hal tersebut di atas dan memperhatikan tanggapan rinci dalam rapat, dapat disimpulkan bahwa dampak lingkungan proyek-proyek ini masih dalam batas-batas yang dapat ditanggulangi (kecuali yang memang telah direncanakan seperti penggenangan daerah waduk) yang tentu saja memerlukan dana dan biaya yang harus diperhitungkan dalam perencanaan dan perhitungan ekonomi proyek-proyek tersebut.

Mataram, 17 Maret 1989

Staff Ahli Menteri PU
Bidang Pengembangan Pengairan

(Ir. Koesdaryono)

Ketua Bappeda
Dati I NTB

PEMERINTAH PROPINSI DATI II BAPPEDA NUSA TENGGARA BARAT

(Drs. H. Lalu Parka Mahardan)

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