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

EXECUTIVE SUMMARY

October 1989

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Prepared by

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in association with

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EXECUTIVE SUMMARY

Introduction

The Kalimantong II Project will provide reliable irrigation water to 2,400 hectares (ha) now dependent largely on rainfall, and provide supplemental irrigation water to 450 ha within the existing Kalimantong I irrigation scheme.

This report has been prepared under the laws of the United States and Indonesia, in order to meet the requirements for environmental impact assessment and management. In both countries, environmental studies are required for all projects deemed likely to exert significant effects on the human and natural environment.

Sponsoring Agencies

This project is 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.

Objective of the Environmental Assessments

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

Scope of Report

Priorit issues were identified as a result of an Environmental Scoping Session and these issues have been organized into four basic categories: water resources, land resources, biological resources, and socioeconomic and cultural resources. This is the scope of the report.

Description of the Proposed Project

Location

The Kalimantong II Project is located in the vicinity of Taliwang Village, Sumbawa District, NTB Province. The catchment area that provides the irrigation supply for the project is that of the Tepas River (also called the Brang Rea) and lies on the western end of Sumbawa Island. (See Figure ES-1, Project Location Map.)

Limits of the Study Area

The study area for this environmental assessment consists of the entire river basin of the Tepas River, as defined above. It also includes the entire land area and population of the villages in which the river basin is located.

Pre-Construction Period

The Kalimantong II Project has been investigated by a series of engineering studies during the 1980's. These include studies by PT Geosurvey Swasti Sarana and by BPP Tri Tunggal. A "Rapid Rural Irrigation Appraisal" (RRIA) was conducted, as well as a Household Survey. Construction began in FY 1984/85, but was halted, due to lack of funds in 1986. The weir stands approximately 20 percent complete.

Construction Period

Major Structures. The diversion of water from the Tepas River will be accomplished by completion of the Kalimantong II weir, begun in 1984/1985 but abandoned the following year due to lack of funds. The completed weir will be a stone masonry structure, four meters (m) high and 70 m long. The site is located approximately five kilometers (km) upstream of Tepas Village. The weir will provide water to right and left bank main canals which will feed a system of subsidiary canals to irrigate existing sawah (bunded rice fields). The existing drainage system will be upgraded to handle excess irrigation water and rain water.

Work Force. The work force for the weir is expected to number about 200, of which 150 will be unskilled (laborers), 35 semi-skilled and skilled, and 15 foremen, managers, and technical staff. The contractor may hire these laborers from the existing labor force in the district.

The workers' camp and construction shops will be located on the left bank of the Tepas River near the weir site. This site was used during the earlier period of weir construction.

Construction of the irrigation system will be carried out under two separate contracts requiring a total work force of approximately 700 (600 laborers, 70 skilled, and 30 technical and management). Base camps and offices will be established along the canal alignments throughout the service area.

Schedule. Construction of the weir is planned to resume in the fourth quarter of 1990 and be completed in 18 months. The canal system construction will overlap with the weir construction and will also require about 18 months.

Operation Period

Method of Operation. Water will be made available to farmers on an as-needed basis. The proposed project cropping pattern calls for water delivery every month of the year except October, when the system could be shut down for maintenance. Water will be provided on a rotation basis, the number of days with and without water depending on the crop.

Responsibility for irrigation scheduling will reside with the PU irrigation inspector, who will operate the system gates to meet estimated crop water requirements. The heads of the water users' associations (P3A) will regularly report their areas' water needs to the PU irrigation inspector.

Chemical Use. An increase in fertilizer and pesticide use is anticipated in response to crop needs and with the advice of the agricultural extension service. Current applications generally are below recommended rates and that situation is expected to continue. The preferred fertilizer is urea, with triple-super-phosphate also used. Prevailing insecticides used are organophosphates and carbamates.

On-Farm Management. The functioning of local water users' associations will be examined and, where necessary, strengthened. The relative roles of the locally elected irrigation foreman (*malar*) and the PU operations and maintenance staff will be examined in terms of the effectiveness and reliability of the water distribution system.

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

A training program for Public Works planning, operating, and management staff will be conducted over a four-year period in order to improve language and computer skills, technical understanding in various fields, and to improve local operations and management ability.

Project Costs

Capital Costs. Funding for completion of the Kalimantong II Project will be provided by direct financing by GOI and loan funds from USAID. The weir construction contract is estimated at Rp 2,342 million (1989 price level) and the sum of the irrigation system construction packages at Rp 8,080 million. Additional funding will also be required for access road upgrading, permanent buildings, and land acquisition. The cost of engineering services and owner's overhead during construction

are estimated at 12 percent of construction cost, or Rp 1,173 million for the project. Total project cost is thus estimated at Rp 12,128 million.

Operation and Maintenance Costs. Operating and maintenance costs for the project are estimated on a per hectare basis at Rp 30,000 per year, which results in an annual O & M cost of Rp 70 million for the project.

Project Alternatives

No-Action Alternative

Without the project, the farmers in the proposed service area will continue to rely on rainfall for one crop of rice and, in some cases, on local irrigation schemes and pumps to provide water during the dry season. Population increase will put pressure on the land's limited productive capacity, resulting in lower living standards and emigration from the area.

Alternative Technologies

Ground Water. The use of ground water for irrigation would deplete this resource for domestic use and its availability is not sufficient on a sustained basis for the entire service area.

Improved Water Management. More effective management of existing surface water resources could not, of itself, improve the agricultural situation very much. It is not an alternative to improved technology.

Siting Alternatives

Structures. There is little latitude in the siting of project structures, partly because the weir already is partially built and partly because of topography and soils. The weir site, immediately downstream of the confluence of several rivers, appears to have been well selected.

Service Area. The area to be irrigated has been determined on the basis of topography, soils, and the presence of several simple irrigation schemes.

Water Use: Lake Taliwang. Several schemes have been advanced to use water from the Tepas River to raise the water level of Lake Taliwang. The 860 ha lake formerly supported a productive fishery, but is now so weed-clogged that fishing is difficult. A small rise in lake level would not solve the weed problem, as long as agriculture in the lake's drainage basin discharges nutrient-laden drainage into the lake. The rise instead might cause some flooding of villages and existing sawah.

The latest proposal for Lake Taliwang would raise the lake level by 10 m, in order to store water to irrigate sugar cane and supply fish ponds along the coast. This costly scheme would have enormous environmental and social effects and will require careful study.

Existing Environmental Conditions

Climate

Rainfall records are available, for varying periods, from a number of recording stations in and around the catchment area. Annual average rainfall varies from 1,370 millimeters (mm) at Taliwang and 1,960 mm at Tepas to 2,210 mm at Rarak, at 650 m elevation, in the upper catchment area. Most of this rain (85 to 90 percent) falls from late October to May.

Water Resources

Flow. The total catchment area at the mouth of the Tepas River is 838 square kilometers (km2), of which 344 km2 lies upstream of the weir. The river flows generally westward and receives several major tributaries, including the Kalimantong River whose subcatchment totals 26 percent of the total catchment area.

The maximum recorded daily flow near the weir site in the last ten years was nearly 400 cubic meters per second (m3/s), in January 1987. During the period of record, the surface flow of the river has nearly disappeared on numerous occasions, leaving the river consisting of a series of large pools connected by trickles of 0.1 m3/s or less.

The annual discharge of the river at the weir has varied over the past 15 years from 300 to 900 million cubic meters (MCM).

Water Quality. Results of water tests indicate a clean, slightly alkaline river with a low silt load and little contamination by human waste. The suspended solids value (sediment load) would be higher during periods of higher flow, but the other chemical values and fecal coliform bacteria would be lower.

Water Use. The river system provides the primary source of water for the majority of the service area population during the dry season and for some of the population year-round. Many households obtain water from wells during the wet season. The village of Taliwang has a filtration plant that provides piped water for some residents and for most of the public buildings. The plant's capacity of 20 liters per second (l/s) is about one-third utilized.

The watering of livestock is a significant use of the river, especially during the dry months.

Land Resources

Land Use. The catchment area above the project weir (344 km2) is approximately 44 percent forested, mostly with dense tropical evergreen forest. Only 1.7 percent of the catchment is devoted to agriculture and settlement. Even the downstream catchment area between the weir and Taliwang Village, which includes most of the project service area, contains substantial areas of dense forest (about 35 percent of the total area), mostly on steep hillsides.

Farming Patterns. Farms in the service area range from 0.35 to 6.0 ha in size, averaging 1.7 ha, according to the farm Household Survey (HHS). The overall cropping intensity is approximately 170 percent. Nearly all available land is planted during the early wet season, in rice or palawija (secondary crops). Farmers with access to pump irrigation put in a second crop of rice late in the wet season (totaling about 250 ha) or lacking irrigation, plant palawija (about 1,000 ha total). A second palawija crop, totaling about 200 ha, is planted by those farmers with access to pump irrigation. Irrigated sawah yields are approximately 50 percent higher (3.3 t/ha) than rainfed sawah (2.2 t/ha). Soybean yields are about 600 kg/ha and mungbeans 350 kg/ha.

Livestock. Water buffalo are the dominant large animal in the project area averaging about two per household.

Marketing. Roughly 60 percent of rice produced is consumed by the grower, 25 percent sold, 10 percent given as wages, and 5 percent kept for seed. By contrast, some 87 percent of the palawija crop is sold.

Biological Resources

Habitat. The upper catchment of the Tepas River is largely covered with dense forest, which provides good habitat for a varied fauna, including deer, wild pig, muntjac, and monkeys. The bird and reptile faunas are reported to be rich and varied. Except for a few illegal local hunters, however, this fauna does not significantly interact with the farm population in the lower catchment.

Fauna. The fauna of the extant forest in and around the service area is more vulnerable to hunting and more apt to produce pest species. Some of the latter, such as rats, were introduced by man centuries ago. Most of the fuelwood used in the region is cut in this patchy local forest. There are no known endangered species in the area.

Socioeconomic and Cultural Resources

Population. The project area, like most of rural Indonesia, contains a rather young population, with 46 percent less than 15 years of age. Family size averages five persons with the larger families tending to be in the upstream area. Sub-district records indicate a low rate of population growth, 0.36 percent per year probably due to the effects of out-migration rather than low rates of natural increase. Approximately half of the population has completed primary school, or are currently attending school, so are considered literate.

Income. Agriculture is the primary source of earning for 71 percent of working adults in the region, the rest being divided among industry, public service, transportation, commerce, and various minor occupations. Farm income, according to the HHS, averages Rp 600,000 to 700,000 per household. After family living expenses are factored in, the average annual household reserve is on the order of Rp 50,000 to 100,000. Households with medium and small farms are seen as living in very marginal circumstances.

Public Health. There is a small health center in Taliwang Village, staffed by eight medical professionals. There are smaller clinics at Beru and Kuang. The major diseases are malaria, dysentery, gastroenteritis, and leprosy, as well as some skin diseases.

Potential Environmental Impacts

Background

Meetings were held in Mataram in 1986 and in Sumbawa Besar in 1988, involving representatives from most local and provincial resource agencies, for the purpose of bringing to light attitudes and concerns about the project and its environment. The records of those meetings (Appendices C and D to this report) show the following general areas of interest:

1. The loss of grazing lands due to intensified cropping.

2. The effects of forest cutting and land clearing in the upper catchment of the project area.

3. Possible increases in land prices, making it more difficult for the small farmer to lease or buy land.

4. The possibility of providing water to Lake Taliwang. As noted above, the use of Tepas River water should not be undertaken without a thorough study.

5. Contamination of aquaculture facilities by agricultural chemicals in irrigation return flows, and availability of water for such facilitie. .

6. The possibility of using local labor for project construction.

These potential impacts were evaluated in this study, as well as certain others perceived by project staff.

Water Resources

Quantity. Diversion of water for irrigation will reduce the flow of the Tepas River by up to 1.6 m3/s between the weir and the Seminar River during the dry season, when the palawija crop is being irrigated. In a wet year, the reduction will not significantly affect the river, but in an extremely dry year, when the flow at the weir drops to less than 2 m3/s, the river will be reduced to a trickle. During August and September of some years there will be only standing pools, which will be used for bathing, laundry, and livestock watering. At such times people will use the canals and even the drains for water. The people of Tepas Village will suffer the greatest hardship, being quite a distance from the left main canal.

If water in the river becomes too low for livestock bathing, farmers will take water buffalo and cattle to bathe in the canals and drains. This is a major cause of erosion of canal banks.

Quality. During periods of minimum flow, water quality in the river will decline somewhat, because approximately the same amount of human and animal waste will be discharged from the drains into a river with a lower assimilative capacity. The increased drainage from the fields will alleviate this impact somewhat.

Existing water quality in the Tepas River, even downstream of Taliwang, is surprisingly good, if the August 1988 figures may be accepted as typical. The threat to human health due to altered flows does not appear to be severe in the near term, but will bear watching. The area population is expected to double in 25 or 30 years. Continued water quality testing is part of the recommended environmental monitoring program.

Land Resources

Livestock Management. Increased cropping intensity of land in the service area is expected to create a shortage of fodder for water buffalo and cattle that now are allowed to graze the fields between crops. This will lead to pressure to create new pasture lands. Some additional cutting of foliage from leguminous trees and some shrubs may also occur.

If the shortage of grazing land becomes acute, farmers may resort to selling water buffalo. Factors favoring this alternative would be: (1) mechanization of field preparation, which would reduce the need for draft animals; (2) alternative means of safely storing surplus wealth, since ownership of livestock is considered a hedge against financial crisis; (3) conflicting demands for the labor of family members now devoted to water buffalo; (4) inability to obtain fodder or grazing lands; and (5) increased market value of water buffalo.

Biological Resources

Catchment Management. Despite concerns shown at the 1988 meeting, the increase in irrigation and cropping intensity is not expected to result in extensive clearing of the catchment area. Some commercial cutting of fuelwood is to be expected both upstream of the weir and in the service area. The threat to forest in the catchment posed by the lumber industry is considerable, however. Any incursions, legal or illegal, for the cutting of timber will cause significant destruction of the wildlife habitat. It will also lead to increased erosion and sedimentation of the weir pool, but sluices at the headworks will allow the flushing of sediment from the pool during periods of high flow.

Pests. Intensification of cropping may be expected to result in greater pest problems from insects, birds, and rodents. Increased use of insecticides and rodenticides is likely. Disease vectors, especially mosquitoes, are likely to increase with more standing surface water in drains and fields.

Socioeconomic and Cultural Resources

Most of the socioeconomic effects of the project are beneficial, some of them being primary objectives of the project, others being secondary effects that should be optimized through integrated social services programs.

Settlement Patterns. Irrigation and increased crop productivity will increase the value of land in the service area, but this will not operate against the small farmer. His increased cash flow should enable him to pay more for land leased and still have higher net gain. The improvement of land values is expected to retain in the area a few farmers who might otherwise give up and seek better opportunities elsewhere. Greater family and community cohesion is expected to result.

Cropping Patterns. Farmers are expected to add a second crop of rice with the availability of irrigation, but after a decade or two, to switch to vegetable crops due to their higher rate of financial return.

The increase in cropping intensity will not be accomplished without greater labor input. Farmers who supply this labor

themselves are likely to use some of their higher income to pay for goods and services that they now provide in the off-season (or receive from family members). Farmers outside the service area will find their labor more in demand as laborers at certain times.

Agricultural Chemicals. The increase in pesticide use and the introduction of new compounds poses some risk to the users and to the local population generally. This risk comes more from chemical storage and handling than from actual application. Despite a rather good safety record in pesticide use, farmers cannot afford to get careless or to adopt new compounds without adequate precautions.

The risk of chemically contaminated drainage water affecting downstream fishponds appears to be minimal, since the pesticides in current use are nonpersistent and fertilizers provide mostly nutrients to the runoff. At present, there are no aquaculture facilities in the estuary.

Public Health. The increase in mosquito populations that may be expected to result from increased surface water will increase the risk of malaria, dengue, filariasis, and other mosquito-borne infections. This will require additional attention on the part of health authorities.

Resource Use: Water. 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 Seminar River. 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. 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. Farmers that now water buffalo in the river will also 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.

Evaluation of Significant Impacts

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 impact. Other significant impacts that are likely to be negative and long-term 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.

Conclusions

The conclusion of this Environmental Assessment is that the Kalimantong II Project is environmentally feasible. It is also concluded that potentially negative environmental impacts have been adequately addressed in the Mitigation Plan.

Mitigation Plan

As might be expected in an area chronically short of water for half of every year, most project impacts amenable to mitigation are concerned with conflicting demands for limited surface water.

Water Resources

Domestic Use. Attention must be paid to the requirements of the local population for clean drinking water and for general purpose water for laundry, bathing, and livestock watering. Except for years of extreme low flow, project irrigation diversions will not use all available streamflow in the reach near the weir. In addition, water of fair quality will be broadly available in the primary and secondary canals. Villagers should be instructed to continue boiling their drinking water.

During years of extreme low flow, consideration should be given to releasing a set amount at the weir, even at the cost of some palawija irrigation, to maintain a small flow in the reach of the river between the weir and the mouth of the Seminar River.

Public Bathing and Livestock Watering. In order to avoid damage to canals by livestock, especially water buffalo, alternative bathing pools will be provided. This has been frequently done at other irrigation sites throughout Indonesia and the Department of Public Works has established workable designs for such pools.

An education and community-sanctioned enforcement program will be required if the people (many of them children) watering livestock are to refrain from using the canals for that purpose. The non-governmental organization, LP3ES (Lembaga Penelitian Pendidikan dan Penerangan Ekonomi dan Sosial) will work with the Department of Public Works to educate the public and assist the villages in developing their own monitoring system.

Quality of Return Flows. Despite the concern voiced at the 1986 meeting, quality of irrigation runoff is not expected to pose a risk to human health or to downstream water users.

Therefore, no mitigation action seems necessary. A water quality monitoring program is recommended.

Land Resources

Livestock Management. We recommend a careful study of livestock grazing requirements and available grazing land, rather than an approach that leaves livestock grazing problems to "solve itself". The Livestock Department should form an integrated livestock management program that takes into consideration livestock nutrition and water requirements that determines local demand and carrying capacity. If additional lands are required, the government should endeavor to develop them in areas where they will not affect other land uses adversely. Consideration should be given to voluntary reduction in herds, if necessary.

Biological Resources

Catchment Management. Protection of the forest of the Kalimantong II catchment area is the responsibility of the Forestry Department, but the effectiveness of such protection, over the life of the project, will effect runoff and siltation rates. Therefore, it behooves Public Works to work with the Department of Forestry to devise methods for minimizing illegal clearing and timber cutting in the catchment.

Socioeconomic Resources

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 Provincial Public Works to develop local medium- and long-term plans.

Public Health. Although an irrigation project cannot be held accountable for diseases that are endemic in the area, Public Works should make local health authorities aware of possible increase in water related diseases and should incorporate health messages into farmer education programs.

Hiring Local Labor. There are substantial advantages to involving the local population in the construction of their irrigation system, among them pride of possession, understanding of it's proper operation and maintenance, respect for the system, and an economic boost for the at-risk population (although, by definition, they are not among the users). We recommend that bidders on this construction contract be required to recruit their laborers within the project area and be allowed to bring in outside laborers only if insufficient local labor is available.

Monitoring Program

Continued periodic data gathering is recommended in the areas of land and water resources. It is assumed that the Department of Public Works will be monitoring the success of the project itself and that problems involving crop pests and disease vectors will be the concerns of the appropriate agencies.

Water Quality

Water samples should be analyzed periodically in order to ensure that project-induced changes are not occurring that would affect human health or downstream water uses. Sampling should be performed, once in February, and once in September or October, every three years, at nine or ten fixed sites between the weir and the mouth of the river. A staff gauge should be established at each sample site.

Land Use

The potential for land use change in the catchment area, particularly cutting of the forest resources which is a problem throughout Sumbawa, suggests that a monitoring program of periodic study be undertaken. If possible, the study should be performed annually, or at least at two- or three-year intervals. Satellite imagery should be used to determine areas, especially in the upper catchment, in forest, savannah, cropland, and other uses. Some remote sensing training will be required at the technician level. Initially, ground verification plots should be established and used to follow changes, and this will require a trained ecologist or forester.

If Public Works has any difficulty in hiring a trained remote sensing specialist to analyze satellite imagery, then a ground verification team should evaluate the entire catchment, preferably by helicopter, every three years. This team should include representatives from BAPPEDA and the Department of Forestry, in addition to Public Works, or the assessment could be contracted to the local university's environmentalists for execution.

Integration of Local and Regional Planning

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. Presumably BAPPEDA will act as the lead agency in monitoring the future need for any increases in social services and basic infrastructure.

Report Finding

Based on the present studies, the conclusion of this Environmental Impact Assessment is that the Kalimantong II Project is environmentally feasible, and that potentially negative environmental impacts have been adequately addressed in the Mitigation Plan.

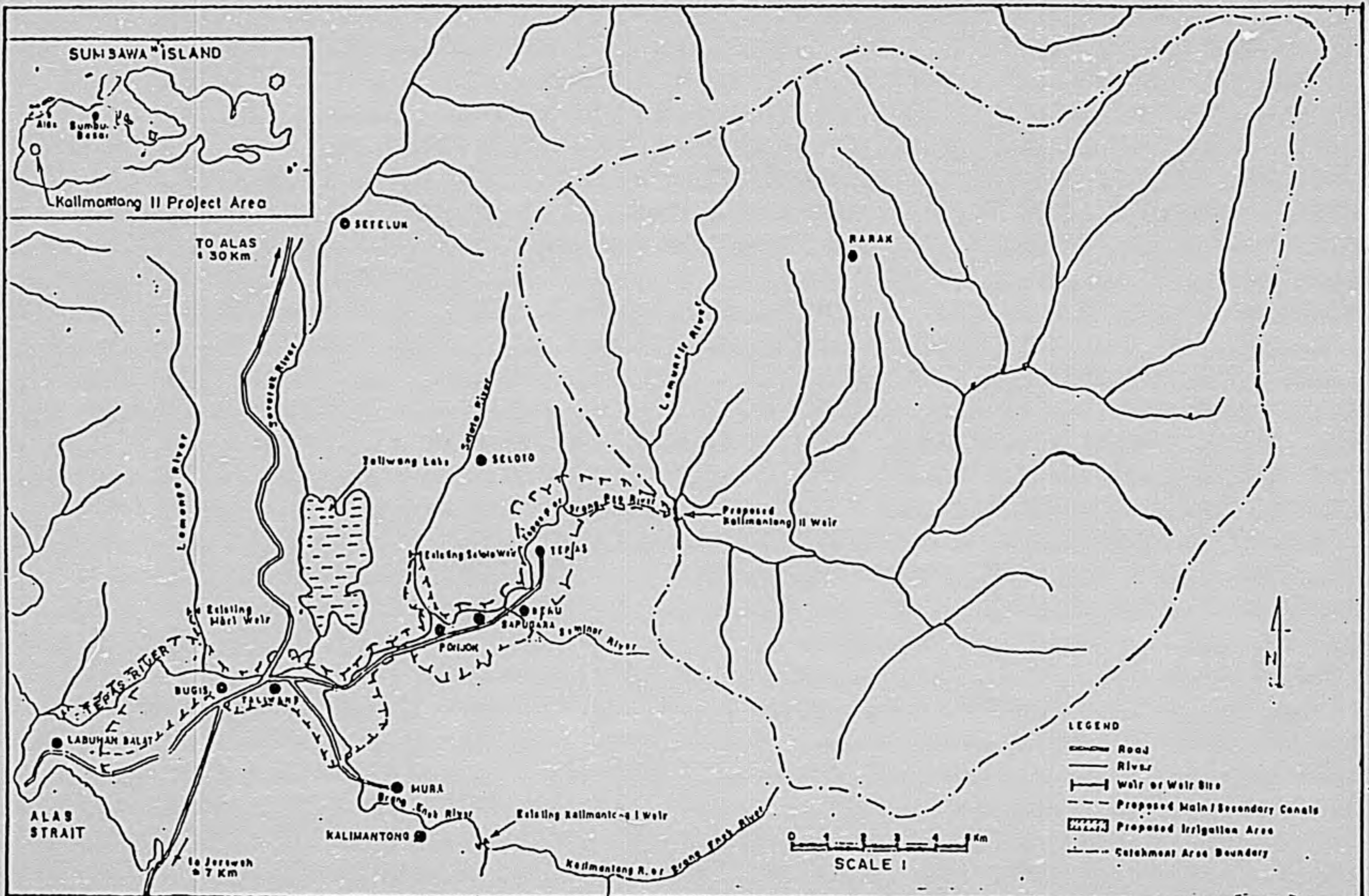

Figure ES-1
Kalimantong II Project
Location Map