BIBLIOGRAPHIC DATA SHEET	1. CONTROL NUMBER PN-AAJ-186	2. SUBJECT CLASSIFICATION (695) AP10-0000-0562

3. TITLE AND SUBTITLE (200)

Jrugung Dam and irrigated area; assessment of environmental impact

4. PERSONAL AUTHORS (100)

Keave, J. W.

5. CORPORATE AUTHORS (101)

AID/SER/ENGR

6. DOCUMENT DATE (110)	7. NUMBER OF PAGES (120)	8. ARC NUMBER (170)
1974	40p.	ID333.910991.N357

9. REFERENCE ORGANIZATION (150)

SER/ENGR

10. SUPPLEMENTARY NOTES (500)

11. ABSTRACT (950)

12. DESCRIPTORS (920)

Indonesia

[illegible]

Environmental impact

Water resources

Irrigation

13. PROJECT NUMBER (150)

497022400

14. CONTRACT NO.(140)

[illegible]

15. [illegible]

16. [illegible]

Assessment of Environmental Impact

Jragung Dam

and

Irrigated Area

John W. Neave
SER/ENGR/SP/UE
AID/W

April 23, 1974

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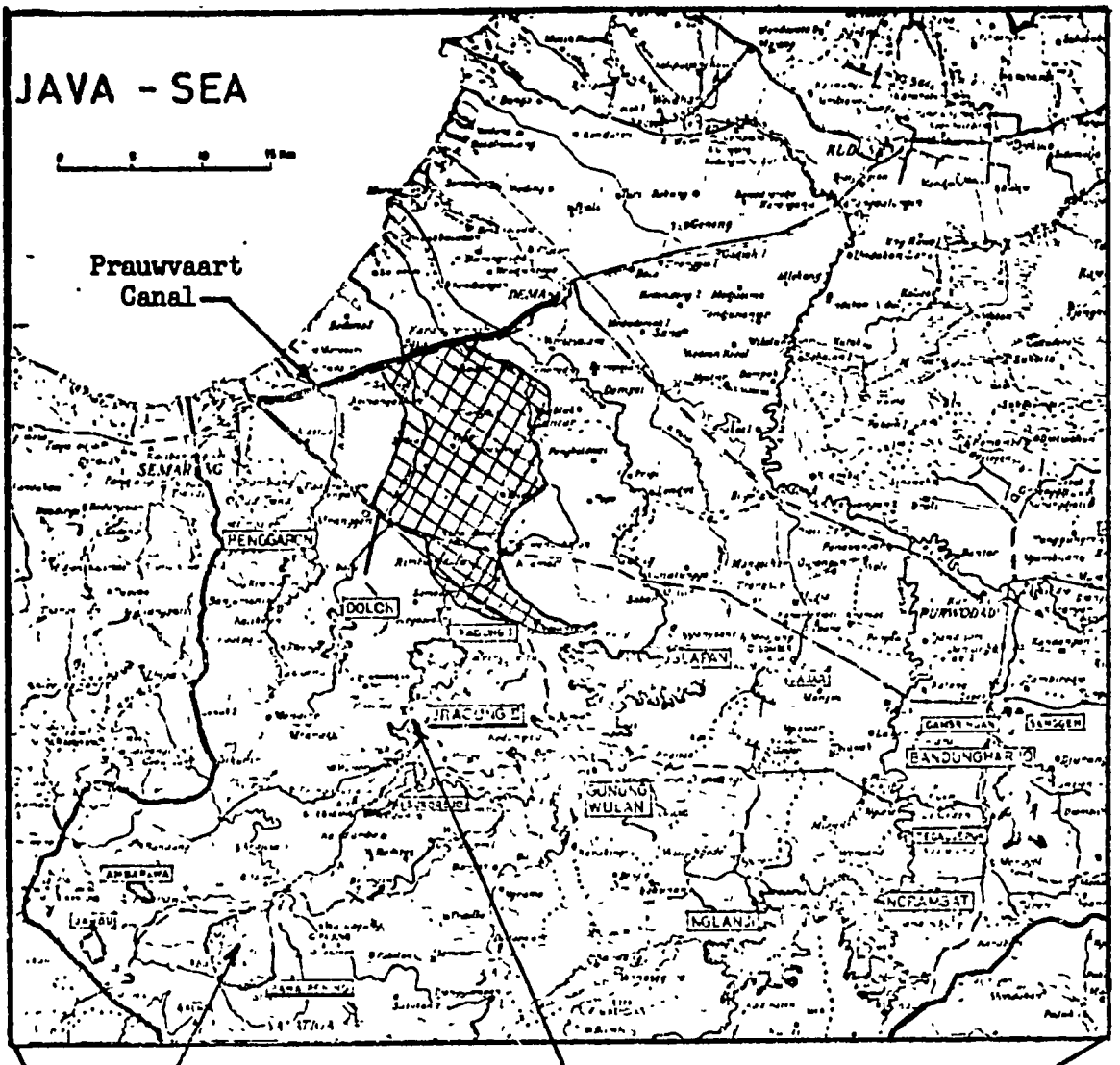
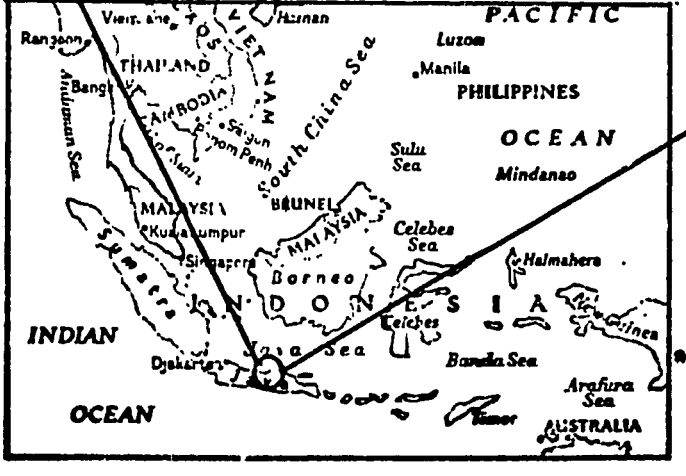
JRAGUNG DAM PROJECT SITE





Area to be irrigated b Jragung Impoundment

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1. Location, Description and Purpose

The project has a long history. In 1914 Hengeveld made a detailed geological field study of an upstream and a downstream site on the Jragung River. He concluded that the downstream site was the more favorable of the two.

In 1967 a design for this dam was developed. In 1968 a reconnaissance survey of development possibilities in the Jratunseluna Basic, financed by the Government of the Netherlands (GON), indicated the desirability of further study of the Jragung Dam.

Netherlands Engineering Company (NEDECO), the consultant for the Jratunseluna Basin Development Project financed by the GON, began work in the area in 1970. NEDECO completed a feasibility study of the construction of dams on the Jragung, Dolok and Penggaron Rivers in December 1971/February 1972. This study concluded that construction of the Jragung Dam at the downstream site would be prohibitively expensive due to various technical problems, but that construction of the dam at the upstream site identified by Hengeveld appeared technically and economically feasible.

During 1972 and 1973 NEDECO studied the upstream Jragung Dam site further in connection with their work on a general development plan for the Jratunseluna Basin. This Jratunseluna Basin Development Plan was substantially complete by the end of 1973.

In April 1973, a representative of the Asian Development Bank (ADB) made an appraisal of the 1971/1972 feasibility study. As a result of this appraisal the ADB requested a reassessment of the feasibility of

the Jragung Dam at the upstream site. The NEDECO Feasibility Study was completed in August 1973.(1)

Location

The Jratunseluna Basin is located on the north coast of Central Java to the east of the city of Semarang (latitude 6°59' south, longitude 110°22' east). It consists of the catchment areas of the Jragung, Tuntang, Serang, Lusi and Juana Rivers. In fact, the name of the basin is derived from the names of these 5 rivers as follows: JRAgung, TUNtang, SErang, LUsi and JuaNA. The area includes 62 kecamatan (subdistricts) in the kabupatens (regencies) of Semarang, Demak, Purwodadi, Jepara, Kudus, Pati and Blora and the Kota Madya (greater city) Semarang.

The project area covers a large portion of the northwestern part of this basin. This area can be more precisely defined as the basin of the Jragung River, consisting of its catchment basin on the extinct Ungaran volcano and in the Kendeng Hills, and the part of the coastal plain between the Dolok and Tuntang Rivers. The Jragung River changes its name several times becoming, in order, the Plosoreja River, the Guntur River and the Gemboyo River before it enters the sea as the Wonokerto River.

There are two distinct seasons in the project area, the wet season which generally lasts from October to April and the dry season from May to September. Average yearly rainfall on the plain amounts to between 2000 and 2500 mm (79-98 in.). Only 5 to 15% of this total falls in the four driest months. A considerable part of the total falls in heavy showers separated by dry periods. These dry periods make

irrigation important in the wet season as well as the dry season. In addition, the heavy showers often cause flash floods in the rivers.

Description

The project consists of design and construction of an earthfill dam on the Jragung River, about 35 km. (21.7 mi.) by road southeast of the city of Semarang, including appurtenant civil works such as the spillway, diversion and outlet works. In 4 out of 5 years the dam will be able to supply irrigation water for the cultivation of rice to 2,800 ha. (400 ha. additional) in the wet season and 7,900 ha. (all additional) in the dry season. Irrigation water from the dam can be distributed to any of about 14,400 ha. interconnected with the Jragung Irrigation System. The project also includes comprehensive improvement of primary drainage in this system.

The Jragung and Guntur Weirs are both located on the Jragung River. The Jragung Weir is located on the upper course of the river about 8 km. (5 mi.) downstream from the site of the proposed dam. The Guntur Weir is located on the lower course of the river after its name has changed to the Guntur River about 16 km. (10 mi.) from the Jragung Weir. In the wet season the Western Glapan Canal receives irrigation water from an outlet in the left bank of the Tuntang River above the Glapan Weir. Irrigation water will be supplied to the Western Glapan Canal in the dry season through a connection with the main left Jragung irrigation canal. The Prauwvaart Canal acts as a collector of terrain water from the rest of the Jragung Irrigation System. This canal can be supplied with irrigation water either from the Jragung River or the Western Glapan Canal through one of several secondary drains.

Before 1969 the Jragung Irrigation System was in poor condition. Among matters requiring attention were: (1) rehabilitation of irrigation systems, (2) restoration of internal (secondary) drainage and (3) a comprehensive improvement of the primary drainage system of the whole area including extensive enlargement of the rivers and other large drains to the sea.

Since 1969 two projects, the Semarang-Kudus Irrigation Rehabilitation Project financed by the GON and the Irrigation Rehabilitation Project Prosida financed by IDA, have been carrying out rehabilitation work in the area covered by the Jragung Irrigation System. The Semarang-Kudus Project includes within its scope rehabilitation of irrigation systems and restoration of internal drainage in the Right and Left Jragung areas served by the Jragung Weir, the Glapan Setu area served by the Western Glapan Canal and the Prauwvaart area.

The Prosida Project is rehabilitating the Glapan-Sedadi Irrigation System which is adjacent to the Jragung Irrigation System on the east. The scope of this project includes construction of the Western Glapan Canal and rehabilitation of irrigation systems in the Pemongan, Ketitang and Guntur areas. Total cost of this project was estimated to be $1.4 million in the IDA Appraisal Report dated 14 August 1968.

Purpose

The principal objective of the project is to increase food production in the area in the Jratunseluna Basin in Central Java which depends on the Jragung River for Irrigation water. This objective will be achieved through extending irrigation for agricultural development and controlling floods which hold back this development.

2. Environmental Impact of the Proposed Project:

a. General comments: Although the project under consideration consists of only Jragung Dam and the impounded reservoir, the discussion of environmental impact will include the irrigated area also.

All of the area to be supplied with irrigation water from the Jragung Dam and Reservoir is presently under cultivation, however, and most of the area is presently supplied with wet season supplemental irrigation water. The project is primarily to supply wet season supplemental irrigation water to that portion of cultivated land under the influence of the Jragung River that is presently rain-dependent, and to supply dry-season irrigation water (thereby assuring successful double-cropping) to 7,900 ha. under the influence of the Jragung River. Even so, most if not all the farmers in the area now attempt to get a second crop of rice by replanting their fields at the end of the rainy season before the fields, rivers and canals have dried up. Without the assured dry-season supply of water, however, they take the chance of greatly reduced yields from the second crop, and in a year of a short rainy season may realize virtually nothing from their efforts at attempting to grow a second crop.

Many farmers within this area have been using supplemental wet-season irrigation water for long periods of time, the construction of the first river diversions and irrigation canals dating back to the 1860's and 1870's. With this past history of irrigation water utilization, the fact that virtually 100% of the arable land affected by this project has been under cultivation of some form for many, many years, and the fact that a stable community and administrative system has been in existence for many, many years, it may well be expected that

the environmental impact of supplying additional water will be considerably less than supplying irrigation water to a virgin land.

b. Resource linkage: Principal resource trade-off in the reservoir impoundment area will be the addition of 90×10^6 cubic meters of impounded water, and the withdrawal from productive use of approximately five hectares of dry-farming agricultural land and 347.5 hectares of teak plantation. The five hectares of agricultural land is used for one rice crop, with cassava and maise planted immediately after the wet-season as a dry-season crop. The produce from this land is for the consumption of the villagers of Kedoeng Glatik, a small village that will be innundated following the construction of Jragung Dam (see para d. below). The 347.5 ha of teak plantation consists of young teak trees planted approximately ten years ago, with harvest of the first trees to take place in from 30 to 50 years.

No migratory fish routes or spawning grounds will be disturbed by construction of the Jragung Dam. If there were any such routes in the past, they were effectively cut off with the construction of the Jragung Weir and the Guntur Weir in 1931-32. Because the Jragung River is reduced to an exceptionally small flow by the end of the dry-season, and occasionally drys up completely, the river does not support a large resident fish population. With the construction of Jragung Dam and the subsequent impoundment, those fish adaptable to a lake environment may increase in numbers and size. Those fish not adaptable to the lake environment would be forced to migrate farther upstream. An increased fishing potential or fishing industry is not presently envisioned for

the impoundment, partly because of the remoteness of the site and partly because steep slopes at the waters' edge will discourage access to the lake. However, another lake on an adjacent river, Rawa Pening, 11 km approximately from Jrugung Damsite, is regularly stocked with fingerlings by the GOI Department of Fisheries; and if a demand for such stocking is created, the Department of Fisheries might well extend their activities to the new lake in the future.

The potential for multiple purpose use of the reservoir to include hydropower generation was considered (see NEDECO Feasibility Study). However, because of the small size of the reservoir, power generation would be dependent on water releases as required for irrigation purposes, and with the present cost of thermal power generation did not appear economically attractive. With a sufficient rise in fuel costs in the future, supplemental hydropower generation could become more attractive. No allocation of water from the Jragung impoundment for domestic water supply was considered, except for that portion of water drawn by inhabitants of the irrigated area which was not returned to the irrigation canals after use. The amount determined to be withdrawn and not returned was insignificant when compared to the quantities of water required for irrigation, so no separate domestic water requirement was identified as such.

The Jragung Dam and water impoundment is compatible with other water resource planning in the area since it is one of a number of impoundments planned for the area. It is planned that most of the Jratunseluna Basin will be supplied with dry-season irrigation water. The Jragung water resource development is also well integrated with other programs of canal rehabilitation (part of which is presently underway under the auspices of the IBRD and part of which is underway by the GOI using NEDECO as consultant), agriculture extension services through the BIMAS (Bimbingan Masal, mass guidance) programs of the GOI, and interconnection with other canal systems for maximum use of irrigation water available until other water resource developments are completed in the future. BIMAS also supplies low-interest credit to the farmers for procurement of fertilizers, improved seed varieties and plant protection materials, and is assisting in improvement of processing and marketing facilities.

c. Physical aspects: The NEDECO Feasibility Study estimates that sedimentation will reduce the storage capacity of the reservoir by only 2.6% during the first 30 years after completion of the dam. The estimate was based on data relating to the nearby Rawa Pening natural reservoir and work done by two investigators in 1919. There is a question of similarity of watersheds and erosion characteristics between the two watersheds and between 1919 and present, and therefore a question as to the accuracy of the 2.6% reservoir capacity reduction estimate after 30 years. This sedimentation problem is being restudied at the time of this writing, and this analysis will be amended as

additional information becomes available. Sedimentation will surely take place in the reservoir, however, and that will decrease sedimentation in supply and distribution canals in the irrigated area thereby reducing maintenance and dredging costs from that of the past when run-of-the-river flows were used for wet-season irrigation.

Water shed use immediately upstream of the impoundment area is teak plantation and forest cover. The steep slopes of the hillsides abutting the sides of the impoundment area are covered with low bush and shrub growth as well as some forest cover. The upper reaches of the watershed, where more rolling country prevails, is cultivated in terraced rice farming during the wet-season, and either an attempt at a second rice crop should the wet-season be an apparently extended one or a dry season crop such as cassava or maise. One village of approximately 1200 inhabitants is also located in the upper reaches of the watershed. Fertilizer run-off and human waste nutrients from this village can be expected to encourage and assist growth of aquatic weeds in the new impoundment. No information is available as to nutrient content of run-off waters at present, however, so no attempt can be made to quantify this effect.

Aquatic weeds will be a problem in the new impoundment, however, as they have become in other lakes in the vicinity. In Rawa Pening, a nearby natural reservoir increased in size and depth by a weir constructed across the outlet, aquatic weeds, principally water hyacinth (Eichhornia Crassipes), form a blanket on the lake surface covering up to 90% of the surface by the end of the dry-season. At times, these

weeds become so dense they form floating islands of considerable size, (see photographs at Attachment 2), and lakeside residents talk of at least one floating island that is now "farmed," with at least one rice crop per year being realized. Most of the weeds, however, are washed over the outlet weir during the wet-season, with a new growth spawned at the beginning of the dry-season. Weeds washed over the weir during the wet season are carried down river into the irrigation canals and become a maintenance problem to the farmers and maintenance organizations downstream. The GOI recognizes this problem, however, and the FAO has completed a study(6) on the control of aquatic weeds in Rawa Pening. Unfortunately, the report of this study was not available in Indonesia at the time of this field investigation, but the report was available through the Reference Center, AID/W.

In addition, a regional workshop on the subject of Aquatic Weeds is scheduled to be held in Indonesia in mid-June, 1974, and shows continuing interest in and concern for this problem. Recommendations resulting from the workshop for aquatic weed control and/or the FAO report could be applied to the Jragung impoundment. The cost of aquatic weed control in the reservoir was not included in the feasibility study for the Jragung Dam.

During a field trip in the existing wet-season irrigated area, aquatic weeds were visible in the supply and distribution canals, and other evidence was visible that other aquatic weeds had been removed during maintenance work on the canals. In general, the weed problem was most severe in those canals that had not yet been rehabilitated and cleaned under the rehabilitation program begun about

two years ago. Continuing maintenance on those canals that had been rehabilitated appeared adequate to keep the weed problem in the canals under control.

Ground water levels may be increased in the area immediately adjacent to the impoundment, and in the hills immediately downstream of the dam due to the somewhat pervious nature of the formation along the Jragung River (NEDECO Feasibility Study, August 1973, para 22 page 10). Percolation of water into the surrounding strata is expected to decrease as the reservoir silts up and the bottom is covered with fine sediment. The aquifers that could benefit most by ground water recharge (i.e., the coastal area north of the Prauwvaart Canal) will not be affected.(2)

Water quality in the impoundment will not change significantly from the quality of the present river water. Primarily this is due to the expected annual fill and draw cycle. The reservoir will fill during the wet-season and be drawn down considerably if not almost totally evacuated by irrigation water demand during the next dry-season. Near the end of each dry season, the water remaining in the reservoir may become devoid of oxygen in the lower strata, depending on the amount of debris remaining in the impounded area after clearing operations are completed. The water would be quickly reaerated following release for irrigation requirements, however, and the use of the water for irrigation requirements would not be impaired. If, in the future, a part of the water is allocated to domestic water supply and the water is taken directly from the impoundment rather than withdrawn from a

downstream location, the lack of oxygen would become more significant. Two proposals are under consideration for clearing of the impounded area: 1) gross clearing only, involving cutting down those trees along the shoreline that would remain exposed above the high water level if they were not removed; and 2) clearing of all harvestable trees and wood in the impounded area on a no-cost-to-the-project basis. Under the second proposal, local inhabitants and wood-gatherers would be allowed to clean the impounded area without restriction. Wood-gatherers are now confined to collecting deadwood and unmarketable trees in the surrounding teak forests, marketing such wood as fuel for local brick kilns. The second proposal is favored by the majority of people concerned with the project, and is recommended; and if carried out, would minimize oxygen depletion of the impounded waters during the critical end-of-the-dry-season period.

Benefits derived from flood control by construction of Jragung Dam have been adequately assessed in the NEDECO Feasibility Study. In brief summary, the project will reduce average annual flooding of rice cultivated areas from 870 ha to 220 ha where inundation occurs for more than three days, and from 1600 ha to 450 ha where inundation occurs for periods of three days or less.

d. Socio-cultural aspects: One village, Kedoengglatik, lies within the impoundment area, and the 405 inhabitants of the village will require relocation. So far, little if anything in the way of planning for the relocation of the village has been done. The NEDECO Feasibility Study assumes that for the "relatively small number of

people involved" relocation will be handled through inclusion "in the ongoing transmigration program." Relocation of the inhabitants of Kedoengglatik to the Jratunseluna Basin area is virtually impossible, since all the land in the basin is presently owned and utilized. Relocation of the inhabitants to a site between the Jragung Damsite and the boundary of the Basin or to some area in the Juana Valley may be possible, but no investigation has been done to confirm this possibility. No socio-cultural survey of the village has been made to define village base-line data or canvass village opinion on relocation desires or needs. Present village location implies that the people of the village are orientated towards obtaining their livelihood through exploitation of forestland and forest products rather than through "flat-land" irrigated farming. The transmigration program is principally for relocation of poorer landless people from the overcrowded island of Java to areas in the Outer Islands where land is plentiful and the potential for economic improvement through the equivalent of "homesteading" is greater than their continued residence on Java. Transmigrants are selected through application by those desiring relocation; their relocation travel and initial living expenses are subsidized by the GOI through the Transmigration Program. The residents of Kedeongglatik do not meet this criteria since they are being displaced--probably against their wishes--and would not normally be applicants under the transmigration program.

Should the GOI simply purchase the land of land-owning residents of Kedeongglatik, these residents would have the option of

purchasing equivalent land in some other area. The landless residents of Kedeongglatik, however, would have little option but to apply to the Transmigration Program for relocation to one of the Outer Islands or to migrate to the larger urban centers (such as Semarang) in hopes of finding work. Such migration of even a small number of people to the larger urban centers would further aggravate an already critical problem.

In view of the above, it would seem preferable to perform a socio-cultural base-line survey of the village as soon as possible, and to initiate planning for the relocation of the village in a site as compatible as possible with the findings of the socio-cultural survey.

As noted previously, the irrigated area of influence of the project has been under at least wet-season irrigation for many years and is a well-developed, socially stable region. There is apparently an abundance of labour in the basin so that outside migrant laborers would not need to be imported for work on the dam project, and therefore no adverse social impact is expected from that aspect.

New cropping patterns, methods and practices will be introduced and encouraged, however, and these will bring about some changes. For instance, the NEDECO Feasibility Study recommends one wet-season rice crop and two dry-season irrigated soybean crops as the cropping pattern that will provide maximum economic gain to the farmer. The Feasibility Study admits, however, that "The adoption of the selection of a cash crop like soybeans for the dry season by the farmers will depend to a large extent on the influence exerted by the Government

to make this choice attractive. Extension Service will be needed to demonstrate the advantages. A method which may be introduced is the taxation of irrigation water in the dry season in order to curb the cultivation of rice and to induce the alternative of soybeans. Good marketing facilities will be essential to stimulate the change of attitude required. It will depend on government policy whether the production of soybeans, assumed in this study as a promising alternative, will indeed be realized." Since farmers in the nearby area obtaining dry-season irrigation water from the Rawa Pening continue with the traditional two rice crops per year, and in view of probable lack of government interest in departing from the traditional two rice crops per year until such time as Indonesia is self-sufficient in rice, the farmers in the area of project influence most probably will not be under social or cultural pressure to depart from their traditional cropping methods.

With the availability of a firm water supply for both wet and dry season irrigation water, however, more farmers in the area will come under the influence of BIMAS (Bimbingan Masal, mass guidance). The BIMAS program 1) provides agricultural extension services and training and encourages farmers to increase yields through use of better seeds (high yield and improved local varieties), fertilizers, adequate irrigation, modern agricultural methods and pest and disease control; 2) supplies the farmers with official low-cost credit (in kind) for purchase of production means and materials, and credit (in cash) for the cost of living during the growing period of the crop concerned;

and 3) promotes better processing and marketing facilities. In other areas already under the influence of BIMAS, increased production has been impressive. Discussions with agriculture extension officers in one BIMAS area, however, indicate that the BIMAS program is most effective on farm holdings that are larger than the average size farm in the project area of influence. They estimate that the minimum size farm for success under the BIMAS program is from 2.5 to 3.0 ha; the average size farm in the project area is 0.7 ha. Conceivably, then, the project and the subsequent influence of BIMAS could lead to land consolidation, with the smaller farmer eventually losing out and the larger more efficient land holding gradually increasing in size.

An agro-socio-economic survey of the Jratunseluna Basin(3) was completed in May 1973, and the subjects of land ownership and land fragmentation were studied. The first two conclusions are repeated here for ease of reference:

(1) The Jratunseluna project affects 80% of the inhabitants whose living depends on agriculture, nevertheless only the group of landowners will receive benefits, i.e., 57% out of 80% of the inhabitants. From development progress occuring in other areas, such as Klaten, it is known that irrigation rehabilitation will primarily be of benefit to farmers who are already relatively better off, and will then attempt to enlarge their land-holdings. Conclusion: there will be more small farmers and landless farm labourers.

(2) The increase in population will cause pressure upon the farm size. Unless minimum limits of land holding are guaranteed, the process of narrowing will further threaten the economic position of farmers. Compare f.i. the situation in Kecamatan Jati (Kudus).

And among the recommendations appears:

3. There needs to be a limitation of the farm size as a result of the system of land inheritance, so that there will be no division of land which is below a certain economical minimal size, such as what occurs in the Kecamatan Jati where the

land possession is continually narrowing. In Klaten and Jepara, for instance, the minimal farm size of 1/2 bau (about 0.3 ha) is already put into practice.

While the agriculture extension officers' forecast of land consolidation under BIMAS influence and the agro-socio-economic survey of on-going land fragmentation seem to be in conflict, it may be reasoned that further land fragmentation and the inefficiencies that will accompany such land fragmentation will actually promote a trend towards land consolidation at some future time.

Traditionally, no water charges have been levied against the farmer for wet-season supplemental irrigation water, and this traditional practice is expected to be continued. However, the NEDECO Feasibility Study recommends that water charges be assessed for dry-season irrigation water, the recommended charge to be Rp. 4,000 per ha. An important precedent has been set in the Jratunseluna Basin, however, since farmers receiving dry-season irrigation water from the natural lake Rawa Pening system do not now, nor have they ever, paid water charges for dry-season irrigation water. No survey of opinion of the farmers has been made (or at least no survey can be identified as having been made) to attempt to define whether or not the farmers will accept the proposition of paying dry-season irrigation water charges. Should the farmers balk at paying water charges because of their traditional beliefs (water falls from the sky, therefore it is free) or the Rawa Pening precedent, socio-cultural stress on the farmer to change his traditional beliefs could be great.

On the other side of the coin, the argument runs thus: The farmers receiving dry-season irrigation water from the Rawa Pening system realize they are in a favored location and receive dry-season

irrigation water free because no capital costs were incurred to develop their natural source of dry-season water.[1/] The farmers in the Jragung irrigation area, however, will realize that they reside in a less-favored location where a large capital expenditure was required to develop the man-made source of their irrigation water, and therefore will be willing to pay dry-season water charges imposed to repay capital costs of development.

While this argument has a basis in logic, it is not known to have been studied or recorded that the farmers will acquiesce to this logic.

e. Public Health aspects: Malaria is endemic in all regions and islands of Indonesia, and the area of project concern is no exception. There is a potential, therefore, for the impoundment to increase the total area suitable for malaria vector breeding. Jragung impoundment has two features that will minimize mosquito breeding and therefore minimize potential malaria impact. First, the steep side slopes of the impoundment and therefore the relatively small area of shallow water in the reservoir should limit mosquito breeding to a lower level per unit area of water than other impoundments in the area or proposed for the future or in comparison to the irrigated land in the vicinity. Second, the water level in the reservoir will be almost

1/ A capital expenditure for a weir at the Rawa Pening outlet was required but was charged to generation of electric power, not irrigation.

constantly changing, filling during the rainy-season and undergoing drawdown during the dry-season. Two relatively quiescent periods will occur as drawdown is halted after dry-season irrigation requirements are filled and before the lake begins to fill again, and after the lake fills during the rainy-season and before drawdown is resumed. While this annual fill and draw cycle may not be as effective a mosquito control device as the more frequent water level change investigated and adopted by the TVA in the United States, the annual cycle will minimize mosquito breeding in the impoundment area. 1/

The area that will come under dry-season irrigation (as well as wet-season supplemental irrigation) following completion of the project is another matter. Approximately 7,000 ha (7,900 ha in 4 out of 5 years) will receive dry-season irrigation water, and by virtue of the necessity of keeping a thin film of water on the paddy land in order to maintain soil saturation, most of the 7,000 ha will become potential breeding area for the rice-field mosquito breeder. Irrigation laterals and drains will also offer additional breeding grounds, although small in area compared to the land to be irrigated. The project will therefore increase the potential for malaria transmission.

On a field trip to the project site, discussions were held with the Director of the Central Java Provincial Health Office at Semarang and with the Chief Malariologist and the Sanitary Engineer, also of the Provincial Health Office. They indicated a 7% infectivity of the inhabitants of the project area. They also supplied some late statistics (1973 only) on malaria incidence as reported monthly by the

1/ See also comments by J. Stivers, TA/H, @ attachment 4.

Kecamatan (sub-district) health clinics located in the Jratunseluna Basin. Since the Jratunseluna Basin includes areas farmed by three different methods, i.e., rain-dependent, single-cropped with wet-season supplemental irrigation water, and double-cropped with firm dry-season irrigation water, positive malaria cases per 1000 health clinic patients tested were plotted vs. time for selected Kecamatans located in the areas using the different cropping methods (See Attach. 1). Surprisingly, the highest peak of malaria incidence occurred in the rain-dependent area, although it was of the shortest duration. Malaria incidence in the single-cropped (with wet-season supplemental irrigation water) area and the double-cropped area, although with a lesser dramatic peak, indicated no significant difference between the two areas but did have a longer period of sustained reported incidence than the rain-dependent area. One possible explanation is the farmers in the rain-dependent area ponded as much water as possible to conserve the water as long as possible whereas the irrigated single and double-cropped area farmers had flowing water - therefore the early high peak of incidence in the rain-dependent area. The ponded water quickly dried up in the rain-dependent area thereby reducing mosquito breeding and reducing reported incidence of malaria; whereas the irrigated areas continued to have water available for mosquito breeding and hence the sustained periods of reported incidence. If the statistics from 1973 are at all accurate, changing the cropping method of the area under influence of the project from a single-cropped area using wet-season supplemental irrigation water to a double-cropped dry-season

irrigated area will not radically change or increase malarial incidence in the project area.

Nevertheless, in all areas of the Basin, including the project area, malaria continues to be a serious problem.

The above discussion is based on 1973 statistics only, and limited statistics at that. There well might be bias in the data. The identification of positive cases was as follows: A blood sample was taken from each person appearing at a health clinic, requesting examination and treatment, and upon examination, was found to have a fever. If the blood sample was identified as malaria positive, the patient was given radical treatment with antimalarial drugs; if found negative, the patient was examined further and treated according to diagnosis. The data did not account for those who were too sick to travel to the health clinic nor those who were feeling ill but not ill enough to undertake the sometimes long trip to the health center. The data certainly did not represent a sampling of total population. 2/

Schistosomiasis is not endemic on the island of Java, nor has a potential snail host as yet been identified on the island of Java. 1/ 2/

The discussions at the Provincial Health Office indicated there is no evidence of filariasis in the Plain of East Semarang (which includes the area of project concern), and in view of the good drainage system necessary for the past decades of irrigation in the area, the absence of filariasis is not unexpected. There are annual outbreaks of dengue (hemorraghic) fever, but the outbreaks are limited to the larger urban areas, Semarang in particular, and are not a problem in the project area. 2/

1/ See also comments by J.L. Stockard, TA/H, @ attachment 3.
2/ See also comments by J. Stivers, TA/H, @ attachment 4.

Cholera outbreaks occur each year, but in general are limited to the area along the seacoast north of the Prauwvaart Canal, approximately 15 km north of the area which will be irrigated by Jragung impounded water, and approximately 30 km (as the crow flies) north of Jragung Damsite. Residents of the coastal area, near the mid-point of the dry season, construct temporary low-level earth dams across the mouth of the irrigation drains as exit flow in the drains decreases, attempting to pond and retain as much water as possible to carry them through the dry season. As the dry season continues, the water quality of the ponds behind the low-level dams deteriorates greatly. Since this ponded water is the only source of non-saline water for most of the coastal residents, cholera is inevitable. With the construction of Jragung Dam and subsequent water releases from the impoundment during the dry season, some additional water from spillage, drainage and wasteage will end up in these lower drains. While the water that reaches these lower drains will probably not be enough to provide a flushing action throughout the dry season so that the coastal residents need no longer build the low-level dams, the dilution water that reaches the lower drains will almost certainly be of somewhat higher quality than the deteriorated quality that now annually persists. The potential will exist that some water from the impoundment could be used directly for such flushing action, although the pressure will be great in the driest years for all impounded water to be allocated to irrigation uses. As other impoundments are constructed in the future in accordance with the Jratunseluna Basin Development Plan, additional water for flushing the

lower drains will become available and the annual cholera outbreak potential should be eased. Of course, the situation will never be remedied until a firm source of acceptable water for domestic purposes is made available to the coastal residents.[1/]

Availability of ground water from wells throughout the Jratunseluna Basin including the area of project concern has been studied by NEDECO.[(2)] Water from deep wells is generally brackish, the salt content increasing toward the north seacoast. Water from shallow or dug wells generally was extremely limited in quantity due to the impermeability of the clayey, silty soils and subsequent slow well recharge. Therefore, nearly all residents (estimated at over 70%) of the irrigated area of project influence take water from the irrigation canals (and sometimes drains) for their domestic uses. Health officials claim that the people allow the fine sediment or turbidity to settle out, decant the clearer water and boil the water prior to use for drinking and cooking. The same health officials estimate that about 20% of the population suffer from some variety of dysentary. Evidently all residents of the area do not boil their water sufficiently or they use non-boiled water for cleaning purposes that cross-connect with or contaminate their boiled supply or contaminate their eating utensils, dishes, etc...

Because the residents of the area use the canals for bathing, washing, excreta disposal, etc., water quality deteriorates in proportion to the distance from the water source. With the new Jragung impoundment and the proximity of the irrigated area under project influence to

1/ See also comments by J.L. Stockard, TA/H, @ attachment 3.

the new impoundment, water quality (bacteriologically) should in general improve by virtue of dilution, most markedly in the dry-season. However, no data on bacteriological water quality is available to support this premise.

The supply of firm wet and dry-season irrigation water and the BIMAS program that will accompany this supply will encourage the increased use of fertilizers, pesticides, fungicides and rodenticides. Subsequent runoff and leaching of these chemicals into the irrigation area drainage system will cause some deterioration of the chemical water quality in the lower reaches of the system. No data is available on present water quality in the irrigation canals or lower drainage system and no estimate of future chemical water quality nor any estimate of the effect of this deteriorated water quality on the human population using such water for domestic purposes is possible.

3. Adverse Environmental Effects Which Cannot be Avoided:

A number of impacts identified under 2. above are identified as adverse, or have the potential for adverse impact.

Aquatic weed control in the reservoir impounded by Jragung Dam will surely become a problem. Although not mentioned in the NEDECO feasibility Study, the problem is known and has been studied, including control procedures, by the FAO.(6) It is therefore assumed that if the aquatic weed problem in Jragung Reservoir develops beyond a simple nuisance, the GOI will undertake control measures. Cost of such a control program, if found necessary, is estimated at approximately Rp. 2.0 million (US$5,000 equivalent) per year. The rehabilitation

and maintenance program outlined and costed in the NEDECO Feasibility Study appears adequate for weed control in the irrigation canals, laterals, drains, etc.

The village of Kedoengglatik, population 405, located in the area to be inundated by Jragung impoundment, will have to be relocated. However, no socio-cultural baseline survey of the village has been done, and little or no planning has been done relative to the relocation of the village inhabitants, the NEDECO Feasibility Study assuming they would be relocated under the GOI Transmigration Scheme. It is recommended that a socio-cultural baseline survey of the village be made as soon as possible, and planning initiated for the relocation of the village in a site as compatible as possible with the findings of the socio-cultural survey. While the expenses of compensation for village buildings at their replacement value was included in the economic cost of the dam and impoundment, relocation costs of the village residents were not. Using an estimated Rp. 246,000 (US$600 equivalent) per person for relocation costs to an Outer Island, total project costs would increase by Rp. 100,860,000 (US$243,000 equiv.). Relocation costs to a nearby site, if one can be found, could reduce the relocation costs as much as ten-fold or an estimated Rp. 10,086,000 (US$24,300 equiv.).

The foregoing costs should be considered as the maximum and minimum limits of additional cost to the project for relocation of villagers, the final cost being somewhere in between these limits. That is, all 405 villagers must move, but it would be unrealistic to

assume that all would accept transmigration; hence some would accept the lower relocation figure and probably migrate to nearby urban centers.

Consolidation of land holdings into larger farms, while possessing a potential adverse effect of reducing some landowners into landless labourers, has been studied,(3) the problem identified and recommendations made, and the project designers, officers and GOI officials are well aware of the problem. No further comment is required here.

Water charges for dry-season irrigation water as recommended by the NEDECO Feasibility Study go against local traditional practice, and therefore may become a source of social stress to the farmer, particularly if he is suddenly confronted with this fact at the time the impounded water becomes available. It is recommended that a survey of farmers' opinion be made to determine acceptance or rejection of the proposal; and if the latter is found to prevail, an educational program be initiated to change farmer opinion through identification of benefits that will be realized or alternately, restructuring the water charge such that it will be acceptable by the area farmers.

If the impoundment area is not cleared prior to inundation, there will be some adverse effect on the impounded water quality (deoxygenation in the lower strata of the lake), hence reduced fish habitat, etc. It is recommended that as a minimum, clearing of all marketable wood on a no-cost-to-the-project basis as discussed in 2.c. above be accomplished. 1/

1/ See also comments by J. Stivers, TA/H, @ attachment 4.

Malaria is endemic in the project area as it is in all of Indonesia, and while the proposed project is not expected to affect the incidence of malaria, either increasing or decreasing incidence drastically, malaria will continue to be a serious problem. In recognition of the seriousness of the country-wide malaria problem, A.I.D. is proposing funding a $24.7 million loan in FY74 for the purpose of malaria control throughout Indonesia over a period of five years.(5) The objectives of the proposed malaria control project are: 1) for Java, Bali and Madura, the prevention of reestablishment of endemicity and reduction of incidence to less than one per thousand; and 2) for the Outer Islands, the reduction of malaria endemicity to a level at which it is no longer a major public health problem. The Director of the Central Java Provincial Health Office in Semarang knows of and is looking forward to the beginning of the malaria control project, anticipating building his present staff of approximately 4,000 back up to the 1965 level of approximately 11,000. With this malaria control project in the offing, no further recommendations need be given here for protection measures against increased malarial incidence due to the proposed Jragung Dam and irrigation project.

Water quality in the lower drainage system which includes drainage from the project area may further deteriorate due to increased use of fertilizers, pesticides, rodenticides and fungicides required for double-cropping with dry-season irrigation water supply. Because many (if not most) of the inhabitants of this region use irrigation canal and drainage system water for domestic purposes including drinking, the deteriorated water quality may adversely impact upon them.

No information or data is available as to present water quality and no estimate of future water quality is possible. It is recommended that the Ministry of Health, through the Central Java Provincial Health Office in Semarang, be encouraged to undertake a program of investigation and monitoring of chemical and bacteriological water quality in the canals and drains from which domestic water is taken, beginning with the area between the Prauwvaart Canal and the northern seacoast and eventually extending the investigation and monitoring upstream as necessary. If the investigations and monitoring is begun at least a year before completion of Jragung Dam and carried out for at least some years thereafter, a measure of the effect of increased use of chemicals in the irrigated area is possible, and the information collected will be invaluable in determining preventive measures necessary for the protection of the exposed population. At the same time, the information collected would be extremely valuable for forecasting potential outbreaks of cholera as well as other bacterial and parasitic disease and health problems, and would be excellent baseline data for domestic water supply treatment processes if such treatment becomes necessary in the future in order to protect the health of the local population.

4. Alternatives to the Project:

As indicated in the NEDECO Feasibility Study, an alternate damsite was considered, but ruled out on the basis of inadequate foundation for the dam structure. The site was not far removed from the chosen site, and the environmental considerations would not have

differed greatly from the chosen site, save perhaps quantity and type of land inundated and numbers of people to be relocated.

NEDECO also included a "no project" alternative in their economic analysis, principally as a means of determining benefits of the project. Environmentally, while the "no project" alternative would not require the relocation of 405 people from the area to be inundated and would not remove some agriculture land and forest land from the resource inventory, neither would it provide the benefits of flood control, increased agriculture production in the area to be irrigated and the impounded water to be added to the resource inventory. On balance, the benefits to be derived from the project outweigh the adverse effects of change caused by the project.

One other alternative was studied by NEDECO, called Variant "B", and involved a new drainage canal from several different river systems within the Jratunseluna Basin. Variant "B" was judged solely on the benefit received from flood control, and the removal of land from the resource inventory as required for the construction of the canal was included in the economic analysis. Since construction of Variant "B" would not change the environmental considerations of the Jragung Dam project significantly whether constructed or not, it was not discussed in detail in this assessment of environmental impact.

5. **Relationship Between Local Short-term Use of the Environment and the Maintenance and Enhancement of Long-term Productivity:**

Short term use of the environment will be limited to the construction period, estimated at from 3 to 4 years. Much of the construction is planned to be done by labor intensive methods, and therefore construction noise, dust, traffic, etc., will be reduced as much as possible. Because of the remoteness of the site, such environmental effects will be limited to the damsite construction and will not affect any urban area.

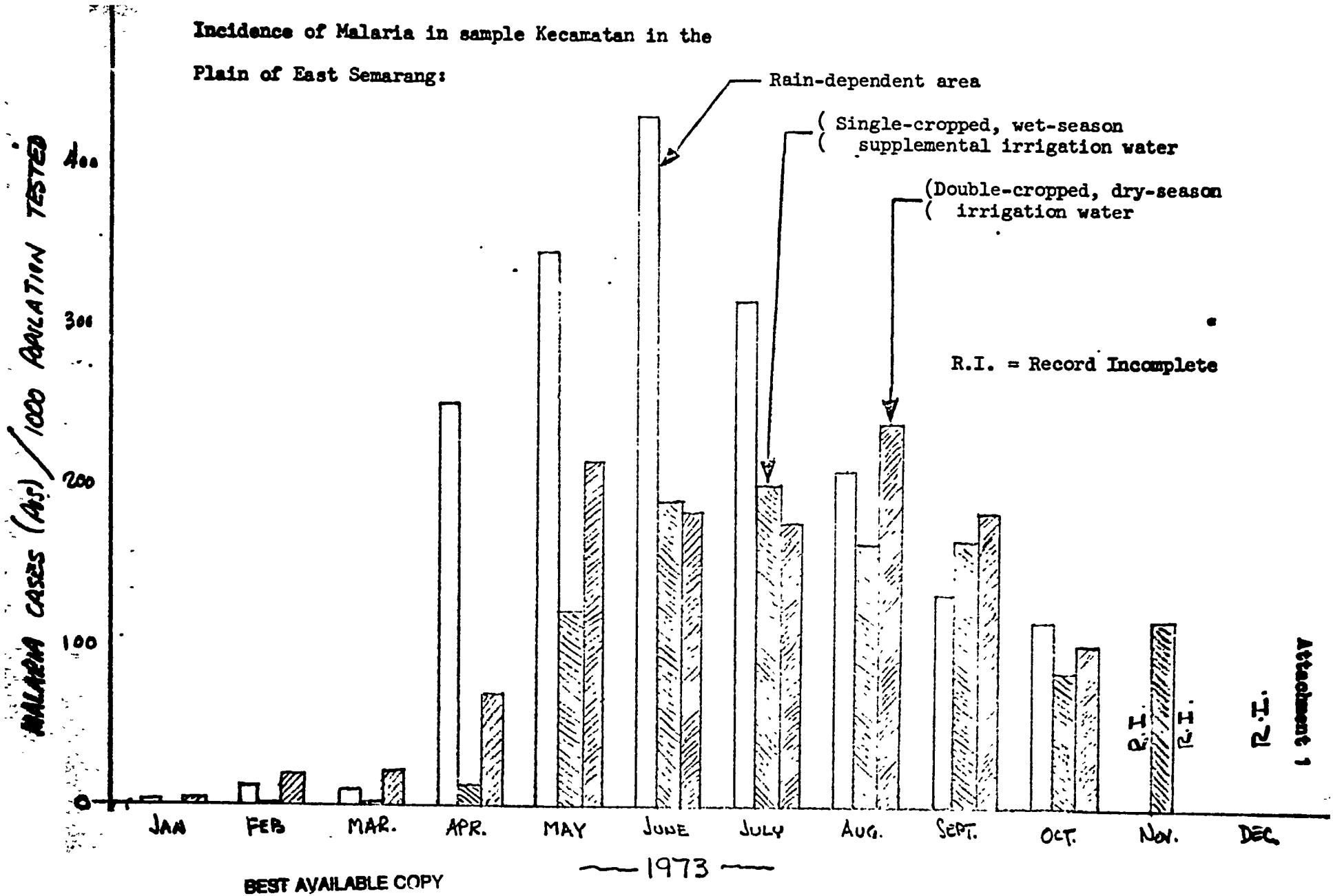
Long-term agricultural productivity will be greatly enhanced, and this has been well documented in the NEDECO Feasibility Study.

6. Irreversible and Irretrievable Commitments of Resources Which Will Be Involved Should the Project be Implemented:

As noted in 2.b. above, 347.5 ha of young teak plantation land and approximately five ha of agricultural land will be inundated and removed from the resource inventory. Total land to be inundated is 450 ha, the remainder of which is non-productive forest land. The NEDECO Feasibility Study has included retirement of this resource as follows: "The cost of inundating the reservoir area consists of actual expenses to compensate for fruit trees and buildings at their replacement value and of the economic cost of foregone benefits from forests and agricultural land, valued as the discounted worth of future yields during 30 years." This cost as calculated by NEDECO, using a 4-year construction period and a discount rate of 10%, is Rp. 93,915,000 (US$226,000 equiv.). Estimated costs are also given for longer construction periods and different discount rates.

REFERENCES

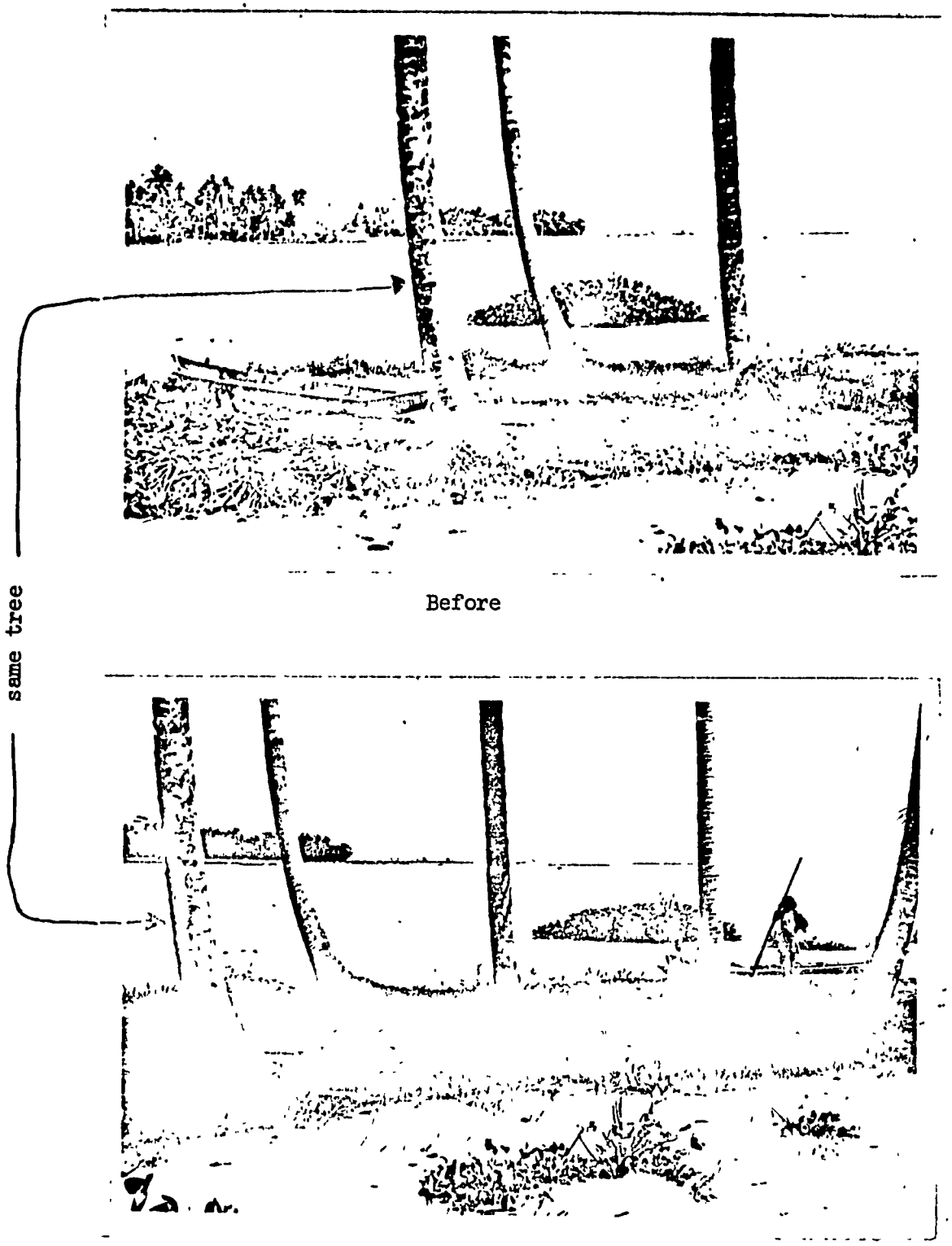
1. Netherlands Engineering Co. (NEDECO), Jragung Dam Flood Control and Irrigation Project Feasibility Study, August 1973.
2. NEDECO, Jratunseluna Basin Development Plan, Supporting Report III, Groundwater Resources, July 1973.
3. Research Institute in Social Sciences, Satya Wacana Christian University, Salatiga, Agro-Socio-Economic Survey in the Jratunseluna Area, Series Research Report No. 9, May 1973.
4. Personal conversations with Dr. Rustanto, M.D., Director of Central Java Provincial Health Office (CJPHO), Semarang; Dr. Ori Pjwee Bing, M.D., Malariologist, CJPHO; and Ir. Nurjoto, Sanitary Engineer, CJPHO.
5. USAID/Indonesia; Capital Assistance Paper, Indonesia - Malaria Control; December, 1973.
6. FAO; Report to the Government of Indonesia on the Control of Aquatic Vegetation in the Lake of Rawa Pening, Central Java; E.C.S. Little; 1968.



Attachment 2a

Aquatic Weed Growth in Rawa Pening, Central Java

A Small Floating Island of Aquatic Weeds, Rawa Pening, Central Java



UNITED STATES GOVERNMENT

Attachment 3

Memorandum

TO : ENGR/SP/UE, Mr. John Neave

DATE: June 5, 1974

FROM : TA/H, Joe L. Stockard, M.D.

SUBJECT: Review of Jragung Dam and Irrigated Areas Environmental Assessment

The paper referred to above is enclosed with an analysis of the malaria section by John Stivers and concurred in by Edgar Smith of our malaria staff.

I have not direct personal knowledge of any areas in Indonesia and feel therefore less than competent to assess the potential environmental impact of this project. However, I will mention the following items which you might take into consideration:

1. I am aware of at least focus of schistosomiasis in a remote area of the Celebes. While this does not appear to present any direct threat to this particular project or to any other irrigated areas on Java and Sumatra, its existence represents an ever present possibility of spread of this chronic debilitating disease. It would seem that the Government of Indonesia would be well advised to begin concerning the possibility of assessing the total extent of the present schistosomiasis problem and controlling or hopefully eradicating any known foci of the disease.

2. Leptospirosis is known to exist in Indonesia but I am not entirely familiar with its epidemiology in that setting. The Batavia sero type of organism that exists in Indonesia is as I recall rat-borne predominately and may well contaminate water in the rice fields through leading to infection of rice field workers in much the same way as occurs among such workers in Italy. However, this same disease in Italy is much milder and is carried by small mice. It would seem possible that an increase in the population of leptospirosis carrying rodents might occur as rice production increases. This might lead to an increase in the incidence of human and even possibly of animal lepto.

3. Plague epidemics have occurred in the recent past in Indonesia. Rats are a reservoir of plague and bubonic plague is transmitted to man by the bite of an infected rat flea. I mention this simply to point out that any major programs to control rats should incorporate plans for first killing rat fleas.

4. Cholera may well be limited in its distribution but there is no assurance that it will not spread widely from existing foci as long as poor sanitary conditions exist throughout large areas of the country.

I hope these comments may be of some value and regret that I am not more knowledgeable about the area concerned.

Enclosures: a/s (Dictated but not read by Dr. Stockard)TA/H:ja

UNITED STATES GOVERNMENT

Attachment 4

Memorandum

TO : TA/H, Dr. J. L. Stockard

DATE: May 28, 1974

FROM : TA/H, John Stivers

Concur
E A Smith

SUBJECT: Review

REF: Jragung Dam and Irrigated Areas Environmental Assessment

My experience in Indonesia and familiarity with its vectors is nil, so I hope that if there is time you will check any academic remarks against Ed Smith's first-hand experience on his return next week.

The steep sides of the reservoir sound good, if they are cleared. The problem with Anopheles in such impoundments as this and TVA, is less that of depth as of emergent vegetation, and tree tops stick ng out of deep water can serve as well as cat-tails and tules on a marshy shoreline.

The rationale behind the water level management in TVA is to keep the shoreline changing so that it doesn't stay in one place long enough to encourage emergent growth. Whether the annual fill and draw-down planned at the Jragung will serve the same purpose will depend on how rapidly the shoreline changes, and the two quiescent periods are almost certain to produce Anopheles unless some effort is made to control the vegetation.

There is not a great deal which can be done about Anopheles breeding in the rice paddies themselves if the water in them is not deep enough to allow stocking with top-feeding minnows, other than careful engineering to minimize puddling. Both feeder and drain ditches should, of course, be carefully graded and kept clean to allow for rapid flow and to avoid accumulation of water. While not too far out of the laboratory yet, some of the work being done with parasitic nematodes may be a ray of hope for the future.

Indonesia is about to revive and revitalize its malaria control program, so it is possible that the disease may be held down despite an increase in potential vectors.

I agree that the '73 statistics are probably biased, but in both directions. It's true that people too sick to make it to the clinic, and those who were ill but not ill enough to go to the clinic were not sampled. On the

other hand nobody was sampled except sick people, so as the author says, its hardly a sample of the total population.

Dengue might increase in importance if the new double-cropping changes the living patterns of the people toward clumping together of dwellings into villages rather than individual farmsteads.

I don't know whether Japanese B encephalitis has been reported from the area in question, but it wouldn't surprise me to learn that it is endemic there, detected or undetected, and its vectors as well as the Anopheles might well show a sharp increase with all that extra water around.