THE REPUBLIC OF INDONESIA

RECONNAISSANCE SURVEY ON WAY RAREM/WAY ABUNG IRRIGATION PROJECT

MARCH 1973

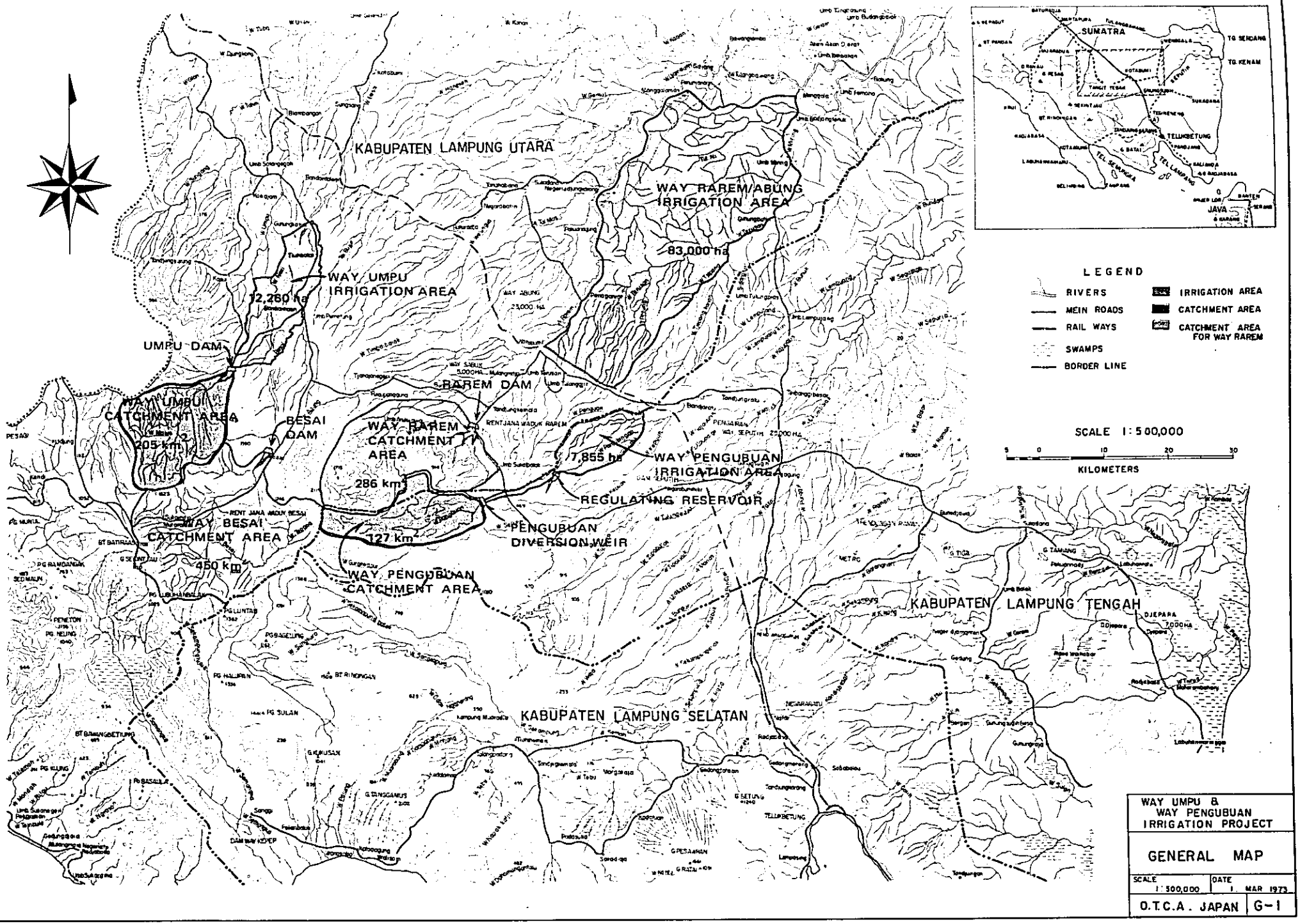
OVERSEAS TECHNICAL COOPERATION AGENCY
GOVERNMENT OF JAPAN

THE REPUBLIC OF INDONESIA

RECONNAISSANCE SURVEY ON WAY RAREM/WAY ABUNG IRRIGATION PROJECT

MARCH 1973

OVERSEAS TECHNICAL COOPERATION AGENCY
GOVERNMENT OF JAPAN


KABUPATEN LAMPUNG UTARA
WAY RAREM/ABUNG IRRIGATION AREA
83,000 ha
WAY UMPU IRRIGATION AREA
12,260 ha
UMPU DAM
RAREM DAM
BESAI DAM
WAY UMPU CATCHMENT AREA
205 km²
WAY RAREM CATCHMENT AREA
286 km²
7,855 ha
WAY PENGUBUAN IRRIGATION AREA
REGULATING RESERVOIR
PENGUBUAN DIVERSION WEIR
127 km²
WAY BESAI CATCHMENT AREA
450 km²
WAY PENGUBUAN CATCHMENT AREA
KABUPATEN LAMPUNG TENGAH
KABUPATEN LAMPUNG SELATAN
SUMATRA
JAVA
LEGEND
RIVERS
MEIN ROADS
RAIL WAYS
SWAMPS
BORDER LINE
IRRIGATION AREA
CATCHMENT AREA
CATCHMENT AREA FOR WAY RAREM
SCALE 1:500,000
KILOMETERS
WAY UMPU & WAY PENGUBUAN IRRIGATION PROJECT
GENERAL MAP
SCALE 1:500,000
DATE 1 MAR 1973
O.T.C.A. JAPAN
G-1

CONTENTS

CHAPTER 1.

GENERAL

1 - 1. Background of the Project

This project aims an Agricultural Development to accommodate transmigrants into the project area and an establishment of a domestic water supply to Kotabumi City, the capital of the North Lampung Prefecture.

Especially, since 1965, transmigration scheme from Java island to the project area has been executed as a part of large scaled governmental transmigration scheme by the Transmigration Bureau, Government of Indonesia.

Recently, the Transmigration Bureau has requested the Directorate General of Water Resources Development, Ministry of Public Works and Power to execute the studies on the Agricultural Water Resources Development in this area. Along with the said request, the Director General of Water Resources Development instructed to the Directorate Irrigation, in November 1971, to carry out a preliminary survey, and a "Preliminary Survey Report" of more than ten (10) pages has been already compiled.

This project is named as Abung Irrigation Project by the Transmigration Bureau following after the name of the village, while the Ministry of Public Works and Power calls it Way Rarem Irrigation Project following after the name of the river which will be a water resource of the project area.

From above mentioned circumstance, it is decided to name the project as Way Rarem/Abung Irrigation Project in this report.

This area is a vast flat land covering 83,000 hectares of total acreage. Approximately 2,500 households, 11,000 transmigrants, have already settled by the end of 1971, and in 1972 it is scheduled to settle another 2,000 households, 10,000 transmigrants in this area.

Moreover, approximately 10,000 hectares of Daya Itoh Plantation (a joint-venture company of C. Itoh and Indonesian enterprise) is included in the area, and also in the area, 5,000 hectares of farm land belongs to the Retired Air Force Servicemen, called PROPAU.

Both the Central Government of Indonesia and Lampung Provincial Government regard this project as serious and an emergency project to be executed to achieve the self-sufficiency of food-stuff for transmigrants and stabilizing their living conditions, and furthermore consolidate the area as transmigration scheme district after 1973.

1 - 2. Planning of the Project

As for the irrigation planning on this project area, following three ideas would be considered, i.e. 1) to take the irrigation water from the upstream of the Way Rarem by diversion weir and lead the irrigation water to the project area by leading canal of about 20 km passing through the Eastern site of the Way Rarem, 2) to irrigate the project area by pumping up the water from the Way Rarem, and 3) to combine the above two ideas.

On the other hand, because of the presumed annual mean discharge of the Way Rarem in the dry season is estimated at 8 cubic meters per second, so that farm products in the dry season can not be expected so much. From the reason, it will be necessary to study a transfer basin from the Way Besai to the Way Rarem through the Way Abung.

Accordingly, if the irrigation Project of the Way Abung can be combined with the proposed Project, it will be more economical and effective regional development project.

In the case of combining, the total project area will be as follows:

Way Rarem/Abung area:	83,000 hectares
Way Abung Area:	35,300 hectares
Total:	118,300 hectares

Considering the overall regional development in the Lampung Province to cope with the economic progress of the Indonesia, a comprehensive regional development scheme would be established to combine the above two projects for the Agricultural

Development through the effective utilization of the water resource of the Way Rarem, Way Abung, and Way Besai, in addition a domestic water supply scheme to the Kotabumi City, which is a capital city of the North Lampung Prefecture, would also be combined for the security of their living water.

1 - 3. Benefit of the Project

By accomplishment of the both two projects, 70,000 hectares of paddy field and upland field will be established, excluding that of the Daya Itoh estate, so that about 30,000 farming families of 150,000 people will be able to be accommodated in the project area as transmigrants. This number is almost the same figure of the planned transmigration families to the Lampung Province during the First Five-year Development Plan.

The agricultural products in the project area will be as follows:

Milled rice production:

wet season rice:	70,000 ha x 2.5 t/ha =	175,000 tons
dry season rice:	30,000 ha x 2.5 t/ha =	75,000 tons
		250,000 tons

Maize (Yellow dry grain):

dry season upland:	40,000 ha x 2.0 t/ha =	80,000 tons

It is assumed that the population in the Lampung Province in 1980 will be about 4 million based upon the rate of population growth of natural and transmigration scheme in this district. On the other hand, from the viewpoint of increasing of rice production in the Lampung Province through the accomplishment of this Project along with the Way Umpu and Way Pengubuan Irrigation Projects, the self-sufficiency of rice in this district will be achieved. Moreover, the production of maize as a cash crop will contribute not only to the regional economy but also to the Indonesian economy as well.

Furthermore, around 1980, the Ferry Boat Scheme to connect Merak in Java Island with South Sumatra, and connecting road construction with the Ferry Boat Port to Tandjun Karang will be accomplished and in future, the road network in the south Sumatra combined with the planned Trans-Sumatra-High Way will be established to connect with these projects areas. Therefore, the Way Rarem and Way Abung Projects will have a potentiality to supply the agricultural products to the Jakarta, a gigantic consuming area as well.

1 - 4. Additional Data Required for the Feasibility Study

At present, topographical maps on the project area showing a part of diversion weir site on the scale of 1:2,000 and a part of the project area covering about 16,000 hectares are available. In addition, the Ministry of Public Works and Power will survey an additional area of about 10,000 hectares in the next year. However, it is necessary, in principle, to perform a topographical survey covering the whole irrigation area, diversion weir site, and the leading canal route to prepare required maps on the scale of at least 1:10,000 and/or 1:5,000 for the feasibility study.

In accordance with the said topographical maps, selections of the diversion weir site, the leading canal route, pump station site, etc. should be exercised to design the most effective and economical plan.

The followings are the data required for the feasibility study:

		Scale
(1)	Topographic maps covering Way Rarem/Abung Irrigation area	1/10,000 1/25,000
(2)	Topographic maps covering Upper stream of the Way Rarem	1/ 5,000 1/25,000
(3)	Topographic maps covering Upperstream of the Way Besai	1/ 5,000 1/25,000

(4) Discharge observation data on the Way Besai at the dam site

(5) Discharge observation data at the confluence point of the Way Abung and the Way Rarem

(6) Discharge observation data at the diversion weir site on the Way Rarem

(7) Daily rainfall observation data in the Way Rarem/ Abung Project area at each 100 square kilometers

(8) Daily rainfall observation data in the catchment area of the Way Rarem and the Way Besai (Two observatories in each catchment area)

On the basis of the above mentioned data, master plans should be prepared for the Way Rarem/Abung Project, the Way Abung Project, and the domestic water supply system to Kotabumi city.

The scale of the project will largely be affected by the river discharge and rainfall in the area which are the key points of the project planning.

And, it is emphasized that studies should be made to select the most economical diversion weir site and canal routes based on these master plans.

From the viewpoints of both soil and climatic conditions, unsuitable place for agriculture is not found in the project area. Also, foundational and geological conditions allow the construction of large scaled structures.

Accordingly, it is necessary to carry out a detailed survey (survey of geology and soil and soil test) on the main structures in accordance with the said master plans.

CHAPTER 2.

THE NATURAL CONDITIONS OF THE PROJECT AREA

2 - 1. General Description

The Way Rarem/Abung Project area is located at East Longitude of 104°53′ and South Latitude of 4°40′, in the north-east of Kotabumi city which is the prefectural capital city of North Lampung, in the southern-middle of the prefecture, Lampung Province, southern part of Sumatra island.

The southern side of the area is closely adjacent to the railway which connects Kotabumi with Telukbetung, and the eastern side is bounded by the Way Tjampang. The western and northern sides are surrounded by the Way Rarem. The total acreage of the project area is about 83,000 hectares. And in the preliminary survey report prepared by the Ministry of Public Works and Power, 40,000 hectares out of 83,000 hectares is selected as the object of the irrigation project.

However, along the commencement of the Djepara Irrigation Project, Rarem district was selected as a transmigrant area for those who have to move out from the catchment area of the Djepara reservoir. In addition, the PROPAU area also requests to be irrigated. Therefore, it is required to expand the object area of the irrigation project.

2 - 2. Topography

The Way Rarem/Abung and Way Abung Project area are located on a plateau, from south of north, of which three sides; east, west and north are surrounded by the rivers. In the area of the flat plateau having 18 kilometers width of the east to the west and 50 kilometers length of the south to the north, there are many small tributaries which will have a effective drainage function during rainy season.

These tributaries are formed by the erosion caused by the water during rainy season. And in the dry season almost no water is observed in these rivers. Accordingly, these rivers are meandering freely and forming U-shaped valley.

2 - 3. Geology and Soils

Along the Indian Ocean coast, the Barisang mountain range is located from south to north. The geology of the mountains belongs to volcanic stratum consisting of igneous rocks, basalt and tuff. Therefore, the project area is covered by weathered such volcanic plateaus. As the project area belongs to the tropical humid zone, the soils are laterized or podzolized by means of leaching by the rainfall from the basic composition in the soils to the acid composition.

In the project area, most of the parent material consists of slightly weathered tuff, and the upper portion is covered with heavily weathered soil and volcanic ash. Also, on the part of northern area, sandy alluvial soil transported by the rivers is observed.

Regarding the soil characteristics, sufficient survey has not been executed yet. However, according to the report prepared based on the survey in Pekuren village, by L.P.M.A., the Institute of Hydraulic Engineering, Bandung, the project area is occupied by reddish-brown lateritic soil and yellowish-brown podzolic soil. It is considered that this portion is acidified to some extent. Most of the soils are clay or silty clay textures in the surface soil, and parent rocks or gravel stone horizon can not be seen within the surface layer. From these aspects, it can be said that most of the soils in the project area will be suitable for agriculture, and an adequate farm management will lead a satisfactory yield.

2 - 4. Climate

2-4-1. Rainfall

The rainfall observation is not yet carried out in the project area but the record of the rainfall at Kotabumi will be able to be used for a project formulation. The rainfall gauging station is located at 32 meters above sea level and the rainfall data are recorded between 1918 thru 1941 and between 1952 thru 1970. According to the preliminary report, the records are as shown below.

Table 2 - 1 Rainfall Records between 1918 thru 1941

Month	Monthly average	Ratio	No. of days	Max. one day rainfall
	mm	percent	days	mm
Jan.	364	15	16.8	74
Feb.	264	11	14.6	63
Mar.	316	13	16.6	59
Apr.	228	9	13.1	53
May	165	7	10.5	51
Jun.	127	5	8.3	42
Jul.	100	4	7.3	38
Aug.	83	3	6.3	35
Sep.	107	5	7.1	41
Oct.	146	6	10.1	46
Nov.	181	8	11.9	43
Dec.	342	14	16.8	64
Total:	2,423	100	139.4	–

In April 1927, there is a record of 162 millimeters max. per day rainfall. And the annual average rainfall is approximately 2,400 millimeters, and rainfall during dry season is 14.3 percent thru 33.3 percent of it. Due to the deficit of the record in some years, statistically it will be difficult to use the whole records between 1952 thru 1970. But the records in some period of year are completely available.

2-4-2. Temperature, humidity and evaporation

In and around the project area the perfect observation records were not found. However, records prepared at the Way Seputih Irrigation Project, located in the south-east from the project area, is as shown below.

Table 2 - 2 Records of Temperature, Humidity and Evaporation

Month	Temperature (°C)			Humidity (percent)			Evaporation (mm per month)
	Max.	Ave.	Min.	Max.	Ave.	Min.	
Jan.	29.9	26.0	22.4	92	71	55	53.3
Feb.	31.2	26.6	22.7	93	76	58	45.8
Mar.	31.1	26.7	22.2	98	78	58	47.3
Apr.	–	–	–	–	–	–	–
May	32.7	26.3	23.7	91	78	51	61.5
Jun.	31.5	25.7	24.4	91	78	51	43.7
Jul.	31.4	26.1	22.4	90	73	50	56.5
Aug.	31.9	26.1	21.7	91	74	47	21.3
Sep.	32.0	26.4	22.0	92	76	50	65.8
Oct.	32.2	26.5	22.5	93	70	52	60.2
Nov.	31.2	25.2	22.2	95	83	55	53.3
Dec.	30.9	26.5	22.1	94	75	56	44.2
Average	31.4	26.2	22.6	92.7	76.3	53	50.3

From the above records, it is understood that the project area belongs to the high temperature and humid zone, and also the evaporation (1.45 - 2.20 millimeters per day) is not so much through a year.

2-4-3. Hydrology

Regarding the discharge of the Way Rarem, water level observation was started from April 1971 at 40 meters upperstream from Tandjung Kamala. Furthermore, discharge observation of the Way Rarem was executed several times, changing observation spot during preliminary survey and after that. However, those observations are not systematical ones and, accordingly, they can not be used as the basic data for the project planning.

If the construction of diversion weir site is settled at the confluence of the Way Rarem and the Way Galing, the catchment area would be 286 square kilometers.

As this catchment area situates between the basins of the Way Pengubuan and the Way Umpu, the discharge, presumed on the basis of the specific discharge of the both rivers as mentioned in the preliminary report prepared by the Ministry of Public Works and Power, would be as follows:

Month	cu.m/sec
Jan.	28.1
Feb.	20.4
Mar.	24.4
Apr.	17.6
May	12.7
Jun.	9.8
Jul.	7.7
Aug.	6.4
Sep.	8.2
Oct.	11.3
Nov.	13.9
Dec.	26.4

CHAPTER 3.

PRESENT SITUATION AND AGRICULTURE OF THE PROJECT AREA

3 - 1. General Description

Except a part of the eastern side, the project area is surrounded by main roads, of which about 80 percent is paved by asphalt while a part of the northern side is left unpaved. The rehabilitation works of bridges with reinforcement concrete are also under construction one after another.

Along the main road there are villages of native Lampung people who engage in farming during the rainy season, and two thirds of them are managing small plantation of cash crops such as pepper, coffee and so on, in the vicinity area of Kotabumi. Therefore, the villagers are leading comparatively well-off life.

The city of Manggala, the oldest port town in Lampung province, which had once prospered as a trading town with Java and Singapore through the Way Rarem; is located at the north-eastern end of the project area. In the south-western area of the project area, coffee, rubber, pepper and others are already cultivated by the native people. Except along the main road, however, most of the project area is covered with alang-alang field and forest. The transmigrants by the Governmental Scheme have already settled in the alang-alang field. Also, spontaneous transmigrants have settled since about 10 years ago and established such villages as Bumimetanti, Surakarta, Abung etc. However, these settlers are living along the road surrounding the project area, and they cultivate crops for their own consumption by shifting cultivation method. Accordingly, most of the alang-alang field in this area is occupied by secondary plant-covered plain.

3 - 2. Transmigration Scheme

In 1905 the initial transmigrants of 115 households from Purwokerto, Central Java, settled in the Way Rarem project area. After that, in the year of 1965, based on the scheme of Transmigration Bureau, 1,226 households from Java island settled here as the transmigrants supported by the Government.

The progress of transmigration scheme after 1965 is as follows.

Year	No. of household	No. of person
1965	1,226	5,006
1967	201	990
1969/70	350	1,586
1971	340	1,499
1970/71	377	1,717
Total:	2,494	10,798

As the transmigration scheme of 1972, 138 households from the catchment area of the Way Djepara Irrigation Project have settled. Besides these, additional transmigrants of about 300 households from Djepara area, and that of 2,000 households from Java island are scheduled.

The Transmigration Bureau established a settlement plan of 20,000 households into the project area, and after the year of 1973 settlement of 15,000 households is scheduled. Therefore, in Bangunsari village, located at the center of the project area, an transmigration office is executing administrative services and the markets, sports ground and public buildings have been already constructed around the office.

In the project area, the villages have been established at respective settlement realized yearly and there are eight villages at present. The main roads connecting these villages are constructed with the width of 8 meters and 90 percent of them are completed. At present, crossing culvert construction and gravel pavement works of these roads are under construction with the budget of Ministry of Public Works and Power.

All these main roads will play an important role in the traffic net works of the project area. However, due to the unaccomplishment of the paving, traffics in the rainy season will be difficult.

The immigration scheme of the retired Air Force Servicemen in the project area is in the stage of constructing residence quarter and so on. One hundred households have settled at present and opened an integrated plantation and growing cashoonuts and etc. Approximately 1,000 families are scheduled to be settled here.

3 - 3. Present Land Utilization

The agricultural land in the Way Rarem Project Area consists of upland fields reclaimed by the afore-mentioned transmigrants and small holding plantations cultivated by native people. These small holding plantations are located in the southern part of the area, and such perennial crops as coffee, pepper, rubber and etc. are cultivated covering about 5,000 hectares.

The underground water level in the dry season is 10 - 8 meters below the ground surface with extremely a little amount. Accordingly, water is hardly enough to be used even for daily life of the settlers and it will be impossible to use it for the irrigation purpose.

If sufficient irrigation water could be supplied, it will be possible to achieve the following yield of crops according to the preliminary report.

Upland paddy:	1.5 ton/ha
Maize:	1.8 ton/ha
Cassava:	2.0 ton/ha
peanuts:	0.4 ton/ha

More than half of the project area is occupied by secondary vegetation of alang-alang and forest. At present, land reclamation and shifting cultivation field are expanding from the south-eastern area toward the northern area. Also, the Daya Itoh plantation located in the south-east of the project area is cultivating maize. This plantation covers 10,000 hectares, and 3,000 hectares out of it has been cultivating maize and yield of 3 tons per hectare is achieved by fertilizer application.

In PROPAU plantation area, perennial crops such as cashoonuts etc. are cultivated and the yield is achieved in good result.

From these examples in this area, it will be possible to increase the yield of production per hectare through application of proper fertilizers and modern agricultural management.

CHAPTER 4.

PROJECT IMPLEMENTATION PLAN

4 - 1. Planning of the Diversion Weir

The Way Rarem, from which irrigation water for the project is derived which, originates in the Tanghit Tahiangin, flows to the north-eastern direction and along the west and north boundaries of the project area through Kotabumi city and frows into the Java sea through the Menggala city.

The downstream of the river below Tandjung Kemala village forms a U-shaped valley having about 15 meters high from the river bed at around Kotabumi city. Near the Karta village, which is located at the north-western part of the project area, the U-shaped valley becomes about 25 meters high from the river bed upto the land. The river has 100 meters of width during the dry season around Karta village, and during the rainy season the river enlarges and has a width of 150 meters and a water depth of 20 meters.

The downstream of the river joins at Pegerdowo village with the Way Kanan and also growing up to a bigger river. The lowlying area of Menggala city is inundated for about 2 months during rainy season by the flooding water from the Way Rarem every year.

The Ministry of Public Works and Power has at present three plans for the intake structure, that is:

The 1st plan

The intake structure is planned at the upperstream of Kotabumi city in the Way Rarem and supplies irrigation water to the project area. The intake elevation of the diversion weir will be around 25 meters.

The 2nd plan

The intake structure is planned at the upperstream of the Way Rarem for the purpose of transferring the basin to the Way Sabuk, being located about 5 kilometers far from the Way Rarem, and a reservoir dam is planned at the Way Sabuk, and the irrigation water will be supplied to the project area and Way Abung project area. The intake elevation of the weir will be about 30 meters.

The 3rd plan

The intake structure is planned at the downstream of the confluence of the Way Rarem and the Way Galing. The irrigation water will be introduced into the project area through the open canal. The intake elevation of the weir will be about 43 meters.

In addition to the above three plans, a pumping irrigation scheme is also studied.

According to the present plan of the Ministry, the elevation of the planned settlement area around the downstream is about 30 meters, while the elevation of the present settlement area is about 42 meters. Therefore, in view of the height of the intake structure, the downstream area is planned as the object of irrigation area.

According to our study on the 1/100,000 map, the elevation of the present settlement area is around 35 meters. Therefore, it will be possible to irrigate this area if the present plan of diversion weir is moved toward upstream.

Accordingly, the said basic plans will be better to be revised judging from the relation of the elevations of the irrigation area and the intake height. At present the inhabitants in the Kotabumi city obtain their living water from their own wells or from the Way Rarem. Therefore, adding to the irrigation scheme, the domestic water supply scheme for Kotabumi city can also be combined through the irrigation canal.

4 - 2. Planning of the Water Resource

Considering the elevations of the proposed irrigation area and the Kotabumi city water supply facility, the intake site is decided on the elevation of 43 meters at the confluence of the Way Rarem and the Way Galing,which covers 286 square kilometers of catchment area. The discharge at the upperstream is estimated at 20 cubic meters per second during the rainy season and 7 cubic meters per second during the dry season according to preliminary survey report. But the river discharge of only 3.6 cubic meters per second was observed on September 4, 1972 by our discharge measurement.

Total acreage of 70,000 hectares consists of about 47,000 hectares of the Rarem district and about 23,000 hectares of the Abung district will be cultivated during rainy season. From this fact, the cropping acreage irrigated during dry season will be about 30,000 hectares.

Considering the above irrigation acreage for wet and dry seasons, the river water from the Way Rarem as a source of the irrigation water will not be enough to cover all of the irrigation area. In the utmost upstream of the Way Abung, which is a tributary of the Way Rarem, the Way Besai approached to the Way Abung, so that, the river discharge of about 15 cu.m/sec from the Way Besai will be able to be transferred to the Way Abung by constructing a hydraulic tunnel, to be used for the irrigation water for the Way Rarem/ Abung area.

4 - 3. Irrigation Plan on the Way Rarem/Abung Area

A diversion weir is planned to divert the irrigation water to the irrigation area and is located at 50 meters down stream site from the confluence point of the Way Rarem and Way Galing. The diversion weir is composed of a fixed weir of 90 meters length excluding 9 meters width flush gate and 14.5 meters height with concrete structure and the right and left side approach dikes to be constructed by earth material of 115 meters and 300 meters, respectively, so that, the total length of the diversion weir will be 515 meters. The general plan of the diversion weir can be referred to the attached drawings, R-2.

In case of 43 meters of the intake elevation, the irrigation water can be led to around Umb. Terusan village in the project area through a leading canal of about 20 kilometers. And 0.1 cubic meters per second of water will be supplied to the Way Umban from the main canal for the Kotabumi city water at the crossing point of the main canal and the Way Umban and then water will be stocked in a reservoir at the suburbs of Kotabumi city.

After the leading canal crosses the existing main road and the railway around Umb. Terusan village, the canal will be divided into the right and left main canals. The irrigation

water of the left main canal will command the Bangunsari village and the villages of the established settlement at the downstream. The length of the left main canal will be about 22 kilometers. The irrigation water of the right main canal will command the village of the planned settlement from the Way Djepara irrigation project through the PROPAU area. The location of the transmigration villages and the related estates are shown in the attached drawings, R-1.

In the main canal of about 30 kilometers from the diversion weir, the irrigation water will be stocked in the Way Semuli as a regulating-reservoir to manage and utilize the irrigation water effectively. The most suitable site for the construction of the regulating reservoir is considered at the crossing point of the Way Semuli and the main canal. The plan of the reservoir dam will be about 800 meters in length, 10 meters in height and about 20,000,000 cubic meters in storage capacity.

The large scaled appurtenant structures of the canal within the project area will not be necessary because of the flat topographical conditions, while some aqueducts and syphons will be necessary for the leading canal of about 20 kilometers from the diversion weir to Umb. Terusan village because of the rolling topography.

4 - 4. Transfer Basin Scheme of the Way Besai

In order to supplement the irrigation water for the Way Rarem/Abung Irrigation Project, the Way Besai river discharge of about 15 cu.meters per second will be necessary to be transferred to the Way Rarem through the Way Abung which is located near the Way Besai and is one of the tributaries of the Way Rarem.

The river water of the Way Abung and the Way Besai will be mixed to be used for the Way Rarem/Abung Irrigation Area, therefore, it is better to plan the Way Abung Irrigation Project together with the Way Rarem/Abung Project to establish more effective and comprehensive regional development scheme.

The water discharge from the Way Besai flows together with the Way Abung and joins with the Way Rarem at the upperstream of Kotabumi city. In addition to the discharge of the downstream basin from the intake point of the Way Rarem, the total river water will be supplied to the Way Rarem irrigation by a pumping station planned at the downstream of the Kotabumi city.

4 - 5. Domestic Water Supply Scheme for Kotabumi City

Kotabumi city, the capital of the North-Lampung Prefecture, has at present about 20,000 of population. The city has governmental office's quarters and is the commercial center of the area as well. All the daily necessities are delivered to the villages by merchants

of the city, while the agricultural products are collected in the city and delivered to Tandjun Karang city.

Under such circumstances, Kotabumi city is considered to be increasingly urbanized in the future. The population of the city in 1980 is estimated at around 50,000. Therefore, the people living in Kotabumi city as well as the surrounding district will suffer from shortage of water due to the fact that there are at present only wells for drinking water and the water surface is quite deep, about 10 to 15 meters, during dry season. Most of the peoples are carrying the water from the Way Rarem by man-power.

The local Provincial Government requested eagery that if the irrigation plan will be carried out, the Kotabumi city water supply scheme will also be included for the regional development project. The daily life water supply scheme will greatly contribute to the regional development.

4 - 6. Estimated Project Cost

According to the preliminary report of the Ministry of Public Works and Power (D.P.U.T.L.), the project cost is estimated as follows:

Preparation and study cost:	Rp. 100,000,000
Model test cost:	25,000,000
Design cost:	60,000,000
Compensation cost:	50,000,000
Temporary roads and buildings:	20,000,000
Diversion weirs and intake structure:	300,000,000
Canal and other structures:	5,000,000,000
Sub-total	5,561,000,000
Contingencies (10%)	556,100,000
Grand Total	Rp.6,117,100,000 (US$ Approx. 15,000,000)

However, according to our current study, a total of the project cost in view of the economic of the development integrating 3 project areas is estimated as follows:

Preparation and investigation cost:	Rp.250,000,000
Model test cost:	50,000,000
Design cost:	600,000,000
Compensation cost:	100,000,000
Rarem diversion weir:	300,000,000
Besai diversion weir:	3,000,000,000
Tunnels for transfer basin:	2,000,000,000
Canal and other structures:	10,400,000,000
City water supply facilities:	500,000,000
Pumping equipments:	3,000,000,000
Contingencies:	1,200,000,000
Total:	Rp.21,400,000,000 (US$ Approx. 51,600,000)

CHAPTER 5.

BENEFIT OF THE PROJECT

According to the preliminary report prepared by the D.P.U.T.L., the paddy field acreage is estimated at 11,000 hectares during rainy season and 3,000 hectares during dry season, so that, the annual production of rice will amount to 35,000 tons. In case of the cropping ratios of maize, cassava and soybean estimated at 5:3:2 respectively other than paddy fields in the total development area of 40,000 hectares, the annual revenue is estimated at Rp.1,294,000,000.

According to our preliminary study, a plan is made for 70,000 hectares of paddy field during rainy season, 30,000 hectares of paddy field during dry season and 40,000 hectares upland field during dry season. The annual revenue will be as follows:

Rice crops

(70,000 + 30,000 ha) x 2.5 ton/ha = 250,000 ton

250,000 ton x 40,000 Rp./ton = 10,000,000,000 Rp.

Upland crop (Maize)

40,000 ha x 2 ton/ha x 18,000 Rp./ton = 1,440,000,000 Rp.

Total: 11,440,000,000 Rp.

In view of the above, the pumping irrigation which costs higher for the operation and maintenance is considered to produce sufficient benefit. In addition, the water charge of Kotabumi city is expected to be a resource of big revenue for the operation and maintenance of the irrigation facilities.

CHAPTER 6.

CONCLUSION

As mentioned previously in the report, the project area will be quite suitable for agricultural land compared with the Umpu and the Pengubuan irrigation area because of flat land with comparatively deeper top soil. The project area is surrounded by main roads, therefore the transportation system has been developed to be very convenient. The fact is an advantageous factor for the project development. In addition, as few native people are living in the project area, no consideration will be necessary about the problem against them. The project area will be one of the most suitable areas for the regional development of the Lampung Province in the future.

The project area has not been developed so much. The shortage of water supply even for their daily life during dry season is usually happened in this area. Water is necessary for the realization of the project. It is of vital importance that the project has to be promoted under mutual cooperation between the Ministry of Public Works and Power and the Ministry of Transmigration and Cooperation.

The project area will have a big potentiality to supply the agricultural products to adjoining Kotabumi city and will contribute to the economy of the regional development with the Kotabumi city water supply scheme.

The data for detail plan are not so sufficient at present and the most important one is a 1/10,000 topographic map covering over the intake point to the project area. The acreage surveyed by the Ministry of Public Works and Power for the fiscal year of 1973 is only 10,000 hectares.

DRAWINGS

R–1. Planning Map for Transmigration Area

R–2. Plan of Weir and Intake

FOR GUHUNGBATIN

FOR TANDJUN KARANG

DAYA ITOH 10,000 ha

BLAMBANGAN

TENEMPATAN 400KK
TH 1971-1972

1971

SPONTAM GUNUGBALAK
300 KK

Tul. Rms

RAIL WAY

MAIN ROAD

CRD SH RROGRAM
TH- 1970-1971

1970

TATAKARJA
1965

SPONTAN
DURNOOAD

PROPAU 5,000 ha

W. Semuli

1965

1967

SPONTAN
DIATIM

W. Terusan

BANGUNSARI
1967

KARIA

Surakarta

Bumimeraabi

KOTABUMI CITY

WAY RAREM / WAY ABUNG
IRRIGATION PROJECT

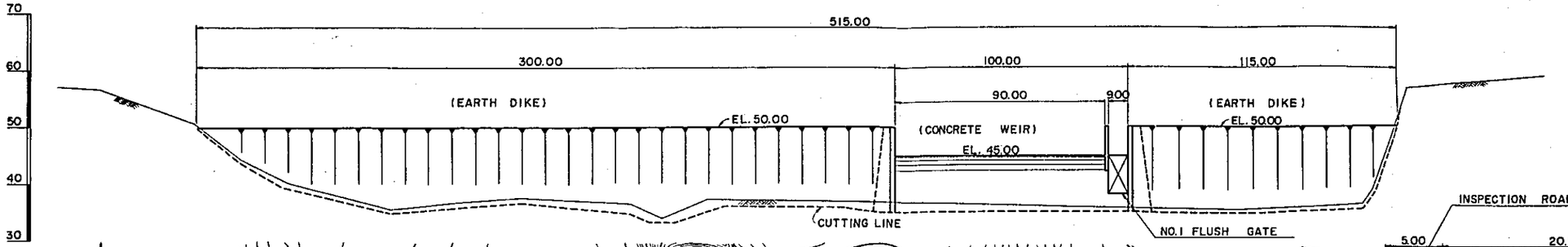
PLANNING MAP
FOR TRANSMIGRATION AREA

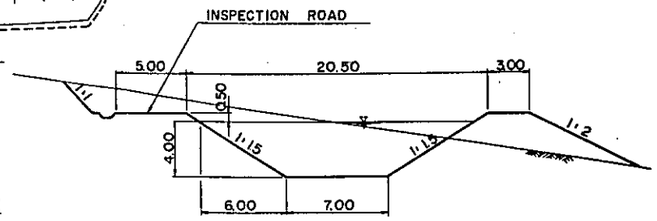
SCALE 1: 50,000 | DATE 20. DEC 1972

O.T.C.A. JAPAN | R-1

UPSTREAM ELEVATION

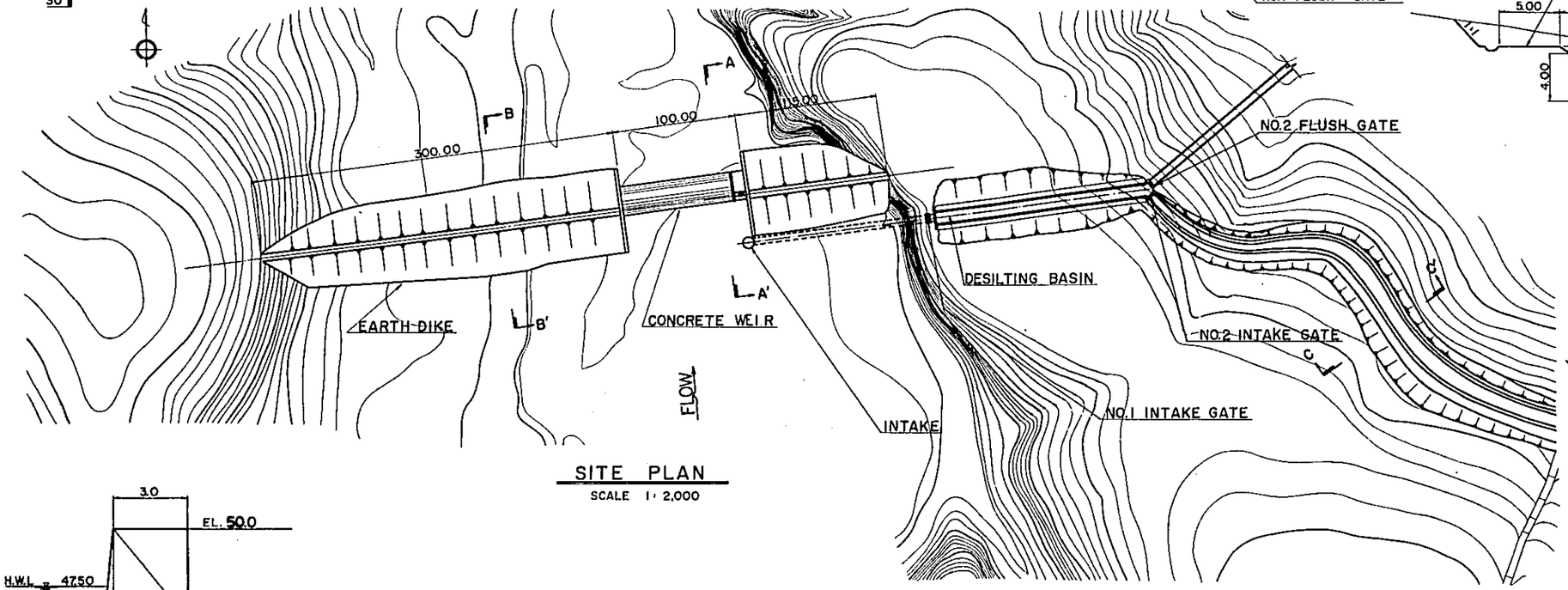
SCALE : HORIZONTAL 1 : 1,000
VERTICAL 1 : 400





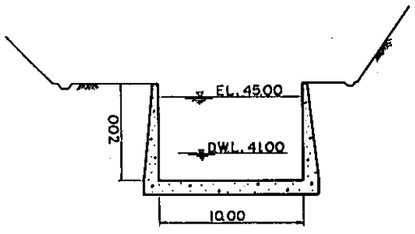
MAIN CANAL SECTION C-C'

SCALE 1 : 200



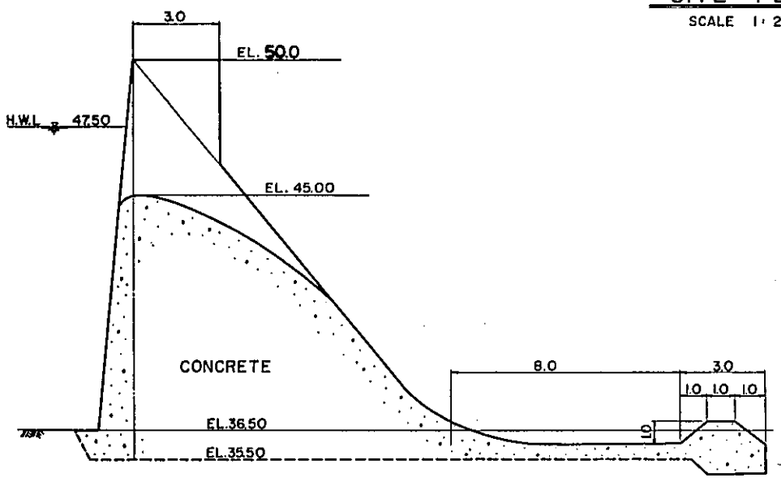
SITE PLAN

SCALE 1 : 2,000



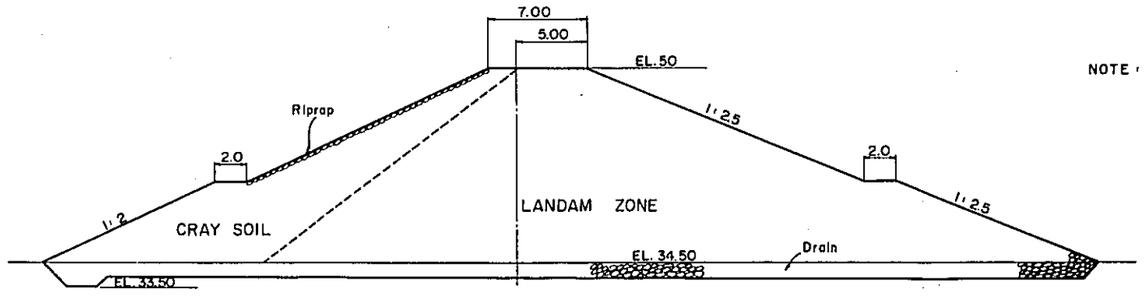
DESILTING BASIN SECTION

SCALE : 1 : 200



SECTION A - A'

SCALE 1 : 100



SECTION B - B'

SCALE 1 : 200

NOTE : DIMENSION IS METER.
EL. IS ELEVETION LEVEL FROM THE SEA.

WAY RAREM / WAY ABUNG IRRIGATION PROJECT	
PLAN OF WEIR & INTAKE	
SCALE 1 : 2,000	DATE 20. DEC. 1972
O.T.C.A. JAPAN	R-2