No. 8

BASIC DESIGN STUDY

ON

THE AGRICULTURAL DEVELOPMENT AND TRAINING CENTRE

(CEDA) CONSTRUCTION PROJECT

IN

THE REPUBLIC OF HONDURAS

JULY, 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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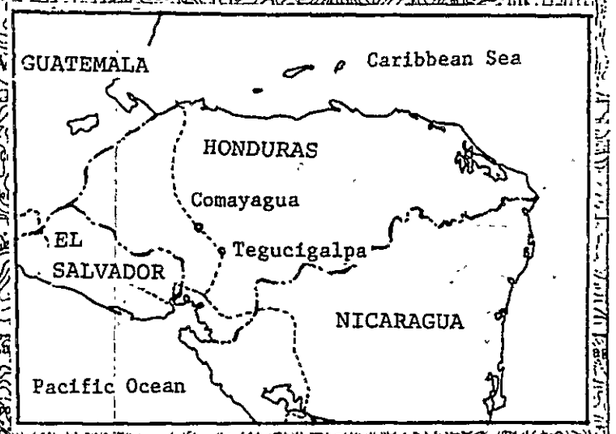
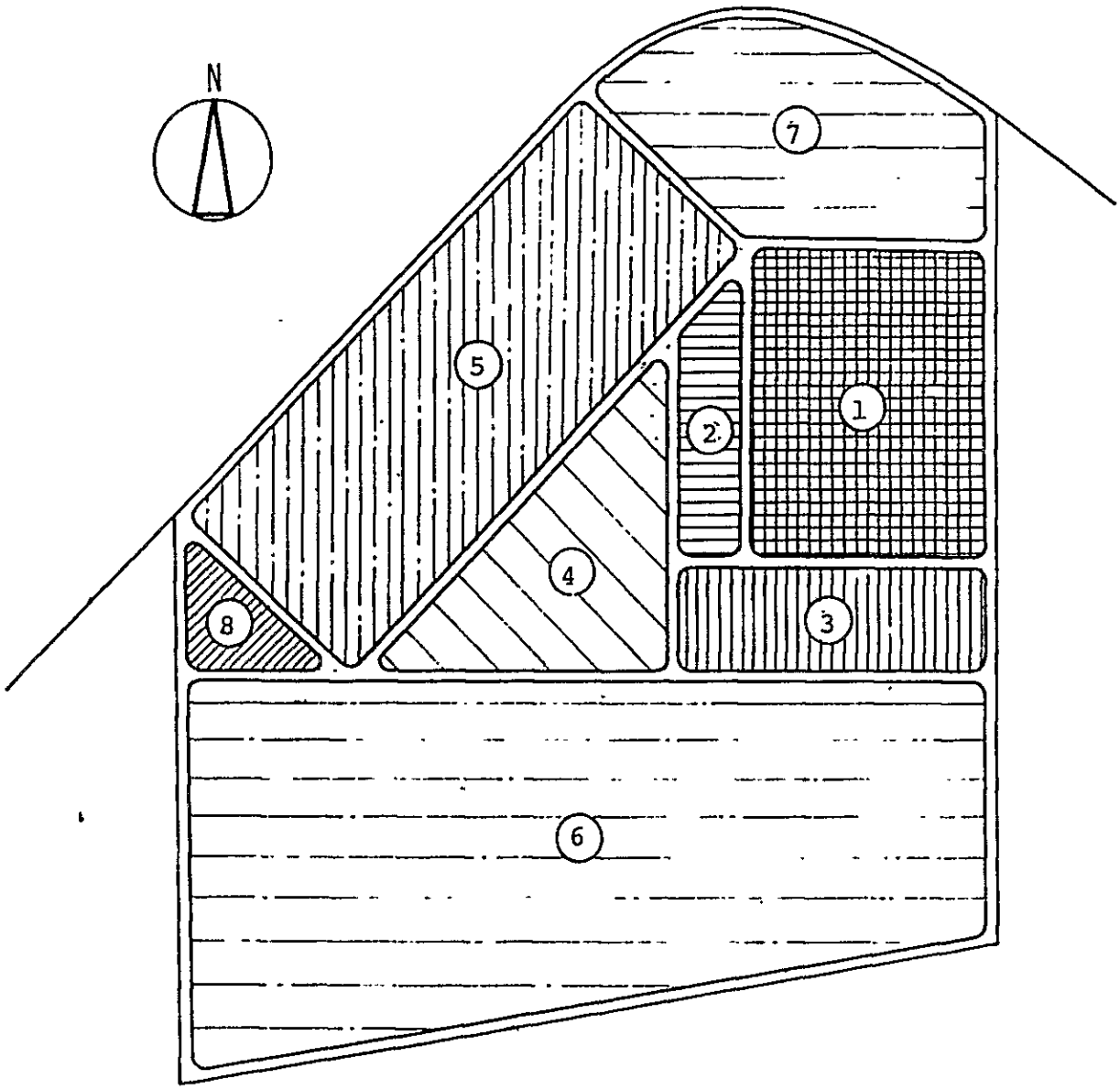
DEPARTAMENTOS DE COMAYAGUA Y LA PAZ 1:50,000

COMAYAGUA



PROJECT SITE (50Ha)

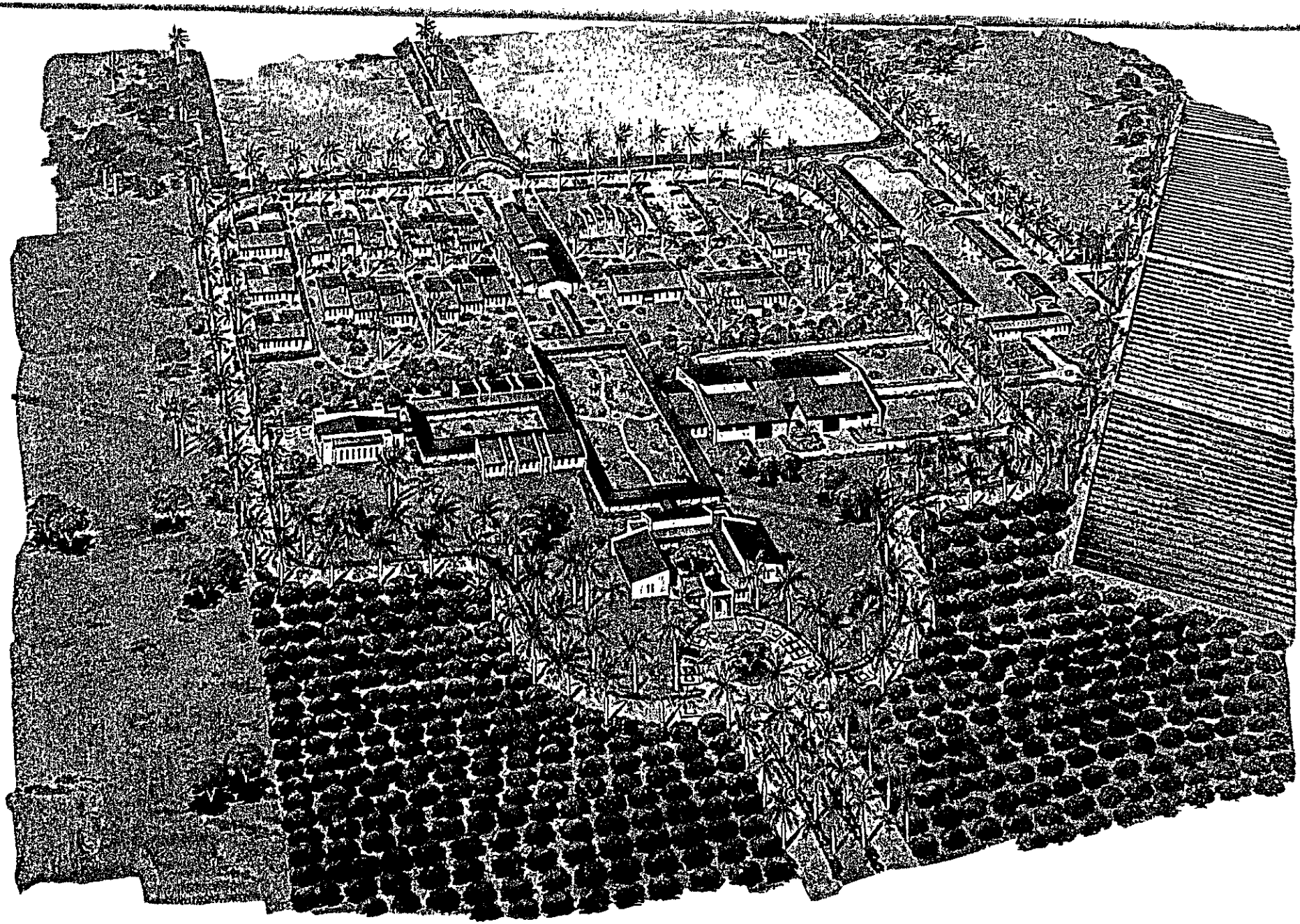
1. CENTER FACILITIES
2. FARM MANAGEMENT AREA
3. SPORTS GROUND
4. TRAINING FIELD FOR CONSTRUCTION MACHINES
5. INTENSIVE FARMING FOR EXPERIMENTAL FARM
6. EXTENSIVE FARMING
7. ORCHARD GARDEN
8. RESERVOIR



SITE ZONING PLAN

PROPOSED SITE FOR AGRICULTURAL DEVELOPMENT TRAINING CENTER
(LOOKING FROM NORTHERN EDGE OF PROJECT SITE)

(LOOKING FROM EASTERN EDGE OF PROJECT SITE)



PANORAMIC VIEW OF GENERAL LAYOUT FOR FACILITIES

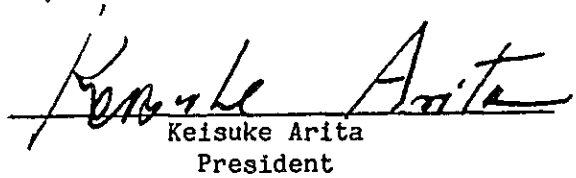
PREFACE

In response to the request of the Government of the Republic of Honduras, the Government of Japan decided to conduct a survey on the Agricultural Development and Training Centre (CEDA) Construction Project and entrusted the survey to the Japan International Cooperation Agency. The J.I.C.A. sent to Honduras a survey team headed by Mr. Akiyoshi TAMAOKA, Chief of Development Division, Construction Department, Tokai Agricultural Administration Office, Ministry of Agriculture, Forestry & Fisheries from 8th to 27th February, 1982.

The team had discussions with the officials concerned of the Government of Honduras and conducted a field survey in Comayagua area. After the team returned to Japan, further studies were made and the present report has been prepared. I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Honduras for their close cooperation extended to the team.

July, 1982



Keisuke Arita
President
Japan International Cooperation Agency

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SUMMARY

Agriculture and forestry are the Honduran economy with bananas and coffee as principal agricultural export products. Staple crops are produced by small farmers who constitute the greater part of the Honduran population. Due to these small farmers dependance upon animal labour and unfatisfactory agricultural extension activities the result is insufficiency of food production.

Agrarian land occupies only 18% of the nation's total land area, within that amount 65% is utilized as pasture land. It is therefore possible to expand the agricultural land. With regard to irrigation facilities, only 2% of cultivable land is served, and even in those areas export crops are mostly produced.

Under these circumstances the Government of Honduras established the Second Agricultural Development Plan (1979-1983) to achieve self-sufficiency in staple crops and effective use of land through land reform. In concrete terms the increase of agricultural productivity is expected by means of land expansion as well as irrigation technology, and furthermore methods of cultivation and selection of proper crops are to be introduced to the farmers.

However, the number of trained personnel capable of planning, designing and executing an irrigation project, and evaluating the most appropriate type of crop and water management are extremely limited at present. To increase the number of trained personnel, the Government of Honduras has prepared a plan to establish an Agricultural Development and Training Centre which includes a request for assistance from the Japanese Govenment under its grant-in-aid program for constructing facilities and providing equipment as well as project based technical assistance.

The objective of the study team dispatched by the Japanese Government is to determine the desires of the Government of Honduras regarding construction planning of the proposed Center and to delineate the facility's scale through selection of the most appropriate equipment site survey, ground water survey and other related infrastructure surveys necessary for basic design.

The study concluded with the provision of a basic facility plan. The study considered irrigated agriculture training facilities

and research required by government engineers, extension service personnel and farm leaders.

The project can be implemented along with a technical assistance program and is expected to contribute to the improvement of human resources in the agricultural sector with three training courses-advanced, intermediate and extension.

The project site comprises approximately 55 ha of flat land owned by the Ministry of Natural Resources and is situated about 5 km west of Comayagua, approximately the Center of Honduras. There are Centro Nacional de Agricultura y Ganaderia (CENAG) and regional office of the Ministry of Natural Resources in the vicinity.

The main structural frame of the center is provisionally planned to be single story, with concrete masonry block as the main building material. The total building area of about 8,000m^2 will include the main building, training building, laboratory building, farm management building, auditorium, dormitories and work shop. The attached farm will cover an area of about 45 ha of land composed of paddy, intensive and extensive farms. Equipment for testing, educational and machine maintenance will be also provided as well as construction machines. Project implementation is divided into 2 phases and is scheduled for a period of 15 months respectively.

It is evident that the construction of an Agricultural Development and Training Centre Project will play an extremely important role in the training of agricultural skilled personnel and technical research and development.

As Japanese Technical Assistance is also involved in overall project implementation, the proposed Center will contribute to agricultural intensification by providing human resources for the extension of agricultural technology. In view of broader perspective of the Center's role the project to be executed under grant-in-aid program of the Japanese Government is expected to greatly effect agricultural development of Honduras.

CHAPTER 1. SURVEY OBJECTIVES AND OUTLINE OF REQUIRED WORKS

1-1. BACKGROUND OF PROJECT PROPOSAL

The land area of the Republic of Honduras is approximately 112,000 sq. km, or slightly less than one third that of Japan, with roughly 65% of the country consisting of mountainous terrain.

Agriculture and forestry comprise the basic industries of the Honduran economy. Agriculture alone accounts for 30% of the gross domestic product (GDP), 80% of total export value, and 65% of the employed labour force. Principal agricultural products are bananas (44%), coffee (19%), corn and beans (22%), and livestock products (15%). In terms of export value for all exports, bananas and coffee occupy the number one and number two positions respectively. However, the above products for export are produced by only an extremely small sector of the economy comprised of a limited number of large-scale enterprises and farm operations.

For the production of staple foods, the country is dependent upon the numerous small farmers who constitute the base of the Honduran economy. Due to the small scale nature of staple crop cultivation, Honduras has been unable to achieve self-sufficiency in food production. Consequently, the vitalization of agriculture through expanded production of such major staple food crops as corn, rice, and kidney beans is a crucial factor in future economic development.

At present, however, only 18% (2 million ha) of the nation's total land area is being utilized for agricultural purposes. Furthermore, within that amount 65% is employed as grazing land. In terms of land ownership pattern as indicated in the table shown on next page, roughly 64% of all landowners are small farmers who possess 5 ha or less. However this group accounts for only 9% of the total area of owned farmland.

From 1974 Survey for the Number of Farmers in Honduras on Per farm Scale Basis

Scale	number of farmers	% of total number of farmers	land area	% of total land area
Less than 1 ha	33,774	17.3	21,534	0.8
1 - 2 ha	38,643	19.8	53,584	2.0
2 - 3 ha	28,699	14.7	69,865	2.6
3 - 5 ha	23,631	12.1	93,696	3.5
5 -20 ha	47,478	24.3	468,983	17.6
20 -50 ha	15.164	7.8	461,464	17.5
Over 50 ha	7,908	4.0	1,485,949	56.0
Total	195,297	100.0	2,655,095	100.0

Development of the existing agricultural land base is not presently at a satisfactory level. Only 2% of cultivable land is irrigated, and even for those areas serviced the performance of irrigation facilities is often inadequate. The level of farm technology is low and with the exception of a few limited farms which are operated on an enterprise basis or have been incorporated into farm cooperatives, farmers are solely dependent on animal power and human labour. As such productivity is low.

An insufficiency of agricultural extension activities and personnel is also evident. The primary reason for this is a serious lack of training facilities for such personnel, as well as facilities for irrigated agricultural research.

In view of the conditions described above, the Government has instituted a Second Agricultural Development Plan (1979-83) to strengthen principal food grains production and redistribution of land ownership through land reform. It is expected that these measures will lead to more effective use of agricultural land and increased agricultural productivity.

Specifically, increased agricultural yield is to be achieved through (i) expansion of the area under cultivation, (ii) introduction of irrigated agriculture technology, and (iii) instruction to farmers in the application of high yield varieties and methods of cultivation. However, the number of trained personnel in the country capable of planning, designing and supervising the construction of irrigated agri-

culture schemes, and evaluating the most appropriate type of crop and maximally effective cultivation method for a given area are extremely limited at present. Consequently, in order to produce sufficient trained personnel to successfully execute its agricultural development plans, the Republic of Honduras has requested assistance from the Japanese Government under its grant-in-aid program for implementation of both the facilities and training program necessary for agricultural development research.

The basic outline for this plan, the Agricultural Development and Training Centre Project, was formulated by the Ministry of Natural Resources of the Government of Honduras under the guidance of specialists in irrigated agriculture dispatched from Japan. Then in October 1981 Japan International Cooperation Agency (JICA) sent to Honduras a preliminary survey team headed by Akiyoshi Tamaoka.

The strongly expressed desire of the Government of Honduras that this plan be concretized and implemented as promptly as possible led to the subsequent dispatch in February of the Basic Design Study Team, again under the leadership of Mr. Tamaoka.

The objective of the said Basic Design Team was to confirm the request of the Government of Honduras and to determine the Centre's outline and facilities through discussion with Honduran officials concerned. Field survey of the Project site and data collection on local conditions for construction were also carried out in this regard. Briefing and explanation on Draft Final Report were held in April, and as a supplementary task boring work has been performed to survey ground water. Members and itinerary of the Team are as shown in Annex I-1 and I-2. For further information on Project background, refer to the report of preliminary survey.

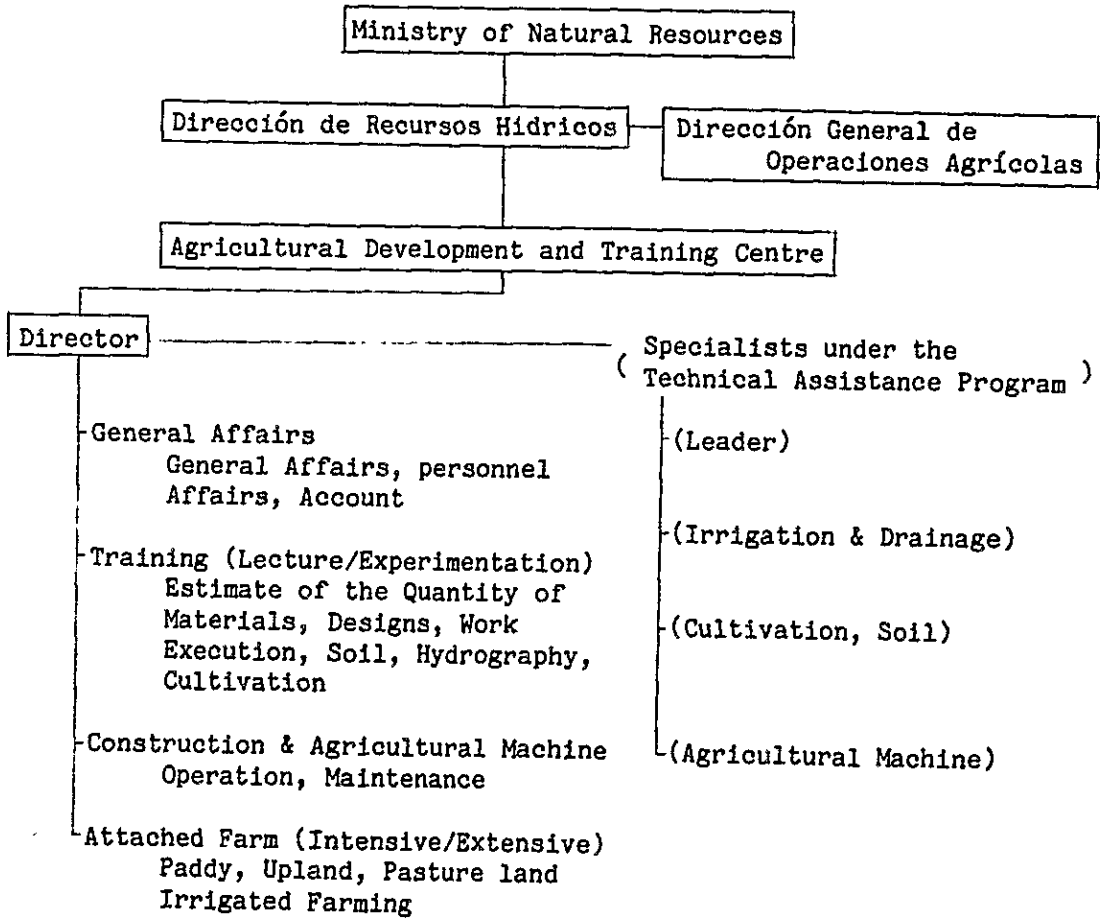
1-2. BASIC OUTLINE OF PLAN

The Agricultural Development Training Centre Project envisages the construction of facilities and establishment of an instructional program to produce suitably trained agricultural development specialists in sufficient numbers to implement the Honduran Government's agricultural development plans. Said specialists are to consist chiefly of technicians to staff related government bureaux and instructors to transfer technology directly to the farmers. The basic and applied knowledge in agricultural technology which these specialists will have mastered in

their training course is expected to provide considerable direct support to the farmer as he shifts to more productive methods of cultivation.

The training centre is to be operated by the Water Resources Bureau of the Ministry of Natural Resources in cooperation with the Office of Agricultural Operations (Direccion General de Operaciones Agricolas) of the same ministry. The Water Resources Bureau has the assigned function of not only constructing and managing irrigation facilities, but also of providing technical guidance in irrigation farming. The Office of Agricultural Operations supervises a number of extension workers who provide technical guidance to farmers in crop planning, wet season cultivation and animal husbandry. The envisaged Centre will offer training in agricultural development based on irrigated farming. In accordance with quotas determined at the central government level, acceptance of trainees for enrollement will be based on recommendations from regional offices of the Ministry.

1-2-1 Centre's Organization



1-2-2. Training Program

There is a serious shortage of agricultural development engineers and technical personnel in Honduras. Furthermore, despite keen interest among concerned personnel in obtaining technical training in agricultural development, there is a lack of sufficient facilities to provide educational opportunities to the required number of students. Through the curriculum outlined below, the Project will contribute to rectifying this problem.

(1) Advanced course

A Course: (for university graduates with B.S. in civil engineering)
-course is 3 months and is offered twice a year; designed for 5-7 persons per time.

B Course: (for university graduates with B.S. in agronomy)
-course is 3 months and is offered twice a year; designed for 5-7 persons per time.

(2) Intermediate course — (for high school, junior college graduates)
-course is 3 months and is offered twice a year; designed for 20-25 persons per time.

(3) Extension course — (for extension workers and farm group leaders)
-course is 10 days and is offered six times a year; designed for 15 persons per time.

(4) Counterpart training — (for candidate instructors at the training centre)
-designed for 8 persons

TRAINING SCHEDULE

	First Year	Second Year	Third Year	Fourth Year
(1) Advanced course A.		⊢⊣	⊢⊣ ⊢⊣	⊢⊣ ⊢⊣
B.		⊢⊣	⊢⊣ ⊢⊣	⊢⊣ ⊢⊣
(2) Intermediate course		⊢⊣ ⊢⊣	⊢⊣ ⊢⊣	⊢⊣ ⊢⊣
(3) Extension course		⊢ ⊢ ⊢	⊢ ⊢ ⊢ ⊢ ⊢ ⊢	⊢ ⊢ ⊢ ⊢ ⊢ ⊢
(4) Counterpart training	⊢			

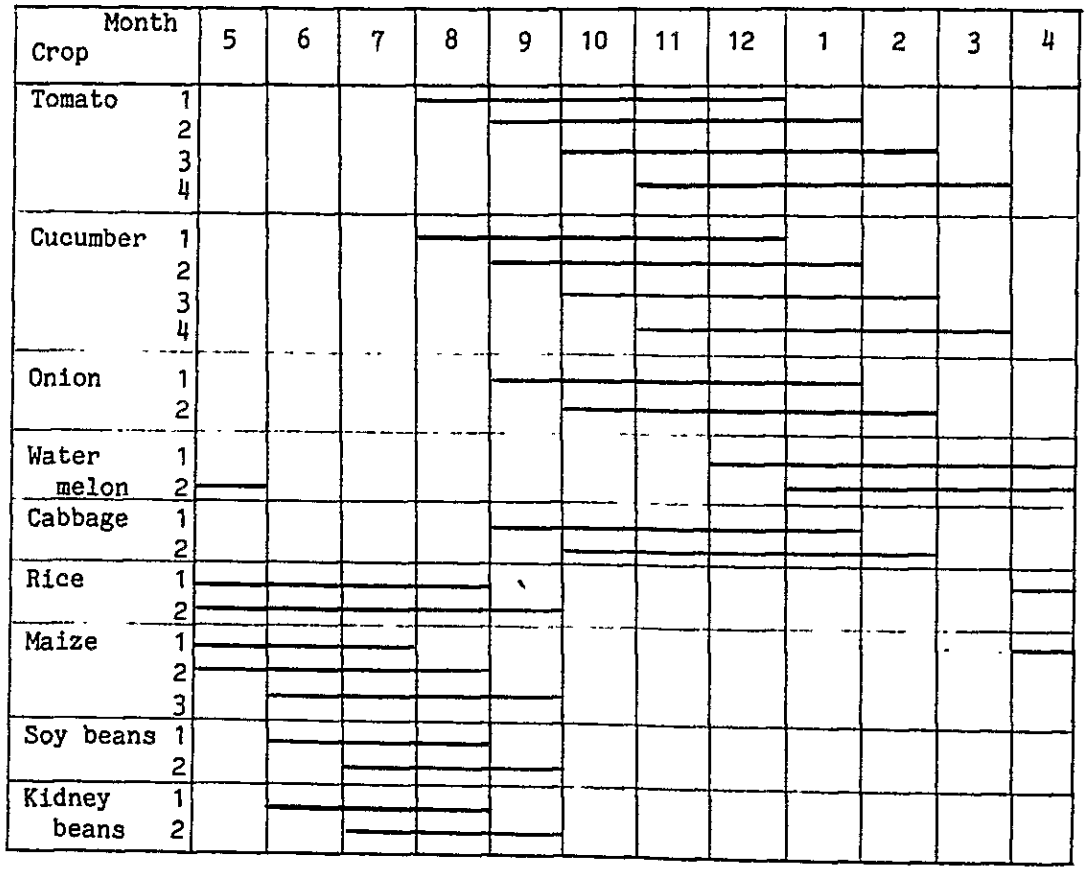
1-2-3. Cropping Pattern

At present, two alternative cropping patterns are under consideration for paddy field:

Pattern	Wet season	Dry season
I.	Paddy	Vegetables
II.	Paddy	Paddy

Final decision regarding pattern to be adopted will be made on the basis of actual curriculum requirements and water availability.

Double cropping of cereal in the wet season and vegetables in the dry season is the most desirable pattern for the intensive upland field. Cultivation of vegetables during the wet season is to be avoided due to potential damage from disease and pests, and injury from precipitation. Cereal crops under consideration include maize, sorghum, soy beans, and kidney beans. Possible vegetable crops are tomato, onion, water melon, cucumber, cabbage, etc. Potential Fruit trees for the orchards would include citrus, mango, banana, and papaya.



Dry season / Wet season		Tomato Cucumber				Onion		Water melon		Cabbage	
		1	2	3	4	1	2	1	2	1	2
Rice	1	○	○	○		○	○			○	○
	2			○	○		○	○			○
Maize	1	○	○	○	○	○	○			○	○
	2		○	○	○	○	○	○		○	○
	3			○	○		○	○			○
Soy beans	1		○	○	○	○	○	○	○	○	○
Kidney beans	2			○	○		○	○	○		○

The area for construction of the Centre comprises 57.4 ha located on the outskirts of Comayagua, and as indicated below is to be the site for administrative buildings, training facilities, staff and trainee accommodations, experimental laboratories, attached farm and appurtenant facilities and structures. A portion of machine and equipment is also to be provided by the Japanese Government.

1.	Training centre facilities (Main building, training facilities, experimental laboratories, dining hall, living accommodations, administrative building for attached farm, workshop)	7 ha
2.	Construction machinery training area	2.7 ha
3.	Intensive farming area (Paddy field 3ha; dry field 6ha; farm roads 1 ha)	10 ha
4.	Extensive farming area (Pasture 25.1 ha; Farm pond 2 ha; Sports ground 3.5 ha; Orchard garden 7.1 ha)	37.7 ha
	Total	57.4 ha

Under its program for technical assistance, the Japanese Government is prepared to undertake the following in conjunction with implementation of the Agricultural Development Training Centre Project:

1. To provide a portion of the materials and equipment necessary for Project implementation;
2. To dispatch advisory specialists to Honduras on a long term basis; and

3. To invite Honduran candidates to Japan for administrative and staff training.

1-3. SIGNIFICANCE OF THE PROJECT

The Honduran economy remains undiversified, based essentially on the primary agricultural products of bananas and coffee. However, although agriculture is the principal sector of the economy, a lack of adequate infrastructure and a low level of irrigated agriculture are major impediments to more productive agricultural development. Strengthening of the agricultural sector is considered an essential component in the amelioration of Honduras's economic situation, in turn contributing to increased social stability.

With one of the lowest per capita GNP in Central America (US$575 per capita in 1979 IMF), the Government of Honduras has sought assistance from the United Nations (UNDP, FAO, etc.) and the industrialized countries for its agricultural development program.

However, with regard to expansion of cultivable land area in particular, only limited success has been achieved. Although the amount of land available for agricultural purposes is geographically restricted to some extent by the mountainous nature of large parts of the country, additional tracts of cultivable land can be substantially obtained through properly implemented flood control and irrigation projects. This additional land could be effectively administered to farmers through the Government's current land reform program, which presently suffers from a shortage of available land for distribution.

Although a number of viable agricultural develpment projects have been identified for potential implementation, the Government lacks not only funds but particularly the skilled personnel to undertake and supervise these programs. Consequently the completed Project is expected to play a major role in training the above required specialists and lead to effective implementation of development plans in the agricultural sector. The ultimate Project beneficiaries will be the farmers, who constitute the most numerous and least economically advantaged segment of the population. By serving to strengthen the Honduran agricultural base, in the broad view the Project will be a contributing factor to increased economic and social stability within the country.

1-4. SURVEY OBJECTIVES

Based on evaluation of the findings of the preliminary survey for technological assistance conducted in October 1981, the Government of Honduras and JICA agreed to proceed with the basic design survey for construction of the Agricultural Development Training Centre. Accordingly, a Basic Design Survey Team was organized by JICA in January 1982. The team met with concerned officials within both the Japanese Government and the Government of the Republic of Honduras, and letters of agreement were exchanged between the two governments regarding basic policy for implementing the Project within the framework of the Japanese Government's technical assistance program.

Furthermore, the survey team traveled to Comayagua and surveyed the proposed Project site and its environs. Circumstances surrounding construction activity in Honduras were examined, as were economic factors such as inflation rate, etc. On the basis of this investigation, a Basic Design Survey Report was compiled including construction cost estimate, construction schedule, and project evaluation.

In the course of its assignment, the team engaged in the following principal activities:

1. Determination of the aspirations and desires of the Honduran Government regarding construction planning;
2. Determination of the significance and effect of the Project;
3. Basic delineation of facility scale;
4. Site survey;
5. Project cost investigation;
6. Formulation of basic construction plan in consultation with concerned officials of the Honduran Government, and incorporation of aspirations thereof into said planning; and
7. Preliminary estimate of total Project cost.

CHAPTER 2. DESCRIPTION OF THE PROJECT SITE

2-1. LOCATION OF PROJECT SITE

The proposed site for the Agricultural Development Training Centre comprises 57.4 ha located 5km outside the old capital of Comayagua (north latitude 14°27', west longitude 87°41'). Comayagua city itself has a population of 12,000-18,000 and is situated 82km north of Tegucigalpa, the present capital of Honduras. The distance between the capital and Comayagua can be readily negotiated by automobile in 1.5 hrs.

The Comayagua Valley constitutes the heartland of the country's agriculture, and coupled with its ready access from Tegucigalpa the Project site is accordingly considered to be geographically well situated.

A Comparison of Comayagua and Other Major Honduran Cities

City Name	Elevation	Distance from Capital	Population (1976)	Comments
Tegucigalpa	1,000m	-	330,000	Capital city
San Pedro Sula	80	246km	150,000	Major industrial and commercial centre on Caribbean Coast
La Ceiba	10	444	50,000	Port and commercial centre on Caribbean Coast
Choluteca	35	142	18,000	Agricultural centre of Fonseca Gulf area
Comayagua	600	82	12,000	Old capital
Santa Rosa de Copan	1,150	416	9,600	Centre for stock farming and tobacco cultivation, and site of Mayan ruins

2-2. PROJECT AREA AND ITS ENVIRONS

The Comayagua Valley consists of 53,700ha, and lies within the provinces of Comayagua and La paz. Of the 46,300ha currently utilized for agricultural purposes within the valley, 64% is grazing land, 30% is under single-crop cultivation, and 7% is multi-cropped.

The catchment area of the Selguapa River has an irrigable area of 30,000ha. At present, however, irrigation facilities are inadequate, and coupled with the fact that mean annual rainfall is only 950mm, irrigation during the dry season (November -April) is particularly insufficient.

A labour population of 18,500 is employed in the above 46,300ha of farmland of the valley, which constitutes a work force concentration of only 0.4 persons/ha. In terms of farm scale, small farmers who cultivate 2-3 ha are most abundant.

Principal factors impeding further agricultural development in the area are (i) lack of financing, (ii) insufficient labour force, (iii) low level of agricultural technology, and (iv) lack of adequate irrigation facilities.

Breakdown of farm scale (for Selguapa and Flores)

1 - 2ha	298 farms	34.4%
2 - 10	442	50.9
10 - 50	117	13.4
above 50ha	11	1.3

2-3 PROJECT SITE

The Selguapa River flows from southwest to northeast on the far side of the road which bounds the Project area to the north. The national highway connecting Tegucigalpa and San Pedro Sula runs approximately 2km to the east of the proposed entrance into the site. 5-6 households currently inhabit the area in and around the site.

In terms of topography, the site is essentially flat, with a less than 1% grade from east to west, and natural cover is good. The mid portion along the eastern extremity of the site is the lowest point in the area, and consists of a depression with sloping around 2%.

An unlined canal runs from east to west across the northern half of the Project area, however it is not being utilized at present.

Another earth canal is routed across several hectares in the southeast corner of the site. This canal is connected to a simple masonry intake structure on the upper reaches of the Selguapa River and currently serves as an important source of irrigation water. (Refer to Annex II-2).

2-3-1 Infrastructure

A 6.5m wide gravel road connecting the national highway to the east of the site with El Taladro approximately 6km to the west runs along the northern boundary of the Project area. A power transmission line has been completed along this road for 5km from its intersection with the national highway to the 5th Army Division base near El Taladro. However, neither water nor telephone service facilities are existent in the site vicinity.

2-3-2 Groundwater

A Yokokawa 3244 (L-10c model) resistivity survey device was utilized to plot the distribution of alluvial strata considered to be the principal water bearing layers (consisting of sand and gravel), and gauge the lithofacies of base rock (Tertiary and Mesozoic formations). On the basis of the findings of said prospecting, groundwater zones were determined as running 50m below the surface from southwest to northeast at 2 locations in the Project area: (i) along the road bounding the site to the north, and (ii) along the southern extremity of the area. (Refer to Annex II-3).

2-3-3 Soil

Soil in the Project area consists of well consolidated sandy silt and sandy clay stratum, underlaid by stratum of clayey gravel intermixed with cobbles. Soil exhibits a weak acidity of PH. 6, and low permeability. Salinity is evident in middle level strata, and a proper drainage system must be accordingly prepared to prevent damage by such to crops.

CHAPTER 3. BASIC DESIGN

3-1. BASIC PLAN

The site for the proposed Agricultural Development Training Centre is located approximately 5km to the west of Comayagua and consists of 57.4 ha situated along the road connecting El Taladro (5th Division Army Camp) with the national highway. The topography of the Project area is nearly flat, with gentle sloping of less than 1% from the only slightly higher west to east. The area is to serve as the site for the Centre's facilities and attached farm.

Facilities will be designed in accordance with the requirements of the training curriculum, and will consist of the following structures:

1) Main building (for administration)
2) Training buildings (for lectures, etc.)
3) Laboratories (for experimentation and training)
4) Auditorium
5) Dormitories and housing (for trainees, staff and guests)
6) Administrative and storage buildings (for attached farm)
7) Workshop (for maintenance and repair of construction and farm machinery)
8) Other appurtenant facilities (roads and walkways,training field, water treatment facilities, service water delivery facilities, atheletic field, drying area)

Attached farm will be designed to take maximum advantage of conditions existing in the Project area. Particular attention during planning will be given to the items below.

1) Excavation will be minimized.
2) Canal gradients will make maximum use of existing topography.
3) The attached farm layout will avoid boulder strewn areas to the extent possible.
4) Positioning of structures will be made with due consideration to sunlight.
5) Relative positioning of structures will be made with due consideration to structure function.

6) Layout will be such that administrative and maintenance operations are simplified and minimized in cost to the extent possible.

7) Layout and construction of facilities will be such that adjustments to future anticipated requirements can be readily made.

8) Construction material will be selected principally on the basis of ease of procurement, cost, performance capabilities and durability.

9) Optimum location and size of wells will be determined on the basis of thorough survey of the area.

3-2. LAYOUT

A breakdown of the area to be occupied by the proposed facilities is as follows:

Buildings	7 ha
Attached farm	
Paddy field	3 ha
Upland field (intensive)	6 ha
Farm road	1 ha
Upland field (extensive) (including farm pond, orchards, athletic field)	37.7 ha
Machinery training ground	2.7 ha

Layout of Centre facilities will place primary emphasis on relative function and inter-relationship of structures, and allowance for adjustment to meet future anticipated requirements. Proposed layout is indicated in Annexed documents IV (Site Plan). Principal factors in determining specific aspects of the layout are described below.

1. Buildings: As the Centre's buildings essentially constitute the core of the overall complex, said structures are concentrated at a location near the proposed entrance into the project area.

2. Farm pond: In view of its function as an irrigation water source, the farm pond is sited on relatively higher ground in the vicinity of paddy field.

3. Paddy, upland field:

Taking into consideration field size and configuration and the need to minimize wasted land and the facilities required for cultivation, the area along the straight portion of the road bounding the Project area in the north has been selected as the location for paddy and upland fields. Positioning of fields will be such that required gradients of irrigation and drainage canals can take advantage of existing topography. Location of fields will also be readily accessible from storage facilities for farm machinery and equipment.

4. Machinery training ground:

The site selected for the machinery training ground is located in close proximity to the machinery repair and maintenance workshop. As configuration of the area is not crucial, it was decided to take advantage of the triangular portion of land between the workshop and attached farm as the location for the training ground.

5. Orchards: Orchards are to be located along both sides of the accessway into the complex, and will thus also function to enhance the scenic appearance of the main entrace to the Centre.

6. Athletic field:

The athletic field is to be situated to the rear of the building complex, and is readily accessible from living quarters.

3-3. ARCHITECTURAL LAYOUT

3-3-1. Planning of Facilities

(A) General conditions

1) Local weather conditions:

Temperatures are high and humidity low, with little rain. (Refer to Annex II-4)

2) Local conditions of topography:

The Project area is generally flat with only slight sloping, and ample space is available for the planned buildings.
(Refer to Annex II-1)

3) Local conditions of construction technology:

Construction technology is not at a high level and only limited kinds of construction materials are available.
(Refer to Annex III-1)

4) Local conditions of construction labour:

A shortage of skilled construction labour exists in the Comayagua area. Estimated construction speed would be 50% less than Japan.

5) Local construction costs:

Local construction methodology for similar facilities will be followed as much as possible to minimize costs. Annual inflation is high, however, for construction costs. (Refer to Annex III-2)

6) Construction period:

Estimation of the construction period is to be made on the basis of similar projects already implemented in the country. Planning of the construction period is affected by such difficulties as procurement of sufficient construction materials and labour, effective construction speed, etc.

(B) General guidelines in planning facilities

Facilities are planned on the basis of conditions delineated in item (A), and are described hereunder.

1) Zoning: Location of buildings is according to the function base method which allows for effective noise control and future extension of the system. The overall complex has been divided into two sections according to function. One section

consists of the central facilities to be utilized by staff and trainees, while the second section is the agricultural management area which contains the facilities for supervising agricultural activities and machinery. the central facilities consist of a main building (administration), training buildings, laboratory buildings, auditorium, and accommodation buildings. The central court of the campus functions to unify the central facilities, and in addition each individual facility subsequently possesses its own inner small court.

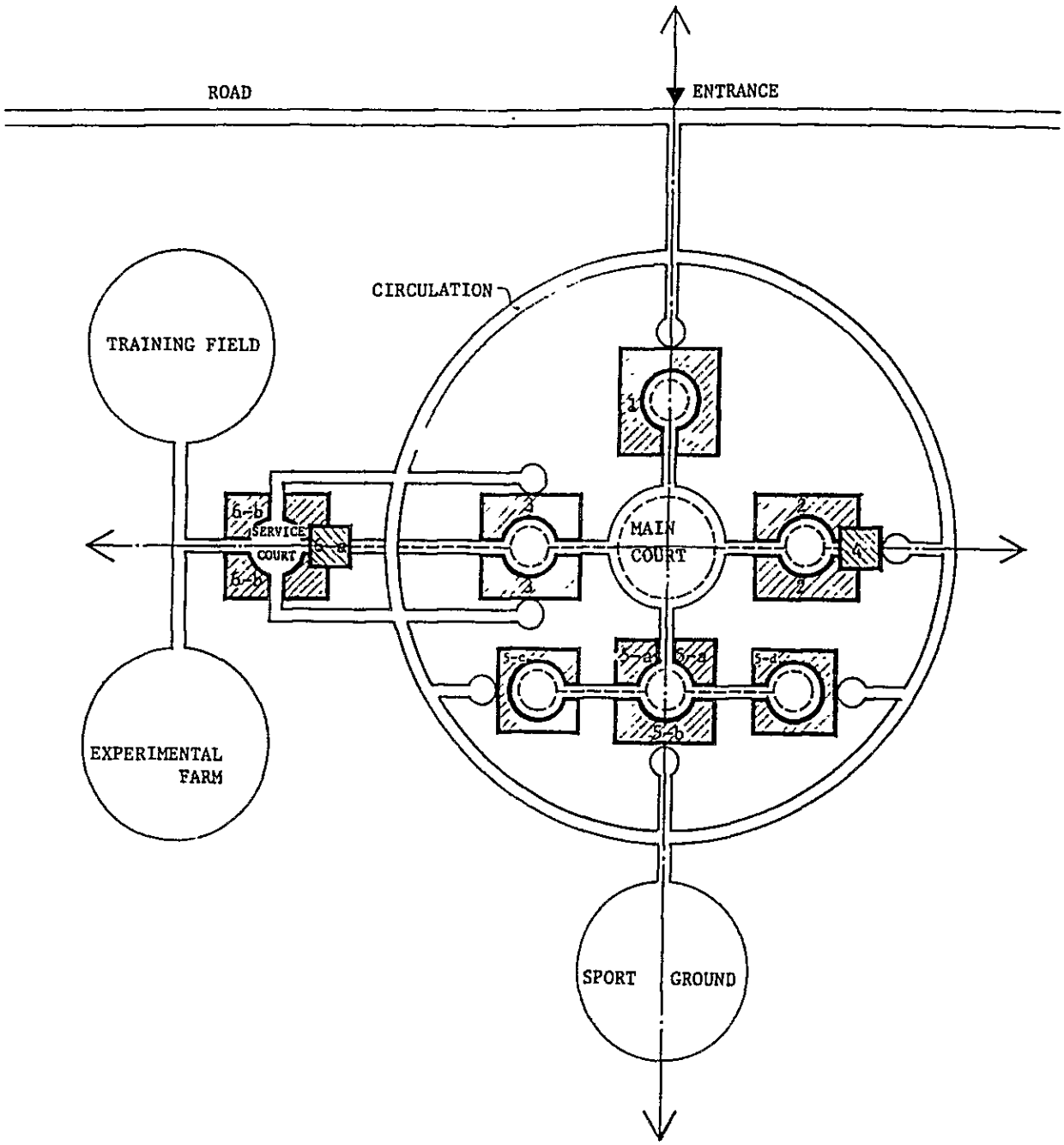
2) Circulation: A road for vehicle circulation is routed around the periphery of the central facilities. The circulation also features parking and loading space adjacent to each building.
Pedestrian circulation is designed within the periphery of the central facilities area to provide ready connection between buildings.
The central court has its own circulating corridor.
(Refer to Functional Diagram on next page)

3) Design of buildings:

All facilities are designed to be single story. Working and living spaces are designed to follow local conditions, such as featuring high ceiling and deep eaves to shield against direct sunshine, and patios to encourage ventilation.

(C) Basic Description of Facilities

Based on the intended function of the proposed Centre, the facilities outlined hereunder are considered necessary.



VEHICLE

PEDESTRIAN

1. MAIN BLDG.
2. TRAINING BLDG.
3. LABORATORY BLDG.
4. AUDITORIUM
5-a. LOBBY
-b. DINNING & KITCHEN
-c. DORMITORIES & GUEST HOUSE
-d. STAFF HOUSE
6-a. FARM MANAGEMENT OFFICE
-b. STORAGES

FUNCTIONAL DIAGRAM

	Facilities	Total Area	Components
1.	Main Bldg.	597 m^2	Director's office ($28m^2$), Assistant Director's office ($28m^2$), Japanese Team leader's office ($28m^2$), Secretary room ($24m^2$) Administration office ($142.5m^2$), Meeting room - large ($130m^2$), small ($50m^2$), Medical room ($16m^2$), Lobby ($42m^2$), Reception ($8m^2$), Telephone room ($15m^2$), Computer room ($16m^2$), Copy & Dark room ($22.5m^2$), Kitchenette ($12m^2$), Lavatory ($27m^2$), Storage ($8m^2$)
2.	Training Bldg.	$468m^2$	Lecture room ($168m^2$), Data & Library ($127m^2$), Drawing room ($77m^2$), Storage for teaching materials ($60m^2$), Lavatory ($18m^2$), Storage ($18m^2$)
3.	Laboratory Bldg.	$947m^2$	Hydrography lab. ($180m^2$), Soils mechanics lab. ($180m^2$), Concrete materials lab. ($180m^2$), Crops lab. ($180m^2$), Laboratory office ($59.5m^2$), Shower & Lavatory ($59.5m^2$), Storage ($18m^2$)
4.	Auditorium	$269m^2$	Auditorium ($166.5m^2$), Stage ($24.5m^2$), Projection room ($9m^2$), Lobby ($33m^2$), Lavatory ($18m^2$), Storage ($18m^2$)
5.	Dormitories	$3,028m^2$	V-1) Lobby ($228m^2$), Dining ($144m^2$), Kitchen ($81m^2$), Lavatory ($32m^2$), Laundry ($32m^2$) V-2) Staff house ($1,779m^2$) V-3) Guest house ($144m^2$) V-4) Dormitories for trainees ($588m^2$)
6.	Farm Management Bldg.	$141m^2$	Farm management office ($70.5m^2$), Waiting room for farm laborers ($70.5m^2$)
7.	Storage	$1,080m^2$	VII-1) Facilities for construction machines ($684m^2$) Hanger, Workshop, Training room, Shop office, Storage for spare parts VII-2) Facilities for farm ($396m^2$) Storage for farm products, Storage for fertilizers &

			agricultural chemicals, Hanger for farm machinery, Storage for farm tools & irrigation equipments, Work shop
8.	Appurtenant Atructures	1,324m^2	Gate house, Fuel tank, Rest house, Storage for sports equipment, Roofed passage

(D) Finishing Materials Plan

The circumstances and cost of building materials and the required construction period were studied and the finishing materials to be used were determined as follows.

1. Main Bldg.
   - Principal Outside Finishing
     Roof = Corrugated slate on asphalt roofing
     Wall = Painting on mortar trowel
     Door & Window = Wooden door & Aluminium window with clear glass or glass louver & mosquito screen
   - Principal Inside Finishing
     Floor = Terrazzo tile
     Wall = Painting on mortar trowel
     Ceiling = Board ceiling with wooden beam

2. Training Bldg.
   - Principal Outside Finishing
     Roof = Corrugated slate on asphalt roofing
     Wall = Painting on mortar trowel
     Door & Window = Wooden door & Aluminium window with clear glass or glass louver & mosquito screen
   - Principal Inside Finishing
     Floor = Terrazzo tile
     Wall = Painting on mortar trowel
     Ceiling = Painting on plywood

3 Laboratory Bldg.
   - Principal Outside Finishing
     Roof = Corrugated slate on asphalt roofing
     Wall = Painting on mortar trowel
     Door & Window = Wooden door & Aluminium window with clear glass or glass louver & mosquito screen
   - Principal Inside Finishing
     Floor = Terrazzo tile
     Wall = Painting on mortar trowel
     Ceiling = Board ceiling with wooden truss

4. Auditorium
   - Principal Outside Finishing
     Roof = Corrugated slate on asphalt roofing
     Wall = Painting on mortar trowel

Door & Window = Wooden door & Aluminium window with clear glass or glass louver & mosquito screen

- Principal Inside Finishing
  Floor = Terrazzo tile
  Wall = Painting on mortar trowel
  Ceiling = Board ceiling with wooden truss

5. Dormitories
- Principal Outside Finishing
  Roof = Corrugated slate on asphalt roofing
  Wall = Painting on mortar trowel
  Door & Window = Wooden door & Aluminium window with clear glass or glass louver & mosquito screen
- Principal Inside Finishing
  Floor = Arabian tile
  Wall = Painting on mortar trowel
  Ceiling = Dining Bldg. = Board ceiling with wooden truss
  Dormitories = Board ceiling

6. Farm Management Bldg.
- Principal Outside Finishing
  Roof = Corrugated slate on asphalt roofing
  Wall = Painting on mortar trowel
  Door & Window = Wooden door & Aluminium window with glass louver
- Principal Inside Finishing
  Floor = Terrazzo tile
  Wall = Painting on mortar trowel
  Ceiling = Wooden truss

7. Storages
- Principal Outside Finishing
  Roof = Corrugated slate on asphalt roofing
  Wall = Brick with reinforced concrete structure
  Door & Window = Wooden door & Steel shutter & Aluminium window
- Principal Inside Finishing
  Floor = Mortar trowel
  Wall = Brick
  Ceiling = Wooden truss

8. Appurtenant Structures
- Roofed passage
  Roof = Corrugated slate
  Column = Wood upperpart
  Limestone underpart
  Floor = Limestone
  Ceiling = Wooden truss

3-3-2. Structural Plan

1. General policy

Main structural frame works will be concrete block masonry for the main building, training buildings, laboratory buildings, auditorium, residential facilities, and agricultural managing facilities.
Frame works for other structures (storages and work shops etc.) will be local brick masonry plus reinforced concrete beam.
Roof structure will be wooden frame.
Long span will be wooden truss.
Foundation will be direct base type of reinforced concrete, although specifics will be decided on the results of soil testing.
Horizontal output by earthquake and wind are almost negligible.
Formal records over a long period are not available.
Because it is a valley site, there are no storm winds affecting the Project area.
There are no special problems affecting structural planning.

2. Structural Design

Honduras has no own structure code but American Standards are applied in general for this kind of construction. Such Standards will consequently be adopted for this Project subject to the conditions below.
In general, output on buildings will be calculated according to American Standards, however local conditions of weather, results of soil tests, function of buildings and construction criteria will also be considered.
Standards of the Architectural Institute of Japan will be applied to intensity of allowable stress for structural materials but will also take into account conditions of local materials.
Standards of AIJ will also be applied to calculate stress and design of sections, if it is equivalent to or more than the requirements of American Standard.

3. Design for external force and load

1) Load

Dead load will be calculated according to structural frame and finishing materials etc.

Live load will not be calculated, because buildings are all single story and slabs are designed as direct bases of reinforced concrete whereby the live load will be directly distributed to the ground.

2) Earthquake load

Intensity of horizontal stress K = 0.1 - 0.2

3) Wind load

Wind load will not be calculated because it is less than earthquake load.

4) Bearing capacity of soil

Supporting ground will be the gravel stratum which exists 1.0 - 1.5m underground at the site. Although A.I.J. standards permit assumption of long-term bearing capacity of 20 - 30 t/m^2, for safety considerations values of 10 t/m^2 for long term, and 20 t/m^2 for short-term will be applied.

5) Concrete unit strength

Planned standards of concrete unit strength will be FC = 210 kg/cm^2.

3-3-3. Electromechanical Equipment

Almost all the Electromechanical equipment and materials to be used for the complex are available in Honduras. However some equipment and material which are produced in Central America is of low quality and it is therefore recommended that Japanese produced equipment be utilized in order to meet the proper maintenance requirements even if the cost is higher than that for locally produced items.

It is also necessary to maintain spare parts for equipment.

1. Planning of electrical system

Electrical input will be supplied by the Government of Honduras. An existing 34,500V transmission line runs along the road located outside of the site.

Supply of electricity to each building will be 220V·60Hz for power use, 110V·60Hz for lighting use.

There are often electric black outs; therefore, the level of voltage will not be stable.

An independent generator is recommended for laboratory buildings.

Lighting will be fluorescent light in general for interiors, minimum exterior lighting is also recommended for security at night.

The Telephone system will be supplied by the Government of Honduras.

2. Planning of water service and drainage system

Potable water is availabe to each facility unit from well to be constructed in project site. Water tower will be provided for the supply of water by gravity system. Well construction and installation of water service system will be carried out by the Government of Honduras. Propane gas or solar heat facility will be provided for hot water supply to dining, kitchen, shower and bath rooms. Waste water will be drained through respective drainage system and be finally treated by sewage disposal facilities. Existing canal will be utilized to drain rainwater as well as water used for farm irrigation.

3. Planning of air-conditioning and ventilation

Power supply and frame for the installation of air-conditioner will be provided to each principal room of administration building and staff house. Each laboratory and kitchen will be provided with ventilation facility.

4. Other facility planning

Dining kitchen and staff house will be furnished with equipment necessary for cooking.

3-4. ATTACHED FARM PLAN

3-4-1. Plot and Cropping Pattern

1) Paddy field

Paddy field configuration and size is determined on the basis of such factors as performance capability of farm machinery to be employed, irrigation and drainage requirements, and soil conditions. Paddy field for the project is to consist of 6 plots, each 0.5ha in area. Each plot is to be rectangular with dimensions of 100m by 50m.

2) Upland field

Upland field for intensive cultivation is to be divided into 3 plots of 2ha each, for a total of 6ha. Each plot is designed as a rectangular field with dimensions of 200m by 100m. Irrigation and drainage facilities and farm roads to service the fields will also be constructed, and one plot will be equipped with sprinkler facilities. The extensive farming area will be equipped with a perimeter road and three transecting roads. Orchards will be situated along both sides of the main access road into the area in order to fulfill the additional function of enhancing the visual appearance of the main entrance.

3-4-2. Farm Roads

Farm roads are to be constructed within the intensive farming area at intervals of 100 - 200m. As this area is not large, no distinction into main and secondary roads will be made. However, road width will be set at 5m to be sufficient to allow two large trucks (2.4m) to pass each other, with an additional shoulder width of 1m on either side. In cases where a canal is to run alongside the road, sufficient area will be allocated to accommodate said facility. Where a canal alone runs alongside a field, a 1.5m footpath will be constructed parallel to the canal for inspection and maintenance purposes. Roads will be gravel and will be designed to handle traffic at speeds up to 40km/hr.

3-4-3. Irrigation Plan

1) Irrigation requirement

Area hydrological features:

i. evapotranspiration (monthly average for past 10 years at Playitas) Max: 7.5 mm/day (Mar.) Min: 3.9 mm/day (Nov.)

ii. effective rainfall (monthly average for past 10 years at Playitas) Max: 178 mm/mon. (Jun) Min: 5.1 mm/mon (Feb) ≒ 0 mm/day

Soil conditions:

Based on findings from test pit exploration in and around the Project area, strata of consolidated sandy silt and sandy clay exist at the site at GL-0.45m -1.40m. Judging

from the granular composition and state of compaction, the coefficient of permeability for these layers is estimated at $K=10^{-6\sim-8}$cm/sec. Underlying these strata is a lower layer of clayey gravel intermixed with cobbles. As the matrix of this stratum is clay and the overall composition of the layer is well consolidated, the coefficient of permeability is calculated at $K=10^{-4\sim-6}$cm/sec. Soil acidity is PH5-6, and data for the intermediate level layer (sandy clay) indicates high salinity.

Groundwater level

Although the precise groundwater level within the site remains undetermined as yet, the level at the existing well in the area immediately adjacent to the site in the north is GL.-6m (EL572m). It is anticipated that for the Project area will be essentially the same.

As the Project area consists of flat alluvial formation exhibiting a low groundwater level, paddy field will dry up unless irrigated. Judging from soil and meteorological conditions, a design field consumptive use of 25 mm/day is considered appropriate.

For upland fields, although some variation exists depending on type of crop, consumptive water amount ET is computed according to the following formula:

$$ET = \alpha \cdot E \cdot Kc$$

α = evapotranspiration ratio (see table on page 30)
E = evapotranspiration amount
Kc= pan evaporation coefficient --- 0.6
(elevation: 600m; humidity 60%)

In calculating ET for upland fields according to the above formula, E is assigned a maximum value of 7.5 mm/day, and is estimated at 1.1 taking into consideration the crops planned for the Project (although some slight variation does occur depending on type of crop). Thus:

$$ET = \alpha \cdot E \cdot Kc = 1.1 \times 7.5 \text{ mm/day} \times 0.6 \doteq 5 \text{ mm/day}$$

Although no concrete plans have been formulated at this stage for use of the extensive agriculture area, in its function as pasture a consumptive water use of 3 mm/day can be expected.

Consequently, based on the above considerations, and incorporating an additional loss of 15% for paddy field and 35% for dry field, overall consumptive use for the attached farm can be calculated as follows:

i. paddy field $30,000m^3 \times 0.025$ m/day $\times \frac{1}{0.85} =$ 882 m^3/day

ii. upland field $60,000m^2 \times 0.005$ m/day $\times \frac{1}{0.65} =$ 462 m^3/day

iii. extensive agriculture area

$322,000m^2 \times 0.003$ m/day $\times \frac{1}{0.65} =$ 1,486 m^3/day

Total 2,830 m^3/day
= 1.97 m^3/min

2) Water requirement for paddy field preparation (puddling)

As the paddy field in the Project area would be normally dry under non-irrigated conditions, the water requirement for paddy field preparation (puddling) is estimated at around 150mm. Flooding of paddy field is planned at a rate of $5,000m^2$ per day. The water requirement for this is thus calculated at:

$5,000m^2 \times 0.15$ m/day = 750 m^3/day = 0.52 m^3/min

3) Peak irrigation requirement

Peak irrigation requirement would occur on the final day of paddy field prepration (puddling). At that time, of the total $30,000m^2$ of paddy field 5/6 would be receiving the water requirement necessary for the rooting period while the water requirement for field preparation would be delivered to the remaining 1/6 of the paddy field area:

i. paddy field:

$30,000m^2 \times 5/6 \times 0.025$ m/day $\times \frac{1}{0.85} =$ 735 m^3/day

$30,000m^2 \times 1/6 \times 0.15$ m/day $\times \frac{1}{0.85} =$ 882 m^3/day

ii. upland field:

$60,000m^2 \times 0.005$ m/day $\times \frac{1}{0.65} =$ 462 m^3/day

iii. extensive agricultural area:

$322,000m^2 \times 0.003$ m/day $\times \frac{1}{0.65} =$ 1,486 m^3/day

Total 3,565 m^3/day = 2.48 m^3/min

The peak irrigation requirement is thus calculated at 2.5 m^3/min.

4) Diversion Plan

Given the fact that where ample water bearing strata are present a standard 50-70m well normally yields 0.5-0.7 m^3/min, 3-4 wells (250-300mm dia) would be necessary in the event groundwater alone were to serve as the source for the above irrigation requirement. However, although a resistivity survey of groundwater distribution within the Project area has been conducted, test wells are necessary to determine precise amounts of groundwater recoverable. Such testing is particularly desirable in the case of multiple wells, as cross-interference between individual well regimes is a possibility. Also, if groundwater is to be relied upon as the sole source of irrigation within the Project area, provision of an adequate power supply for pump operation presents a potential problem.

Another possible source of irrigation water is diversion from the Selguapa River. Almost all diversion from the river occurs presently at the headworks (constructed with assistance from West Germany) on its upper reaches. The remaining river discharge below the dam is tapped at another 5 locations for irrigation purposes between the dam site and the point where the river passes the Project area. Consequently, during the dry season virtually no discharge is available from the river in the vicinity of the site, and what little is divertible would be the object of potential water rights dispute.

On the other hand, the diverted discharge in the canal from the headworks remains fairly constant throughout the year, and is carried by the said intake canal in the direction of La Paz and Playitas. Along the way, water is diverted from the canal for irrigation. Consequently, water shortages have been reported in the vicinity of La Paz during the dry season. However, canal water management lies within the jurisdiction of the Ministry of Natural Resources, and authorities therein have expressed their willingness to permit a limited amount of diversion during the rainy season from the canal to the Project area. For this purpose a 3.3km long additional canal would be necessary to connect the existing canal (from the vicinity of the 5th Division army camp) with the site.

In view of all the considerations discussed above, it is proposed that a combination of groundwater pumping and surface water diversion be utilized to irrigate the Project area. Groundwater would be relied upon during the dry season as the principal water source, to be supplemented as needed with water conveyed by canal. During the rainy season the reverse would be applied, with diversion by canal playing the major role in water supply.

The costs for canal construction would be recovered in a reasonably short period of time, given the savings on power consumption which would normally otherwise occur if pump-operated wells were solely relied upon as a water source. The desirability for inclusion of a canal in the irrigation scheme is further underscored by uncertainties regarding precise amounts of groundwater recoverable.

On the other hand, dependence on diversion by canal alone for irrigation would give potential rise to water rights disputes over the limited amount of water available.

Specifically, an irrigation plan incorporating a single induction canal and two wells, with alternated seasonal utilization as discussed above, is considered as most appropriate for the Project area.

Finally, a suitable supply of irrigation water is made further imperative by the need to prevent crop damage from the high salinity caused by the volcanic ash content in the sandy clay layer distributed in the Project area at GL -0.5m -1.0m.

Crop Coefficient for Field and Vegetable Crops for Different Stages of Crop Growth and Prevailing Climatic Conditions

Crop	Humidity Wind m/sec		RHmin > 70% 0 - 5	 5 - 8	RHmin < 20% 0 - 5	 5 - 8
	Crop stage					
Corn (grain) (maize)	initial	1				
	crop dev.	2				
	mid-season	3	1.05	1.10	1.15	1.20
	at harvest or maturity	4	0.55	0.55	0.60	0.60
Cucumber		3	0.90	0.90	0.95	1.00
		4	0.70	0.70	0.75	0.80
Melons		3	0.95	0.95	1.00	1.05
		4	0.90	0.90	0.90	1.00
Onion (dry)		3	0.95	0.95	1.05	1.10
		4	0.75	0.75	0.80	0.85
" (green)		3	0.95	0.95	1.00	1.05
		4	0.95	0.95	1.00	1.05
Soybeans		3	1.00	1.05	1.10	1.15
		4	0.45	0.45	0.45	0.45
Tomato		3	1.05	1.10	1.15	1.20
		4	0.60	0.60	0.65	0.65

From FAO IRRIGATION AND DRAINAGE PAPER 24

3-4-4. Drainage Plan

In order to permit independent irrigation and drainage operations, separate canals are to be designed for these two functions. As drainage canals are to handle both surface and sub-surface runoff, they are to be a relatively deep 1.0 - 1.2m. Canal cross-section will be sufficient to carry both irrigation drainage and a portion of precipitation runoff (10 year records for Playitas indicate maximum rainfall on a single occasion of 82.4mm in 6 hrs.). Unlined trench type construction, and dimensions of 1.0m depth, 0.5m base width and 1:1 side gradient are considered most appropriate given the intended drainage function. Drainage canals are to be routed through the centre of paddy field plots, and along the periphery of the extensive agricultural area.

3-5. OTHER FACILITIES

3-5-1. Farm Pond

A farm pond serves to rectify imbalances which occur within the irrigation network when large fluctuations in diversion amount, canal discharge, or irrigation requirement arise. By providing the system with flexibility to absorb such fluctuations, it functions to protect facilities from damage as well as to ensure smooth operation of the network. Temporarily holding water passing through the irrigation system, the pond also fulfills a secondary role of raising water temperatures to a level more conducive to plant growth. In periods where diversion from the main water source is insufficient, water stored in the farm ponds serves as a temporary supplementary supply.

The capacity of a farm pond is generally equivalent to the irrigation requirement for 0.5-1 days. However, as the cultivation scale for the attached farm is small, the capacity of the farm pond for the Project is planned at minimum 5,700m^3 which is for 2 or 3 days. Construction is to be of the simple excavation type, with clay blanket lining over sandy soil portions to prevent seepage.

3-5-2. Machinery Training Ground

Approximately 3 ha of area is to be provided for test driving and training in the operation of construction and agricultural machinery. Location is to be in proximity to machinery storage facilities and the maintenance and repair workshop.

3-6. MACHINERY AND EQUIPMENT

Machinery and equipment to be utilized will be determined with consideration for training course objectives and the level of technology which can be readily applied to agricultural development within the country. Such machinery and equipment will be selected as is necessary to impart to the trainees a solid basis of knowledge in intermediate level agricultural technology. Emphasis will also be given to factors of maintenance ease and economical cost.

A portion of the necessary agricultural machinery and equipment for the project is to be provided by the Japanese Government as part of its technical assistance.

1) Construction Machine

Item	Quantity
Bulldozer (11 tons)	1
Dozer Shovel (1.2m3)	1
Hydraulic Excavator (0.35m3)	1
Tire Roller (10 tons)	1
Air Compressor (29 HP)	1
Tractor-trailer (20 tons)	1
Generator (50KVA)	1

2) Educational Equipment

Item	Quantity
Microphone, Loud Speaker, Amplifier	1
16mm Movie Projector	1
Slide Projector	1
8mm Movie Projector	1
8mm Movie Camera	1
Tape Recorder	2
Overhead Projector	1
Photo Camera and Lens	1
Spare Parts	1

3) Machine Maintenance Equipment

Item	Quantity
Lifting and Moving Equipment	1
Lubrication Equipment	1
Painting Equipment	1
Metal Forging Equipment	1
Welding Equipment	1
Oxy-Acetylene Equipment	1
Washing Equipment	1
Engine Recondition Equipment	1
Electric Recondition Equipment	1
Body-fender Recondition Equipment	1
Track Overhaul & Tire Service Equipment	1
Battery Charger	1
Machinist Tool	1

Inspection Equipment	1
Spare Parts & Others	1

4) Testing Equipment for Soils

Item	Quantity
Specific Gravity Test Bottle Set	1
Water Content Test Set	1
Grain Size Analysis Test Set	1
Liquid Limit Test Set	1
Plastic Limit Test Set	1
Moisture Equivalent Centrifuge Test Set	1
Shrinkage Limit Test Set	1
Compaction Test Set	1
CBR Test Apparatus	1
Field Density Test Set	1
Compression Test Apparatus	1
Standard Consolidation Apparatus	1
Permeability Test Set	1
Standard Penetration Test Apparatus	1
Shear Test Apparatus	1
Swedish Sounding Apparatus	1
Constant Pressure Apparatus	1
Soil Mixer	1
Balance and Scale Set	1
Electric Oven	1
Soil Auger Set	1
Spare Parts & Others	1

5) Testing Equipment for Concrete and Materials

Item	Quantity
Test Sieve Set for Aggregates	1
Aggregate Test Set for Specific Gravity, Absorption and Surface Moisture	1
Aggregate Measure Set for Unit Weight, Volume, Yield and Air Content of Concrete	1
Colorimeter Tube Set for Sand Organic Impurities Test	1
Aggregate Decantation Test by Water	1

Slump Test Set	1
Air Meter	1
Concrete Strength Test Set	1
Concrete Mixer	1
Internal Vibrator	1
Block Core Cutting Machine	1
Concrete Test hammer	1
Poisson's Ratio Apparatus	1
Capping Set for Concrete	1
Hydraulic Slab Saw for Rock Sample	1
Thermo-Regulator for Water Bath	1
Balance and Scale Set	1
Spare Parts and Others	1

6) Testing Equipment for Hydrography

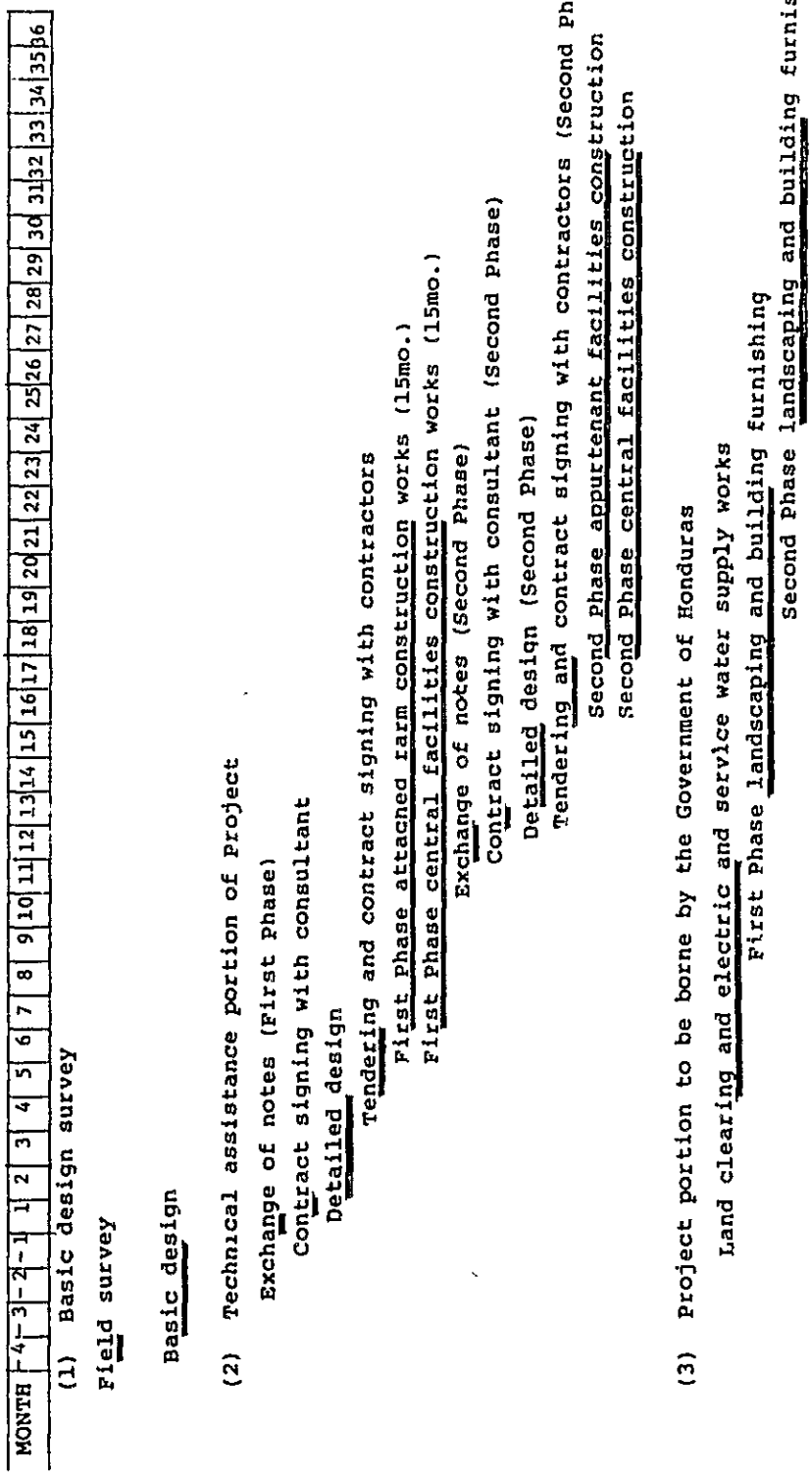
Item	Quantity
Inclinable Open Channel (slope 0 to 1/30)	1
Static Water Tank	1
Water Rectification Tank	1
Elevated Tank	1
Underground Reservoir	1
Reservoir	1
Centrifugal Pump	1
V-Notch Weir	1
Venturimeter	1

CHAPTER 4. PROJECT IMPLEMENTATION

4-1. IMPLEMENTATION SCHEDULE

Dividing the overall Project into 3 components, i.e., (i) basic design survey, (ii) portion to be covered under the grant-in-aid technical assistance program of the Japanese government, and (iii) that portion to be borne by the Government of Honduras, the implementation schedule can be shown as below:

OVERALL IMPLEMENTATION SCHEDULE



4-2 EXTENT OF WORKS

	Phase I	Phase II
Buildings, Facilities	Main building (administration)	Auditorium
		staff quarters
	Training buildings	Trainee qurters (engineers and specialist)
	Concrete materials Laboratory	
	Hydrography laboratory	Farm administrative building
	Dining & Kitchen	
	Lobby	
	Staff quarter	Soils mechanics laboratory
	Guest house	
	Trainee quarters (farm leaders)	Crops laboratory
		Rest house & Walkways
	Work shop & shop office	
	Irrigation wells	Storages
	Diversion canal	Farm pond
	Paddy and dry fields	Dry field
Equipment, Machinery	Concrete test equipment	Educational equipment
		Machine maintenance equipment
	Hydrographic model and equipment	Concrete test equipment
	Construction machinery	Construction machinery
		Soil test equipment

4-3 ITEMS TO BE BORNE BY THE GOVERNMENT OF HONDURAS

(LEMPIRA)

Item	Estimated Cost (in Lps.)
Service water and sewerage systems	43,000
Power transmission and telephone lines and facilities	30,000
Building furnishings	46,000
Land clearing	167,000
Landscaping	340,000
Domestic transportation	65,000
Total	691,000

CHAPTER 5. PROJECT EVALUATION

5-1. APPROPRIATENESS

(1) The Center is expected to play a role in training irrigation engineers and will act as one of the most important programs among agricultural development policies envisaged by the Government of Honduras. Consequently, it will contribute to the self-sufficiency in food production.

(2) The Center equipped with experiment facilities is to be used for training the staff of each regional office under the Ministry of Natural Resources, agriculture promoters, farm leaders as well as to increase the number of irrigation engineers and skilled personnel thereby extending the agrariam land with irrigation systems for food production increase.

(3) Mono-agricultural patterns in the Honduran characterized by products of banana and coffee are regarded as a shadowy existence for the small farmers, but they are actually engaged in the main food production of the nation. Personnel to be trained in the Center are expected to put their irrigation skills to good use for not only food production, but also to demonstrate to the farmers the importance of land utilization and reform and thereby improve their living conditions.

(4) The Center will become a prop to symbolize agricultural technical cooperation between Japan and Honduras with possibility of the implementation of future agricultural development projects in a specified area. The Center also contribute to promotion of friendly relations between the two nations.

(5) Although there exist a Pan American Agricultural School in Honduras teaching and training students of different nationalities in Latin America, there is no irrigation course. Therefore each Latin American country is drawing attention to the Center for mutual supplementary interests. Foreign countries and international organizations assisting in Honduras also have interest in the acti-

vities of the Center in order to lead its effectiveness to move useful direction for their own programs.

5-2 PROJECT EFFECTIVENESS

(1) Under the program of the training center, every year 48 skilled persons are scheduled to complete the courses as below:

Advanced course	12
Intermediate course	24
Extension Course	12
Total	48

If an irrigatin project team would be organized by 8 persons composed of 2 of advanced, 4 of intermediate and 2 of extension, six teams could be formed to engaged in 6 different projects.

(2) The total land area being utilized for agricultural purposes in Honduras is 2 million ha. including 48,000 ha of irrigated land and 300,000 ha of irrigable. The potential land to be developed for agriculture is estimated at 800,000 ha, and consequently 300,000 ha of cultivated land and 800,000 ha of potential land area will be the principal objective of the trained personnel graduating from the Center.

(3) If the development plan for 1.1 million ha. of total area as mentioned above would be implemented by the year 2,000, it should be carried out at the rate of 80,000 ha per year. And if the six teams composed of trained personnel in the Center would be formed every year, they would become an appropriate technical man-power core to meet the requirements for implementation of various projects of the nation.

5-3. ESTIMATION OF OPERATING COSTS

Annual expenditures for the Centre are roughly caluculated as follows:

1) Personnel expenditures

Personnel	No.	Salary (per month)	Total (per month)
Director	1	3,000 Lps.	3,000 Lps.
Sub-director	1	2,600	2,600
Staff	5	1,700	8,500
Clerk/assistant	21	700	14,700
Typist	10	400	4,000
Mechanic	4	500	2,000
Driver	8	400	3,200
Telephone operator	1	200	200
Farm laborer	10	150	1,500
Cook	8	130	1,040
Custodian	8	120	960
Security officers	2	150	300
Sub-total			42,000
Annual salary	(42,000 x 13 months + bonus equivalent to montly salary)		546,000
Travel expenses	(40 persons x 12 months x 70)		33,600
Total			579,600 Lps.

Note: The positions of (1) assistant director and an additional (3) staff are to be filled by Japanese specialists under the Technical Assistance Program and have therefore been omitted from operating cost estimation.

Number of personnel necessary for proper management and operation of the Center is based on following personnel placement plan.

Building & Facility	Number of Personnel To Be Placed											
	Director	Sub-director	Staff	Clerk assistant	Mechanic	Typist	Telephone operator	Driver	Farm laborer	Cook	Security officer	Custodian	Sub-total
Main building (administration)	1	2	2	4		4	1	3				2	19
Training building													
Laboratory building (Soil, Concrete, Hydrography and Crop)			4	8		4						4	20
Accommodations										8		2	10
Farm administrative building				5				3	10				18
Work shop (Construction & Agricultural machinery)			2	4	4	2		2					14
Others											2		2
Sub-total	1	2	8	21	4	10	1	8	10	8	2	8	83

2) Expenses for water and electricity

Farm	20,000 Lps.
Building	60,000
Total	80,000

3) Expenses for consumption goods (incl. building maintenance)

40,000 Lps.

4) Expenses for fuel (for vehicle and machine)

50,000 Lps.

5) Expenses for machine maintenance service

40,000 Lps.

Grand total of operating cost for the first year 789,600 Lps.

Each item marked as ′ is calculated on the basis of actual expense charged to Dirección de Recursos Hídricos --- 120% more than the expense actually paid by D.R.H.

Above annual operational cost is equivalent to about 0.5% of 1982 budget approved for the Ministry of natural Resources and 11% of budget for Dirección de Recursos Hídricos.
Funds are expected to be raised from the budget for the development of man power under the program of M.N.R.

CHAPTER 6. RECOMMENDATIONS

1. As indicated in Annex I-6, the number of trainees to be enrolled at the institution per year is 45 - 54 persons. Of this total number, 10 - 14 individuals are to receive the advanced course, 20 - 25 are to study under the intermediate course, and the extension course is planned for a 15 student capacity.

Within the Ministry of Natural Resources, 46 individuals are targeted for the advanced course, while 220 and 102 persons are scheduled to eventually take the intermediate and extension courses respectively. As evidenced by these figures, the number of personnel qualified for enrollment in the advanced course is small; in particular, about 15 persons from the ministry are prepared to enter the A Course in civil engineering.

On the other hand, from government bureau specifically concerned with agriculture, 190 (of which 76 are from the Insituto Nacional Agrario), 191 (48 from INA) and 208 (202 from INA) persons are slated for the advanced, intermediate and extension course respectively.

Consequently, administration of the training centre must be accomplished with close coordination between all government bureaux involved in agricultural development, in order to provide enrollment opportunity to as many concerned sectors and levels of government as possible. It is particularly important to maximize INA participation in the training program.

2. As discussed earlier in section 3-4-3, the irrigation requirement for the Project area is to be obtained through diversion by canal from a point approximately 3,300m upstream from the site, and from two wells to be dug within the Project area. The diversion canal would serve as the principal water source during the rainy season for rice cultivation, and the wells would be primarily relied upon for water during the dry season when cultivation of vegetables would be undertaken (according to the optimum cropping pattern for the Project). This approach not only offers advantages in terms of effective water use and minimized operational and maintenance costs, but also permits the trainees to experience first hand both canal and well irrigation technologies.

3. According to the report by the British engineering consulting firm of Sir Willian Halcrom, the soil in the vicinity of the Selguapa River exhibits saline content in amounts sufficient to adversely affect crops. Consequently it is particularly important that proper drainage facilities be prepared and that evaporation of moisture in the soil be minimized to the extent possible.

4. On its part, the Government of Honduras will be counted on to faithfully execute the procedures and construction works for which it is to assume responsibility. In particular, it must take measures to ensure that the funding required for the operational budget of the training centre is available each fiscal year.

ANNEX I

I-1 MEMBER LIST OF STUDY TEAM

Basic Design Team (from Feb. 8, 1982 to Feb. 27. 1982)

ASSIGNMENT	NAME	POSITION
Team Leader	Akiyoshi TAMAOKA	Director of Development Div., Construction Dept., Tokai Agriculture Administration Office. Ministry of Agriculture, Forestry and Fisheries
Operation Planning	Ikuo FUJIMORI	Director of Administration Dept., Japan Regional Crop Seed Association
Coordinator	Syozo MATSUURA	Staff of Basic Design Div., Grant Aid Dept. Japan International Cooperation Agency
Irrigation & Drainage	Shun WATANABE	Chuo Kaihatsu Corporation
Architectural Planning	Makoto MIKI	Chuo Kaihatsu Corporation
Agriculture	Keisaku KOBAYASHI	Chuo Kaihatsu Corporation
Topo-Survey & Facility	Kazuyoshi KAGEYAMA	Chuo Kaihatsu Corporation
Architectural Design	Masahiro TSUNODA	Chuo Kaihatsu Corporation
Interpreter	Mitsuko TAKEI	International Cooperation Service Center

Draft Report Team (from April 16, 1982 to April 26, 1982)

Team Leader	Isao KABURAGI	Chief of Agricultural Development Div., Agricultural Development Cooperation Dept., Japan International Cooperation Agency
Irrigation & Drainage	Shun WATANABE	Chuo Kaihatsu Corporation
Architectural Planning	Makoto MIKI	Chuo Kaihatsu Corporation

Ground Water Suvey (from April 14, 1982 to June 2, 1982)

Ground Water Survey	Kazuyoshi KAGEYAMA	Chuo Kaihatsu Corporation

I-2 ITENERARY OF THE MISSION

Basic Design Team

Date	Day	Description
Feb. 8	Mon.	Flight from Tokyo to Mexico city
9	Tue.	Flight from Mexico city to Tegucigalpa
10	Wed.	Courtesy call to the Japanese Embassy and Minister of Natural Resources; discussion on schedule at Dirección de Recursos Hídricos.
11	Thu.	Meeting at D.R.H.; discussion on inception report; explanation of Grant Aid system; Field party moved to Comayagua
12	Fri.	Visit to Lujosa Experimental Farm and intake weir in Cholteca; field reconnaissance and field survey
13.	Sat.	Visit to Agricultural Training Center in Zamorano; field survey
14.	Sun.	Moved to Comayagua; visit to Project area; field survey; meeting in Comayagua
15.	Mon.	Visit to INFOP Agricultural Training Center in La Paz and return to Tegucigalpa; field survey
16.	Tue.	Meeting in D.R.H. and discussion on training curriculum; field survey; groundwater sounding
17.	Wed.	Meeting in D.R.H.; discussion on operation and equipment program; field survey; ground water sounding
18.	Thu.	Meeting in D.R.H.; discussion on plans and facilities program; collection of data; preparation of the Minutes of Discussions; topographic survey; ground water sounding
19.	Fri.	Signing of the Minutes of Discussions; briefing to the Japanese Embassy; topographic survey; ground water sounding
20.	Sat.	Flight of first departure group from Tegucigalpa to Los Angeles (Messrs. Tamaoka, Fujimori, Matsuura, Kobayashi); meeting in D.R.H. and discussion on plans and layouts; Topographic survey; Study of soil and canals
21.	Sun.	Flight from Los Angeles of first group ; meeting in D.R.H. and discussion on plans; collection of data; topographic survey; study of soil

Date	Day	Description
Jan. 22.	Mon.	Arrival at Tokyo of first group; meeting in D.R.H. and discussion on technical aspects for building construction; visit to Comayagua Cement Plant
23.	Tue.	Meeting in D.R.H. and discussion on technical aspects; collection of data; courtesy call to D.R.H. regional office of Comayagua; move to Tegucigalpa
24.	Wed.	Meeting in D.R.H. and briefing; collection of data
25.	Thu.	Flight from Tegucigalpa to Los Angeles of remaining members
26.	Fri.	Flight from Los Angeles to Tokyo
27.	Sat.	Arrival at Tokyo of remaining members

Draft Report Team

April 16.	Fri.	Flight from Tokyo to Mexico city
17.	Sat.	Flight from Mexico city to Tegucigalpa
18.	Sun.	Meeting of members
19.	Mon.	Courtesy call to the Japanese Embassy and Direccíon de Recursos Hídricos; explanation of draft final report at D.R.H.
20.	Tue.	Explanation of draft final report at D.R.H.; visit to project site at Comayagua
21.	Wed.	Meeting in D.R.H.; discussíon on draft final report
22.	Thu.	Signing of the Minutes of Disccussíons; briefing to the Japanese Embassy
23.	Fri.	Courtesy call to D.R.H. and the Japanese Embassy
24.	Sat.	Flight from Tegucigalpa to Los Angeles
25.	Sun.	Flight from Los Angeles to Tokyo
26.	Mon.	Arrival at Tokyo

Date	Day	Description
Ground Water Survey		
April 14.	Wed.	Flight from Tokyo to Mexico city
15.	Thu.	Flight from Mexico city to Tegucigalpa
16.	Fri.	Courtesy call to Direccíon de Recursos Hídricos; visit to project site at Comayagua
17.	Sat.	Meeting with local boring contractor
18.	Sun.	Meeting with members of drft report team
19.	Mon.	Courtesy call to the Japanese Embassy; supervision of access route preparation work for boring machine at Comayagua
20.	Tue.	Supervision of access route preparation work for boring machine at Comayagua
21.	Wed.	Meeting with local boring contractor; presenting order of work
22.	Thu.	Meeting in D.R.H.; briefing to officials concerned
23.	Fri.	Boring machine (Rotary) moved to Comayaguna; setting of machine
24.	Sat.	Boring work commenced; drilling became impossible due to collapse of gravel at 4m deep from ground surface
25.	Sun.	Meeting with boring contractor
26.	Mon.	Meeting with boring contractor, D.R.H. staff and JICA expert
27.	Tue.	Boring machine mobilized again to Comayagua; drilling became impossible due to collapse of gravel
28.	Wed.	Meeting with borig contractor; briefing to D.R.H.
29.	Thu.	Visit to existing wells in Comayagua area
30.	Fri.	Meeting with boring contractor and discussíon on schedule
May 1.	Sat.	Visit to work shop for the machine under repair
2.	San.	Office work in Comayagua
3.	Mon.	Leveling work along proposed diversion canal line

Date		Day	Description
May	4.	Tue.	Leveling work completed; meeting with staff of D.R.H.
	5.	Wed.	Briefing to the Japanese Embassy; request for prolongation of work period
	6.	Thu.	Visit to boring contractor and discussion on schedule
	7.	Fri.	No contact was made with boring contractor machine left unrepaired
	8.	Sat.	Looked for an another contractor of siguatepeque
	9.	Sun.	Contact was made with boring contractor; machine scheduled to be mobilized to Comayagua on 11th.
	10.	Mon.	Briefing to staff of D.R.H. and JICA expert
	11.	Tue.	Visit with chief of irrigation Dept. of D.R.H. to contractor
	12.	Wed.	Machine not mobilized to Comayagua; meeting in D.R.H.; contact was made with SANAA
	13.	Thu.	Meeting in SANAA; visit to pipe manufacturing company
	14.	Fri.	Meeting in SANAA; procedure to use SANAA's machine (percussion)
	15.	Sat.	Boring machine moved to Comayagua; setting of machine; commerced boring
	16.	Sun.	Bored 9 meters deep with a casing of 25cm in diameter
	17.	Mon.	Reached 15 meters deep; collapse of bore hole
	18.	Tue.	Boring became impossible due o collapse; visit to D.R.H. and SANAA; request for casing and transportation
	19.	Wed.	Meeting in D.R.H.; visit to SANAA's repair shop; procedure to use casing of SANAA
	20.	Thu.	Recommenced boring with two casing; reduction of depth of bore hole to 10 meters because of collapse
	21.	Fri.	Briefing to D.R.H.; contact was made with HIDRO-SISTEMAS, boring contractor of San Pedro Sula
	22.	Sat.	Arrival at Comayagua of machine from San Pedro Sula; no access of machine to project site because of rain

Date		Day	Description
May	23.	Sun.	Work to take SANAA's machine out of prject site
	24.	Mon.	Visit to Army, CHOHDEFOR and SECOPT: request for dump truck and wheel loader to gravel access road
	25.	Tue.	Abandonment of boring work; briefing to D.R.H.
	26.	Wed.	Extraction of casing; visit to HIDRO SISTEMAS in San Pedro Sula
	27.	Thu.	Extraction of casing completed
	28.	Fri.	Work to carry bit, casing and other related attachments out of project site
	29.	Sat.	Office work in Tegucigalpa
	30.	Sun.	Office work in Tegucigalpa
	31.	Mon.	Flight from Tegucigalpa to Los Angeles
June	1	Tue.	Flight from Los Angeles to Tokyo
	2	Wed.	Arrival at Tokyo

I-3 HONDURAS GOVERNMENT OFFICIALS CONCERNED

Ministerio de Recursos Naturales

Ministro	Ing. Miguel Angel Bonilla
Dirección de Recursos Hídricos	
Director General	Ing. Miguel Lardizabal
Sub-Director	Ing. Carlos Rivas
Jefe Dpto. de Ingeniería de Riego y Drenaje	Ing. Orlando Avilés
Jefe de Planificación	Lic. Jaime Lanza
Jefe Dpto. de Aguas Subterraneas	Ing. Sergio Diaz Orellana
Jefe Dpto. de Operación y Mantenimiento	Ing. Roberto Rivera Lanza
Ingeniero de D.R.H.	Ing. Joaquin Guardado
Ingeniero de D.R.H.	Patricio Rueda

Centro Nacional de Agricultura y Ganadería

Director	Ing. Jorge Abastidas

Oficina Regional de Recursos Naturales (Comayagua)

Director	Ing. Francisco Rodas

Experto de JICA

Dirección de Recursos Hídricos	Ing. Kunio Takagaki
Dirección de Recursos Hídricos	Ing. Hideo Ago

I - 4 MINUTES OF DISCUSSION

MINUTA DE DISCUSIONES SOBRE EL PROYECTO DE CONSTRUCCION DEL CENTRO DE ENTRENAMIENTO DE DESARROLLO AGRICOLA

En atención a la solicitud del Gobierno de la República de Honduras para asistencia económica no reembolsable en el establecimiento del Centro de Entrenamiento de Desarrollo Agrícola en las cercanías de Comayagua (en adelante se denominará "EL CENTRO"), el Gobierno del Japón, a través de la Agencia de Cooperación Internacional del Japón (JICA), envió una Misión presidida por el Señor Akiyoshi TAMAOKA (Director, División de Administración, Departamento de Construcción, Oficina de Administración Agrícola de Tokai, Ministerio de Agricultura, Foreste y Pesca), con fecha 9 de febrero de 1982, con el fin de supervisar el diseño básico del Proyecto.

Durante su estadía en la República de Honduras, la Misión sostuvo una serie de conversaciones e intercambios de ideas con las autoridades competentes del Gobierno de Honduras respecto al establecimiento y construcción del Centro.

Ambas partes acordaron recomendar a sus respectivos Gobiernos y autoridades competentes examinar los resultados de la supervisión para la realización del Proyecto, que acompañan a la presente.

Tegucigalpa, D.C., 19 de febrero de 1982.

ING. MIGUEL LARDIZABAL BECERRA
Director General de Recursos Hídricos

AKIYOSHI TAMAOKA
Jefe, Equipo Japonés de Supervisión.

1. El objetivo del Proyecto es proveer los edificios, instalaciones y equipos necesarios para promover el desarrollo agrícola y actividades de entrenamiento.

2. El terreno propuesto para la ejecución del Proyecto estará ubicado en las cercanías de Comayagua y se indica en el plano adjunto (Anexo I).

3. El Equipo Japonés de Supervisión transmitirá al Gobierno del Japón el deseo del Gobierno de Honduras de solicitar la cooperación económica japonesa no reembolsable para la construcción de edificios y otras instalaciones descritas en el Anexo II.

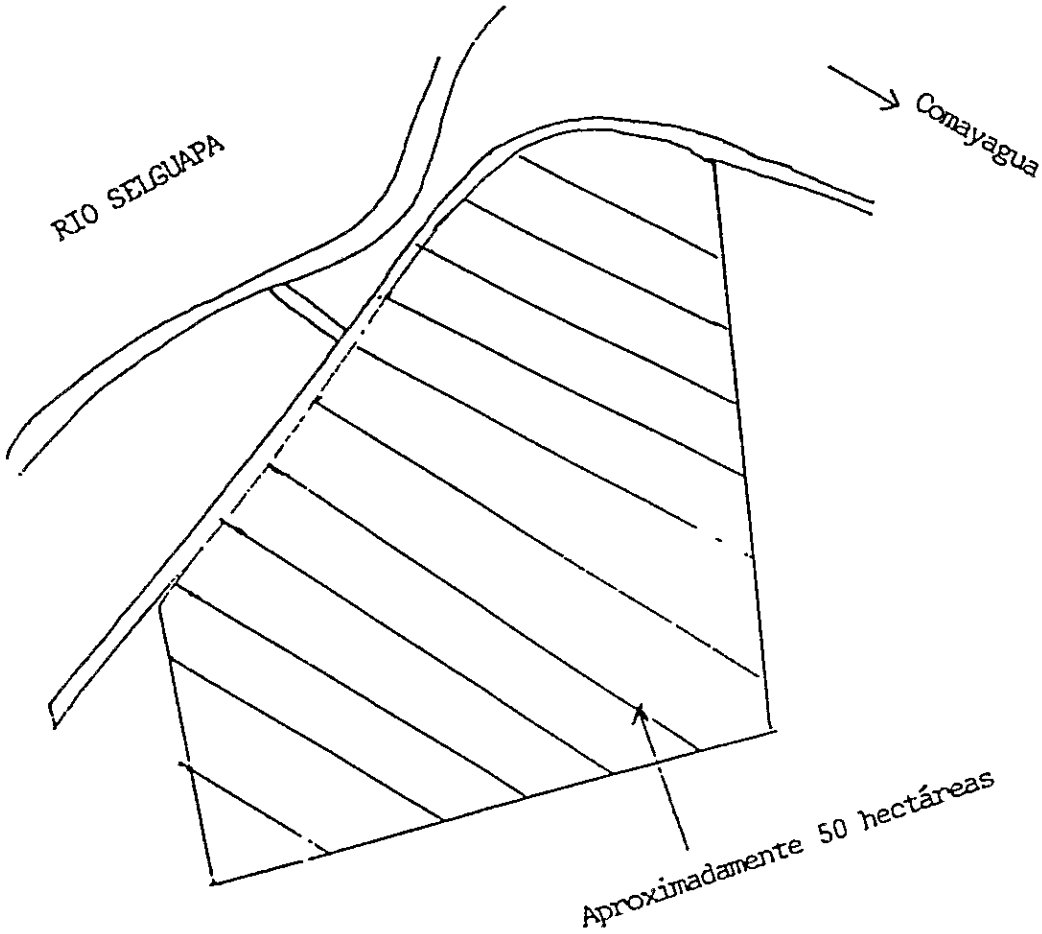
4. El Gobierno de Honduras tomará las siguientes medidas para facilitar la realización del Proyecto con la asistencia económica no reembolsable del Gobierno del Japón:

   1) Proveer datos e informaciones necesarios para el diseño y la construcción.
   2) Adquirir el terreno requerido para la construcción
   3) Limpiar y nivelar el terreno del Proyecto, en caso necesario, antes de la construcción.
   4) Construir y preparar las vías de acceso al terreno del Proyecto, si es necesario.
   5) Proveer otros renglones enumerados en el Anexo III.
   6) Asegurar el pronto desembarco y despacho aduanero en Honduras de materiales y equipos importados para la construcción y facilitar también, su transporte interno.

7) Eximir del pago de derechos aduaneros, impuestos internos y otras cargas fiscales que se impongan a los nacionales japoneses en Honduras con respecto al suministro de los productos y servicios para la construcción.

8) Acordar y obtener los permisos, licencias y otras autorizaciones necesarias para llevar a cabo el Proyecto.

ANEXO I



ANEXO II

Renglones solicitados por el Gobierno de Honduras cuyos costos serán sufragados por el Gobierno del Japón.

1. Edificios e instalaciones

   1) Oficina de Administración
   2) Laboratorios
   3) Aulas
   4) Bodega para maquinaria y equipo
   5) Bodega para materiales
   6) Talleres y garage
   7) Viviendas para los instructores
   8) Viviendas para el personal
   9) Dormitorio

2. Equipos

   1) Equipos de laboratorio
   2) Equipos de entrenamiento

3. Granja Experimental

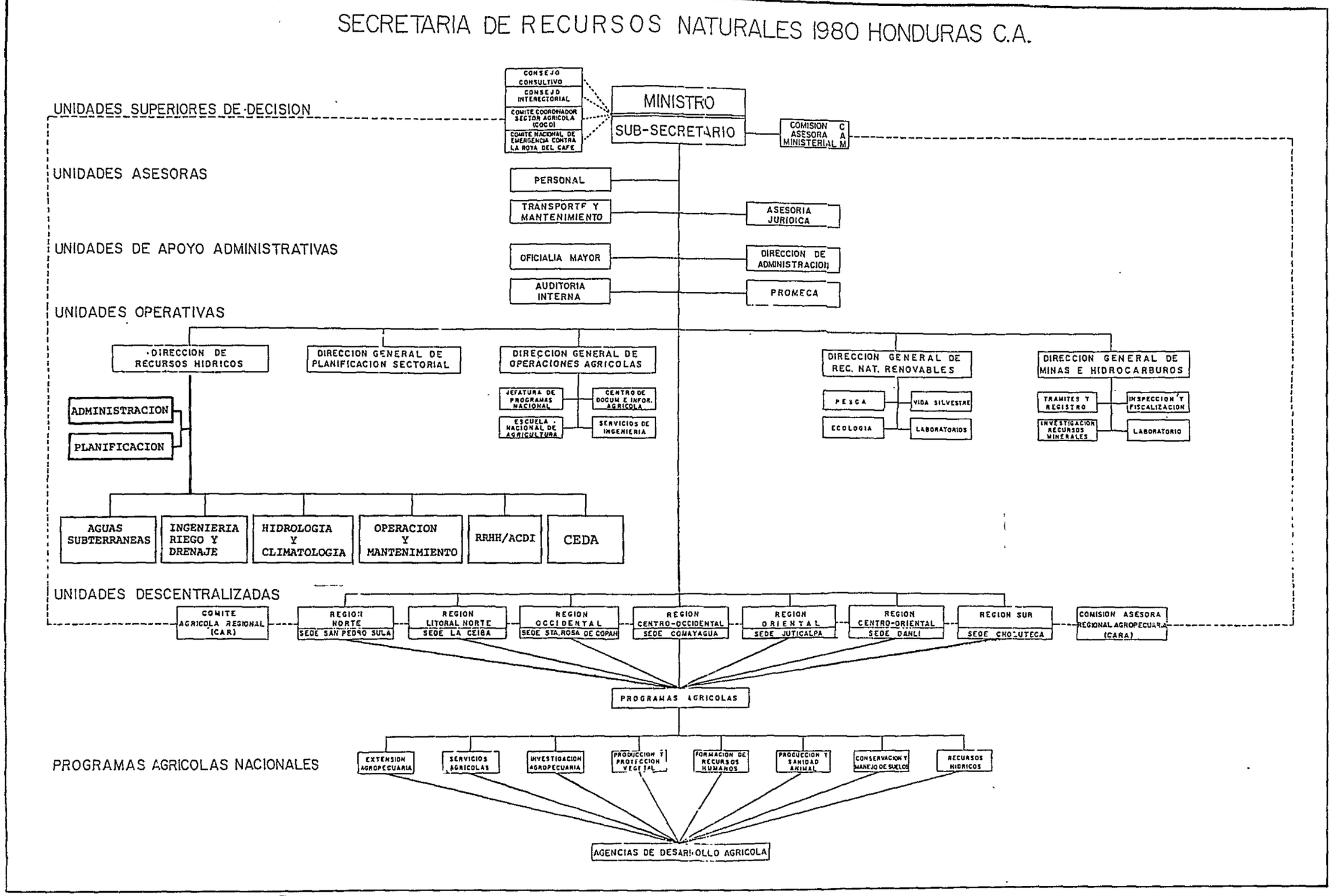
   1) Casa de bombeo
   2) Obras complementarias para el campo experimental agrícola

ANEXO III

Renglones cuyos costos serán sufragados por el Gobierno de Honduras.

1. Cañería matriz de agua potable hasta el edificio del Centro.
2. Drenaje exterior desde el edificio del Centro y facilidades de tratamiento de aguas negras.
3. Línea matriz de energía eléctrica hasta el edificio del Centro.
4. Líneas telefónicas y equipos
5. Instalaciones exteriores y jardinería
6. Preparación del terreno necesario para tal construcción: oficina provisional, área de trabajo, almacenaje y otros.
7. Muebles, cortinas, alfombras y otro mobiliario si es necesario.
8. Costo de mantenimiento, operación y gastos

I - 5 ORGANIZATION OF THE MINISTRY OF NATURAL RESOURCES



I-6. TECHNICAL PERSONNEL IN GOVERNMENT

In October 1981, the Water Resources Bureau of the Ministry of Natural Resources studied by means of questionnaire the potential technical personnel to receive training in agricultural development at the proposed center.

The questionnaire was sent out to 23 agencies and organizations involved in agriculture and civil engineering and was received back from 14.

The number of personnel subject to consideration for training at the center are given on a per organization basis in the table below.

(A) Ministerio de Recursos Naturales	
Ministerio de Recursos Naturales	(49)
Ingeniería Riego de la Dirección de Recursos Hídricos	(30)
Servicio de Ingeniería de la Dirección General de Operaciones Agricolas	(312)
Direccion General de Recursos Naturales Renovables	(127)
Sub-total	(518)
(B) Agricultural related organizations	
INA	(761)
PNIA	(87)
BNDA	(168)
COHDEFOR	(65)
Sub-total	(1174)
(C) Other government organization	
SECOPT	(79)
SHC	(11)
SANAA	(755)
ENEE	(42)
Dirección Ejectivo del Catastro	(7)
Sub-total	(894)
TOTAL	2586 persons

Distribution of Technical Personnel

	(A)	(B)	(C)	Total
Ing. Agrónomos	38	161 (58)	0	199
Ing. Civiles	15	11 (5)	98	124
Ing. Agrícolas	0	18 (13)	0	18
Agrónomos	220	191 (48)	0	411
Promotores	102	208(202)	12	322
Topógrafos	3	18 (16)	35	56
Dibujantes	17	12 (9)	57	86
Planificadores	0	40 (23)	10	50
Operarios Equipo	15	134(132)	15	164
Regante de Campo		24 (12)		24
Ayudante de Campo	6	168(102)	618	792
Economistas	4	7	3	14
Otros	113	177(141)	36	326
Total	533	1169(761)	884	2586

'All figures in parentheses express the number of staff engaged with INA

I-7 BUDGET TRANSITION
(1979 - 1982)

	(1) National Budget (Lps)			(2) M.N.R. Budget (Lps)			(2)/(1)
	Total Amount	Domestic Currency	Foreign Currency	Total Amount	Domestic Currency	Foreign Currency	%
1979	1,004,410,819	749,542,405	254,868,414	119,232,480	79,533,464	39,699,016	11.8
1980	1,136,765,818	905,135,300	231,630,518	160,532,344	88,228,784	72,303,560	14.8
1981	1,344,000,000	1,020,815,500	319,184,000	151,600,000	97,051,662	54,548,338	11.2
1982	1,551,512,523	1,128,384,697	423,127,826	153,120,977	76,416,346	76,704,631	9.8

I - 8 Outline of A Paddy Farm in Cholteca

1. There is a large scale paddy farm in Cholteca.
   The Team observed the paddy farm at Cholteca on 12 February 1982 with Mr. Patricio, R. Rueda N. (Agronomist), Direction Recursos, Hidrico, RRNN.

2. According to the FAO Production Yearbook 1980, paddy field in Honduras totals 24,000ha and paddy production was 41,000 tons in 1980. Average paddy yield is as follows:

	1969/71	1978	1979	1980
Area (ha)	11,000	16,000	19,000	24,000
Yield (kg/ha)	1,304	1,675	1,491	1,725
Production (ton)	15,000	27,000	29,000	41,000

Source: FAO Production Yearbook, Vol. 34, 1980

3. The acreage of paddy farm is about 200ha, and was developed from former meadows and bush area about five years ago by a private land owner. The soil in the paddy field, all of alluvial origin is somewhat variable in texture and suitable to a wide range of crops including paddy.

4. Paddy cultivation is by double cropping. The cropping pattern for the farm is as follows;

   1st crop;from January to April/May

   2nd crop;from May/June to November

The varieties of paddy planted on the farm are IR-22 and CICA varieties including No. 4, No. 5 and No. 8, which were introduced through Nicaragua. The yield of the paddy is about 1.2 ton per hectare.

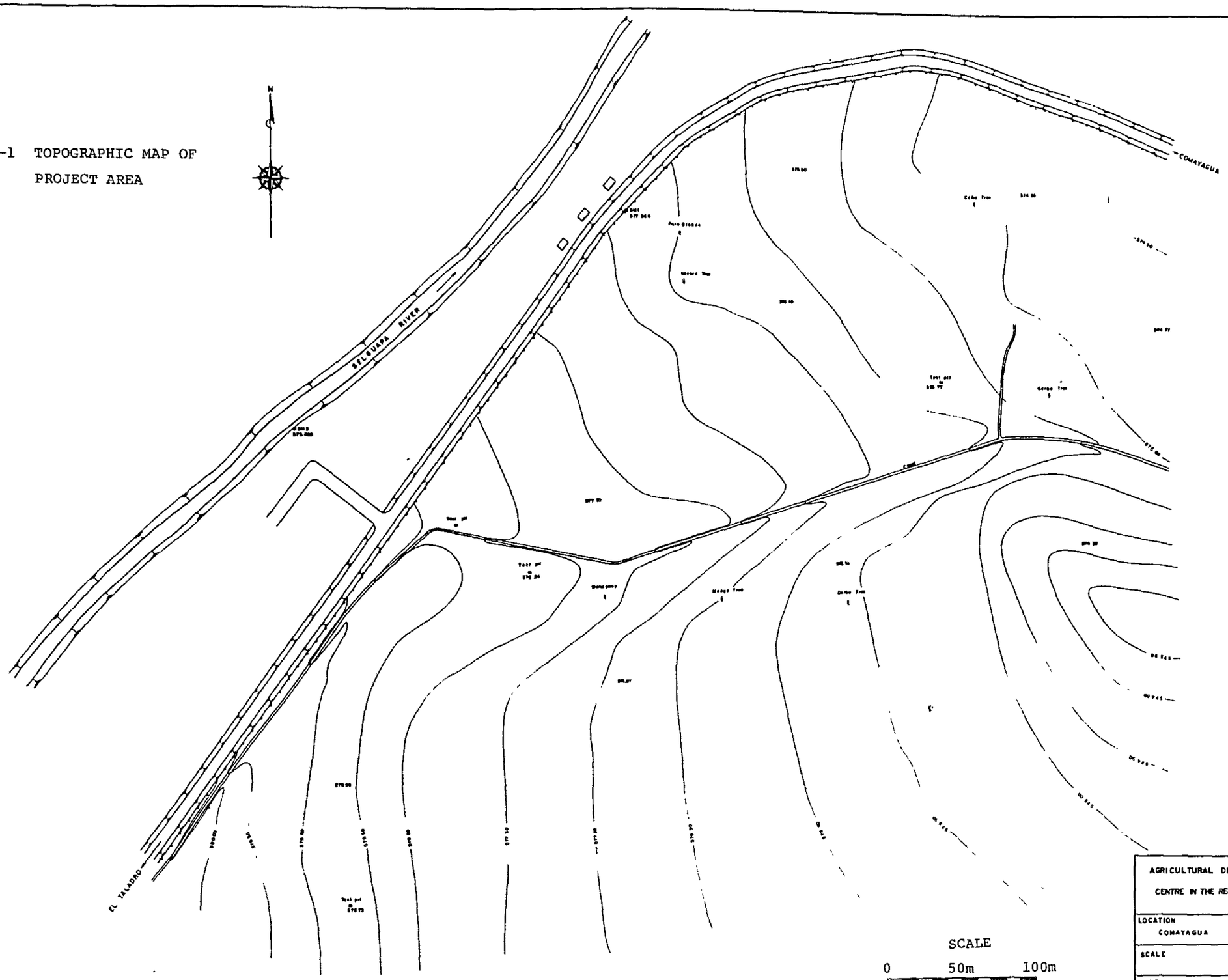
5. The farming practices are fully mechanized. At the begining of January in the care of the 1st crop, land preparation is undertaken utilizing the 70 HP class tractor with mounted disc plough having 4 bottoms. Soil saturation with pre-irrigation is practiced to facilitate the ploughing. Harrowing by 9 discs with 2 gangs is required at least twice after the ploughing in order to make the land level. A disc harrow is attached to the tractor for this practice.

6. Application of the basic fertilizer and chemicals is accomplished by airplane. Sowing of the paddy seeds consists of broad casting by hand directly in the paddy field. After germination of the seeds, the field is irrigated by pumping irrigation. The evapo-transpiration is about 6mm per day.

7. Harvesting is conducted utilizing rice combine harvesters with 4.5m cutting width. Approximately 2 weeks prior to harvesting, the fields are drained completly. The paddy farm has no rice mills. The paddy is consequently sold to a rice mill in Cholteca city.

ANNEX II

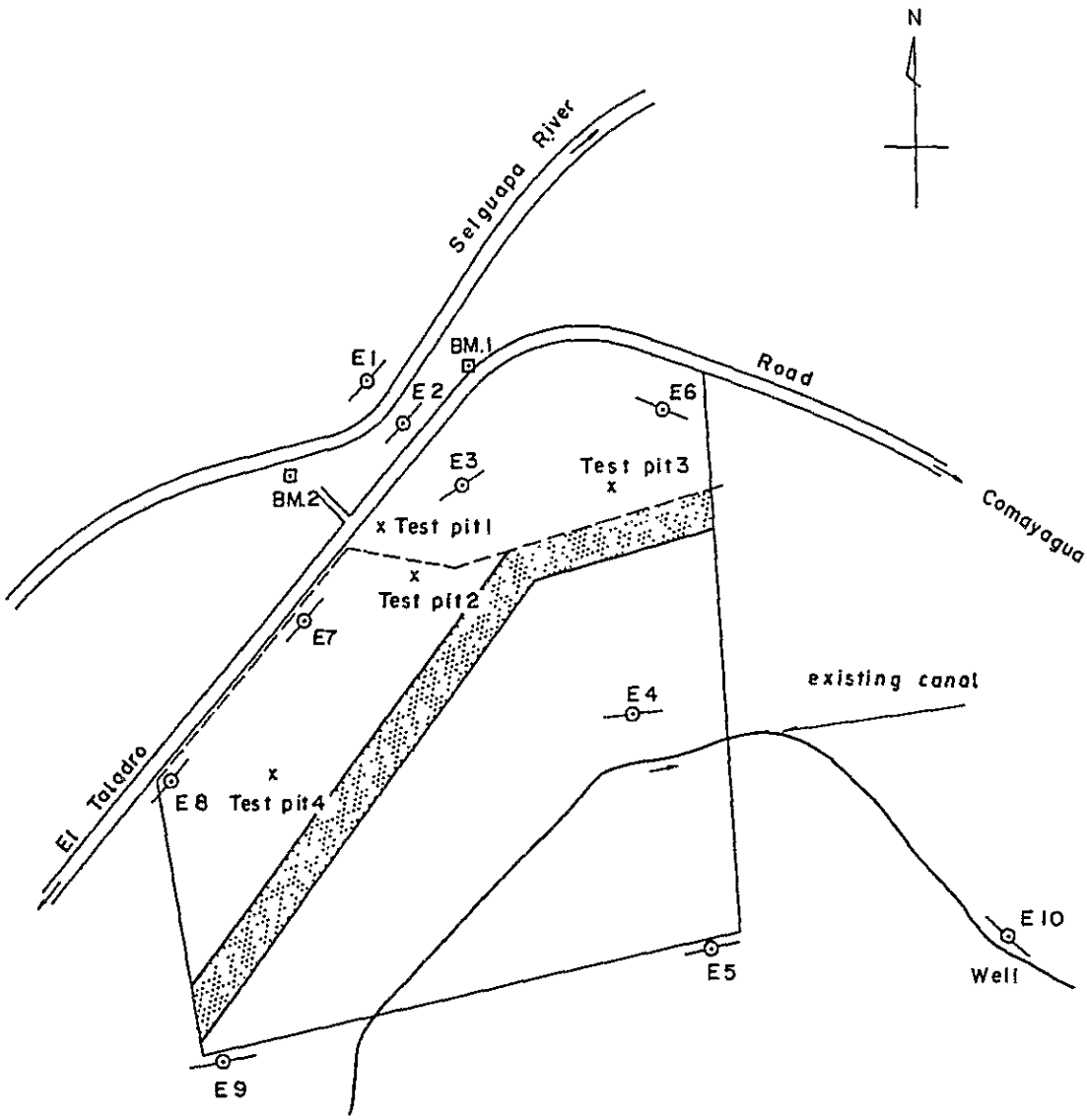
II-1 TOPOGRAPHIC MAP OF
PROJECT AREA



AGRICULTURAL DEVELOPMENT TRAINING CENTRE IN THE REPUBLIC OF HONDURAS

LOCATION COMAYAGUA	PROGRAMED BY JAPAN INTERNATIONAL COOPERATION AGENCY
SCALE	EXECUTED BY CHUO KAIHATSU CORP
DATE	DRAWN BY MASAHIRO SHIROTA

II - 2 LOCATION OF GROUND WATER SOUNDING



------ Earth Canal

⊡ B.M. (ELV. B. M. 1: 577.369, B.M. 2: 575.009)

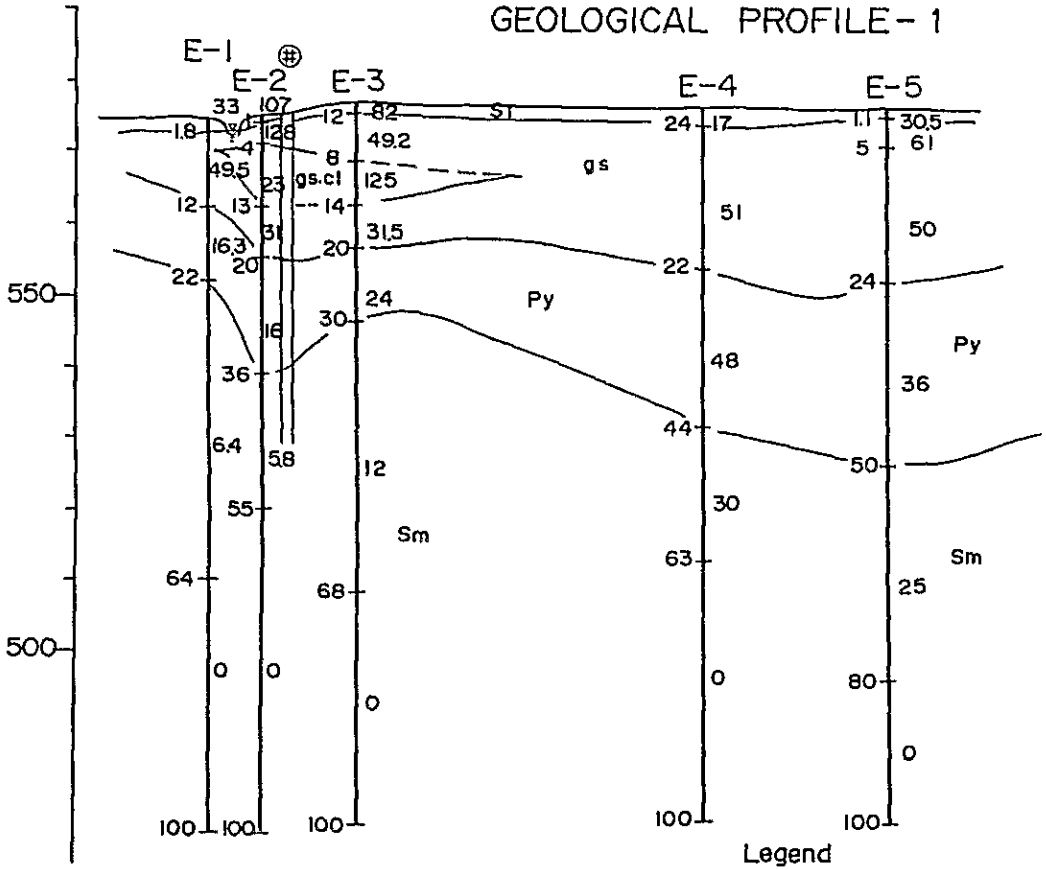
—⊙— E6 Point of Ground Water Sounding

x Test Pit Location

▒ Area of Gravels

II – 3 FINAL RESULTS OF GROUND WATER SOUNDING

GEOLOGICAL PROFILE – 1



Legend

S1	First layer	Silt. clay	
gs	Second layer	Gravels	Ground water zone
gs.cl	Third layer	Gravels. clay	Ground water zone
py	Fouth layer	Volcaniclastic rocks	Potential water zone
Sm	Fifth layer	Mudstones. shale. sand	Impermeable layer

GEOLOGICAL PROFILE-2

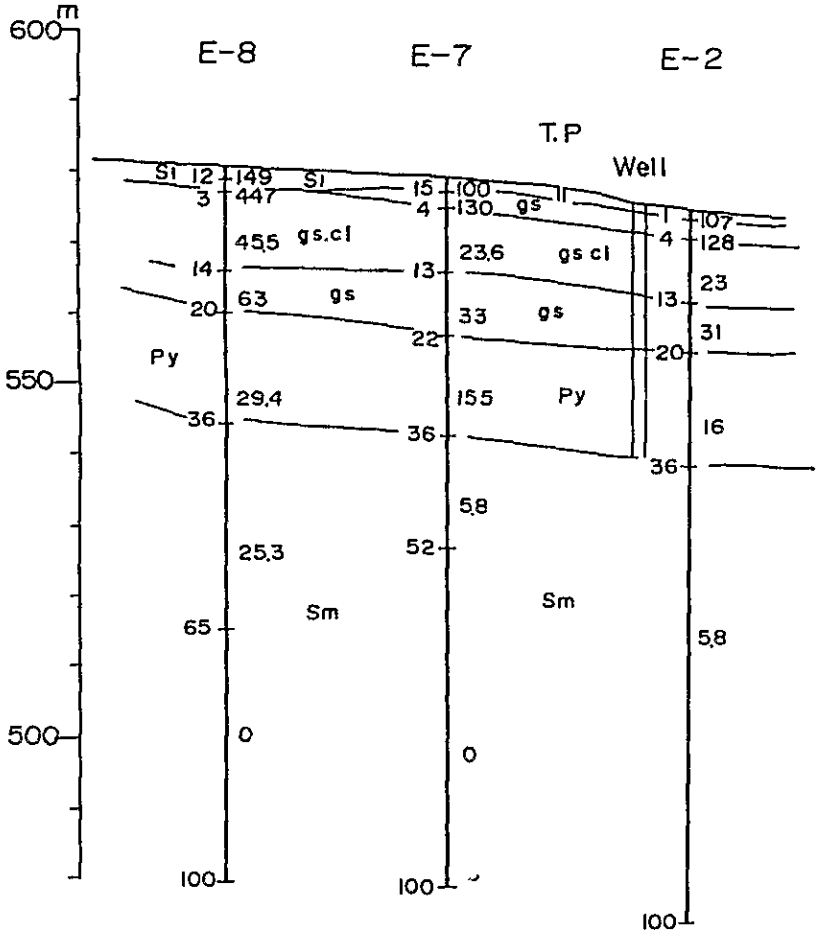
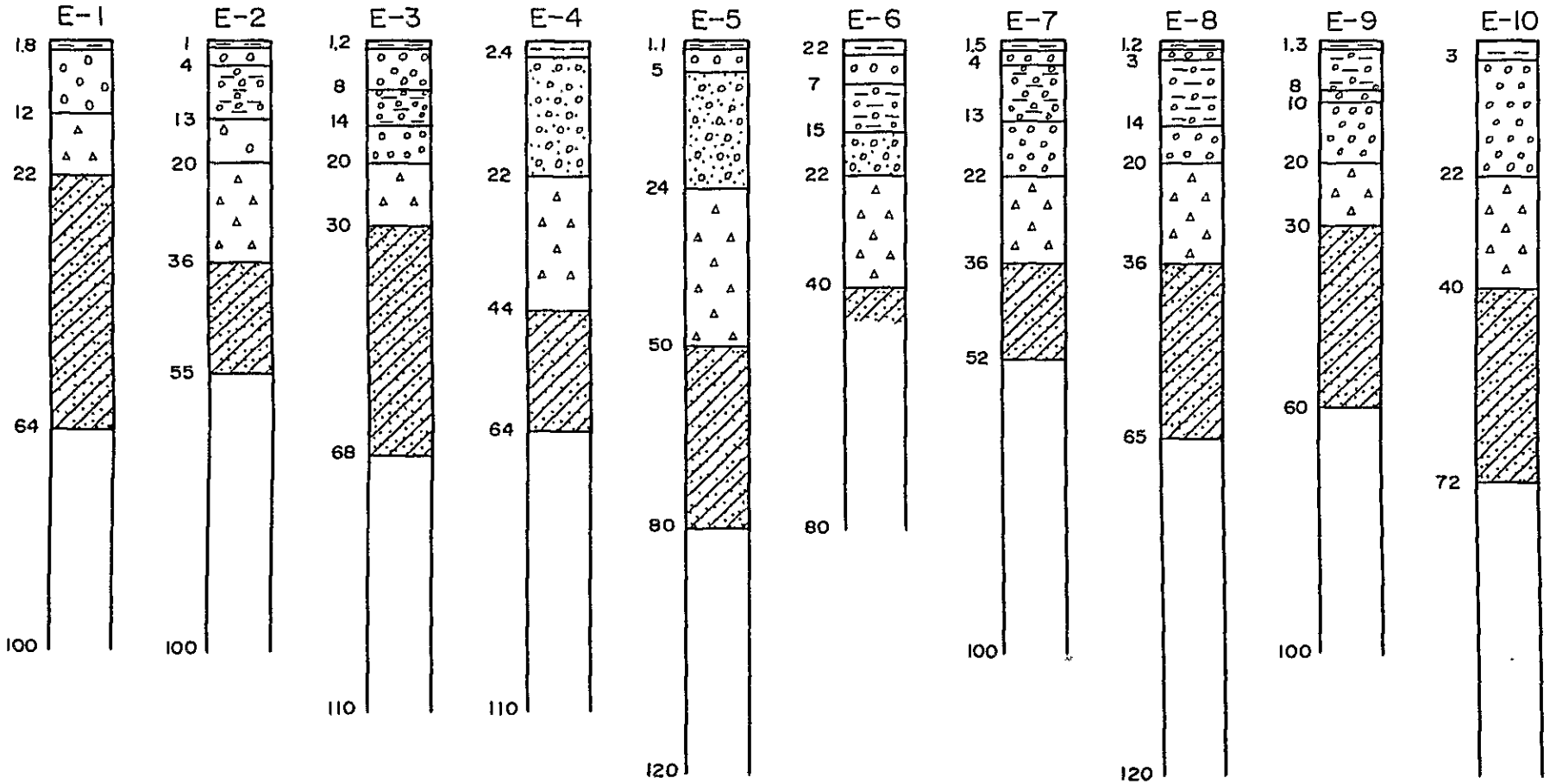


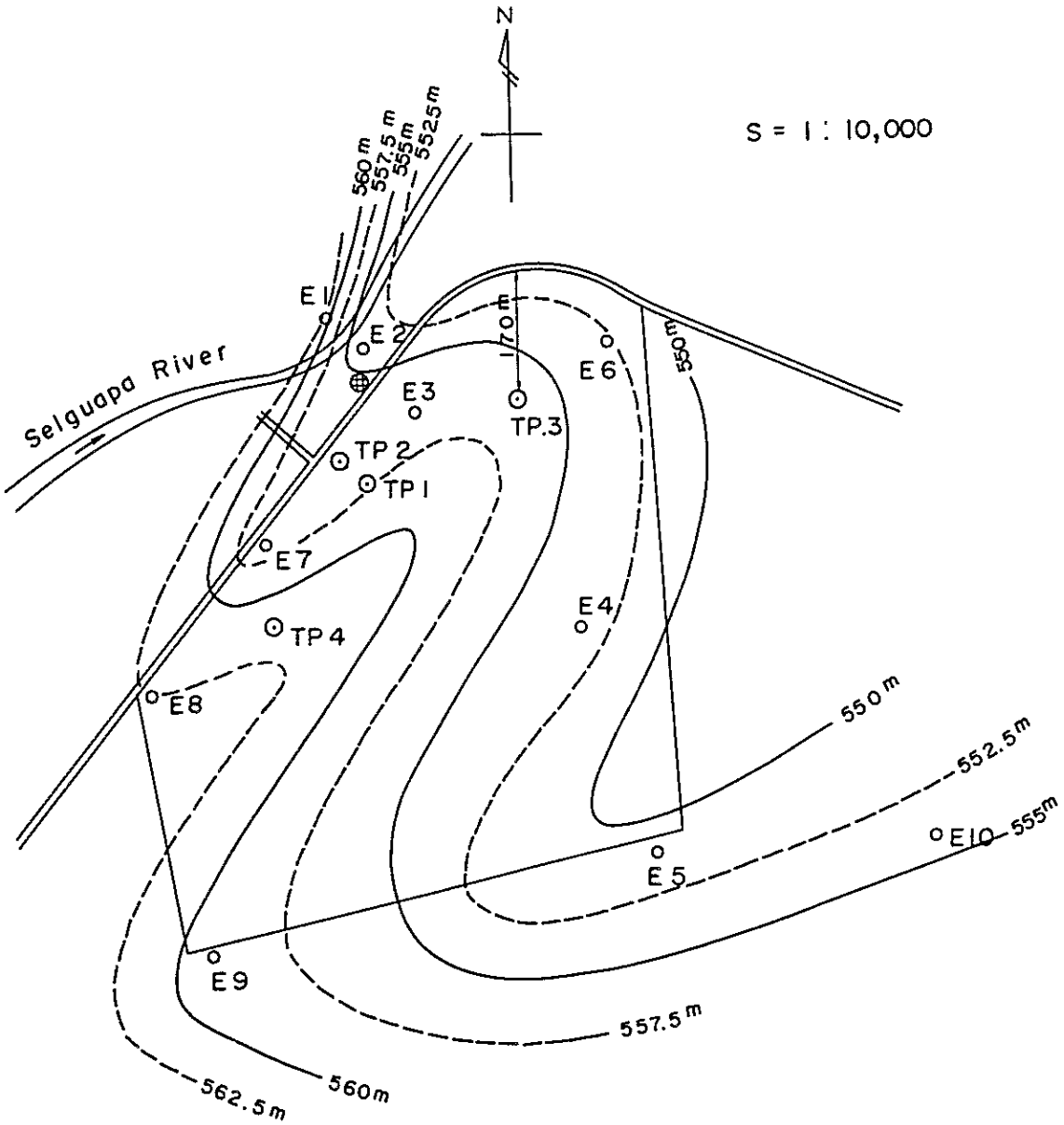
Table of Resistivity for Ground Water Sounding

No	EL. (m)	First Layer		Second Layer		Third Layer		Fouth Layer		Fifth Layer	
		Depth (m)	Resistivity (m)	Depth (m)	Resistivity (m)	Depth (m)	Resistivity (m)	Depth (m)	Resistivity (m)	Depth (m)	Resistivity (m)
E1	574.5	0-1.8	33	1.8-12	49.5			12-22	16.3	22-64	64
										64-	0
E2	574.5	0-1.0	107	1-3	128	4-13	23	20-36	16	36-55	5.8
				13-20	31					55-	0
E3	577.0	0-1.2	8.2	1.2-8	49.2	8-14	12.5	20-30	24	30-68	12
				14-20	31.5					68-	0
E4	575.5	0-2.4	17	2.4-22	51			22-44	48	44-63	30
										63-	0
E5	575.5	0-1.1	30.5	1.1-5	61			24-50	36	50-80	25
				5-24	50					80-	0
E6	574.5	0-2.2	15	2.2-7	60	7-15	12	22-40	18.2	40-	0
				15-22	34						
E7	579.0	0-1.5	100	1.5-4	130	4-13	23.6	22-36	15.5	36-52	5.8
				13-22	33					52-	0
E8	580.5	0-1.2	149	1.2-3	447	3-14	45.5	20-36	29.4	36-64	25.3
				14-20	63					64-	0
E9	578.0	0-1.3	139	8-10	80.6	1.3-8	55.6	20-30	17.7	30-60	14.2
				10-20	52					60-	0
E10	576.0	0-3	11	3-22	66			22-40	26	40-72	65
										72-	0

GEOLOGIC COLUMN



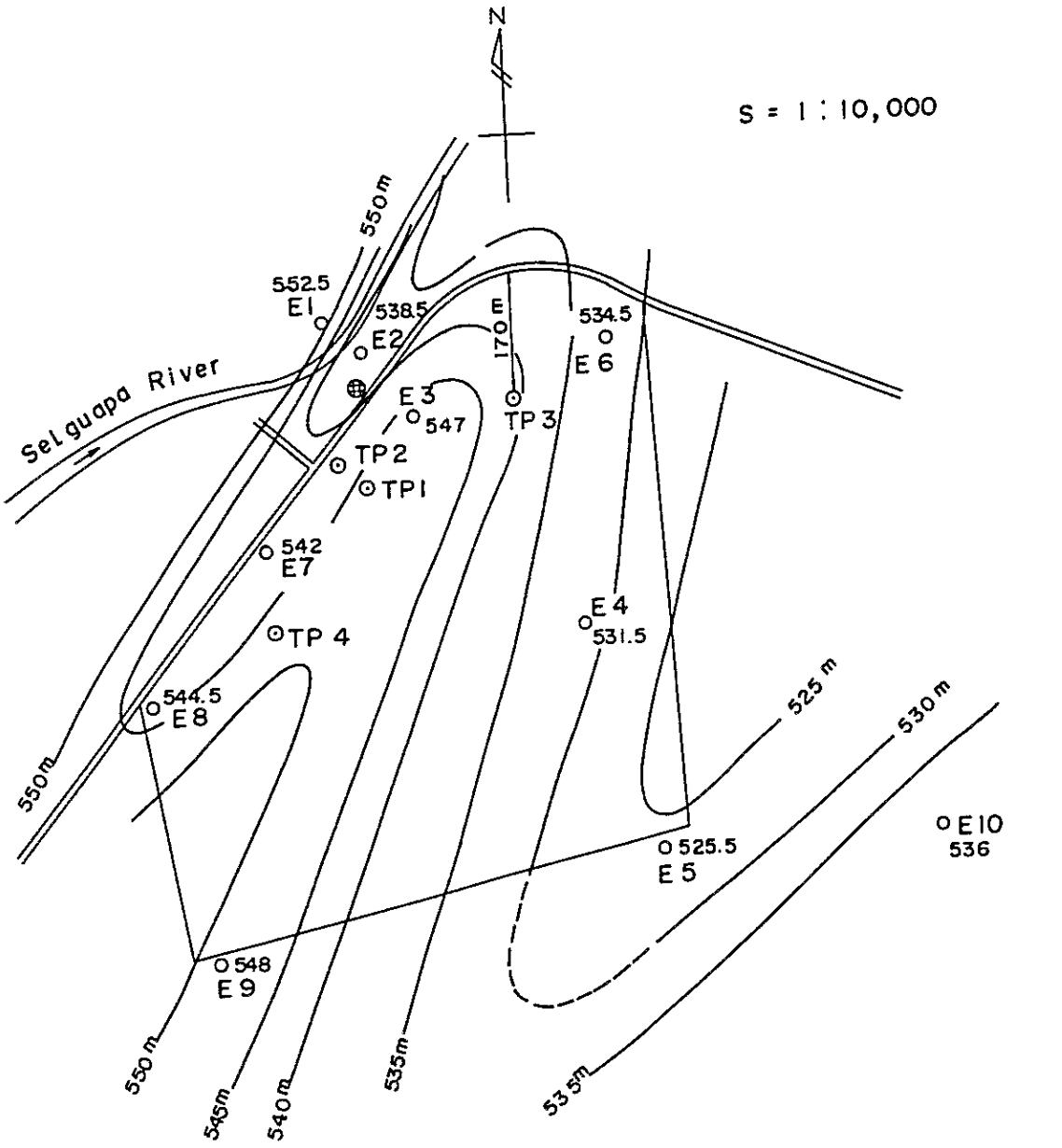
FOURTH LAYER CONTOUR LINES



O E Ground Water Sounding Location

⊙ TP Test Pit

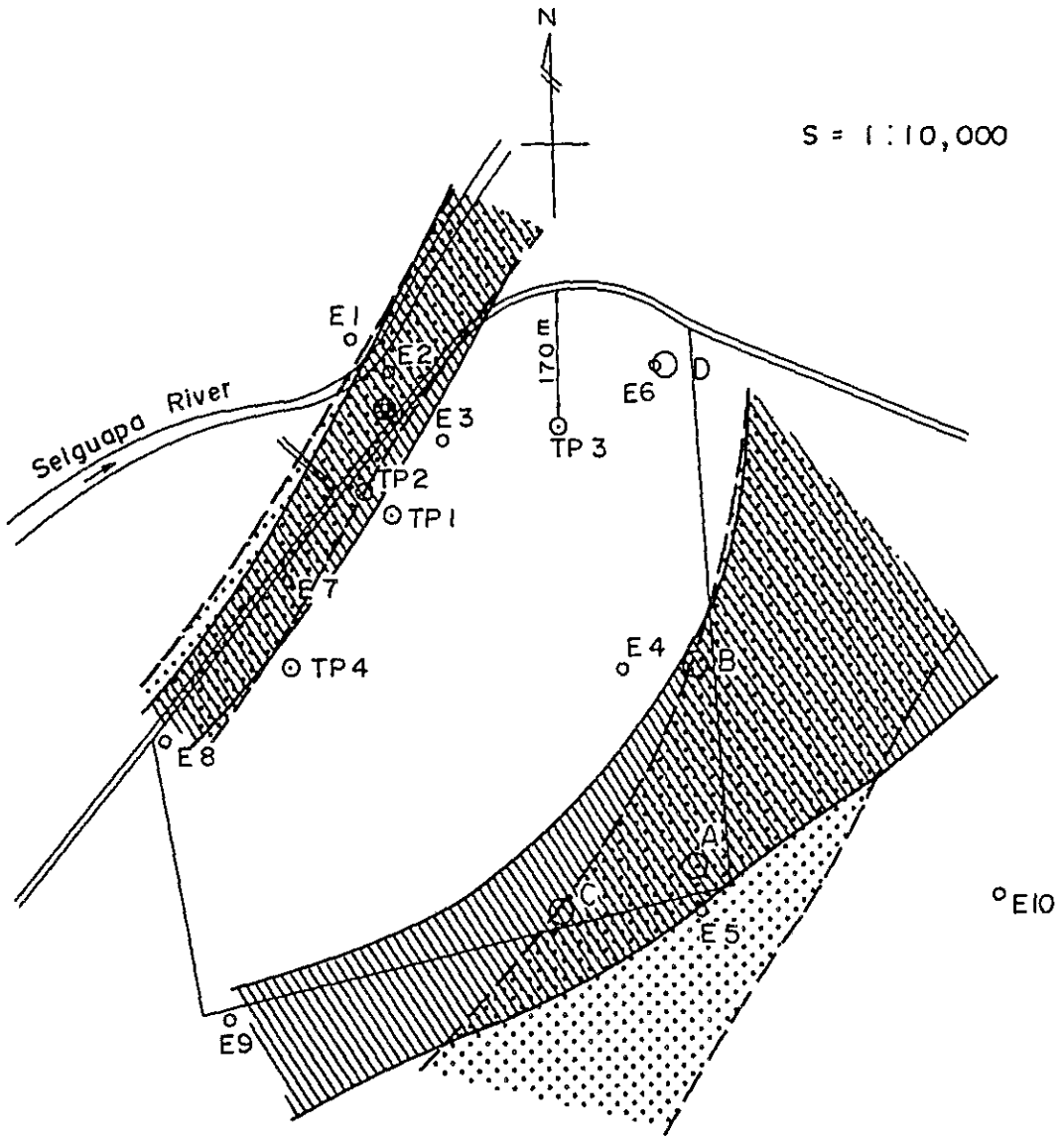
FIFTH LAYER CONTOUR LINES



O E Ground Water Sounding Location

⊙ TP Test Pit

GROUND WATER ZONING MAP



o E Ground Water Sounding Location

⊙ TP Test pit

Fourth Layer Valley

Fifth Layer Valley

A – D Recommended Location of Well Drilling

A Recommended Location of Test Boring

II-4. GROUNDWATER SURVEY (BORING)

Based upon the data made by the Basic Design Team dispatched in February 1982, a ground water survey was carried out for a period of 50 days starting from April 14, by means of boring to the depth of 50 meters. The bore site was selected for E-5 (See Annex II-2) which is the most promissing location for obtaining a sufficient quantity of water.

In response to our request, a local boring contractor, HASBUN, mobilized a rotary machine to the Project site, with tri-cone bit of about 30 centimeters in diameter. Work commenced on April 24, however, it was, impossible to continue due to the collapse of gravel at a point of 3 meters underground. As a result of three trials made at E-5 point, it was determined that the machine was not appropriate for the geological structures found in the area and should be changed to the percussion method. Contact was therefore made with Servicio Autonomo Nacional de Acueductos y Alcantarillados (SANAA) in order to be provided a percussion mahcine. By this method, a casing of 6 meters long and 25 centimeters in diameter was used at the cobble layer existing between 1.2m and 5m underground, with drilling upto 15 metes where the bore hole collapsed again. Another casing was connected to the previous one to protect the bore hole from breaking down the materials, where upon the casing was hammered down, but it subsided at a depth of 8.5 meters leaving 3.5 meters aboveground, the eariler collapse filled the bore hole with 5 meters of cobble and earth. In addition, at this point the machine had serious mechanical trouble which caused abandonment of the work with SANAA's machine.

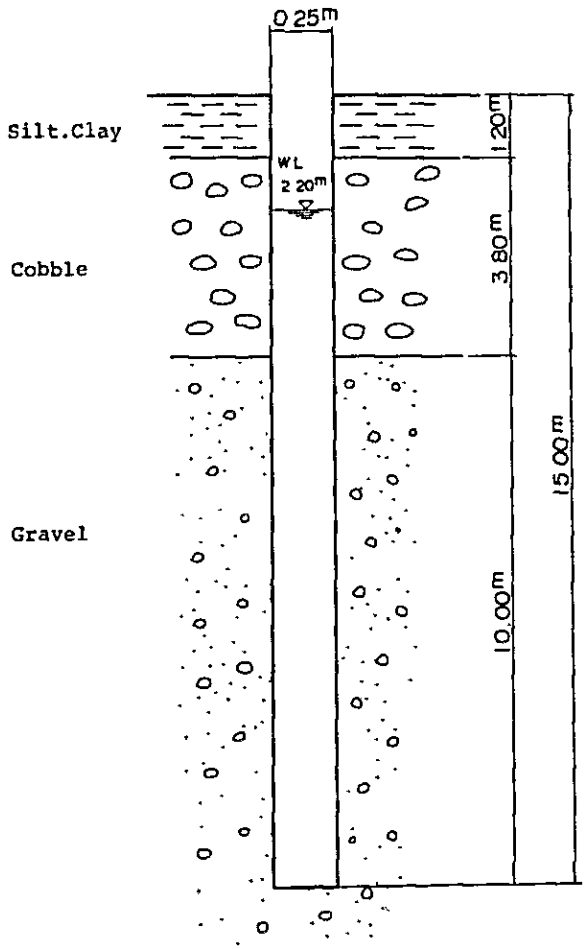
A Rotary Machine weighing 25 tons arrived on May 22 at Comayagua from San Pedro Sula for a final trial. Although the machine had been on stand by for three days because of a previous heavy rain, the ground condition remained unfavorable for the machine's transportation to the Project site, resulting in a standstill of the boring work.

The ground water survey however ascertained that water exists at 2 meters underground in the boring area and it reaches to the

depth of at least 15 meters which is a layer consisting of sand and gravel. The gravel is composed of fine particles of 1 or 2mm, and according to the data obtained by electric water sounding, it is about 24 meters deep at E-5 point. Water quality is good with a temperature at about 27°C.

Note: It is important to know that full-equipped boring contractor is not avail in Honduras, nor the Contractor equipped with a bit of more than 35cm in diameter. It is therefore necessary to bring from outside all principal equipment such as casing, screen, bit, pump etc. for a boring operation at the construction stage.

E-5 GEOLOGICAL COLUMN



Water Quality by TOHO Water Quaiity Meter Type EST-3

Temperature: 26.7 °C
Resistivity: 380MU/cm

II - 5 METEOLOLOGICAL INFORMATION AT COMAYAGUA

ESTACION: PLAYITAS DEPARTAMENTO: COMAYAGUA

LONGITUD: 87°41'31" LATITUD: 14°26'00" ELEVACION: 600 Mts.

(1) PRECIPITACION TOTAL MENSUAL EN mm.

ANOS.	ENE.	FEB.	MAR.	ABR.	MAY.	JUN.	JUL.	AGOS.	SEPT.	OCT.	NOV.	DIC.
1965												0.8
1970	16.0	0.5	0.0	0.0	82.5	135.6	237.1	131.9	184.4	147.6	13.0	24.3
1971	1.5	10.7	10.4	20.6	130.0	48.7	127.6	181.5	139.8	145.6	55.7	12.1
1972	4.5	8.1	0.0	67.8	60.0	230.5	74.5	86.1	97.0	180.7	39.1	16.8
1973	4.4	10.1	17.0	16.3	157.8	160.4	68.2	131.1	163.1	110.8	37.5	2.7
1974	2.3	7.1	6.7	6.8	83.4	221.6	64.2	136.2	184.1	140.0	23.2	3.1
1975	11.6	0.0	0.0	0.0	206.6	60.1	54.7	92.1	348.5	46.2	80.9	3.8
1976	3.5	1.9	4.4	277.4	121.1	412.5	61.1	98.3	97.3	73.2	21.5	4.6
1977	0.0	0.6	0.0	29.0	196.9	140.6	48.6	81.5	217.5	67.4	28.7	11.7
1978	40.7	3.9	6.1	73.0	101.6	139.9	137.6	179.0	151.9	71.6	50.7	5.3
1979	0.3	7.4	36.2	169.0	20.7	165.5	102.1	88.0	152.0	81.0	20.7	23.0
1980	0.4	5.6	0.0	42.0	73.5	246.8	122.8	71.1	169.0	120.4	19.4	30.1
Promedio	7.7	5.1	7.3	63.8	112.2	178.4	99.9	116.1	137.1	107.7	35.8	12.5

ESTACION : PLAYTAS DEPTO. COMAYAGUA

LONGITUD : 87°41'31" LATITUD : 14°26'00" ELEVA. 600msnm.

(2) INTENSIDADES MAXIMAS DE PRECIPITACION en Mm/h

ANOS.	5'	10'	15'	30'	1h.	2h.	6h.	12h.
1971	180.0	168.0	138.8	88.8	74.8	25.0	9.9	
1972	186.0	147.6	134.8	115.8	70.4	41.2	13.2	
1973	178.8	127.8	115.2	90.4	62.2	33.0	9.6	
1974	132.0	96.0	80.4	70.2	51.5	27.9	9.5	
1975	120.0	120.0	100.0	82.0	63.0	33.2	8.7	
1976	168.0	138.0	120.0	98.8	58.8	27.7	10.0	
1977	150.0	105.0	88.0	64.6	38.7	20.7	8.1	
1978	120.0	120.0	104.0	75.6	42.4	27.1	8.0	
1979	120.0	120.0	120.0	90.0	66.2	34.8	4.6	
1980	106.8	72.0	60.0	49.0	40.5	24.7	6.5	

ESTACION: PLAYITAS
LONGITUD: 87°41'31" LATITUD:14°26'00"

DEPTO. COMAYAGUA.
ELEV. 600.ms.n.m.

(3) EVAPORACION DE TANQUE TOTAL MENSUAL EN Mm.

ANOS.	ENE.	FEB.	MAR.	ABR.	MAY.	JUN.	JUL.	AGOS.	SEPT.	OCT.	NOV.	DIC.
1971	132.0	147.3	221.2	200.3	190.8	155.3	154.8	151.1	120.1	126.6	111.4	126.8
1972	146.8	155.0	241.0	220.8	183.2	166.9	149.4	155.6	163.1	153.8	120.3	127.9
1973	160.8	176.8	246.7	234.0	213.3	---	171.9	168.9	157.5	128.2	117.9	113.5
1974	143.7	168.3	212.6	241.1	219.3	177.3	175.3	193.7	148.3	124.4	118.2	128.3
1975	155.8	202.9	279.9	283.6	219.4	192.1	216.4	199.9	137.1	137.3	111.9	111.7
1976	99.9	144.3	221.4	186.4	158.8	---	160.9	183.6	169.1	109.0	109.2	113.7
1977	153.4	170.6	245.0	212.3	173.6	141.8	173.0	189.1	155.8	151.5	121.8	133.3
1978	136.1	170.0	216.4	233.1	203.5	160.7	131.5	149.2	129.5	126.5	116.6	124.8
1979	167.1	171.2	224.6	201.1	177.1	138.9	161.2	160.8	131.6	130.6	124.7	128.7
1980	165.7	184.8	214.1	178.7	203.4	143.7	154.2	146.4	122.2			
Promedio	146.13	169.12	232.29	219.14	194.24	127.67	164.86	169.83	143.43	131.99	116.89	123.19

NOTA: (---) Indica que no hay informacion.

ESTACION : PLAYITAS DEPTO. COMAYAGUA

LONGITUD : 87°41'31" LATITUD : 14°26'00" ELEV. 600.m.s.n.m.

(4) HUMEDAD RELATIVA MEDIA MENSUAL.

ANOS.	ENE.	FEB.	MAR.	ABR.	MAY.	JUN.	JUL.	AGOS.	SEPT.	OCT.	NOV.	DIC.
1970	64	64	54	50	59	69	--	76	79	80	78	71
1971	66	61	55	59	62	66	68	73	77	75	75	66
1972	63	61	52	54	64	71	68	69	71	73	71	68
1973	61	59	51	54	64	--	66	70	77	80	75	71
1974	63	57	54	53	63	72	71	70	78	81	78	72
1975	67	56	48	47	60	66	62	67	79	79	81	73
1976	74	66	--	--	--	--	--	--	--	--	77	73
1977	62	63	52	62	68	73	67	67	72	72	--	--
1978	69	62	61	57	64	72	74	74	75	76	75	68
1979	65	61	60	60	67	76	--	--	78	78	75	74
1980	64	63	61	71	71	85	82	79	80			
Promedio	65	61	55	57	64	72	70	72	77	77	76	71

NOTA: (--) Indica que no hay informacion.

ESTACION : PLAYITAS DEPT. DE COMAYAGUA.

LONCITUD : 87°41'31" LATITUD : 14°26'00" ELEV. 600.m.s.nm.

(5) TEMPERATURA AMBIENTE MEDIA MENSUAL EN C°

ANOS.	ENE.	FEB.	MAR.	ABR.	MAY.	JUN.	JUL.	AGOS.	SEPT.	OCT.	NOV.	DIC.
1970	23.2	22.6	26.5	28.1	26.4	25.9	24.5	25.0	24.4	24.4	21.2	22.1
1971	22.5	23.7	25.0	25.2	26.6	25.6	25.0	24.5	24.5	24.6	23.1	23.2
1972	23.3	23.4	25.4	27.5	26.9	25.8	26.0	25.3	25.5	24.9	24.5	23.1
1973	22.9	23.5	28.1	27.2	25.8	---	24.7	25.4	24.9	24.2	23.6	20.1
1974	23.2	23.4	26.0	27.1	27.0	25.4	24.8	25.4	24.4	22.6	22.1	22.1
1975	22.8	24.4	26.9	27.9	27.7	26.5	25.8	25.4	24.0	23.6	22.3	21.2
1976	20.5	22.0	25.4	25.0	25.3	---	24.6	25.2	25.4	24.8	22.6	23.0
1977	22.9	24.0	27.0	25.9	25.9.	25.3	25.7	26.5	25.7	24.9	23.7	23.4
1978	22.2	23.9	25.7	27.7	27.7	25.7	24.7	25.3	25.1	24.3	24.1	23.7
1979	23.3	23.8	26.0	27.4	26.8	25.4	26.1	25.7	24.7	24.6	23.2	22.8
1980	24.1	24.4	26.6	26.1	28.2	25.7	25.6	25.8	25.4			
Promedio	22.81	23.55	26.24	26.83	26.46	25.70	25.23	25.41	24.91	24.29	23.04	22.47

NOTA: (---) Indica que no hay informacion.

ESTACION : PLAYITAS DEPT. COMAYAGUA.

LONGITUD : 87°41'31" LATITUD : 14°26'00" ELEV. 600 msnm.

(6) TEMPERATURA MAXIMA MEDIA MENSUAL EN C°

ANOS.	ENE.	FEB.	MAR.	ABR.	MAY.	JUN.	JUL.	AGOS.	SEPT.	OCT.	NOV.	DIC.
1971	28.6	30.4	32.0	30.8	32.4	30.7	30.1	30.2	29.6	29.6	27.6	28.2
1972	28.8	28.7	32.1	33.6	32.5	31.0	31.0	30.6	30.8	29.7	29.6	28.3
1973	29.4	30.3	34.9	34.6	33.0	---	30.7	30.8	30.0	28.8	28.3	26.4
1974	28.7	29.7	32.1	33.1	33.1	30.7	29.7	30.8	29.5	26.4	26.4	27.3
1975	28.5	30.7	33.4	34.6	33.7	30.8	31.6	31.2	28.4	28.2	26.4	26.2
1976	25.5	27.5	32.0	31.2	31.4	---	30.0	30.9	31.1	29.4	27.5	28.2
1977	28.6	30.2	34.2	32.2	32.1	30.0	31.2	32.2	31.7	29.6	28.8	29.8
1978	28.4	30.2	32.2	34.1	33.6	31.1	29.9	30.6	30.5	29.6	29.6	29.9
1979	29.9	30.3	32.5	33.2	32.6	30.3	31.7	31.2	30.0	29.6	28.2	28.0
1980	30.2	30.7	33.2	31.8	34.1	30.9	31.1	31.7	31.5			

NOTA: (---) Indica que no hay informacion.

ESTACION : PLAYITAS DEPT. COMAYAGUA.

LONGITUD : 87°41'31" LATITUD : 14° 26'00" LEV: 600.msnm.

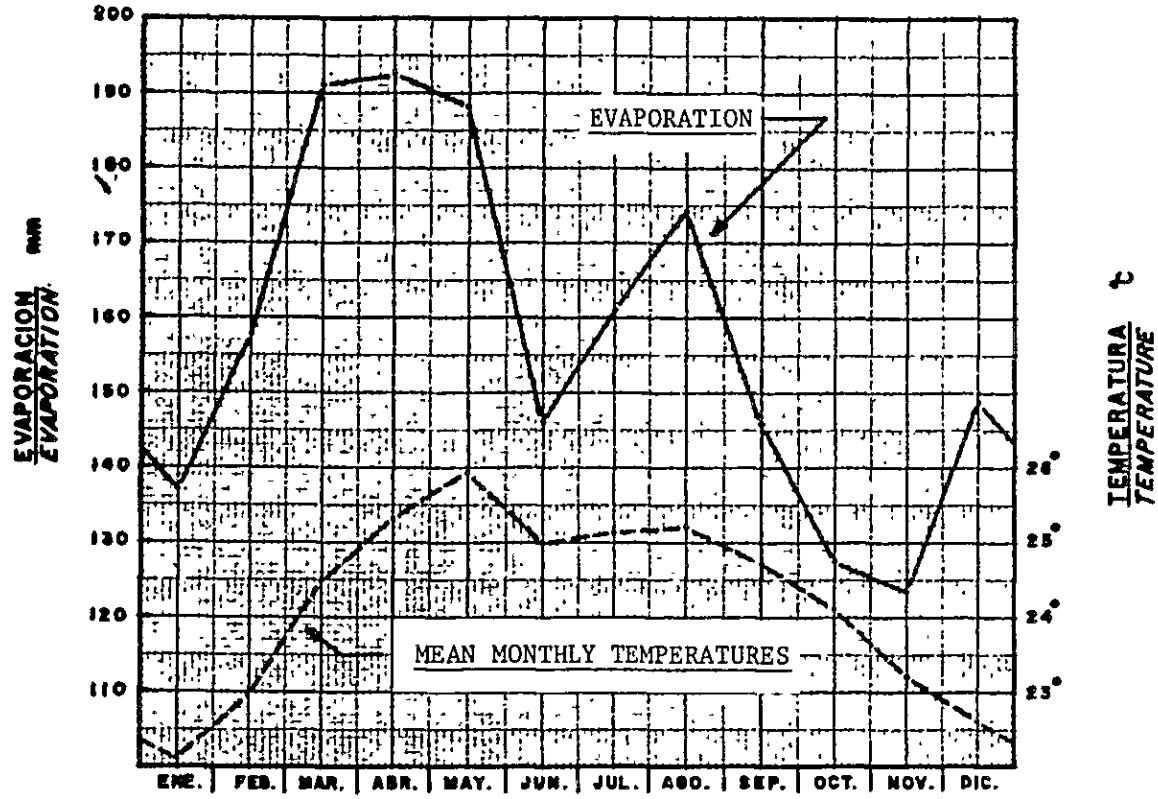
(7) TEMPERATURA MINIMA MEDIA MENSUAL EN C°

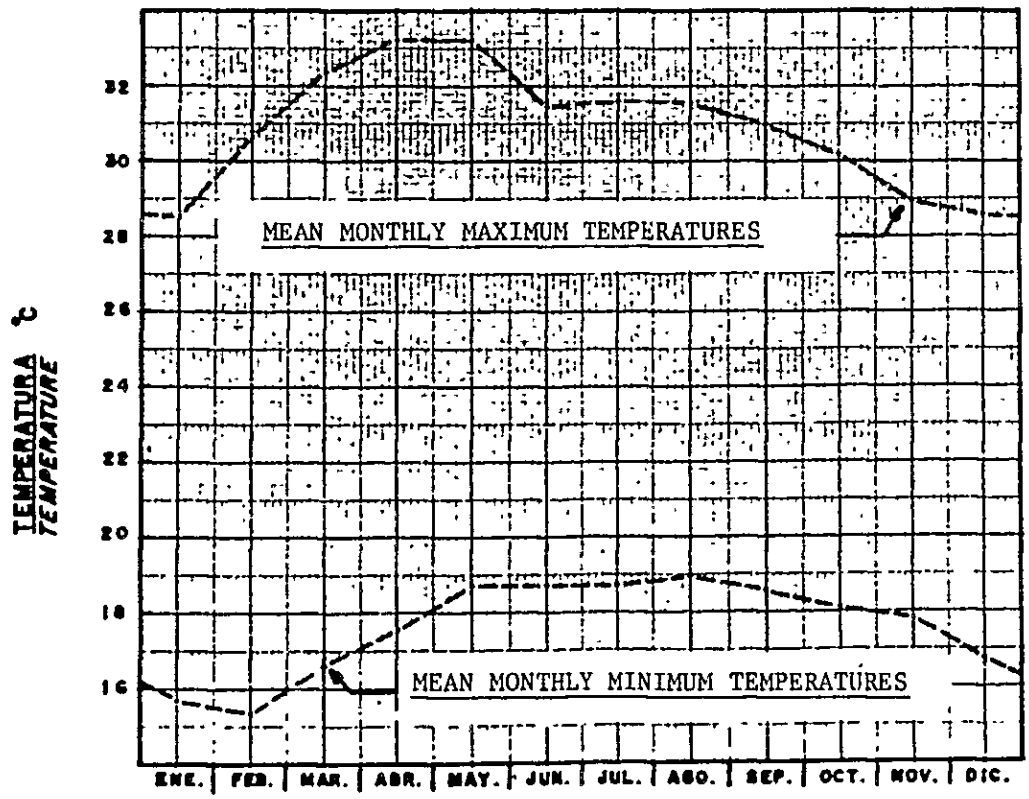
ANOS.	ENE.	FEB.	MAR.	ABR.	MAY.	JUN.	JUL.	AGOS.	SEPT.	OCT.	NOV.	DIC.
1971	15.9	15.6	16.6	17.4	19.5	19.6	20.2	20.0	20.4	20.7	18.6	18.4
1972	18.5	18.0	17.8	20.9	21.4	20.8	20.2	19.2	20.0	19.6	19.1	17.6
1973	16.4	16.6	19.2	20.9	20.9	---	19.6	20.0	20.0	19.9	17.8	14.3
1974	16.4	15.3	17.1	18.8	20.1	19.8	18.5	19.5	19.1	18.7	17.3	16.4
1975	16.9	15.6	17.1	18.6	20.8	20.2	18.4	19.5	19.7	19.4	18.7	15.8
1976	15.8	15.3	16.3	19.0	19.8	---	19.6	19.6	19.6	20.3	18.0	17.4
1977	14.8	16.7	16.9	18.2	18.2	18.1	17.4	19.8	19.8	19.3	18.6	16.9
1978	15.9	16.6	18.1	20.0	20.9	19.8	19.2	19.5	19.3	18.9	18.6	16.6
1979	15.7	16.4	18.7	19.7	20.0	20.1	19.2	19.5	19.7	19.0	17.9	17.2
1980	16.7	16.6	16.8	18.7	20.7	19.8	19.0	18.7	18.8			

NOTA: (---) Indica que no hay informacion.

VALLE DE COMAYAGUA
COMAYAGUA VALLEY

Promedios Mensuales de Temperaturas y Evaporación
Mean Monthly Temperatures and Evaporation





ESTACION : PLAYITAS DEPTO. COMAYAGUA

LONGITUD : 87°41'31" LATITUD : 14°26'00" ELEVA. 600.msnm.

(8) HORAS DE SOL TOTALES MENSUALES.

ANOS.	ENE.	FEB.	MAR.	ABR.	MAY.	JUN.	JUL.	AGOS.	SEPT.	OCT.	NOV.	DIC.
1971	169.7	139.0	261.7	184.6	235.8	181.9	206.4	---	189.9	210.8	181.7	214.7
1972	233.3	218.9	---	235.4	196.0	210.9	204.3	---	204.6	---	---	213.1
1973	---	---	280.8	221.9	208.2	---	209.1	209.1	195.1	191.0	217.9	197.7
1974	220.5	---	259.2	253.9	---	195.0	239.7	218.4	186.0	158.4	---	186.3
1975	---	258.8	295.7	277.3	224.1	228.5	260.8	214.5	---	167.9	---	---
1976	---	---	309.5	229.0	---	154.5	202.2	---	---	210.1	163.5	177.8
1977	237.1	204.9	306.6	---	---	---	231.4	---	224.7	219.8	---	---
1978	206.9	235.8	239.2	251.1	256.7	233.6	287.1	---	190.0	207.8	208.6	226.8
1979	238.2	214.4	---	233.7	226.7	---	236.4	201.6	145.5	195.4	166.6	190.7
1980	---	241.1	274.3	139.1	---	204.2	228.3					
Promedio	217.6	216.0	278.4	225.1	224.6	201.2	230.6	210.9	190.8	195.2	187.7	201.0

NOTA : (---) Indica que no hay informacion.

ESTACION : PLAYITAS DEPTO. COMAYAGUA

LONG. 87°41'31" LATITUD : 14°26'00" ELEVA.600.msnm.

(9) PORCENTAJE POSIBLE DE HORAS DE SOL MENSUAL

ANOS.	ENE.	FEB.	MAR.	ABR.	MAY.	JUN	JUL.	AGOS.	SEPT.	OCT.	NOV.	DIC.
1972	66	65	--	64	51	56	52	--	57	--	--	60
1973	--	--	75	61	54	--	51	57	54	52	63	56
1974	65	--	70	69	--	51	61	57	50	44	--	53
1975	--	80	80	76	58	60	66	56	--	46	--	--
1976	--	--	83	65	--	40	57	--	--	62	47	52
1977	67	63	82	--	--	--	61	--	62	60	--	--
1978	58	73	64	71	66	61	49	--	57	57	60	64
1979	67	66	--	64	58	--	60	52	40	53	48	54
1980	--	72	74	48	--	54	58					
Promedio	64.6	69.8	75.4	64.8	57.4	53.7	57.2	55.5	53.3	53.4	54.5	56.5

NOTA : (---) Indica que no hay informacion.

ESTACION : PLAYITAS

LONG. : 87°41'31" LATITUD : 14°26'00"

DEPTO. COMAYAGUA

ELEVA. 600msnm.

(10) RADIACION SOLAR MEDIA MENSUAL

(Calorias de sol en CM^2)

ANOS.	ENE.	FEB.	MAR.	ABR.	MAY.	JUN.	JUL.	AGOS.	SEPT.	OCT.	NOV.	DIC.
1970	---	---	---	---	---	---	---	---	604.6	581.9	436.3	458.6
1971	447.6	602.2	645.9	598.3	639.3	591.5	651.4	641.4	583.3	540.8	479.0	467.7
1972	534.2	593.0	675.7	684.3	612.2	672.1	678.7	698.1	677.3	621.5	551.5	487.5
1973	449.1	570.1	573.4	520.0	645.9	665.9	692.6	722.3	719.7	658.2	584.8	---
1976	---	618.2	693.6	683.7	683.7	---	---	---	---	558.5	490.8	526.4
1977	---	---	667.5	719.8	708.9	840.2	750.4	749.9	---	642.1	594.9	596.9
Promedio	477.0	595.9	651.2	641.2	658.0	692.4	693.2	702.9	646.2	600.5	523.0	507.4

NOTA : a) 1974,1975 no hay informacion.

b) (---) Indica que no hay informacion.