REPUBLIC OF THE PHILIPPINES

DESIGN REPORT
ON
THE PILOT INFRASTRUCTURES IMPROVEMENT WORKS
FOR
BOHOL AGRICULTURAL PROMOTION CENTER PROJECT

OCTOBER 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

REPUBLIC OF THE PHILIPPINES

DESIGN REPORT
ON
THE PILOT INFRASTRUCTURES IMPROVEMENT WORKS
FOR
BOHOL AGRICULTURAL PROMOTION CENTER PROJECT

OCTOBER 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

The Government of the Republic of the Philippines carried out the policy of the comprehensive rural development to adjust the differencies of livelihood between urban and local peoples in 1970s, although the province of Bohol of region seven has rather high weight in the agriculture compared to the other regious.

Related to the aforesaid policy and to enhance the development of the Bohol especially through agricultural aspect, the kinds of cooperation involving the investigation of development were requested to the Government of Japan. Accordingly, the Agricultural Promotion Center (APC) project was started its cooperation program of five years period, based on the R/D (Record of Discussion) signed on February 2, 1983.

At present, six Japanese experts are dispatched and continues the researches to improve the varieties adopted to the rural agriculture in the experimental farms, which were constructed in 1983 and 1984 by the model infrastructure project of JICA.

With the understanding that the aforesaid project has been in the midway of the whole course, the farms for extending the results of various experiments are expected to be provided.

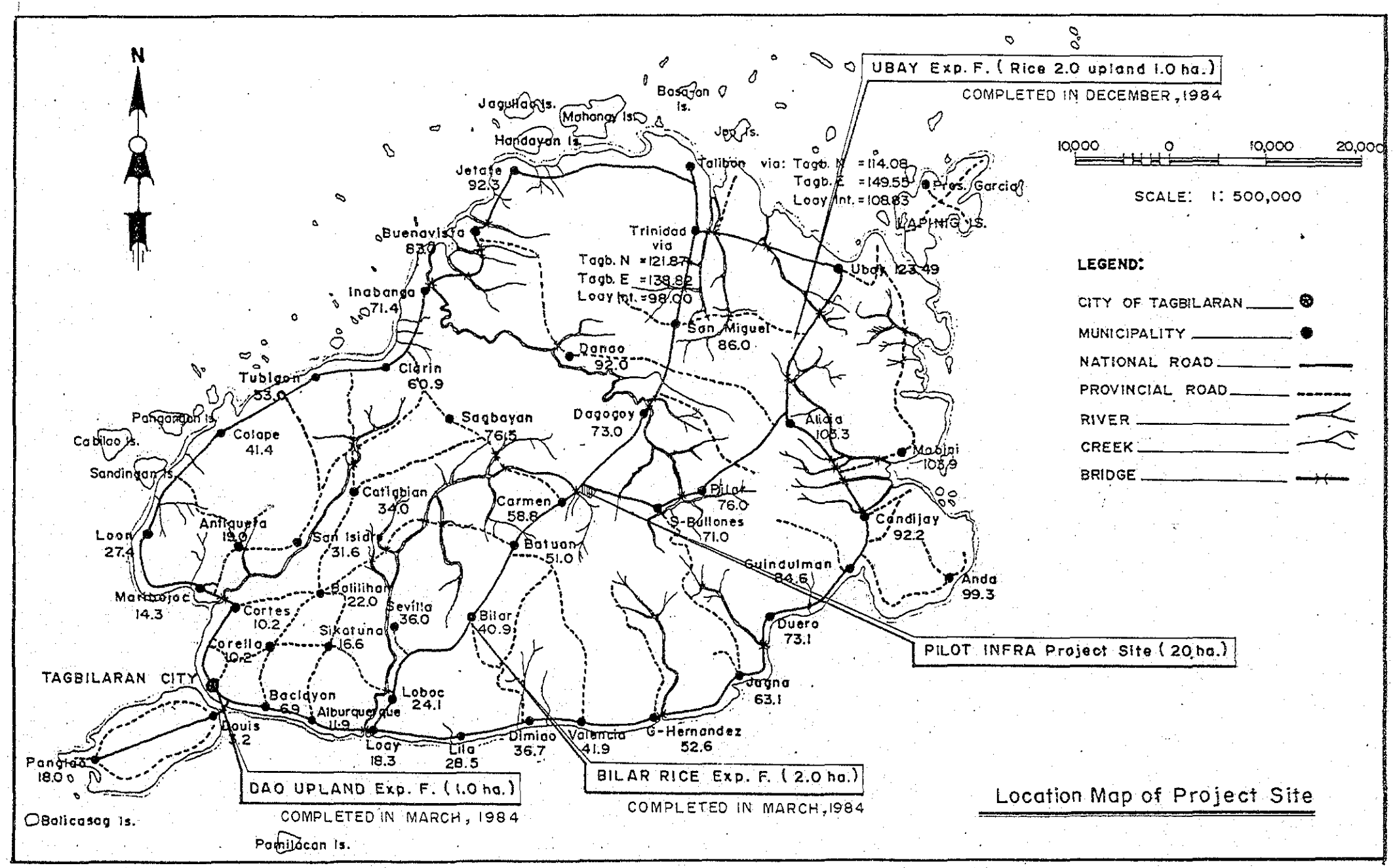
Pursuant to the background of the APC project, the JICA team, headed by Mr. Shigekazu Yoshida, the deputy director of Sapporo Development and Construction Department, Hokkaido Development Bureau, Prime Minister's Office, was sent as the detail design survey team of pilot infrastructure project aimed to conduct the land consolidation with a certain appropreate acreage. This report is made as the results of field surveys in the Philippines and the design works in Japan, and wished to serve for the further development of the project.

Finally, I express my appreciation to the officials concerned of the government of the Republic of the Philippines for their close cooperation extended to the team.

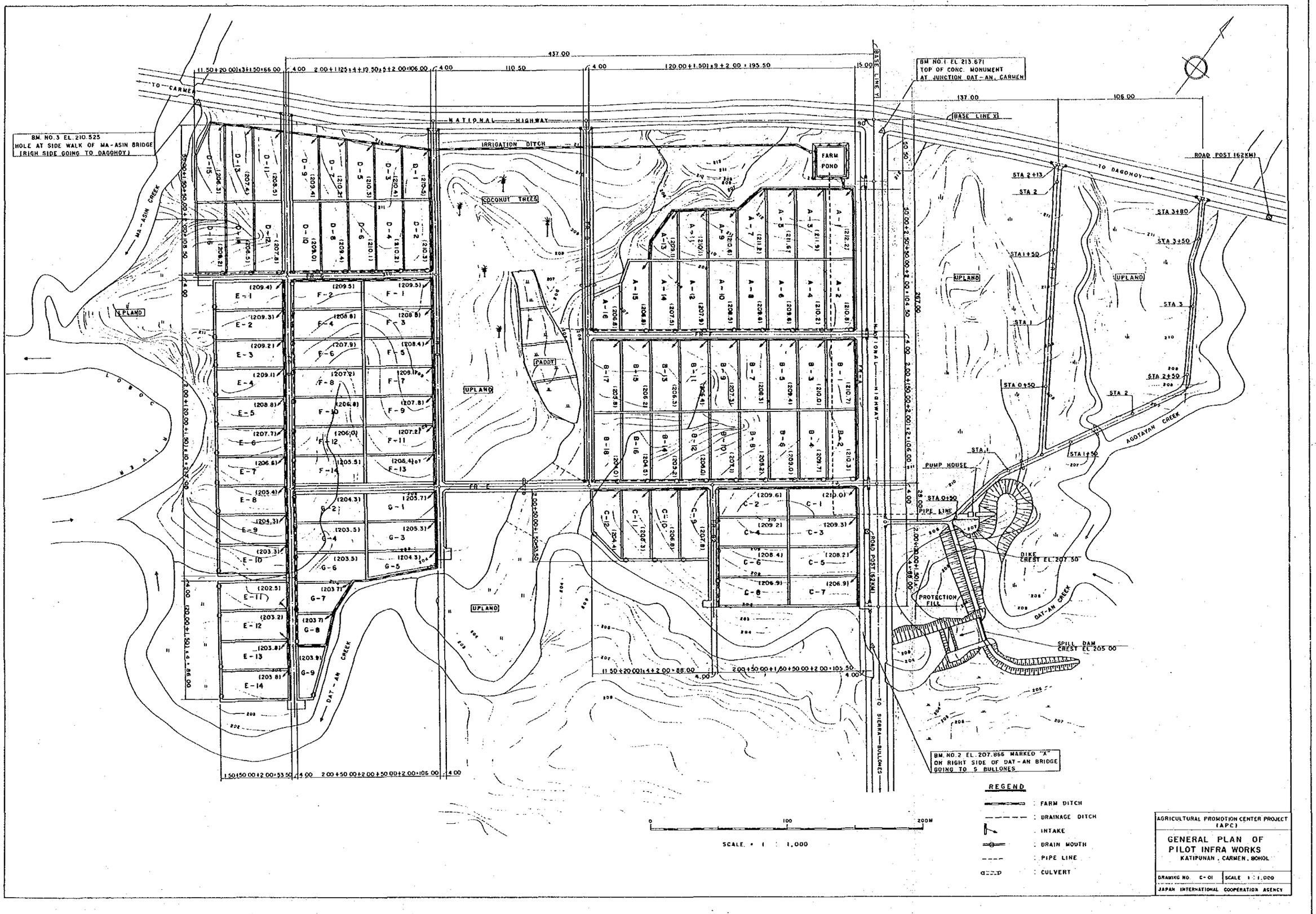
October, 1985

Takashi Tauchi
Director

Agricultural Development Cooperation Department
Japan International Cooperation Agency



Location Map of Project Site



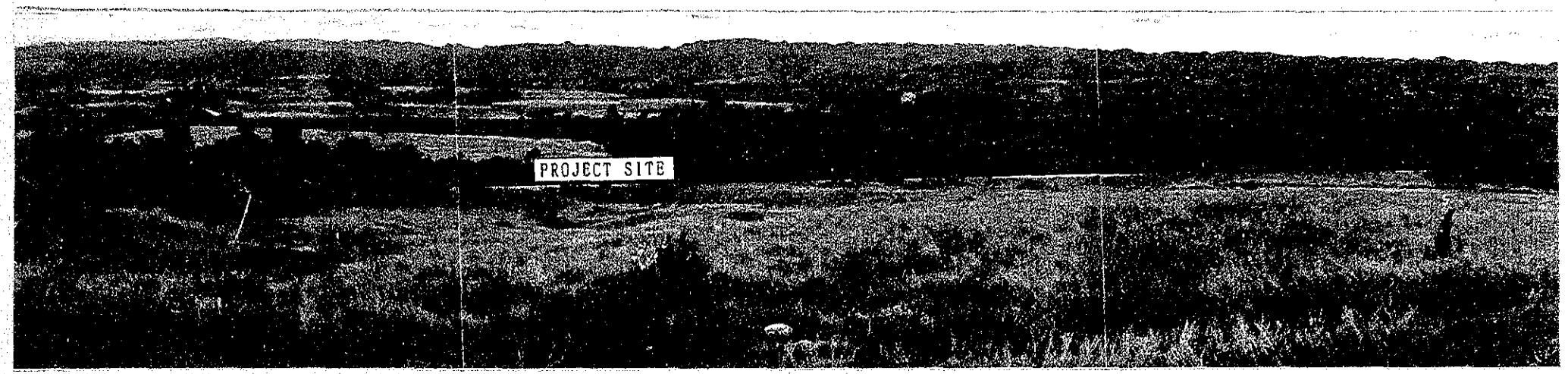
AGRICULTURAL PROMOTION CENTER PROJECT (APC)

GENERAL PLAN OF PILOT INFRA WORKS

KATIPUNAN, CARMEN, BOHOL

DRAWING NO. C-01	SCALE 1 : 1,000

JAPAN INTERNATIONAL COOPERATION AGENCY



1. THE VIEW OF PROJECT SITE FROM NORTHERN HILLY AREA

2. THE VIEW OF EASTERN AND WESTERN PLATEAUS FROM COCONUTS FIELD

3. EXISTING PADDY BETWEEN PLATEAUS

4. THE VIEW OF PROPOSED DAM AREA FROM THE DAT-AN BRIDGE

5. THE VIEW OF FIELD SOIL TESTING BY JAPANESE EXPERT

Contents

ABBREVIATIONS AND GLOSSARY

1. Agencies

APC	:	Agricultural Promotion Center
BIADP	:	Bohol Integrated Area Development
BIP	:	Bohol Irrigation Project
NACIAD	:	National Council on Integrated Area Development
NIA	:	National Irrigation Administration
NEDA	:	National Economic and Development Authority
NFA	:	National Food Authority
MA	:	Ministry of Agriculture
MPWH	:	Ministry of Public Works and Highway
JICA	:	Japan International Cooperation Agency

2. Units of Measurement

Length

mm	:	Millimeter
cm	:	Centimeter
m	:	Meter
km	:	Kilometer

Area

sq.cm, cm^2	:	Square centimeter
sq.m, m^2	:	Square meter
sq.km, km^2	:	Square kilometer
ha	:	Hectares

Volume

l, lit	:	liter
cu.m., m^3	:	cubic meter
lit/sec	:	liter per second
m^3/s	:	Cubic meter per second

Weight

g	:	gram
kg	:	kilogram
ton	:	metric ton

Others

EL	:	Elevation
F.W.L.	:	Full Water Level
H.W.L.	:	High Water Level
sec	:	second
min	:	minute
hr	:	hour
%	:	percent
H.P.	:	horse power
m/s	:	meter per second
max	:	maximum
min	:	minimum
°C	:	degree centigrade
No.	:	number
Et	:	Evapotranspiration
₱	:	Peso
¥	:	Yen

1. DISPATCH OF THE SURVEY TEAM

1. Dispatch of the Survey Team

1-1. Background and Objectives of the Team

The Bohol Agricultural Promotion Center Project in the Philippines has come to the stage that the experimental farms at Dao, Bilar and Ubay are now in full swing in their activities. With understanding that the aforesaid Project has been in the midway of the whole course, the Government of the Philippines requested the Japanese Rouing Mission for survey and guidance in March 1985 to carry out the Pilot Infrastructure Improvement Works to provide the extension farms with a certain appropriate acreage for demonstrating the results of various experiments in cropping techniques.

Since, however, the request from the field office did not clarified the present conditions and the farmers' organization as major working body in the candidate site in Carmen after the completion of the works, the Japan International Cooperation Agency (JICA) dispatched to the field Mr. Noriaki Ibaraki, Acting Chief of Agricultural Development Devision, Agricultural Development Cooperation Department, the JICA, as the Technical Guidance Team to meke the matters clear.

This survey has resulted in specifying the prerequisites of selecting the candidate site for the Pilot Infrastructure Improvement Works as follows;

1. the candidate site should provide typical topography and soils in Bohol so that the results of various experiments can be well applicable through demenstration and extension works,

2. the candidate site should be easy to secure sources of irrigation water in due consideration of the irrigated agricultures in future in Bohol Province,

3. the candidate site should provide a certain appropriate acreage and be effective for demonstration of the experiment results.

In such condition, the town of Carmen is selected as a candidate area for the site in taking into account the fact that Carmen can reasonably meet the aforesaid conditions and has been strongly recommended as the project site by the local officials together with much expectation from the town people, and furthermore, the farmers' organization can be the executing body of the operation and maintenance of the faciilities after completion of the Works.

When conducted the aforesaid survey, the following items are recommended to the BIADP especially regarding to the farmers' organization and landholding, in order to maintain the necessary area as the candidate site of the Pilot Imfrastructure Project, which matter made dispatch the Technical Guidance Team.

1. The project area shold be held as large as possible to enhance the demonstration and extension effects by means of involding the surroundings in the Project area within the limitation of the budjet.

2. Pursuant to the clause 1. and the project purpose of extension activities, the extensive consolidation are adopted in the works. Moreover, considering the project area will become the pilot area of the future development in Bohol, the project formation of Bohol Irrigation Project Phase I is also to be considered.

3. After the completion of the construction works, the farms and related iririgation facilities will be managed by farmers themselves, so that the farmers' organization is to be established to keep the favorable relation between landowners and tenant-farmers. Considering the

existing organizations in Bohol, which were established by the Communal Irrigation Project under the NIA's assistance, the establishing of new organization in the Project area is assumed to be possible. The articles of the organization must be described to cooperate with the extension activities of the experimental results of APC project.

4. The riglt of cultivation in the farms should be make clear in the contract to ensure the right of tenant-farmers. In the above recommendations especially related to the clauses of 3 and 4, the BIADP was requested to confirm these outlines before arriving the JICA Survey Team.

In reply to such prerequisites, the Survey Team was dispatched to the Philippines to execute various surveys and investigations as tollows for confirming the prerequisites of the Pilot Infrastructure Improvement Works.

1. Hearing of various requirements from the Philippine Authorities and the Japanese Experts concerned,

2. Survey of actual topography, soils, and soil mechanics, irrigation/drainage etc.,

3. Preliminary design and recapitulation of construction costs,

4. Collection of data necessary for implementing the construction works, and

5. Establishment of the farmers' organization for operation and maintenance of the farmlands and facilities after completion of the improvement works and well coodination of the Philippines Authorities concerned to establish favorable relations between the landowners of the farms and the tenant-farmers.

1-2. Members of the Survey Team

The Survey Team is consisted by following members.

Name	Position	Dispatch Period
SHIGEKAZU YOSHIDA	Team Leader	July 10-24, 1985
MASAFUMI KINOSHITA	Coodinator	- do -
OSAMU FUKUDA	Design Engineer(Farm)	July 10 - Aug. 23
MASAMICHI WATANABE	Disign Engineer(Facility)	- do -

2. PROJECT FORMATION

2. Project Formation

The Project site is determined through the discussions of the project purpose between APC experts and the Survey Term. Succeeding to the discussions, the project scale and facilities are designed based on the field survey for natural conditions and social infrastructures concerened to the Project area.

2-1. Project Purpose

The Project is formulated for the purpose of land improvement with a certain appropreate acreage to extend the experiment results which have been researched in the experimental farms. The results is to be extended to the local farmers in viewpoint of five years' cooperation period of APC project, although the APC comes to the middle term since its beginning from February, 1982.

Furthermore, the additional two effects are expected as follows;

1. Bohol Irrigation Project (BIP), run in parallel with the APC as the Japanese Government assisted projects in Bohol, is coming to start its construction work as Phase I Program targetted the 5,300 hectares. In advance to BIP, the land consolidation project with a appropreate acreage which aims the extention of experiment results, is expected to forecast the future of the BIP by choosing the Project site of typical geographic conditions in Bohol.

   Therefore, the Project which links the both government projects is highly availed to get the wide understanding and assistance from the local farmers to the government activities.

2. The settlers, who are given the average farming size of Bohol, will organize the new cooperative organization under APC assistance.

   The organization will be consisted mainly by the enthusiastic settlers to introduce the developped farmings and be managed voluntarily by settler-farmers.

   Furtheremore, the organization is expected to become the model of the farmers' association which will be established in the BIP area in the future.

2-2. Extension Results

The project site is determined at Catipunan, Carmen which is located at the Highway junction in the center of Bohol, based on the purposes as noted in 2-1.

The extension effects of the Project site are expected as follows;

1. In the wide uncultivated area of the north-east in Bohol where the low production of upland crops of cassava and others is marked, the irrigation and fertilizer have brought the remarkable effects against the traditional cultivation through the experimental activities of APC.

   In addition to them, the experiment results of upland crops are also expected to be extended to farmers.

   Considering the traffic inconvenience in the midland of Bohol, the Project site is to be selected as exhibitable as possible.

2. The geographic formation of BIP area is consisted by mild rolling hills, so that the Project site should represents

the said geography to become the model farm for the local farmers, who will conduct the land consolidation work by themselves after BIP completion.

Moreover, the Project development along the National Highway in Carmen town, which is located at the entrance of the wide uncultivated area except for paddies scattered at the narrow creek, is expected to enlighten local farmers in the viewpoint of agricultural promotion that is the principle purpose of the APC Project.

2-3. Design Policy

Considering the general background, the Project scale and design are determined under the following policies:

(A) Farm Design

1. Considering the existing plants and geography in the Project site, the environment and farming convenience will be reflected in the topographic designings.

2. The earth work is planned to be managed within a designed paddy plot in principle. The earth management among plots will be suspended to avoid a correction of the existing geography.

3. The concreted u-type flume is to be producted at the Project site and is applied for the farm and drainage ditches to enhance the efficiency of pumping irrigation and utility of drop work.

(B) Facility Design

1. The facility design is aimed to allocate the limited bedget as big as possible for the land consalidation work.

2. Dam construction cost is to be minimized by applying the "occasional" flood discharge in the viewpoint for irrigation water storage but for the flood control.

3. Pump and its related equipments are designed to minimize the operation cost compared to the initial investigation for procurement in the consideration of operations by the farmers themselves.

2-4. Farming Management

(A) Settler farmers

The determination of the number of the farm households and settler-farmers in the proposed Project site was made according to the following policies after confirming the acreage of 10.0 ha each for paddy field and upland field that were decided based on the scale of the Project and topographical conditions of the site.

1. In taking into consideration the average size of the farm households in Bohol, one farm household should essestially keep 1.0 ha of paddy field as to well maintaining his own farms together with maintaining the newly established farmers' organization, as mentioned in 2-5 (A).

2. The four tenant-farmers cropping in the proposed Project site should be reasonably compensated as settlers.

3. Three landowners who possess 20.0 ha of the land to be converted into paddy field in the site should be participated in the Project as the settler-farmers for getting their cooperation, so that the new farmers' organization involving the present tenant-farmers can be operated smoothly and effectively.

4. Therefore, the settler-farmers from outside of the Project site are three in the proposed ten. These three settler-farmers should be selected by the Screening Committee consisting mainly of the APC staffs. These farmers should be well qualified as trainees of new farming techniques given by APC and as the core farmers of the farmers' organization with enthusiasm and reliability.

(B) Screening Committee

The Screening Committee should be a standing committee to give various advices from time to time as the supporting body to the farmers' organization, so that the Project site can successfully play as the pilot area for extending the experiment results to the individual farmers, even after finishing the selection of the new settler-farmers.

The Screening Committee should consist mainly of the APC Staffs and other members to be qualified as follows;

1. to have sutficient knowledge on the actual status of agriculture in Bohol as well as research and excension activities as major objectives of the APC Projects.

2. to have power to give the administrative support and guidance as to the Project operation in the Pilot area,

3. to continuously play the role as personnel in charge in the future as well

The farms should be, in principle, managed and maintained independently by the farmers' organization consisting of ten settler-farmers. The Committee however, should let the farmers thoroughly know the fact that the Project is the very foundation of further extension services rendered by APC. In other respect, a great care should be

exercised to introduce the new techniques of fertilizing and other farmings developed by APC so that the settler-farmers can positively work in their farms.

(C) Farmers' Organization

There are about 140 farmers' organization existed in the Province of Bohol, about 40 of which are organized based on the contract document and the remainings are operated and working on the verbal confirmation basis only.

The existing organizations have mainly performed the control of water distribution, making cropping plan, and maintenance of canals and other irrigation facilities.

The farmers' organization of the project should have following functions reflecting the rules of existing organizations in Bohol.

1. Farm management through operation and maintenance of the field.

2. Receiving the trainings of improved farming techniques.

3. Collective purchase of agri-inputs and collective sales of agri-outputs.

4. Collective operation of farming machines.

5. Introduction of agricultural creditting system

The memorandum prepared for establishing the new organization is attached hereto in Supplement 6.

2-5. Size of Farming Household and Project Effects

The kind and types of the irrigation facilities to be maintained by the settler-farmers' organization should be determined carefully in considering the economic background, together with paying attention to the average farming level in the Bohol.

Followings show the procedures taken for determination of the size of farm household and the Project effects on the level of the farm income.

(A) Size of Farm Household

The average size of farm households in the Bohol shall be determined according to the results of the survey carried out in the BIP Phase II Area in the beginning five months, 1985.

According to the survey, the agricultural census in 1981 reveals the following matters in the Phase II Area of San Miguel, Trinidad and Ubay.

Average farming size per household	2.6 ha	1.2	Seasonal crops (including paddy)
		0.8	Perenial crops
		0.4	Fallow
		0.2	Grass land

The farming size excepting for fallow land and grass land is 2.0 ha. And in reference to the fact that the average farming size of the whole Bohol is 1.4 ha, it is deemed reasonable that the farm land to be provided for the settler-farmers is determined 1.0 ha for paddy field and 1.0 ha for upland field, respectively.

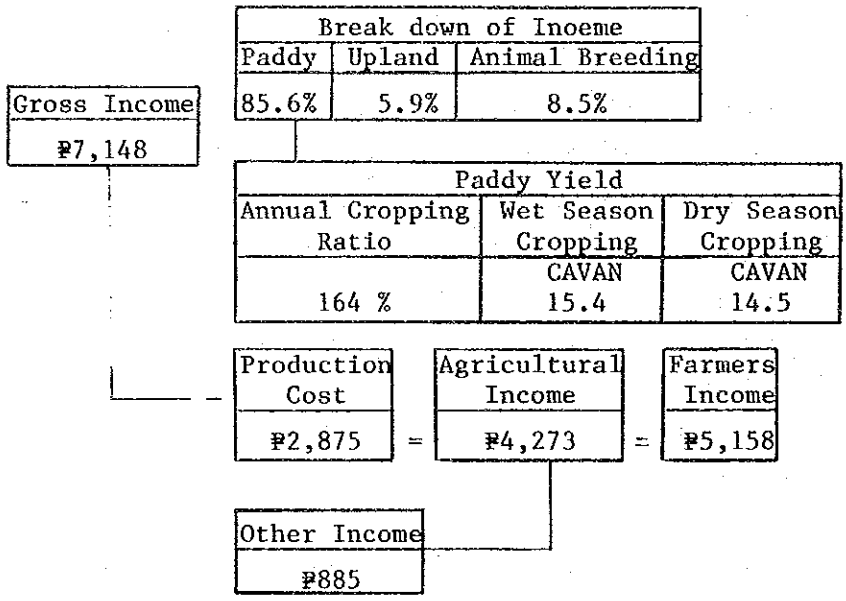
In other respect, some data suggest that the farmland acreage ranging from 1.0 ha to 2.0 ha will be most suitable in the current productivity and labour intensity.

(B) Project Effects

(i) Present Condition

The following shows the present annual income of the farmers in the Phase II Area who have the farmland of 2.0 ha equivalent to that of the Project area.

Without Project



(ii) With Project

The agricultural production, after the completion of the construction with irrigation facilities and so on, can be consevatively estimated at 4.3 tons/ha with two crops per year, although the experiment in Ubay have resulted in 5.0 tons/ha. The present yield of cassava is adopted for the estimation of upland product, which is excluded from the irrigation target.

Cropping Item	Acreage (ha)	Yield (ton)	Farm Gate Price (₱/kg)	Gross Income (₱)
Paddy	1.0	4.3 x 2crops = 8.6	3.5	30,100
Upland	1.0	4.7	1.2	5,640
Total				35,740

Production Cost (40% of total Gross Income)	14,296
Construction Cost of (15% of Paddy Yield)	4,515
Irrigation Facilities	
Net Income	16,929
Land Cost (25% of Net Income)	4,232
Agricultural Income (Net income after deduction of land charge) ...	12,697

The production cost in the above table is estimated at 40 percent of the gross production cost according to the data of the aforesaid study report on Phase II Area. On the other hand, the construction cost for the irrigation facilities is estimated at about 15 percent of the gross income from the paddy production.

The estimation is made based on the following assumption that the construction cost of the facilities includes the O and M cost of pumping facilities (2/3) and the depreciation cost of these facilities (1/3), and also that the one hectare paddy field can produce 15 bags of palay (45 kg/bag) according to the date collected from the NIA's Communal Irrigation Projects in Bohol.

As for the land cost, the hearing from NIA officials concerned revealed that the landowners had collected the land charge from their tenant-farmers by 1/3 of the net income until 1972, but the rate has been reduced to 1/4 since 1973. At the same time the contract of land lease has been concluded between lendowners and leasers with documents, in which the term of "tenant" have been changed to "leaser".

As a result, the income of the settler-farmers will be trippled to the current income if the experiment results of two crops per year can be successfully introduced to the Pilot Works.

3. FIELD INVESTIGATION AND TESTING RESULTS

3. FIELD INVESTIGATION AND TESTING RESULTS

3-1. Social Infrastructure

(A) Population

The census conducted as of December 31, 1984 for the town of Carmen, Bohol indicated a population density of 1.50 persons per hectare of land area. Farming has been noted as the occupation of the majority of the town residents.

Only a small percentages are engaged in office work or other lines of activities.

(B) Marketing

The produce of rice farmers, in most cases, is just enough for the consumption by their own families especially those cultivations made on unirrigated rice fields.

If there is an excess, this usually goes to their creditors to pay off their debts, and to the different private middlemen who are rampant in the locality going from one place to the other engaged in the palay "buy and sell" business activity. Lately, the farm gate price of palay rose to ₱3.00 per kilo from a previous of ₱2.50 per kilo during the immediately preceding cropping season.

In turn, these middlemen would make profit by selling the palay to big time rice millers or dealers in the community and in nearby towns.

Although there are some government agencies and cooperatives such as the National Food Authority, the Samahang Nayon and the like which are likewise involved in buying palay, the local farmers and the middlemen give preference to private businessmen because of the following marked difference in price.

Government support price for palay at present is only ₱3.50 per kilo. On the contrary, the private sectors are offering as much as ₱4.00 per kilo.

(C) Financing

There are various lending institutions in the province of Bohol which offer agricultural loans to countryside farmers. Foremost of which are the rural banks.

These rural banks are strategically located in the towns to cater to the needs of farmers on agricultural credit assistance. Under the MASAGANA loan program of the Government which is altimetry coursed through the rural banks, farmers can avail themselves of a character loan (without any collateral) at ₱2,500 per hectare with an interest rate of 25% per annum.

Other financial institutions are found in the city of Tagbilaran, the capital of Bohol province, which is situated about 55 kilometers away from Carmen, Bohol.

Among them, to mention a few, are the Development Bank of the Philippines, Cooperative Rural Bank, Bank of Calape, First Consolidated Rural Bank of Tagbilaran, Insular Bank of Asia and America, and others.

Despite the recent calamities which occurred in the province such as the two successive typhoons "Nitang" and "Undang" in 1984 and the drought in 1983, the feedback to the banks from the farmers particularly those covered by existing irrigation facilities, is able to satisfactorily pay their amortization.

3-2. Market Price of Construction Materials and Labor

Investigations on the current prices of construction materials are being done in the City of Tagbilaran. Hence, the hereunder stated price list holds true only in the province of Bohol, particularly Tagbilaran City, where procurement of said locally available materials could be possibly made. Compared to the previous investigations undertaken sometime in July, 1984 during the construction of Ubay Experimental Farm, the price escalation at present is relatively more stabilized mainly because of the absence of peso devaluation for the past twelve months. Materials and labor costs are listed as follows:

Item	Unit	Cost	Remarks
1. Materials:		(₱)	
Cement	bag	57.00	40 kg/bag -delivered to site
Steel Bar (ϕ16 mm)	kg	15.20	6.00 M/pc -do-
(ϕ12 mm)	kg	18.11	6.00 M/pc -do-
(ϕ10 mm)	kg	17.32	6.00 M/pc -do-
Form Lumber	bd.ft	7.65	
Tie Wire	kg	25.10	for concrete work
G.I. Plate	sht	130.30	
Concrete U-Flume	pcs	138.50	50 x 55 x 60 cm
R.C. Pipe (ϕ200 mm)	pcs	180.00	price at project site
(ϕ300 mm)	pcs	296.00	-do-
(ϕ1,000 mm)	pcs	1,708.00	-do-
C. Hollow Block	pcs	3.93	40 x 20 x 10 cm
	pcs	5.89	40 x 20 x 15 cm
Sand	cu.m	268.00	hauling distance -63.5 km
Gravel	cu.m	259.00	hauling distance -60.5 km
Gasoline	liter	8.50	
Diesel Fuel	liter	6.50	
2. Labor:			
Common Laborer	man/day	47.00	
Carpenter	-do-	60.00	
Machine Operator	-do-	93.00	

3-3. Present Land Condition

The project area of 20 hectares, bordered on two sides by the National Highway, is divided into cultivated and uncultivated area as follows:

1. Cultivated Area

Cassava	6.3 ha
Corn	1.5
Coconut	1.8
Banana	0.7
Paddy	0.4
Total	10.7 ha

2. Uncultivated Area (Grass Land)

In the main development area for the paddy field, the four tenant farmers are scattered. The three of the farmers are located at the coconut field along the National Highway and the other is at the corner of Highway junction.

The cultivated area has been divided mainly into the western plateau where cassava and coconut plant are cultivated and the eastern plateau which is mantled by a formation of tall grasses and shrubs.

The present land formulation is shown in Fig. 3-1.

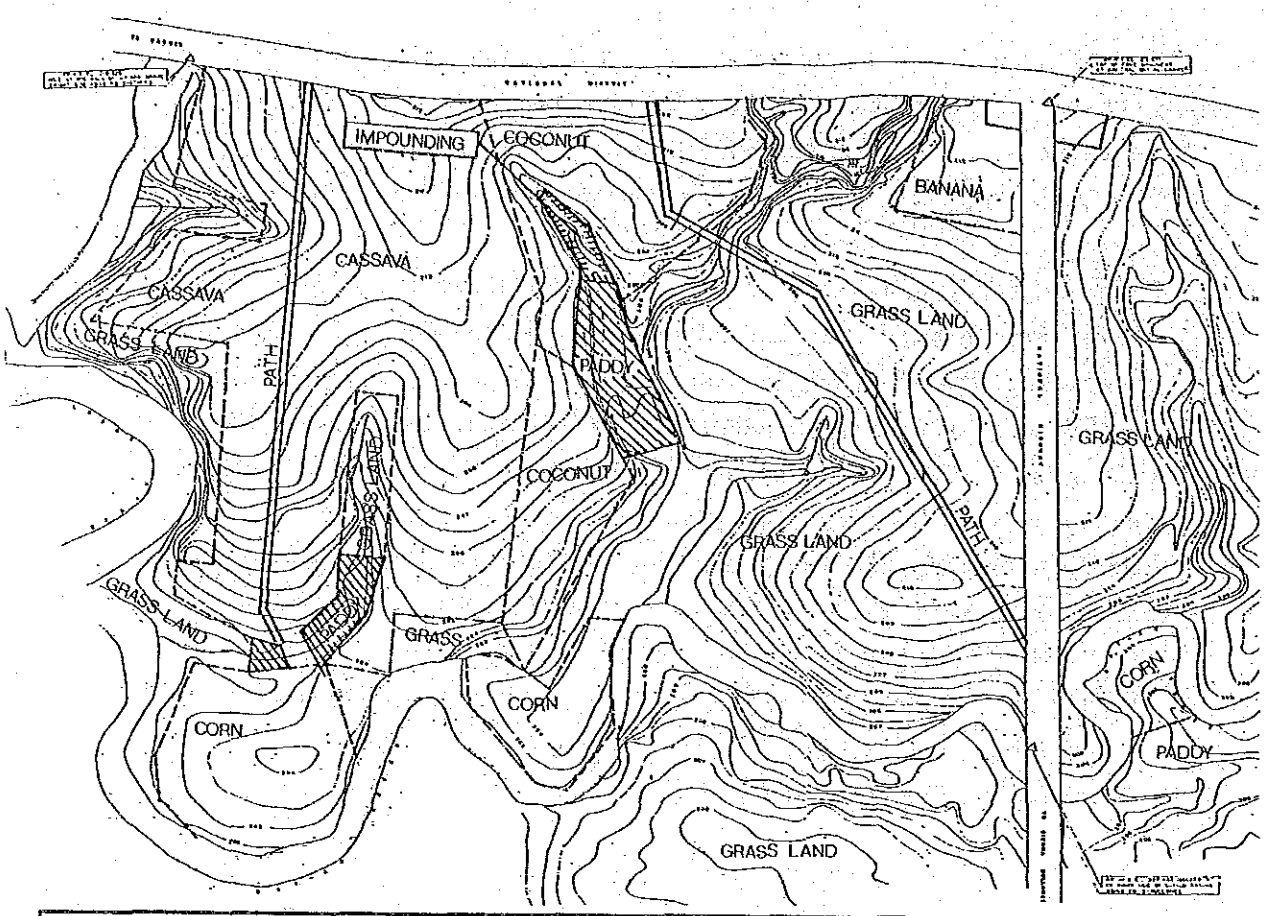


FIG.3–1 EXISTING CONDITION MAP OF THE PROJECT SITE

3-4. Landholdings

The land targetted for paddy development covers an area of 20 hectares. This is composed of four distinct and separate lots owned by the families of Digal, Galang and Mumar. The proposed upland area of six hectares located in the eastern part of the main project area is owned by six families.

The corresponding map showing the property boundaries or limits of the above-mentioned lots is shown in Fig. 3-2, for ready reference.

Lot No. 1 & 2 situated at the west, comprising an area of 9.20 hectares, belongs to the Digal family, the middle portion with 2.65 hectares by Galang family and the third one in the east by the Mumar family.

The topographic configuration and behavior of subject land is characterized by a 0.4 hectare paddy field and 10.3 hectare upland except for 10.0 hectare of grass land. Lot No. 1 owned by the Digal family is presently planted with cassava. Lot No. 3 owned by the Galang family is partly planted with coconut trees and a portion is developed into lowland rice paddies. Lot No. 4 owned by the Mumar family has been idle for years due to the lack of irrigation water in the locality.

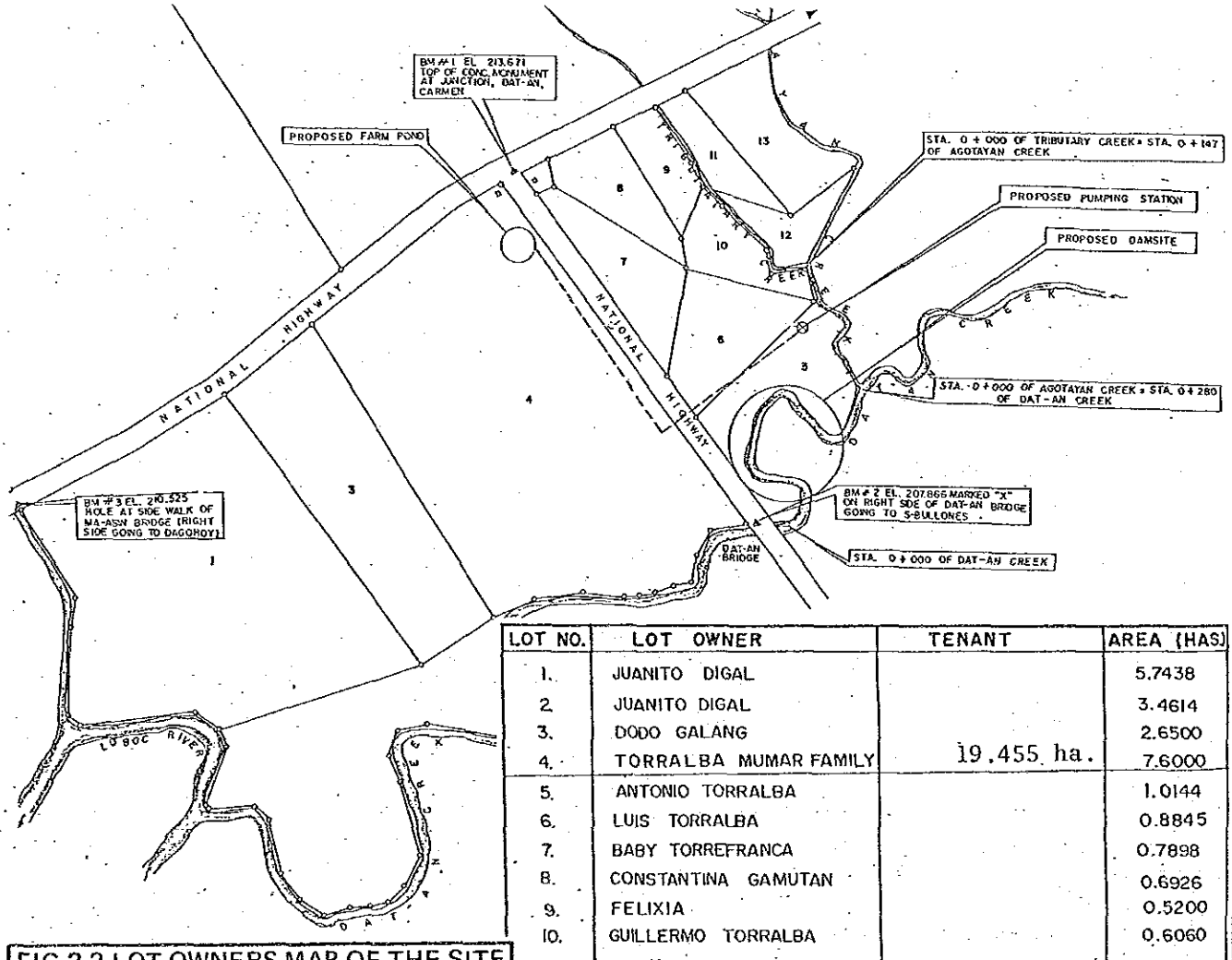


FIG.3-2 LOT OWNERS MAP OF THE SITE

LOT NO.	LOT OWNER	TENANT	AREA (HAS)
1.	JUANITO DIGAL		5.7438
2.	JUANITO DIGAL		3.4614
3.	DODO GALANG		2.6500
4.	TORRALBA MUMAR FAMILY	19.455 ha.	7.6000
5.	ANTONIO TORRALBA		1.0144
6.	LUIS TORRALBA		0.8845
7.	BABY TORREFRANCA		0.7898
8.	CONSTANTINA GAMUTAN		0.6926
9.	FELIXIA		0.5200
10.	GUILLERMO TORRALBA		0.6060
11.	FELIXIA		0.3750
12.	GUILLERMO TORRALBA		0.3125
13.	MAXIMO TORRALBA	6.039 ha.	0.8438
			25.494

3-5. Geography

The targetted development area is bordered by the National Highway on the northern and western side.

The Dat-An Creek which has 8.2 sq.km basin runs to configurate the southern boundary of the project area and meets with the Loboc river which has the biggest catchment in Bohol. The opposite boundary of the project area is also divided from the hilly area of volcanic rock formation by the National Highway.

The small creeks, flowing from the northern hilly area across the highway, erodes the middle part of the project area and devides the area into two distinct planteaus. The divided western plateau contains cassava and coconut plants and its geography is formulated from north to south. On the other side, the eastern plateau is inclined perpendicularly to the western plateau and covered with grasses.

The elevation of the project area is extended from 202 m to 213 m and the slope is inclined 1.5 - 4.0°. The area is spread out over an area of 500 m in width from east to west and 400 m in length from north to south.

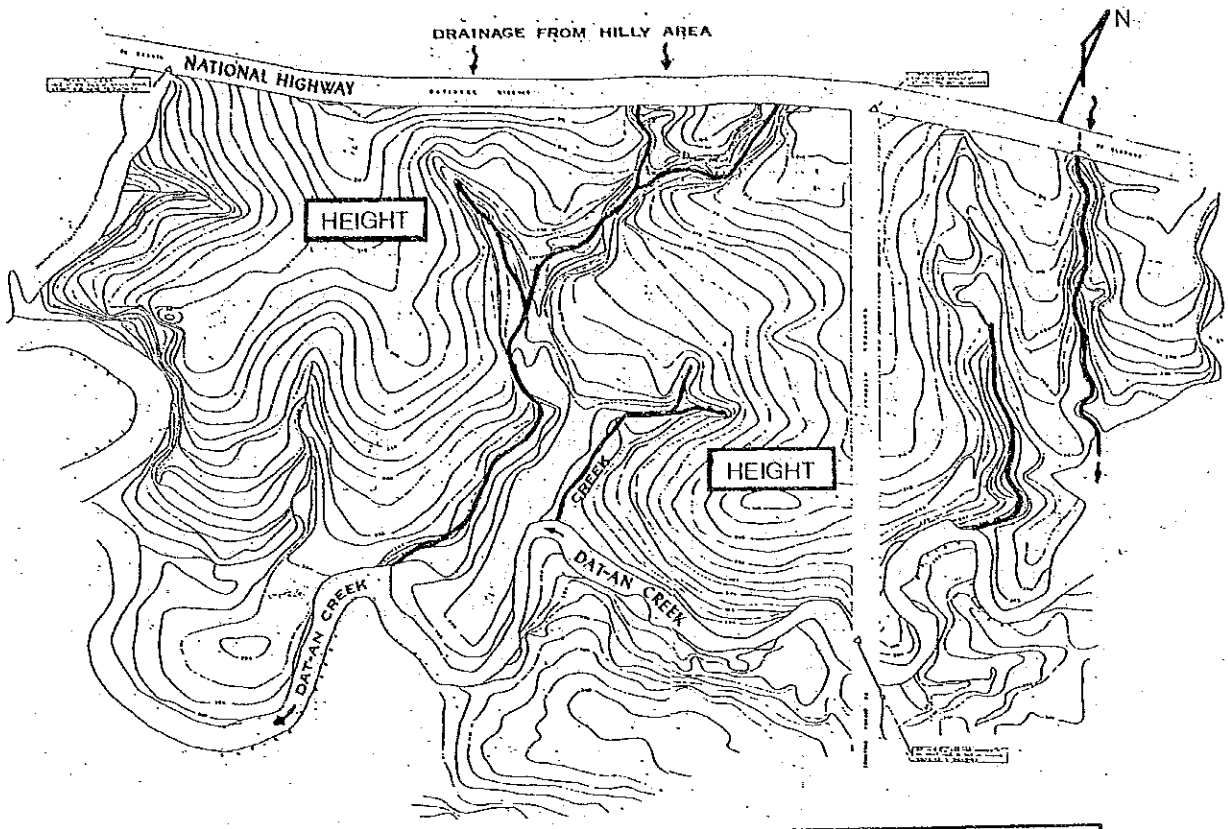


FIG.3–3 GENERAL GEOGRAPHIC MAP OF THE PROJECT SITE

3-6. Geology

The foundation consisting mostly of sand rock can be observed at below 1.5 m below ground surface and is inclined from north to south.

The top soil is characterized by high acidity. The area where the land slopes into the center is marked by its shallow toposil.

The foundation of the northern hilly area is formulated by volcanic rock and its top soil is also has a low acidity. The eroded soil from the northern hill is sedimented over the clayey soil in the lower part of project area along creeks and makes a fertile paddy field affected by weathered volcanic materials.

3-7. Soil

The sampling of the 10 test pits was carried out at every 100 m x 150 m grid mainly within the paddy development area of 20 hectares. In the field investigation, test pits of 1.5 meter in depth were excavated depending on the convenience for the subsoil and rock foundation observation. The investigation was supervised by the A.P.C. experts in the field. Then, a laboratory analysis followed.

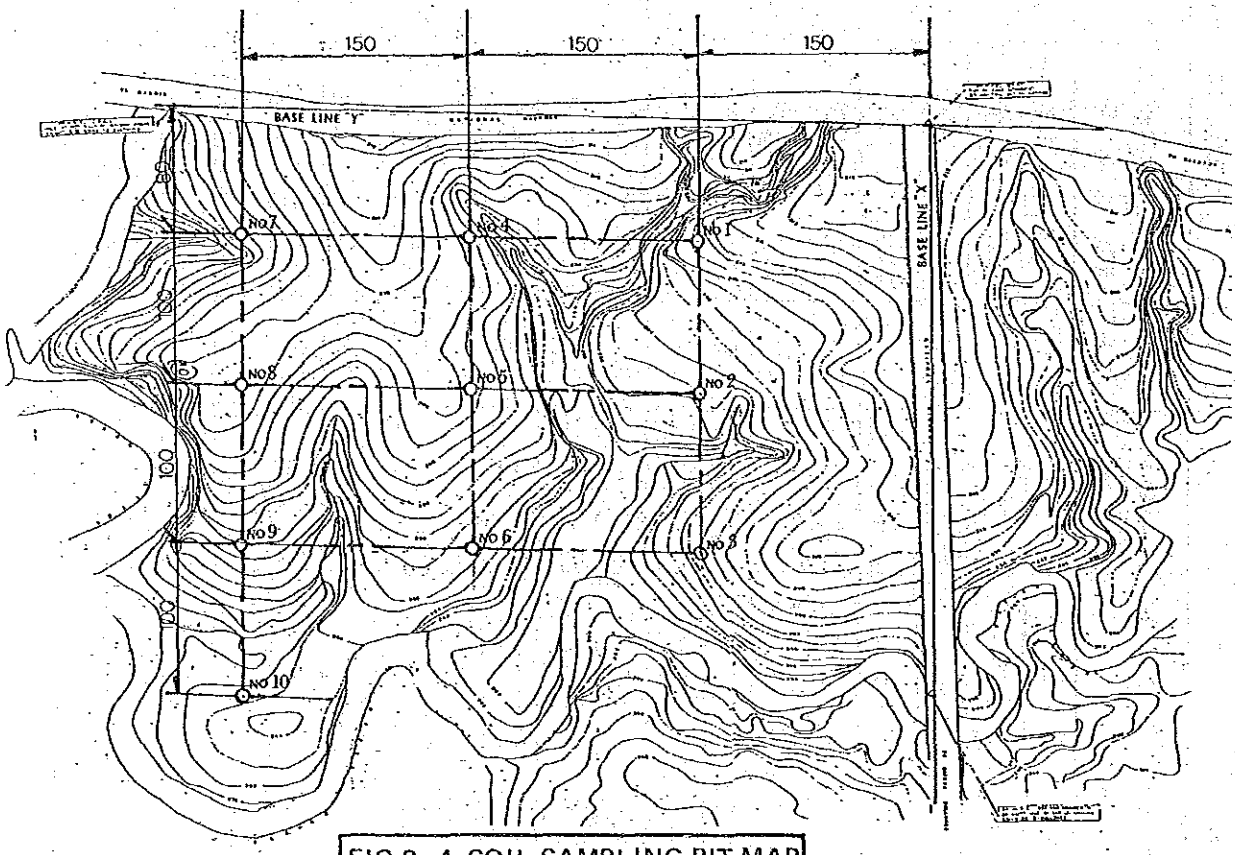


FIG.3-4 SOIL SAMPLING PIT MAP

The analysis was made for three purposes as follows:

1. To confirm the adoption of experiment results obtained in the experimental farms of Bilar and Ubay in the project area at Carmen by comparing the soil characteristics and fertility.

TABLE 3-1 SOIL CHARACTER OF PROJECT AREA

TEST NO	FIELD TEST					LABORATORY TEST					
	LAYER	DEPTH (CM)	DENSITY (KG/CM^2)	TEXTURE	AVAILABLE SOIL DEPTH (CM)	PH		ORGANIC M. %	T-NITROGEN %	AVAILABLE P_2O_5 %	AVAILABLE K_2O %
						H_2O	KCL				
1	I	19	10.2	L	90	5.11	3.72	1.9	0.074	0.0022	0.008
	II	38	31.1	SL		5.06	3.67	1.9	0.062	0.0036	0.004
2	I	28	11.8	L	120	5.05	3.69	2.2	0.094	0.005	0.004
	II	45	14.3	L		-	—	—	—	—	—
3	I	20		CL	165	4.95	3.59	3.2	0.117	0.0022	0.007
	II	31		LIC		4.91	3.57	2.2	0.085	0.001	0.003
4	I	20	11.8	LIC	130	4.98	3.61	2.2	0.092	0.0004	0.004
	II	37	7.4	HC		-	—	—	—	—	—
5	I	23	11.8	SL	128	5.11	3.67	2.0	0.096	0.001	0.009
	II	45	10.2	G.SL		5.08	3.71	2.0	0.053	0.0004	0.003
6	I	20	16.7	SC	105	4.9	3.59	2.2	0.070	0.0006	0.01
	II	39	14.3	SC		-	—	—	—	—	—
7	I	23	14.3	LIC		5.18	3.75	2.4	0.094	0.0012	0.006
	II	43				4.81	3.60	1.7	0.073	0.0004	0.005
8	I	15	14.3	L	107	4.96	3.63	2.4	0.102	0.0014	0.008
	II	34	14.3	GL		-	—	—	—	—	—
9	I	20	20.6	L		5.02	3.72	2.7	0.135	0.0014	0.008
	II	32	20.6	LC		5.03	3.75	1.8	0.041	0.00004	0.003
10	I	28	8.5	CL	145	5.35	3.76	2.5	0.142	0.0008	0.009
	II	45	8.5	LC		-	—	—	—	—	—

NOTE:- OLSEN'S METHOD

2. To find out the practicability of project expansion by carrying out as a pilot farm of 20 hectares to the Bohol irrigation project which has an area of more or less 13,000 hectares where continued soil research has been done by A.P.C. experts.

3. To establish a design criteria of land consolidation work based on the present condition of the available soil depth and foundation as observed in the cross section of test pits.

In order to determine the technical specifications for land consolidation works, especially in the care and handling of top soil, an analysis will be made of the first and second soil layers which are mixed together due to bulldozer operations. In addition the effects of the crawler (caterpillar) type bulldozer movement on the soil will be studied taking into account also the heavy equipment operations during wet conditions caused by rains.

(A) Testing Results

According to the aforementioned purposes, the test pit locations are shown in Fig.3-4 and the analyzed results are summarized in Table 3-1. Based on the results of the analysis, the soil characteristics of the project area are noted as follows:

1. The distribution of top soil layers in the field is such that the loamy (light) soil is spread over the plateaus, while the lower portion is covered with clayey (heavy) soil.

Location	Sample Pit No.	Soil Character
Height	1 to 3, 5, 8 to 10	L to CL
Lower portion	4, 6, 7	Lic to Hc

2. Top soil of the entire area is divided into two layers of which the first one from the surface is measured to 28 cm in depth and the second one is at 45 cm in depth.

The second layer consists of gravelly soil with secondary concretion composed of Mn and Fe, which is not present during land cultivation.

The available soil depth reaches 100 cm. It is safe to conclude that the soil condition of the project site is better than that of the experimental farms at Bilar and Ubay. Moreover, the foundation below the available soil is characterized by low concretion.

3. The laboratory test results as compared to the results of on-going investigations at the Bohol irrigation Project area showed similarity in the PH, available P_2O_5 and K_2O values, and indicated relatively high values of C/N and T-Nitrogen ratios.

Therefore, the test results confirm that the soil character of the project site is fully representative of the Bohol Irrigation Project area.

Laboratory Test	Testing Values	Estimation
Organic materials	1%	low
C/N ratio	15	low
T-Nitrogen	0.06 to 0.07	low
Available P_2O_5	0.0004 to 0.005	low
K_2O	0.003 to 0.01	low
H_2O PH	5.2 to 5.3	strong acidity
KCl PH	3.7 to 3.8	-do-
H = H_2O - KCL PH	1.5 to 1.6	fairly high

The soil PH indicates high acidity so that the soil amendment of reaction is necessary and likewise in the Bohol Irrigation Project Area. Although, in the case of the catchment vicinity of the dam reservoir which consists of limestone formation, the possibility of neutralization will be expected for the said amendment. The observed PH value of Dat-An creek is mesured at 7.6 alkaline.

4. The soil structure is characterized by a low development of the particle named "Single-grained structure" which causes the increase in soil density after moisture absorption and its later dry condition. It means that the operation of the heavy equipment machines during and after the rainfall will result in a high soil density which makes difficult the soil removal during the construction and likewise, lessens cultivation efficiency during farming operations. To avoid the said difficulties, the machine operations will be recommended to be suspended during the presence of high moisture content in the soil.

3-8. Embankment Materials

The material testing for the embankment and filter is conducted in order to determine the borrow pit area. This is made possible with the cooperation of the personnel of the soil testing laboratory of Bohol Irrigation Project 1, NIA. The borrow pit area for Embankment materials is selected out of two alternative sites "A" and "B" shown in the figure below considering the convenience of hauling and embankment works.

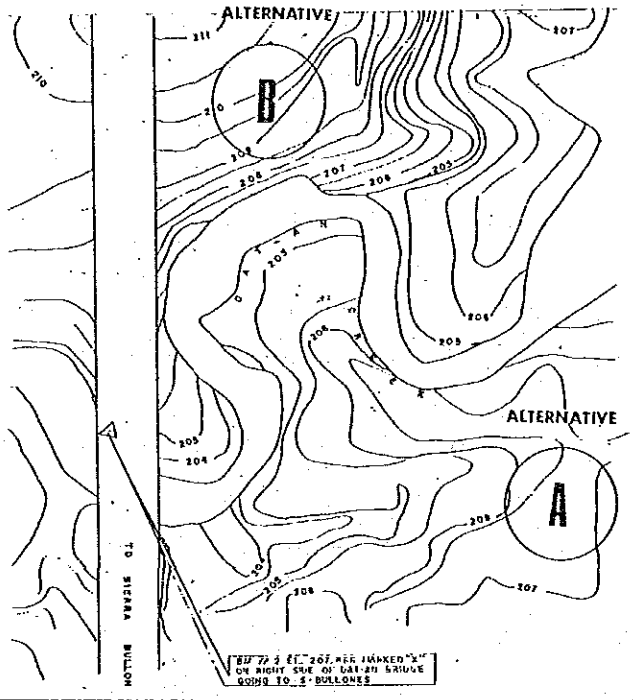


FIG.3–5 ALTERNATIVE BORROW PIT MAP OF EMBANKMENT WORK

The results for the two sites are summarized as follows:

(A) Alternative "A" Site

The results of testing and analysis concurred that the material sampled at "A" site is MH or, more particularly described as Inorganic silts with high plasticity.

It may be noted further that this type of soil (MH) has several weak or undesirable engineering properties. The adverse properties of soil are herein listed and discussed, as follows:

1. Workability when Compacted and Saturated is Poor

MH soils are highly plastic materials as indicated by their symbol which carries a descriptive letter "H" denoting high plasticity.

Common experience also showed that highly plastic soils are difficult to compact and merely tumble or make a somewhat wavy and spongy reaction of the ground formation upon passage of rolling equipments. Undoubtedly, it takes time for highly plastic soils to attain the usual required degree of compaction of 95% for embankment construction.

2. Volume Change and Erosion are Critical

Materials with high plasticity such as MH soils are highly expansive when wet and, likewise, shrink considerably when dry.

Large variation in the volume is significant considering that this remarkable volume change will always be accompanied by internal stresses within the soil mass producing crack formations.

Moreover, highly plastic soils are apparently critical to erosion since these are consisting preponderantly of very fine particles which make them unable to resist high velocity runoff.

3. Shearing Strength when Compacted and Saturated is Poor

This indicates that no matter how properly compacted the material is, still its shearing strength remains low. Such situation will greatly affect the slope stability of the embankment dam.

The internal frictional resistance or shearing strength even approaches zero value the moment the material becomes fully saturated especially during full reservoir operation.

Thus, MH soil obviously fail in this aspect as these have poor shearing strength.

4. Compressibility when Compacted and Saturated is High

Large settlement occurrences are still expected in soils with high plasticity even during the post-construction period.

Worst conditions occur when differential or uneven settlements exist, especially due to non-uniformity of compaction, which will correspondingly introduce some detrimental crack patterns.

The herein soil is, therefore, not reliable for use as construction material for embankment works.

(Recommendation)

In view of the unwanted engineering properties inherent in MH soils reviewed by evaluation based on Engineering use chart, MH soil is deemed it unfit to use particularly in embankment.

The types of soil highly recommended for use in the construction of homogeneous embankment are in the following order of preference.

1. Clayey-Gravel (GC)
2. Silty Gravel (GM)
3. Clayey-Sand (SC)

(B) Alternative "B" Site

The results of soil samples representing another prospective borrow pit area of "B" site reveals that the said borrow area has a GM soil classification or otherwise described as Silty-Gravel.

GM materials as indicated on the "Unified Soil Classification System Chart" contain fines of at least 12%. Its important engineering properties as noted from the "Engineering Use Chart" are enumerated hereunder:

1. Permeability when compacted - Semi-previous to Impervious;
2. Shearing strength when compacted and saturated = Good;
3. Compressibility when compacted and saturated = Negligible;
4. Workability as a construction materials = Good
5. Relative desirability for use in the construction of homogeneous embankment = 2

The series of test pits and laboratory tests conducted for representative samples obtained at different prospects for borrow areas showed that the soil within the vicinity of the dam has a silty characteristic.

As a consequence, the material prefers to recommend Silty-Gravel (GM) soil for this purpose as this ranks second in the order of relative desirability for use in the construction of homogeneous embankment.

(Recommendation)

Extra care should also be exercised in the field in connection with the application of Silty-Gravel soil as embankment materials, so that the following conditions can be met and maintained:

1. Percentage of fines (passing sieve 200) not less than 12% but not greater than 50%;
2. Maximum thickness of embankment lift or layer before compaction not to exceed 20 cm;
3. Maximum particle size not larger than 7.5 cm;
4. Fill moisture content to be controlled within the limits of 25% dry and 3% wet of the Specified Laboratory Optimum moisture content;
5. No lenses or pockets being formed during placement/compaction of embankment materials;
6. Materials to consist of:

   Gravel = 34%
   Sand = 32%
   Fines = 34%
   Total = 100%

7. No large lumps, decayed matters, vegetation or any form of organic materials, and
8. Atterbergs limit with liquid limit = 48% but not to exceed 50%, and plasticity index = 18%.

Special attention should likewise be taken in the compaction of fill materials at abutment contacts.

The following data are supposed to be obtained after compaction to check the consistency of the physical characteristics and properties of in-place embankment materials:

i) For in-place embankment materials with fines of not less than 12%

- Gradation
- Atterbergs limit (Liquid Limit & Plasticity Index),
- and Degree of Compaction.

ii) For in-place embankment material with fines of less than 12%

- Gradation, and
- Relative Density.

(C) Filter Material

The material is sampled at Wahig river located 15 km away from the project site. The material for the sand and gravel filter zone should at least meet the USBR criteria on the selection of filter materials aside from attaining the desired quality acceptable to the technical specifications.

Strict observance should further be made on the Criteria adopted by specifications in the selection of filter materials, as follows:

$$\frac{\text{15\% Grain size of filter materials}}{\text{15\% Grain size of materials protected by filter}} > 5\%, \text{ and}$$

$$\frac{\text{15\% Grain size of filter materials}}{\text{85\% grain size of materials protected by filter}} < 5,$$

15% or 85% grain size means grain size materials finer than respective percentage by weight of total volume of the materials.

The gradation curve of filter materials, generally speaking, should be parallel with the gradation curve of the protected materials, or GM in this case.

Filter materials should be clean, sound, durable and dense; furthermore, it should not contain fines greater than 5%.

It is, moreover, recommended that the engineer in charge of the dam construction should, as a generally required procedure, use of field density test apparatus (sand cone) to determine and ensure attainment of the specified degree of compaction for in-place embankment materials containing fines of not less than 12%.

For in-place embankment materials with fines of less than 12% like sand and gravel filter, a water replacement test is recommended to ascertain that the generally required minimum relative density of 70% is reached immediately after the compaction of a particular embankment lift.

3-9. Geography and geology on the dam axis

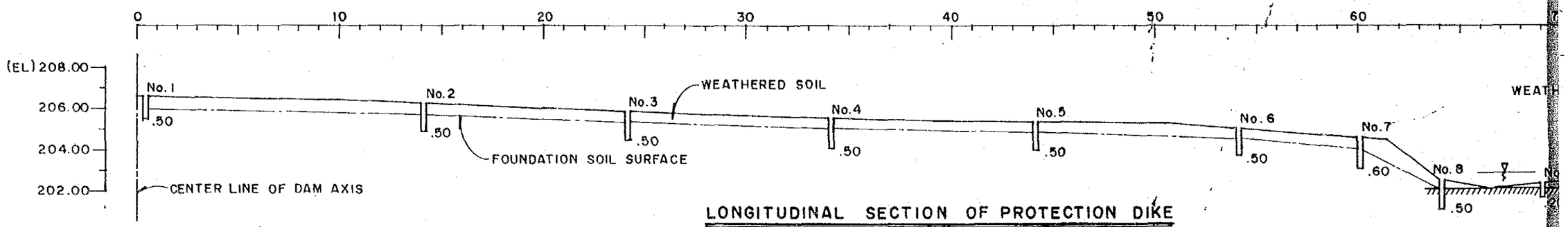
The test pits were excavated at least 1.5 m in depth to observe the topsoil thickness and embankment foundation along the dam axis and protection dike as shown in Fig. 3-6.

The pits on the both banks of the Dat-An creek were developped at the interval of 5 m, although the others were arranged in 10 m.

The foundation is recognized below the topsoil of 50-70 cm, which lower layer is consisted by gravelly clay, and the rock formation is seen at the creek bottom of el. 202 m.

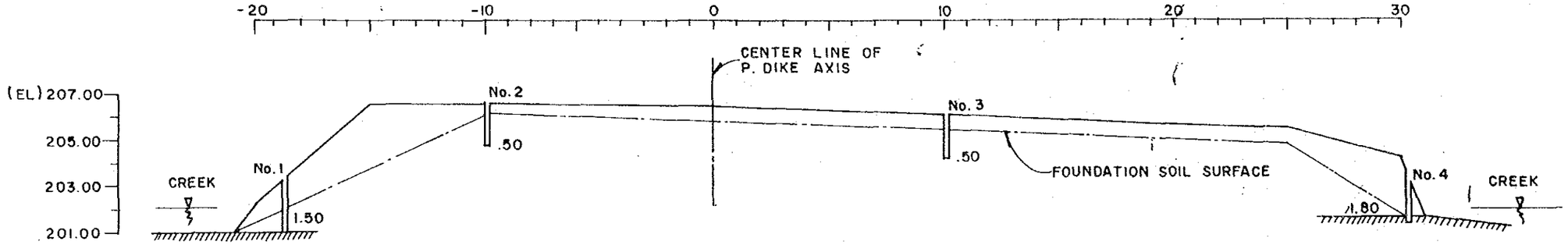
Therefore, the foundation in the dam construction area is estimated to be enough for the embankment work.

Fig. 3–6 Test Pit Results of Dam and Embankment Dike Foundation



LONGITUDINAL SECTION OF PROTECTION DIKE

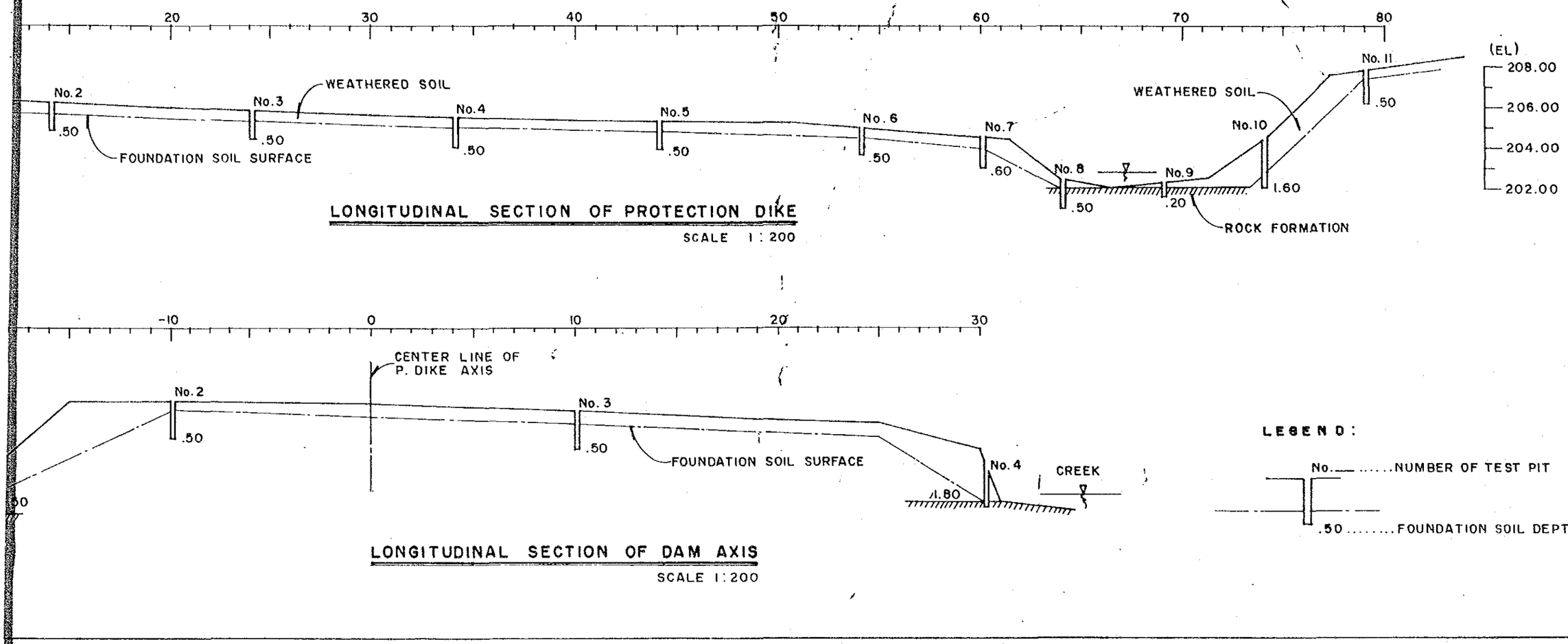
SCALE 1 : 200



LONGITUDINAL SECTION OF DAM AXIS

SCALE 1 : 200

Fig. 3-6 Test Pit Results of Dam and Embankment Dike Foundation



LONGITUDINAL SECTION OF PROTECTION DIKE

SCALE 1 : 200

LONGITUDINAL SECTION OF DAM AXIS

SCALE 1:200

4. DESIGN OF IRRIGATION FACILITIES

4. DESIGN OF IRRIGATION FACILITIES

4-1. Background

A study of the project area which spreads from elevation 202 m at its lowest level to 213 m at its highest level within a 20 hectare terrain will be made to determe whether or not it can be possibly developed into a gravity type irrigation. In this way, among the available water resources three alternatives have been identified as follows.

Resources (Creek)	Location	Catchment Area	Creek Bed Slope
1. Agotayan	east of site	1.3 km^2	1/60
2. Ma-asin	west	0.8	1/50
3. Dat-an	south	8.2	1/1,000

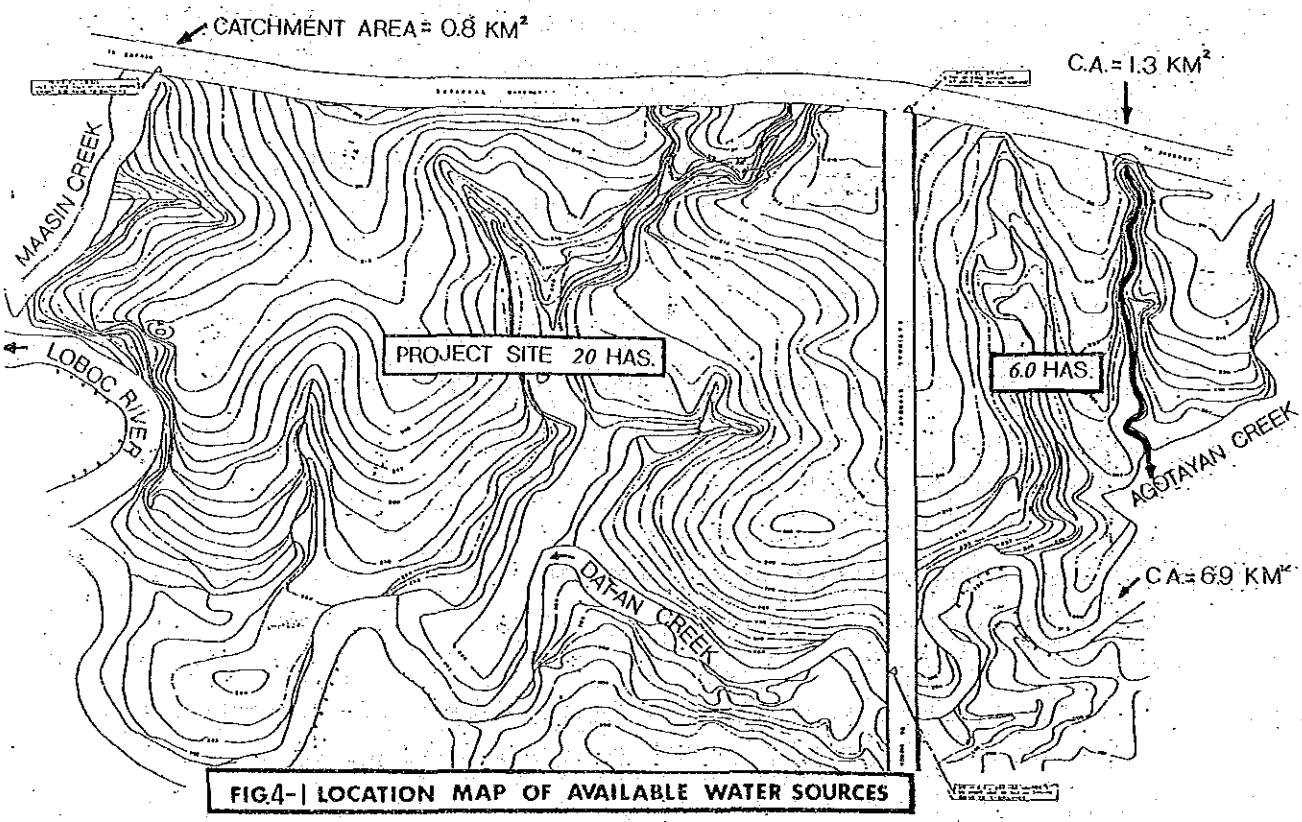


FIG.4-1 LOCATION MAP OF AVAILABLE WATER SOURCES

The above-mentioned two creeks, Agotayan and Ma-asin, are not considered to be advantageous sites due to their limitations in topography and reservoir capacity.

1. Their steep beds with slopes ranging from 1/50 to 1/60 are deterrent factors for economical reservoir development in view of high dam construction, limited reservoir capacity, and possible rapid sedimentation.

2. Their catchment areas are hilly and covered with grasses and their base discharges are not reliable during drought periods.

The Dat-an creek has a sufficient catchment area which is good for 20 hectare irrigable land, although its low creek bed at elevation 201 m at dam site and its creek bed with a slope of 1/1,000 are not practical to bring the water by gravity to the project site.

Therefore, instead of gravity type, pumping irrigation from Dat-an creek of the most stable water resources, is deemed advisable coupled with dam construction. In addition, farm pond is planned from the viewpoint of smooth operations and maintenance by the farmers and minimization of pumping hours.

4-2. Irrigation Plan

The scheme of irrigation is confined only within the 10 hectare paddy field areas. Thus, posterior proposal to include the upland is definitely ruled out.

The Cropping period is designed based on the farm management capability of the 10 settlers.

The monthly mean rainfall at Dagohoy located 10 km north-east of the project site is shown in Fig. 4-2, and the proposed cropping pattern is outlined in Fig. 4-3.

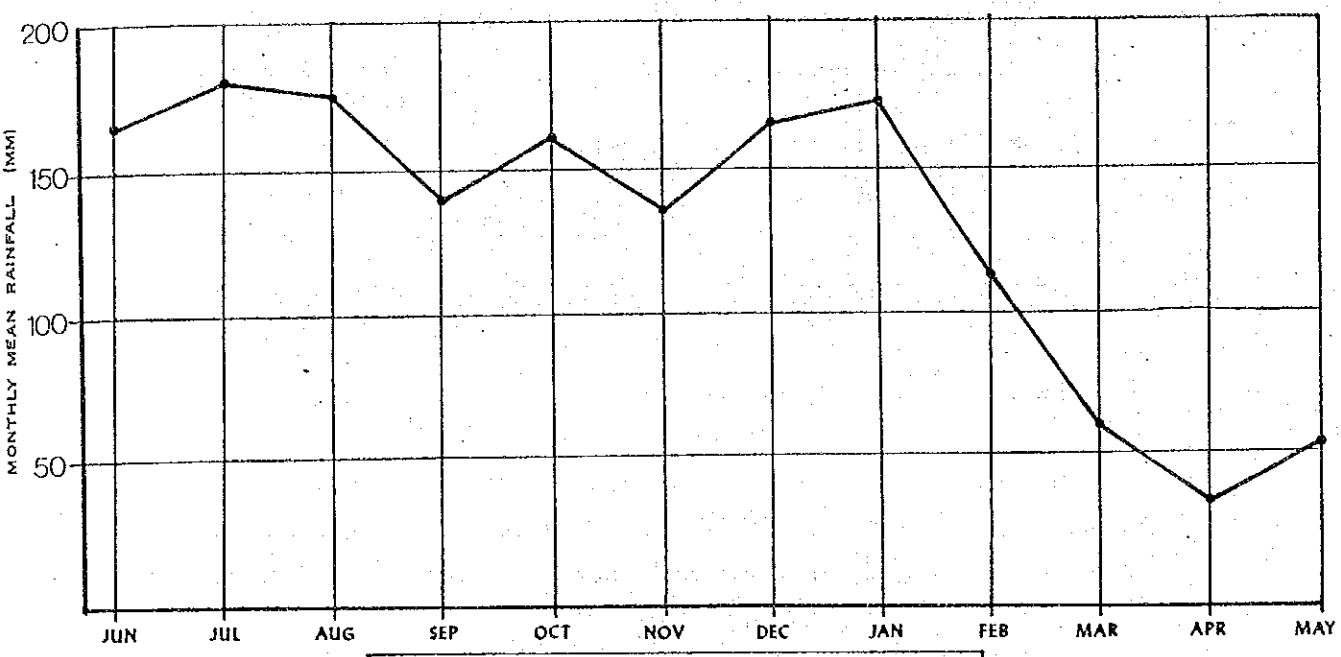


FIG.4-2 RECENT 10 YEARS MONTHLY MEAN EFFECTIVE RAINFALL AT DAGOHOY

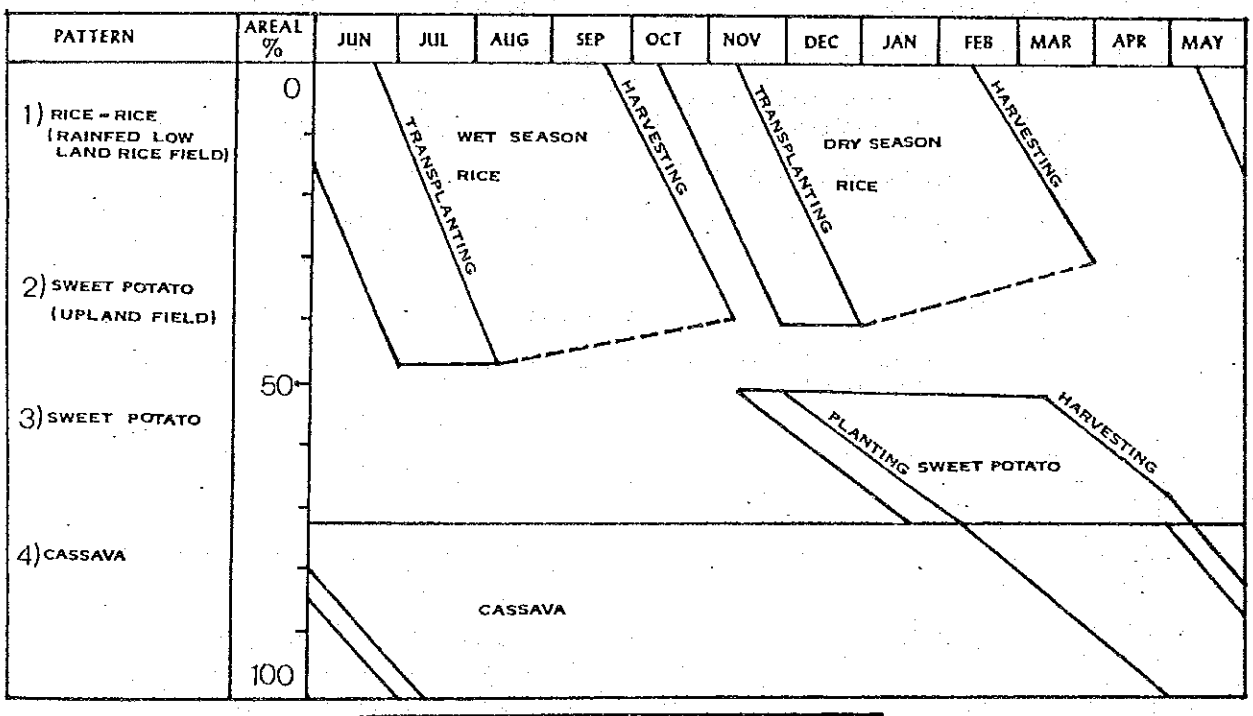


FIG.4-3 PRESENT CROPPING PATTERN

1. Irrigation area - 10 ha paddy field
2. Irrigation period - First crop : June to September;
   Second crop: November to February
3. Puddling period - 10 days
   Irrigation day = (land preparation + cropping period) x 2 season
   = (30 + 90) x 2 = 240 days
4. Dry season crop - March to May (out of irrigation)

4-3. Basic Irrigation Factors

The basic irrigation factors are determined by collating all the data and results of soil characteristics investigation conducted on the three experiment farms and those from other field observation initiated by A.P.C. experts.

The basic factors are noted as follows;

1. Daily consumption - 5.5 mm/day
2. Percolation - 1.0 mm/day
3. Puddling consumption - 130 mm/day
4. Irrigation efficiency - 63%
   (field efficiency x conveyance efficiency = 70% x 90%)
5. Maximum requirement - final day of puddling period
   - Net requirement = (9/10 x 6.5 mm/day + 1/10 x 130 mm/day) x 10 ha
     = 0.0218 cu.m/sec
   - Gross requirement = 0.0218/63% = 0.0346 cu.m/sec

4-4. Reservoir Operation

(A) Reservoir Capacity

The dependable reservoir volume is computed from the irrigation water requirement during 8 months of paddy management taking into account the hydrologic cycle analysis of continued drought period for the last 10 years.

1. Continued Drought Period

Based on a 10-year hydrologic record, the monthly drought period including the days with ineffective rainfall depth of less than 5 mm is shown in the Table 4-1. The maximum value during the irrigation period is recorded of 31 days, not including the extreme value which occurred in June 1983, and for the past ten years, it has an average of 19 days. Considering the importance of the reservoir and the frequency of drought period, the reservoir capacity is to be designed for 31 days of operation.

2. Base Discharge of Dat-an Creek

The discharge record of Dat-an creek is lacking, although 8 liters per second is observed after 16 days of continued drought.

In this regard, the base discharge conservatively adopted is 0.5 lit./second per 1.0 sq.km of catchment area.

Base Discharge = 8.2 km^2 x 0.5 l./sq.km = 4 liter/sec.

3. Paddy Consumption ..... 5.5 mm/day

4. Reservoir Surface Evaporation

- Surface area at high water level - 23 x 10^3 sq.m (at el.205.0 m)
- Evaporation ..... 5.0 mm/day

5. Reservoir Efficiency 0.90

6. Demand Reservoir Capacity Q'

$$Q' = (\text{Consumption} - \text{base discharge} + \text{evaporation}) \times \text{designed drought period/efficiency}$$
$$= (5.5 \times 10^2/0.63 - 4 \times 86.4 + 5 \times 23) \times 31/0.9 = 22{,}100\ m^3$$

(B) Design Water Level

The reservoir capacity - elevation relation are shown in Table 4-2 and Fig. 4-4 respectively.

The design water levels that provide stable pumping operations and sufficient irrigation storage are determined as follows;

1. Low water level (LWL) .... el. 203.50 m
2. High water level (HWL) ... el. 205.00 m
3. Available storage Q = HWL - LWL = 31,000 - 7,000
   = 24,000 cu.m
   demand reservoir
   capacity Q'

TABLE 4-1 MONTHLY PERIOD OF EFFECTIVE RAINFALL

CROPPING PATTERN	FIRST CROP			SECOND CROP				DRY SEASON CROP					
MONTH / YEAR	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	REMARKS
1974	10	14	(19)	8	9	6	6	6	12	13	27	29	
75	5	5	(19)	12	5	11	8	5	14	18	23	11	
76	9	8	11	12	(20)	20	3	11	5	▷	▷	68	
77	11	7	8	9	8	4	[31]	8	8	35	10	11	
78	7	7	5	5	5	(10)	9	6	16	26	25	5	
79	14	13	(15)	9	16	12	6	11	6	41	18	16	
80	5	7	6	(16)	6	9	8	10	11	17	13	23	
81	(17)	8	13	13	6	6	5	7	4	19	▷	44	
82	21	10	7	9	4	14	(24)	▷	▷	▷	▷	▷	
83	(144)	6	23	12	7	9	7	4	5	11	14	36	

NOTE: ▷ ------ CONTINUED DROUGHT MONTH

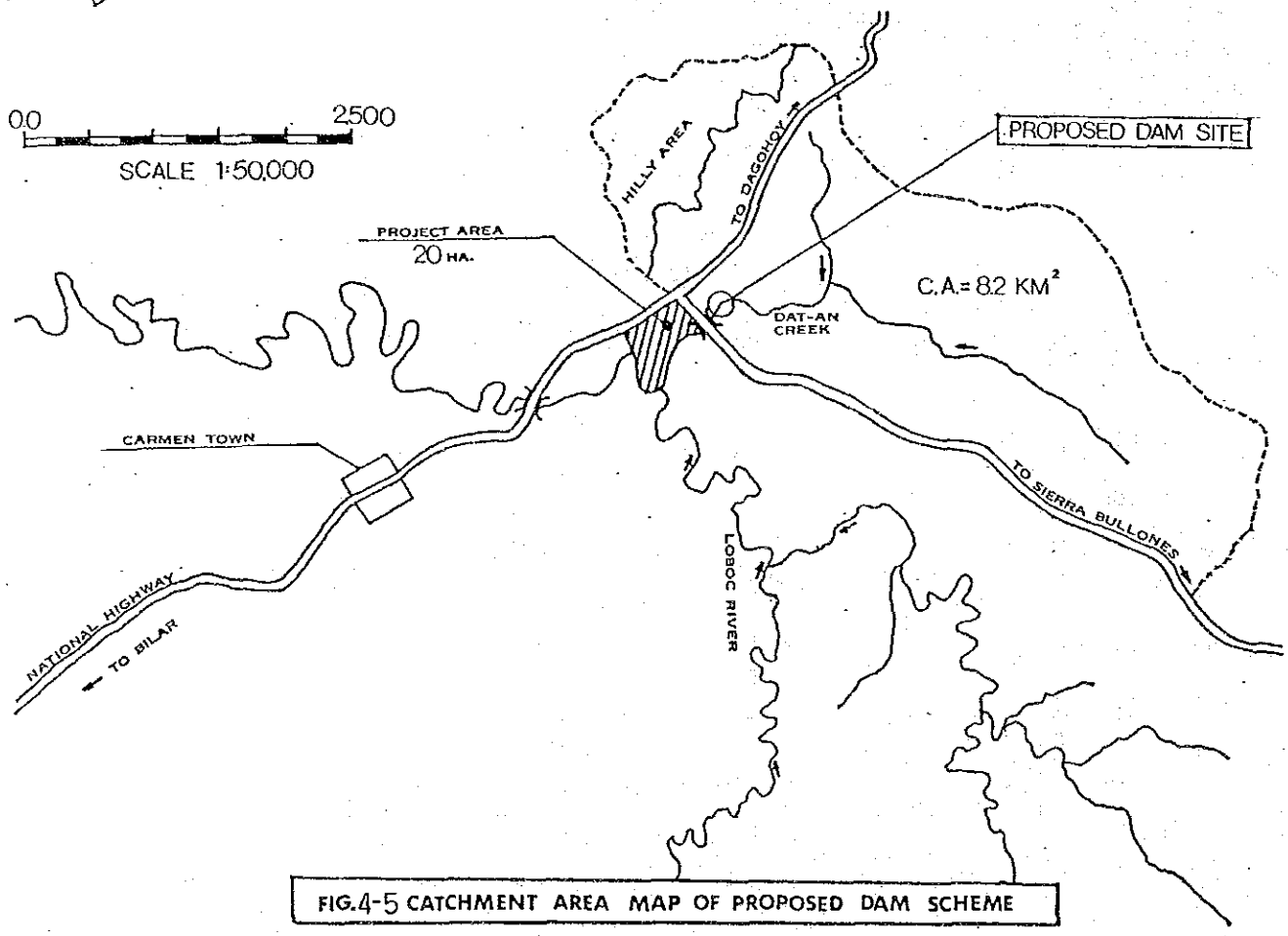


FIG.4-5 CATCHMENT AREA MAP OF PROPOSED DAM SCHEME

TABLE 4-2 ELEVATION CAPACITY AT PROPOSED DAM SITE

ELEVATION	RESERVOIR CAPACITY		REMARKS
	EL. 0.5M EACH	ACCUMULATED	
201.0			CREEK BED AT DAM SITE
.5	29	29	
202.0	362	391	
.5	909	1,300	
203.0	1,557	2,857	
.5	3,951	6,808	
204.0	5,935	12,743	
.5	7,803	20,606	
205.0	10,607	31,213	
.5	13,776	44,989	
206.0	18,085	63,074	

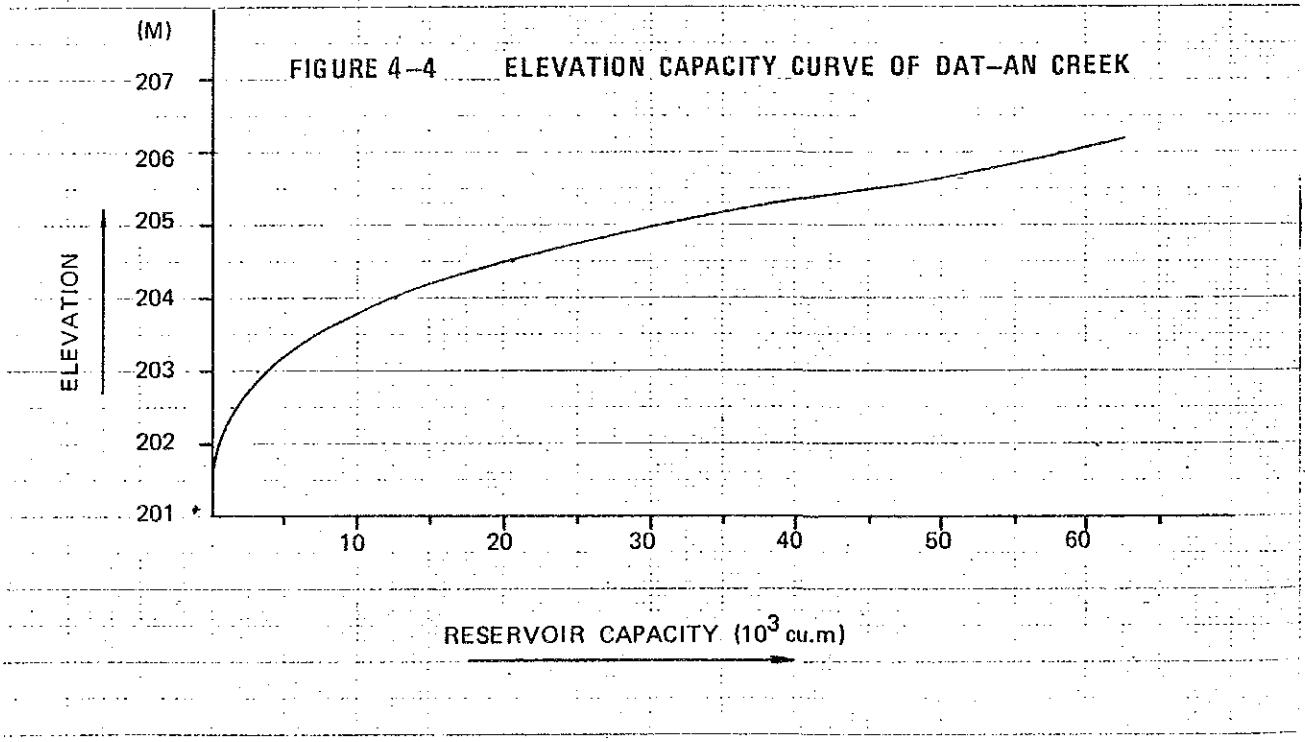
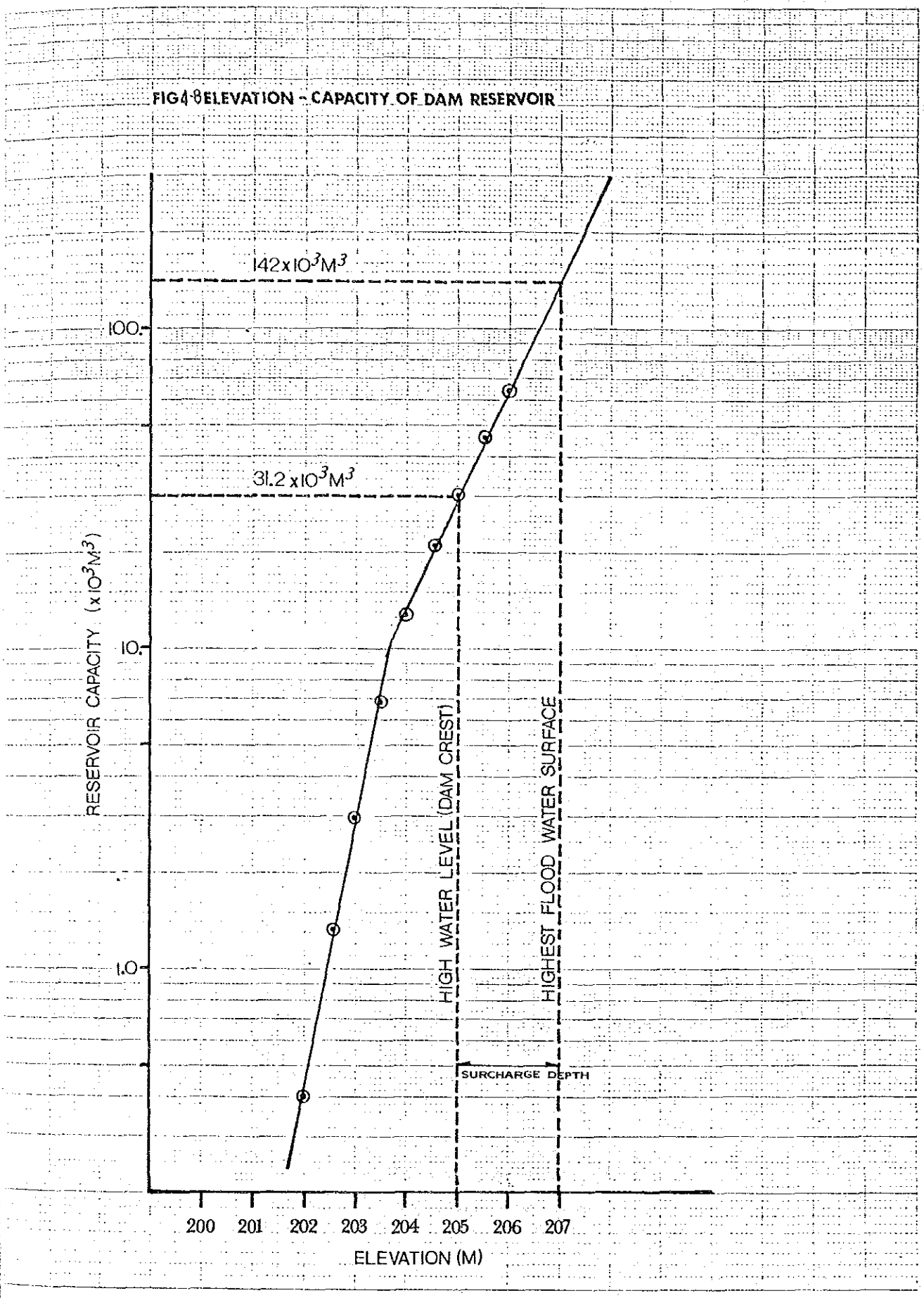


FIGURE 4-4 ELEVATION CAPACITY CURVE OF DAT-AN CREEK

FIG4-8 ELEVATION - CAPACITY OF DAM RESERVOIR



(C) Design Flood Discharge

There are no long-term discharge records of Dat-an creeks; thus making it impossible to estimate design flood discharge. The flood discharge, therefore, is estimated based on the following formulas commonly used in Philippines. In due consideration of the importance of the dam, included the effects on the downstream area, the third formula for occasional discharge is applied for the estimation.

$$\text{Peak discharge } Qp = \frac{235\ A}{\sqrt{A + 22}} \quad \text{(Extreme)}$$

$$= \frac{155\ A}{\sqrt{A + 13}} \quad \text{(Rare)}$$

$$= \frac{85\ A}{\sqrt{A + 11}} \quad \text{(Occasional)}$$

$$= \frac{50\ A}{\sqrt{A + 9}} \quad \text{(Frequent)}$$

A: CATCHMENT AREA (sq.km)

From Fig. 4-5 A = 8.2 sq.km

$$\text{Therefore, } Qp = \frac{85 \times 8.2}{\sqrt{8.2 + 11}} = 159 \text{ cu.m/sec}$$

(D) Location and Type

In general, the governing conditions of the dam location are as follows:

1. To ensure attainment of demand reservoir capacity, and stable pumping operations
2. To be close to the irrigable area and to be economical for pumping operations
3. To be convenient for construction works and easy for hauling the embankment materials
4. To have a firm dam foundation, high reservoir efficiency and the alignment of river banks generally straight and smooth.

The dam is preferred to be an earthfill one to take advantage of sufficient availability of embankment materials within the immediate vicinity of the dam site.

Regarding above conditions, two alternative schemes are planned.

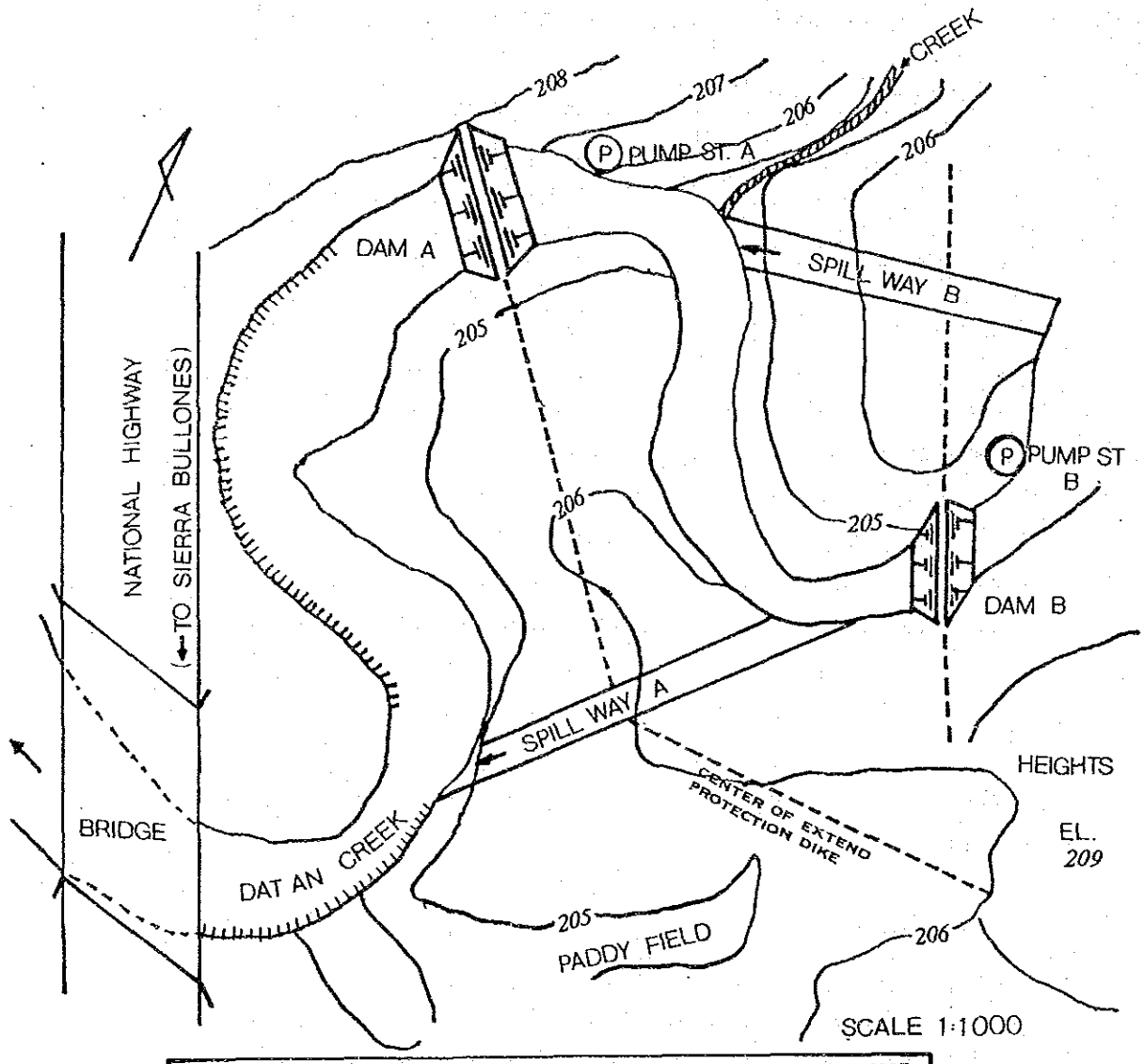


FIG. 4-6 ALTERNATIVE LOCATION OF PROPOSED DAM SCHEME

The comparison of two location alternatives are as follows:

Comparison	Plan "A"	Plan "B"
1. Temporary Work		
° Highway to spillway	50 m	120 m
° Highway to dam	80 m	120 m
° Bypass when dam embankment	Spillway use (safe side)	Conduits intalled under dam body (critical side)
2. Pumping St. Location (distance to F. Pond)	400 m	480 m
3. River Dike Protection	40 m cut at right bank	140 m masonry protection of both side banks
4. Extension Dike	100 m length at left side of dam body	200 m length at right side of dam body

The results show the advantages of the "A" scheme in the following aspects:

1. To minimize the temporary work
2. To shorten the pipe line length
3. To avoid the river dike protection at downstream of the dam body
4. To minimize the volume of the extended dike embankment

When deciding the dam type, the following consideration prevails:

1. Dam crest elevation = HWL + surcharge water depth + freeboard
   = el. 205.0 + 2.0 + 2.0 = el. 209.00 m

   In this regard, the protection dike with a height from 2.0 m to 4.0 m will necessarily stretch over a 100 m length at the left bank of the dam body but no longer necessary at the right bank.

2. The design peak discharge is obtained from the formula of "occasional" frequency, so that should this be exceeded due to the relatively large catchment area of 8.2 km^2 the spillway capacity becomes inadequate. Moreover, the estimation of surcharge volume in view of the absence of a more precise topographic map of the entire catchment area was based only on a 1/500,000 scaled military map. The design spillway capacity therefore, runs the risk of being exceeded.

   On the other hand the enlargement of spillway channel adversely effects the economy of the project and consequently reduces the limited construction budget for land consolidation works and other facilities.

The foregoing problem has been resolved in the light of the guiding principles herein stated below:

1. The peak discharge is derived from the said "occasional" formula with the viewpoint that the dam purpose is for irrigation water storage and not for flood control.

2. The exceeded design peak discharge is provided with the following contingency measures:

   - Dam embankment is not the perfect closing type
   - Flood waters are spilled over the weir type dam up to a 2.0 m surcharge in depth

   The excess waters above the 2.0 meter surcharge depth will further be spilled over the fuse dike which is laid across the paddy field of el.205.0 m for 40 m in width at the left bank.

   This is outlined in the succeeding figure.

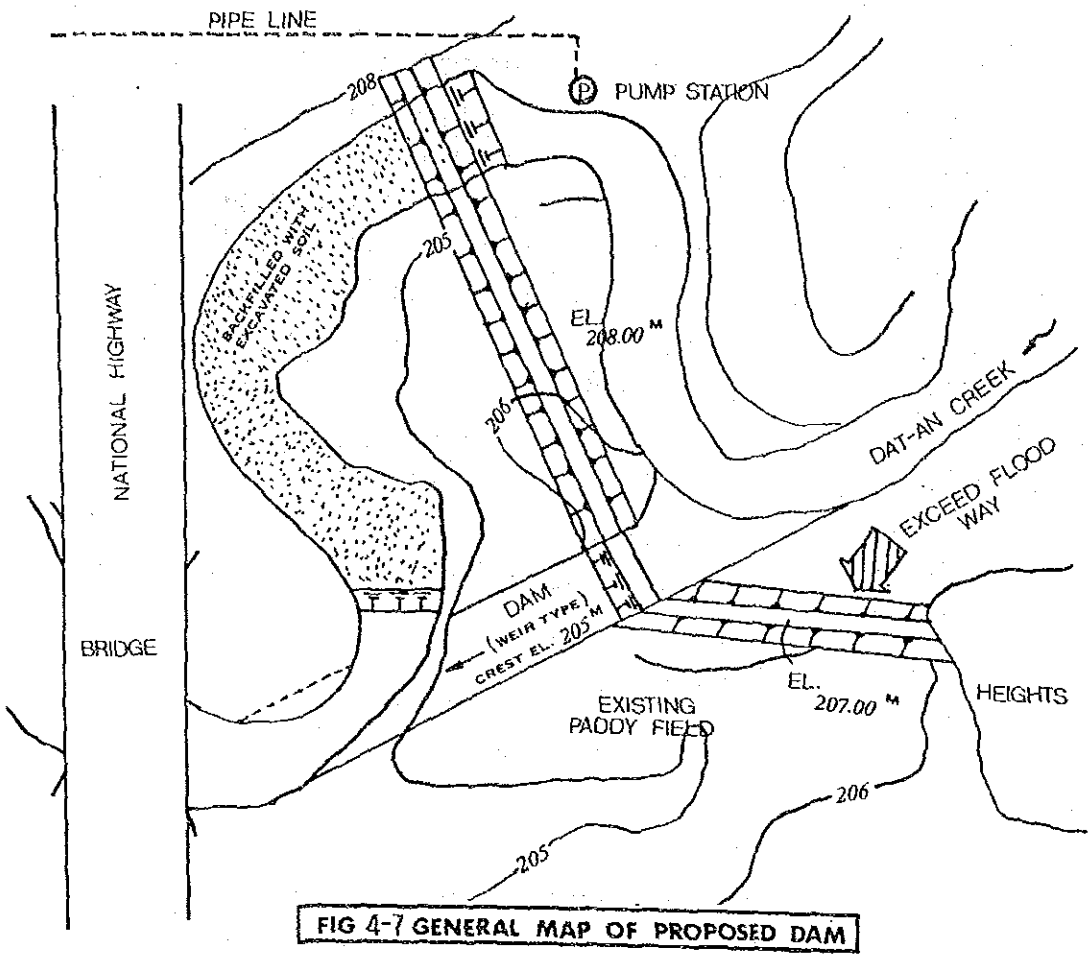


FIG 4-7 GENERAL MAP OF PROPOSED DAM

(E) Dam Factors

In order to satisfactorily compute the crest length, the designed flood discharge is determined by considering the surcharge effect of flood water.

1. Peak flood discharge ..... 159 cu.m/sec
2. Surcharge depth ..... 2.0 m
3. Surcharge storage ..... 110,000 cu.m
   from the Fig. 4-4 of reservoir capacity
   at el. 207.0 m ..... 142,000 cu.m
   el. 205.0 m ..... 31,200 cu.m
4. One hour runoff at peak discharge . 572,000 cu.m
5. Surcharge effect ..... 110,000/572,000 = 19.2%

Therefore, designed flood discharge Q = 159 x (1.0 - 0.192)

= 128 m^3/sec

from the weir equation Q = CBH 3/2

the crest length of B = $\frac{128}{2.1 \times 2.0^{1.5}}$ = 22 m

4-5. Farm Pond

The farm pond capacity is designed based on two purposes, namely, the reduction of pump and motor capacity designed at peak demand of puddling period, and the ease and convenience of the farmers in operating the irrigation facilities.

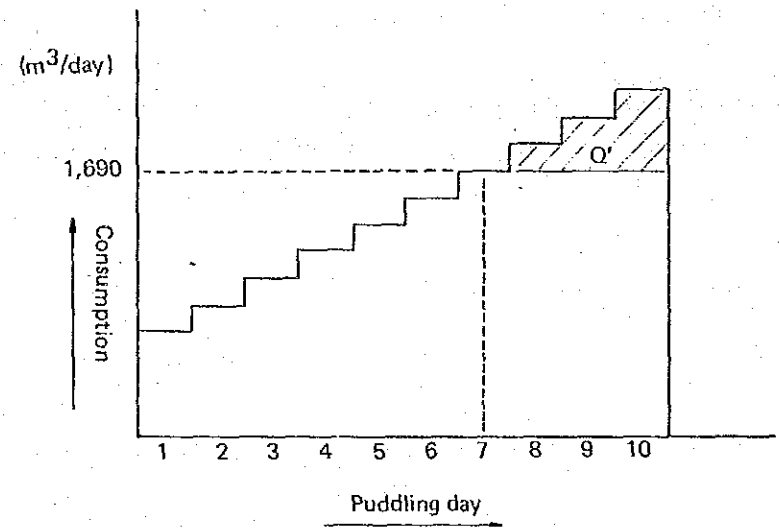


FIG.4-9 FARM POND CAPACITY AT THE PUDDLING PERIOD

The design capacity is aimed to reduce the peak requirement of the puddling period definitely after the eighth day equivalent to two-thirds of the 10-day days.

Puddling

7th day .... q^7 = (1/10 x 130 + 6/10 x 6.5) x 10 = 1,690 cu.m

8th day .... q^8 = (1/10 x 130 + 7/10 x 6.5) x 10 = 1,755 cu.m

9th day .... q^9 = (1/10 x 130 + 8/10 x 6.5) x 10 = 1,820 cu.m

10th day .... q^{10} = (1/10 x 130 + 9/10 x 6.5) x 10 = 1,885 cu.m

Cutted peak demand Q' = (1,755 + 1,820 + 1,885) - 1,690 x 3 = 390 cu.m

Therefore, farm pond capacity Q = Q'/irrigation efficiency

= 390/0.63 = 620 cu.m

The low water level (LWL) of farm pond is designed to conform with the paddy level at el. 211.30 m at the farthest end of the 400 m irrigation ditch from the farm pond.

LWL = paddy elevation + impounding depth + conveyance loss

= el. 211.30 + 0.05 + (400 x 1/1,000) x 1.4 = el. 211.80

HWL = LWL + available storage depth = el. 210.60 + 1.40 m = el. 212.00

The design water level for farm pond is given below:

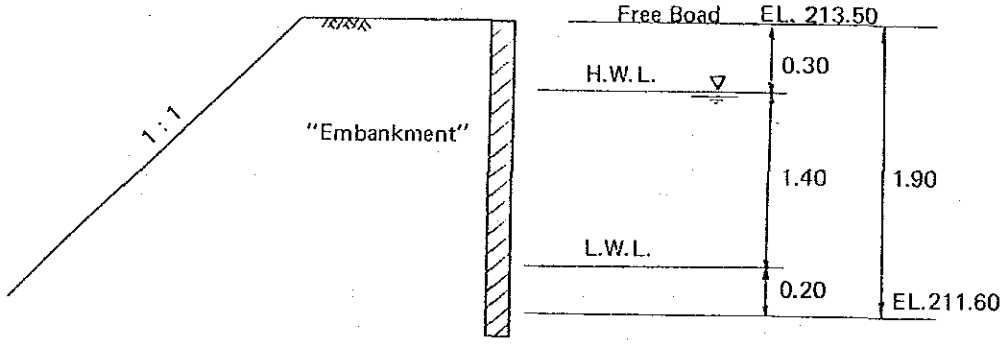


FIG.4-10 DESIGNED WATER LEVEL OF FARM POND

4-6. Pipeline

The pipeline diameter is designed at maximum consumption discharge and velocity during the puddling period.

In the selection of pipe materials, cognizance is given to construction efficiency, durability and cost.

1. irrigation hours at peak discharge .... 18 hr/day
2. peak discharge ..... 7th day of puddling period (1,690 cu.m/day)

   Q = 1,690 cu.m/day/irrigation efficiency
   = 1,690/(18 hr x 60^2 x 0.63) = 0.0414 cu.m/sec
3. pipe diameter ..... D = 200 mm
4. design velocity ..... V = 1.32 m/sec

Supposed the pipe material is PVC

velocity coefficient ..... C = 150

pipeline length ..... L = 350 m

then, friction head loss

$hr = 10.666 \times C^{-1.85} \times D^{-4.87} \times Q^{1.85} \times L = 2.46$ m

including the other losses equivalent to 10% of friction loss therefore

Total Head Loss ..... 1.1 x hr = 2.71 m

4-7. Pump

Pump capacity is also determined at the peak consumption of the puddling period and its necessary pumping head.

When considering the facility maintenance and present power supply conditions, the pump capacity should be divided into two units, one is motor driven and the other is a diesel engine type.

1. Pumping discharge (q)

Peak consumption (7th to 10th) days at puddling period

q' = 1.690 cu.m/day/(18 hr x 60 min x 0.63) = 2.48 cu.m/min

therefore one unit load q = q'/2 = 1.24 cu.m/min

2. Pumping head (H)

Total head H = HWL of F Pond - LWL of reservoir + pipeline loss

= 213.20 - 203.50 + 2.71 = 12.41 m

3. Type and diameter

type .... centrifugal pump (based on its local availability and economy)

diameter $D = 100 \times q^{1/2} = 100 \times 1.24^{1/2} = 111$

therefore, design pump diameter ... ϕ125 mm

4. Motor and engine

Motor capacity is computed as follows;

q; pumping discharge ..... 1.24 cu.m/min

H: pumping head ..... 12.41 m

r: allowance rate ..... 15% (motor)

p: pump efficiency 65%

t: connection efficiency ... 100%

$$P = \frac{0.163 \times q \times H \times (1 + r)}{p \times t} = \frac{0.163 \times 1.24 \times 12.41 \times 1.15}{0.65 \times 1.0} = 4.4$$

therefore, motor capacity ..... 5.5 kw

engine capacity ..... 7.5 HP

The power line of 11 KV, 4 phase is at supplied as far as Carmen Town and the distance of 2.2 km from Carmen to the project site is provided for only a single phase of 11 KV and 220 V.

Thus, for supplying the 220 V, 3 phase line to the proposed pump station, the above mentioned 220 V line is necessarily changed to a 3 phase.

Moreover, the 220 V, 3 phase line is to be newly installed for a distance of 400 m from the Highway junction to the pumping station. Regarding this matter, NIA continues negotiations with Bohol Electric Company (BOHECO) through the provincial government.

If the arrangement of power supply is not in time for the construction schedule, both pump units will be driven by engine.

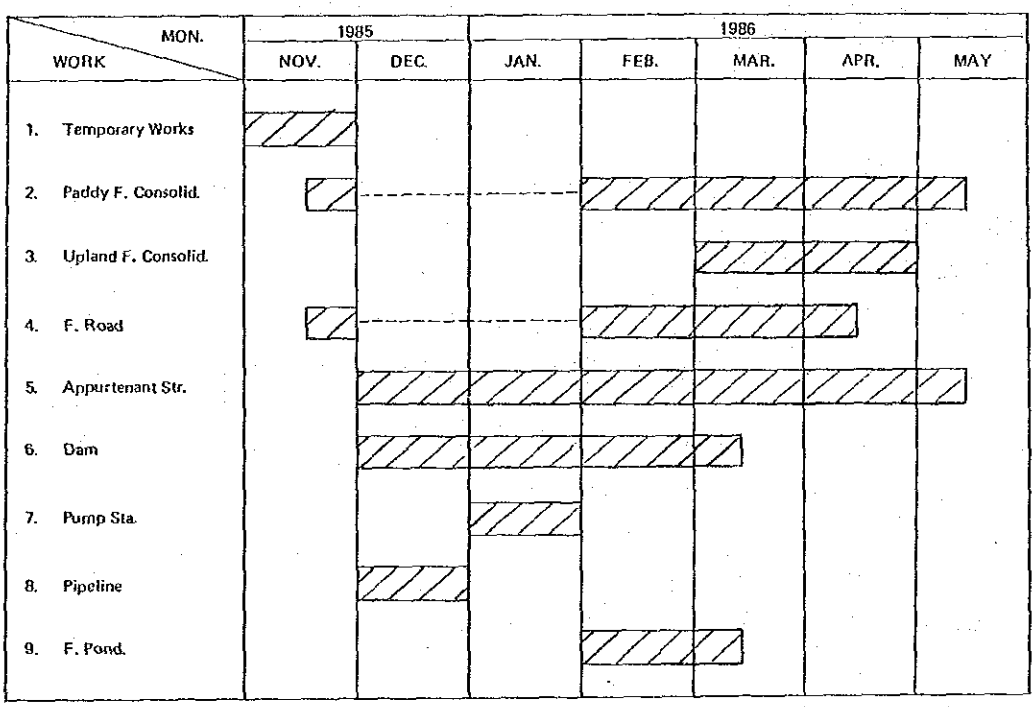
5. CONSTRUCTION SCHEDULE

5. CONSTRUCTION SCHEDULE

5-1. Construction Period

The construction period is planned for 6.5 months, in consideration of the paddy consolidation work which takes the longest scheduling and appurtenant structure work that includes the manufacturing and installation of concrete flumes. Based on the climatic conditions during the construction period that the rainfall is concentrated up to January and the drought season starts from the middle of February, the earth work is to be scheduled in the first and last three months as shown in the chart below.

CONSTRUCTION SCHEDULE FOR PILOT INFRA. PROJECT



5-2. Construction Schedule

The several works of farm pond, pipeline and pumping station consist mainly of manual work except for the excavation, so that

the schedule of these works are not affected by the others.

The paddy field consolidation is the orderly work between a lower and higher plotting in the order of topsoil baring, foundation soil removal and topsoil recovery.

The consolidation will become a critical work in the whole construction schedule, so that the mobilization plan of machines at the jobsite is to be established to achieve the earth work within a limited construction period.

The concrete work on the dam is scheduled to be carried out in the two rainfall months and the earth works of creek backfill and dike embankment will follow in drought months.

(A) Paddy Field Consolidation

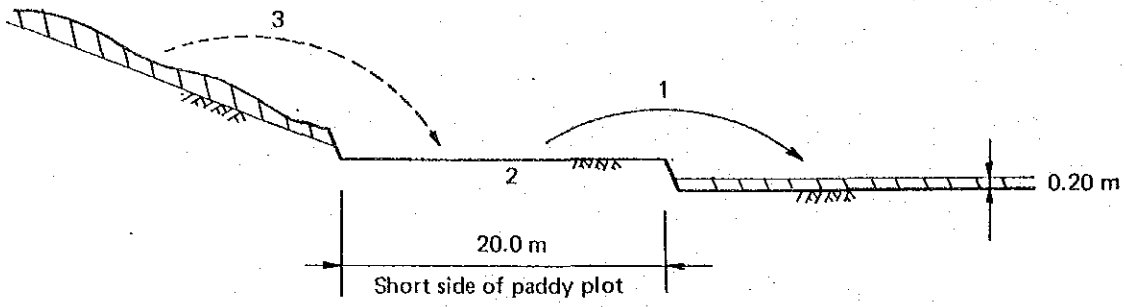
The estimated soil quantities for paddy field consolidation are computed to 20,000 cu.m of topsoil and 19,650 cu.m of subsoil. Based on the bulldozer capacity in a unit hour, the total operation time of machines is computed as follows:

Work	Ave. Hauling Distance (m)	Capacity (cu.m/ha)	Time (hr)
Topsoil	Short side of plot (20)	52	385
Subsoil	Half of long side (25)	29	678

Assuming seven hours of operation in a day, the total implementation period of bulldozed work is estimated at 152 days.

Therefore, the period of normal operation is designed at 75 days, excluding Sundays, Holidays, and days suspended by rainfall, two bulldozers of 11 tons capacity are necessary only in the mentioned orderly works.

The earth work in each plot is to be carried out from lower to higher within a paddy block surrounded by farm roads.



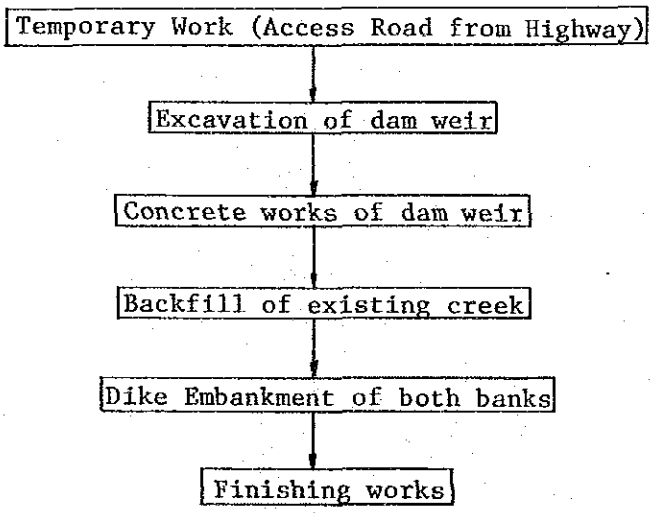
ORDER OF CONSOLIDATION WORK FOR PADDY FIELD

The work is orded as follows;

1. Topsoil baring
2. Foundation soil removal
3. Topsoil recovering and levelling

(B) Dam

The dam works are planned to conducted as follows:



Backfill material is diverted from excavated soil for weir dam. During the concreting period of weir dam, the excavated soil is temporarily placed in the existing corn field located at the right bank of the proposed weir dam. The backfill necessary to meet the shortage will be hauled from the designed borrow pit area (G.M Soil) at the right bank of Dat-An Creek.

The heavy equipment machines for the dam work are listed to be mobilized as follows:

Machines	Capacity	Number
1. Bulldozer	11 tons	x 1
2. Hydraulic excavator	0.5 cu.m	x 1
3. Tire Roller	20 tons	x 1
4. Vibrated road roller	3 tons	x 1
5. Concrete Mixer	0.3 cu.m	x 1

(C) Appurtenant Structures

The U-type flume of 30 x 30 x 60 cm is manufactured at the project site and used for the farm and drainage ditches. Considering the available construction days and the total producted flumes of 4,200 pieces, the plant capacity for production is to be 24 pieces per day.

(D) Pipeline

The pipeline work is progressed daily in the following order; 1. excavation, 2 pipe installation and 3. backfill. The backfill of a 30 cm thickness above the installed pipe is to be fully compacted by manual force.

5-3. Selection of Contractor

The contractor is expected to select NIA for those reasons listed as follows;

1. NIA has conducted the three experimental farms constructions at Dao, Bilar and Ubay in the last two years and has been certified by these responsible performances. Moreover, regarding this Carmen project, NIA also expects to participate in construction work.

2. After the completion of the construction works, NIA will continuously support to the establishment of the farmers organization under the APC. Moreover, considering the maintenance of irrigation facilities such as pumps are also under the NIA's assistance, NIA is able to take the responsibility of supporting the project.

3. A private contractor was not employed for the construction of the irrigation facilities and land consolidation in Bohol.

4. NIA keep the indirect construction cost lower than private firms.

6. CONSTRUCTION COST

Construction Cost for Carmen Pilot Infrastructure Project

I. Direct Cost	Amount
A. Preparatory Work	141,550
B. Land Consolidation	
1. Paddy Field Consolidation	1,079,700
2. Upland Consolidation	140,000
3. Farm Road	407,520
4. Appurtenant Structure	676,872
C. Irrigation Facility	
5. Dam	554,544
6. Pump House	40,837
7. Pipeline	41,155
8. Farm Pond	122,322
Total	₱3,204,500
II. Overhead Cost (20% of D. Cost)	₱ 640,900
III. Contingency (10% of (I + II))	₱ 384,540
Grand Total	₱4,229,940
Converted in Japanese Yen	¥57,104,190

Item	Description	Unit	Q'ty	Unit Cost	Amount	Remarks
C-BQ-0	Preparatory Work					
C-U-01	Site clearing	ha	13			regard. to tree and bush w/o vegetable area
C-U-02	Well development	pcs	2			shallow well type
C-U-03	Camp house	L.S				two storied bodega
				Total	₱	
C-BQ-1	Land Consolidation (Paddy field)					
C-U-11	Top soil baring	cu.m	20,000			
C-U-12	Foundation soil removal	cu.m	19,650			
C-U-13	Land levelling	sq.m	100,000			Found. and top soil
				Total	₱	
C-BQ-2	Up Land Consolidation	sq.m	100,000			To plowing stage
C-BQ-3	Farm Road					
C-U-31	Embankment	cu.m	6,180			
C-U-32	Gravel paving	cu.m	600			
				Total	₱	

Item	Description	Unit	Q'ty	Unit Cost	Amount	Remarks
C-BQ-4	Appurtenatn Structure					
C-U-41	Irrigation canal					
C-U-41-1	Excavation	cu.m	282			
C-U-41-2	Embankment	cu.m	180			
C-U-41-3	U-flume	pcs	290			50x50x60 cm
C-U-41-4	Al-concrete	cu.m	2			
C-U-41-5	Grouted riprap	cu.m	3			
C-U-41-6	R.C. pipe (ø450)	pcs	12			
				Sub-total .... ₱		
C-U-42	Siphon structure					
C-U-42-1	R.C pipe (ø300)	pcs	107			
C-U-42-2	Al-concrete	cu.m	6			
				Sub-total .... ₱		
C-U-43	Farm ditch					
C-U-43-1	U-flume	pcs	2,787			30x30x60 cm
C-U-43-2	R.C. pipe (ø300)	pcs	25			
C-U-43-3	R.C. pipe (ø450)	pcs	90			
C-U-43-4	Grouted piprap	cu.m	30			
C-U-43-5	Turn-out box	pcs	4			
				Sub-total .... ₱		
C-U-44	Drainage ditch					
C-U-44-1	U-flume	pcs	1,413			
C-U-44-2	R.C pipe (ø 300)	pcs	8			
C-U-44-3	R.C pipe (ø 450)	pcs	32			
C-U-44-4	R.C pipe (ø1,000)	pcs	50			
				Sub-total ... ₱		
				Total .... ₱		

Item	Description	Unit	Q'ty	Unit Cost	Amount	Remarks
C-BQ-5	Dam					
C-U-51	Excavation	cu.m	5,000			
C-U-52	Backfill	cu.m	3,850			Diverted from excav.
C-U-53	Embankment	cu.m	2,368			
C-U-54	Rubble masonry	cu.m	300			
C-U-55	A2-concrete	cu.m	23			
C-U-56	R.C pipe (ϕ300)	pcs	5			
C-U-57	Sodding	sq.m	160			
				Total .... ₱		
C-BQ-6	Pumping House					
C-U-61	Excavation	cu.m	86			
C-U-62	Rubble masonry	cu.m	14			Inlet structure
C-U-63	C.H.B wall	sq.m	54			- do -
C-U-64	Building	L.S.				
				Total .... ₱		
C-BQ-7	Pipeline					
C-U-71	Excavation	cu.m	560			
C-U-72	Backfill	cu.m	543			
C-U-73	B-concrete	cu.m	1			
C-U-74	Pipe-installation	m	350			Except pipe cost
				Total .... ₱		

Item	Description	Unit	Q'ty	Unit Cost	Amount	Remarks
C-BQ-8	Farm Pond					
C-U-81	Excavation	cu.m	1,800			
C-U-82	Backfill	cu.m	694			
C-U-83	C.H.B wall	sq.m	202			10x20x40 cm
C-U-84	Al-concrete	cu.m	2			
				Total	₱	
				Grand Total	₱	

Supplement

Supplement List

Supplement 1. Recommendation Letter of the Technical Guidance Team
(Addressed to BIADP dated on June 14, 1985)

June 14, 1985

Mr. Reynaldo de Sagun
Project Director, BIADP
National Council on Integrated Area Development
FBI Building, 60 Timog Avenue
Quezon City

Subject: Recommendation on Pilot Infrastructure Improvement Work for Bohol Agricultural Promotion Center Project

Dear Director de Sagun:

The undersigned visited the province of Bohol, Philippines from June 10 to June 16, 1985 and made the field observations from June 11 to June 14 being the representative of the Japanese Technical Guidance Team.

I made a survey and investigation of the site of the pilot infrastructure improvement work (hereinafter called " the work") for the Bohol Agricultural Promotion Center Project (hereinafter called "the project").

As the result of the investigation, I would like to submit several recommendations attached hereto in order to have a successful result of the work of the project, which is tentatively planned in Carmen, the central part of Bohol, for the time being.

Finally, I would like to express my deep appreciation for your kind cooperation extended.

Sincerely yours,

Noriaki Baraki

NORIAKI BARAKI
Represntative
Japanese Technical Guidance Team

c.c.
: Gov. Rolando Butalid G.
: Mr. Aniano F. Bondal
: Engr. Calixto Seroje

Recommendations on Pilot Infrastructure Improvement Work for Bohol Agricultural Promotion Center Project

1. Scale of Work:

The scale of the work should be as large as possible in order to show and extend the results of the research in the experimental farms of the project to as many farmers as possible.

2. Method of Land Improvement:

The method of land improvement must be effective and economical in Bohol condition in order to show to the farmers the practical extension of the results of the research activities of the project, considering the future practical land development plan of the Wahig-Pamacsalan Phase I Area.

3. Establishment of Farmers Association:

Farmers themselves have to manage and maintain the pilot farms improved by the work in order to extend the results of the research through the farmers activities and they have to pay the operation and maintenance costs of the irrigation facilities. Therefore, the establishment of Farmers Association is necessary and the guideline of Farmers Association activities should be prepared by the time when the detailed design survey team of the work will be dispatched.

4. Establishment of Land Holdings:

It is presumed that non-land-owner farmers will join the cultivation of the pilot farm. In this case, it is necessary to establish the land usership of these farmers. Therefore, the contract between the land owners and farmers hereto be made. This is also very important and should be arranged by the above-mentioned time.

Supplement 2. Commitment Letter of NIA's Implementation
(Addressed to JICA Team dated on July 18, 1985)

Republika Ng Pilipinas
PAMBANSANG PANGASIWAAN NG PATUBIG
(National Irrigation Administration)
Purok Blg. VII
OFFICE OF THE PROVINCIAL IRRIGATION ENGINEER
Dao District, City of Tagbilaran -- 6301
Tel. No. 33-72

July 18, 1985

Mr. Shigekazu Yoshida
Team Leader
JICA Mission for APC Pilot Infra Project
Tokyo, Japan

Thru the Project Director
Bohol Integrated Area Development Project
APC Building, Tagbilaran City

SUBJECT: Pilot Infra Project at Carmen, Bohol

S i r :

In connection with the proposed development of a Pilot Infra Project at Carmen, Bohol, I have the honor to submit hereunder the commitment of the office of the National Irrigation Administration (NIA), as follows:

1. That the NIA shall make the landowners and the prospective settlers understand that the subject project is a component of the APC project and is going to be implemented under the technical cooperation program now existing between the government of Japan and the government of the Republic of the Philippines;

2. That the NIA shall negotiate with the landowners to give priority to the present tenants in cultivating the improved farms and/or extend fair treatment to new settlers in the same manner as their present tenants;

3. That the NIA shall establish a farmer's organization for an effective operation and maintenance of the newly improved facilities/field, and cooperate with APC for the proper supervision and guidance of farming activities of above-mentioned organization which shall become part of the model group;

4. That the NIA in coordination with the APC, BIADP and other government agencies shall cooperate with each other for the success in the implementation of this particular project.

Mutual understanding relative to this matter is highly expected.

Very truly yours,

CALIXTO M. SEROJE
Provincial Irrigation Engineer

Supplement 3. Endorsement Letter of BIADP for NIA's Implementation
(Addressed to JICA Team dated on July 22, 1985)

NACIAD

REPUBLIC OF THE PHILIPPINES
Office of the Prime Minister

NATIONAL COUNCIL ON
INTEGRATED AREA DEVELOPMENT
FBI BLDG., 60 TIMOG AVENUE
QUEZON CITY
TEL. NO. 97-85-21 to 25

July 22, 1985

Mr. Shigekazu Yoshida
Team Leader
JICA Mission for APC Pilot Infra Project
Tokyo, Japan

SUBJECT: Pilot Infra Project at Carmen, Bohol

S i r :

We are forwarding herewith the letter-Commitment dated July 18, 1985 of the Office of National Irrigation Administration as represented by Mr. Calixto M. Sereje, the Provincial Irrigation Engineer of Bohol province, relative to the proposed development of Pilot Infra Project at Carmen, Bohol.

Furthermore, the undersigned is favorably endorsing the aforementioned Commitment.

Very truly yours,

REYNALDO E. De SAGUN
Project Director
Bohol Integrated Area Development Project

Copy furnished:
1. Governor Rolando Butalid, G.
   Tagbilaran City
2. Mayor Alfredo Galang
   Carmen, Bohol
3. Dr. Masamoto Yasuo
   Team Leader of JICA Experts
   APC - Tagbilaran City
4. Mr. Aniano Bondal
   APC-Project Manager, Dao, Tagbilaran City

Supplement 4. Summary Report of the Team
(Addressed to BIADP dated on Juiy 23, 1985)

23 July 1985

Mr. Reynaldo E. de Sagun
Project Director, BIADP
National Council on Integrated
Area Development

Subject: Summary Report of the Detail Design Survey Team for the Pilot Infrastructure Improvement Works of Bohol Agricultural Promotion Center Project.

Dear Sir:

The Japanese Detail Design Servey Team (herein after referred to as "The Team") organized by Japan International Cooperation Agency (herein after referred to as "JICA") visited the Republic of the Philippines, from July 10th to July 24th (to August 23rd for the consultant), for the purpose of formulating a detail plan on the Pilot Infrastructure Improvement Works (herein after referred to as "the Works") for Bohol Agricultural Promotion Center Project (herein after referred to as "the Project").

During its stay in the Philippines, the team exchanged views and had a series of discussions with Philippines authorities concerned of the Project on the necessary measures to be taken by both governments for successful implementation of the Works for the Project, though it cannot be decided at present whether it will be realized.

As the result of exchange of views and surveys, I have the honor of submitting you the Summary Report of the Team attached hereto, showing the outline of the Works, and detail design of the construction works will be consolidated by consultant members during their stay in the Philippines.

Finally, I express my deep appreciation for your kind cooperation and I hope that necessary arrangment will be taken for the smooth implementation of the Works.

Manila, July 23, 1985

Yours Sincerely,

SHIGEKAZU YOSHIDA
Team Leader

Japanese Detail Design Survey Team
for the Pilot Infrastructure
Improvement Works for Bohol
Agricultural Promotion Center Project

SUMMARY REPORT

OF

THE DETAIL DESIGN SURVEY TEAM

FOR

THE PILOT INFRASTRUCTURE IMPROVEMENT WORKS OF

BOHOL AGRICULTURAL PROMOTION CENTER PROJECT

1. Purpose of the Pilot Infrastructure Improvement Works. The Pilot Infrastructure Improvement Works (herein after referred to as "the Works") are implemented for demonstrating and extending the experimental achievement and improved techniques, at farmer's level, which have been developed in Agricultural Promotion Center.

2. Provision of land and Management of Improved Land. We confirmed in discussions with the Governor of Bohol Province, Mayor of Carmen Town and National Irrigation Administration (herein after referred to as "NIA") concerned that land which is owned by private sector can be provided for the Works by the Philippine side and that newly improved land is to be managed by farmer's organization which will be established for effective operation, maintenance and farm management, introducing 10 settlers, under the guidance of NIA.

3. Location and Scale

The Works are carried out at southside of the junction of national highway in Katipunan, Carmen Town, (see Annex 1). The objective area will be 10 ha for paddy field and 10 ha for upland field.

The construction works mainly consist of land consolidation, small dam at Dat-an creek for water resource and irrigation pumping station.

4. Outline of the construction works

The construction works are mainly composed of Land Consolidation and Irrigation Facilities.

(1) Land Consolidation

Item	Note
a. for paddy field	10 ha 50 x 20 m of unit plot
b. for upland field	10 ha
c. Farm road	4.0 m width of gravel paving
d. Appurtenant structure	incl. farm and drain ditches, drop work, etc.

(2) Irrigation Facilities

Item	Note
a. Earth dam	Homogeneous type at Dat-an creek
b. Pumping station	2 units of pump with motor
c. pipeline	a.p. x 400 m length of PVC pipe installation
d. Farm pond	

Reference: Subject to be changed by the following detail survey.

5. Preparation

1. For the execution of the construction works, Negotiation and arrangement for smooth implementation of the works such as timely harvesting, electric supply, etc. will be conducted by NIA, when necessity arises.

2. For the procedure of Japan International Cooperation Agency.

   a. A formal letter to request for the Works should be forwarded in the name of Project Director, Bohol Integrated Agricultural Development Project to Resident Representative of Manila Office of Japan International Cooperation Agency.

   b. When necessity arises, equipment and materials for the Works will be provided, and A4 Form should be forwarded to the Embassy of Japan as soon as possible.

   c. When necessity arises, the construction supervisor (short term expert) will be dispatched, and A1 Form should be forwarded to the Embassy of Japan as soon as possible.

6. Schedule of the Works

1. Interim report for the detail design survey will be submitted by Messrs. O. Fukuda and M. Watanabe before their departure on August 23, 1985.

2. Final report will be submitted by JICA through Manila Office in October, 1985.

3. The construction works will be commenced in November 1985 and completed in March, 1986.

Supplement 5. Draft of Construction Agreement

Appendix
- A. General Conditions
- B. Construction Cost
- C. Construction Schedule
- D. Construction Drawings
- E. Specifications

MEMORANDUM OF AGREEMENT

KNOW ALL MEN BY THESE PRESENT:

This Memorandum of Agreement entered into and executed this _____ day of _____, by and between:

THE JAPAN INTERNATIONAL COOPERATION AGENCY, with office address at the 2nd Floor, L.C. Bldg., 375 Buendia Extension, Makati, Metro Manila, hereinafter referred to as "JICA" and represented by its Team Leader of Japanese experts for the Bohol Agriculture Promotion Center Project, BIADP, MASAMOTO YASUO:

- and -

THE NATIONAL IRRIGATION ADMINISTRATION, with office address at NIA Bldg., EDSA, Quezon City, Metro Manila, hereinafter referred to as "NIA" and represented in this Agreement by its Assistant Administrator for Operations, MANUEL R. TICADO;

WITNESSETH:

WHEREAS, the JICA is establishing the Bohol Agriculture Promotion Center Project under the Bohol Integrated Agricultural Development Project (BIADP) of the National Council on Integrated Area Development (NACIAD);

WHEREAS, as a component of BIADP, the JICA desires to construct another pilot farm at KATIPUNAN, CARMEN, aside from the existing experimental farms at Dao, Tagbilaran; Gabi, Ubay; and Bilar in Bohol;

WHEREAS, in this connection, JICA desires that NIA will undertake the construction using its own personnel and equipment;

WHEREAS, NIA is willing to work/cooperate with JICA in this undertaking;

NOW, THEREFORE, JICA and NIA hereby mutually agree to the following stipulations:

ARTICLE 1

Obligation of JICA

1. JICA shall designate at least one (1) Engineer to engage in consultancy services and supervisory works in order to ensure the smooth prosecution of project plans and program covered by this Memorandum of Agreement.

2. JICA, in consideration with the implementation of this project by NIA *Bohol Provincial Irrigation Office, Tagbilaran City*, shall make payments direct to the latter in the form of checks the total amount of (₱) which is the mutually agreed estimated project cost as reflected under the "Cost Estimates" marked Annex B. The herein total amount shall, however, be adjusted to conform with the actual project cost provided that the reason for such adjustment shall be based mainly on the work quantities actually accomplished during the project implementation and not because of price changes. Absolutely, under no circumstance, shall any payment adjustment be sanctioned by reason of price and/or unit cost changes.

Payment shall be made in the following manner:

a. Advance Payment: The amount of (₱), equivalent to twenty (20) percent of the mutually agreed estimated project cost, shall be paid in advance within two (2) weeks after the signing of this Memorandum of Agreement. It is understood that within the two-week period aforementioned, all equipments needed to implement the initial project activities shall have been mobilized and made available at jobsite.

b. Interim Payment: To be effected monthly according to the progress and value of the works actually accomplished which shall be subsequently inspected and evaluated by JICA upon request of NIA. Each payment shall be done within utmost two (2) weeks from the date of submission of Monthly Accomplishment Report by NIA to JICA.

c. Final Payment: To be effected upon full and satisfactory completion by NIA of the works contemplated under this Memorandum of Agreement and after the same shall have been duly accepted by JICA. This particular payment shall be correspondingly adjusted to conform with the work quantities actually accomplished which shall be duly determined by JICA based on its own evaluation and assessment to be conducted within one (1) week after the date of the reported project completion.

ARTICLE II

Obligation of NIA

1. NIA shall provide all the necessary personnel, supplies, materials, equipment and other facilities to undertake the following activities in accordance with Annex A, B, C, D & E.

   a. Construction of the pilot farm at KATIPUNAN, CARMEN.

      1) Preparatory works
      2) Paddy field consolidation of ten (10) hectares
      3) Upland field consolidation of ten (10) hectares
      4) Farm Road Development
      5) Apurtenant structures for field irrigation and drainage
      6) Dam structures with protection dike
      7) Building of pumping house and inlet structures
      8) Pipe installation from pumping station to farm pond
      9) Farm pond of 620 cu.m capacity

ARTICLE III

Terms of Agreement

1. This Agreement shall be effective upon the execution by both parties.

2. Both parties reserve the right to terminate this Memorandum of Agreement by giving the other party thirty (30) days notice in writing subject to mutual agreement of full settlements of all claims that may arise out of this termination.

IN WITHNESS WHEREOF, the parties hereunto set their hands this 1986.

JAPAN INTERNATIONAL COOPERATION AGENCY	NATIONAL IRRIGATION ADMINISTRATION
BY:	BY:
MASAMOTO YASUO Team Leader of Japanese Experts Bohol Agricultural Promotion Center Project, BIADP	MANUEL R. TICAO Assistant Administrator for Operations

WITNESSES

REYNLDO E. DE SAGUN Project Director Bohol Integrated Area Development Project (BIADP) National Council on Integrated Area Development (NACIAD)	CALIXTO M. SEROJE Provincial Irrigation Engineer National Irrigation Administration Bohol Provincial Irrigation Office

ANNEX A. GENERAL CONDITIONS

CONTENTS OF GENERAL CONDITIONS

GENERAL CONDITIONS

GC-01. DEFINITIONS

Wherever the following terms are used in this Memorandum of Agreement, they shall have the following meaning:

Philippines	:	The Republic of the Philippines
JICA	:	The Japan International Cooperation Agency
NIA	:	The National Irrigation Administration
JICA'S Representatives	:	JICA Officers and persons authorized by JICA
Committee	:	The Committee of the Japan International Cooperation Agency, specially established for the Project.
Administrator	:	The managing head of the National Irrigation Administration of the Philippines.
Engineer(s)	:	An individual, partnership, corporation, association, firm of joint venture or syndicate which have been engaged by JICA to assist in engineering services and supervision of the work to be done under this Memorandum of Agreement.
Project Manager	:	The managing head of the particular Project where this project will be implemented.
Attached Documents	:	Documents attached to this Memorandum of Agreement which are General Conditions, Technical Specifications, Drawings, Payment and Construction Schedule.

Furnish	:	All works done and all expenses, including labor, materials, plant and overhead incurred by NIA in providing and delivering to the geographical location designated in the specifications, a specified item, article, or piece of apparatus or equipment.
Erect and Install	:	All works done and all expense, including labor, materials, plant nd overhead incurred by NIA in receiving a specified item, article, or piece of apparatus or equipment at a geographical location designated in transporting it to and storing it the site of work, and there erecting, placing or laying it as shown in the plans or as directed, to be by and at the expense of NIA unless otherwise specified.
Permanent Works:		The permanent structures to be constructed and completed in accordance with the Memorandum of Agreement.
Temporary Works:		All temporary structures of every kind required for the execution and completion of the Permanent Works.
Works	:	Refer to Permanent Works and/or temporary Works.
Construction Plant	:	All equipment, facilities, supplies, and other incidentals required for execution and completion of the work but exclusive of materials or other things intended to form or forming part of the Permanent Works.
Drawings	:	All Construction Drawings referred to in this Memorandum of Agreement and any modification of such drawings approved in writing by the Engineer and such other drawings as may from time to time be furnished or approved in writing by Engineer for construction of the Works.

Site	:	The lands on which the Works are to be executed or carried out and any other lands or placed provided by JICA for the purposes of this Memorandum of Agreement.
Approved	:	Means approved in writing by duly authorized persons.
Extra Work	:	Such additional labor, materials, supplies, equipment, facilities, and other incidentals as are required to complete the Works for the purpose for which it was intended but not, originally covered or called for in this Memorandum of Agreement.

GC-02. CORRELATION AND INTERPRETATION OF ATTACHED DOCUMENTS

The Attached Documents are complementary, and what is called for by one shall be as binding as if called for by all. In case of discrepancy, defective description, errors, omissions, or ambiguity between or in any of the Attached Documents, the following shall be the rules of interpretation.

Drawings shall govern over the General Conditions; and the Technical Specifications shall govern over the General Conditions and the Drawings.

Detailed Drawings shall govern over General Drawings. Figures written on Drawings shall govern over the Drawings themselves.

If NIA, either before commencing the work or during its performance, discovers any conflict, discrepancy, error, or omissions between or in any of the Attached Documents, he shall promptly notify the Engineer thereof in writing. On receipt of such notice, the Engineer promptly investigate the matter and give appropriate instructions to NIA.

Omissions from the Attached Documents or misdescription of details of work which are manifestly necessary to carry out the intent of this Memorandum of Agreement, or which are customarily performed, shall not relieve NIA from performing such omitted or misdescribed details of work and shall perform as if fully and correctly set forth in the Attached Documents.

GC-03. LIABILITY FOR SPECIAL RISKS

JICA shall hold NIA harmless from all liability for damages or destruction of the Works of property whether owned by JICA, or any other third parties and for injury or loss of life caused, directly or indirectly, by declared or undeclared war, invasion, insurrection, or usurped power in the Philippines, hereinafter referred to as "Special Risks".

GC-04. RESPONSIBILITY FOR THE WORK

NIA shall assume full responsibility for the Work. Until its final or partial acceptance as specified in the Technical Specifications the NIA shall be responsible for any damage to or destruction of the Work, except for special risks as provided for in Clause GC-03 Liability for Special Risks, to make no claims against JICA for damages to the works from any cause except for said special risks.

GC-05. SAFETY OF PERSONNEL AND THIRD PARTIES-PREVENTION OF ACCIDENTS-RESPONSIBILITY

Except for special risks as provided for in Clause GC-03 Liability for Special Risks, NIA is solely responsible for the safety, protection and security of his personnel, third parties, the public of large, the works, equipment, installations, etc. Accordingly, NIA shall comply

faithfully with any and all pertinent laws, at his own expense, take all requisite protective measures to the end of eliminating the occurrence of accidents, loss or damage of any kind during the performance of the Work and until their final acceptance. NIA shall provide, erect and maintain all necessary barricades, suitable and sufficient warning lights, danger signals and other signs, and shall take all necessary precautions for the protection of the Work and the safety of their personnel and the public. Roads closed to traffic shall be protected by effective barricades and obstructions shall be illuminated at night in accordance with the existing pertinent ordinances and other regulations.

GC-06. SUPERINTENDENCE

NIA shall give efficient superintendence to the works, using his best skill and attention, and shall, during the execution of the Work, provide a competent full time Superintendent and necessary assistants.

The Superintendent shall be the authorized representative of NIA and shall receive on behalf of NIA notices and instructions from JICA.

GC-07. INSPECTION OF THE WORK

All the Works shall be performed in a skillful and workmanlike manner. Inspection of all the Work shall be made by JICA while such Work is in progress to ascertain that the completed works will comply in all respects with the standards and requirements set for the in these attached documents. Notwithstanding such inspection NIA shall be held responsible for the acceptability of the finished Works.

The Engineer shall assist JICA in the inspection of all the Work.

JICA, the Engineer and their representatives shall at all times have access to the Works and NIA shall provide proper facilities for such access, and shall furnish promptly, without additional charge, all facilities, labor and supplies reasonably needed for safe and convenient inspection.

If any works should be covered up without prior approval or consent of JICA, it must, if required by the JICA, be uncovered for examination and properly restored at NIA expense.

GC-08. CORRECTION OF WORKS

NIA shall promptly replace all materials and correct all Works determined by JICA or his duly authorized representative as failing to meet the requirements specified in the Attached Documents and shall bear the cost of damage done to other parties occasioned by such removal or replacement.

GC-09. EXTENSION OF TIME DUE TO FORCE MAJEURE

NIA shall not be in default under this Memorandum of Agreement if any delays in the prosecution or completion of the Work or any separable part thereof are caused by "force majeure", provided, that NIA submits a notice in writing to JICA about delays, and in the opinion of JICA the delays are caused by force majeure.

"Force Majeure" shall be defined as any event, the happening or pernicious results of which could not be prevented even though a person against whom is happened or threatened to happen were to take such appropriate care or necessary precautionary measure as might be expected from him.

GC-10. DISPUTE

Any controversy or dispute arising out of or relating to this Memorandum of Agreement shall be resolved by discussion between JICA and NIA.

GC-11. LANGUAGE AND UNIT SYSTEM OF WEIGHTS AND MEASURES

All drawings, designs, specifications, manuals, name plates, markings, operating instructions, estimates, statements, charts, schedules, reports, notices, documents and all written communications between JICA or the Engineer and NIA, concerning this Memorandum of Agreement shall be in the English language and the metric system of weights and measures in principle may be used.

GC-12. PUBLICATION AND PICTURES

Publicizing the works or any part thereof, without the prior written approval of the Administrator and JICA, in the form of announcements or publications, either verbal or in writing, or pictures, movies or in any other manner, is prohibited.

GC-13. ANTIQUES AND OBJECTS OF VALUE

All ruins, relics, coins and other artistic or antique objects of any nature and value discovered during the performance of the Work belong to the Republic of the Philippines. The NIA upon discovery of such objects, shall immediately inform JICA and Project Manager and, pending such action on his part, shall take all indicated measures, including suspension of any affected part of the work, for preserving instant and guarding said objects. No rights whatsoever shall accrue to NIA and no compensation of of any

nature shall be due to him for the discovery of aid objects and all rights accruing under the law to the discovery shall devolve exclusively to NIA.

GC-14. CHANGED CONDITIONS

NIA shall promptly, and before such conditions are disturbed, notify JICA in writing of: (a) Sub-surface or latent physical conditions at the Site differing materially from those indicated in the Attached Document, or (b) unknown physical conditions at the Site or an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Memorandum of Agreement. JICA shall investigate the conditions, and if it finds that such conditions do so materially differ and provided that NIA has submitted a notice in accordance with Clause GC-09 Extension of Time due to Force Majeure and Clause GC-15 Extra Work, then JICA shall direct NIA to perform such Extra Work, as provided for in Clause GC-15 Extra Work, as may be necessary in the opinion of JICA and he shall grant NIA such extension of time as may be justified.

GC-15. EXTRA WORK

JICA may, at any time by written notice and without notice to the Sureties, direct NIA to perform extra work if such Extra is within the general scope of this Memorandum of Agreement. No Extra Work shall be undertaken unless in pursuance of such written notice by JICA, and no claim for payment shall be valid unless the Extra Work was so notified. NIA shall promptly proceed with the Extra Work as directed by JICA and the amounts to be paid to NIA for any such Extra Work shall be determined subsequently by one or more of the following methods:

(a) By a supplemental bill of quantities and schedule of payment proposed by NIA and approved by JICA.

(b) By a reasonable lump sum proposal from NIA acceptable to JICA.

GC-16. NIGHTS, SUNDAYS, HOLIDAYS AND OVERTIME

Work at night, on Sundays, on Holidays, as overtime shall be governed by the pertinent laws, regulations and acts and shall be the sole responsibility of NIA. All costs and expenses associated with work at night, on Sundays, on Holidays as overtime will be paid by NIA and will be included in the cost agreed in this Memorandum of Agreement.

GC-17. CONSTRUCTION PROGRAM

NIA shall furnish JICA a complete construction program providing for the orderly performance of the Work. The program shall be in such form and in such detail as to show properly the sequence of operations, the period of time required for completion of the Work under each item or group of items of the Work. Such construction programs shall be up-dated and submitted at intervals of not more than one (1) month; however, NIA shall immediately advise JICA of any proposed change in the construction program. Revised construction programs shall show construction operations for each item of the Work from the starting date to the anticipated completion date, indicating the periods during which the Work was previously underway, as well as estimated future period of construction operations.

GC-18. PROJECT REPORTS

NIA shall within seven (7) calendar days after the end of each month furnish JICA, without cost to JICA in a form and number of copies to be determined by the Engineer, the following:

(a) Physical Progress Reports for the month and estimated progress for the succeeding month.

(b) Completion Schedules (target and actual) based on the approved Construction Program as provided for in Clause GC-17 Construction Program.

(c) A listing of equipment utilized for performance of the Work during the month.

GC-19. CONSTRUCTION EQUIPMENT AND TOOLS

All construction equipment and tools to be used for the Work shall be furnished by NIA.

GC-20. RIGHT TO CHANGE

JICA reserves the right to make changes in the work as are required for its proper completion, including, but not limited to: design modifications which may increase or decrease the quantities of unit price items of the work.

JICA may grant NIA extension of time for the completion of the work or extra work for delays due to the changes in the work and other specified causes, all to the extent provided for by Clause GC-09 Extension of Time due to Force Majeure.

All notices for changes will be given in writing. A notice which provide for an adjustment or an extension of time will be given only by change notice.

GC-21. SUSPENSION OF THE WORK

By written notice to NIA, JICA may suspend the work wholly or in part, for such period as JICA may deem necessary in case of change of the Work.

A suspension notice will be considered a cause for time extension as provided for by Clause GC-09 Extension of Time due to Force Majeure nd adjustment in compensation to the same extent as other changes in the working may be granted.

GC-22. PREPARATORY WORK

NIA shall furnish labor, materials, supplies, equipment, and other facilities to install such Temporary Works and Construction Plant as described in Section 1 of the Technical Specifications.

GC-23. UPRICE ESCALATION DURING CONSTRUCTION

No price escalation shall be imposed upon the construction unit cost referred in Annex "D" notwithstanding the National Economic and Development Authority recommends the price adjustment according to the Presidential Decree No.1594, Section 8 "Adjustment Contract Price".