REPORT OF SURVEY FOR BASIC DESIGN ON TRAINING CENTER FOR FOREST CONSERVATION IN PANTABANGAN

March 1978

JAPAN INTERNATIONAL COOPERATION AGENCY

Preface

In response to a request from the Government of the Republic of the Philippines, the Government of Japan decided to perform a survey necessary for a basic design of the Training Center for Forest Conservation in Pantabangan. In accordance with this decision, the survey was carried out by the Japan International Cooperation Agency.

This projected training center is located in the catchment area of the Pantabangan multipurpose dam on the upper reaches of the Pampanga River, one of the afforestation project areas to which the Government of the Republic of the Philippines is giving top priority. The important task is to stabilize forestlands in this area so as to prevent the inflow of mud and sand from impairing the function of the dam. In the meantime, the Japan International Cooperation Agency has been carrying out technical cooperation for afforestation in this area since 1976. The training center, when established, will make it possible to transfer technology for the conservation of forests, including the techniques for erosion control and will serve to strengthen the existing technical cooperation structure in the afforestation of this area.

We would be immensely happy if this training center could serve to contribute to the development of cooperation projects in forestry and eventually to the fostering of the ties of friendship between the two countries.

I wish to express sincere appreciation to every member of the survey team, officials of the government agencies of the Republic of the Philippines who have rendered full cooperation as well as officials of Japanese Ministry of Foreign Affairs, Ministry of Agriculture and Forestry and Japanese Embassy in Manila.

February 1978

Shinsaku Hogen
President
Japan International
Cooperation Agency

Location map of Training Center for Forest Conservation in Pantabangan

$$S = \frac{1}{50,000}$$

Main Building of training Center

District Forest Office

Access Road

Gauging dam

Carrent Trial

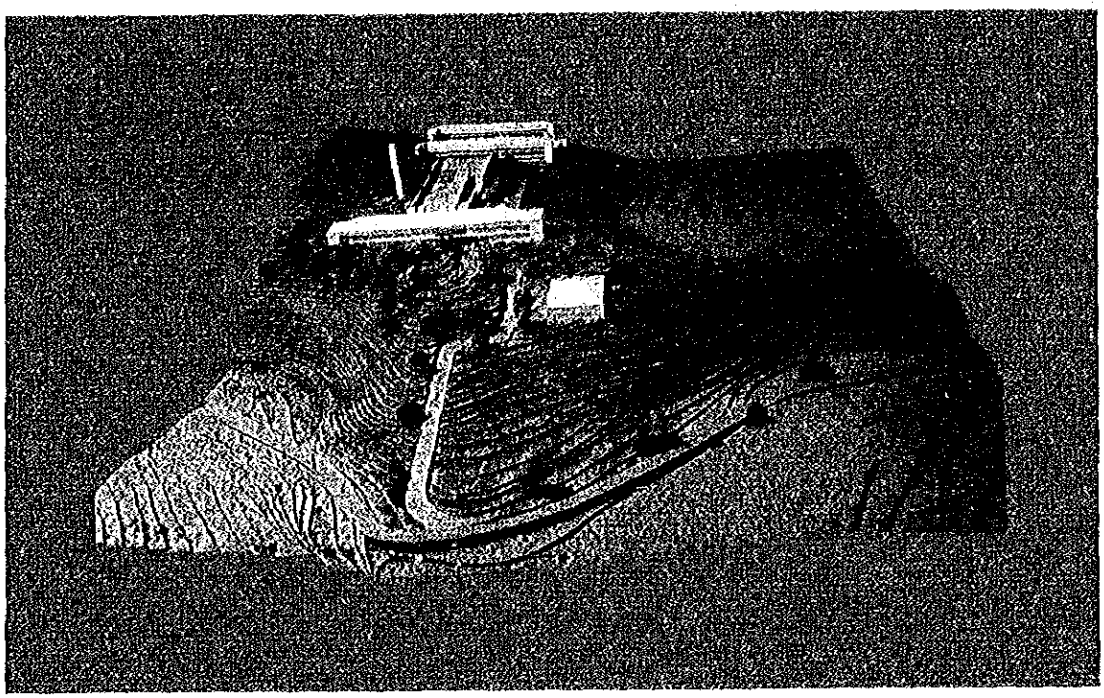
Model Erosion control work

LAKE PANTABANGAN

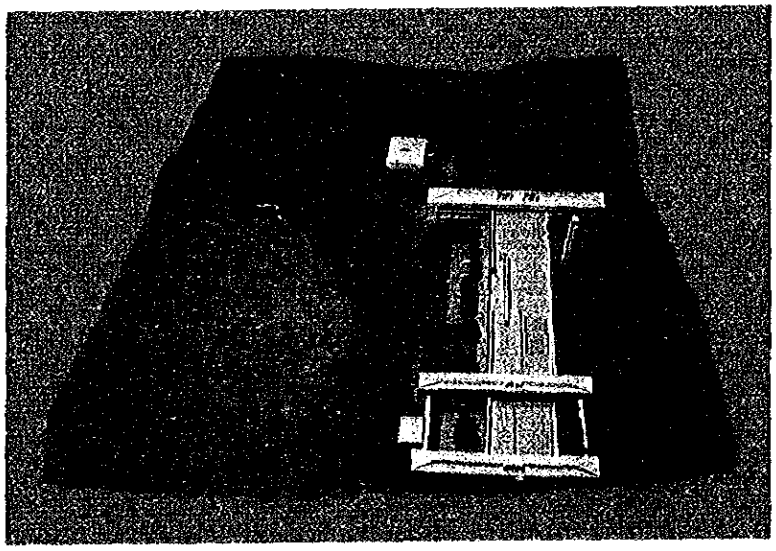
AandD

CONCEPTIONAL PICTURES OF BUILDINGS AT COMPLETION

(Mainbuilding and annex buildings of Training Center for Forest Conservation in Pantabangan)



View from the South



View from the North

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REPORT OF BASIC SURVEY ON TRAINING CENTER FOR FOREST CONSERVATION IN PANTABANGAN

1. SUMMARY

1-1. Back Ground and Transition

1-1-1. Inauguration of afforestation project

There are about 1,500,000 hectares of land in the Philippines where afforestation is required. In the country, afforestation has become a pressing issue from the point of view of continuously securing wood resources for the conservation of national land. To meet the requirements, the Japan International Cooperation Agency (JICA) has been conducting necessary surveys at the request of the Government of the Philippines since 1973. As a result, the grass land area on the upper reaches of the Pantabangan River has been selected as an area subject to the cooperation to be extended by Japan. It is the catchment area for a multi-purpose dam, the Pantabangan Dam, which is under construction with the funds loaned from the International Bank of Reconstruction and Development (World Bank); so the area will sway the function of the dam. On the basis of the results of the surveys, a technical cooperation project aimed at establishing the technology of afforestation in the area was launched in June, 1976.

1-1-2. Outbreak of great disasters and growing necessity erosion control technique

This area was greatly damaged by downpours in May 1976. The feasibility study for forestry development conducted between February and March 1977 has revealed that the damage suffered by the area subject to the cooperation is great and unless countermeasures are taken to reconstruct the damaged mountain areas, it will pose a great obstacle to the afforestation project.

Soil and sands from the damaged areas are polluting the water of the dam and are piling up at the bottom of the reservoir. There is a possibility that if the state is left as it is there will develop trouble with the function of the dam on which the Philippine Government

is placing great expectations as a source of water to the Luzon plains and for many other purposes.

The Government of the Philippines, therefore, asked the Government of Japan in June 1977, as follows to establish an afforestation center for the transfer and establishment of mountain conservation technology under the 1978 grant assistance project, and to this end to send a survey team.

> The Department of Foreign Affairs presents its compliments to the Embassy of Japan and has the honor to inquire into the possibility of the Government of Japan considering favorably the request of the Bureau of Forest Development (BFD) for assistance in the establishment of an RP-Japan Training Center.
>
> The project involves the training of Filipino foresters on forest managerial planning, including the preparation of various basic maps, forest mechanization, large-scale erosion control and the use of advanced machineries for both erosion and forest road construction.
>
> It may be mentioned that the request was taken up in the preliminary discussions between the officials of the BFD, Japan Forestry Agency and Japan International Cooperation Agency (JICA) in Tokyo on 23 April 1977.
>
> The Department avails itself of this opportunity to renew to the embassy the assurances of its highest consideration.
>
> Manila, 9 June 1977

1-2. Implementation of the Basic Design Survey

In response to the request by The Government of the Philippines, the JICA carried out a preliminary survey for basic design in August 1977, and implemented, through the two engineering firms (Forestry Engineering Consultants for Model Erosion Control Work, Satow Architects and Engineers for Main and Annex Buildings), the survey for basic design in October the same year (as shown in Figures 1 and 2). As a result of surveys and discussion on the objectives, scale and location of the afforestation

center, the JICA and the Philippine Government have agreed on the MINUTS (as shown in the following page) in principle on the basic objective of the center, and the share in the expenses of both sides.

The name of the center has been changed from the tentative Afforestation Center proposed by the Government of the Philippines to the Training Center for Forest Conservation in Pantabangan because the subject of training for the time being will be centered on erosion control and related problems.

Table 1-1 Member of Survey Team

1) Preliminary Survey for Basic Design

Name	In Charge	Occupation
Katsuhiro Kootari	Leader	Special Assistant to the President, JICA
Eio Shimokawa	Planning	Director of Planning Div. Forestry Agency, Ministry of Agriculture and Forestry
Ryoya Shimada	Erosion Control Plan	Deputy Director, Conservation Div. Forestry Agency, Ministry of Agriculture and Forestry
Yorio Tanimura	Planning Cooperation	Assistant Director, Second Economic Cooperation Division, Ministry of Foreign Affairs
Masakazu Kashio	Coordination	Staff of Forestry Development Cooperation Department, JICA

2) Survey for Basic Design

Name	In Charge	Occupation
Katsuhiro Kootari	General Leader	Special Assistant to the President, JICA
Ryoya Shimada	Leader	Deputy Director, Conservation Division Forestry Agency, Ministry of Agriculture and Forestry
Iwasuke Yamaguchi	Erosion Control Design	Director, Second Erosion Control Div. Forestry Engineering Consultants
Shunji Kudoo	Erosion Control	Deputy Chief, Erosion Control Div. Forestry Engineering Consultants
Masaharu Konno	Forest Civil Engineering	Deputy Chief, Forest Road Div. Maebashi Branch Office, Forestry Engineering Consultants

Name	In Charge	Occupation
Shun Yoneda	Forest Civil Engineering	Engineer, Forest Road Div., Hokkaido Branch Office, Forestry Engineering Consultants
Masayuki Toojoo	-do-	Engineer, Forest Road Div., Hokkaido Branch Office, Forestry Engineering Consultants
Kunihiro Kono	Architecture	Director, Planning Dept., Satow Architects and Engineers
Masaru Oono	-do-	Staff, Planning Dept., Satow Architects and Engineers
Norio Goto	Coordination	Staff, Planning Div., Planning, Survey and Coordination Dept. JICA
Keiji Iimura	Planning	Second Economic Cooperation Division, Ministry of Foreign Affairs

Table 1-2 Survey Itinerary

1) Preliminary Survey for Basic Design

August 3 Tokyo - Manila

4, 5 Meeting with parties concerned

6, 9 Preliminary survey at the site

10, 12 Meeting with parties concerned

13 Manila - Tokyo

2) Survey for Basic Design

September 26 Tokyo - Manila

27, 28 Data gathering in Manila; meetings with parties concerned

29 (Forest conservation and civil engineering group) Visit to the site

October 3		(Construction group) Visit to the site
13	Rough design	Rough design
16	↓	↓
17	Discussion among survey team members	
18	Consultations with Philippine officials on designs and expenses to be shared	
22	Manila - Tokyo	

MINUTES OF THE CONSTRUCTION PROGRAM
OF THE TRAINING CENTER FOR FOREST
CONSERVATION IN PANTABANGAN, NUEVA ECIJA
THE REPUBLIC OF THE PHILIPPINES

At the request of the Government of the Philippines for assistance in establishing the Training Center for Forest Conservation in Pantabangan, Nueva Ecija (hereinafter referred to as "The Center"), the Government of Japan through Japan International Cooperation Agency (hereinafter referred to as "JICA") has sent a preliminary survey team headed by Mr. Katsuhiro KOHTARI, Special Assistant to the President of JICA, to conduct a basic design survey on the program for twenty-seven days from September 26, 1977.

The team held a series of discussions and exchanged views with the Philippine Authorities concerned on the construction and establishment of the Center.

Final Draft Report will be expected to be submitted to the Philippine Authorities in February, 1978.

As a result of the survey and discussions both parties have agreed to recommend to their respective Governments to take the necessary measures toward establishing the Center. Minutes of the discussions are attached herewith.

21 October 1977
Manila, Philippines

K. Kotari

MR. KATSUHIRO KOHTARI
Team Leader
The Japanese Survey Team

MR. EDMUNDO V. CORTES
Director
Bureau of Forest Development

M I N U T E S

1. The proposed Center will be established in Pantabangan, Nueva Ecija.

2. The objectives of the Center are to provide theoretical and practical training for forestry technicians and foresters who will be contributing their knowledge and techniques acquired through the training to the forest conservation especially in Pantabangan area.

3. The Center will consist of main building, annex buildings, dormitory and housing and model erosion control facilities aiming at training a maximum of twenty (20) trainees at a time as projected in Annex I.

4. The Government of Japan will take necessary measures to provide such buildings and facilities of the Center as listed in Annex II.

5. The Government of the Republic of the Philippines will take necessary measures to provide such items listed in Annex III.

ANNEX I

Training Plan

(1) Training courses

Ordinary courses (from the 1st year)

	Duration	Trainees
Erosion control course	6 mos.	15
Operation course	1 mo.	5

Senior courses (from the 2nd year or 3rd year)

	Duration	Trainees
Erosion control course	1 yr.	5
(General Course)	0.5 mo.	15-20

(2) Training subjects

Erosion control engineering
Erosion control planning
Design of erosion control facilities
Construction and maintenance of erosion control facilities
Afforestation for erosion control
Mechanization for construction of erosion control facilities

ANNEX II

Buildings and Model facilities for training to be provided by the Government of Japan

1. Buildings

Main Building

A. Administration office
B. Lecture rooms
C. Instructor's rooms
D. Conference room
E. Drafting room
F. Library

Annex Building

A. Workshop
B. Garage
C. Concrete and Soil Testing Laboratory
D. Machinery Store

Dormitory

A. Dining room
B. Lobby
C. Kitchen

Housing

A. Housing for Instructors
B. Housing for Staffs

2. Model Facilities for Training

1. Facilities for water flow survey
2. Facilities for stream controls
3. Facilities for hillside works

ANNEX III

Items whose costs should be borne by the Republic of the Philippines

1. Infrastructures

a. Site preparation
b. Power supply
c. Water supply
d. Drainage and sewage
e. Landscaping
f. Parking lots
g. Furnitures, rugs and drapes

2. Access road construction work

a. Access road to model site

1-3. Program to Establish the Training Center for Forest Conservation in Pantabangan

The objective, scale and other details of the Training Center for Forest Conservation in Pantabangan reached after the surveys and discussion by the JICA are as follows.

1-3-1. Objectives

This training Center for Forest Conservation in Pantabangan is to be established as a training facility designed to have Philippine forestry technicians and foresters acquire Japan's erosion control techniques intensively and practically and acquire knowledge of designing forest conservation measures, to foster able technical leaders and to smoothly and completely absorb Japanese erosion control technology --- all in order to reconstruct the heavily damaged mountain areas in Pantabangan so that a great obstacle to a full-scale afforestation in the areas can be eliminated.

For this purpose, it is indispensable to build an outdoor model erosion control work for practical studies and a machinery practice facility (concurrently to serve as a repair shop) and furnish with a soil quality and concrete study room, a facility for examining waters and other facilities and instruments to collect and analyze basic data necessary for formulating erosion control programs, not to mention proving the trainees with study programs, thereby helping the Center function like an erosion control technology center.

1-3-2. Site for the Training Center

The water and power supply, transport convenience, the difficulty of construction of the buildings and other factors have been studied in selecting the site for the Training Center. As shown in the separate figure, the government-owned land in Baluarte located about two kilometers away from Carranglan which is the central village in the upper reaches of the Pantabangan is considered best suited for constructing the Center. Adjoining the nursery of R P - Japan technical cooperation project, it is hilly grass land facing east, and about three hectares of the land is suited for building the training facilities.

As for water, to which the utmost consideration should be given, the level of underground water is considerably high and easy to pump up. Power supply will be available from the Pantabangan dam which will start supplying power shortly.

It is located in the center of land where R.P. Japan technical cooperation project is planning to carry out afforestation. Adjoining the 44th and 45th forests which were hard hit by the downpours, the projected site is convenient for the trainees' outdoor studies and for using the training center as the facility to manage erosion control work in the future.

1-3-3. Training program

The Government of the Philippines wishes to train as many technicians as possible in the shortest period of time possible. It also wants to provide the trainees with knowledge about forest conservation using human power as well as that incorporating machinery.

Taking into consideration these requirements, the following training programs have been worked out so that the trainees can acquire the skill of handling machines and develop the capacity of guiding and supervising the simple way of carrying out the forest conservation using human power. The programs also are designed to develop technicians with the ability of formulating erosion control plans and of drafting detailed designs of the conservation plans.

Table 1-3 Training courses, etc.

Courses		Duration	No. of trainees each time	Remarks
Erosion control course	To develop erosion control technicians	6 months	15	From the 1st year
Operation course	To train machine and instrument operators	1 month	5	"
Advanced erosion control course	Selected from among those completing the erosion control course; designed to develop instructor	12 months	5	After second year

Courses		Duration	No. of trainees each time	Remarks
Ordinary course	For chiefs of district forest offices	0.5 month	15 - 20	After second year

2. Subjects of training (including practical exercises)

Subjects		Course	Duration	Remarks
Erosion control facilities	(1) Methods for erosion control plans	Erosion control course	20	Includes geology
	(2) Methods for designing and operation management	"	60	Includes basic mathematics, applied mechanics, surveying and drawing and forest hydrology
	(3) Methods for afforestation for erosion control	"	6	
	(4) Methods of operation	Erosion control course; operation course	20	
Forest working	(5) Forest environment	"	3	Includes soil study
	(6) Forest management	"	3	
	(7) Forest protection	"	3	
	(8) Nursery practice	"	3	

3. Number of instructors

Subjects	Number of lecturers	Remarks
(1) Methods for erosion control planning (excluding geology)	1	

Subjects	Number of lecturers	Remarks
(2) Methods for designing and operation management	2	Assistant 1 Short-term expart 1
(3) Methods of operation	2	Assistant 2 Short-term expart 2
(4) Methods of afforestation for erosion control (5) forest environment (6) - (8)	1	
Total	6	

1-3-4. Summary of basic design of main building and annex building, etc.

1-3-4-1. Planning of facilities

(1) Site planning

The Training Center is made up of the main training center building, the repairing practice workshop, and the housing accommodations.

The activities pattern of this Center is separated of the day and of the night.

In the day time, the instructors and trainees will be working at the day zone, south half of the site, toward the evening they will move down to north, where is a night activity zone as the housing accommodations.

Between those zones, there is a communication space which is called a Plaza for the Center.

(2) Architectural planning

The main building (the floor area is 1,151.8 M^2) includes the educational and training functions (Major & Minor Lecture Rooms, Drafting Rooms, Library).

Laboratories (Soil & Concrete Testing Rooms and Stores), and Administration Functions (Director's Room, Vice Director's Room, Office, Reception, Conferences,

Instructors' Room, Wash Rooms and Storage).

The Housing Blocks (1,500.9 M^2) includes each compartments (Trainees' Room, Instructors' Room, Staff ' Room, Service Men's Room and Guest House) and Service Functions (Dining Hall, Lobby, etc.)

The Repairing practice workshop (504,1 M^2) includes a Repair Shop, Garage, Storage and so on.

Totaled floor area is 3,156.8 M^2.

(3) Mechanical and electrical planning

The library, office, instructors' room and the housing block have their own private cooling system, but any room has no heating system.

1-3-4-2. Cost estimation

Conditions of cost estimation are as follows.

1) The construction is to be done in accordance with grant aid base.

2) The construction period is in the account for the '78th fiscal year.

3) According to the Minutes (of Oct. 1977), the Philippine side is responsible for the items which are concerned with construction preparations.

4) Other conditions

i) Construction is to be done by Japanese company.

ii) Materials are of Japanese one and some Philippine one.

iii) Philippine labour

iv) Infrastructures cost (site preparation, access road, water supply, power supply, landscaping, and furniture, etc.) are to be excluded.

On these conditions, the total cost is estimated 570,000,000 yen, and it is detailed as follows:

Unit = 1,000 Yen

a) Building cost 436,513,000

i) Construction cost 369,786 (@115/m^2)

	Architectural work	Electrical work	Mechanical work	Total
Main Building	96,225	29,851	10,300	136,376
Reparing practice workshop	45,170	6,891	1,200	53,261
Housing block	135,071	20,378	24,700	180,149
Total	276,466	57,120	36,200	369,786

ii) Transportation cost 16,373

iii) Expenses necessary for experts' dispatch from Japan 14,312

iv) Expenditure

(i) + ii) + iii)) x 9 % 36,042

(i) + ii) + iii) + iv)) 436,513

b) Expenditure

i) Drawing & supervision cost 62,858

ii) Others 20,629

c) Equipment for laboratory work 50,000

PROJECT COST (i) + ii) + iii)) 570,000

1-3-4-3 Work planning

When materials be procured smoothly, there won't be heavy delays in the construction of the reinforced concrete building in the Philippines.

Total working schedule may take 12 months.

1-3-4-4 Infrastructure

Infrastructure as follows is to be prepared by The Government of the Philippines

Table 1-4

	Item	Specification	
o	Approach road	620m x 5.5 m	
o	Plaza	4,000 m^2	Lawn 2,000 m^2, some parts of cement tile 2,000 m^2
	Court	2,000 m^2	Lawn 800 m^2, some parts of cement tile 1,200 m^2
o	Retaining wall (1)	H = 4 m 130 m long	Exposed concrete, bushhammer finish
	(2)	H = 3 m 40 m long	"
o	Fire Reservoir (Swimming pool)	(W = 25 x 12 = 300 m^2 H = 1.2 - 1.5 m	Concrete, tile finish
o	Site preparation	15,000 m^2	-
o	Drainage (wasted water)	600 m	Conduit (fume pipe)
o	Exterior lighting	120 pcs	Landscaping lamp (40 W)
o	Equipment		
	Water supply	Capacity of tank Day consumption Main pipe Exterior piping	2 ton 10 ton D = 500 mm
	Drainage	Soil pipe	L = 500 m D = 250 mm
	Fire installation pressure pump	(near the water source)	

Equipment for Pool	Circulating filter installation
Septic	Capacity of tank for 40 persons B.O.D. 10 PPM
Electrical equipment	Capacity of transformer 200 KVA

1-3-5 Summary of basic design of model erosion control work, etc.

1-3-5-1 Outline of work plan

The model work is located in Toban Creek located in central part of devastated area neighboring the main building of training center. There, besides model erosion control work, two dams for stream gauging and sediment measurement are built to carry out routing investigation of forest influences on wash-out sand prevention, flood control and water conservation in tropical region. Erosion control work is in Bayabas Creek (stream and hillside works) and Ororo Creek (stream work), upstream of Toban Creek, is detailed as follows:

a) Check dams (ordinary dam) 11

Concrete dam for sand checking and stream gauging	2
Steel buttress dam	2
Concrete dam for ground sill	7

b) Hillside greening 1.0 ha

Concrete wall	5 (200 m)
Wire basket wall	4 (80 m)
Steel fence	4 (282 m)
Flume channel	2 (50 m)
Sod channel	3 (100 m)
Greenbelt simple step	2,000 m
Cogon simple step	2,000 m
Mat covering	1,400 m

Slope frame 1,400 m

Seed shooting 2,800 m^2

Grading 6,300 m^3

c) Access road 6,160 m

Width (total 4 m, effective 3 m)

Gravel road 6,160 m

Bridge (span 14 m)

1-3-5-2 Outline of work cost

According to the Minutes (Oct. 21, 1977) the Government of the Philippines bears the cost of access road to the Model Erssion Control site. Erosion control constructions are undertaken by Japanese side. Materials of steel and of those hard to be obtained in this region are imported from Japan. Labour, cement, timber, etc. are obtained in the region.

The working period is estimated to be nine months and outgo of Japanese side is expected to be put in the budget of 1978. Japanese engineering consultants are in charge of detailed design and supervisory services.

The total cost (excluding the access road) is estimated 230,000,000 Yen, and it is detailed as follows:

Table 1-5 Detail of Working Cost

Item	Type	Amount	Unit	Price	Sum
				Yen	1000 Yen
No. 1 gauging dam	Concrete	653.7	m^3	30,521	19,952
No. 1 sub dam	Concrete	91.8	"	31,019	2,848
No. 2 steel dam	Steel	25.601	t	464,922	
	buttress	265.63	m^3	29,500	19,738
No. 3 concrete dam	Concrete	522.0	m^3	26,794	13,986

Item	Type	Amount	Unit	Price	Sum
No. 4 - 8 Concrete dam	Concrete	1,150.0	m^3	29,177	33,554
No. 9 concrete dam	Concrete	249.0	m^3	28,168	7,031
No. 10 gauging dam	Concrete	191.2	m^3	32,027	6,123
No. 11 Steel dam	Steel buttress	9.05 11.88	t m^3	475,453 32,100	8,022
Sub-Total		11	Spot		111,254
Hillside Works	Hillside basic and greening	1.0	ha	37,029	37,029
TOTAL					148,283
Others	Design and supervision etc.	1.0	A complete set	81,717	81,717
GRAND TOTAL					230,000

Detail of Working Cost

(Rewrite)

(1,000 Yen)

Labour	34,864
Material and official	86,696
Cost of operation, etc.	26,723
Sub-total (Contract)	148,283
Others	81,717
Total	230,000

1-3-5-3 Course of work practice

Under the tropical climate structural work should be carried out in dry season (November - April) and greening work is

desirable to be carried out immediately before wet season (May - October).

Annual rainfall averages 2,040 mm, most of it being concentrated in wet season. These squall type rains have large intensities showing hourly maximum of 180 mm. Since large intensity means short duration, it is possible to practice considerable amount of work in wet season. But it must be remembered that there may happen one or two month extension of working period under unexpected rainfall condition. Effort is to be made to use labour in the region as much as possible.

As to heavy works such as excavation, cutting, heavy transportation, concrete mixing, etc. heavy equipments are planned to be used.

Technical instructions are necessary for control of work, quality and amounts of work done, etc. Therefore it is expected that government officials will join the field work for administrative and instructive connection and technical study.

1-3-5-4. Access road

This road is necessary for transportation of working materials, equipments and labors on establishment of model erosion control works and also in use as traffic road for tracing of gauging test and training of forest conservation, etc.

Therefore it should be built before starting of model erosion control works by Philippines in conformity with Minutes (Oct. 21, 1977).

The route was selected as shown in location map as a result of preliminary and actual survey.

The route starts from a point on the Provincial road 1.7 km south west of the site where the main building of the Training Center is to be established and comes to the end of center in model erosion control works, 54 th forest, and it is 6,160 m long.

Width	:	Total 4.0 m, effective 3.0 m
Vertical curve	:	Maximum 12 %
Radius of curve	:	Minimum 15 m

As a result of the above, 12 ton truck can pass.

Draining of steep slope against tropical squall is inevitable.

Totaling of work is as follows:

The earth works

Items		
	Earth cutting	33,544 m^3
	Soft rock cutting	13,051 m^3
	Banking	21,272 m^3
	Sod tamping	12,077 m^2
	Slope greening	19,669 m^2
	Gravel paving	3,679 m^3
	Route clearing	6,132 m
	Wire basket	324 pieces
	Concrete wall	516 m^3
	Frame	1,257 m^2
	Earth excavation	645 m^3
	Soft rock excavation	251 m^3

The channel

Items		
	Inlet	31 pieces
	Hume pipe ϕ 40 mm	108 pieces
	Corrugated pipe ϕ 60 mm	287 m
	Corrugated pipe ϕ 100 mm	72 m
	Corrugated pipe ϕ 120 mm	25 m

The bridge

Items -	H.B.B upper construction (steel)	13.8 ton
	Construction cost (truck-crane)	a complete set
	Scaffold	324 m^3
	Painting	a complete set
	Abutment concrete	55 m^3
	Frame	130 m^2
	Soft rock excavation	101 m^3

1-3-6 Machines and tools for training

A variety of machines and tools are necessary for the construction of various erosion control facilities. It is desired that the trainees master how to operate and maintain basic machines and can handle them with full confidence. To this end, it is required to furnish the machines listed in the following Table. The expense for these machines will total 250 million yen.

Table 1-6 Machines and Instruments for Training

Category	Items	Number	Price 1,000 yen
1. For forest conservation planning	1. Wheather observation apparatus		6,900
	° Pluviograph	6	
	° Thermo-Hygrograph	1	
	° Combined windvan and anemograph	1	
	° Jordan's sunshine recorder	4	
	° Actiongraph	2	
	° Water level recorder	3	
	2. Land survey instrument		3,100
	° Theodolite	5	
	° Tilting level	5	
	° Stereo scope	2	
	° Other measuring tools		

Category	Items	Number	Price 1,000 yen
	3. Instruments for geological survey		18,900
	° Slope failure detectors	1 set	
	° Inclino meter	1 set	
	° Water level recorder	1 set	
	° Earth registance tester	1 set	
	° Seismometer	1 set	
	° Drilling machine	1 set	
	° Cable crane		
	4. Instrument for soil survey		8,400
	° PH meter	1	
	° CHN corder	1	
	° Atomic absorption/flame spectrophotometer	1	
	° Flask shaker	1	
2. For forest conservation working	5. Excavators		72,000
	° Bulldozer (12 ton)	2	
	° Dozer shovel ($1.5\ m^3$ shovel)	2	
	° Power shovel ($0.2 \sim 0.55\ m^3$ shovel)	1	
	° Wheel shovel roader ($1.4\ m^3$ shovel)	2	
	6. Concrete work machines		29,800
	° Concrete mixer truck ($3.2\ m^3$ mixer)	1	
	° Concrete pump car	1	
	° Air compresser	1	
	° Rock drill	1 set	
	7. Concrete working tools		13,900
	° Vibrator	5	
	° Underwater sand pump	1	
	° Portable generator	1	
	° Metal form	1 set	
	° Wood form	1 set	
	° Concrete test instruments	1 set	
3. Other Instruments	8. Transportation of material		22,500
	° Dump truck (5 ton)	2	
	° Dump truck (10 ton)	2	
	° Belt conveyer	4	
	°		
	9. Securing aggregate		13,000
	° Raw concrete aggregate plant	1 set	

Category	Items	Number	Price 1,000 yen
	10. Transportation of trainees and workers		13,400
	° Micro bus (26 persons)	1	
	° Truck (11 ton)	1	
	11. Hand tools		1,600
	° Pickax		
	° Scoop		
	° Wheel barrow		
	° Hoe		
	12. Teaching materials		5,000
	° Copying machines	1	
	° Movie projector	1	
	° Video taperecorder	1 set	
	° Movie film	1 set	
	13. Machine repair tools		5,400
	° Wrench set		
	° Driver set		
	° Hammer set		
	° Nipper		
	° Tools for measuring		
	° Vice		
	° Drill		
	° Electric grinder		
	° Welding set		
	° Other necessary tools for machine repairing		
	14. Emergency Generator		35,000
Total			250,000

1-3-7 Total Cost

The estimated cost to be borne by Japan may total 1,050 million yen.

Details are as follows

Unit = million yen

Main building and annex building, etc.	570
Model erosion control works, etc.	230
Machines and tools for training	250
Total	1,050

2. BASIC DESIGN OF MAIN BUILDING AND ANNEX BUILDINGS, ETC.

2-1. Site Planning Study

2-1-1 Basic idea

The site planning considerations are;

a) The landscaping should have the coordination with the surrounding environment.

b) The minimum excavation and preservation of the existing trees.

c) The totalization of the three functional groups which are training function, exercise function,and housing accommodations.

d) The climatological adaptation of the buildings to the site is especially from the point of view of cross ventilation and the solar radiational protections. Above those four items were taken into account, and the site planning was composed of three stand points. The first is zonings, the second is transportations, the third one is landscapings.

The followings are the outline of the those three points.

- Zoning --------- the total functions of the Training Center were studied and grouped and then superimposed on the proposed site.
- Transportation ---the superimposed functions to the site have to have connections by means of such the transportations systems, as traffics, mechanical and electrical services.
- Landscape---------the spaces composed have to be coordinated to match with the environment of surroundings.

2-1-2 Zoning for functional groups

This zoning plan was proceeded as an almost plane functional pattern of the structures (The three building blocks are located in each three zone).

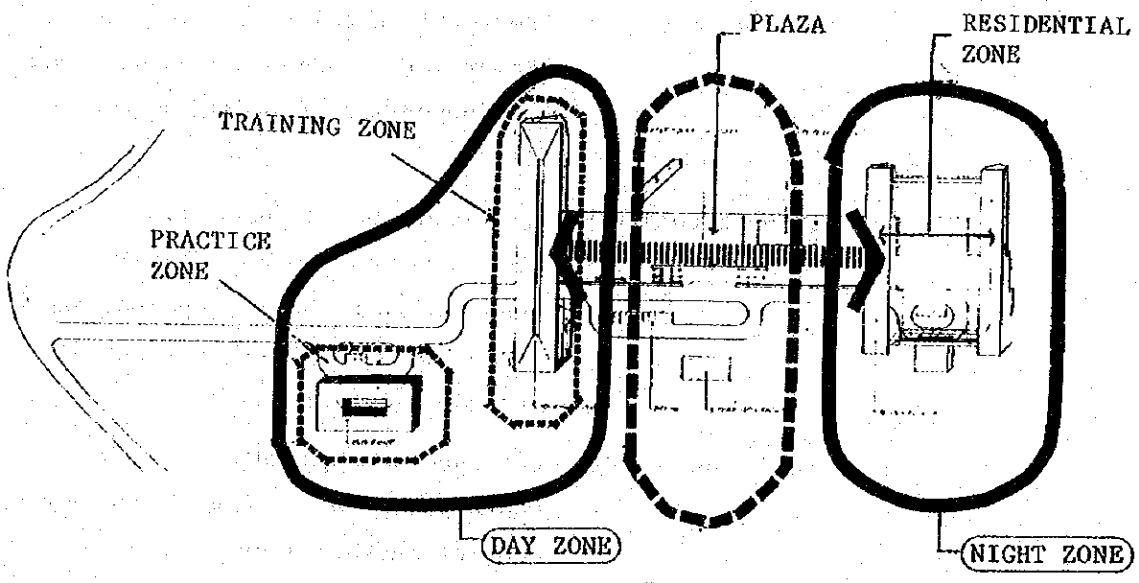
a) The training zone has the main buildings for teaching and exercise activities.

b) The repairing practice workshop is located in the practice zone where the operation of machinery and repair exercise is expected.

c) Housing accommodation block is located in the residential zone.

The former two zones a) and b)), the training and practise zones, are grouped as a day-zone, and residential zone is called as a night-zone. The day zone has higher activity pattern, in the south side of the site where come the machinery, automotives, and some material, for training and living.

The residential zone in the north which is separated from the day-time activities can have the more privacy.



(Plaza)

The isolated community as this training center, has to have the totalized communication spaces by all means. The plaza located between the day zone and the night zone should have the most important function as of urban communications.

2-1-3. Transportations system

The transportation plan of this project is very important. The low rise of buildings are spreaded in the wide area, so the connection is everything for the totalization of the training center as a total facility. Systems composed of the persons, cars, water, energy, and the information flows have to be sophisticated based on the total planning, engineering, and cost ideas. The following four systems are major components of total transportation systems.

Traffics system (persons, cars, goods)

Water systems

Energy systems

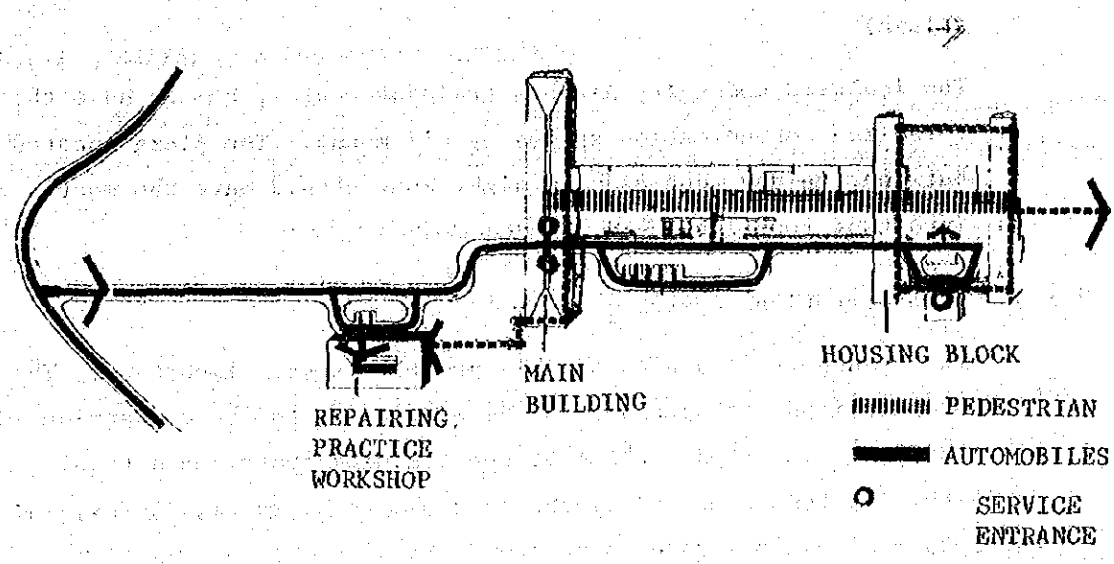
Information systems

a) Traffic flow systems (persons, cars, goods)

[Persons] ---- The people moves on the plaza between the day-zone and the night-zone probably several times in a day. Where should be the more for the residents to meet and communicate each other.

[Cars] ---- As almost all transportations to the site depend on the cars, so the automobile traffics had better to be separated from the pedestrian traffics, with the system as similar as cul-de-sac system.

[Goods flow system] ---- The experimental and exercise materials, foods and other supplies are coming along the approach road, so the large quantity of goods and heavy traffics to be treated better near from the entrance.



b) Water flow system

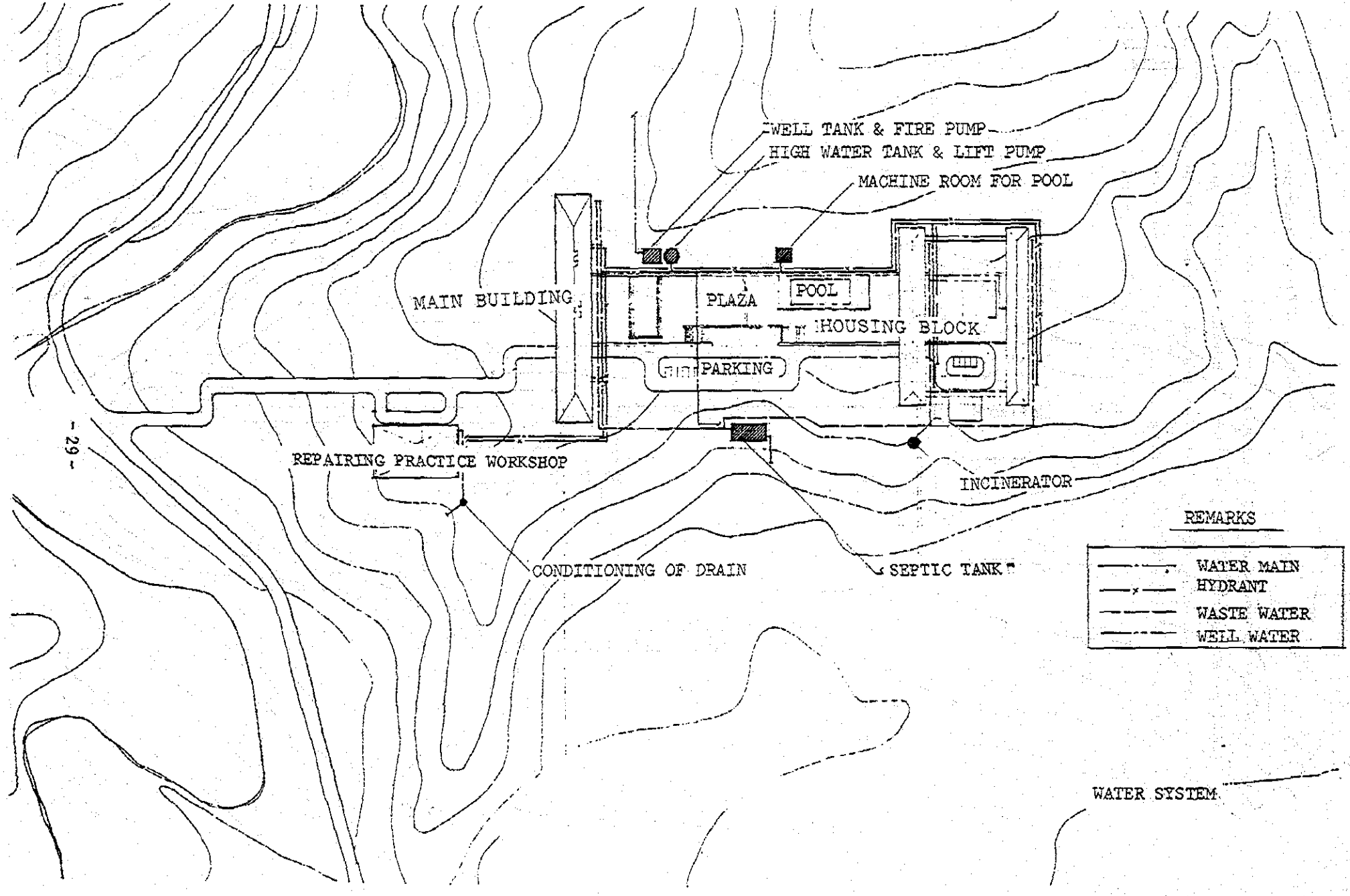
[Water supply] ---- The water resource may be the deep well. The water is to be treated and pumped up to the high tank to get the pressure and will be supplied to each facility.

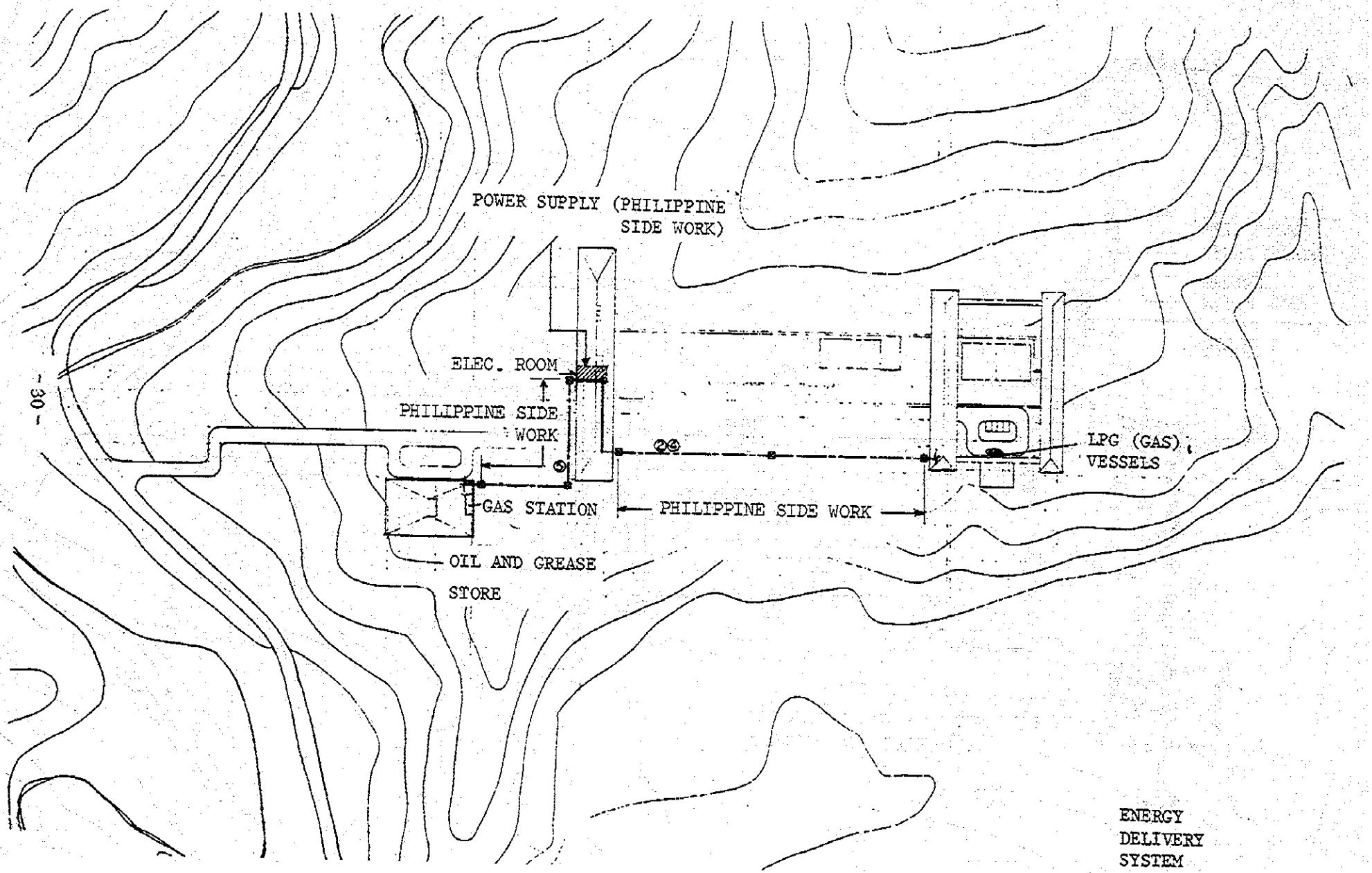
well — reservoir — sanitation — water tank — supply

[Waste water] ---- The rainy drainage - storm line, isn't planned as it will be able to depend on the natural environment surroundings. The waste water system from housing accommodations and from the dining kitchen and other wash rooms are planned to be collected at the septic tanks and treated not to make the excess impact load to the existing environmental ecosystem.

c) Energy delivery system

The electricity, kerosene, other petroleum fuels and some gas can be supplied to the site. Among those the electric power line is said to come up to the nearest community of Baluarte area in the very near future, so there may be a chance to have extension to this site where voltage of the power line is less than 7,200 V, so the transformation and the break down in the facility is easier, which connection will be under the plaza and along the road.


WELL TANK & FIRE PUMP
HIGH WATER TANK & LIFT PUMP
MACHINE ROOM FOR POOL
MAIN BUILDING
PLAZA
POOL
HOUSING BLOCK
PARKING
REPAIRING PRACTICE WORKSHOP
INCINERATOR
CONDITIONING OF DRAIN
SEPTIC TANK
REMARKS
WATER MAIN
HYDRANT
WASTE WATER
WELL WATER
WATER SYSTEM



ENERGY DELIVERY SYSTEM

d) Information flow system

There is no chance for this facility to connect with any existing telephone exchange. However, the wireless transmitting substation is expected to have, and can make the communication between the Center and the nearest District Forest Office. The internal communication will depend on the intercom system.

2-1-4. Landscaping

The all facilities have to be planned considering visual aspect as well as functional and engineering points of view. The landscaping should be considered from the every standpoints, not only inside the facilities but also outside the site. Those have been studied as followings.

a) The views from the approach road and the nearby facilities. The proposed site is located on top of a small hill, so any structure on the site can be a landmark. Especially from the nearest villages and approach road, the Center structure should be nice to look, besides the characteristic of this center can be the symbol structure for the afforestation project in this Pantabangan area, so the scale of structure here has been decided better to be with some urban scales.

b) Views from Plaza

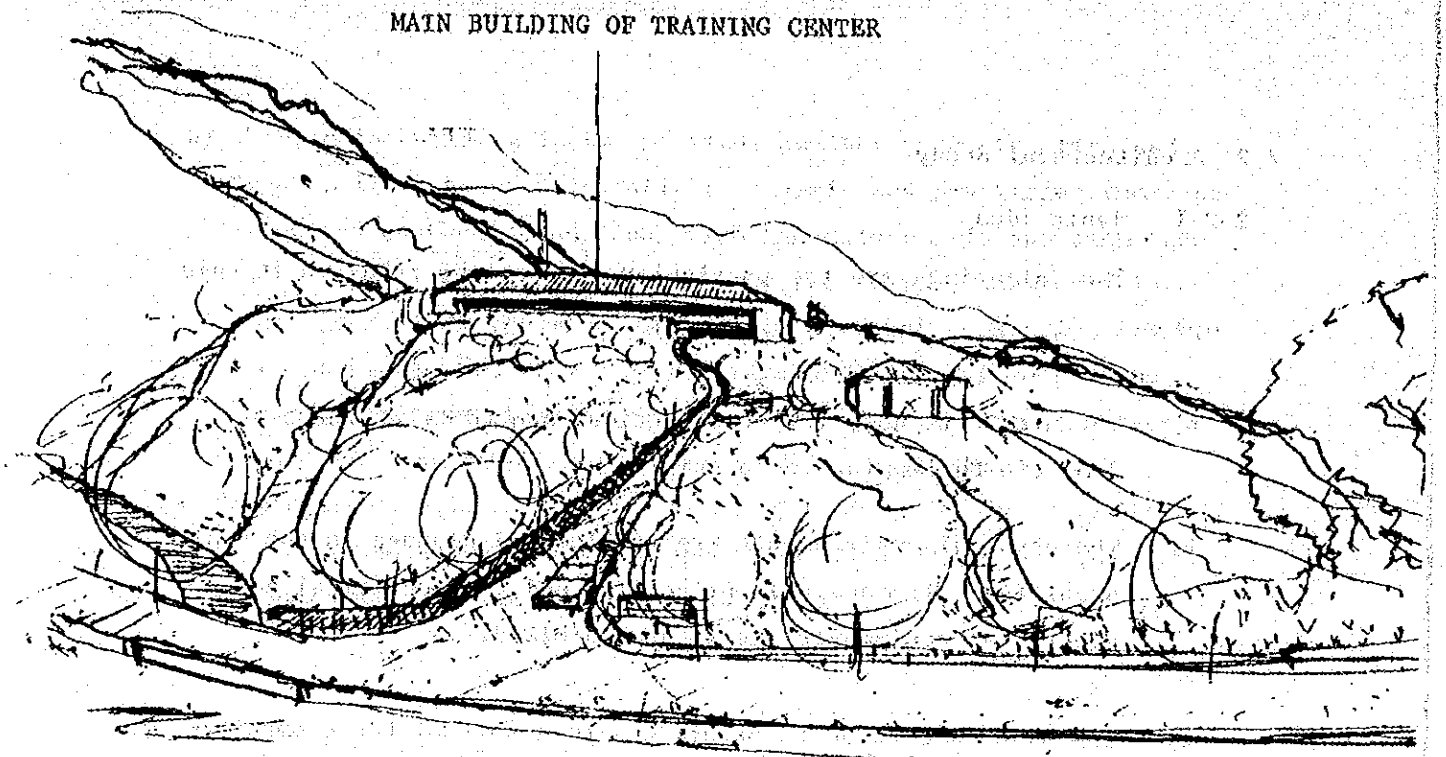
This small plaza provides many chances to communicate between each other people, people and objects, people and natures. The communication space with a human scale where is enclosed with the low structures of buildings and retaining walls, like the Agora in an ancient Acropolis, can be expected here, to have the amenity.

c) Views from inside the facilities

The fantastic east side landscaping is also planned to be taken into the dining hall. The main building has a view of a small hill in front and the approach road in front, the housing accommodation blocks through behind the plaza for the more total and visual administration.

The housing accommodation blocks have their own small court within, as the visual communication media, where the residents can have the more chances to talk, to play sports and dances and so on.

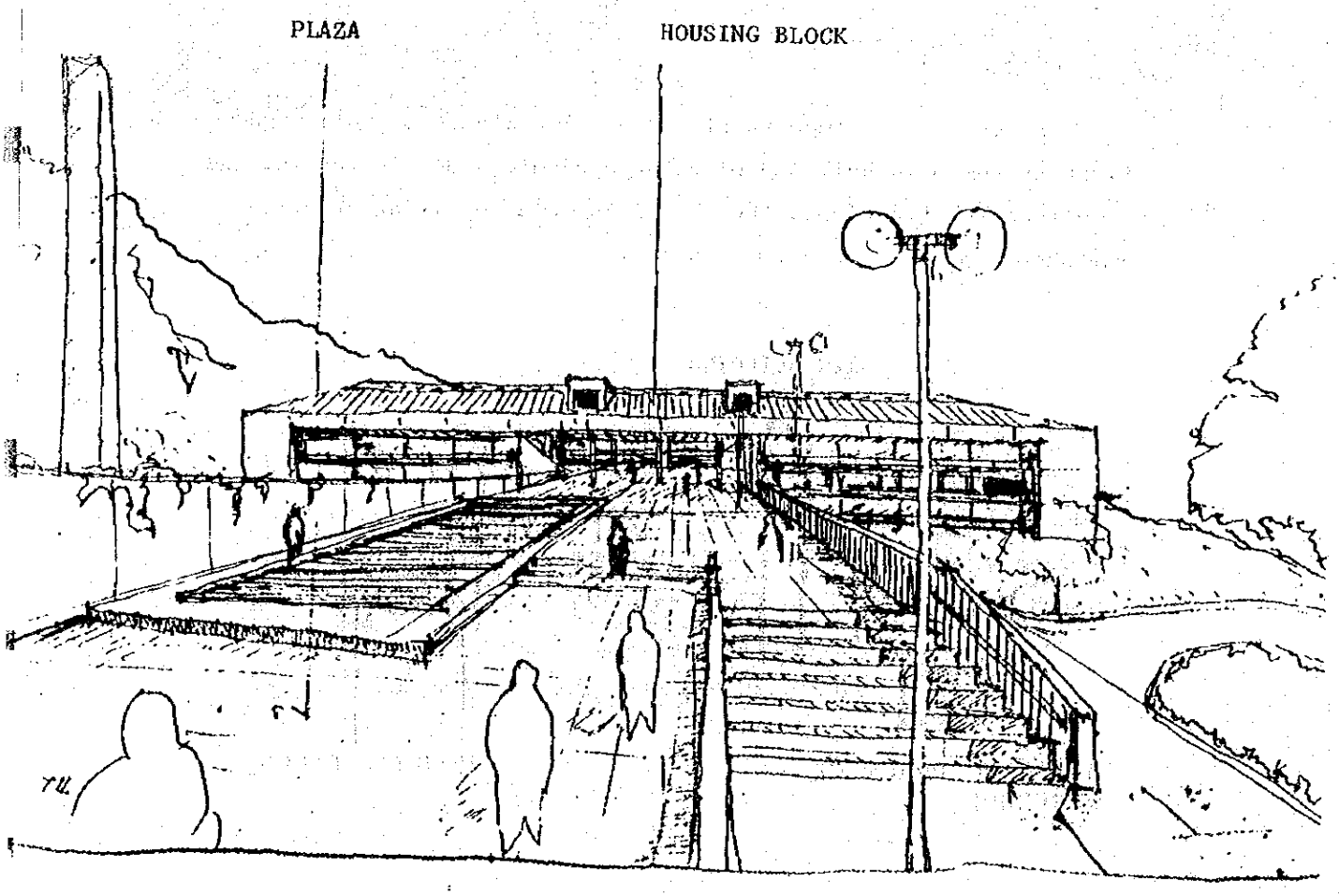
MAIN BUILDING OF TRAINING CENTER



VIEW FROM THE ROAD

PLAZA

HOUSING BLOCK



2-2 Architectural Study

2-2-1. Basic idea

The followings are the particular items to be retained in this plan.

a) The materials used for constructions are to be as those of domestic Philippines as possible.

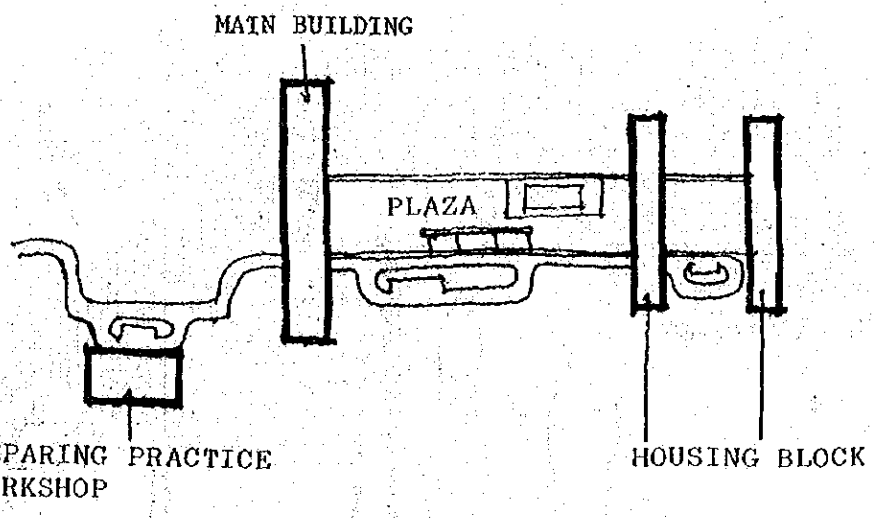
b) The physical environments are studied and planned as the basic architectural concern in principle, and the mechanical and electrical equipments are to be minimized.

c) The plans are to be cooperative with a sort of the community development in the area at the same time.

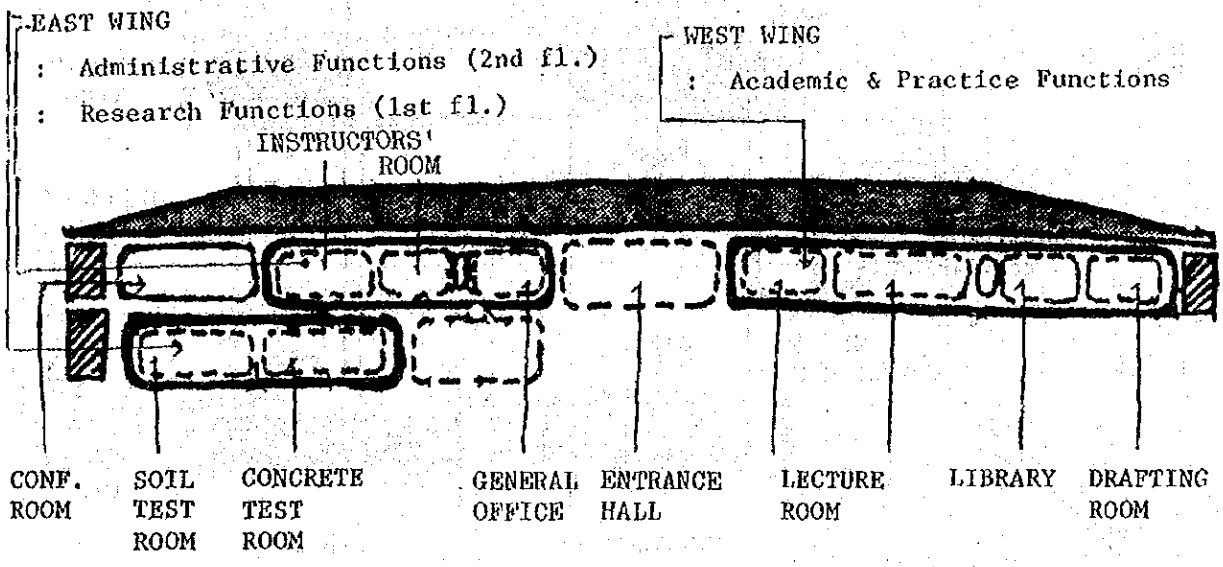
d) The scale and dimensions for spaces and for the material are to have the Philippine domestic ones and based on the national standards.

2-2-2. Spaces

The center is composed of three major blocks of buildings, which first is the main building with the academic, administrative, and some research functions, the second to be a repairing practice workshop, and the third for housing.

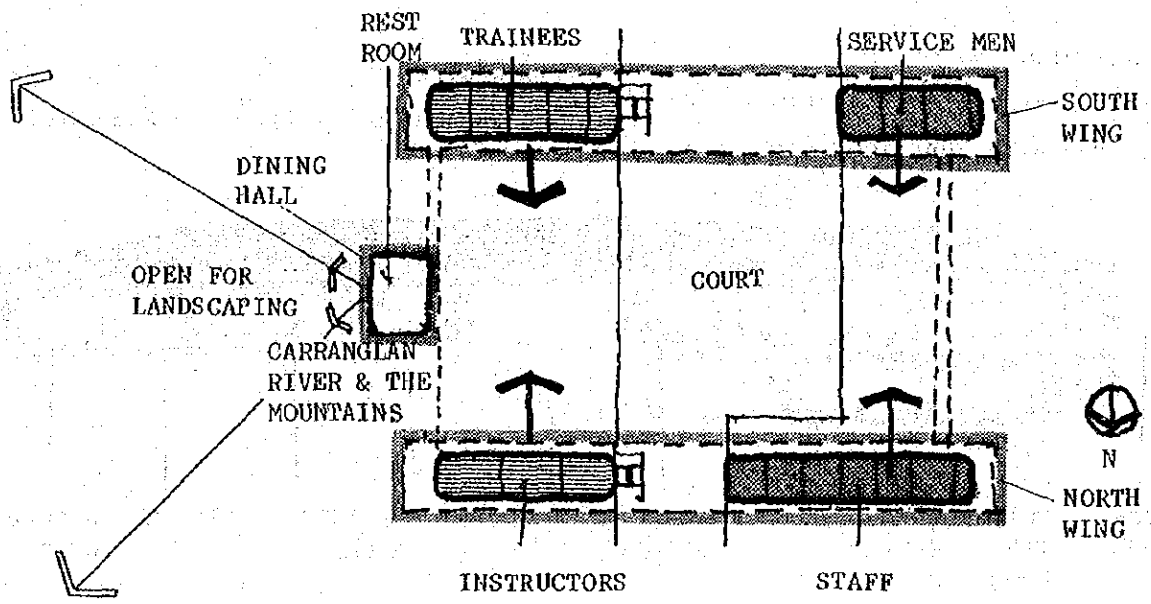


a) The main building is two-storied, and the major function and space like the administrative, academic and practicing rooms are located on the second floor with the direct main approach from the Plaza. The lecture rooms, and the library and the related are located on the west wing, kept in enough separation for the noise protection from the repairing practice workshop. The administrative wings as the director and vice-director private offices, general office, instructors' preparation room, conference rooms, etc. are on the east wing of the same floor. The research functions and spaces as the soil-test room, concrete-test room and the related are on the first floor east.



b) The repairing practice workshop block, housing the garages for the construction machinery, fuel and oil storage, apart from the main building and housing accommodations, for the noise and welding flash protection. The repairing practice workshop are expected to be used at the same time for the trainees' exercising easy manual techniques and learning how to operate or to maintain the machinery.

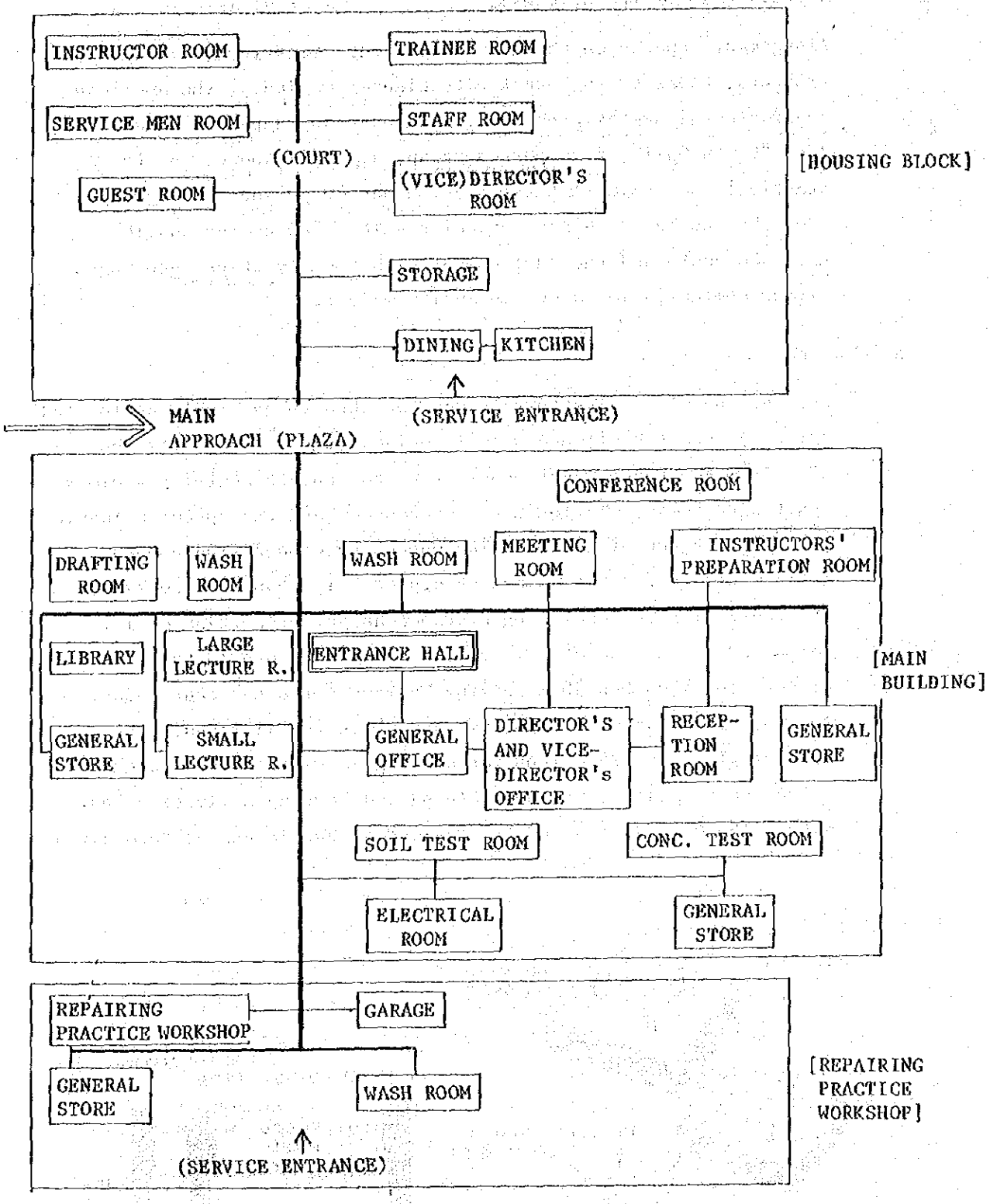
c) The housing accommodation blocks are composed of three buildings, the south wing, the north wing and the dining hall. The trainees' and the service men's compartments are in the south wing. The instructors' and staffs' are in the north wing for more privacy. The dining hall is planned as for the central services to all personnel, and is located open toward the east with fantastic landscape in the middle of the two wings and open to the court behind the west. The court and the dining hall are expected to work together to provide the indoor and the outdoor communication chances among trainees, instructors, staff and others, day and night or even when rainy days all year around.



2-2-3. Personnel movement

The three groups of personnel are supposed to move for their own particular purposes and time, whose first is to be the trainees and instructors attending the lecture, exercising works, returning to their own rooms and so on, the second to be the instructors and staffs for teaching and administrating purposes, the third to be the service men maintaining and carrying goods to supply fuel, foods, tools, stationery and so on.

ORGANIZATION OF THE FACILITY



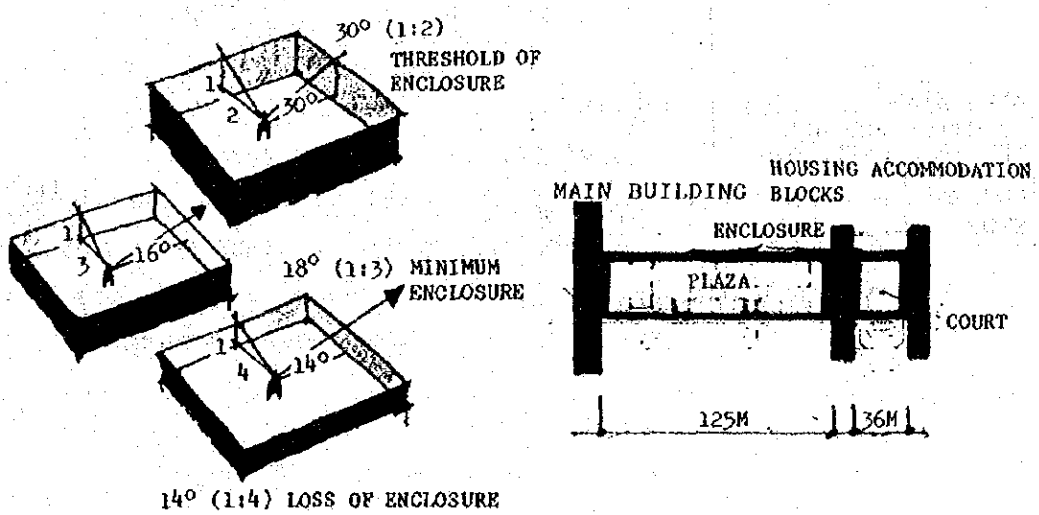
2-2-4. Spaces for the community

2-2-4-1. Basic unit of the community

Among many reports on the community study, research and trial projects, those by the Greek city planner Doxiades, the American environmental system planner C. Alexander and Japanese domestic idea "Gonin-Gumi", five-person group, are well known. As the practical idea said in these days, about 40 persons of a group can make the better basic community unit. The center should have the scale and the environment with amenity which encourages closer communication among community member.

2-2-4-2. Community spaces

The spacing of architectural blocks or structures should be located not only from the climatological engineering point of view, but also from the space ideas considering the environmental psycology dealt with human relationship with contact and the space enclosure produsd a sence of relief. The spaces have been studied and defined with the urban community spaces. The housing blocks have the court with the enclosing distance-height proportion of 1 : 3 north and south, and of 1 : 2.5 east-west as shown in the diagram and also has 36 M spacing between north and south wing, for the better natural lightings and cross ventilations. The central plaza is 125 M long for spacing as of the good enough urban scale to separate the training and housing activities, but within 135 M long in which the motions of people can be recognized.



2-2-5. Buildings

2-2-5-1. Main building

<First floor>

The soil and concrete testing room are next door each other, and the foundation for testing equipments are isolated for protection from the test vibrations and noise transmissions through the architectural structures.

<Second floor>

Two lecture rooms are located here, which major one can be used for a joint class of all trainees, however can be divided when may be required for two more smaller groups for the seminars. The ceiling height is about 4.5 M and provided for the future audiovisual facilities. The library is small but good enough for such particular field of books and resources to stock and with some space for reading. The drafting room is naturally lighted from north windows and from the roof top. The administration office is located at the center of main building which can keep controls and maintenances of all facility. The entrance hall is expected as a central social communication space, and the display space at the same time.

2-2-5-2. Repairing practice workshop

The repair shop here is noisy while motor vehcles are operated and repairing is done, so the garages and fuel store should be planned in this block. The ceiling here is planned to be high for better ventilation as the work room. And it is naturally lighted with ventilation openings or the roof top. The enclosings for the noise leakage protection and the opening for the lighting and ventilation is incompatible. However, the spacing of building location and the directions of openings, as the windows and top lightings can make the problem solvable. The material storage for services related to the repairing practice workshop is located near the workshop.

2-2-5-3. Housing block

The housing compartments have been prepared as followings.

[Trainees] 2 personnels - 10 rooms
(with shower and lavatory) (14 m^2/unit)

[Instructors] 1 personnel - 6 rooms
(with bath, shower, and lavatory) (35 m^2/unit)

[Staffs and assistant instructors]

1 personnel - { 6 rooms for Instructors
3 rooms for Assistant instructors.

(with shower and lavatory) (28 m^2/unit)

[Director's, Vice-director's and Guests']

1 personnel - each room.
(with bath, shower and lavatory) (35 m^2/unit)

[Service men's] 2 personnels - 3 rooms
(with shower and lavatory) (14 m^2/unit)

The dining hall located toward east, with an outstanding landscape, can be also used for such multipurpose as the lounge in the night-zone.

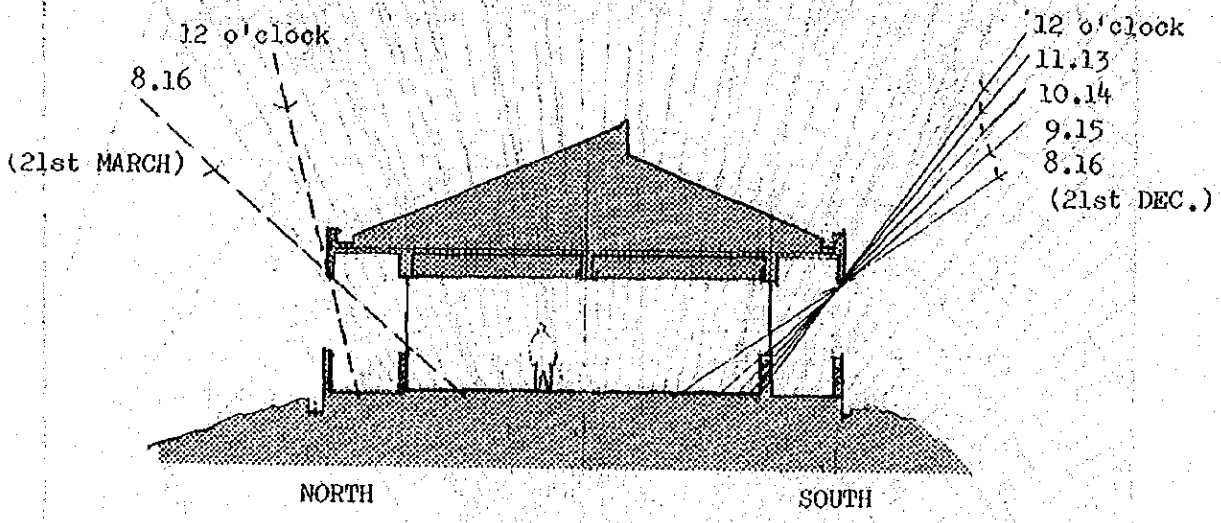
2-2-6. Physical environment controls

The climatological character here is very high temperature and is heavy moisture especially in rainy season, besides which lasts almost half a year. The environmental control idea, against the climate here, should be based on architectural techniques first and the manmade environment techniques as mechanical and electrical engineerings to be succeeded from the maintenance point of view and also for the energy conservation.

2-2-6-1. Sun radiation

The project site is located about 15 degree north on the latitude, so the orientation of buildings is of east and west axis for all year round protection from the strong solar radiation, especially when sun rise and down here. The thick controlled wall is plan-

ned to be installed on the east and west ends of buildings. (See the diagrams following)

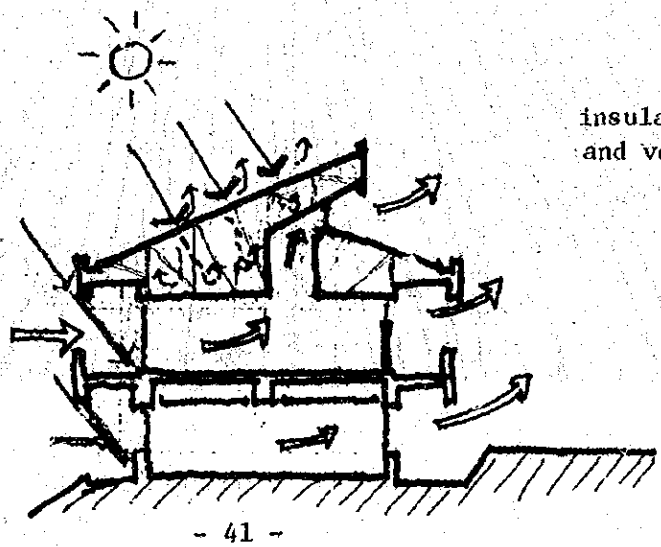


2-2-6-2. Cross ventilations

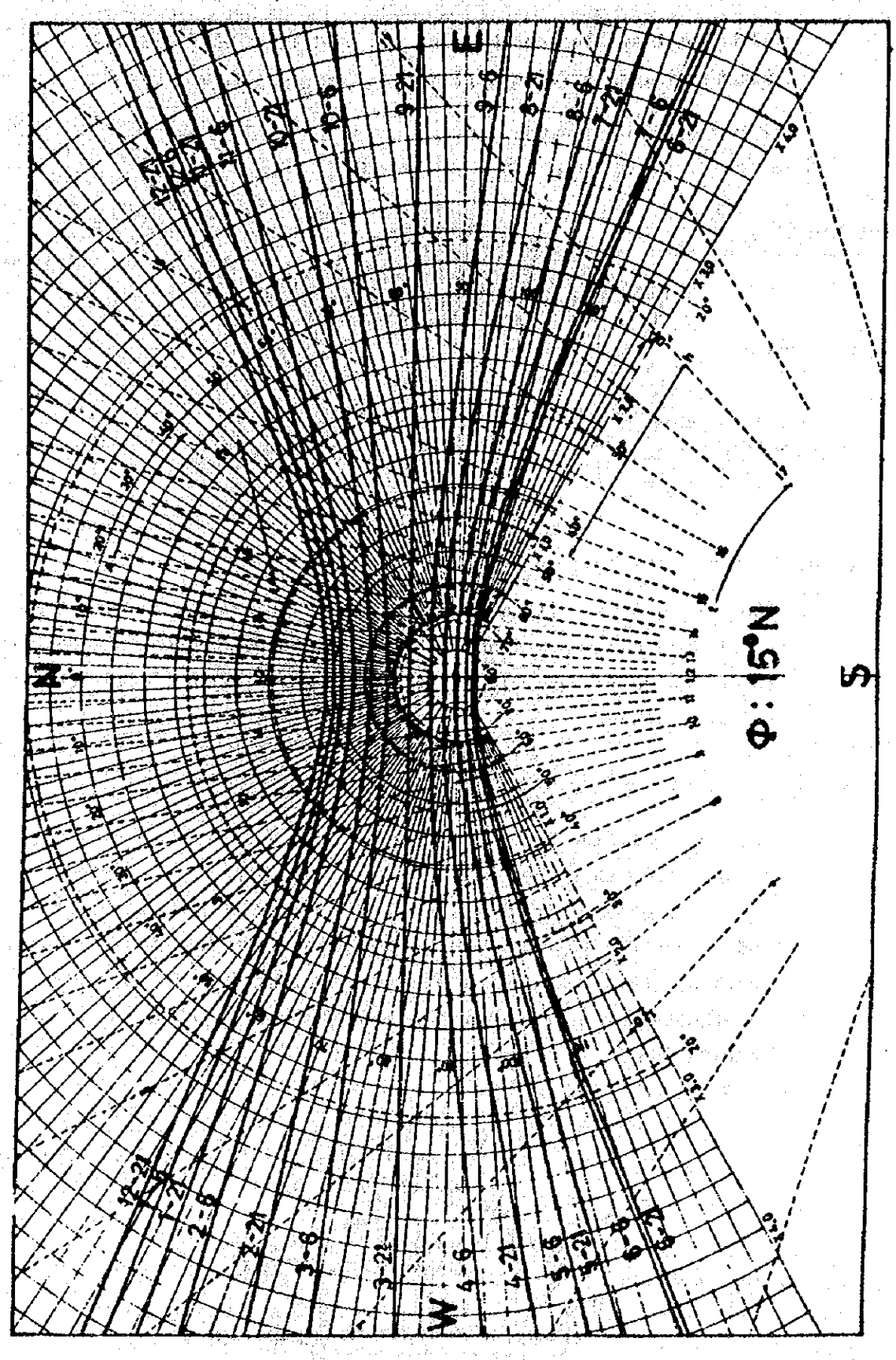
The seasonal prevailing window is from south-west, the openings of windows and doors should be so designed as the opening position to be controlled and with water tight system when closed for the stormy weather.

2-2-6-3. Thermal insulation

The sun radiation here is so strong where without any shelter around here, that the buildings here have been so insulated, as cushioned by the air which is kept always ventilating itself underneath the roof, and have also insulation material laid underneath of roof covering. The ceiling height is 3.5 M and more for the better heat protection from the roof top and for the ventilation.



insulation and ventilation


E
W
N
S
Φ = 15°N

2-2-6-4. Noise protection

The exterior walls and partitions of the buildings are specified as of the concrete or the concrete block for the better sound insulations.

2-2-7. Modular basis

Several years ago "the foot & pound dimension" system was changed to the metric system. However some of the construction material in the market was still shown by the "foot & pound" when surveyed on October '77, the metrics is going to be familiar with and industrial development here is making it pushed, so that this plan has been based on the metrics system as the modular for spaces and constructions.

2-3. Structural Study

2-3-1. Basic idea

- o The constructions are to be as of domestic Philippine ones as possible. (concrete, steel, etc.)
- o The framings are to be of the reinforced concrete.

2-3-2. Framings

The span is 7.0 M by 5.0 M in the main building and the repairing practice workshop, and 7.0 M by 6.0 M (5.0 M) in the housing blocks.

2-4. Mechanical & Electrical Studies

2-4-1. Basic ideas

The followings are the man-made environmental check items which may require in the decision of mechanical and electrical equipments and the conditions in these items will be designed with various other factors in the Philippines.

1. Ventilation
2. Temperature
3. Humidity
4. Lighting
5. Washing & Sterilization

2-4-2. Coolings

The coolings by the packaged type air conditioners are to be installed just in the particular rooms.

2-4-3. Sanitary & plumbings

2-4-3-1. Water supply

The resource is the deep wells near the proposed site, the underground water is pumped up and once pooled at the reservoir and treated well with such as filtration, chlorine and so on. Then after the water will be pumped up once again to the high water tank for pressure before supply to the each sanitary wares and tap.

The following is the estimated daily consumption of water.

Average Daily Consumption	:	40 person x 250 ℓ/D.P. = 10 t/day
Capacity of High Water Tank	:	10 t/8 h = 1.25 t 2 t/max. capacity of high water tank

2-4-3-2. Waste water

The rain can be let it flow, however waste water should be treated not to exceed the feasible maximum environmental impact loads, using the local septic tanks to decrease the number of B.O.D., and then after should be thrown away to the nearest river.

2-4-3-3-. Hot water

The electrical hot water supply system should be installed for the reason why the maintenance is much more easier, and the initial cost is not so expensive for mass production.

2-4-3-4. Gas

The propane gas equipment is provided to supply with pressure vessel to the kitchen, which will be used for just cooking.

2-4-3-5. Incineration

The incinerator is of forced burning type, which treats rubbish from every room and garbage from kitchen, kitchen.

2-4-4. Electrical equipment

2-4-4-1. Transformation

The electrical room is located on the 1st floor of the main buildings, where is expected to install the reception and transformation equipment on the RP's obligation, based on the Minutes dated on Oct. 1977.

The estimated capacity of transformation is approximately 200 KVA.

2-4-4-2. Emergency generator

The emergency generator is of diesel-engine and provides the power for the emergency lighting fixtures and for water supply and waste water pumps, which capacity is about 50 KVA.

2-4-4-3. Power line system

The piping and wiring system for main power line is planned through the whole buildings.

2-4-4-4. The power

The power lines and control panels from transformation equipment to the machinery are included.

2-4-4-5. Other equipments

- o Lighting fixtures & receptacles
- o Sound system
- o Intercom. system among the administration offices and buildings
- o Fire alarm system and lightning protection for each block of buildings and the high tank

2-5. Project Cost Study

The following four items are the conditions taken into account in estimating of the project cost.

a) The construction is to be proceeded according to the expected Grant Aid to be agreed by the both Governments.

b) The construction must be completed not later than 31th March.

c) According to the Minutes dated Oct. 1977, the items of infrastructures are the obligation, of the Republic of the Philippines.

d) Other conditions

- o The professional services' provision and construction works for the buildings are to be done by Japanese firm
- o Materials are of Japanese ones and some of Philippine ones
- o The construction works should be proceeded by means of Philippine labor.
- o Infrastructural costs (for site preparation, roads, water supply, power supply, landscaping, and furniture, etc.) are not included in the cost.

The total cost have been estimated as composed of the following three items; the construction cost, the running expenses, and the installation of laboratory equipments.

i) Construction cost - in thousand yen 436,513

(1) Building cost 369,786 (115 m^2)

	Archi-tectural works	Electrical works	Mechanical works	Total
Main building	96,225	29,851	10,300	136,376
Repairing practice workshop	45,170	6,891	1,200	53,261
Housing block	135,071	20,378	24,700	180,149
Total	276,466	57,120	36,200	369,786

(2) Transportation cost

109,157 (Japanese goods for construction) x 15 %

= 16,373

(3) Travel etc. (Expense necessary for dispatching specific works exparts of the contractor from Japan)

9 (Man . Month) 14,312

Equipments (electrical, mechanical work) ..... 5 Man x Month

Doors and windows work ..... 1 "

Form building ..... 2 "

Reinforcement work ..... 1 "

((1) + (2) + (3)) 400,471

(4) Overhead cost

((1) + (2) + (3)) x 9 % 36,042

((1) + (2) + (3) + (4)) 436,513

ii) Expenditure - thousand yen

(1) Detailed planning & supervision etc. cost 62,858

DESCRIPTION OF PROFESSIONAL SERVICES

	Building Cost (1)	P.I.A. Rate (2)	Detailed Planning [(1)x(2)x60%] (3)	Supervision [(1)x(2)x25%] (4)	Travel & Staying for Inspection (5) *	Foreign Professional Service Fee (6) [{(3)+(4)}x50%]	Total
Main building so on	231,352	8 %	11,105	4,627	13,102		
Housing block	205,161	10 %	12,310	5,129			
TOTAL	436,513	-	23,415	9,756	13,102	16,585	62,858

* Expense necessary for dispatching inspectors of the consultant firm from Japan.

1 MAN x 6 MONTH 8,266

20 MAN.TIME 4,836

13,102

(2) Others 20,629

iii)	Installation of laboratory equipments (in thousand yen) (Soil & concrete test room including transportation cost)	50,000
TOTAL PROJECT COST (i) + ii) + iii)		570,000 (in thousand yen)

2-6. Infrastructure

Infrastructure as follows is to be of the RP's obligation.

[Items]		[Outline Specification]	
o	Approach road	620m x 5.5 m	(with in the proposed site)
o	Plaza	4,000 m^2	Sod (2,000 m^2), and pavement (2,000 m^2)
	Court	2,000 m^2	Sod (800 m^2), and pavement (1,200 m^2)
o	Retaining wall (1)	H = 4 m (130 M long)	Exposed concrete, bush-hammer finish
	" (2)	H = 3 m (40 M long)	"
o	Fire reservoir (Swimming Pool)	(W = 25 x 12 = 300 m^2) H = 1.2 - 1.5 m	Concrete, tile finish
o	Site preparation	15,000 m^2	
o	Drainage (waste water)	600 m	Conduit (fume pipe)
o	Exterior lighting	120 pcs	Landscaping lamp (40 W)
o	Equipment		
	Water supply	Capacity of high water tank	2 ton
		Average daily consumption	10 ton

	Main pipe (exterior piping)	
Drainage (Waste water)	Soil pipe	L = 500 m D = 250 mm
Fire installation (pressure pump)	(near the reservoir)	
Equipment for Pool	Circulating and filteration installation	
Septic	Capacity of tanks for 40 persons B.O.D. 10 PPM (local installation)	

Electrical Equipment Capacity of transformer 200 KVA max.

2-7. Tabulations

2-7-1. Building area

2-7-1-1. Building floor area

(m^2)

	Floor	Net Floor Area	Total Floor Area (including balcony and exterior corridors so on)
Main building (Training center)	1 F	354.7	658.0
	2 F	797.1	1,316.0
	Sub Total	1,151.8	1,974.0
Housing blocks (two wings & dining hall)	B2F	154.5	154.5
	B1 F	400.3	711.2
	1 F	342.9	609.6
	2 F	603.2	1,069.7
	Sub Total	1,500.9	2,545.0
Repairing practice workshop	1 F	504.1	661.0
Total	-	3,156.8	5,280.0

2-7-2. Building room area

(m²)

Main building (Training center)	1st Floor (except garage)	General store (equipment tools)	72.5
		Concrete test room	75.5
		Soil test room	109.7
		Reception	6.0
		Spare rooms	13.4
		Electrical room	77.8
		(Sub Total)	354.7
	2nd Floor	General store (West)	75.5
		Library	52.3
		Instructors' preparation room	28.7
		Wash room (West)	13.4
		Large lecture room	108.4
		Small lecture room	65.3
		Entrance hall	81.3
		General office	65.3
		Director's and vice-director's office	108.4
		Wash room (East)	13.4
		Drafting room	80.9
		Conference & Meeting room	28.7
		General store (East)	75.5
		(Sub Total)	797.1
Housing accommodation blocks (two wing & dining hall)	B2F	Dining, Kitchen	154.5
	B1F	Instructors' & trainees' rooms	400.3
	1F		342.9
	2F		603.2
		(Sub Total)	1,500.9
Repairing practice workshop	1F	Repair shop	223.3
		General store (equipment, tools)	74.5
		Office	
		Garage	165.7
		Wash room, etc.	40.6
		(Sub Total)	504.1
Total			3,156.8

2-7-2 Outline specifications

a) Exterior

Roof	:	Spanish roof tile
Wall	:	Exposed concrete, bushhammer finish
Window	:	Aluminium
Floor	:	Concrete, terrazzo finish

b) Interior

Main building	Floor	Wall	Ceiling
o General store (equipments & tools)	Mortar topping	Paint on exposed concrete	Cement asbestos board
o Concrete test room	"	Paint on mortar topping (E.P.)	Rock wool ceiling tile
o Soil test room	"	"	"
o Reception room	V.A.T.	"	"
o Spare room	Mortar topping	"	"
o Electrical room	"	"	Cement asbestos board
o General store	"	Paint on exposed concrete	"
o Library	V.A.T.	Wood panneling	Rock wool ceiling tile
o Instructors' prep. room	"	"	"
o Wash room	Porcelain tiles	Porcelain tiles	
o Large lecture room	V.A.T.	Wood panneling	Rock wool ceiling tile
o Small lecture room	"	"	"
o Entrance hall	"	"	"
o General office	V.A.T.	"	"
o Director's office	"	"	"
o Drafting room	"	"	"

Housing block	Floor	Wall	Ceiling
o Traineesroom	"	Vinyl cloth covering	Vinyl cloth covering
o Instructor's room	"	"	"
o Assistant instractor's room	"	"	"
o Principal's room	"	"	"
o Guest room	"	"	"
o Staff room	"	"	"
o Servicemen's room	"	"	"
o Storage	Mortar topping	Paint on exposed concrete	Cement asbestos board
o Dining	V.A.T.	Wood panneling	Wood framing finish.
Repairing practice workshop			
0 Repair shop	Mortar topping	Paint on mortar topping (E.P.)	Cement asbestos board
o Equipment tools	"	"	"
o Garage	"	"	"
o Wash room	Porcelain tile	Porcelain tile	

2-8. Project Schedule & Construction Administration

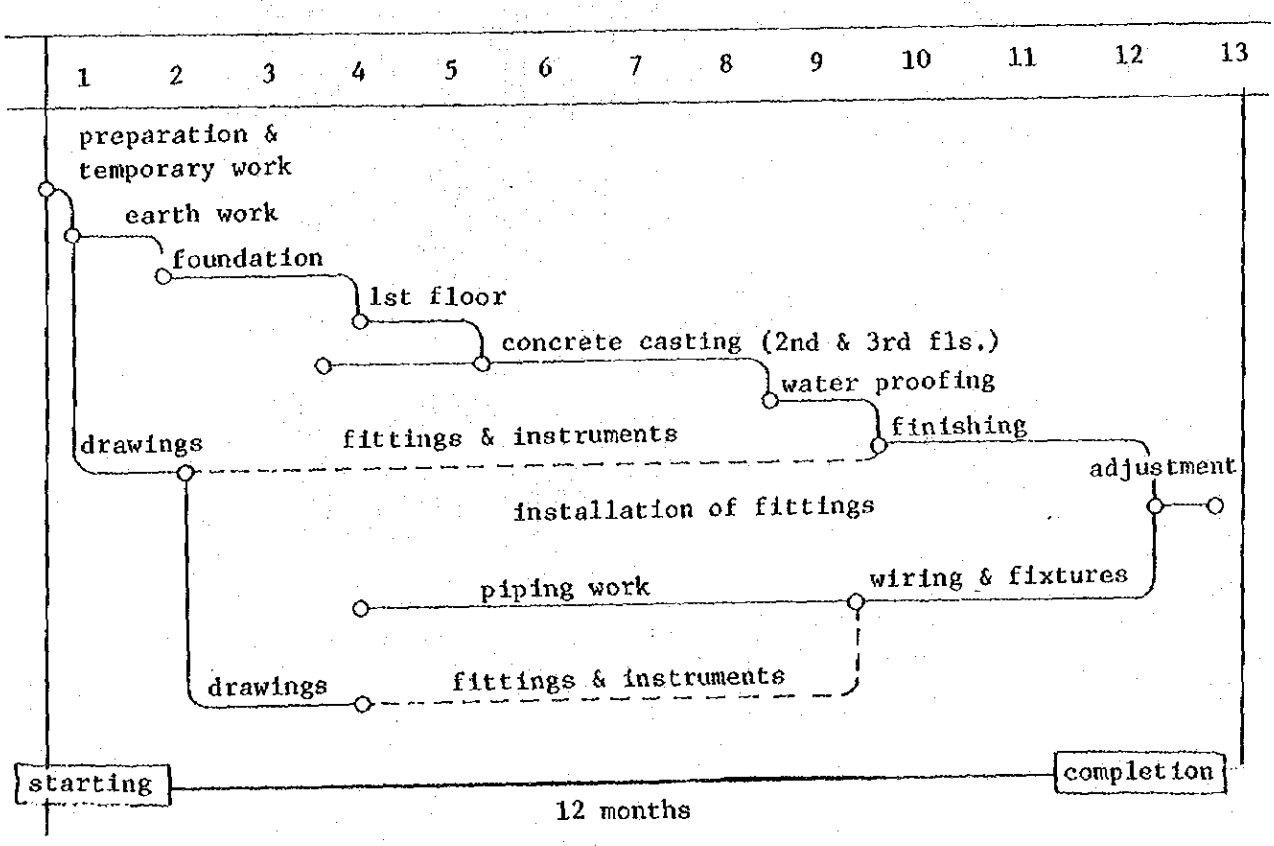
2-8-1. Works and cooperations

Considering two on-going projects here being financed by the Japanese Grant Aid , it is not easy to implement the work in accordance with the set time schedule.

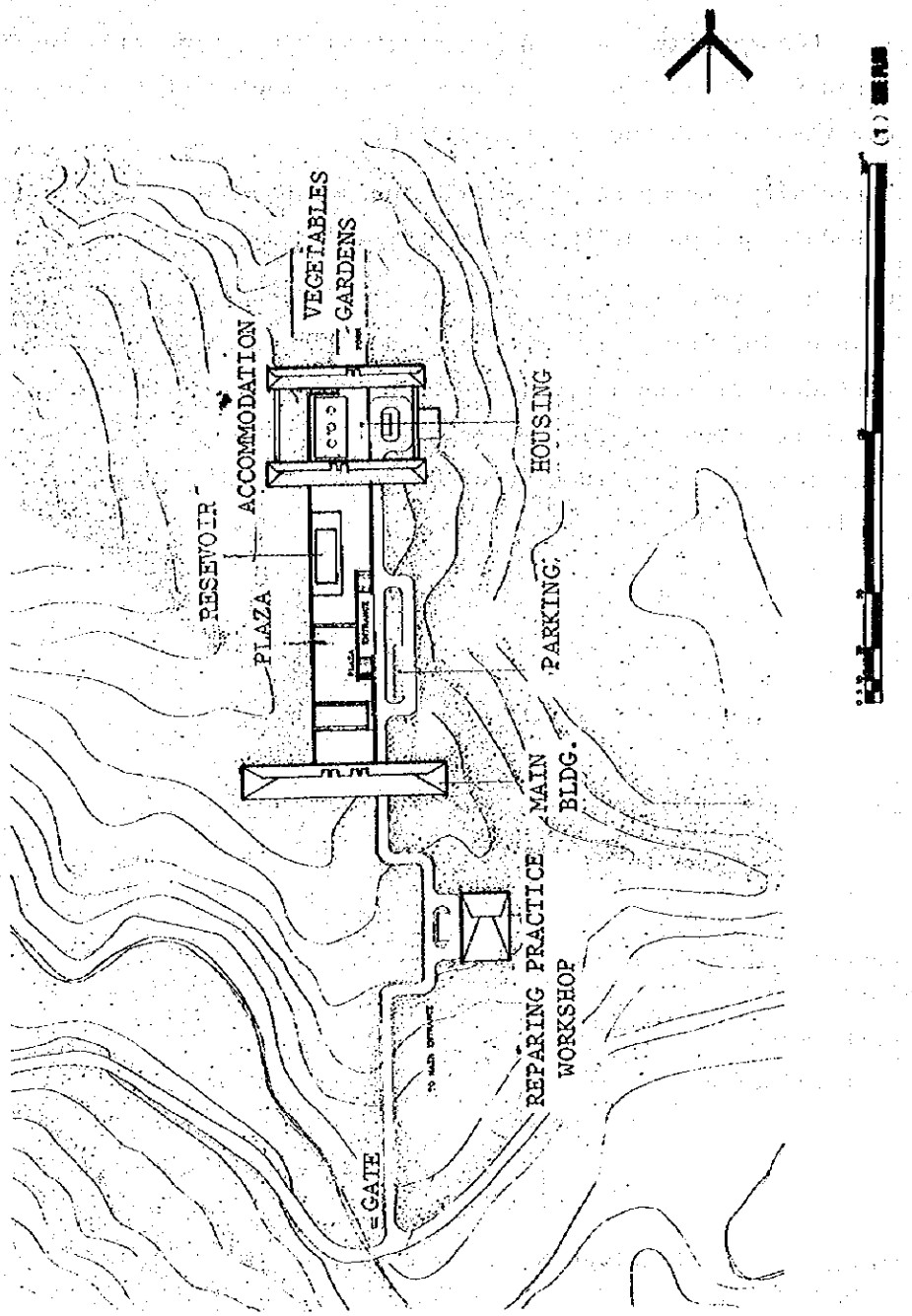
Especially the metal sashes and equipments must be controlled on schedule as long as those are provided from Japan.

One thing to worry about in this step is that the speed of the reinforcing work with steel bars and formation work for concrete casting will take longer time than in Japan, as the project site is at the mountain area and the skilled labor is not enough. Therefore the total construction period is estimated about twelve months.

2-8-2 Project schedule

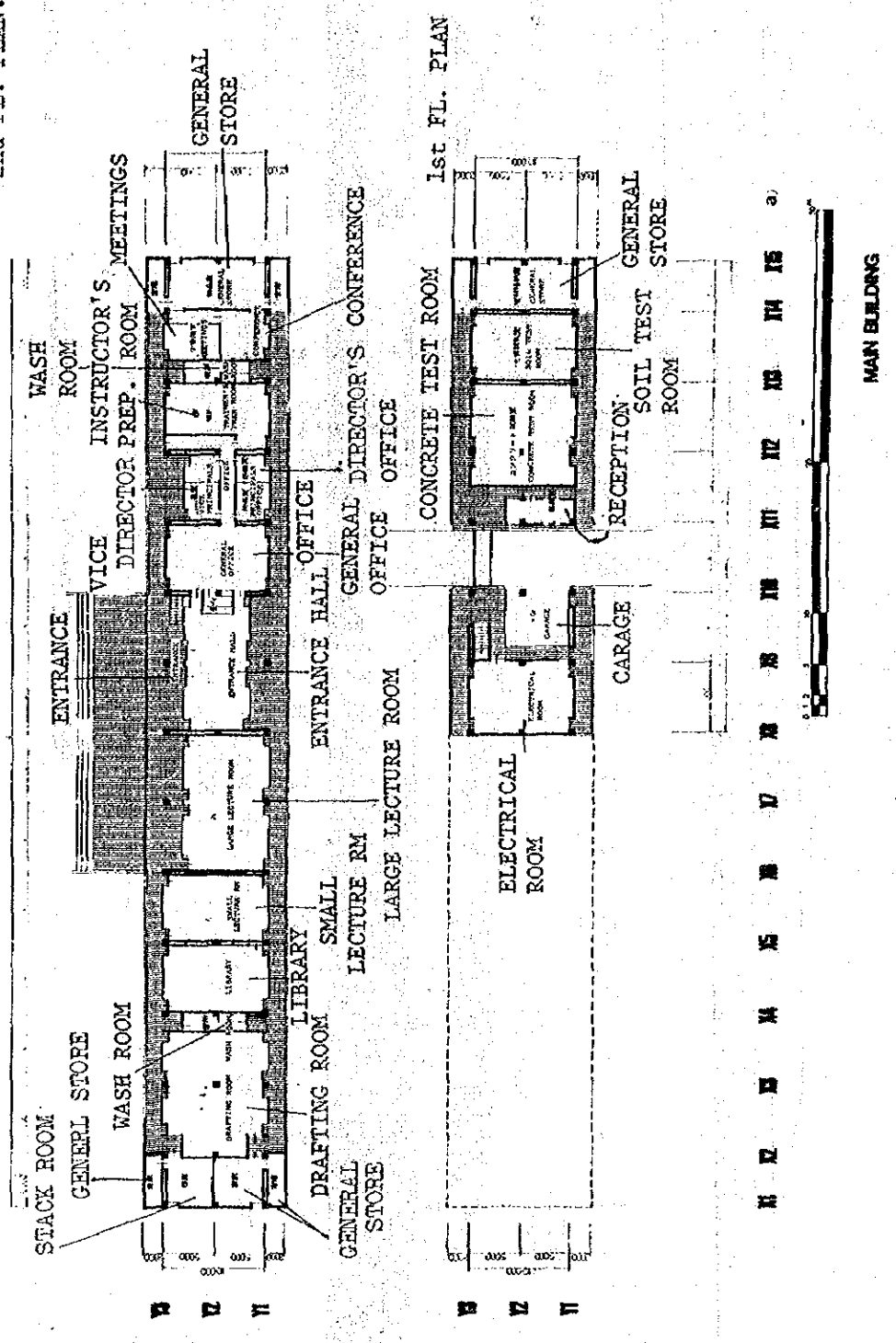


2-9-1. SITE PLAN

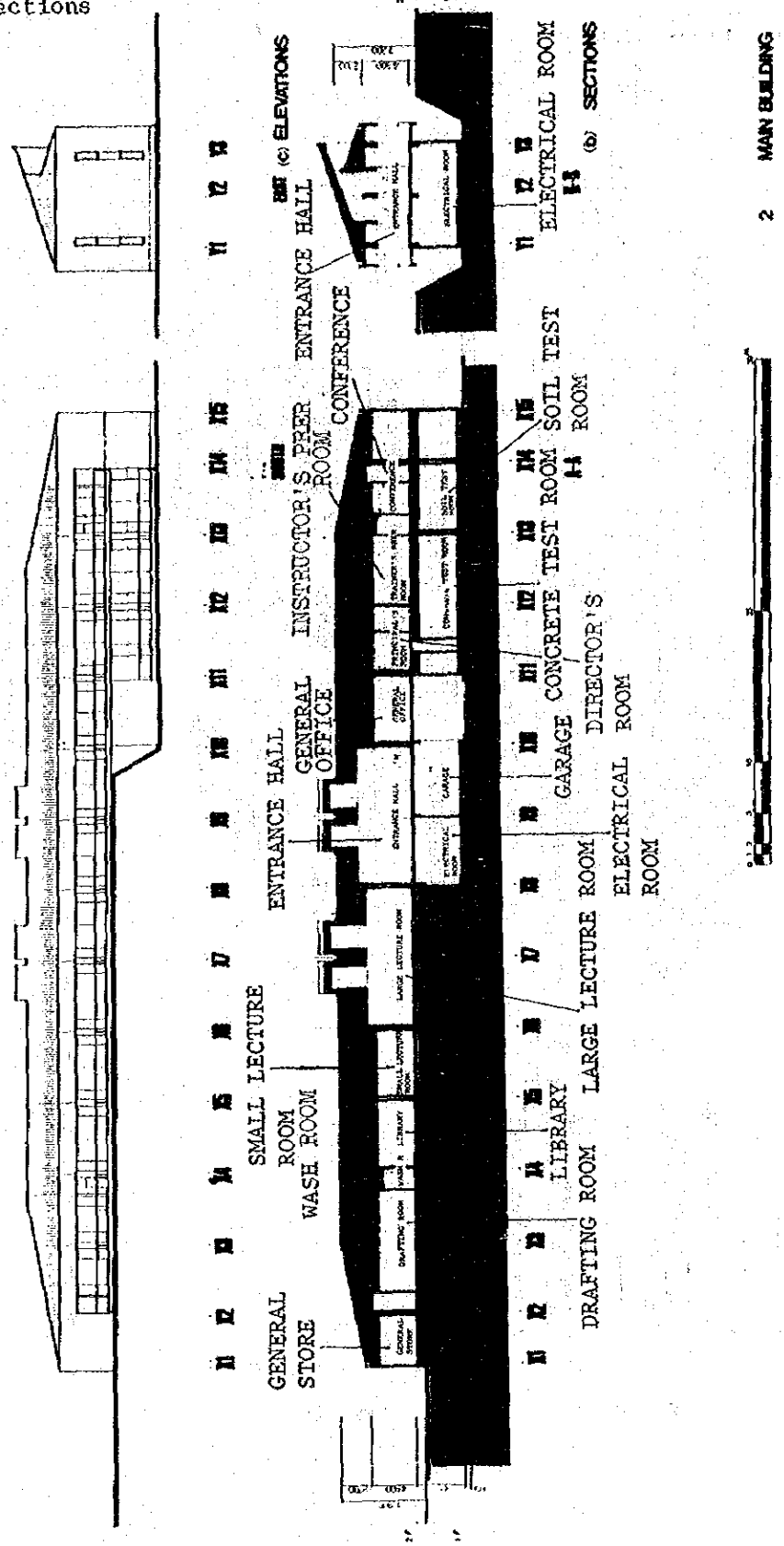


2-9-2. MAIN BUILDING (Training Center)

(a) Floor plans

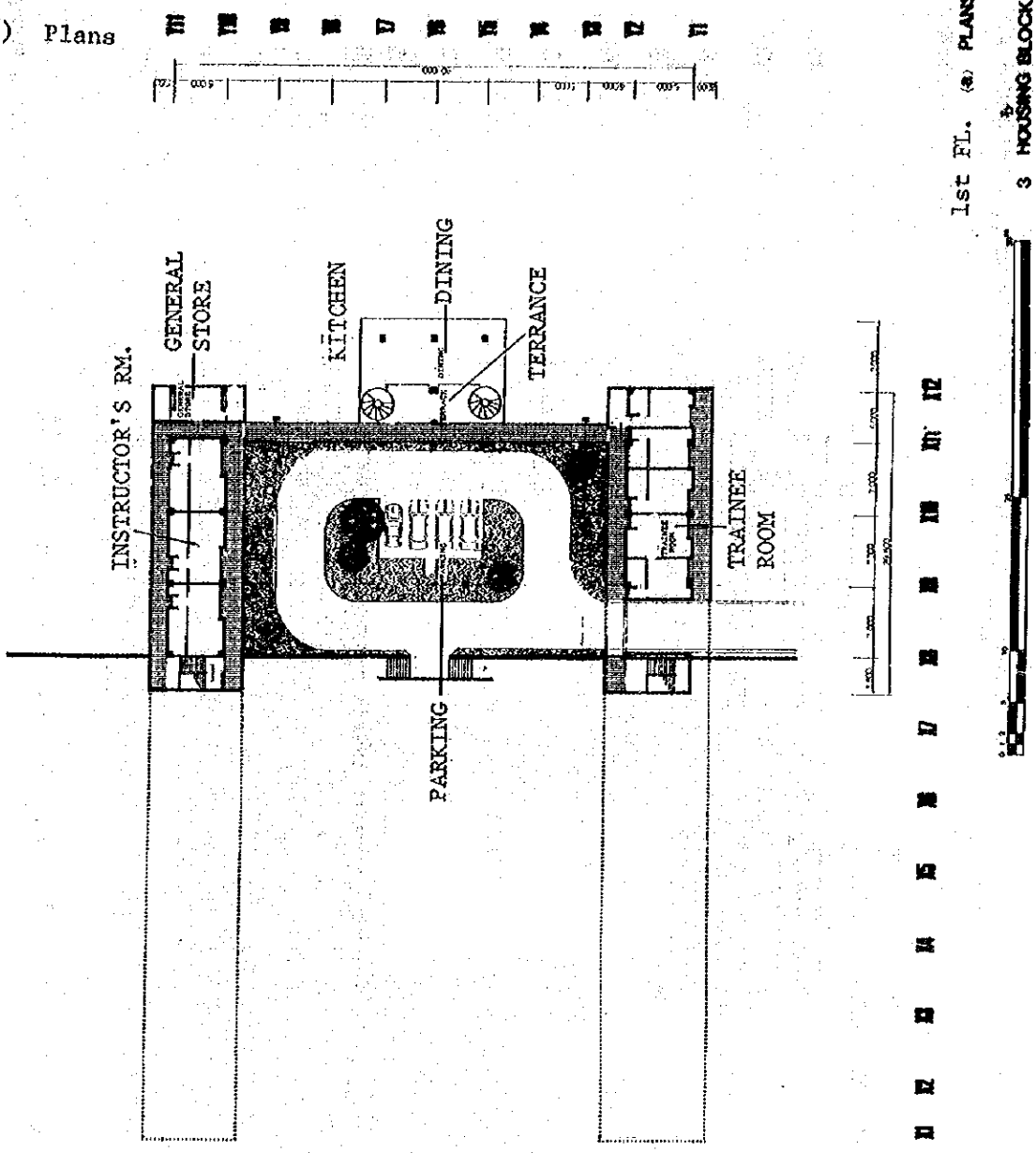


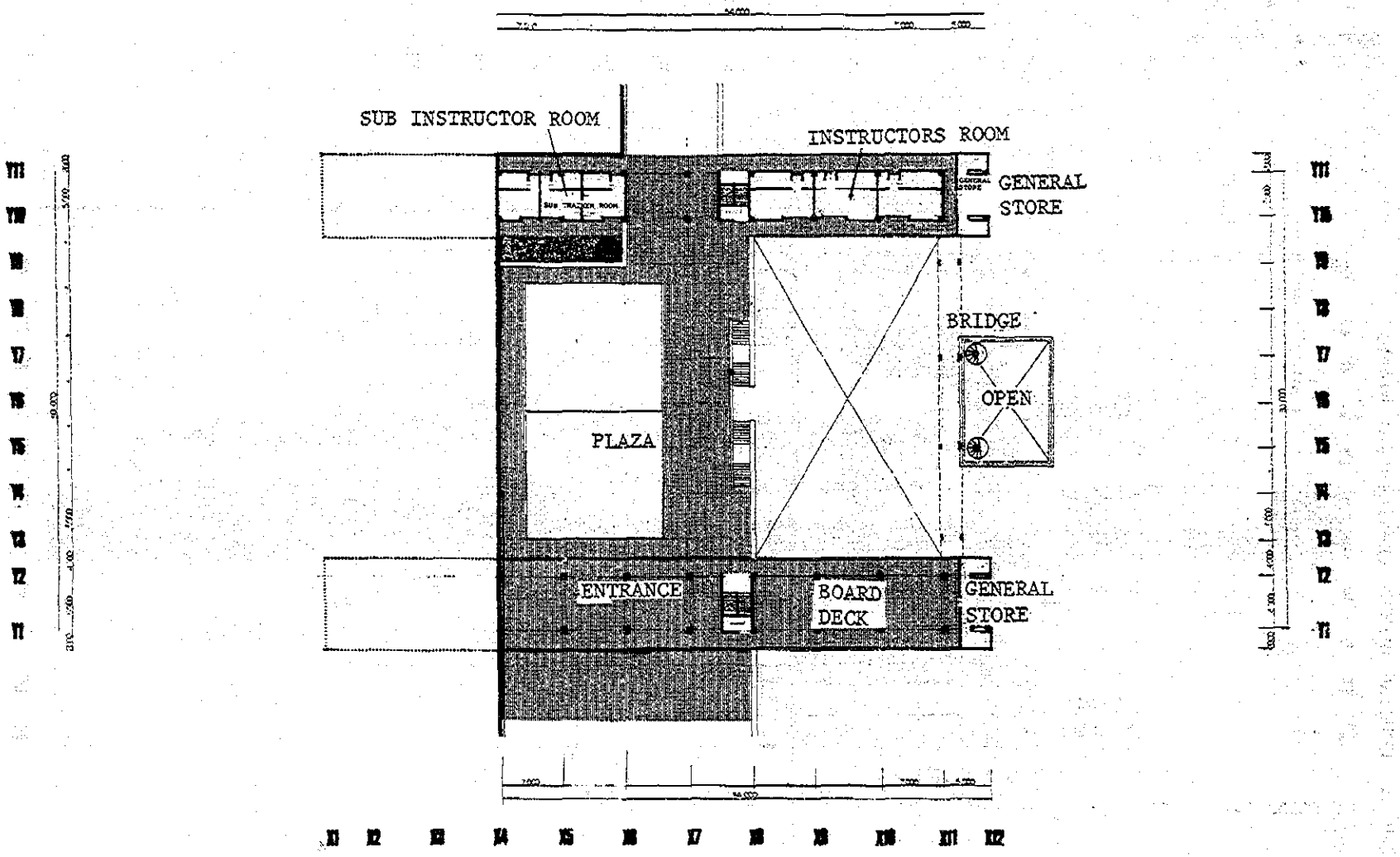
(b) Sections


(c) ELEVATIONS
(b) SECTIONS
2 MAIN BUILDING
ENTRANCE HALL
INSTRUCTOR'S PREP ROOM
CONFERENCE
ELECTRICAL ROOM
SOIL TEST ROOM
CONCRETE TEST ROOM
GARAGE
DIRECTOR'S
ELECTRICAL ROOM
ENTRANCE HALL
GENERAL OFFICE
SMALL LECTURE ROOM
WASH ROOM
LARGE LECTURE ROOM
LIBRARY
DRAFTING ROOM
GENERAL STORE

2-9-3. HOUSING BLOCKS (Residential Block)

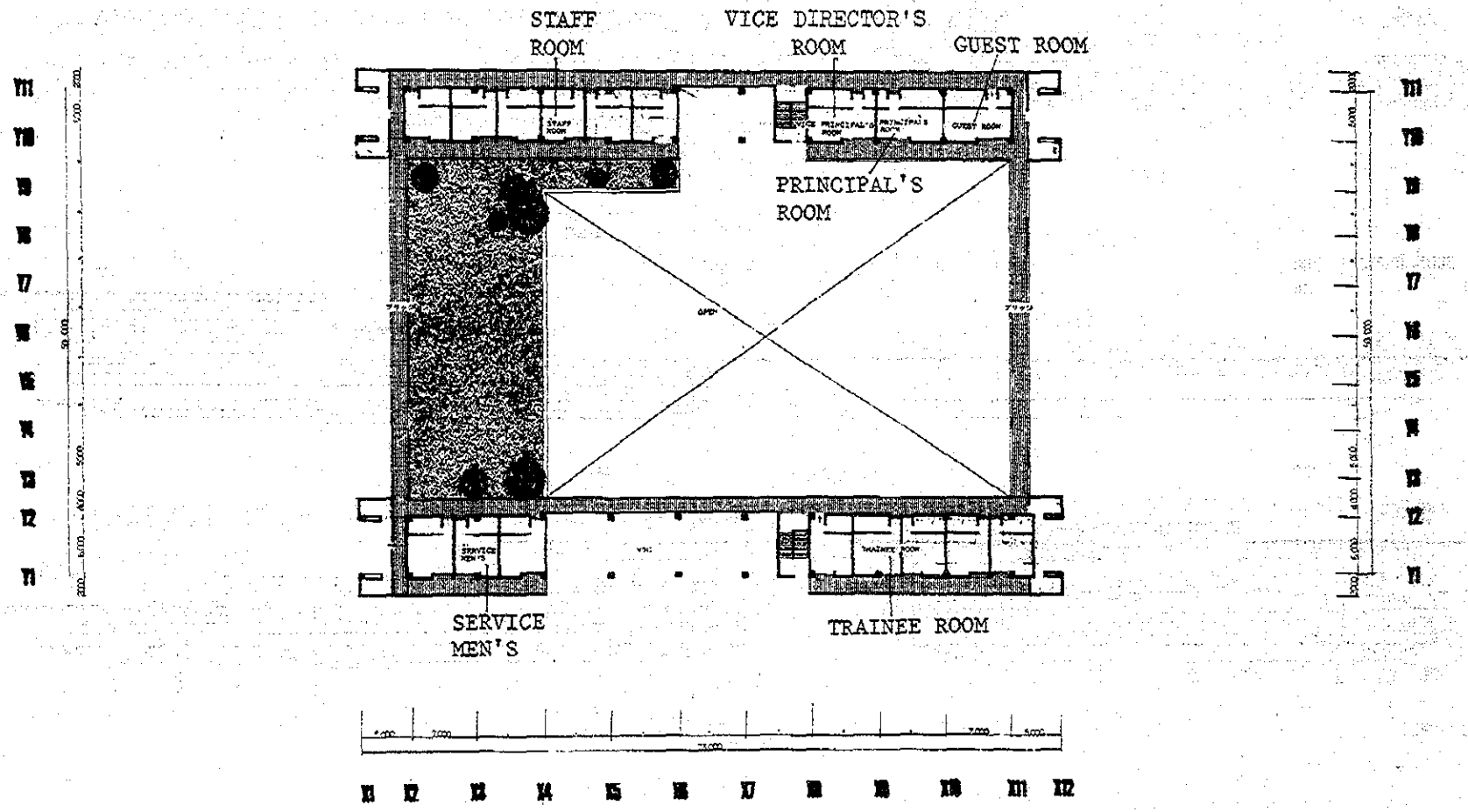
(a) Plans





2nd PLAN (a) PLANS

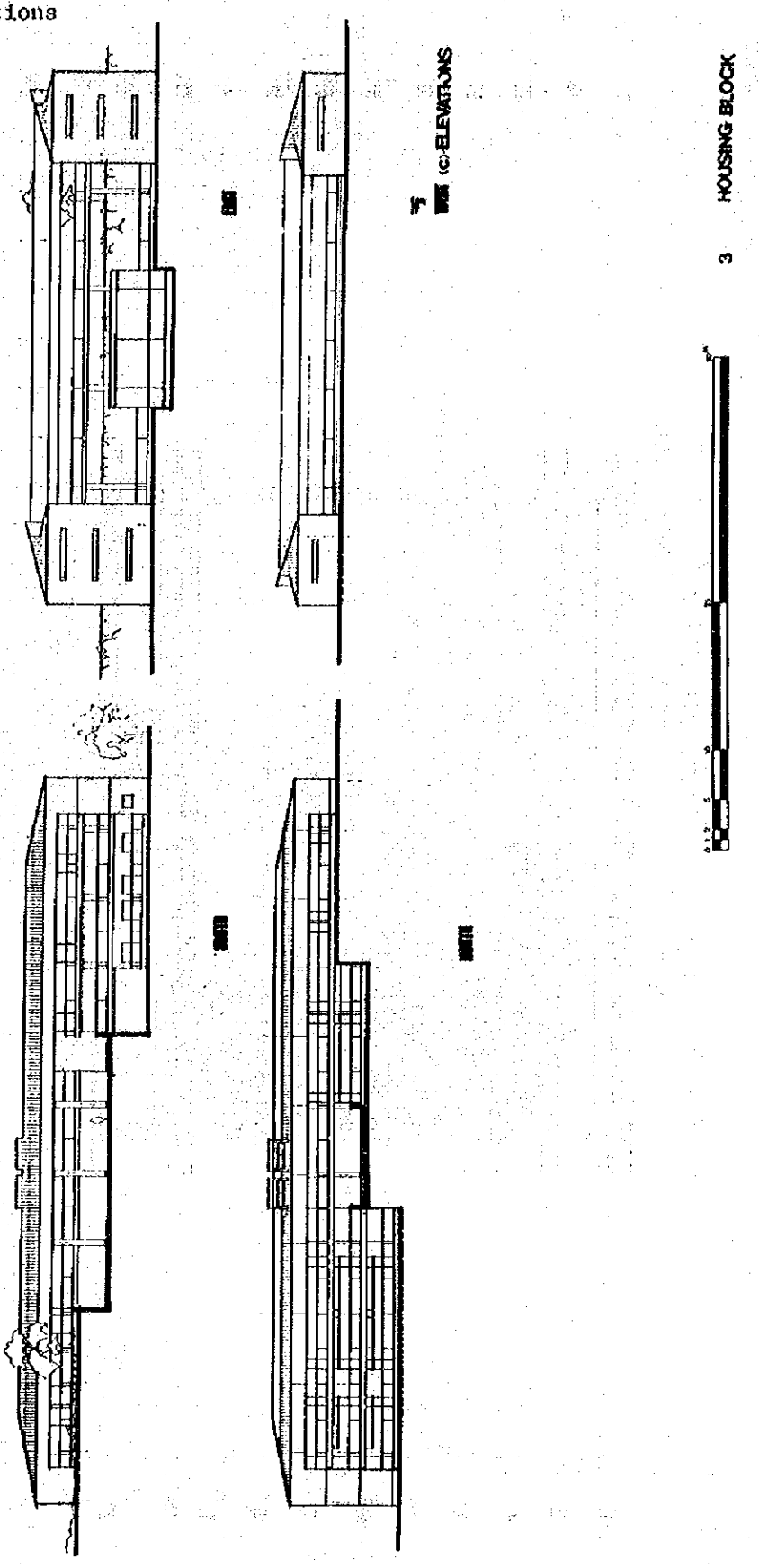
3 HOUSING BLOCK

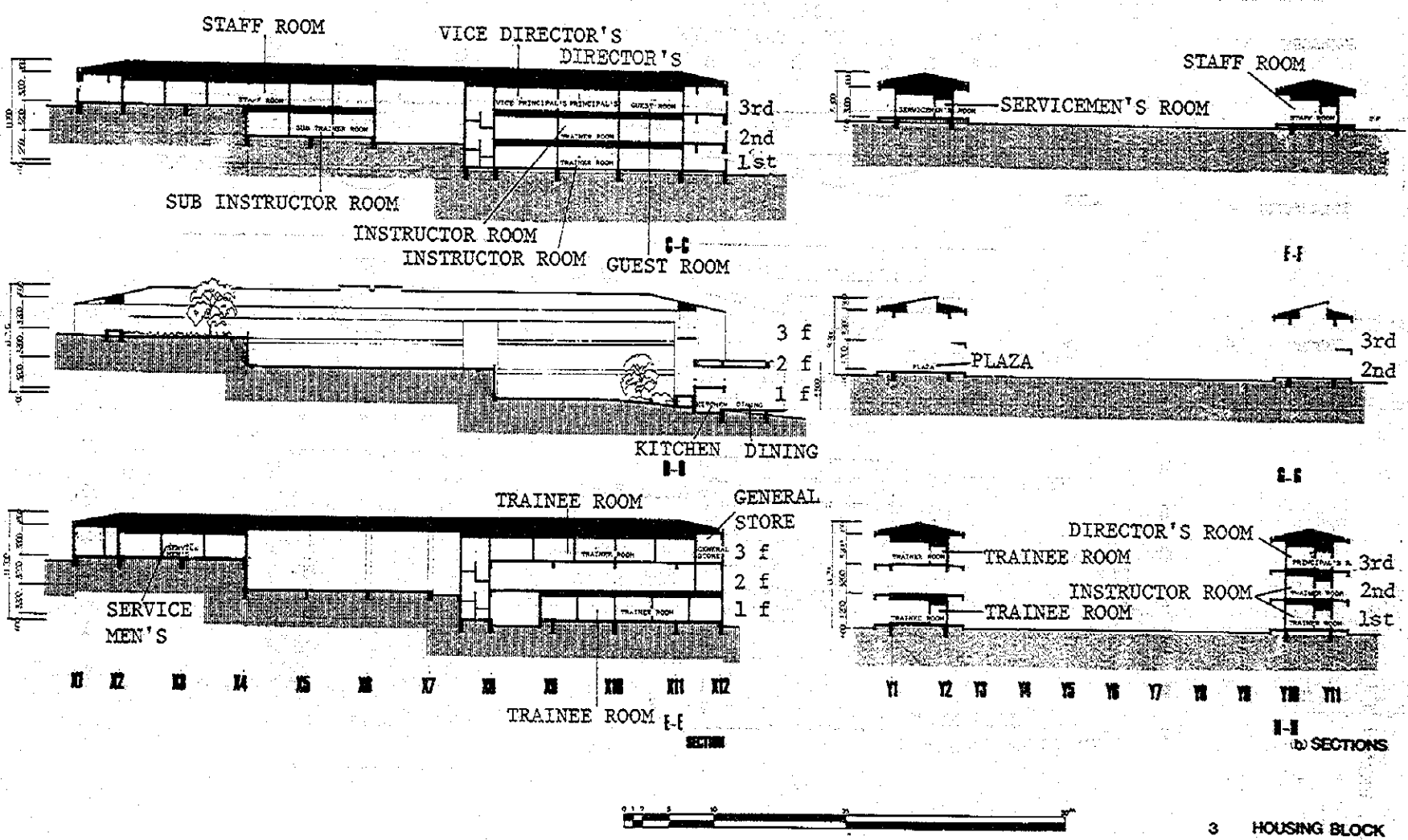


3rd FL. (a) PLANS

3 HOUSING BLOCK

(c) Elevations

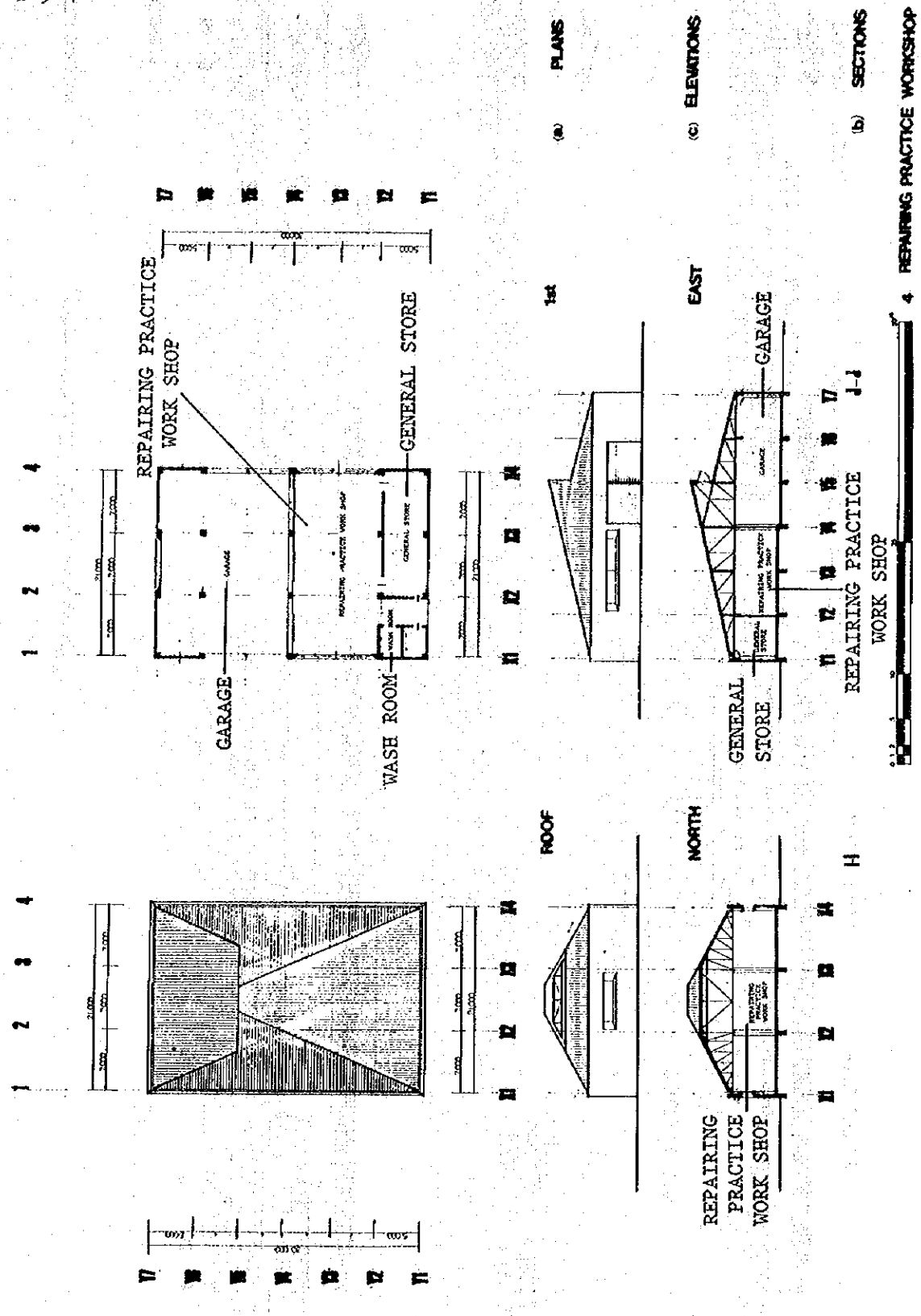


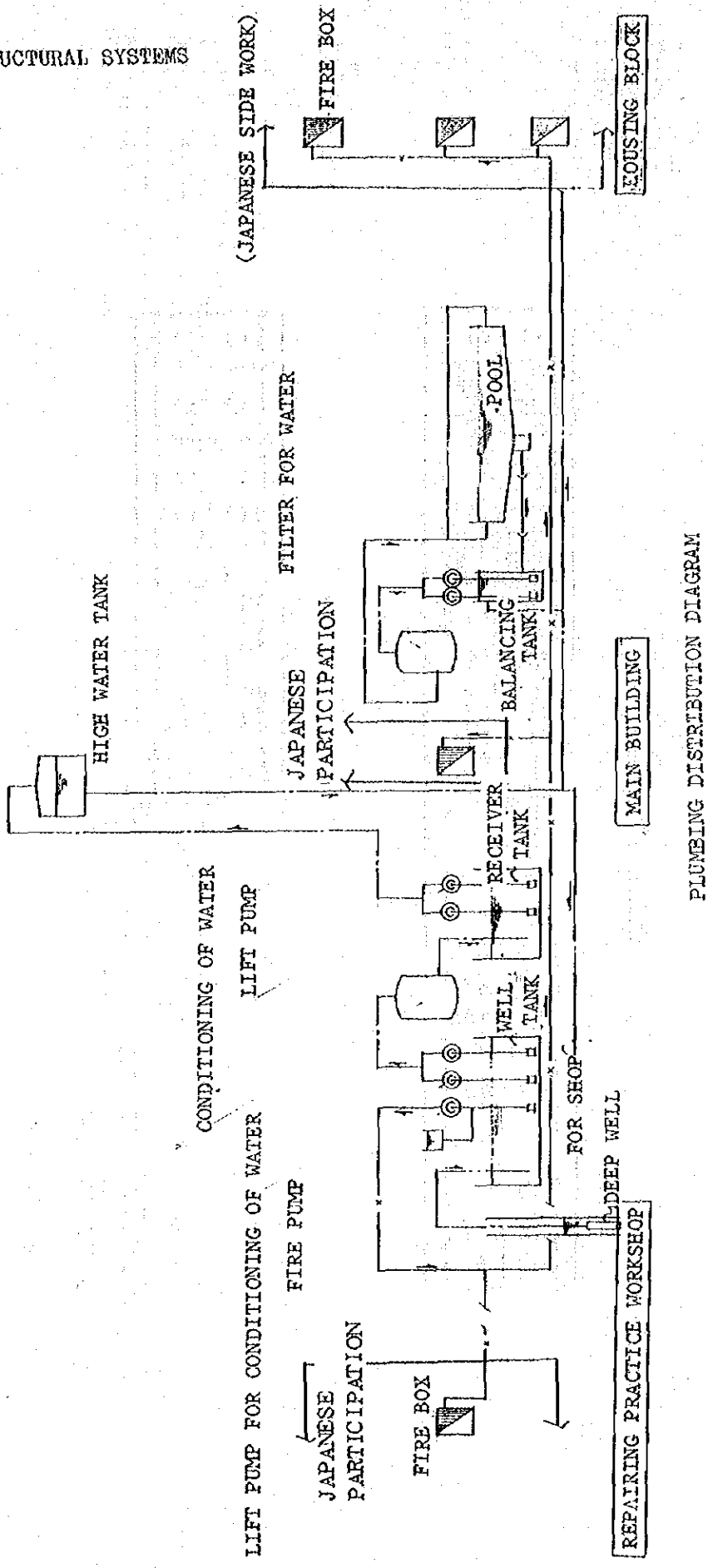


(b) SECTIONS

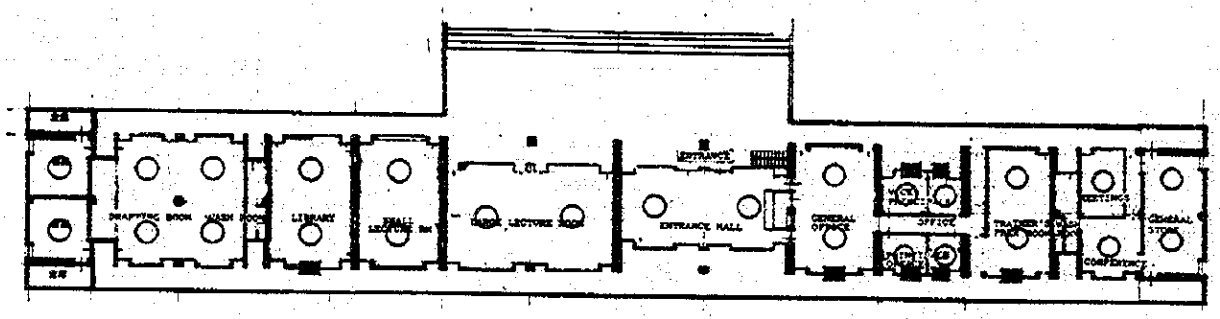
3 HOUSING BLOCK

2-9-4. REPAIR WORK SHOP

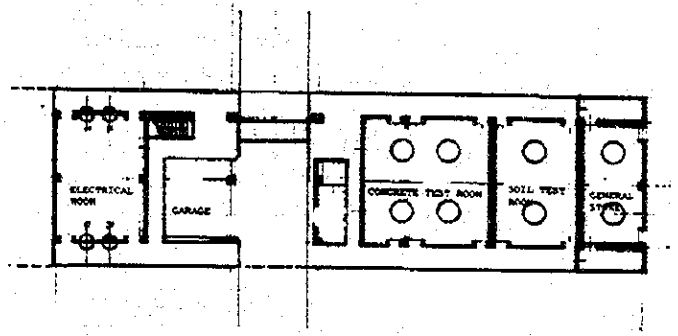




PLUMBING DISTRIBUTION DIAGRAM



2FL

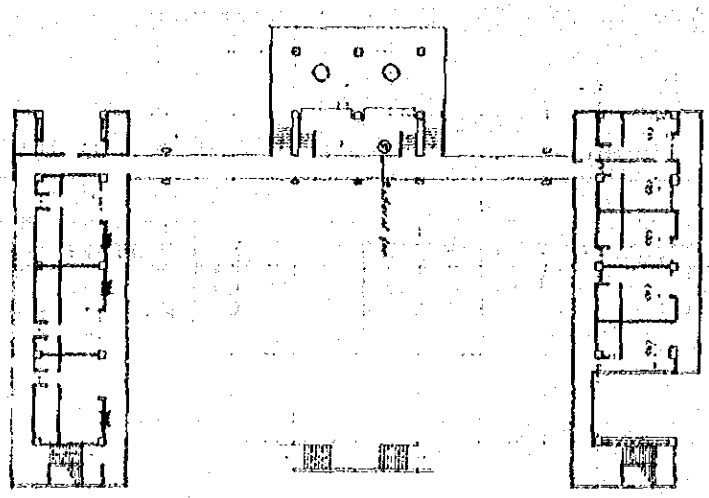


■ AIRCONDITIONER

○ CEILING FAN

• VENTILATOR

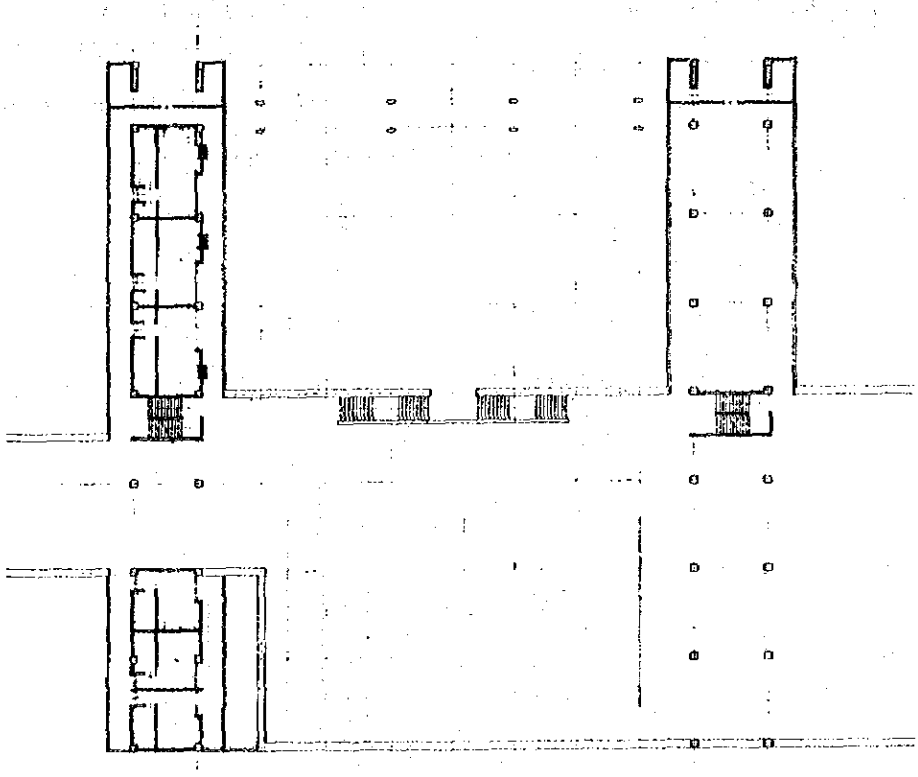
MAIN BUILDING 1FL



■ AIRCONDITIONER

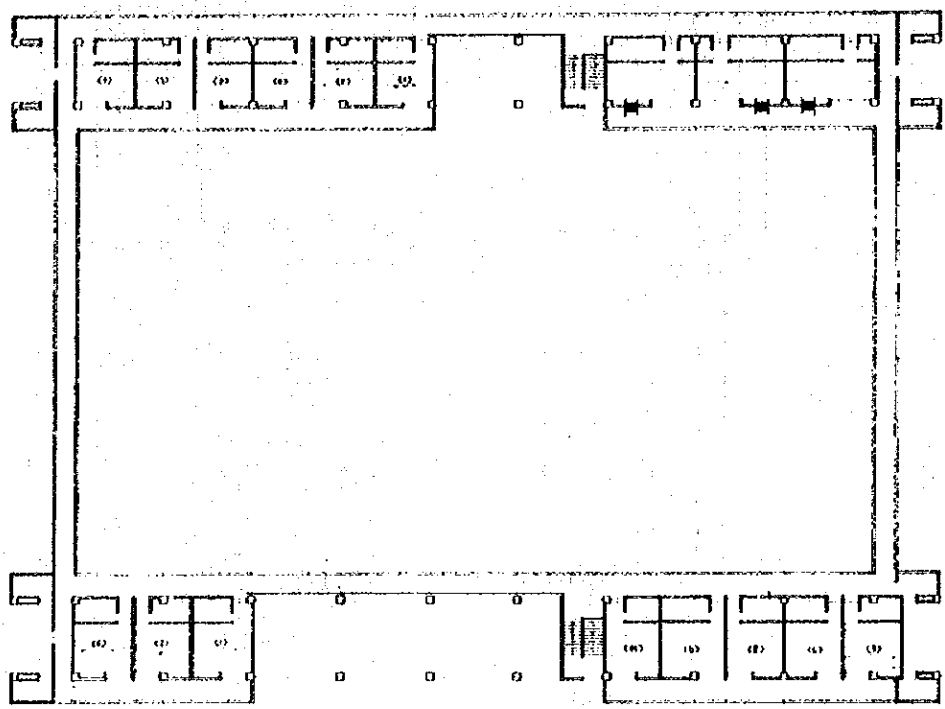
○ CEILING FAN

HOUSING BLOCK 1FL.



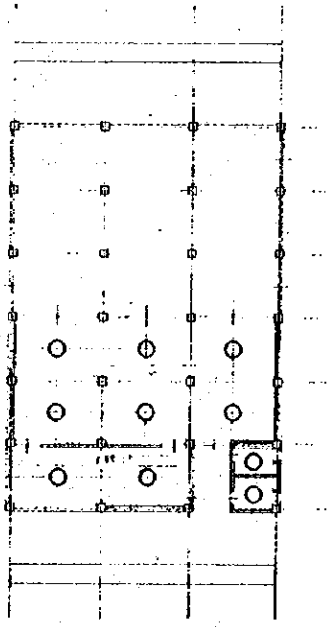
■ AIRCONDITIONER

HOUSING BLOCK 2FL



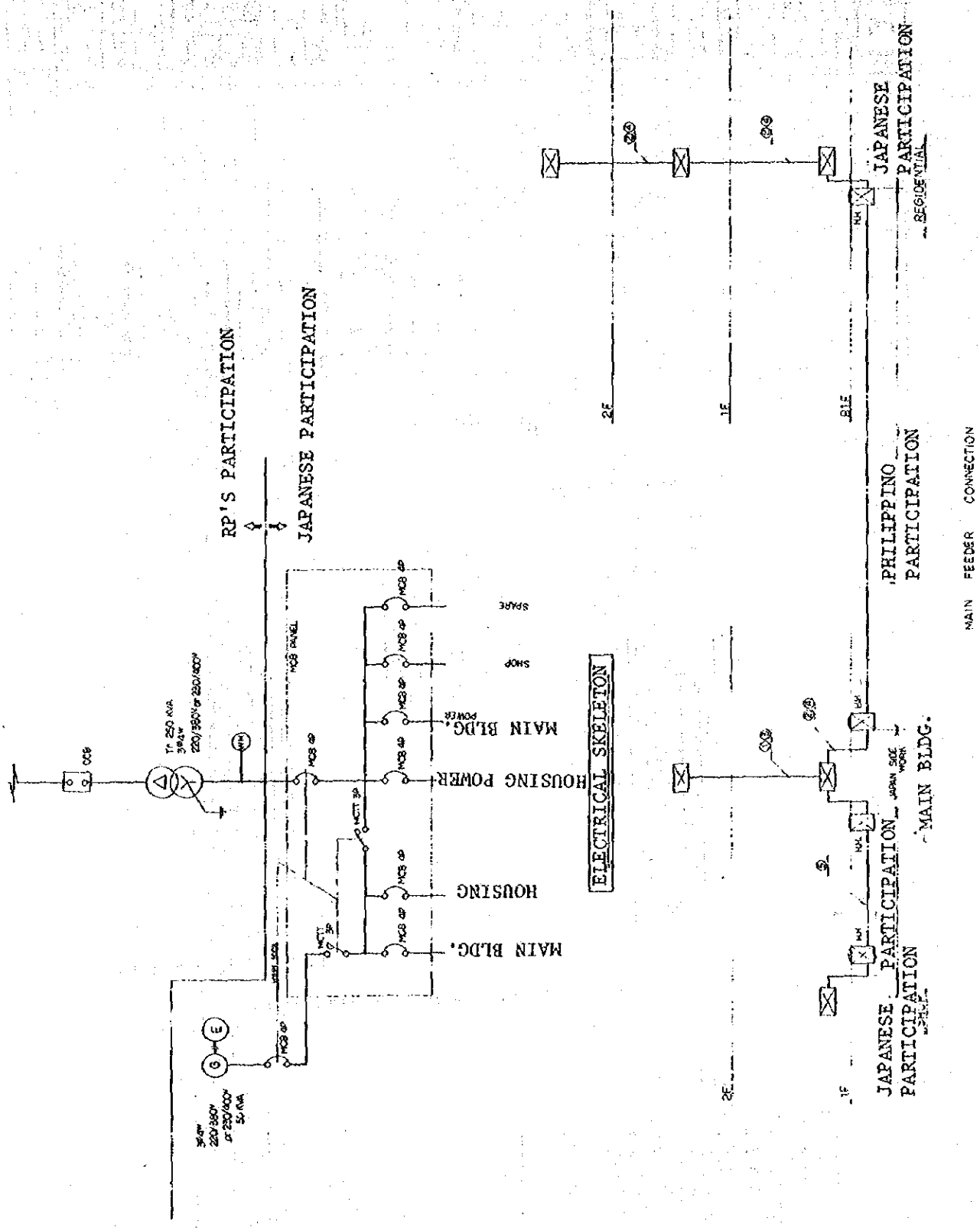
■ AIRCONDITIONER

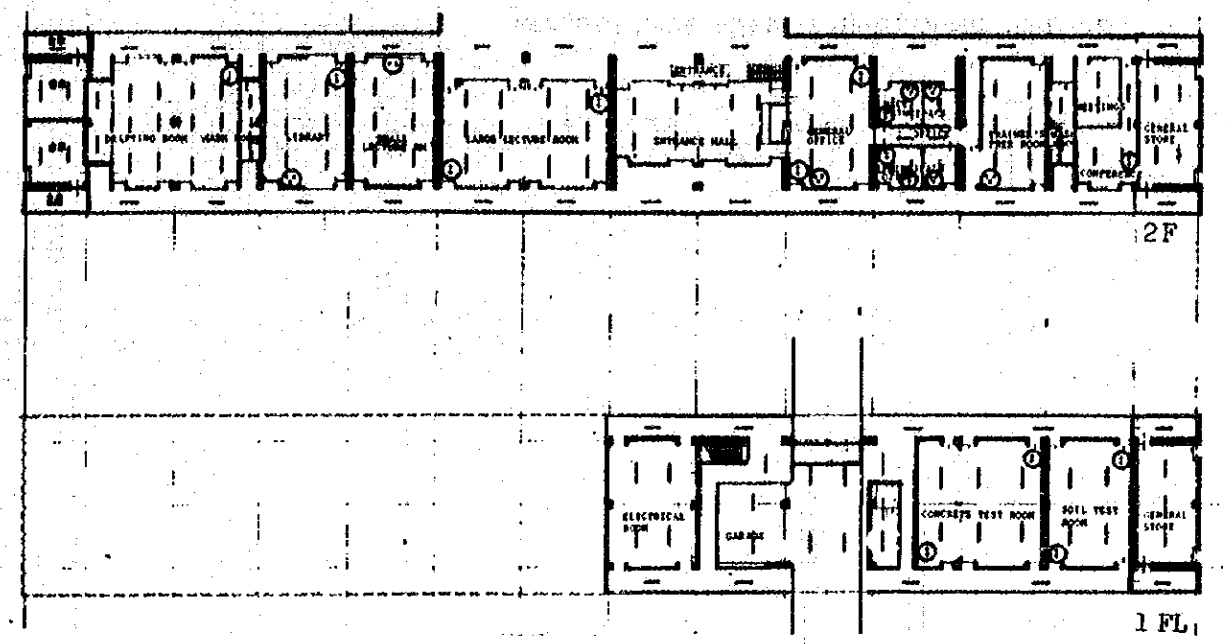
HOUSING BLOCK 3F



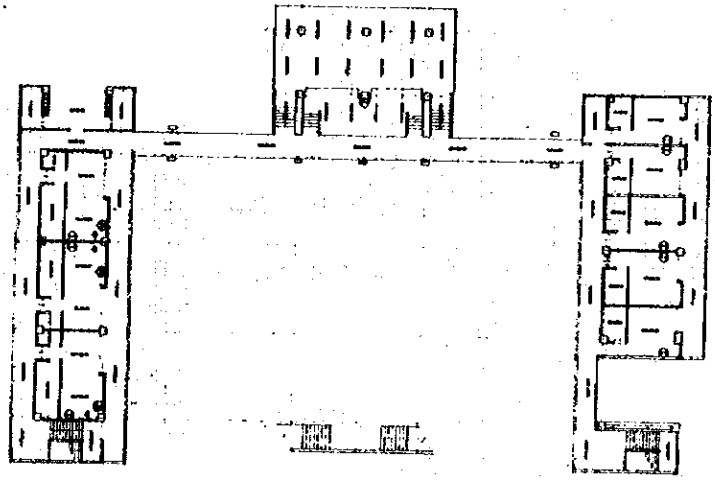
○ CEILING FAN

REPAIRING PRACTICE WORK SHOP


RP'S PARTICIPATION
JAPANESE PARTICIPATION
ELECTRICAL SKELETON
HOUSING POWER
HOUSING
MAIN BLDG.
SPARE
SHOP
MAIN BLDG.
PHILIPPINO PARTICIPATION
JAPANESE PARTICIPATION
JAPANESE PARTICIPATION
MAIN BLDG.
RESIDENTIAL
MAIN FEEDER CONNECTION



MAIN BUILDING

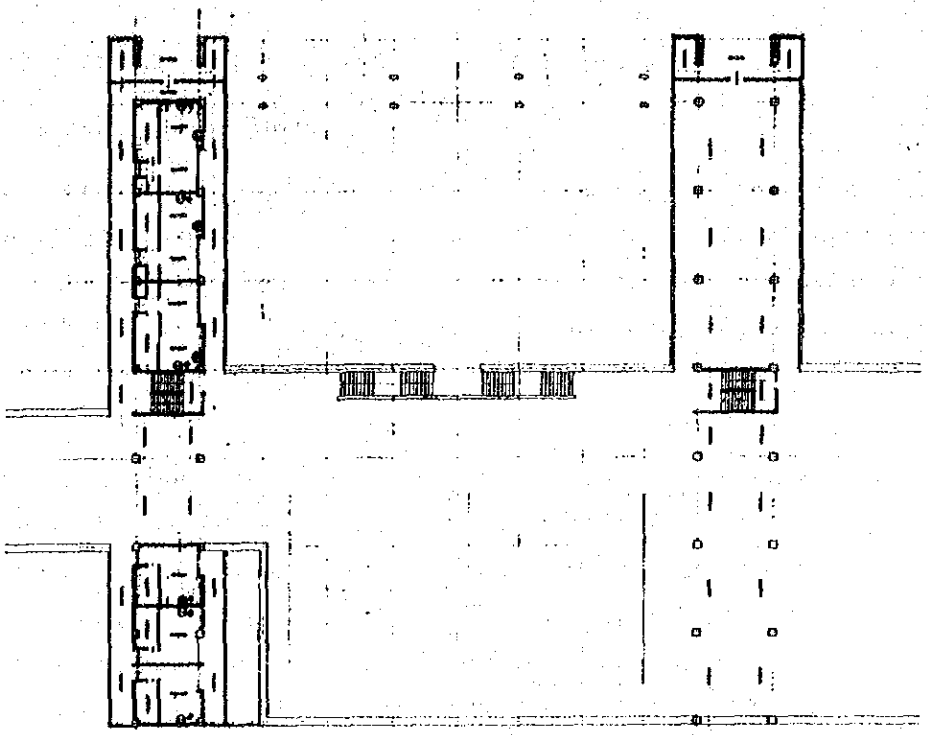


HOUSING BLOCK 1 Fl.

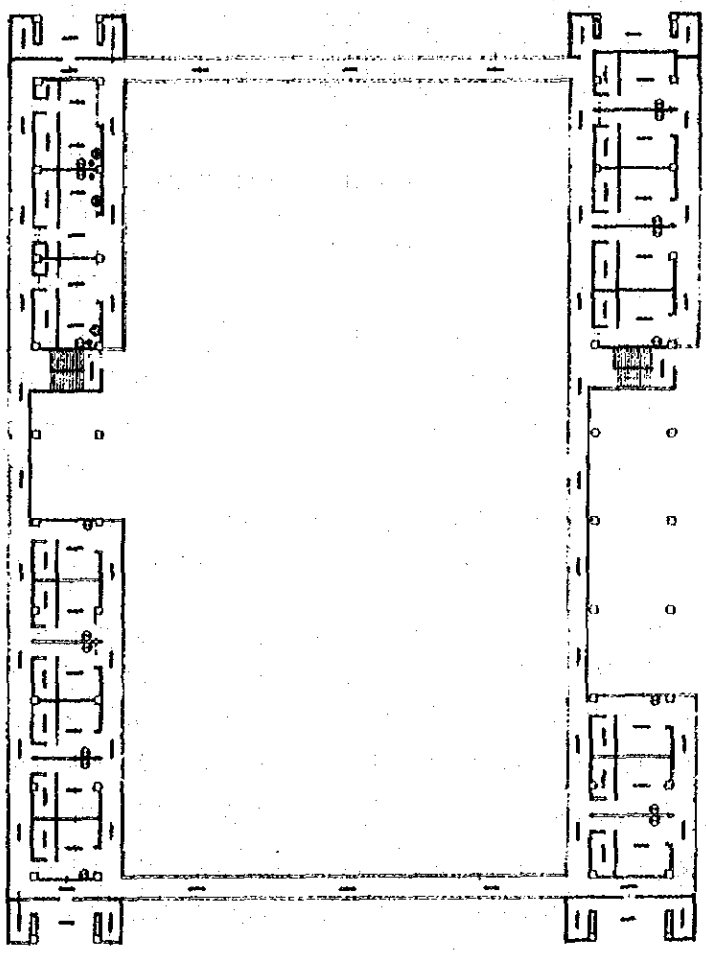
LIGHTING FIXTURES & RECEPTACLES

LEGEND

SYMBOL	N A M E
——	LIGHTING FITTINGS (FLUORESCENT LAMP)
•	LIGHTING FITTINGS (INCANDESCENT LAMP)
⊖	PLUG SOCKET
●	PLUG SOCKET (FOR COOLER)

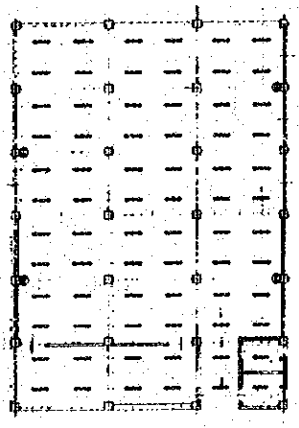


HOUSING BLOCK 2F1



HOUSING BLOCK 3F1.

LIGHTING FIXTURES & RECEPTACLES



LIGHTING FIXTURES
&
RECEPTACLES

3. BASIC DESIGN OF MODEL EROSION CONTROL WORK ETC.

3-1. Location of Area Surveyed

This area is located in the middle of Luzon, 200 km apart from Manila along National road No. 5. It is in 54th forest of Pantabangan National Forest in Carranglan Town. And it is located in the Carranglan River basin, the upper reach of multi-purpose dam and Lake Pantabangan and occupies the whole watersheds of Bayabas and Ororo Creeks, tributries of Toban Creek.

The watershed area of Bayabas Creek is 108 ha and that of Ororo Creek is 203 ha. In the former model erosion control work (including check dams and a check dam with combined uses for stream gauging and sediment measurement) is planned, while in the latter a dam for stream gauging and sediment measurement is planned. The model work site is about 6 km from upper Pampanga River Basin Multiple-use Management District Forest Office (UPRBMUMD), BFD, DNR., 8 km from the site for main building of Forest Conservation Training Center and 6 km from Digdig - Carranglan Prefectural road. (See location map.)

3-2. Feature of Area Surveyed

3-2-1. Natural feature

3-2-1-1. Topography, Geology

The area is rolling hilly land of Tertiary and Quarternary (diluvium) formation, 300 - 400 m above the sea level. There are many creeks with difference of elevation about 50 m. It seems that diluvium layer covers uncomformly over Neo-tertiary and outcrops of conglomerate are seem in depressions at the height of less than 330 m above the sea level.

The topography is of transitional type from late young to early mature stage in erosion cycle. Though there remain some planes and ridges of old diluvium formation, it is presumable that repeated severe erosions have occurred on slopes near creek heads.

Creek width are 30 - 40 m and their slopes, 2 - 3 % showing abrupt changes at creek heads into depression slopes of

hillsides as generally seen in Tertiary - diluvium regions. Most creek heads seem to be located near the border of Tertiary and diluvium. Soft sand and gravel layer of diluvium has considerable cohesion to form steep slope. But when cohesion is lessened by seepage water it becomes susceptible to be eroded and washed out. Creek beds consist of hard conglomerate, sandstone and silt rock, while slopes of stream sides and creek heads consist of unset diluvium conglomerate. That the above geological feature seems to control micro topography is one of the points to determine the direction of erosion control work.

Creek side slopes are 30° - 35° and tops of creek heads show 45° - 60° slopes. Ground rock is alternate formation of conglomerate, sandstone and silt rock showing fold inclination due to severe crustal movement. Diluvium layer consists of round gravel filled with soil of sand and laterite which is unconsolidated and similar to diluvium gravel layer of Japan. Both Tertiary and diluvium layers hold round gravel of andesite and partly diorite. All of gravel, sand, silt and clay seem to be of volcanic origin.

3-2-1-2. Forest soil

In tropical climate characterized by dry and rainy seasons residual soil on ridges is reddish brown laterite; colluvial deposit and sediment along creek are yellowish brown laterite; on flat or depressed portions under the influence of ground water ground-water-laterite soil is formed. On depressions on gentle slopes retarding groundwater gri-soil is formed making marshes in places. In partially humid climate of tropical and subtropical regions the accumulation of humus is a little and decomposition and separation of Na, K, Ca base in soil are quite severe. Soil becomes slight alkali and under average annual temperature of over 20°C silicic acid dissolves and flows out with base. Fe, Al, Mn, etc., which do not dissolve, remain and accumulate in soil layer. Hydrolysis of such neutral - slight alkali is called lateritic

action. When this action is heightened there are produced weathered soil rich in Fe and Al, that is laterite. Moderate action produces red soil not good for tree growth without fertilizer or soil improving tree.

In this area red soil layer is relatively thick about 1 m on ridges and gentle slopes. But it becomes shallow on steep slope and shallower on ruptured slope showing outcrops of sand and gravel layer.

3-2-1-3. Climate

Annual temperature averages 27.7°C, annual difference being 4.1°C. Average annual precipitation is 2,042 mm at Pantabangan 208 m above the sea level; 95 % of annual amount falls in rainy season May - October.

Monthly maximums in 1970 - 1976 are 1,222 mm in July and 906 mm in May. Daily maximum is 208 mm. That monthly amount is large and daily amount relatively small is one of features of this region and it tells that in rainy season there is some amount of rainfall almost everyday.

Though the record of daily rainfall is not completely adjusted, it can be presumed, from records of 140 mm and 180 mm, that most part of hourly rainfall concentrates in 1 - 2 hours letting the rest of the day be fine. Computation of probable rainfall by Gumbel and Choh method gives us 261.9 mm of probable maximum daily rainfall in 50 years and 290.0 mm of that in 100 years, being similar to those in Japan.

The rainfall which caused serious devastation in the watershed of Lake Pantabangan in May 1976 showed the maximum daily amount of 208 mm. This is the rainfall recuring in 13 - 14 years. The above rain continued from 21st - 25th day of May totaling 755.3 mm. The cause of the serious disaster may be attributed to the total amount rather than the daily maximum. Most of the devastated sites are found on stream heads along the border of tertiary and diluvium 330 - 350 m above the sea level. The rise of

pore water pressure (ground water) due to long rain is presumed to be the main cause.

3-2-1-4. Forest condition

Gentle topography of this area attracted people to live in and shifting cultivation and grazing were repeated. Owing to adverse soil and water condition the plateau is covered with Samon and Cogon and thinly scattered Arinbanban trees which are strong against fire. On diluvium deposit and debris and talus cone we see jungles of tropical broad-leaved trees, etc. Planted teak and Ipilipil forest seen here and there show good growth. Cogon and Samon are typical graminaceous plants. The former likes colluvial deposit and yellowish brown laterite having relatively good physical properties, while the latter is seen on ridge covered with poor reddish brown laterite.

Deposit and sediment layers in most of land slide sites have considerable depth 3 - 10 m. These layers have physical properties favorable to tree growth. Therefore if we control outflow of these soil layers with the aid of check dams and retaining walls, they will certainly be converted into expectable forest sites.

The upper portions of collapsed slopes are steep exposing diluvium sand and gravel layers. Without artificial grading, weathering and erosion will not cease until the slopes take gradient 30° - 35° (stable slope). But, being located near ridges danger of enlargement of these collapsed area is not great. Moreover there is possibility to establish green cover of Samon, etc. in relatively short period.

3-2-2. Devastation situation of mountaineous area

3-2-2-1. General situation of devastation

Most of devastated plots were produced by heavy rain in May 1976. Though there are some slides of surface layer slip type about 1 m deep, most slides are of deep collapse

type (ground water type) 3 - 10 m deep to which the majority of unstable deposit and sediment are attributed.

Colluvial deposits of earth block shape choke creeks. On these deposits having many cracks there are stable dense growth of Samon and Cogon. Upper parts of collapsed plots are very steep and 10 - 20 m high exposing outcrops of unset sand and gravel ground layer. Areas of collapsed plots range 0.01 - 3.5 ha averaging 0.14 ha and are larger than those of Japan.

Creeks beds consisting of comparatively small and similarly sized round gravel show 2 - 3 % gradient being independent of watershed areas. These creeks flow meandering through wide diluvium deposits continuing narrow deepening.

Though diluvium deposits are covered with jungle, both sides and beds of creeks consist of hard conglomerate of Tertiary and sand and gravel deposit layers have depth about 1 m. Erosion control of deposits near creek heads is one of the most important problem in soil conservation.

Devastated area percentage of Pantabangan watershed is as follows: hillside 6 %, creek 1 %, total 7 %; that of Bayabas watershed, where the model erosion control work is planned, hillside 14 %, creek 1.3 %, total 15 %; that of Ororo watershed, total 8 %.

Area of the watershed of Lake Pantabangan is about 100,000 ha in which mountaineous area occupies 80,000 ha and grass-growing hilly area, 55,000 ha.

Computation of volume of sediment presumed to have been produced under the heavy rain of May 1976 and to have been carried into Lake Pantabangan gives us data shown below.

Severely devastated section	area 12,000 ha
Net devastated area	1,284 ha (10.7 %)
Moderately devastated section	area 25,000 ha
Net devastated area	1,750 ha (7.0 %)
Slightly devastated section	area 18,000 ha

Net devastated area 270 ha (1.5 %)

Net devastated area total 3,304 ha

Unstable sediment (12,380 m^3 per 1 ha of devastated area)

Unstable sediment total

12,380 (m^3) x 3,304 (ha) = 40,000,000 m^3

From the above data we have to pay great attention to future silting situation of Lake Pantabangan.

3-2-2-2 Actual situation and feature of landslide area

Landslide is classified into shallow slip type and deep collapse type.

(1) Shallow slip type

On reddish brown laterite layer bound by Samon roots downslips are caused by piping action due to intermediate flow between the soil layer and ground layer. Between laterite layer and ground layer there is porous intermediate layer in which piping action occurs under continuous heavy rain. Laterite layer itself has relatively large cohesion.

Together with the binding function of Samon root the laterite layer slips down as a whole.

It deposits on gentle slope downward or creek head exposing ground gravel layer on the upper part of collapsed plate. These slips seem to have happened at the end of rain when continuous rain reached the maximum.

In Bayabas watershed there are 94 (85 %) slips and the total area of them amounts 8.1 ha (56 %), while the volume of unstable earth produced is relatively small.

(2) Deep collapse type (ground water type)

With the depth of 3 - 10 m this type appears on plane - or slightly convex-shaped gentle slope near creek head at the height of over 330 m above sea level. Colluvial

Table 3-1 Table Summarizing Devastation Situation

Watershed Name of Grand Classification : Panpanga Riv.

Watershed Name of Basic Classification : Carranglan Riv.

Watershed Name of Branch Classification : Bunga Riv.

Date of Investigation : Oct. 10, 1977

Person in Charge : Forest Civil Engineering Consultants Foundation

Unit watershed name	Watershed area (S)	Land slide			Special land slide		Bare land		Land slip area (E)	Wild creek		Area of devastation (F)=(A)+(B)+(C)+(D)+(E)	P.C., of devastation (F)/(S)	Land slide estimating area	Land slide estimating volume (f)	Unstable earth and sand volume in watershed area (a) ∿ (f)	Facilities for work		Forest condition			Forest road		Outline of direct liable property	Note
		Area (A)	Volume of erosion (a)	Volume of spreading estimate (b)	Area (B)	Volume of erosion (C)	Area (d)	Volume of erosion (D)		Area (e)	Unstable earth and sand volume						Hillside	Creek	Estimating area of devastation	Deforested area	Infancy forest	Constructed	Scheduled		
	ha	94 spots ha	m^3	m^3	spot ha	m^3	spot ha	m^3	ha	7 spot ha	m^3	ha	%	ha	m^3	m^3	ha	spot m^3	ha	ha	ha	m	m		
Bayabas Creek	108.00 ha	14.54	58,160	14,540	-	-	-	-	-	3.76	54,400	18.30	16.94			127,100	-	-	-	-	-	nothing			
Ororo Creek	203.00	14.00	56,000	14,000	-	-	-	-	-	0.90	27,000	14.90	7.34	-	-	97,000	-	-	-	-	-	"			
Total	311.00	28.54	114,160	28,540	-	-	-	-	-	4.66	81,400	33.20	10.68	-	-	224,100	-	-	-	-	-	nothing			

deposit fills creek and makes pools in places. On the upper part of the deposit there are many tensile cracks and on the lower part, compressive cracks. The cause of this kind of slide is the rise of pore water pressure in clayey layer between Tertiary silt rock and diluvium conglomerate. Many of these slides occured under the rain in May 1976. It would be natural that most slides happened at the time of the maximum in continued rain.

A large quantity of deposits have still filled creeks. But they are in danger of flowing out under next heavy rain in the form of mud and stone flow. It is necessary to build check dams and walls to prevent the outflow of these deposits at earliest convenience.

In Bayabas watershed there are 14 (15 %) slides of this type area being 6.4 ha (44 %). Majority of dangerous unstable deposits belong to this type.

3-2-2-3 Actual situation and feature of wild creek

Devastation of creek is caused by unstable deposit and vertical and lateral erosion (deepening and widening). Mud and stone flow produced under heavy rain is the most disasterous event. Creeks under survey are on conglomerate and sand-stone base, having double sections. On both sides of creeks there lie diluvium deposits or terraces 30 - 40 m wide. Between deposits or terraces creeks run meandering. Creek beds are occupied by relatively hard conglomerate, sandstone, etc.

Creek bed slopes are 2 - 3 %. Along creek sides there grow dense jungles of large trees. These green belts are very effective for flood control.

As mentioned before deposits produced under 1976 rain are seen in creeks of 1st order near creek heads. They have not comedown to creeks of 2nd order. Erosion control work should be carried out to stop the former. Besides, if necessary, check dams in creeks of 2nd order are to be

planned for prevention of creek deepening and sediment out flow.

3-2-3 Social economic feature

This project is originally taken up in connection with Pantabangan dam. The dam was completed in 1974 with the aid of circulating medium capital of The World Bank. This is a multiple dam having capability of irrigating 61,000 ha paddy field in the central plane of Luzon, generating 200,000 kW electric power and flood control. The maximum ponding area is 8,000 ha. Watershed area is about 100,000 ha, 55,000 ha of which is occupied by hilly wild area called "Kogon Land". This area has been paid much attention from the standpoint of land conservation. But in May 1976 this area suffered serious devastation under extraordinary heavy rain. Urgent problem was proposed for maintenance of dam function and prevention of disaster. In the area upstream of dam there are many communities, Carranglan, Bonga, Bunga, etc. together with crop fields. Farmers having lost their lands by dam establishment moved to lakeside areas and are living on farming and grazing. New communities are scattered on diluvium area along Toban Creek.

Since the dam has storage capacity of more than a billion m^3, its silting-up might not be today's problem. However, it is true that silting has begun from shallow portion along circumference of the lake and it gradually proceeds toward the center. Even small amount of silt may give considerably large effects on water utilization and electric power generation. One of the problem's is that the circumferential area especially Carranglan city and farms should be paid special attention. Another problem is labour, material, transportation and communication related to the model erosion control work. As regards labour sufficient supply may be expected from Carranglan town having 4,000 people located within 10 km and from scattered neighboring farmer families. But it must be noted that these people have had no experience on erosion control work. Construction material concern is as follows: Cement, timber, etc. can be obtained at Manila; Steel is supplied mostly from Japan; Concrete aggregate can be collected in the vicinity of working field. Main transportation is by truck from Manila.

Access road between prefectural road and working spot is built by Philippines side. Model erosion control work will be greatly affected by the progress of this road construction. This is very important point for the work in rainy season.

Problem of communication, hygiene, etc. may be solved by close connection with administrative agency, district forest office and JICA in the region. There is a clinic attached to NIA at Lake Pantabangan and a hospital in San Jose City (20 km towards Manila).

3-3. Basic Design of Model Erosion Control Work, etc.

3-3-1. Model erosion control work

The work is classified into two categories; the one is the work related to creek gauging dam and the other is that to hillside restoring work

3-3-1-1. Work related to creek gauging dam

The aim of creek gauging is to find forest influences (of tropical forest) upon (lowering of) flood discharge especially flood peak, water resource conservation, drought mitigation and erosion control. Gauging sites are selected at the entrances of two watersheds in order to compare the above-mentioned functions of two watersheds. One is Bayabas creek, covering 108 ha, where model erosion control work and ordinary erosion control work are carried out, while the other watershed covers 203 ha. Both watersheds are hilly lands of Tertiary and diluvium (of Quarternary) formation being covered with dense Samon and Cogon growth. The features and happenings in these watersheds were already explained. As already stated, how will the situation of runoff and sediment change with the progress of erosion control work and the improvement of forest condition is the object of creek gauging.

Annual rainfall averages 2,042 mm, 95 % of which falls in the period ranging May - November. In the period ranging

December - April in dry season we have little rain.

Extreme values of rainfall are already explained. In planning creek gauging equipments under natural condition above mentioned the following items should be taken into deliberate consideration.

(1) In order to obtain precise runoff data make water storage capacity of dam large as possible and give outlet ample size.

(2) For precise data of droughty runoff give double section outlet and add triangular notch of steel.

(3) Use Self-recording water gauge of float type (winding 3 months) for water level measurement.

(4) Make steel dam at proper site upstream of gauging dam for prevention of dam siltation and for periodical measurement of flowout mud and sand as well.

(5) Set self-recording rain gauge at proper site near by.

(6) Design gauging dam so that it may act to check mud and sand.

3-3-1-2. Check dam and hillside restoring work

In the area where model erosion control work is to be carried out much deposits fill up creeks (0 order). They are in danger of converting into mud and stone flow under next heavy rain and extending the size of devastation. The counter-measure is summarized as follows: The first step is to build check dam at the point where collapsed slope faces of creek. Then the dam not only stabilizes creek as well as unset deposit but also prevents the extension of devastation on side slopes. Next step is greening work on Side slopes of creek at proper time. This work should be carried out under careful observation of transition of creek condition after work.

The above measure is very effective to the work at the foot of colluvial deposit near stream head. There in most cases

hillside greening is accomplished by relatively simple work.

In the area we surveyed there are many collapsed sites of large scale. Considering the early invasion of graminaceous plants peculiar to tropical region it is suggested that for the time being the work of stabilizing the foot of collapsed site should be intensively promoted. Though check dam is most efficient in such case the group of wire basket dams is very effective.

It is also economical, because the boulders in the basket can be collected in the working field. It must be noted that the plan of this time is so made for model work area that all kinds of work are designed for the purpose of instruction.

The kind of work, its object and function will be shown below.

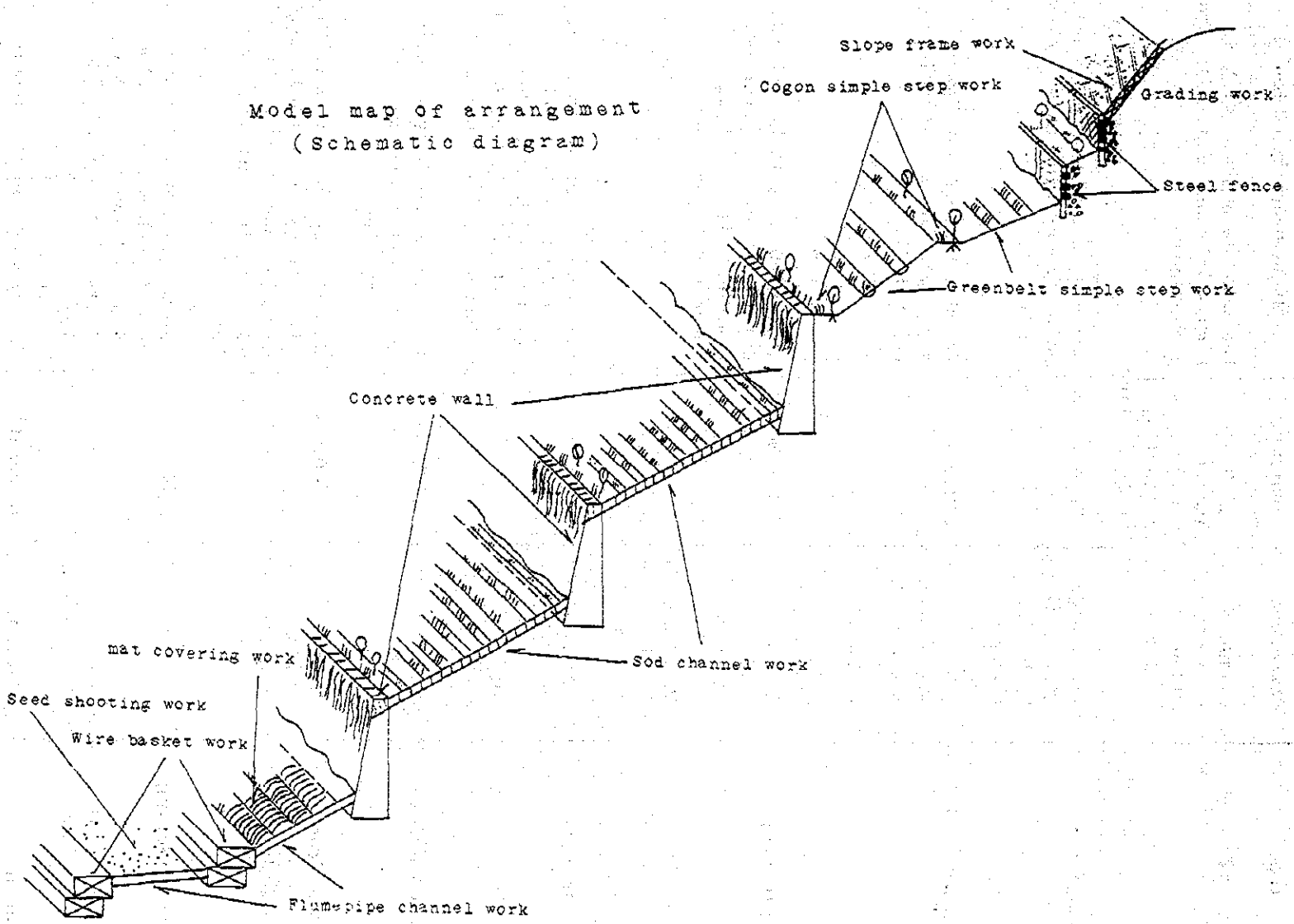
Table 3-2 Object and Function of Works

Item	Structure	Volume	Object and Function
(Steam works)			
No. 1 Gauging dam	Concrete Height : 6.0 m Length : 43.0 m	653.7 m^3	Tracing survey on effect of forest conservation in tropical region and prevention of wash-out sediment (in Bayabas creek, area : 100 ha) By setting raingauge carry out measurement and analysis of relation between flood and droughty discharge. Storage capacity : 2,000 m^3
No. 1 Sub-dam	Concrete Height: 2.0 m Length : 36.0 m	91.8 m^3	Prevention of scouring of front yard of No. 1 dam.
No. 2 Steel dam	Buttress Height : 4.0 m Length : 61.0 m	Steel : 25.6 ton Concrete: 265.6 m^3	Prevention of wash-out sediment, esp. control of gauging dam siltation. Control of the decrease of storage capacity. Measurement of wash-out sediment for the purpose of studying the effect of forest

Item	Structure	Volume	Object and Function
			conservation work upon sediment wash-out. Storage capacity 15,000 m^3.
No. 3 Dam	Concrete Height : 5.5 m Length : 45.5 m	522.0 m^3	Control of creek deepening and slope base fixation. Stabilized sediment 15,000 m^3.
No. 4 - 8 Dams	Concrete Height : 4.0 m Length : 30.0 m	1,150.0 m^3	The same as above. Stabilized sediment 8,000 m^3.
No. 9 Dam	Concrete Height : 4.0 m Length : 32.5 m	235.67 m^3	The same as above. Stabilized sediment 3,200 m^3.
No. 10 Dam	Concrete Height : 4.5 m Length : 17.0 m	168.95 m^3	The same as No. 1 dam, but located at the entrance of Ororo creek without hillside work. For the purpose of comparison with No. 1 dam. Storage capacity 1,500 m^3.
No. 11 Steel dam	Buttress Height : 5.0 m Length : 21.0 m	Steel : 9.05 ton Concrete : 115.9 m^3	The same as No. 2 dam. Periodical measurement of wash-out sediment for the purpose of comparison with Bayabas creek.
(Hillside works) Concrete wall	Height : 2.0 m Crown Width : 0.3 m Slope : 0.3, 0	Length : 200 m	Stabilizing the slope and fixing the base of greening works.
Steel fence	Height : 0.9 m Embedded Length : 1.5 m Pitch : 2.35 m	282 m	The same as above. Located on deep colluvial deposit.

Item	Structure	Volume	Object and Function
Wire basket	Height : 1.0 m Width : 1.2 m	80.0 m Basket 0.5 m, 2 storied, Stone filling	The same as above. Rich in flexibility and stability and economical
Channel	Flume pipe 50cm x 32 cm With sod channel	50.0 m	Located in hillside depression suffering erosion under heavy rain.
Channel	Sod Arc-shaped arc length: 1.0 m Depth : 0.3 m	100.0 m	Paved with Cogon or Samon sod sheet for soil erosion control.
Simple step	Cogon Step Width : 0.5 m Virtical Height : 1.5 m	2,000 m	Very popular work having the nature of soil preparation. Grading step cutting Cogon stock planting.
Simple step	Green belt	2,000 m	Green belt (mat 10 cm wide, 50 cm long, 1 cm thick together with seed and fertilizer). Placed between Cogon simple step works.
Mat covering	Width : 1 m	1,400.0 m^2	Rice straw set by peg, help seed germination, prevent soil erosion.
Slope frame	Wooden frame bar 1 x 1 m	1,400.0 m^2	Wooden frame set on collapsed site (original ground), place greening bag (seed and fertilizer in it) between frame bars.
Seed shooting		2,800 m^2	Use mixture of water and covering chemical together with seed and fertilizer. Widely used on road side slope.
Grading	Cutting paving	6,300 m^3	Carried out on the upper part of collapsed slope to make stable gradient (about 80 - 70 %).

Model map of arrangement
(Schematic diagram)



3-3-2. Access road

This road is necessary for transportation of working materials, equipments and labors on establishment of model erosion control works and also in use as traffic road for tracing of gauging test and training of forest conservation, etc.

Therefore it should be built before starting of model erosion control works by Philippines in conformity with official proceeding (Oct. 21, 1977). At practice of basic design we think that the sides of faculty and economy are important, and make effort selection of route, structure and standard to be proper.

Before the fact surveyed several routes. And finally we selected the route to be shown located map as a result of preliminary and actual survey.

The route starts from a point on the prefectual road 1.7 km south west of the site where the Main Building of Training Center is to be established and comes to the end of center in model erosion control works, 54th forest.

The attention about selection of route is paid to the followings.

* Lessen the length and smooth the route.
* From the standpoint of balancing of cutting and banking, consider the use of both plus and minus slopes.
* Avoid the route passing through steep slopes and land-slide sites.
* Review competitive routes.

From the section between starting point and up to about 2.3 km it passes on compartively flat ridge. And then it leaves away from ridge, passes through steep slope and at the site 3.0 km from the starting point runs down the left bank of Toban creek. Then passes along it the deposit. At the narrow place (4,015 m) crossing over Toban creek, enters the watershed area within Ororo creek, climbs obliquely steep slopes, passes the boundary ridge between Ororo area and Bayabas area and comes to the end (6,160 m). Crossing over Toban creek, there are generally steep topography with ups and downs.

Accordingly, it needs many walls and channels. And then it will be a difficult construction.

Width	:	Total 4.0 m, Effective 3.0 m
Vertical Curve	:	Maximum 12 %
Radius of Curve	:	Minimum 15 m

As a result of the above, 12 ton truck can pass. Considering local climate and soil condition at practice of basic design, we adopt proper grading slope for balancing of cutting and banking. And then we plan sod tamping of Cogon and Samon on the banking faces and greening works of seeding shooting on the cutting face.

To cut down a price of the construction we adopt many wire basket wall. But we plan also concrete walls as occasion calls. We take care draining of steep slope for tropical squall and we adopt hume pipes (ϕ 40 cm) or corrugated pipes (ϕ 60 cm - 120 cm) in proportion to catchment areas. The span of bridge is 14 m. And upper construction is H.B.B. but this is possible to change P.S. concrete.

We plan use of dozer (12 t) on earth work and blasting operations by dynamite on soft rock works. But it is also possible cutting by backhoe, etc.

It is necessary to practice subsurface exploration at the step of practical design. Totaling of work is as follows:

The earth works

Items		
	Earth cutting	33,544 m^3
	Soft rock cutting	13,051 m^3
	Banking	21,272 m^3
	Sod tamping	12,077 m^2
	Slope greening	19,669 m^2
	Gravel paving	3,679 m^3
	Route clearing	6,132 m
	Wire basket	324 pieces
	Concrete wall	515 m^3
	Frame	1,257 m^2
	Earth excavation	645 m^3
	Soft rock excavation	251 m^3

The channel

Items		
	Inlet	31 pieces
	Hume pipe ϕ 40 mm	108 pieces
	Corrugated pipe ϕ 60 mm	287 m
	Corrugated pipe ϕ 100 mm	72 m
	Corrugated pipe ϕ 120 mm	25 m

The bridge

Items		
	H.B.B. upper construction (steel)	13.8 ton
	Construction cost (truck-crane)	a complete set
	Scaffold	324 m^3
	Painting	a complete set
	Abutment concrete	55 m^3
	Frame	130 m^2
	Soft rock excavation	101 m^3

3-4. Individual Explanation

3-4-1. Idea of design of model erosion control work

3-4-1-1. Selection of kind and practice of work

Model Erosion Control Work arranges standard kinds and practices for instruction in forest conservation training planned in Philippines. It might seem non-practical from economical view point. But this is the first field practice of standard erosion control work in this country and it has an important meaning to be the index for future forest conservation practice.

By the way in Shiga prefecture Japan a check dam built by Drehk, Dutch engineer, at the beginning of the 20th Centrury has survived till today and is paid special attention as a model work.

Considering the value of model work it is planned to use up-to-date materials such as concrete, steel, etc. having high stability and durability. On the other hand, from

practical standpoint our plan adopts economical and effective way of carrying out work fitting to topography, geology and other natural conditions of the working field. Thus stable and durable materials such as concrete and steel are used in stream work, while relatively simple measures such as wire basket, fence, wooden frame, Cogon step work, mat covering and seed shooting are used in hillside restoring and greening work except partial retaining wall and fence.

3-4-1-2. Stability condition of structure

(1) Flood runoff (discharge)

Since record of hourly rainfall has not been adjusted, the data of 180 mm/hr by hearing is used. The maximum discharge is computed by rational formula.

If watershed area is considered we have to use rain amount in 20 minutes for Bayabas watershed and that in 30 minutes for Ororo watershed. But as special coefficient of 20 - 30 minute rainfall for probable hourly rainfall is not yet definite, the above mentioned hearing data 180 mm/hr is adopted and ample size is given to outlet cross-section of gauging dam.

Maximum discharge formula

$$Qmax = 0.2778 \times f \times r \times A$$

Where

Qmax : Maximum discharge m^3/sec

f : Runoff coefficient 0.6

r : Maximum hourly rainfall 180 mm

A : Watershed area Km^2

Bayabas watershed

$$Qmax = 0.2778 \times 0.6 \times 180 \times \underset{(Km^2)}{1.08} = 32\ m^3/sec$$

Ororo watershed

$$Qmax = 0.2778 \times 0.6 \times 180 \times \underset{(Km^2)}{2.03} = 61\ m^3/sec$$

(2) Shape of outlet and discharge

No. 1 Gauging dam (Bayabas Creek)

Rectangle ; discharge computed by contracted weir formula.

$$Q = 1.77\ B \times h^{3/2}$$

where

Q : Allowable maximum discharge m^3/sec

B : Outlet width 15 m

h : Outlet height 1.5 m

$$Q = 1.77 \times 15 \times 1.5^{3/2} = 48\ m^3/sec.$$

Because 48 m^3 > 32 m^3, we know its safety. To heighten its safety we make the height 2 m. No. 10 Gauging dam (Ororo Creek)

$$Q = 1.77 \times 10 \times 2.5^{3/2} = 70\ m^3/sec.$$

Because 70 m^3 > 61 m^3, we know its safety. Further, since both sides of dam site consist of exposed hardrock overflow in flood time will do no harm to dam.

Other dams : Given trapezoidal shape with 45° sides of outlet, sizes are computed in the same manner as applied to the above mentioned 2 dams.

(3) Droughty discharge

Discharge in dry season is very small being presumed less than 0.1 m^3/sec. For such case it is planned to add a triangle-shaped notch to outlet. (1 site 80 cm, right-angled triangle)

(4) Storage capacity

To obtain precise runoff data it is necessary to give gauging dam such storage capacity that it may make the velocity of approach of ponding water approximately zero.

From the above standpoint the following is planned:

No. 1 Gauging dam : Length 43 m, Height 6 m, Storage capacity 2,000 m^3.

No. 10 Gauging dam : Length 17 m, Height 4.5 m Storage capacity 1,500 m^3.

(5) Bearing capacity of base ground

For general use : Soft-rock 80 t/m^2, sand and gravel layer (Stream bed and original slope) 50 t/m^2, sediment layer 10 t/m^2.

It is suggested that precise field test be made on each case.

(6) Coefficient of friction between structure and ground.

For general use : Soft-rock 0.8 - 1.0, sand and gravel layer 0.6.

It is suggested that precise field test be made sounding for determination of N value, etc.

(7) Stable gradient of slope.

For general use : Cutting slope 40°, banking slope 33°.

It is desirable to supplement these values by sounding practice, etc.

(8) Stability computation, etc.

Computation is made in the following way :

General : by "Standard of Erosion Control Technique" by Forestry Agency of Japan.

Concrete structures: by "Table of Cross-section of Dam and Retaining Wall" by Forest Civil Engineering Consultants.

Steel buttress dam, steel fence, and wooden frame are dealt with in the manner specific to respective structures.

3-4-1-3 Mix preparation of concrete

Computation is made according to standard specification. However, it is desirable to carry out field test of aggregates and supplement the computed values.

3-4-1-4. Others

Aggregate and gravel are collected from Toban Creek and transported by tructor shovel and human labor.

Working road is planned, as shown in figure (located map), to be about 2 Km and carried out by 2 dozers and human labor. However for practical design further field survey and designing are desirable.

As to bridge over creek H.B.B. is planned.

3-4-2. Suggestion on model erosion control work practice

3-4-2-1 Working order

Considering progress of equipment and labour and climatic condition the following plan of work stage is made. (See table)

Though the period from May to October is regarded as rainy season, most rains are caused by Typhoon or of squall type peculiar to tropical region. So it seems that the number of days wholly non-working is very small and considerable amount of work may be carried out even in rainy season.

Since the most progressive working time is later than September, it may be possible to complete whole work by presumed period. However, greening work is desirable to be carried out immediately before rainy season.

Table 3-4 MODEL EROSION CONTROL WORKS PROGRESS SCHEDULE

Item	Months / Days	1st 10 20	2nd 10 20	3ed 10 20	4th 10 20	5th 10 20	6th 10 20	7th 10 20	8th 10 20	9th 10 20	10th 10 20	11th 10 20	Using Equipment
Practical Design		*1 design work											
Preparation & Temporary Work				2 bull				backhoe					Backhoe, Bulldozer Tractor-shovel (transport)
Aggregate Extraction, Transport				*2 field office etc.				bridge building					Tractor-shovel
Excavation	No. 1, No. 2 Dams												2 Backhoe
	No. 3 - No. 9 Dams												2 Backhoe
	No. 10 - No. 11 Dams												2 Backhoe
Concrete Coasting	No. 1, No. 2 Dams												1 Batcher Plant 2 Vibrator
	No. 3 - No. 9 Dams												As same above
	No. 10 - No. 11 Dams												As same above
	Wall												As same above
	Bridge for works												
Steel No. 2, Dam													2 Backhoe
Framing No. 11 Dam													
Grading Work													2 Backhoe
Wall and Steel Fence													
Slope Frame Work													
Channel Work													
Mat Covering Work													
Simple Step Work													
Seed Shooting													1 Hydro-seeder
Readjustment													equipment and building removal

*1 - field work *2 - leveling of ground

3-4-2-2. Practical measures for site and kind of work, etc.

Near the entrance of Toban Creek is built a concrete dam 43 m long and 6 m high.

This dam playing a role of stream gauging besides sediment checking, its wings and base are made intrude into rock of dam site. Moreover water leaking is prevented by grouting cement milk together with placing water proof plate along expansion joint. In such a way concrete work is operated elaborately to give it high quality.

As regards stability of dam water pressure including overflow is used in computation for safety. Further a counter-dam 2 m high is planned to prevent scouring of front yard of dam.

Stream gauging dam (No. 10, 17 m long, 4.5 m high) to be put near the entrance of Ororo Creek is designed after the above mentioned dam. But it is a little lower than the former because of larger hardness of dam site rock. In nearest upstream steel dams No. 2 and No. 11 are planned for the purpose of checking sediment as well as measuring its volume. They are of buttress type using H shaped steel. Gaps between H bars are covered with zinced expand metal to stop sand passing through.

In model work area of Bayabas watershed No. 3 check dam (ground sill type) is planned at the end of the devastated tributary of Bayabas main stream. In the creek at the foot of collapsed slope No. 4 - No. 9 small dams are planned to prevent colluvial sediment from being washed out as well as to stabilize the base of collapsed slope.

Planned gradient of newly built stream bed above No. 3 dam is 2 % and those of No. 4 - No. 9 dams are 4 %. The height of No. 3 is 5.5 m and those of No. 4 - No. 9 are 4.0 m. No. 4 - No. 9 dams being built on sedimentary layer it is necessary to operate sounding to examine dam stability. If the bearing capacity of base ground is small foundation work such as footing should be carried out.

Hillside restoring work is so practised that it may match the working site condition and at the same time play a role of displaying the kinds of erosion control work. Thus, the following plan is made.

Concrete wall, flume pipe channel, sod channel in depression of hillside.

Wire basket filled with boulder at the foot of colluvial deposit to prevent base setting. Steel fence along the border of deposit and original ground.

Slope greening work is as follows :

Seed shooting on gentle slope downward, Mat covering on the upper part of the former, Greenbelt work along the slopes between Cogon simple step works,
Grading (= 80 %),
Simple wooden frame work and soil dressing with sodding on the upper part of collapsed slope.

3-5. Administration Plan for Model Erosion Control Work

3-5-1. General items

3-5-1-1. Object of practice administration

Important point of practice administration in contract work is to make elaborate plan and to carry out it in field. In doing so, the work should be of good quality and able to attain the object and the practice should be safe and finished in presumed period. It is also important to lead working practice so that the contractor may gain reasonable profit.

When the plan execution is determined secondary field survey should be practiced and established detailed plan for practice instead of the plan having made for the purpose of estimation.

In the above process work administrator, having a close connection with contractor, should make precise and rational plan by investigating following items besides field survey;

materials, equipments, transport facilities, labour supply, monetary relations, selection of workers leader, etc. He must not forget the understanding between him and sender of order.

The success of contract work, excluding the adequacy of progress control, depends on selection of material, labour, and subcontractor, and also rationalization of work practice.

3-5-1-2. Function of practice administration

This function is classified into practice plan, work progress administration, quality administration, cost administration, material and equipment supply, equipment maintenance and safety administration.

Practice plan is to determine practice measures of making structures according to planning papers and drawings. In other words it is to find out such condition and working order that expected structures may be made within presumed period and with minimum expense. Work progress administration is to determine and control the most rational and economical progress on the basis of practice plan. Quality administration is to check and guarantee the quality of structure; checking should be made constantly by planning specification including stability check; thus it aims at prevention of producing structures of poor quality, quality examination and disposal of structures of bad quality.

Cost administration is to adjust expenditure in order to practice economical work by means of recording costs of material, labour and official and of making comparison between standard cost and actual cost.

Material and equipment supply is to supply those goods to right site at right time; purchase, storage, transport and withdrawal are also included in this function.

Equipment maintenance is very important to carry out works efficiently and economically. Maintenance of other tools and installations are included in this function.

Safety administration aims at mostly prevention of labourers' misfortunes.

3-5-2. Paper of working order and practice planning

Outline is read in separate sheets. Network of different works is planned at the stage of practice planning on the basis of complete field survey.

3-5-3. Progress plan of labour and equipment

3-5-3-1. Progress plan of labour

The aggregate number of workers is computed as follows:

Erosion control work (woman inclusive)	50,760
Special worker (guardman inclusive)	1,218
Frame worker	1,996
Ordinary worker or assistant (woman inclusive)	5,744
Workers' leader (head)	1,310
Scaffold man	91
Masonry	846
Total	61,947

Since working period is 9 months, the average number of workers per day is

$$\frac{61,947}{9 \times 23} = 300$$

where 23 is average number of working days per month.

Considering geographical condition and work efficiency 150 workers (about 1/2 of the average number of workers per day) are made living-in. As these workers would work extra hours the required number of workers might be decreased

(20 - 30 %). But total amount of labour cost does not change due to the extra wage of living-in workers. As a result this work is expected to be carried out by 150 living-in workers and 50 - 100 living-out workers.

Owing to the possibility of sufficient supply of workers from vicinity work progress is computed on the basis of heavy equipment's progress and the number of workers per day can be adjusted by living-out workers.

By taking the above measure we expect to save expense of equipment, because in this country lease of heavy equipment is very high 3.5 times as much as that in Japan.

3-5-3-2. Progress plan of equipment

Principal equipment to be used is shown below. Daily rent is computed as the sum of the following:

Lease stipulated by Contractors Association in Manila

Premium of used period (purchased 3 years before)

Wages of operator and assistant

Premium of extra use

Rent of truck is computed by unit cost of daily contract.

* Backhoe (Crowler type, 0.35 m^3, 12 ton) 2 chassises
  Practical total number of days : 156 days (including transporting days)
  Using object : excavation, grading, etc.

* Tractor shovel (Crowler type, 1.3 m^3, 12 ps) 1 chassis
  Practical total number of days : 52 days (including transporting days)
  Using object : aggregate and materials extraction, transportation

* Dozer (D50P-15) 2 chassises
  Practical total number of days : 123 days (including transporting days)
  Using object : land readjustment, making road

* Batcher plant 1 chassis
  (mixer 0.4 m^3, batcherscale with
  vibrator 2

mixing volume : 29 m^3 per day)

Practical total number of days : 127 days (including transportation, set and removal days)

Using object : concrete mixing

* Vibrator (flexible type, 38 mm, 4.5 ps) 3 chassis

Practical total number of days : 123 days

Using object : concrete tamping

Details are written on table-5 or design works.

3-5-4. Material plan

Materials in works and it's total are written on table-5, amounts of main materials and preparation planning are written on table-6.

3-5-5. Building and repair works plan

Lodges for labour live-in	:	5 houses (502 m^2)
Field office, etc.	:	2 houses (160.7 m^2)
Cement and materials storehouses	:	3 houses (100.4 m^2)

The heights near the field and at left bank of Toban Creek are fit for a place of construction.

Computing base is as following.

* Lodges for labor live-in

$$\frac{62,582 \text{ men} \times 1/2}{270 \text{ days} \times 23/30} = 150 \text{ men}$$

18 feet x 60 feet x 5 houses = 502 m^2 (including cooking and toilet room)

$$\text{Per 1 man} = \frac{502\ m^2}{150 \text{ men}} = 3.3\ m^2$$

* Field office, etc.

24 feet x 36 feet x 2 houses = 160.7 m^2

* Storehouses

12 feet x 30 feet x 3 houses = 100.4 m^2

Table 3-5-1 TOTAL TABLE OF LABORS AND MATERIALS

Item / Labors & Materials	Dam Works	Hillside Works	Indirect Works	Total	Note
Cement	747.72 t	69.69 t	14.83 t	832.24 t	
Sand	1,457.9 m3	140.0 m3	37.65 m3	1,635.55 m3	
Gravel	2,915.8 m3	217.5 m3	52.32 m3	3,185.62 m3	
Steel	34.65 t	12,444t	13.818t	60.912t	
Frame	3,801.9 m2	408.8 m2	196.3 m2	4,407.0 m2	
Light Oil	9,634.6 ℓ	2,944.6 ℓ	3,974.2 ℓ	16,553.4 ℓ	
Gasoline	3,466.6 ℓ	265.2 ℓ	59.85 ℓ	3,791.65 ℓ	
Epoxide Resin	416 kg			416 kg	
Pozzolan	1,846.7 kg	136.8 kg	36.4 kg	2,019.9 kg	
Concrete Plant	111.7 days	9.4 days	6.2 days	127.3 days	
Vibrator	110.74 "	8.25 "	4.4 "	123.39 "	
Backhoe	140.97 "	8.74 "	6.70 "	156.41 "	
Tractor shovel	43.74 "	3.58 "	5.0 "	52.32 "	
Bulldozer		42.0 "	80.67 "	122.67 "	
Grout Mixer & Pump	4.47 "	-	-	4.47 "	
Scaffold	apparent 927.3 m3	-	apparent 366 m3	apparent 1,293.3 m3	
Elaslite	148.1 m2	24 m2	-	172.1 m2	
Cut off Wall	32 m	-	-	32 m	
Gas Pipe	910 kg	-	-	910 kg	
Hose	633 m, 100 m	48 m	-	681 m, 100 m	
Hemp Bag	223 sheets	-	-	223 sheets	
Miscellaneous Materials	-	-	-	-	
Sub-Total					
Erosion Control	22,439.4 men	7,410.7 men	20,909.8 men	50,759.9 men	
Special Worker	1,073.6 "	94.5 "	49.88 "	1,217.98 "	
Frame Worker	1,711.2 "	266.7 "	17.67 "	1,995.57 "	
Assistant	5,135.4 "	438.1 "	170.92 "	5,744.42 "	
Head	158.0 "		1,152.45 "	1,310.45 "	
Scaffold Man	55.8 "		34.9 "	90.7 "	
Masonry	845.9 "			845.9 "	
Sub-Total	31,419.3 "	8,210.0 "	22,335.6 "	61,946.9 "	
Hydro-seeder		2.39 days		2.39 days	
Wire Basket		40 pieces		40 pieces	
Flume Pipe		50 m		50 m	
Green Belt		4,000 sheets		4,000 sheets	
Gravel		7.6 m3		7.6 m^3	
Slope Frame		1,937.6 m2		1,937.6 m^2	
Mats		1,400 sheets		1,400 sheets	
Shooting Materials		28 bag		28 bag	
Seed		58.5 kg		58.5 kg	
Cogon		400 bundles		400 bundles	
Sods		1,800 sheets		1,800 sheets	
Water-hole Pipe		60 m		60 m	
Paints			18.4 kg	18.4 kg	
Thinner			1.76 ℓ	1.76 ℓ	
Building and Repairs			763 m2	763 m^2	
Truck Transport			101.1 days	101.1 days	
Sundry Expenses			a complete set	a complete set	
Sub-Total					
Total					* 1472

Table 3-5-2 TABLE OF LABORS AND MATERIALS (Dam Works)

Item / Labors and Materials	No.1 Gauging Dam 653.7 m3	No. 1 Sub-Dam 91.8 m3	No. 2 Steel Dam 25.60 t 265.63 m3	No. 3 Concrete Dam 522.0 m3	No. 4 Concrete Dam 230.0 m3	No. 5 Concrete Dam 230.0 m3	No. 6 Concrete Dam 230.0 m3	No. 7 Concrete Dam 230.0 m3	No. 8 Concrete Dam 230.0 m3	No. 9 Concrete Dam 249.6 m3	No. 10 Gauging Dam 191.2 m3	No. 11 Steel Dam 9.05 t 115.88 m3	Total
Cement	160.802 t	20.655	59.767	117.450	51.750	51.750	51.750	51.750	51.750	56.16	48.06	26.073	747.72 t
Sand	294.2 m3	41.3	119.5	234.9	103.5	103.5	103.5	103.5	103.5	112.3	86.0	52.2	1,457.9 m3
Gravel	588.3 m3	82.6	239.1	469.8	207.0	207.0	207.0	207.0	207.0	224.6	172.1	104.3	2,915.8 m3
Steel	-	-	25.6	-	-	-	-	-	-	-	-	9.05	34.65 t
Frame (wooden)	570.6 m2	195.1	220.8	556.8	317.9	317.9	317.9	317.9	317.9	342.9	196.1	130.1	3,801.9 m2
Light Oil	1,692.2ℓ	292.1	1,144.5	1,320.8	682.1	682.1	682.1	682.1	682.1	676.1	532.3	566.1	9,634.6 ℓ
Gasoline	699.5 ℓ	98.2	284.2	558.5	246.1	246.1	246.1	246.1	246.1	267.1	204.6	124.1	3,466.6 ℓ
Epoxide Resin	304 kg	-	-	-	-	-	-	-	-	-	112	-	416 kg
Pozzolan	372.6 kg	52.3	151.4	297.5	131.1	131.1	131.1	131.1	131.1	142.3	109.0	66.1	1,846.7 kg
Concrete Plant	22.54 day	3.17	9.16	18.00	7.93	7.93	7.93	7.93	7.93	8.59	6.59	4.00	111.7 days
Vibrator	22.34 day	3.14	9.08	17.84	7.86	7.86	7.86	7.86	7.86	8.53	6.54	3.97	110.74 days
Backhoe	20.59	4.59	21.71	16.30	10.08	10.08	10.08	10.08	10.08	9.09	6.93	11.36	140,97 days
Tractor-shovel	8.83 day	1.24	3.60	7.05	3.10	3.10	3.10	3.10	3.10	3.37	2.58	1.57	43.74 days
Grout Mixer	"	"	-	-	-	-	-	-	-	-	-	-	
Pump	3.27	-	-	-	-	-	-	-	-	-	1.20	-	4.47 days
Scaffold	apparent												apparent
	258.4 m3	-	-	173.8	66.0	66.0	66.0	66.0	66.0	92.0	73.1	-	927.3 m3
Elastite	34.3 m3	4.1	-	40.1	11.6	11.6	11.6	11.6	11.6	11.6	-	-	148.1 m2
Cut off Wall	32.0 m	-	-	-	-	-	-	-	-	-	-	-	32 m
Gas Pipe	(131m)												
	700 kg	-	-	-	-	-	-	-	-	-	210 (39)	-	910kg(170m)
Hose	127 m	18	52	102	45	45	45	45	45	49	37	23	633 m
	10 m	10		10	10	10	10	10	10	10	10		100
Hemp Bag	45 bags	6	18	36	16	16	16	16	16	17	13	8	223 m
Miscellaneous Materials													-
Sub Total	men												
Erosion Control	4,372.1	660.9	1,987.6	3,537.2	1,599.0	1,599.0	1,599.0	1,599.0	1,599.0	1,731.4	1,288.8	866.4	22,439.4 men
Special Worker	218.9 "	30.3	87.7	172.3	75.9	75.9	75.9	75.9	75.9	82.4	64.3	38.2	1,073.6 men
Frame Worker	256.8	87.6	99.4	250.6	143.1	143.1	143.1	143.1	143.1	154.3	88.2	58.6	1,711.2 men
Assistant	1,013.0	155.6	408.9	818.5	369.3	369.3	369.3	369.3	369.3	400.5	310.0	182.4	5,135.4 men
Head	29.2	3.9	17.9	21.9	11.1	11.1	11.1	11.1	11.1	11.6	9.2	8.8	158.0 men
Scaffold Man	15.5			10.4	4.0	4.0	4.0	4.0	4.0	5.5	4.4	-	55.8 men
Masonry	148.6			180.3	79.4	79.4	79.4	79.4	79.4	84.4	35.6	-	845.9 men
Sub-Total													31,419.3 men
Total													

Table 3-5-3 TABLE OF LABORS AND MATERIALS (Hillside Works)

Item / Labors and Materials	Concrete Wall 200 m'	Steel Fence 282 m	Wire Basket 80 m	Flume Pipe 50 m	Sod Channel 100 m2	Cogon Simple Step 2,000 m	Greenbelt simple step 2,000 m	Slope Frame 1,400m2	Mat Covering 1,400m2	Seed Shooting 2,800m2	Grading 6,300m3	Total
Cement	54.0 t	15.54		0.15								69.69 t
Sand	108.0 m3	31.1		0.9								140.0 m3
Gravel	216.0 m3	-		1.5								217.5 m3
Steel	-	12.444 t	-									12.444 t
Light Oil	650.2 ℓ	37.3		2.6						99.9	2,154.6	2,944.6 ℓ
Gasoline	256.8 ℓ	6.5		1.9								265.2 ℓ
Concrete Plant	8.27 day	1.07		0.06								9.4 days
Vibrator	8.2 day			0.05								8.25 "
Backhoe	8.74 day											8.74 "
Tractorshovel		0.31		0.03								3.58 "
Bulldozer	3.24 day										42.0 day	42.0 "
Hydro-seeder	-									2.39 day		2.39 "
Pozzolan	136.8 kg											136.8 kg
Elastite	24 m											24 m2
Hose	47 m			1.0								48 m
Frame	408.8 m2											408.8 m2
Wire Basket			40 pieces									40 pieces
Flume pipe				50.0 m								50 m
Greenbelt							4,000 sheets					4,000 sheets
Gravel				7.6 m3								7.6 m3
Slope Frame								1,937.6m2				1,937.6 m2
Mat									1,400sheets			1,400 sheets
Shooting Materials										28 bags		28 bags
Seed										58.5 kg		58.5 kg
Cogon						400bundles						400 bundles
Sod				300 sheets	1,500							1,800 sheets
Water-hole Pipe	60 m											60 m
Miscellaneous Materials			-									-
Sub-Total												
Erosion Control	2,981.0 men	536.4	415.6	103.9	98.0	1,130.0	878.0	490.0	302.4	59.6	415.8	7,410.7 men
Special Worker	79.2 "	2.8	-	0.6						11.9		94.5 "
Frame Worker	212.5 "	12.3	4.0	2.8				14.0		14.8	6.3	266.7 "
Head, Slope Worker	394.7	33.9	-	2.6						6.9		438.1 "
Assistant												8,210.0 men
Sub-Total												
Total												

Table 3-5-4 TABLE OF LABORS AND MATERIALS (Indirect Works)

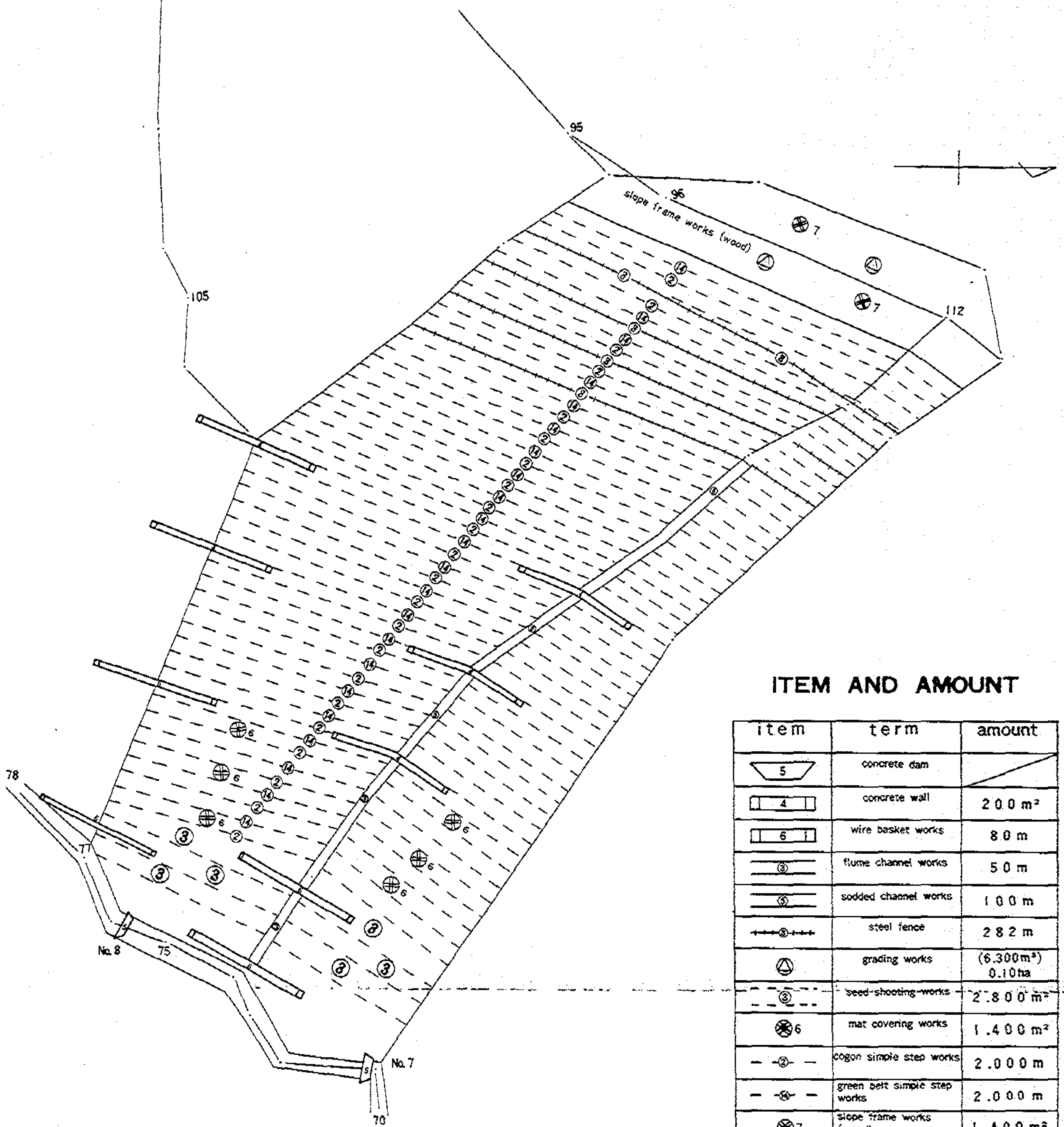
Item / Labor and Materials	Plant Trans. Set Removal 3.1 t	Tractor Trans. Removal 12t x 3	Other Equip. Trans. Removal 2t	Frame Scaffold Trans. Removal 36t(600m2)	Working Road 2,000 m Bridge 14 m	Leveling of Ground 1,200m2 (10days)	Cost of preparation 50 men	Safety Cost 1,080men	Building and Repairs 763 m2	Sundry Expenses a complete set	Total
Cement					370.74t						14.83 t
Sand					37.65m3						37.65 m3
Gravel					52.32m3						52.32 m3
Steel					13.818 t						13.818 t
Frame					196.3m2						196.3 m2
Light Oil					3,461.2ℓ	513.0ℓ					3,974.2 ℓ
Gasoline					59.85 ℓ						59.85 ℓ
Pozzolan					36.4 kg						36.4 kg
Concrete Plant	4.0 days				2.2						6.2 days
Vibrator					4.4 days						4.4 days
Backhoe	4.0 days				2.70						6.70 days
Tractor-shovel	2.0 days				3.0						5.0 days
Scaffold					apparent						apparent
					366.0m3						366.0 m3
Paint					18.4 kg						18.4 kg
Thinner					1.76 ℓ						1.76 ℓ
Building and Repair									763 m2		763 m2
Bulldozer	4.0 days				66.67	10.0					80.67 days
Miscellaneous Materials											
Truck Transport	3.1 t	60.0 t	2.0 t	36.0 t							101.1 days
Sub-Total					men						
Erosion Control					20,760.8	99.0	50.0				20,909.8 men
Special Worker	30.0 men				19.88 men						49.88 men
Frame worker					17.67 "						17.67 men
Assistant					170.92"						170.92 men
Head					70.95 "	1.5		(1,080.0)			1,152.45 men
Scaffold Man					34.9						34.9 men
Masonry											
Sub-Total											22,335.6 men
Sundry Expenses										4,981.574	

Table 3-6 MAIN MATERIALS PREPARATION PLANNING

Items	Standard	Amount	Preparation Planning
Cement	Portland 40 kg bag	832.24 ton	From Manila to field, truck transport,
Sand	less than 5 mm River in bed	1,635.55 m3	Toban Creek, extraction, transportation under direct control
Gravel	less than 40 mm River in bed	3,185.62 m3	Toban Creek, extraction, transportation under direct control
Steel	H beam 250 x 125 x 6 x 9 350 x 175 x 7 x 11 125 x 125 x 6.5 x 9 150 x 150 x 7 x 10 800 x 300 x 14 x 26 Expand metal	47.09 ton	From Japan to Manila truck transportation
Steel	800 x 300 x 14 x 26	13.82 ton use for bridge	
Frame	Wooden board or plywood	4,407.0 m2	About 1,000 m3 making, from Bongabon to field, truck
Light Oil		16,553 ℓ	From Manila or Sun Jose to field, truck
Gasoline		3,792 ℓ	From Manila or Sun Jose to field, truck
Epoxide Resin		416 kg	From Japan via Manila to field
Pozzolan	No. 8	2,020 kg	From Manila to field
Wire Basket	1.2 m x 4.0 m x 0.5 m	40 pieces	From Japan via Manila to field
Flume Pipe	500 x 320	50 m	From Japan via Manila to field
Greenbelt	10 x 50 x 1m	4,000 sheets	From Japan via Manila to field
Slope Frame	Wooden, sungrit I type etc.	1,938 m2	From Japan via Manila to field
Mat	Width 1 m, etc.	1,400 sheets	From Sun Jose to field
Elastite	Thickness 1 cm	172 m2	From Japan via Manila to field
Cutoff Board	JISK 6773 Width 230 x Thickness 9	32 m	From Japan via Manila to field

3-6 Schematic plans and Drawings

3-6-1 Arrangement map of model erosion control work

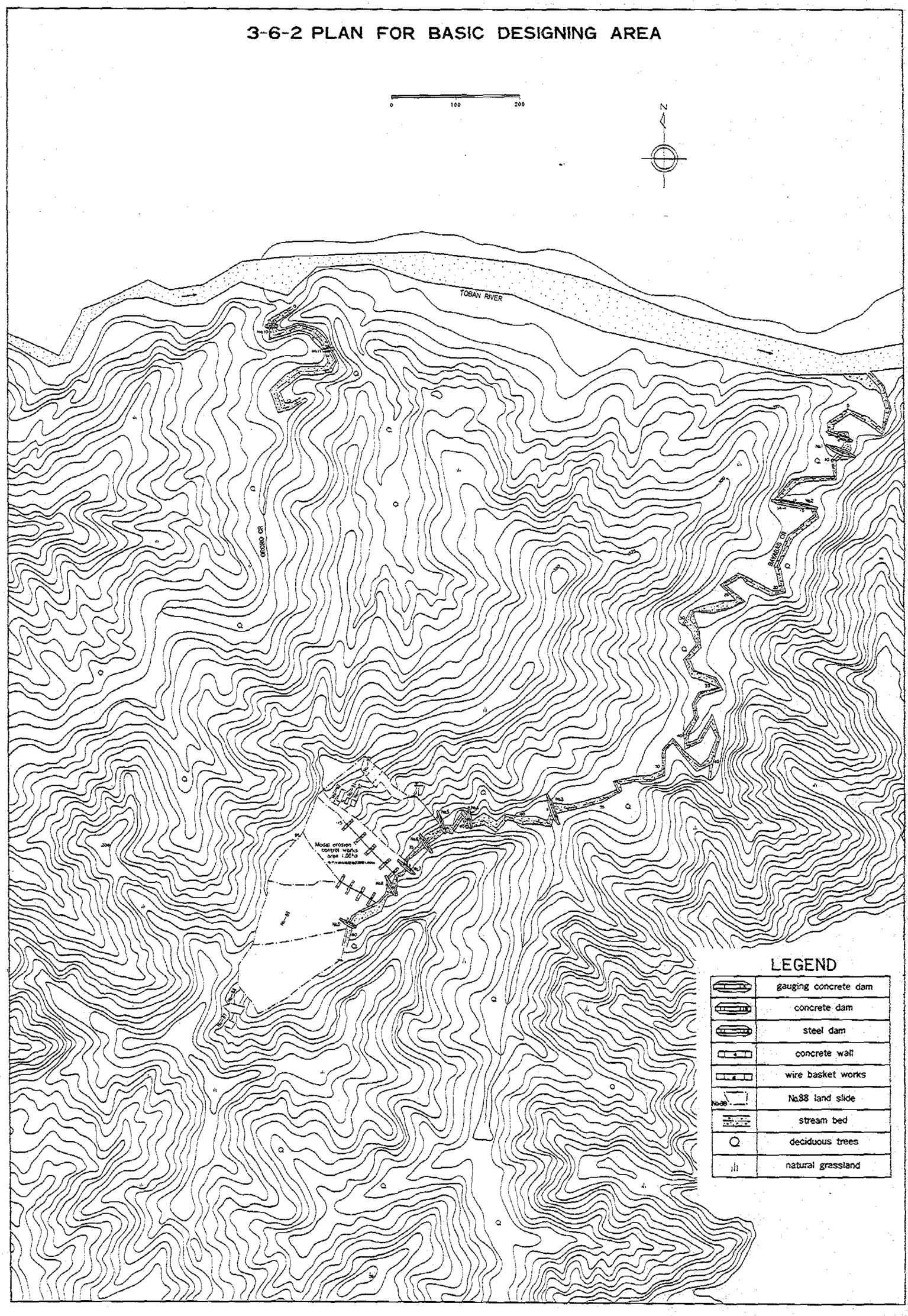


ITEM AND AMOUNT

item	term	amount
5	concrete dam	
4	concrete wall	200 m²
6	wire basket works	80 m
8	flume channel works	50 m
5	sodded channel works	100 m
3	steel fence	282 m
	grading works	(6,300m³) 0.10ha
3	seed-shooting works	2,800 m²
6	mat covering works	1,400 m²
2	cogon simple step works	2,000 m
14	green belt simple step works	2,000 m
7	slope frame works (wood)	1,400 m²

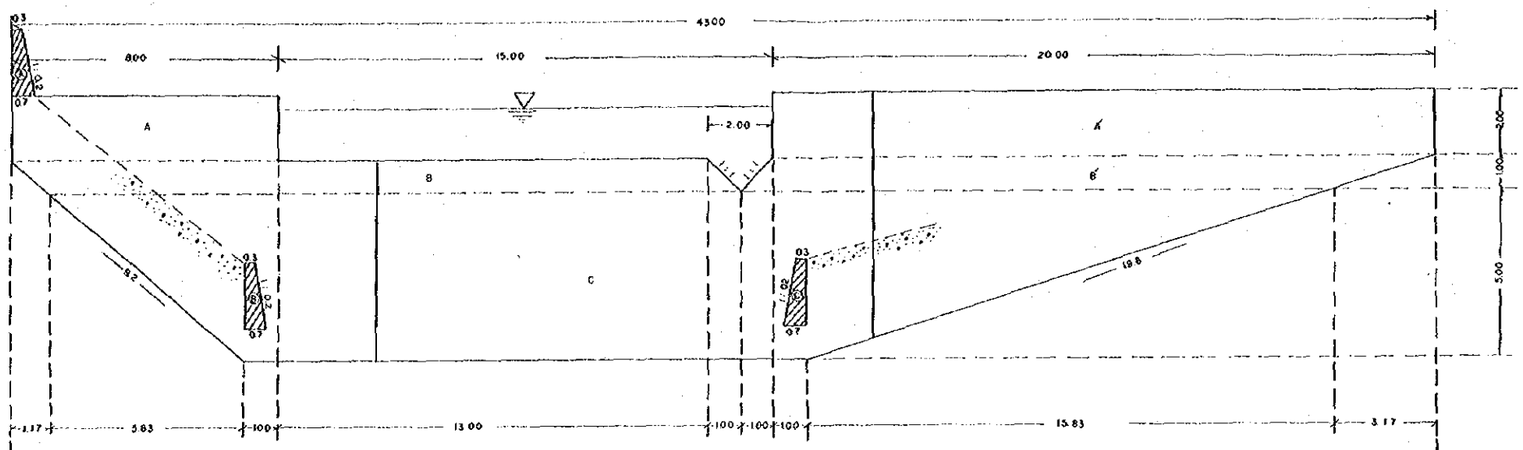
Area 1.00ha

3-6-2 PLAN FOR BASIC DESIGNING AREA

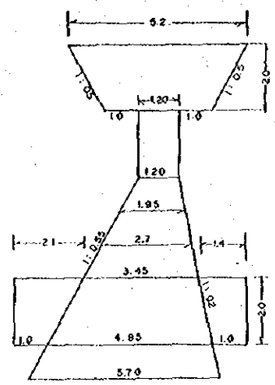


3-6-3 No.1 gauging dam (concrete)

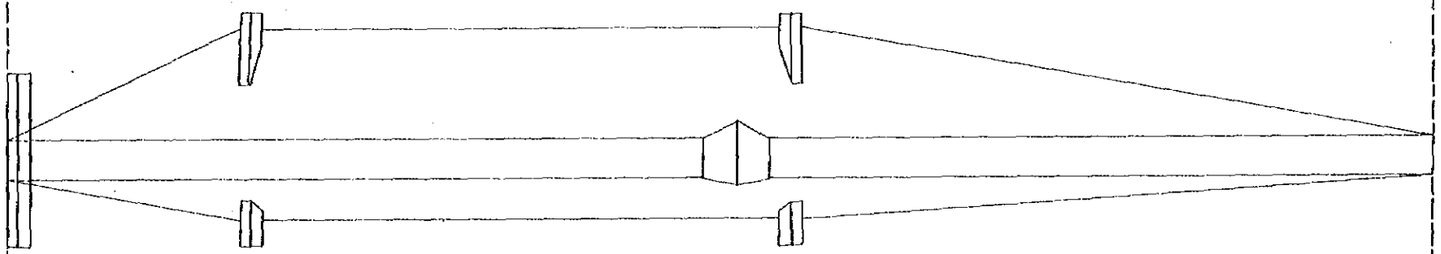
front view



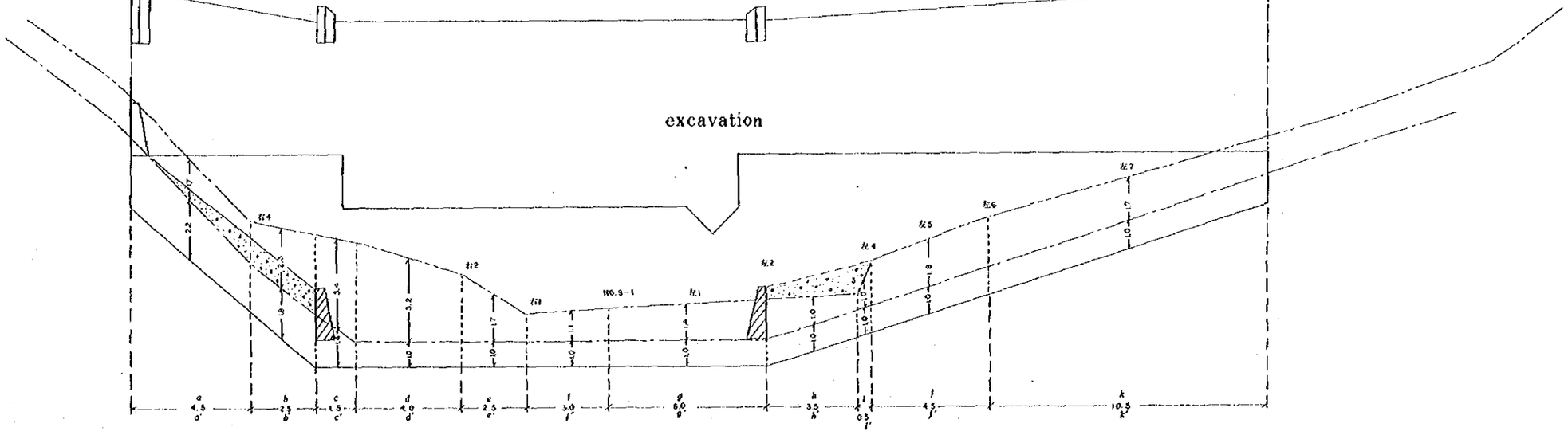
sectional plan



plan

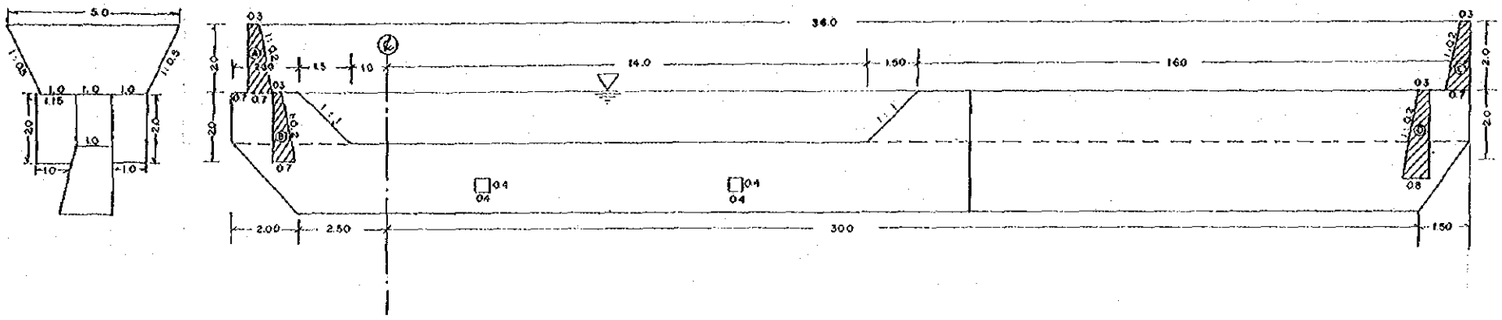


excavation

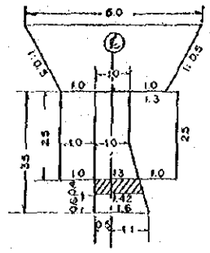


3-6-4 No.1 sub dam (concrete)

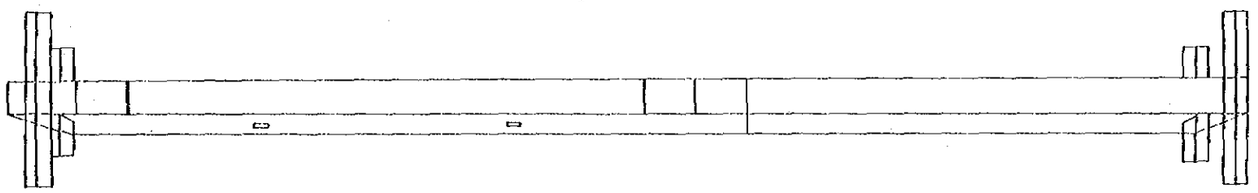
front view

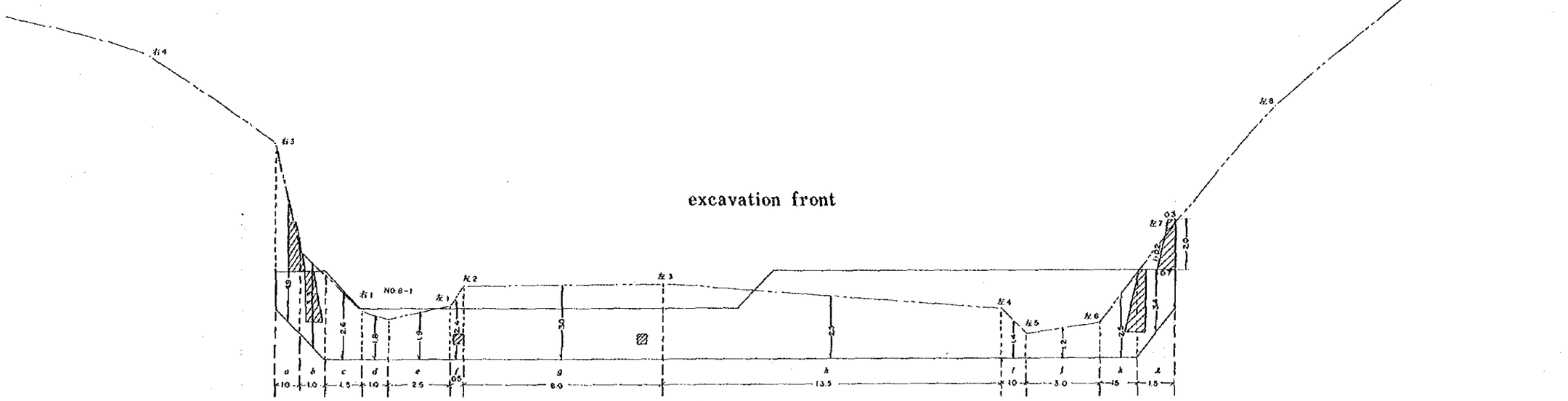


sectional plan



plan



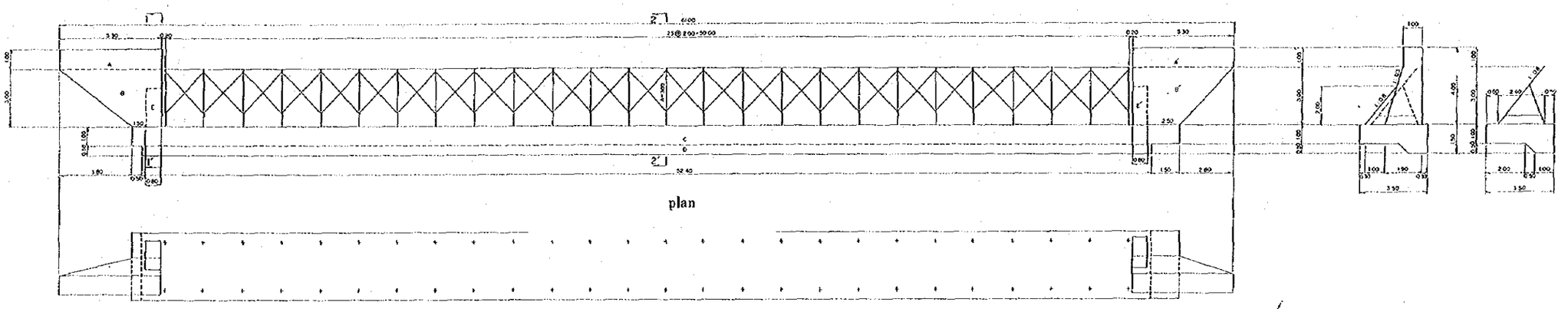


excavation front

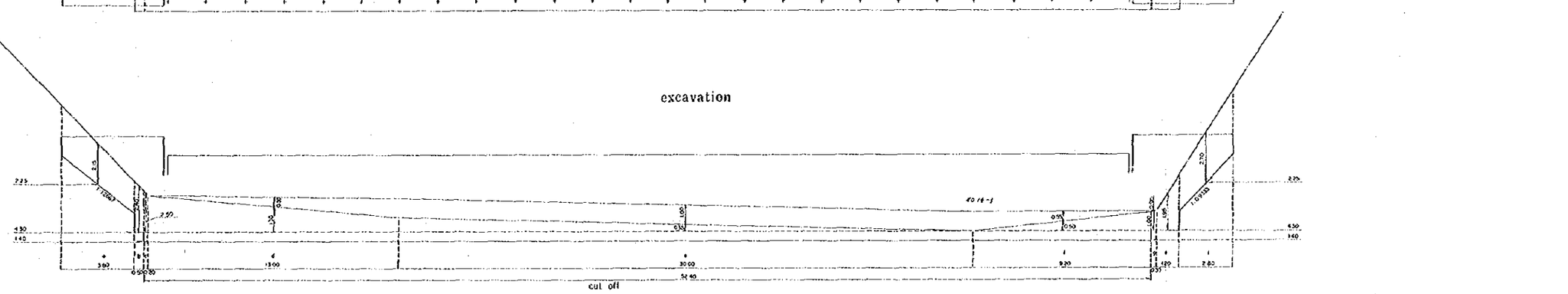
3-6-5 No.2 dam (steel)

front view

sectional plan1-1' sectional plan2-2'

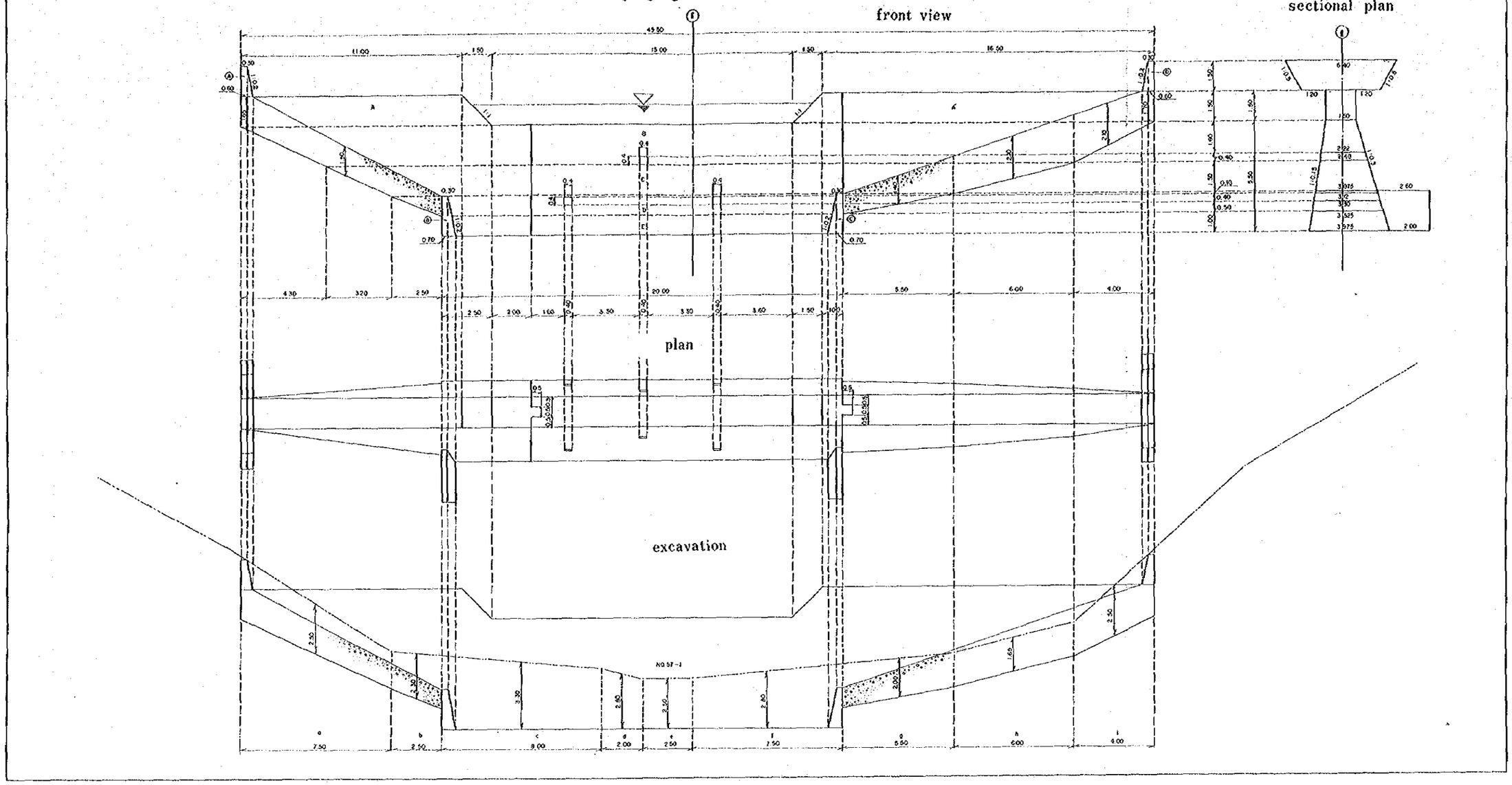


plan

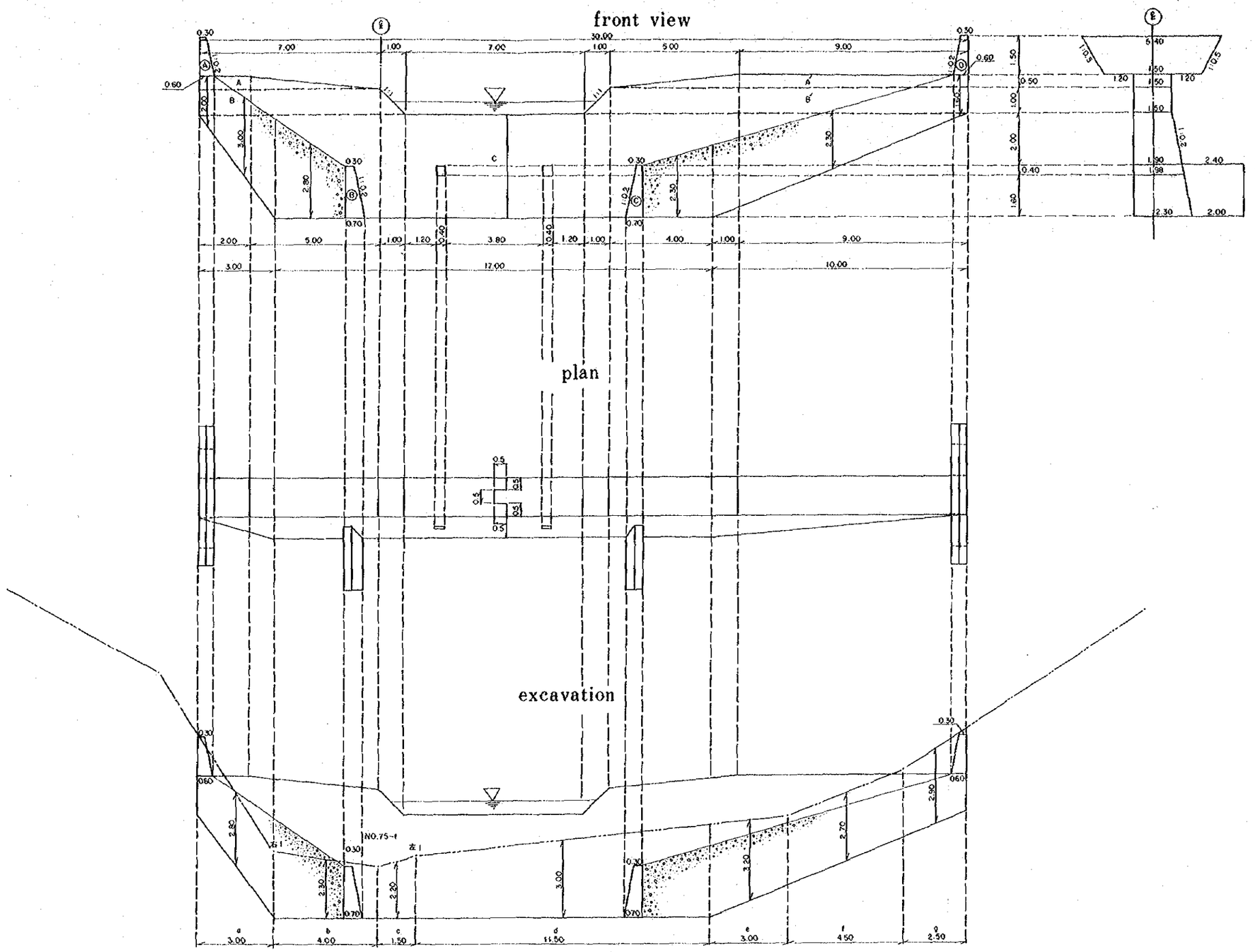


excavation

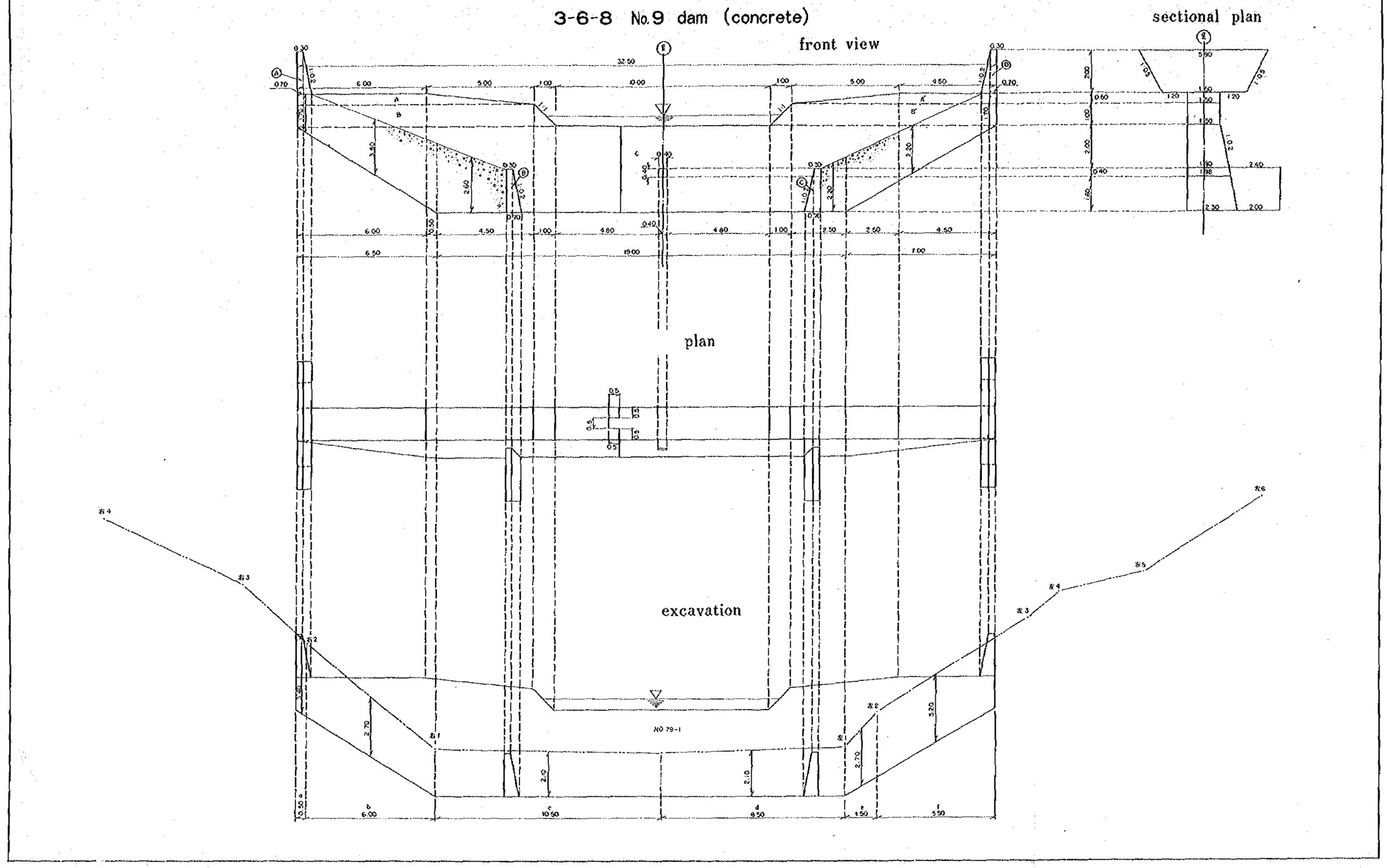
3-6-6 No.3 dam (concrete)



3-6-7 No.4～8 dam (concrete)

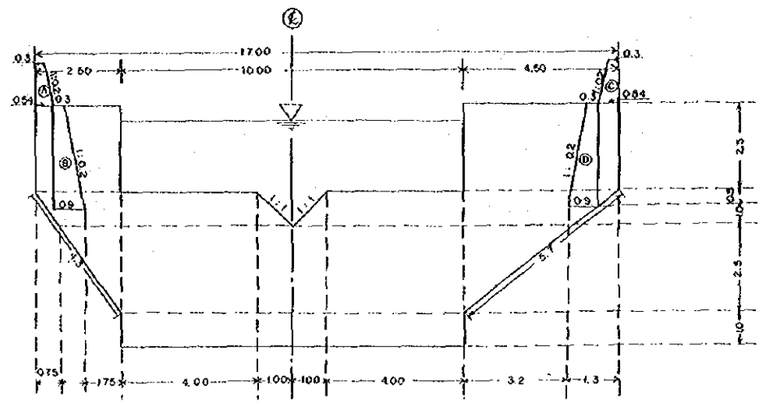


3-6-8 No.9 dam (concrete)

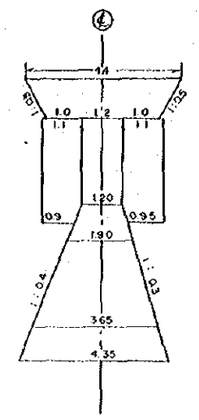


3-6-9 No.10 gauging dam (concrete)

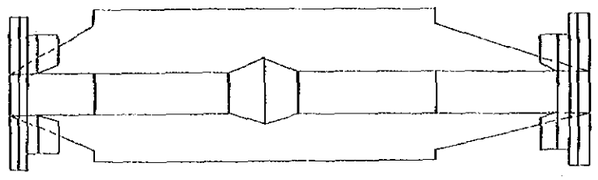
front view



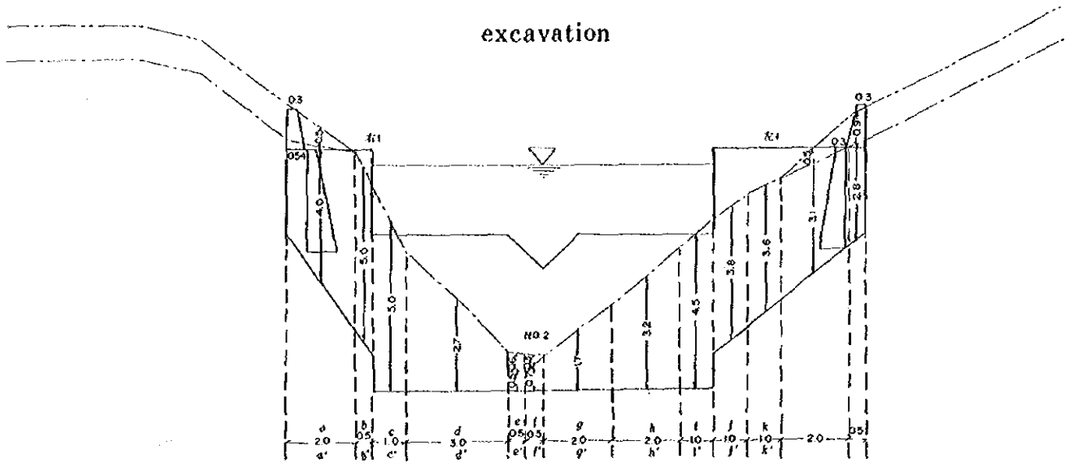
sectional plan



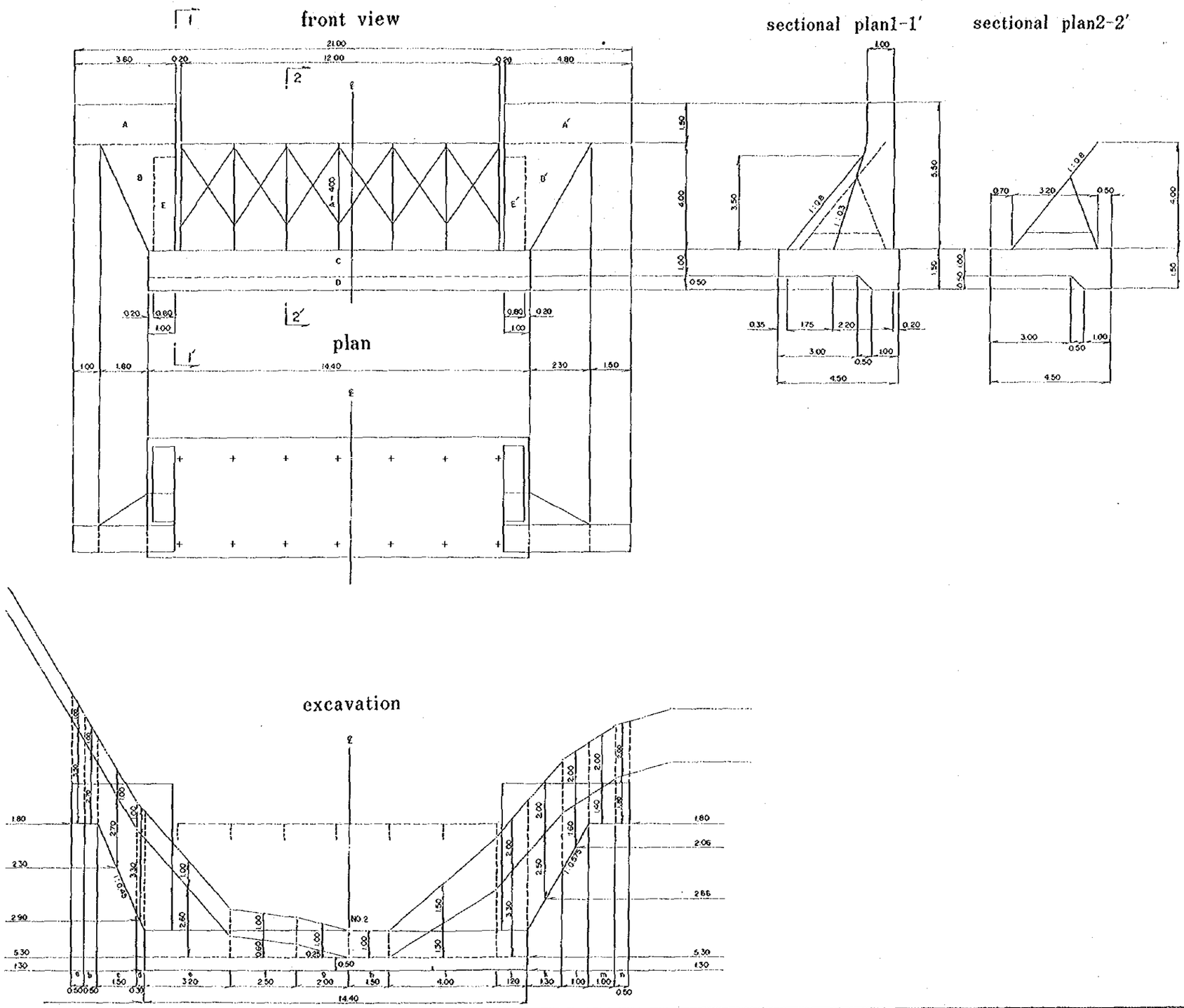
plan



excavation



3-6-10 No.11 dam (steel)



ANNEX