. Size of Experimentation Forest: (11 treated plots + 1 comparison plot) x 1.69ha x 2 = 40.56ha.

. Establishment of Experimental Compartments: Same as a) above.

c) Teak Plantation

. Purpose of Experiment: to study forest growth by conducting selective cutting for each age class.

. Types of Plots: adopting 5 age classes and 4 selective cutting methods, 20 plots will be introduced with different combinations of these two factors.

Age Classes - 5, 10, 15, 20 and 25 years
Selective Fell in Methods - extensive, medium, minor and no selective cutting

. Size of Experimental Forest: (15 treated plots + 5 comparison plots) x 1.69ha x 2 = 67.6ha.

. Establishment of Experimental Compartments: same as a) above but only large circles will be used for inspection purposes.

2.3.5 Forest Road Plan

Forest roads (Access road) will be required to establish and maintain the exhibition and experimentation forest and must be capable of ensuring the safe passage of 4-wheel drive vehicles and the prevention of forest fires. It was originally decided that forest road planning should be based on the exhibition and experimentation forest plans taking the aerial photo-interpretation and field survey results and easy access to the main center site from the existing road into consideration. In view of the facts that access roads to the main center site and exhibition and experimentation forest are already well developed and that RFD officials are generally against the idea of developing additional forest roads to prevent illegal felling, however, it has been decided that the construction of open cross culvert near to gate of the Center will be conducted.

2.3.6 Observation Footpath Plan

While observation footpaths are required by visitors to the exhibition and experimentation forests and also for study and forest management purpose, it has been decided that no observation footpaths will be introduced for the exhibition and experimentation forests to be established by the Project except for a partial footpath in the dry dipterocarp forest. This footpath has subsequently been dropped in the detailed design as the floor of the subject forest has been improved enough for walking and, therefore, no budgetary measure is required for it under the Project.

2.3.7 Related Facility Plan

Possible facilities relating to the establishment of the experimental plots, forest management and maintenance, the implementation of field surveys and the compilation of survey results, etc. include firebreaks, riverbed roads, research buildings, water supply facilities, power generation facilities, car port, seed storage, stump preparation house and storage, glasshouses, irrigation facilities for the nursery and arboretum, etc. The facilities have been decided based on the results of a study on similar facilities and sites owned by the TIC, AIFM and FIO in adjacent areas and also on drawings of existing buildings taking the local climate and the availability of construction materials and equipment into consideration.

CHAPTER 3

Detailed Design

3. Detailed Design

The on-site surveying, designing and cost estimation for the exhibition and experimentation forests, forest road, observation footpath and related facilities were conducted in accordance with the Thai side's agreement. The location of Forest Research, Demonstration and Extension Center (FRDEC) is shown in Fig. 4.

3.1 Forest Road (Access Road)

3.1.1 Route Selection

The proper selection of the route is extremely important in terms of not only keeping the construction cost low and maintaining the road conditions after its completion but also in terms of assisting the full functioning of the Center. Therefore, priority was given to satisfying the safety, functional and economy requirements in the selection of the actual route based on the aerial photo-interpretation and field survey results. It was also attempted to distribute the Center buildings and the exhibition and experimentation forests in sites where the existing road(s) can be utilized as much as possible.

3.1.2 Outline of Forest Road

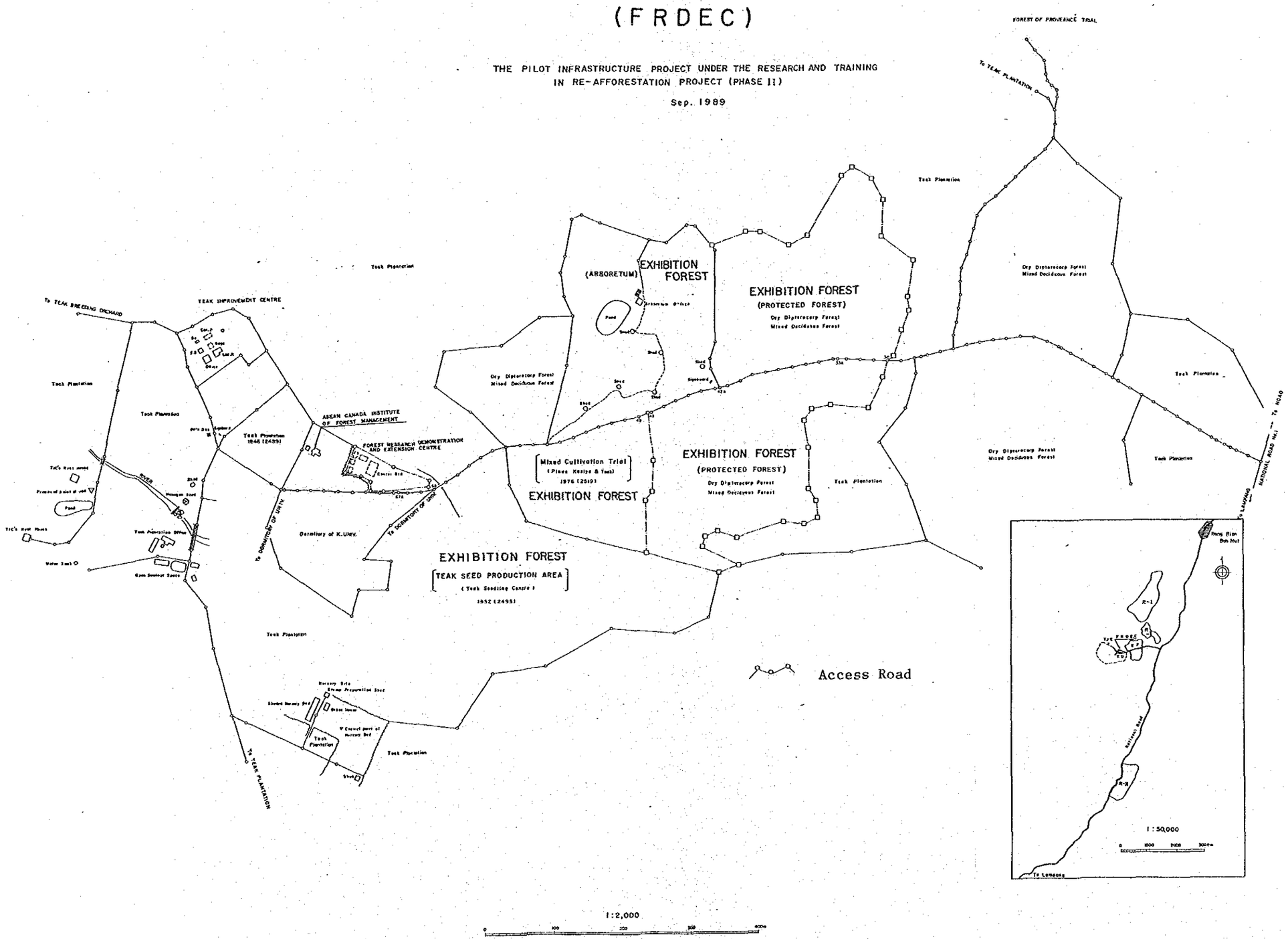
(1) The existing access road (1,42m long and 4m wide) which connects the project site with NR. 1 some 68km from Lampang will be repaired.

(2) The planned repair of the access road (520m long) which branches from the center post No. 25 to the experimentation forest of teak plantation and the construction of a riverbed road have been abandoned due to financial reasons. The plan and the longitudinal section of the road are shown in Fig. and Fig. respectively.

LOCATION MAP
OF
FOREST RESEARCH DEMONSTRATION AND EXTENSION CENTRE
(F R D E C)

THE PILOT INFRASTRUCTURE PROJECT UNDER THE RESEARCH AND TRAINING
IN RE-AFFORESTATION PROJECT (PHASE II)

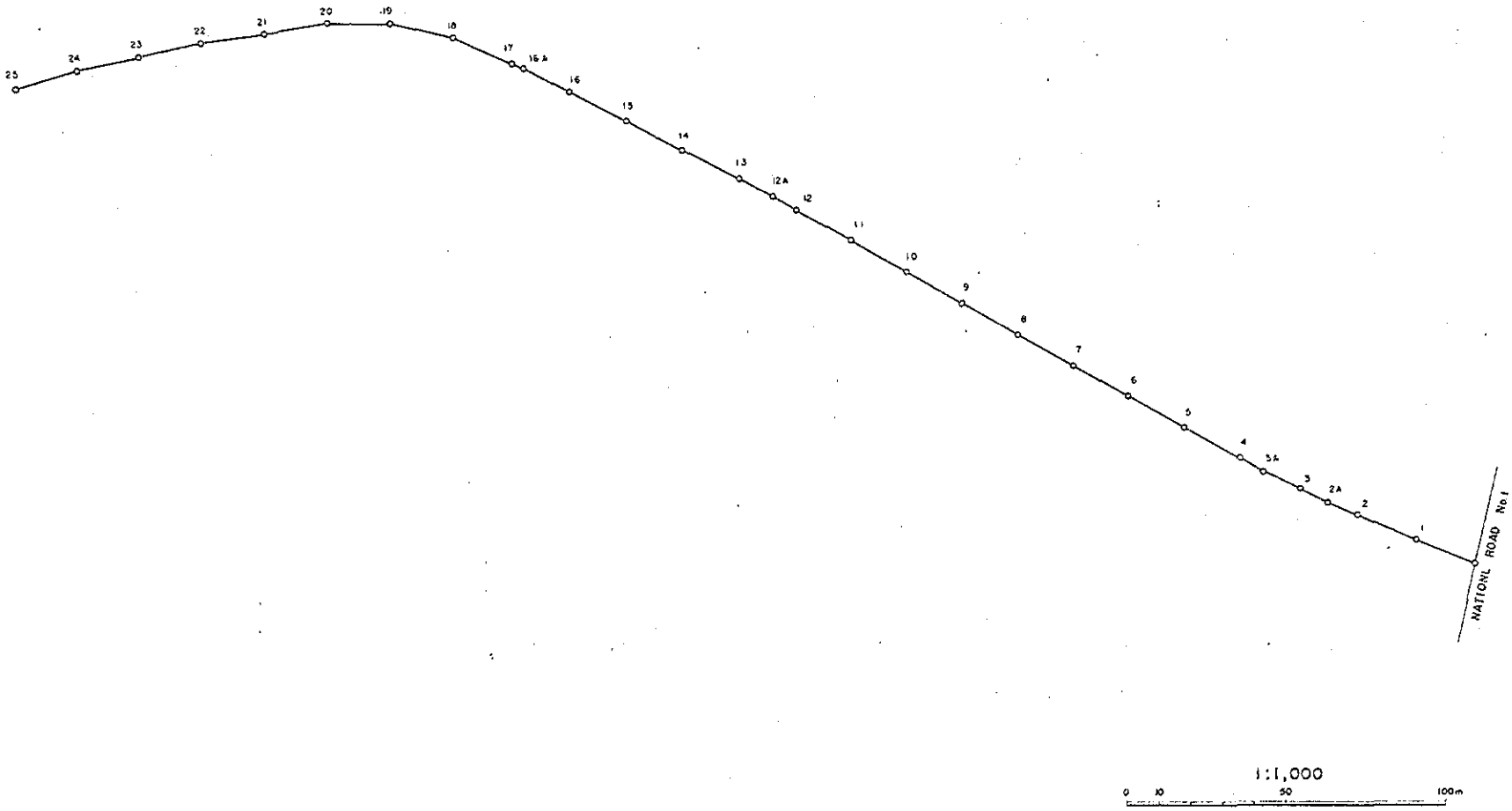
Sep. 1989



HORIZONTAL ALIGNMENT OF ACCESS ROAD (AR·BP-76A) 3 - 1

THE PILOT INFRASTRUCTURE PROJECT UNDER THE RESEARCH AND TRAINING IN RE-AFFORESTATION PROJECT (PHASE II)

Sep. 1989



1:1,000

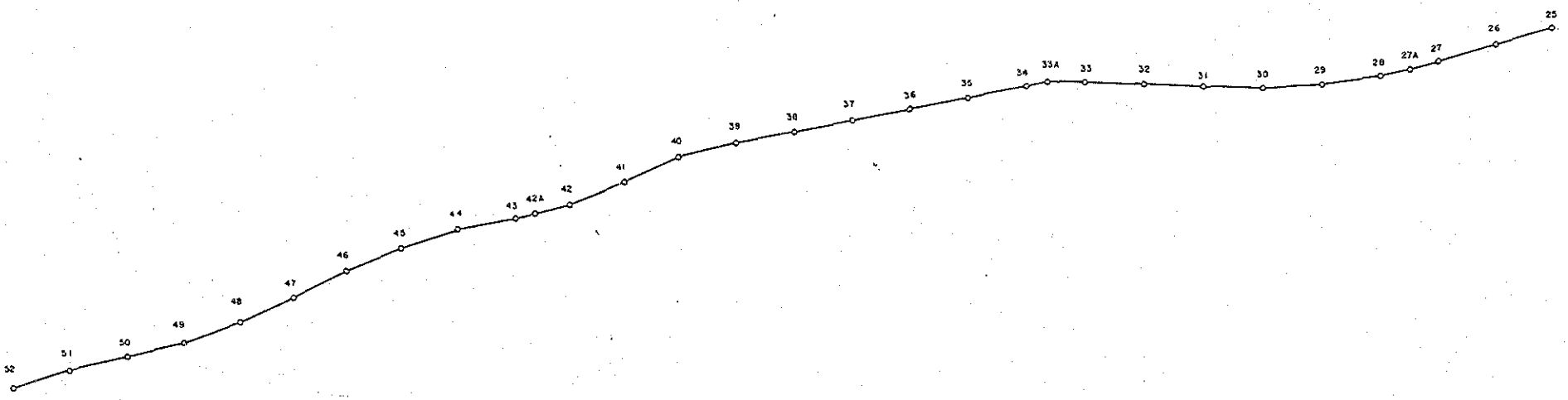
0 10 50 100m

Fig. 5.1 Horizontal Alignment of Access Road

HORIZONTAL ALIGNMENT
OF
ACCESS ROAD (AR·BP-76A)
3 - 2

THE PILOT INFRASTRUCTURE PROJECT UNDER THE RESEARCH AND TRAINING
IN RE-AFFORESTATION PROJECT (PHASE II)

Sep. 1989



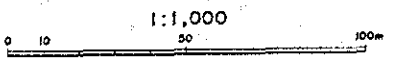
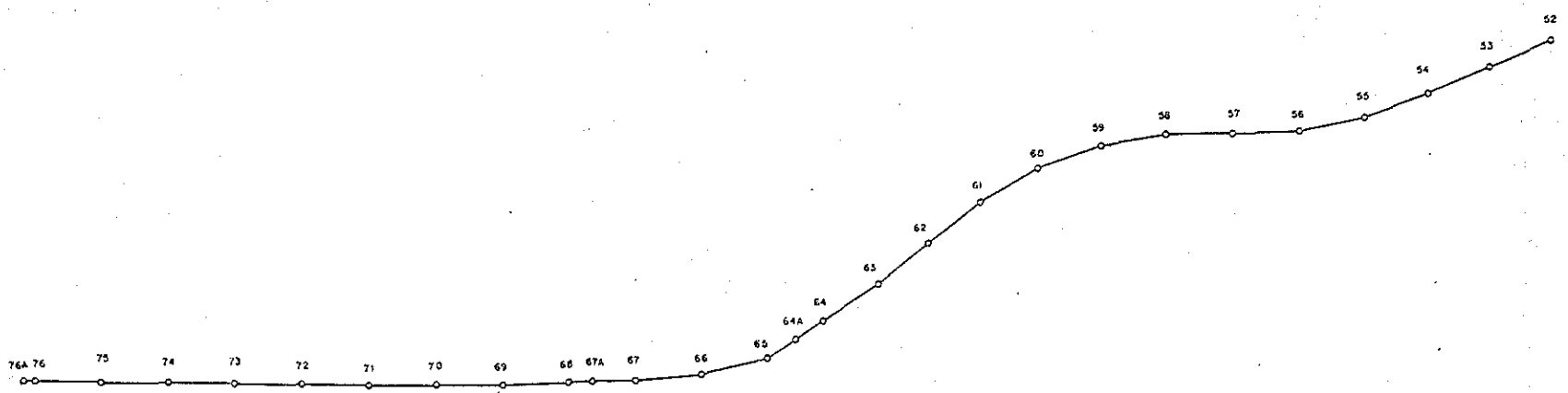


Fig. 5.2 Horizontal Alignment of Access Road

HORIZONTAL ALIGNMENT
OF
ACCESS ROAD (AR·BP-76A)
3 - 3

THE PILOT INFRASTRUCTURE PROJECT UNDER THE RESEARCH AND TRAINING
IN RE-AFFORESTATION PROJECT (PHASE II)
Sep . 1989 .



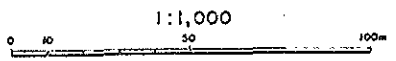


Fig. 5.3 Horizontal Alignment of Access Road

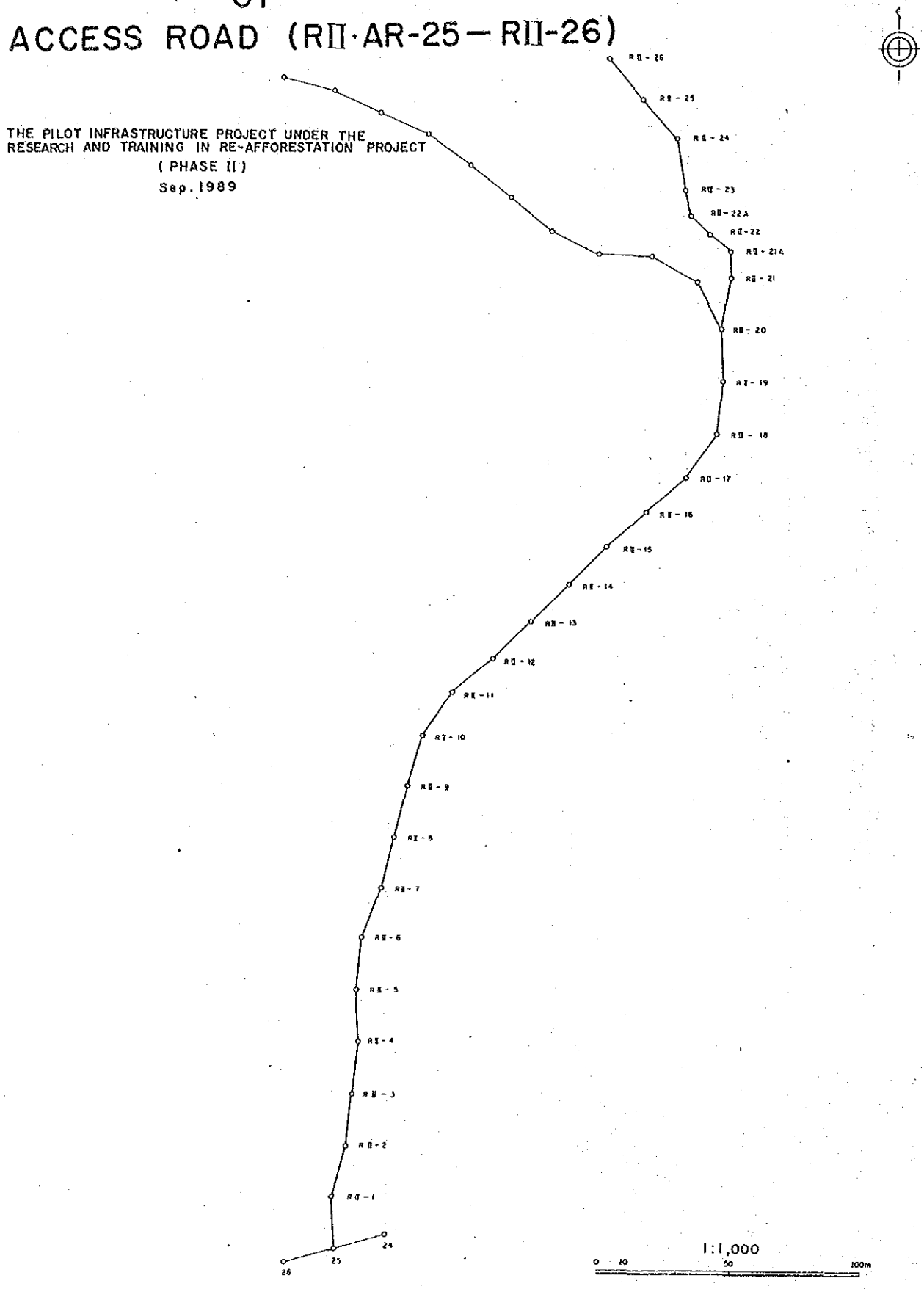


Fig. 5.4 Horizontal Alignment of Access Road

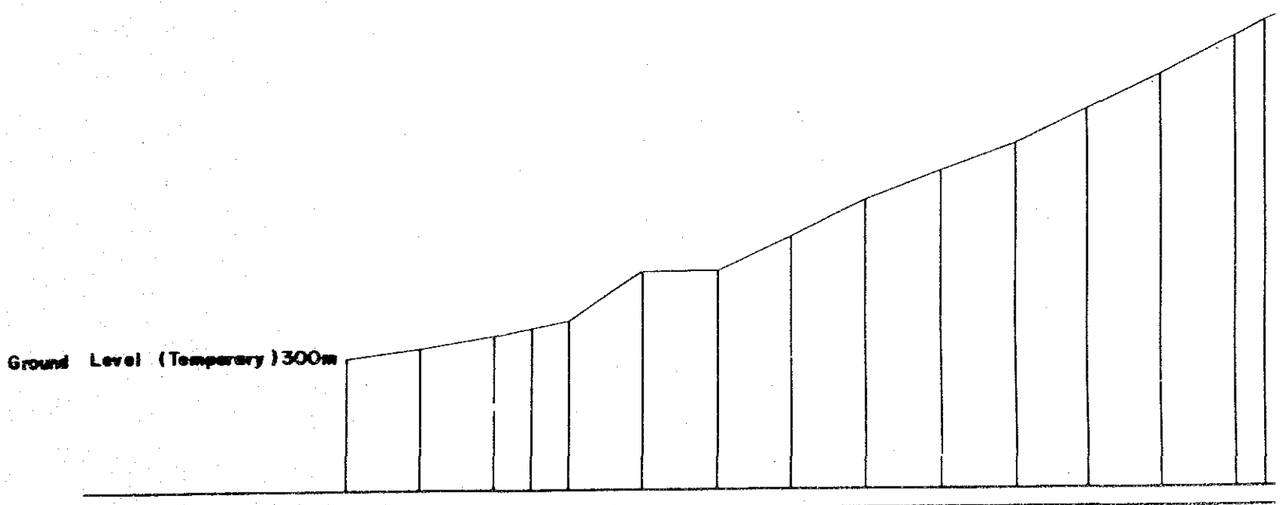
VERTICAL ALIGNMENT
OF
ACCESS ROAD (AR·BP-76A)

THE PILOT INFRASTRUCTURE PROJECT UNDER THE RESEARCH AND TRAINING
IN RE-AFFORESTATION PROJECT (PHASE II)

Sep. 1989

Horizontal Scale $= \frac{1}{1,000}$

Vertical Scale $= \frac{1}{100}$



GRADE (%)														
BANKING HEIGHT (m)														
CUTTING HEIGHT (m)														
FORMATION HEIGHT (m)														
GROUND HEIGHT (Temporary) (m)	300.0	300.2	300.5	300.7	300.9	302.0	302.0	303.1	304.1	304.8	305.6	304.5	307.6	308.4	308.0
TOTAL DISTANCE (m)															
DISTANCE BETWEEN POINT (m)	0.0	20.0	20.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	B.3
SURVEY POINTS	B.P	NO.1	2	2-A	3	4	5	6	7	8	9	10	11	12	12-A
CURVE															

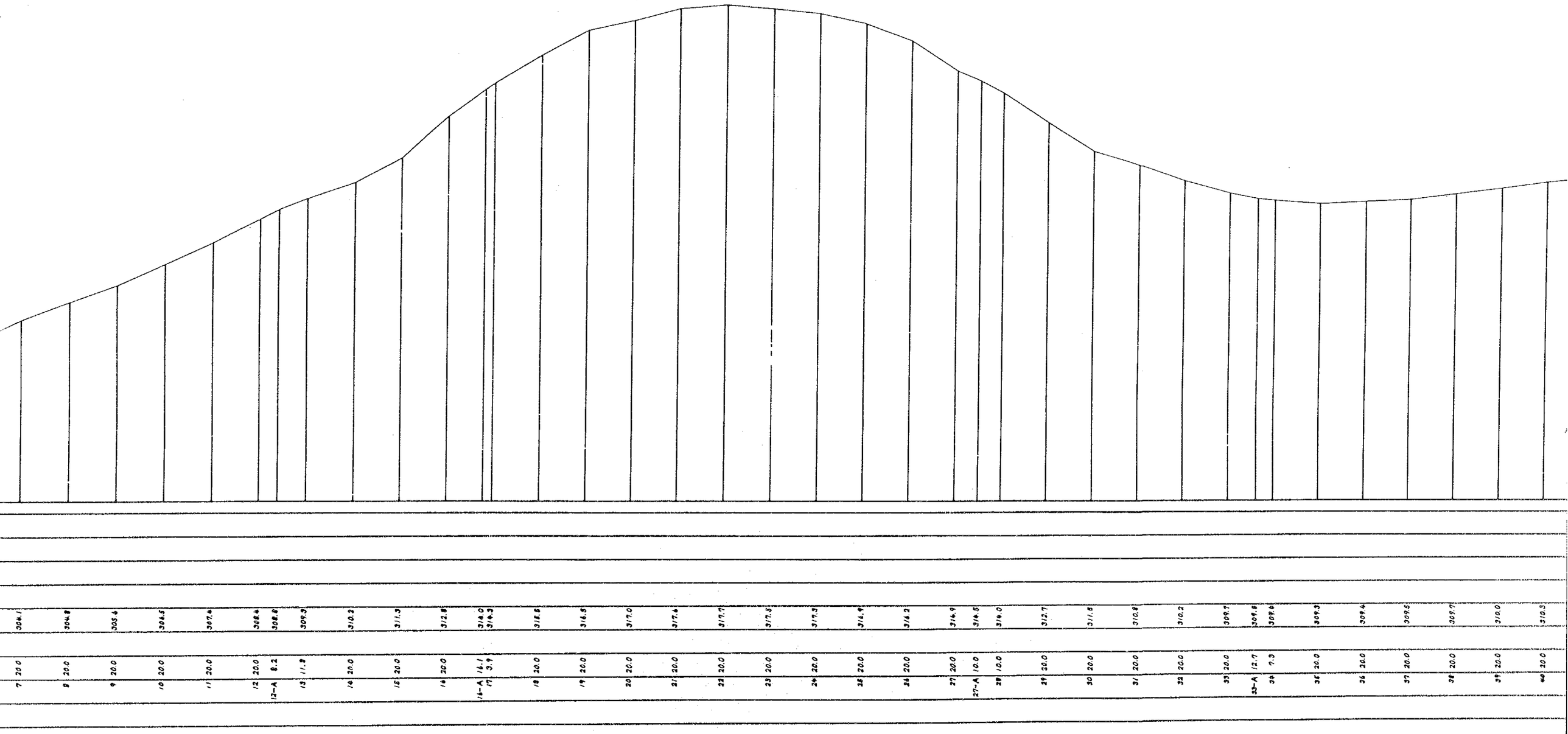
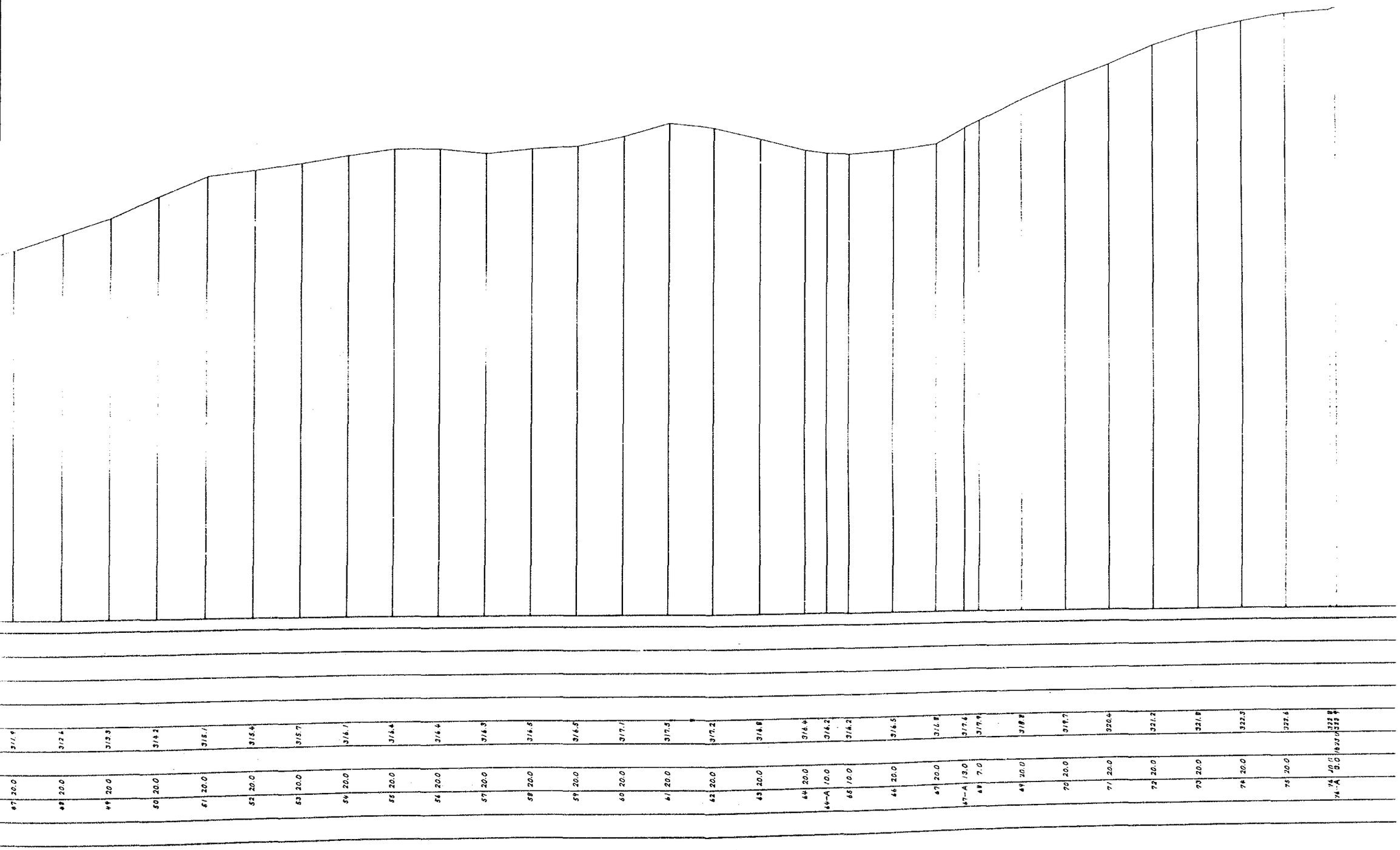


Fig. 6.1 Vertical Alignment of Access Road

33	20.0	309.7	
33-A	12.7	309.8	
34	7.3	309.8	
35	20.0	309.3	
36	20.0	309.4	
37	20.0	309.5	
38	20.0	309.7	
39	20.0	310.0	
40	20.0	310.3	
41	20.0	310.8	
42	20.0	310.6	
42-A	12.3	310.7	
43	7.7	310.7	
44	20.0	310.9	
45	20.0	311.1	
46	20.0	311.4	
47	20.0	311.9	
48	20.0	312.6	
49	20.0	313.3	
50	20.0	314.2	
51	20.0	315.1	
52	20.0	315.6	
53	20.0	315.7	
54	20.0	316.1	
55	20.0	316.4	
56	20.0	316.6	
57	20.0	316.9	
58	20.0	316.5	
59	20.0	316.5	
60	20.0	317.1	
61	20.0	317.5	
62	20.0	317.2	
63	20.0	316.8	
64	20.0	316.4	
64-A	10.0	316.2	
65	10.0	316.2	
66	20.0	316.5	



VERTICAL ALIGNMENT OF ACCESS ROAD (RII·AR-25 – RII-26)

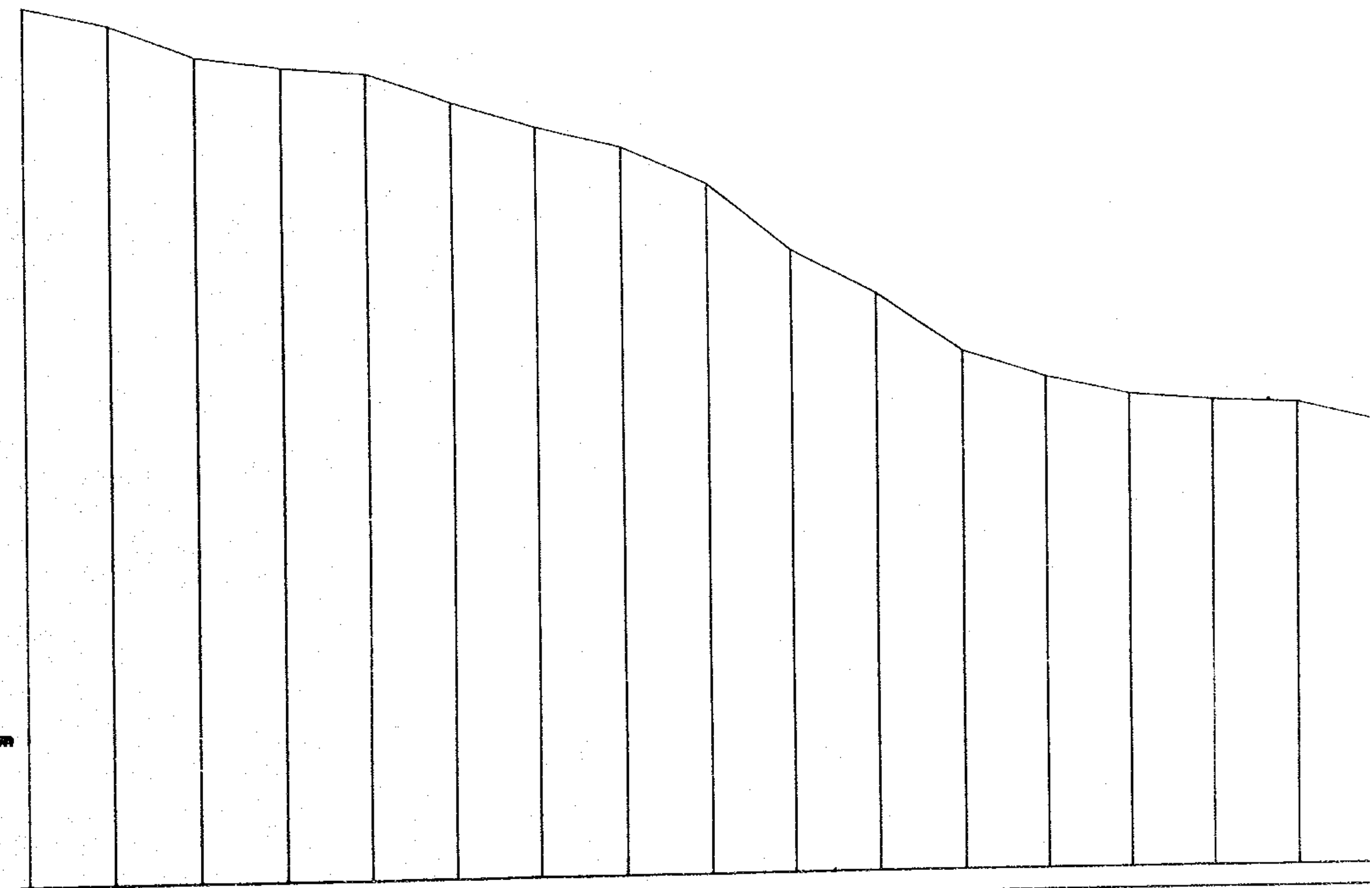
THE PILOT INFRASTRUCTURE PROJECT UNDER THE RESEARCH AND TRAINING IN RE-AFFORESTATION PROJECT (PHASE II)

Sep. 1989

Horizontal Scale = $\frac{1}{1,000}$

Vertical Scale = $\frac{1}{100}$

Ground Level (Temporary) 300m



GRADE (%)																
BANKING HEIGHT (m)																
CUTTING HEIGHT (m)																
FORMATION HEIGHT (m)																
GROUND HEIGHT (Temporary) (m)	316.9	316.6	315.7	315.4	315.3	314.6	314.0	313.5	312.6	311.1	310.0	308.5	308.0	307.6	307.4	307.3
TOTAL DISTANCE (m)																
DISTANCE BETWEEN POINT (m)	0.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
SURVEY POINTS	AR-25	RE-1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CURVE																

Fig. 6.2 Vertical Alignment of Access Road

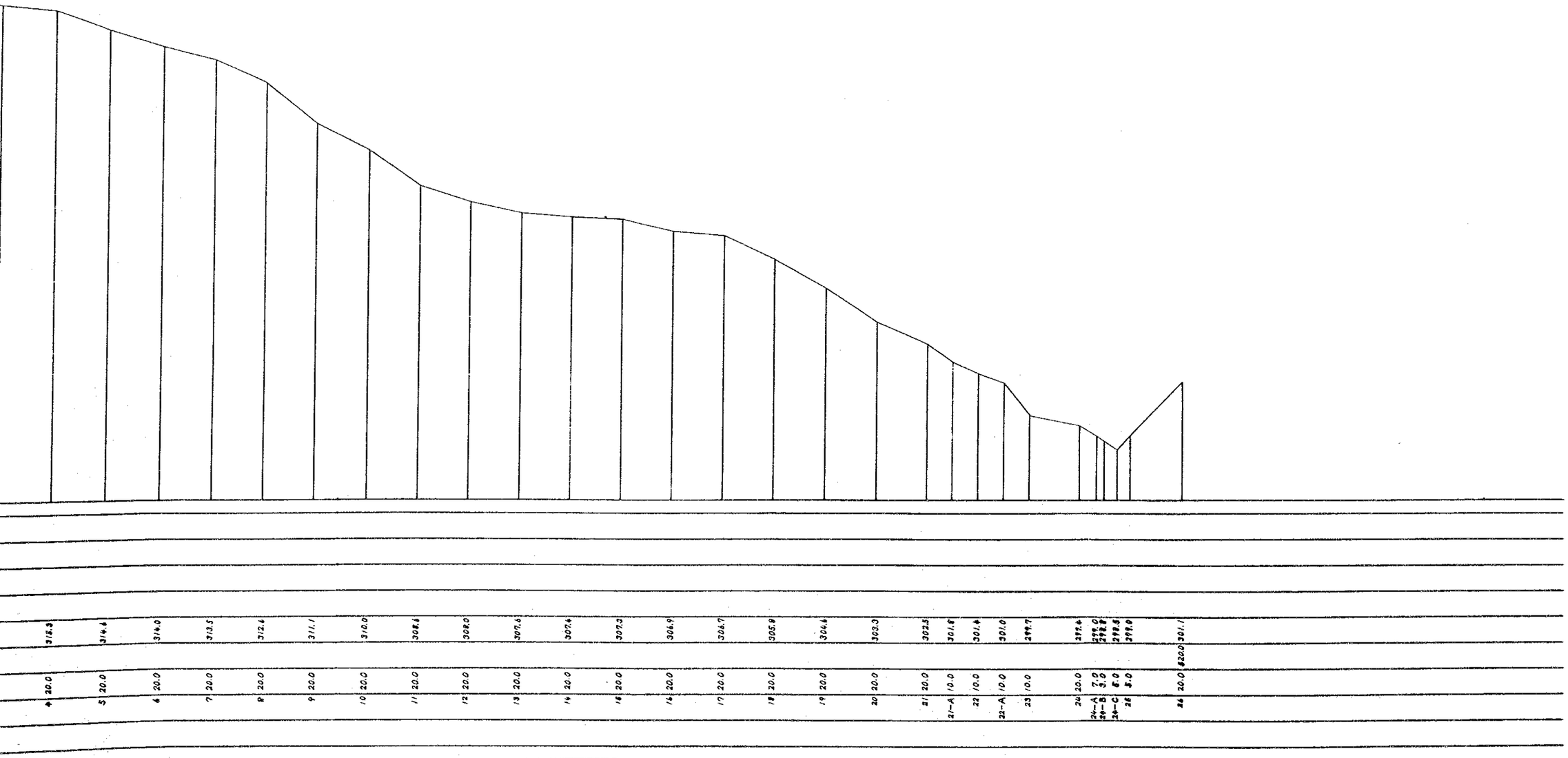


Fig. 6.2 Vertical Alignment of Access Road

(3) Profile Levelling

Since no bench mark is available, a bench mark (BM) with an elevation of 300m was assumed at the point branching out from NR. 1 to proceed with the levelling work.

. BMs were installed at a rate of one BM per 500m. As wooden posts were used, there is no guarantee for their long use.

. The ground elevation was calculated based on the elevations of the survey points along the center line and starting and ending points of the planned route. Levelling was also conducted at the planned sites for wells and water tanks.

(4) Cross Levelling

Cross levelling was conducted in the following manner.

. The work was conducted with a pole equipped with a plumb-line level.

. The work was conducted at a right angle to the center line at the survey points along the center line and plus posts for a distance of 10m on both sides.

3.2 Observation Footpath

In accordance with the decision described in 2.3.6 - Observation Footpath Plan, an observation footpath has been designed in exhibition forest of dry dipterocarp forest based on the survey results on the preferable line of flow so that the rest areas to be introduced in the forest can be connected by a single path (see Fig. 4).

3.3 Exhibition Forests

Representative stands of the existing teak plantation, mixed deciduous forest and dry dipterocarp forest were identified and were selected as the respective exhibition forests. The locations of these forests are given on the topographical map and colour sign posts were erected following the on-site surveying (Fig. 7 & 8).

EXHIBITION FOREST

THE PILOT INFRASTRUCTURE PROJECT UNDER THE RESEARCH AND TRAINING IN RE-AFFORESTATION (PHASE II)

Sep. 1989

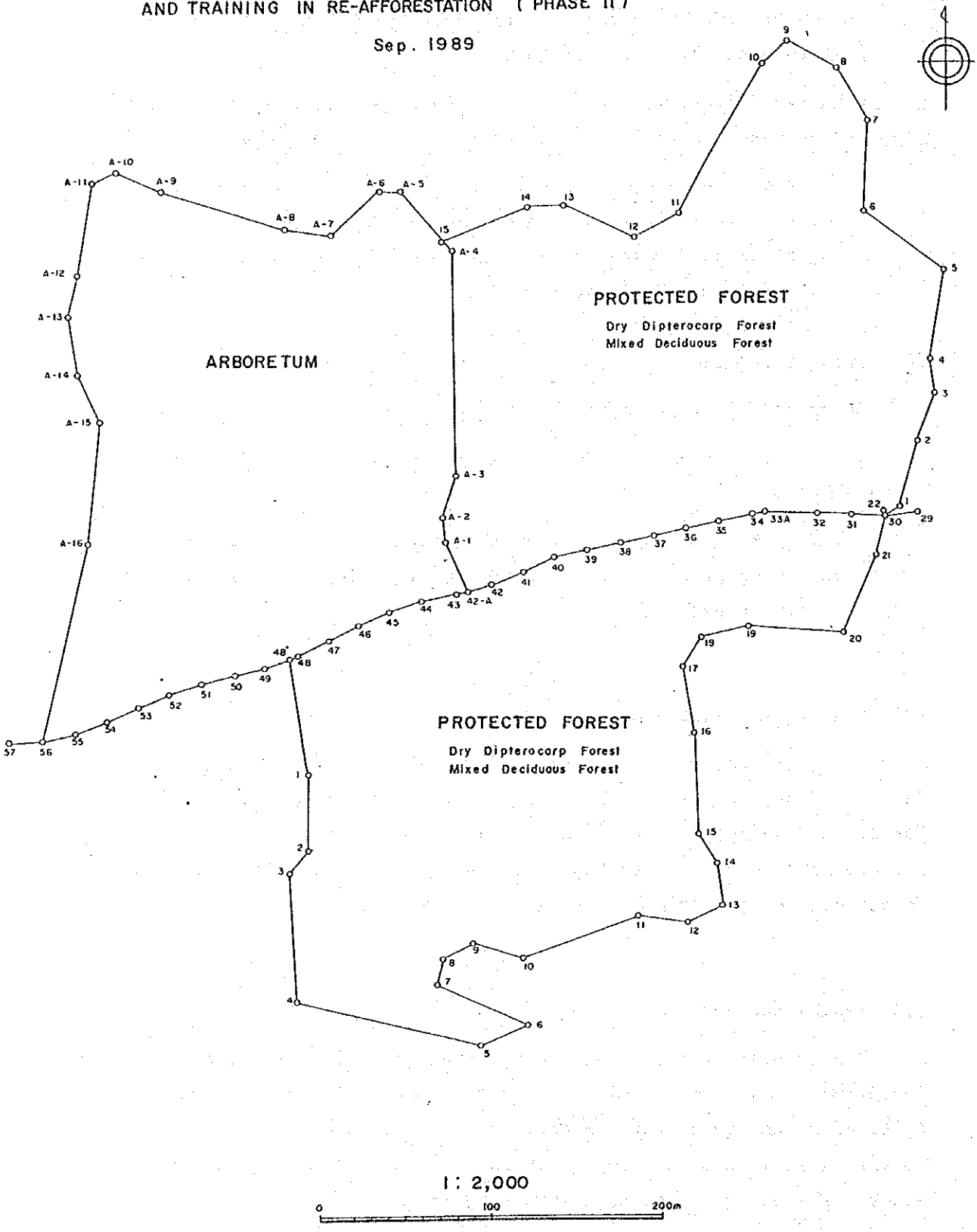


Fig. 7 Exhibition Forest

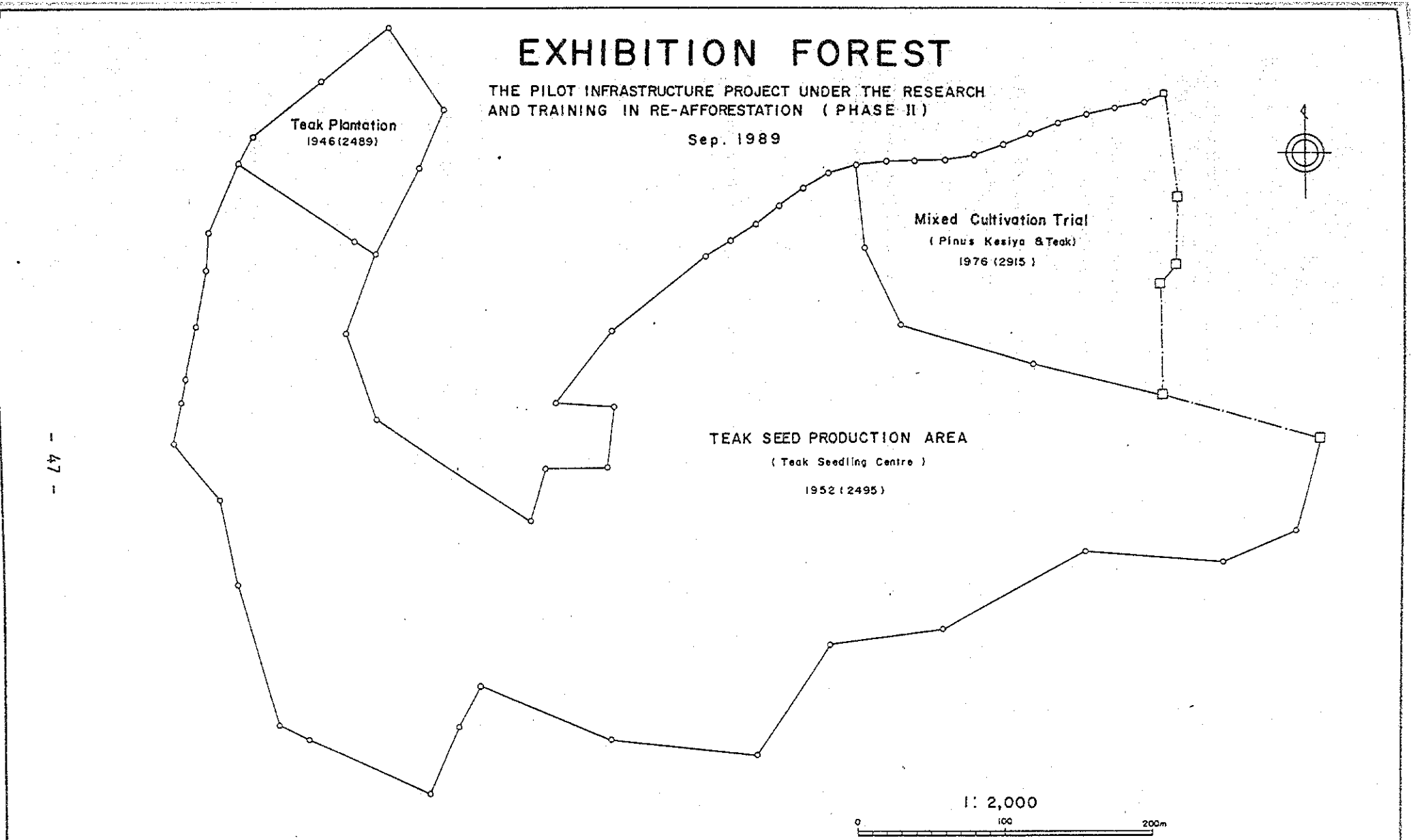


Fig. 8 Exhibition Forest

3.4 Experimentation Forests

The experimentation forest sites were determined in the existing dry dipterocarp forest, mixed deciduous forest and teak plantation. In the case of the dry dipterocarp forest, compass surveying was conducted to determine the boundaries and division lines in order to establish firebreaks. A colour sign was then erected at each survey point. A colour sign post was then erected at each survey point. It was decided that the location of the experimental plots would be determined to best serve its purpose using the survey post locations in the division line survey.

The location of the experimentation forest of mixed deciduous forest was determined using the survey line for the access road and survey points for the center line.

The location of the experimentation forest of teak plantation was determined using the survey points for the center line of the access road (see Fig. 9, 10 and 11).

3.5 Related Facilities

3.5.1 Decision on Main Center Site

It was decided at a meeting of all related people that the main center site would be located on flat ground with no trees along the access road as shown in the attached drawing.

3.5.2 Preparation of Plans and Other Drawings

It was decided to use the following scales for project-related drawings.

Plans and Elevations 1:100
Cross-Sections ..... 1:30 - 1:50

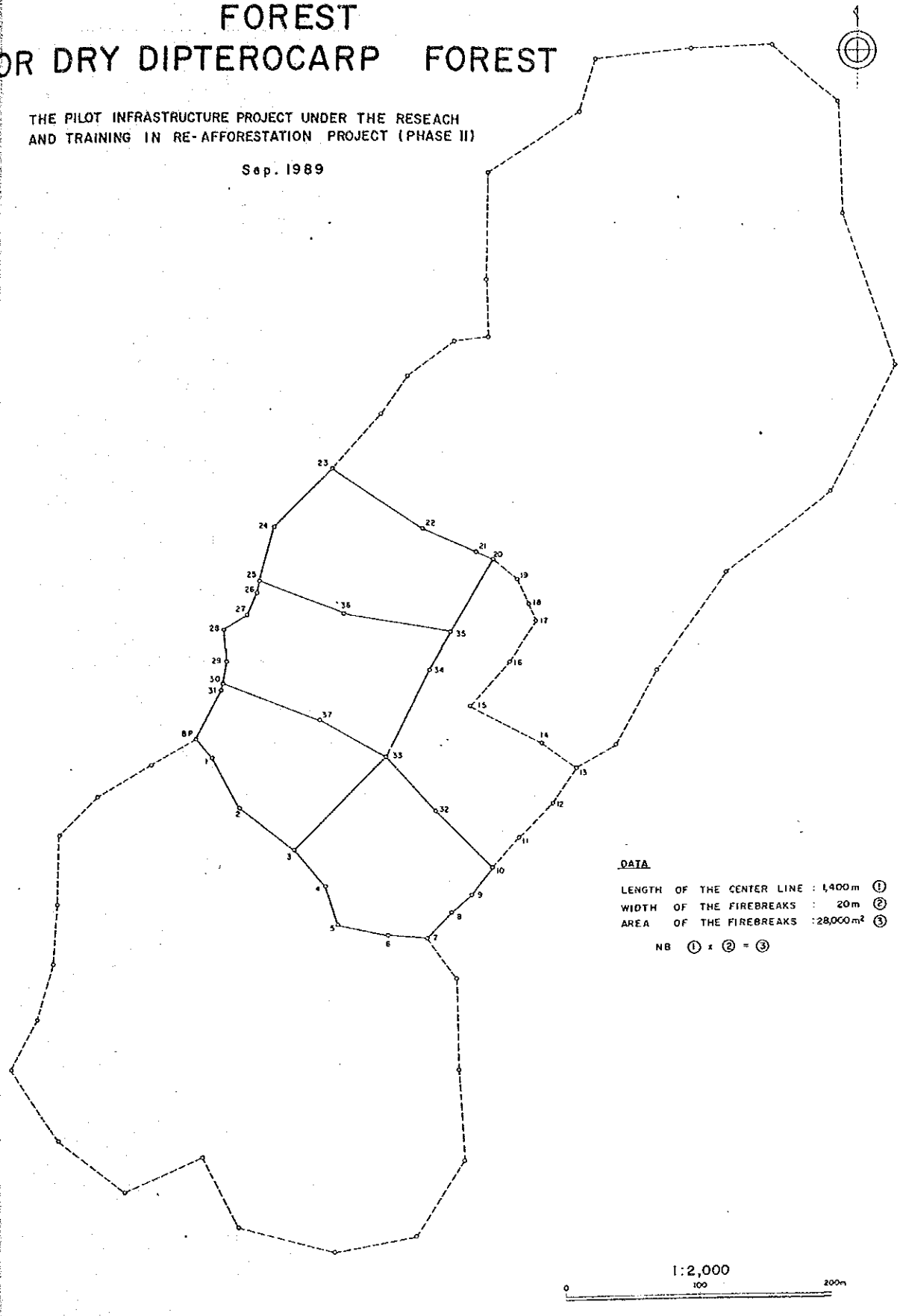


Fig. 9 Experimentation Forest for Dry Dipterocarp Forest

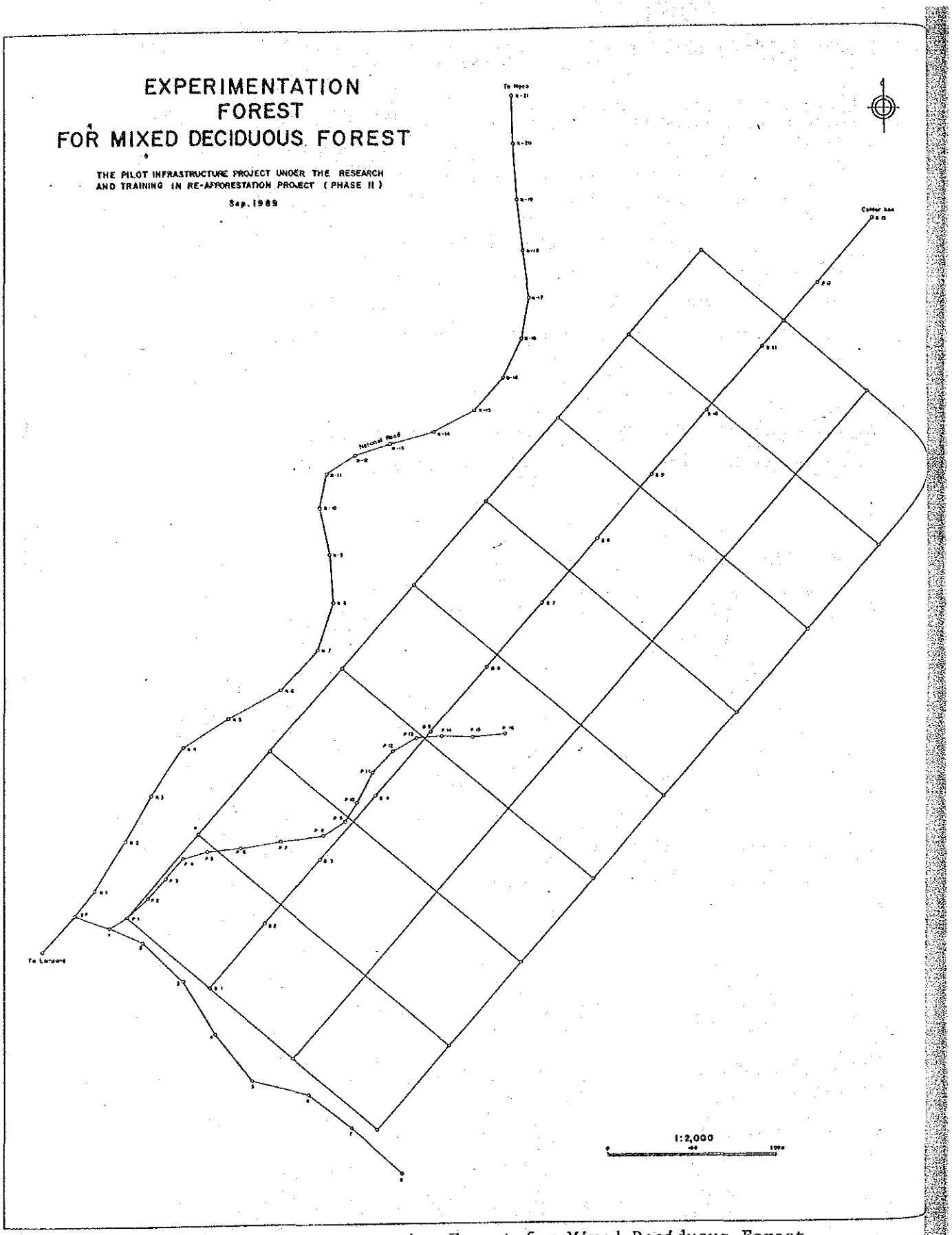


Fig. 10 Experimentation Forest for Mixed Deciduous Forest

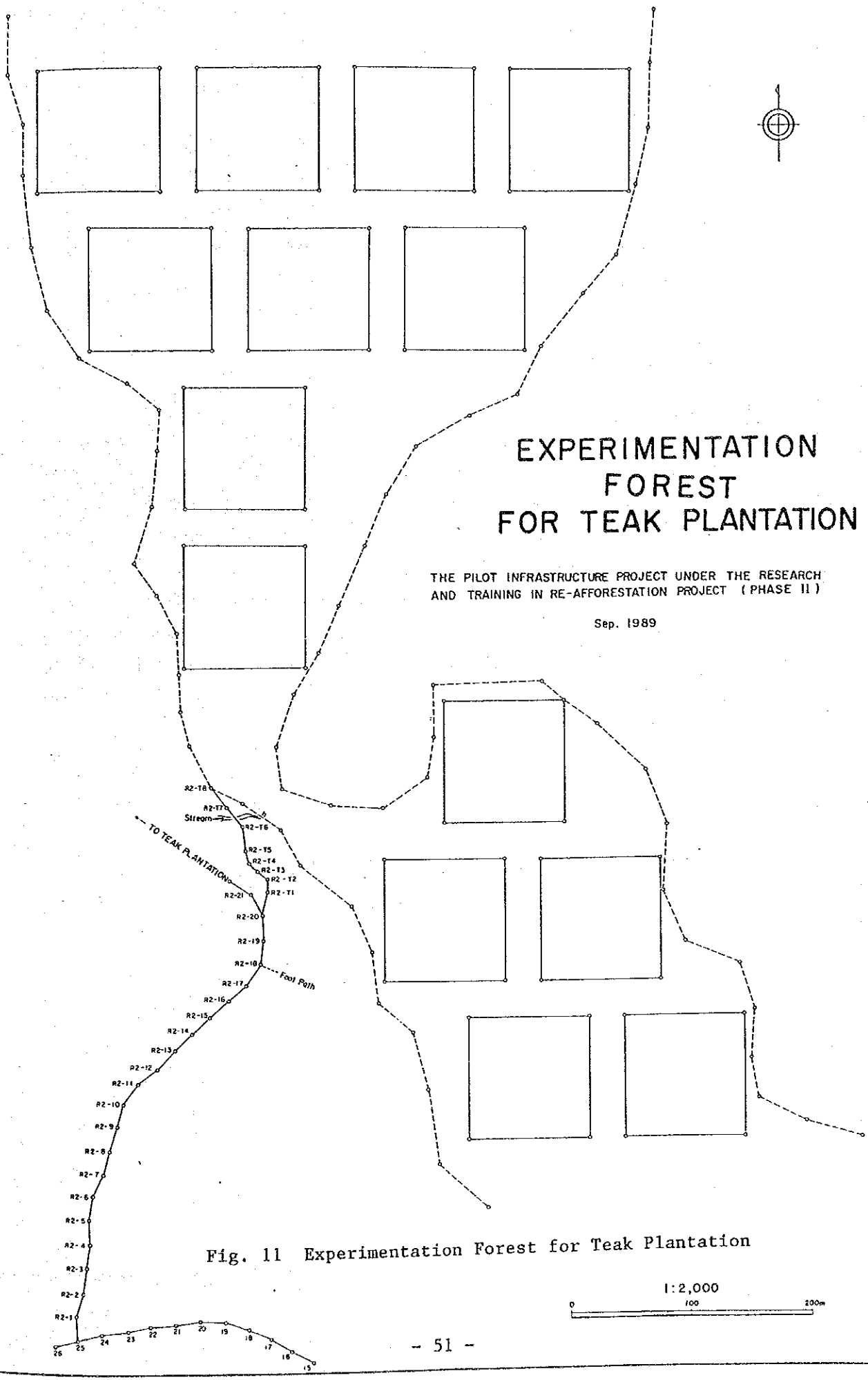


Fig. 11 Experimentation Forest for Teak Plantation

3.5.3 Facilities

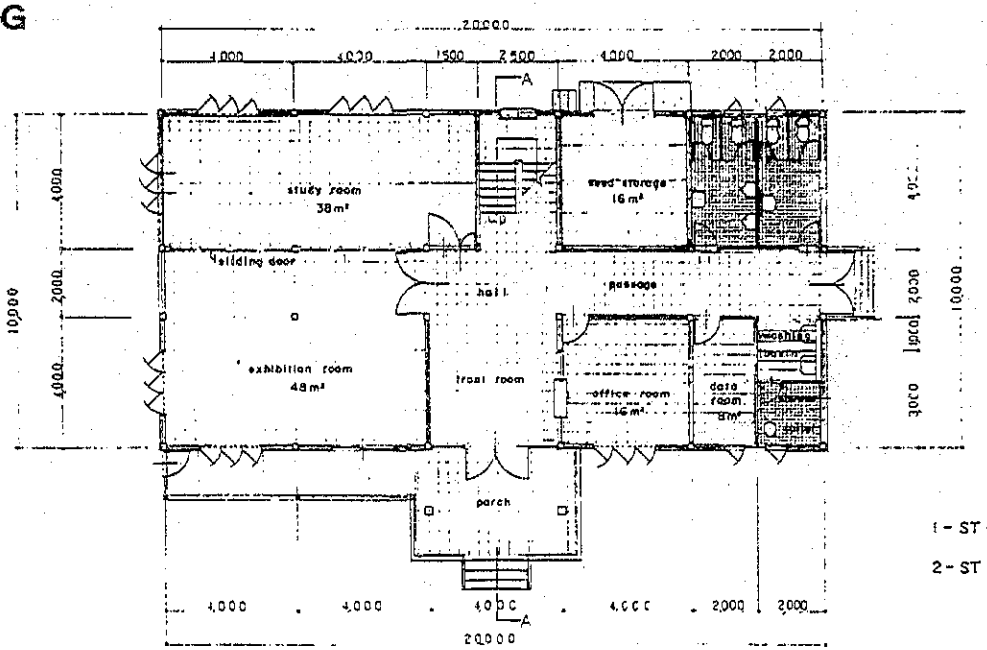
(1) Office Building (Center Building): 340m^2

Exhibition Room	1 x 48m^2 = 48m^2
Training Room	1 x 38m^2 = 38m^2
Research Rooms (Soil and Insects)	2 x 16m^2 = 32m^2
Research Room (Ecology)	1 x 22m^2 = 22m^2
Reference Room	1 x 16m^2 = 16m^2
Reference Room	1 x 8m^2 = 8m^2
Sleeping Room	1 x 8m^2 = 8m^2

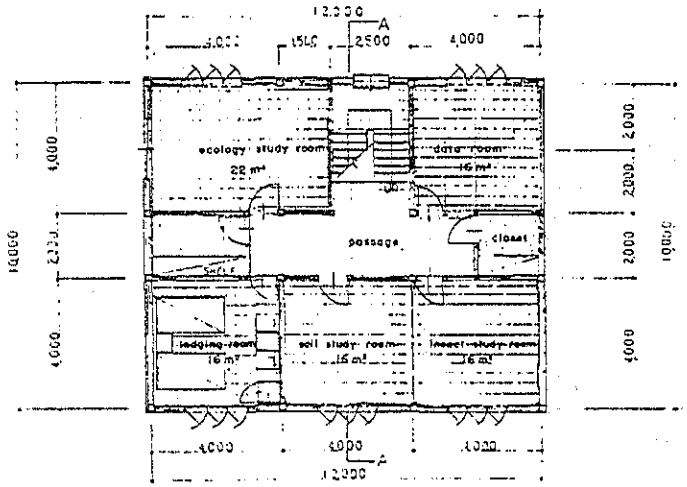
The AIFM building constructed with Canadian cooperation was studied. This is a 2 story concrete building of Thai design with a floor area of 135m^2 and a column span of 4m x 4m (column cross-section: 20cm x 20cm). The Study Team was able to obtain the drawings for the building which proved of great assistance in the design of the Center building. The Center building will have a Japanese style design and will use ceramic balusters which are a speciality of the Lampang area. A hot-water supply room will be installed beside (see Fig. 12, 13, 14, 20 and 21).

CENTER BUILDING

GROUND FLOOR PLAN



2-NO-TH FLOOR PLAN



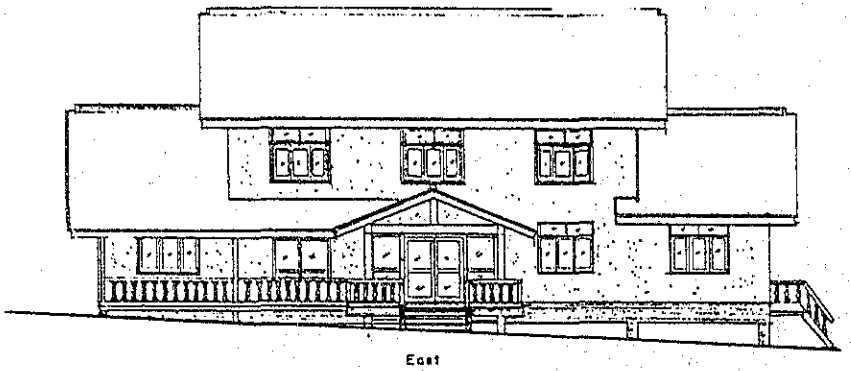
1-ST-TH FLOOR SPACE	220.00m²
2-ST-TH FLOOR SPACE	120.00m²
TOTAL	340.00m²

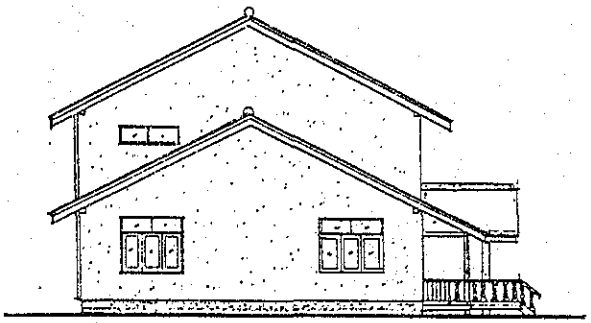
CONSTRUCTION WORK FOR FOREST RESEARCH
DEMONSTRATION AND EXTENTION CENTER

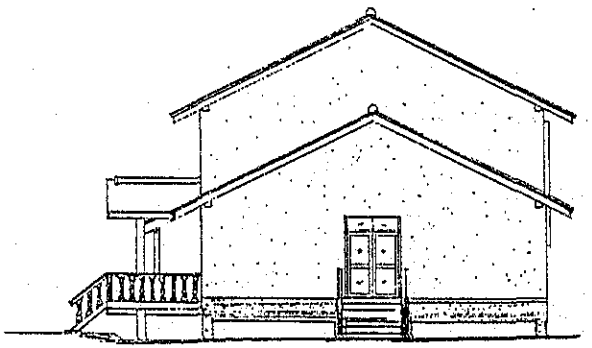
Fig. 12 Center Building (Floor Plan)

CENTER BUILDING
(ELEVATION)

S = 1/100







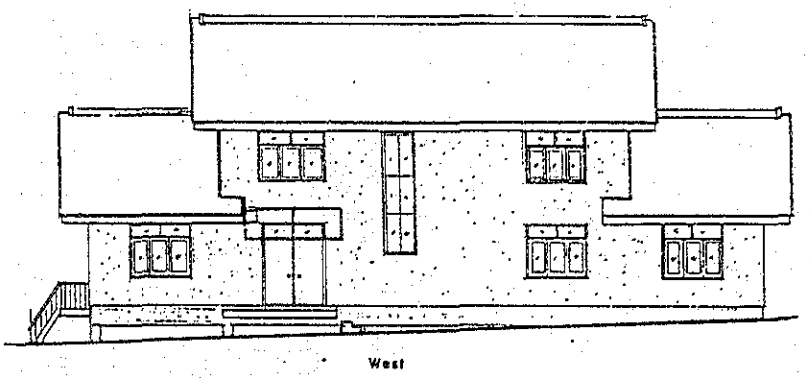


Fig. 13 Center Building (Elevation)

CONSTRUCTION WORK FOR FOREST RESEARCH
DEMONSTRATION AND EXTENTION CENTER

CENTER BUILDING

A-A SECTION S = 1 / 50

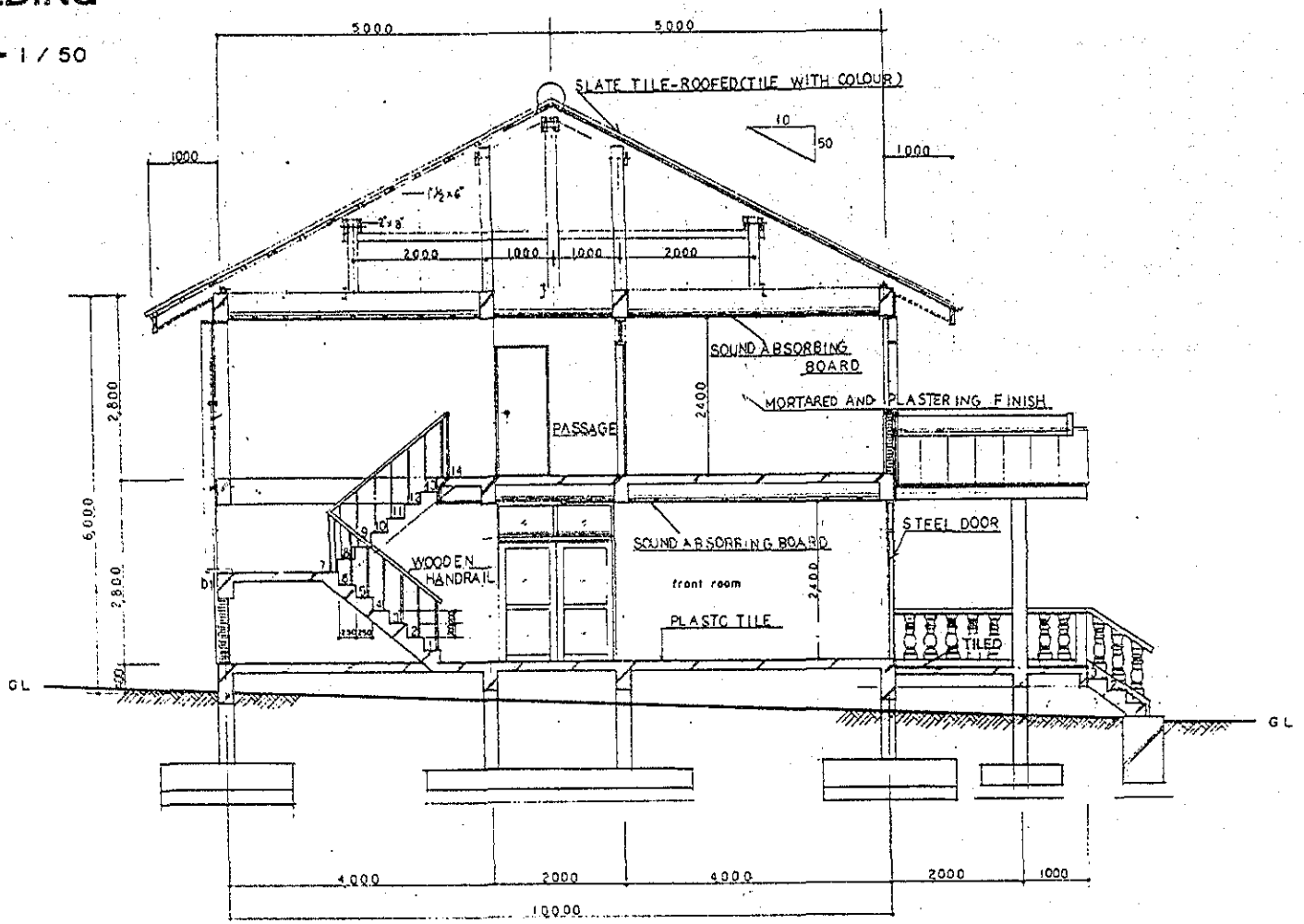


Fig. 14 Center Building (Section)

CONSTRUCTION WORK FOR FOREST RESEARCH
DEMONSTRATION AND EXTENTION CENTER

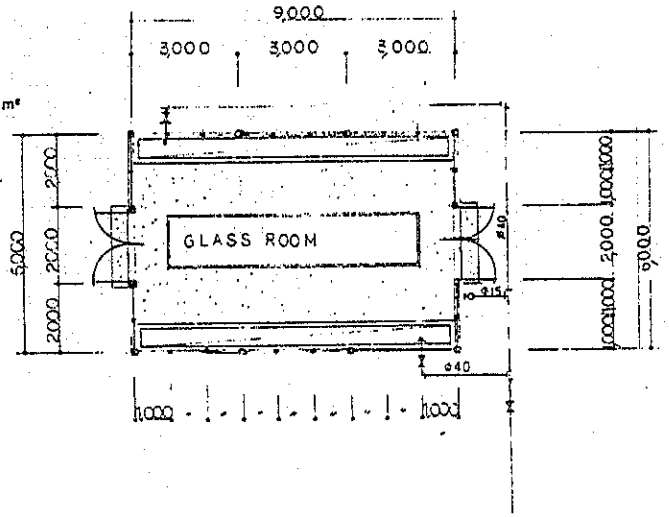
(2) Glasshouse

In the design of the glasshouse, the steel frame glasshouse of the TIC nursery and the steel frame glasshouse of the FIO were studied for reference purposes. While the former has glass walls throughout, the latter has half brick walls. The latter has work tables located at the center and near the side walls and appears to be fully functioning.

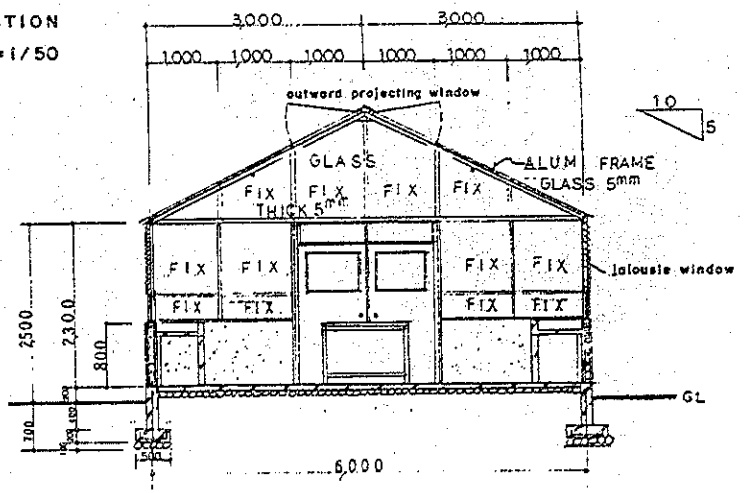
While the provision of a mist spray system and sprinklers was requested by the Thai side, the provision of only sprinklers with a skylight has been decided due to the limited capacity of the independent power generation unit and other reasons. The study results on the FIO glasshouse also contributed to this decision. H type steel will be used as frames and aluminium will be used as the structural material for other parts.

GLASS HOUSE
S=1/100

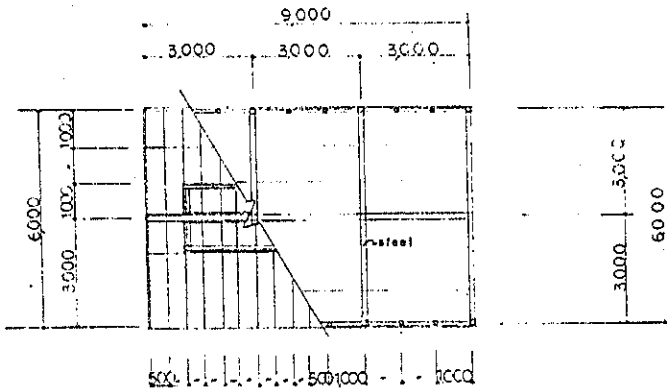
FLOOR SPACE 54m²



SECTION
S=1/50



ROOF PLAN
S=1/100



ELEVATION
S=1/100

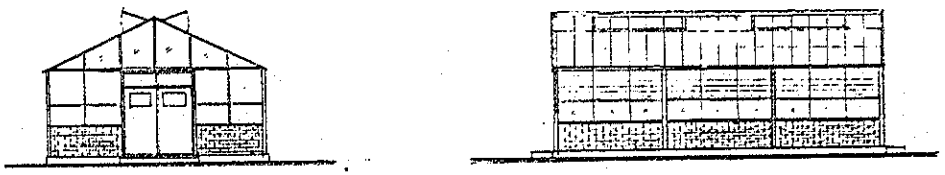


Fig. 15 Glasshouse

CONSTRUCTION WORK FOR FOREST RESEARCH
DEMONSTRATION AND EXTENTION CENTER

承認	設計	担当		縮尺	工事名称	図面番号
				設計年月日	図面名称	No 10/15

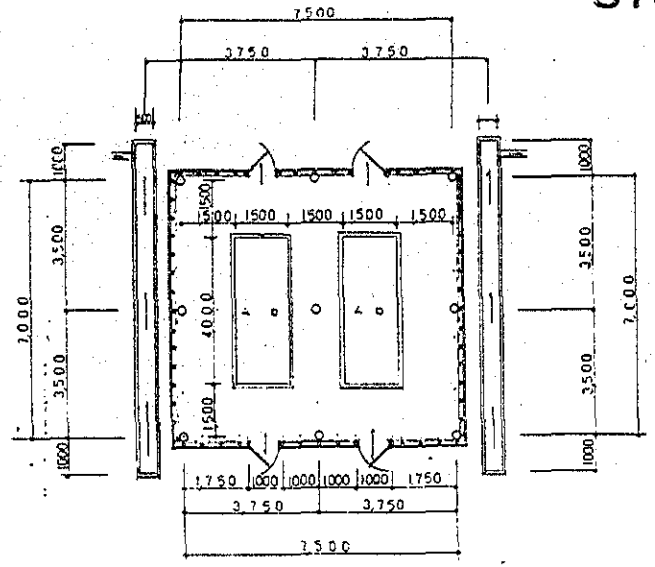
(3) Stump Storage

The Study Team visited and studied the two stump storages at the nursery of the FIO which are 2-3 years old with thatched roofs and walls and a cool interior which is suited to the storage of stumps. The structure is fairly simple, using round columns of some 20cm in diameter to support the storages (1.5 x 4m), and the structural strength is judged appropriate (the thatched roofs and walls are renewed every 5 years). Hardly any nails are used and local products, including bines, are used as binders for the thatching. As the price is low (1 mat - 3Bahts), the construction cost is kept low.

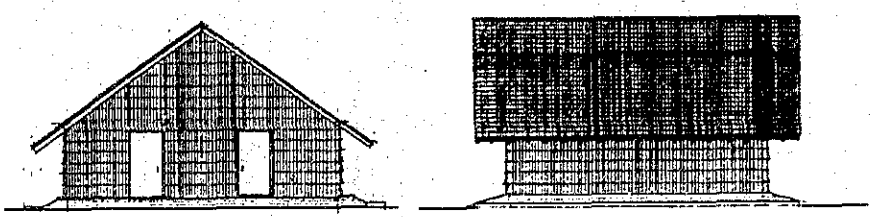
While the production of 1 million stumps was originally proposed, the present design has been prepared based on the production of 10,000 stumps following examination of the nursery seize and other related aspects.

STUMP STORAGE

FLOOR PLAN
S = 1/100



ELEVATION
S = 1/100



SECTION
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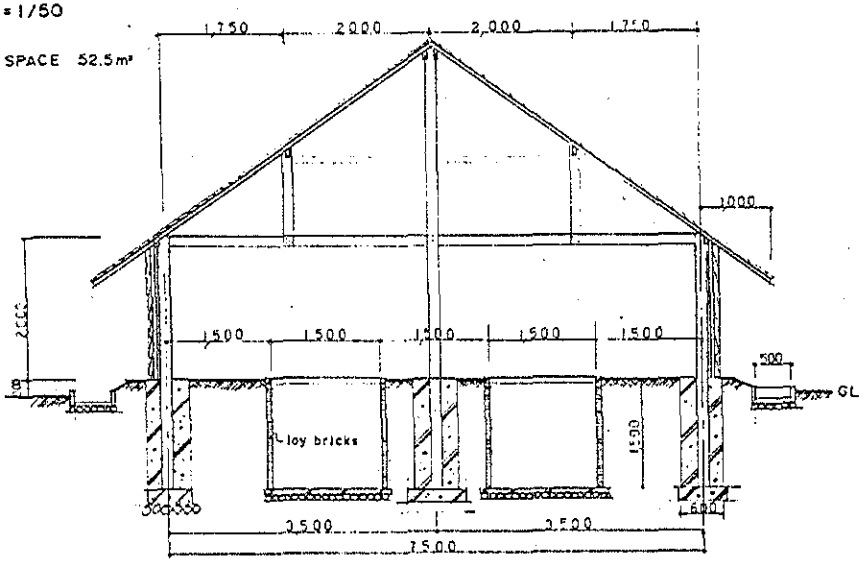
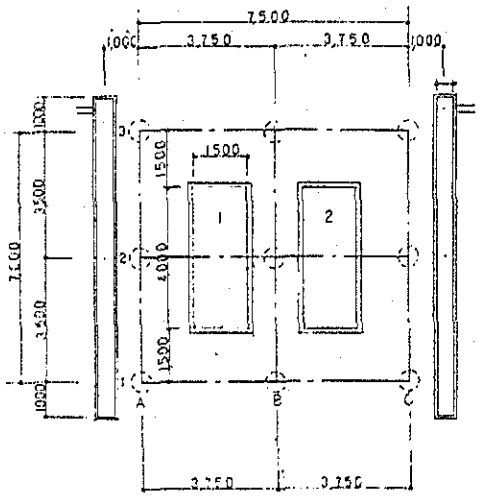
FLOOR SPACE 52.5m²



FOUNDATION CEILING PLAN
S = 1/100



SHED CEILING PLAN
S = 1/100

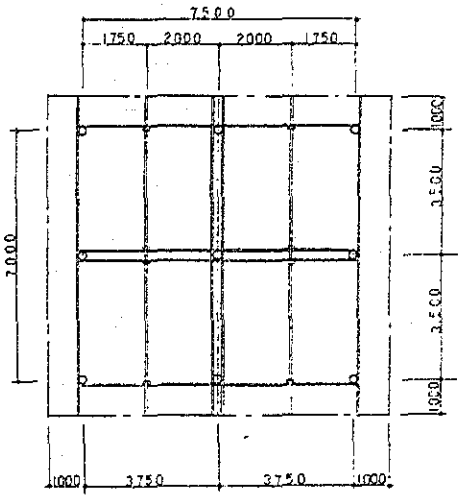


Fig. 16 Stump Storage

CONSTRUCTION WORK FOR FOREST RESEARCH
DEMONSTRATION AND EXTENTION CENTER

承認	設計	担当		縮尺	工事名称	図面番号
				設計年月日	図面名称	No 11/15

(4) Stump Preparation House

The Study Team visited and studied a similar facility current in use at the nursery of the TIC which is a simple hut with a thatched roof and supported by round columns of 15 - 20cm in diameter but lacking walls. A worktable (3 x 4m) is provided. An official of the TIC has requested a stump preparation house with concrete columns and a slate roof for the Project.

In conclusion, as the house will only be used for stump preparation 1 - 2 months a year, it has been decided that a concrete floor will be provided to make the house suitable for various purposes. It has been decided that the stump preparation room will be located next to the garage.

STUMP PREPARATION HOUSE

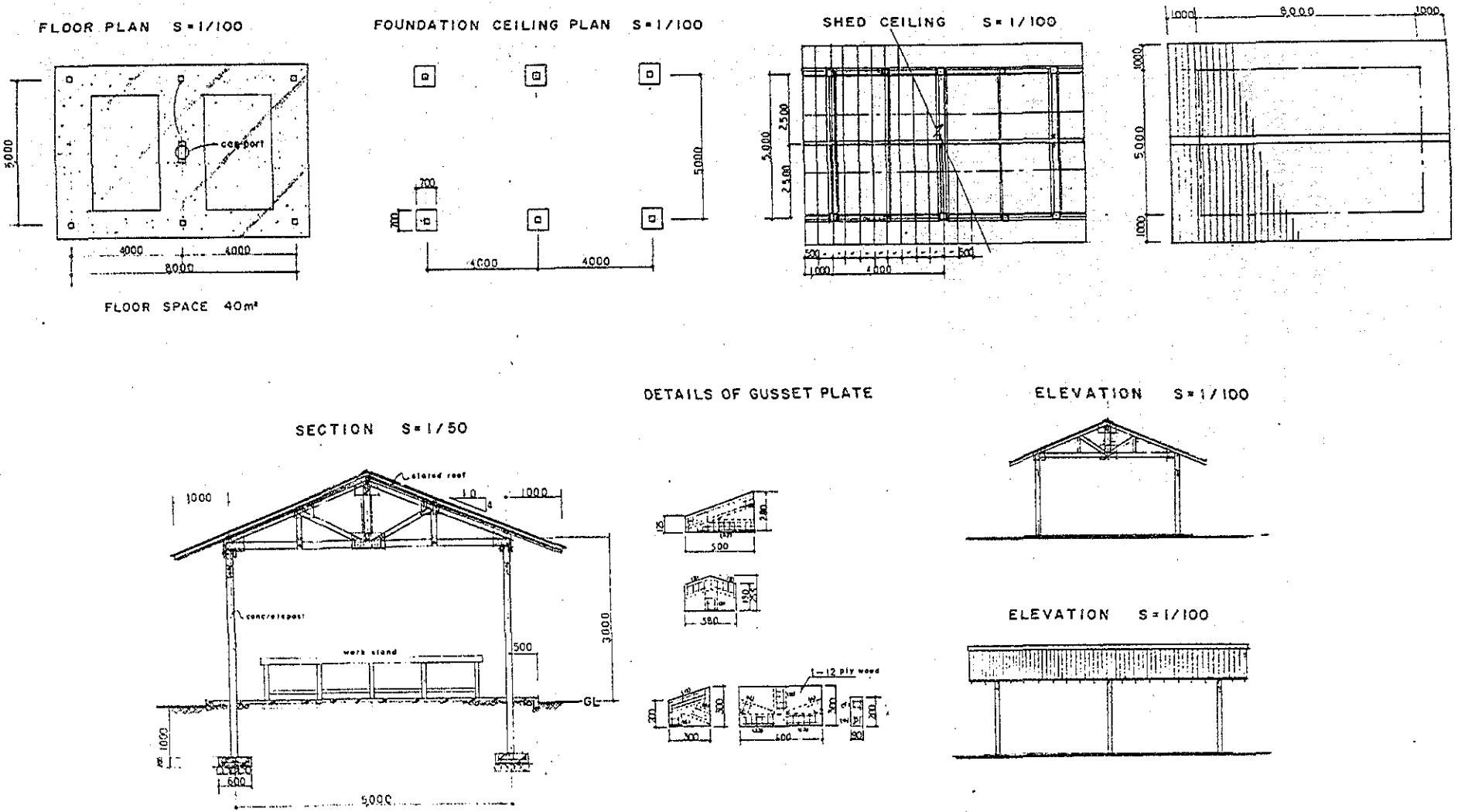


Fig. 17 Stump Preparation House

CONSTRUCTION WORK FOR FOREST RESEARCH DEMONSTRATION AND EXTENTION CENTER	承認	設計	検査		縮尺	工事名称	図面番号 No. 15/15
					設計年月日	図面名称	

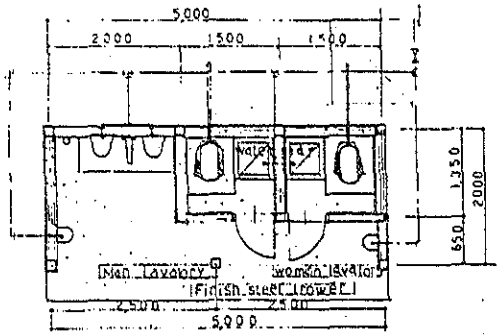
(5) Seed Storage

The TIC currently uses a reinforced concrete seed storage with a floor area of some $30m^2$. This storage has a high floor and, therefore, is rather expensive to build. Although the Thai side requested the same type of seed storage, the possibility of using a room ($16m^2$) in the Center building was considered instead due to the budgetary constraints of the Project. As the Center building will have a partial high floor due to it being constructed on sloping land, the seed storage has been designed under this high floor section and the entrance to the seed storage will be located at the back of the Center building. It is believed that the provision of the seed storage will not result in any design complications (see Fig. 12).

(6) Car Port

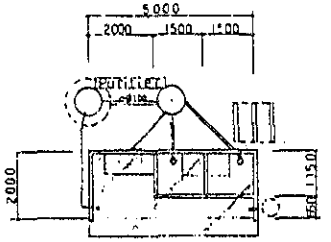
The existing car port of the TIC, AIFM, FIO and the Lampang RFO were studied for reference purposes. All these car ports have a simple structure using planks except for the columns and the roofs are covered by corrugated slates. They are all of the car port design without walls and with direct concrete placing on the ground. In the design of the car port for the Project, the use of gusset plates (12mm thick plywood) for the framework has been decided in order to reduce the cost (see Fig. 18).

PUBLIC CONVENIENCES



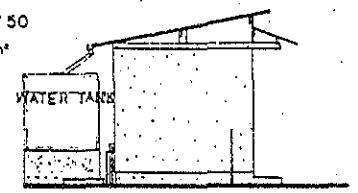
FLOOR PLAN S=1/50

FLOOR SPACE 10m²

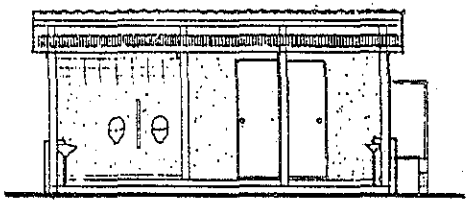


FOUNDATION CEILING PLAN

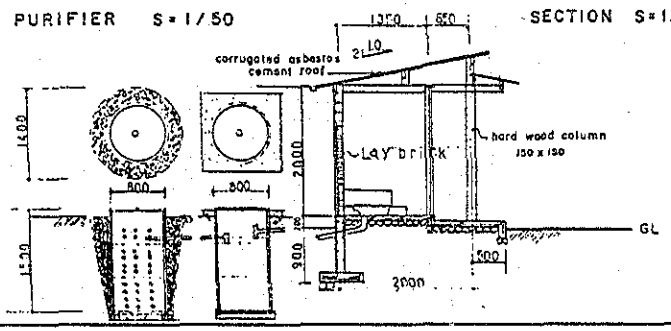
S=1/100



ELEVATION S=1/50



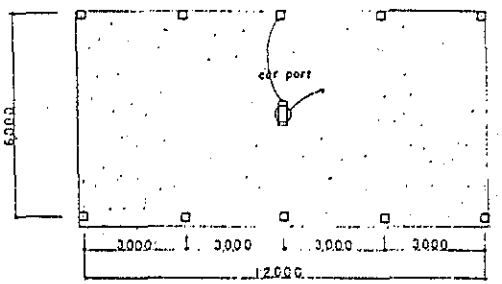
PURIFIER S=1/50



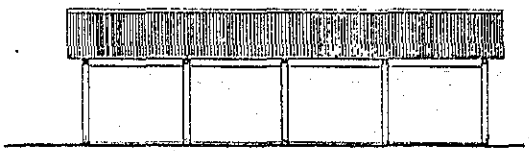
SECTION S=1/50

CAR PORT

FLOOR PLAN S=1/100

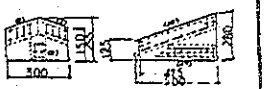


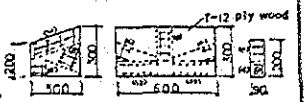
FLOOR SPACE 72m²

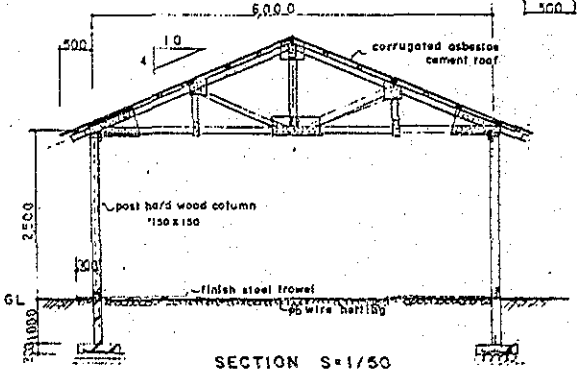


ELEVATION S=1/100

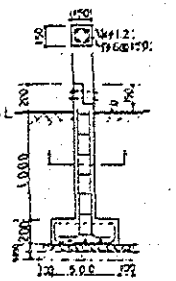
DETAILS OF GUSSET PLATE







SECTION S=1/50



FOOTING DETAIL

CONSTRUCTION WORK FOR FOREST RESEARCH
DEMONSTRATION AND EXTENTION CENTER

(7) Water Supply Facilities

The well located on the neighbouring Kasetsart University site was studied. Water from this well is pumped from a depth of 60m and the well is indispensable during the dry season. Since the well water has a high Fe content (Refer to Chapter 8.6), making it unsuitable for drinking, the installation of a filter has been decided. While the originally designed size of the water tank was 4m x 4m x 4m, this has been reduced to 4m x 4m x 3m ($48m^3$) in view of the results of the evaluation of the possible water consumption volume (see Fig. 19).

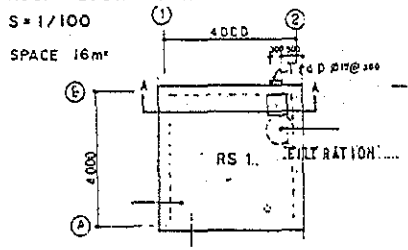
(8) Power Facilities

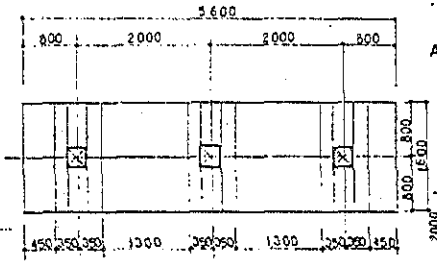
As the public power supply terminal is only 5km from the project site, the possible extension of this public power line and the use of an independent power generation unit were both studied. No conclusion was reached during the study period and the present design therefore incorporates both cases. The capacity of the independent power generation unit for the Center building will be kept to a minimum to cater for only lighting. However, wall sockets will be provided throughout the building in the case of the public power supply becoming available.

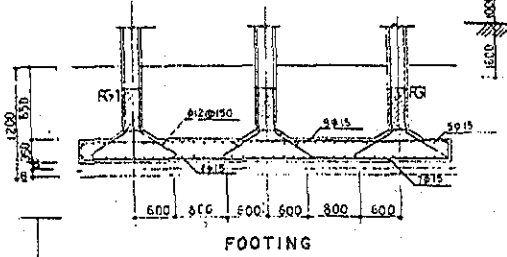
(9) Public Conveniences

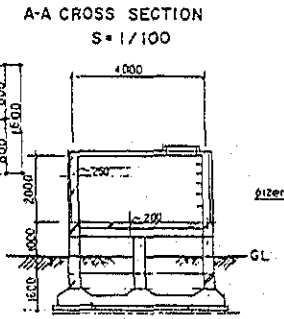
Based on the Thai side's strong request for the provision of public conveniences in the exhibition forest which currently lacks such facilities, it has been decided that a minimum facility ($10m^2$) will be constructed which will be of Thai style and which will use rainwater. Water will also be pumped from a neighbouring pond in the dry season.

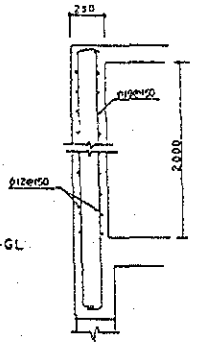
WATAR TANK

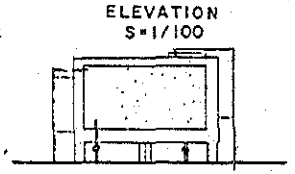


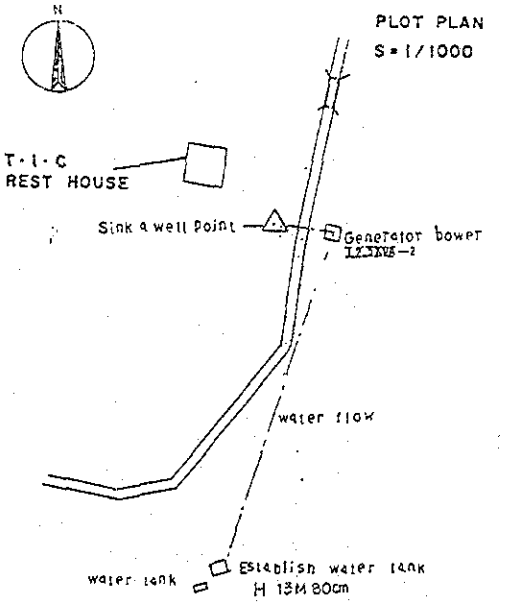


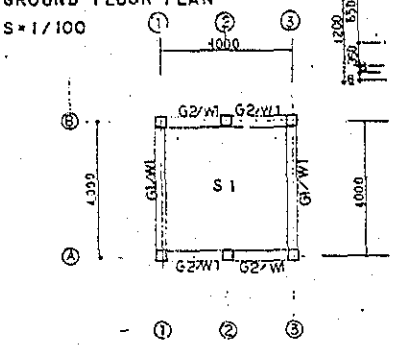


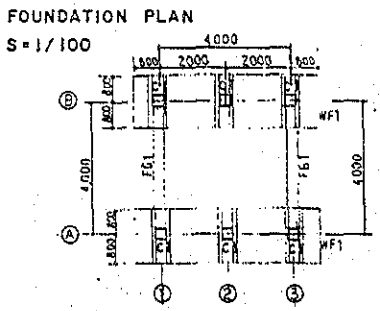


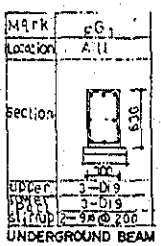


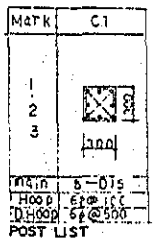






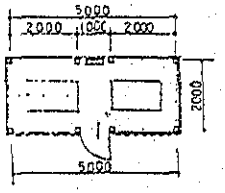


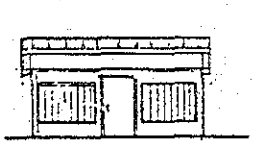


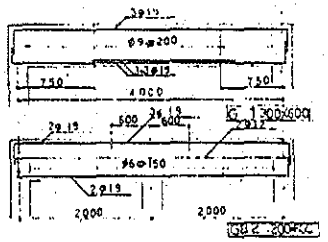


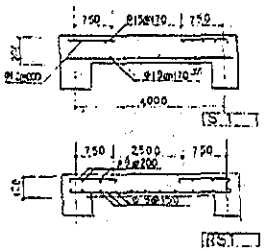
FOUNDATION DETAIL PLAN S=1/30

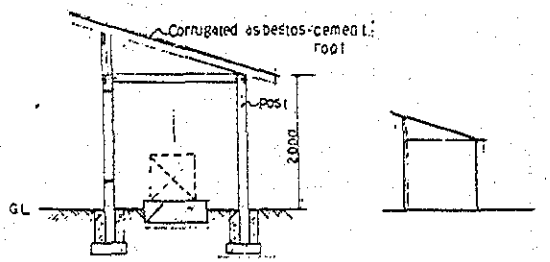
Exterior	Waterproofed cement.
Interior	Metallic type waterproofing.











CONSTRUCTION WORK FOR FOREST RESEARCH
DEMONSTRATION AND EXTENTION CENTER

- 99 -

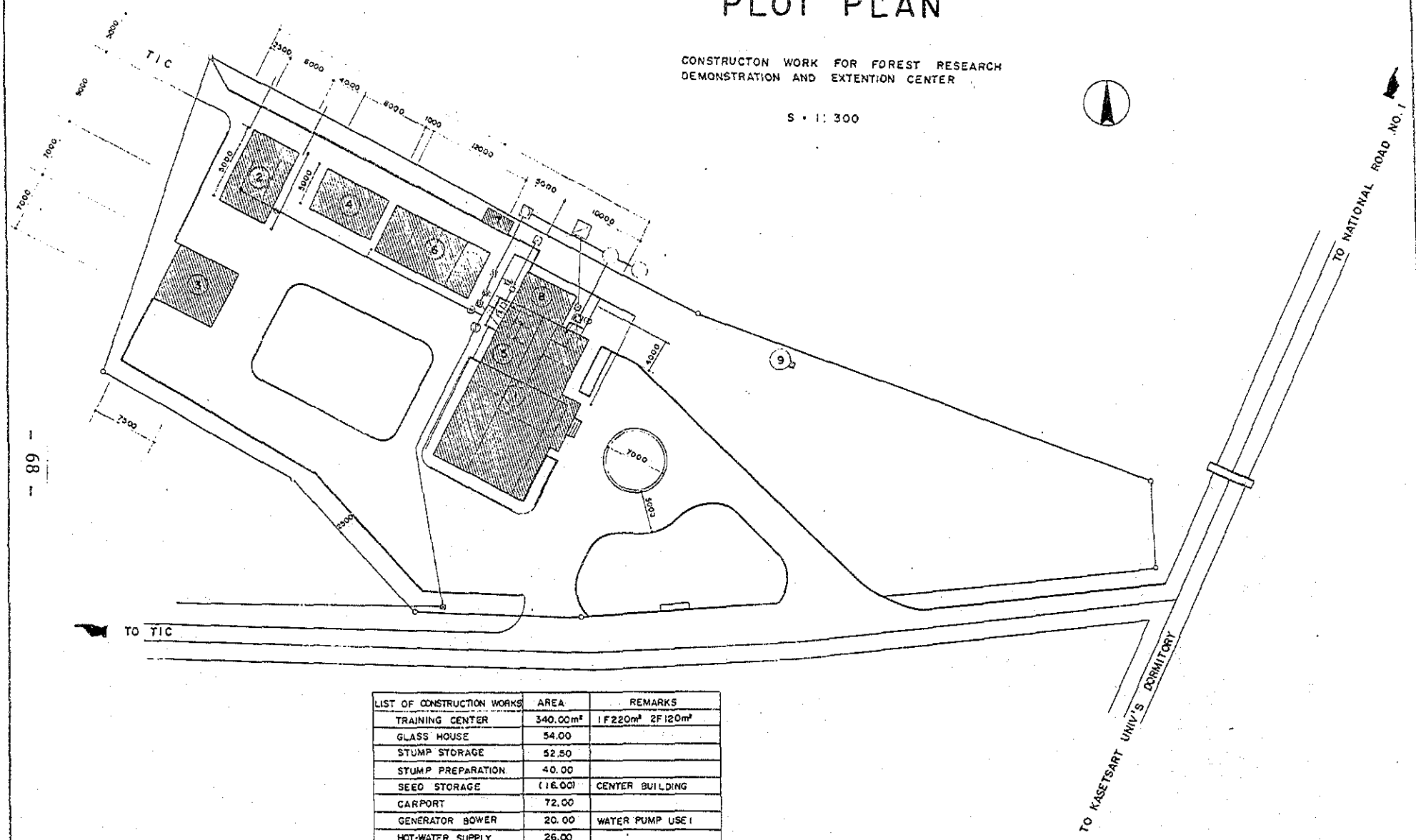
3.5.4 Preparation of Plot Plan

Based on the various drawings referred to earlier, the layout of the Center building, glasshouse, stump storage, stump preparation house and car port, etc. has been decided in view of maximizing their functions with the effective distribution of passageways.

PLOT PLAN

CONSTRUCTON WORK FOR FOREST RESEARCH
DEMONSTRATION AND EXTENTION CENTER

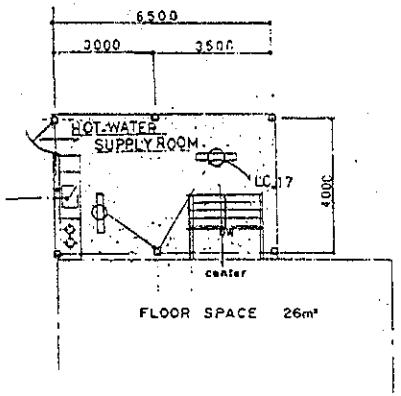
S = 1: 300



LIST OF CONSTRUCTION WORKS	AREA	REMARKS
TRAINING CENTER	340.00m²	1F220m² 2F120m²
GLASS HOUSE	54.00	
STUMP STORAGE	52.50	
STUMP PREPARATION	40.00	
SEED STORAGE	(16.00)	CENTER BUILDING
CARPORT	72.00	
GENERATOR BOWER	20.00	WATER PUMP USE I
HOT-WATER SUPPLY	26.00	
CLIMATIC STATON	1 BOX	
WATER TANK	1 PLACE	

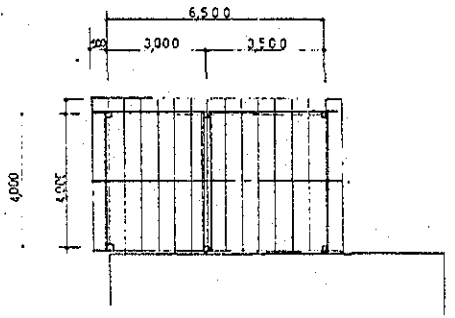
HOT-WATER SUPPLY ROOM

FLOOR PLAN S=1/100

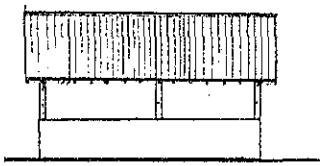


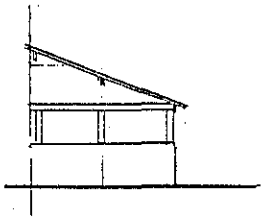
FLOOR SPACE 26m²

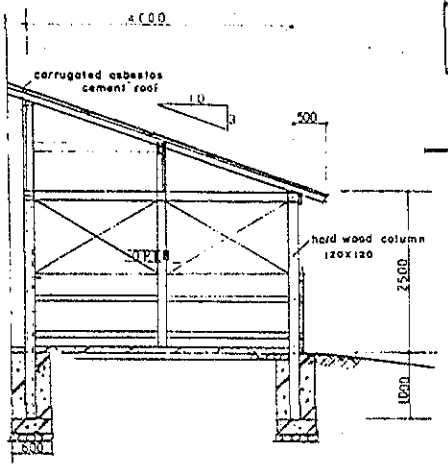
SHED CEILING S=1/100



ELEVATION S=1/100

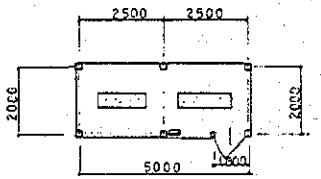




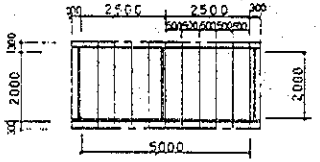


SECTION S=1/50

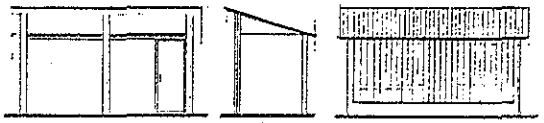
GENERATOR BOWER



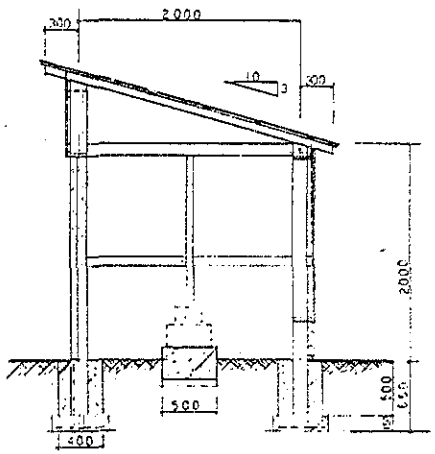
FLOOR PLAN
S=1/100
FLOOR SPACE 10m²



SHED CEILING
S=1/100



ELEVATION S=1/100



SECTION
S=1/30

CONSTRUCTION WORK FOR FOREST RESEARCH DEMONSTRATION AND EXTENTION CENTER	承認	設計	作図	縮尺	工事名称
				設計年月日	図面名称

図面番号 No. 15/15

Fig. 21 Hot-water Supply Room & Generator Bower

CHAPTER 4

Project Cost Estimate

4. Project Cost Estimate

The project cost has been estimated as follows based on the study and design achievements.

(1) The estimate of the main work cost assumes the use of sub-contractors.

(2) The estimates of the equipment, material and labour costs are based on the unit prices given by the study in the Ngao area which was conducted in August, 1989. Since a construction boom is currently in progress in the project area, resulting in both price increases and shortages of construction materials, the unit prices adopted are for arrival on site and are based on the assumption that construction work under the Project will commence in the first half of 1990.

(3) The rate of miscellaneous expenses has been set at 20% of the direct work cost in view of the miscellaneous expenses in current construction examples in Thailand.

CHAPTER 5

Tentative Work Schedule

5. Tentative Work Schedule

Facility	Item	Qunatity	Unit (Number)	Work Duration (days)
Center	Center Building (with Land Preparation)	340	m^2	Contract 20
	Glasshouse	54	m^2	
	Stump Storage	525	m^2	
	Stump Preparation House	40	m^2	
	Seed Storage	(16)	m^2	Inside Center Building
	Car Port	72	m^2	
	Hot-water Supply Room	26	m^2	
	Water Supply Facilities	1	set	
	Extension of Public Power Supply	1	set	
	Generator Bower	20	m^2	
Arboretum	Public Conveniences	10	m^2	
	Information Boards	1		
	Name Plates for Trees	1	set	
	Bridge	1		

CHAPTER 6

Construction Period

6. Construction Period

The planned construction period is some 165 days, from January 1990 to July 1990, as work in the dry period is preferable.

CHAPTER 7

Estimate

7. Estiamte

7.1 Table of General Construction Costs (Using Own Power Generation Unit)

No	Type of Work	Quantity	Cost(Baht)	Remarks
1	Land Preparation and Exterior Work	1	318,089	
2	Center Building	220m^2 (gd. fl) 120m^2 (1st fl) 26m^2(hot-water supply room)	3,824,610	56,406B for hot-water supply room
3	Glasshouse	54m^2	379,985	
4	Stump Storage	52.5m^2	98,066	
5	Stump Preparation House	40m^2	115,361	
6	Seed Storage	16m^2	0	Inside Center Building
7	Car Port	72m^2	94,867	
8	Information Board at Access Point on NR.1	1	69,293	
9	Name Plates for Trees	1	74,000	
10	Public Conveniences	10m^2	136,793	
11	Cross Open Culvert	1	41,877	
12	Water Supply Facilities (including Water Tank)	1	1,856,533	
13	Climatic Box	1	26,000	
	Total Direct Cost		7,035,474	
14	Site Expenses (10% of Total Direct Cost)		703,547	
15	Miscellaneous Expenses (5% of Total Direct Cost)		351,774	
16	Taxes (3.4% of Total Direct Cost, Site Expenses and Miscellaneous Expenses)		275,087	
	Total Expenses		1,330,408	
	GRAND TOTAL		8,365,882	

7.2 Cost Breakdown Tables (Using Own Power Generation Unit)

1. Breakdown of Land Preparation and Exterior Work Costs

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Land Preparation	Grading	1			64,000	
Building Name Plate	Wood	1			30,000	
Curb	Concrete	437	m	330	144,210	
Gravel		1,100	m^2	60	66,000	
Transportation		1			13,879	
TOTAL					318,089	

2. Breakdown of Center Building Construction Cost (including Seed Storage Cost)

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
A. Construction Work						
(1) Temporary Work						
	Lay-out	1			1,100	
	Scaffolding	1			81,180	
	Compensation for Damaged Materials	1			20,150	
	SUB-TOTAL				102,430	
(2) Grading and Excavating						
	Excavating	186	m^3	36	6,696	
	Backfilling	1			1,934	
	Crushed Stones and Foundation	30	m^3	250	7,500	
	SUB-TOTAL				16,130	
(3) Concrete Work						
	Blind Concrete Placing	9	m^3	1,900	17,100	
	Structural Concrete Placing	92	m^3	2,100	193,200	
	Compensation for Damaged Forms	1,169	m^3	300	350,700	
	SUB-TOTAL				561,000	
(4) Structural Steel Work						
	Structural Steel Shapes	27.1	t	14,700	398,370	
	Processing and Assembly	1			61,818	
	Miscellaneous	1			6,808	
	SUB-TOTAL				466,996	

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
(5) Brick Work						
Brick Walls		301	m^2	300	90,300	
Transportation		1			4,816	
SUB-TOTAL					95,116	
(6) Carpentry and Joinery						
Timber		15	m^3	7,000	105,000	
Reception Counter		1			10,000	
Storage Shelves		1			5,000	
Handrails		1			7,100	
Work Cost		1			126,000	
Nails and Hardware		1			8,000	
SUB-TOTAL					261,100	
(7) Roofing Work						
Slate Tile	Foundation Work included	357	m^2	300	107,100	
Corrugated Asbestos Sheets	Eaves	1			1,785	
Waterproofing Metal Plates		40	m	200	8,000	
SUB-TOTAL					116,885	
(8) Tiling Work						
Floor Tiles	Entrance Portch	13.5	m^2	500	6,750	
Mozaic Tiles	Toilet Floor	20	m^2	400	8,000	
Wall Tiles	Toilet Walls	66	m^2	450	29,700	
Non-Slip Tiles	Stairs	33	m	350	11,550	
SUB-TOTAL					56,000	

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
(9) Metal Items						
Lightweight Steel Frames	Ceiling	302	m^2	200	60,400	
Balusters		1			5,000	
SUB-TOTAL					65,400	
(10) Plaster Work						
Mortar Coating of Floor		359	m^2	140	50,260	
Mortar Coating of Baseboards		125	m	40	5,000	
Mortar Coating of Interior Walls	with Plaster Finish	600	m^2	180	108,000	
Mortar Coating of Exterior walls	with Water-proofing Coat	251	m^2	190	47,690	
Mortar Coating of Handrails	Entrance and Stairs	12.4	m^2	190	2,356	
Fitting of balusters	Ceramic Blue	72		150	10,800	
Terrazzo Partitions		1			46,130	
SUB-TOTAL					270,236	
(11) Steel Doors and Windows						
Entrance Door	with Steel Frame	1			25,000	
Corridor Door	"	1			15,000	
Storage Door	"	1			15,000	
Exhibition Room Door	with Aluminium Frame	1			15,000	
Installation Cost		1			5,160	
Glass		1			5,210	
SUB-TOTAL					80,370	

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
(12) Wood Doors and Windows						
Windows	with Frame and Net	13		7,000	91,000	
Window	with Frame for Stair Room	1			7,000	
Small Window	with Frame and Net	1			2,500	
Entrance Door	for Exhibition Room with Frame	1			8,000	
Entrance Door	for Training Room with Frame	1			7,000	
Entrance Doors	for All Rooms	11		3,000	33,000	
Movable Partitions	1F, 2F	3		35,000	105,000	
Toilet Doors		4		2,500	10,000	
Installation Cost		1			32,600	
Hardware		1			38,700	
Glass		1			2,892	
SUB-TOTAL					337,692	
(13) Painting Work						
Oil Paint	Steel Parts	1			23,400	
Varnish	Wood Parts	1			25,500	
SUB-TOTAL					48,900	
(14) Interior Work						
Plastic Tile Installation	Floors	274	m^2	400	109,600	
Baseboard Decoration		83	m^2	80	6,640	
Fibreboard Installation	Ceilings	274	m^2	300	82,200	
SUB-TOTAL					198,440	

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
(15) Miscellaneous Work						
Towel Hangers		1			500	
Office Desks and Chairs		1			185,185	
Washbasins		1			5,000	
Blackboards	with Screen	1			8,000	
Ventilation Fan	for Storage	1			3,000	
Handrails (Wood)	for Inside Stairs	6	m	1,000	6,000	
Solar Heater		1			55,000	
Veranda Door		1			2,000	
Curtains		4		2,500	10,000	
Beds		2		9,300	18,600	
Locker Unit		1			6,000	
Tables		2		3,500	7,000	
Chairs	Leather	2		2,500	5,000	
SUB-TOTAL					311,285	
TOTAL					2,987,980	
(16) Transportation						
Transportation		1			82,613	
SUB-TOTAL					82,613	
GRAND TOTAL					3,070,593	

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
B. Electric Installation						
(1) Electrical Distribution						
Wiring for Lighting		47		340	15,980	
Wiring for Switches		31		105	3,255	
Wiring for Power Outlets		44		215	9,460	
Apparatus		1			70,000	
Panelboard Installation		1			20,000	
Work Cost		1			35,000	
TV Wiring		1			12,000	
Telephone Wiring		1			10,000	
Extension of Main Power Line		1			30,000	
Generator	5KVA	2	set	93,000	186,000	
Power Supply Switchover Unit	Includ Box	1			5,000	
Fuel Tank		1			5,000	
Installation and Adjustment		1			5,000	
Expendables		1			1,904	
Miscellaneous Materials		1			3,808	
Transportation		1			11,442	
SUB-TOTAL					423,849	
(2) Generator Hosue						
Lay-out		1			50	
Excavating		2.1	m^3	36	75	
Crushed Stone Foundation		0.5	m^3	250	125	
Concrete Placing		1.8	m^3	2,000	3,600	
Forms		19.6	m^2	300	5,880	
Steel Bars		0.04	t	26,000	1,040	
Timber		0.56	m^3	7,000	3,920	
Asbestos Cement Sheets		8		430	3,440	

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Work Cost		1			500	
Transportation		1			540	
SUB-TOTAL					19,170	
TOTAL					443,019	

C. Plumbing Installation

Outside Water Pipes	Steel (1")	85	m	315	26,775
Outside Water Pipes	Steel (3/4")	40	m	215	8,600
Outside Water Pipes	Steel (1/2")	5	m	165	825
Inside Water Pipes	Steel (3/4")	25	m	215	5,375
Inside Water Pipes	Steel (1/2")	10	m	165	1,650
Joints for Water Pipes		1			11,169
Gate Valves	with Boxes	5		2,000	10,000
Expendables and Miscellaneous Materials		1			1,287
Water Supply Work Cost		1			15,808
Sewer Pipes	VP 4"	60	m	813	48,780
Sewer Pipes	VP 3"	50	m	505	25,250
Sewer Pipes	VP 2"	10	m	235	2,350
Joints for Sewer Pipes		1			1,527
Catch Basin	Concrete	9		1,000	9,000
Catch Basin	Concrete, ϕ800 - 5 stages	1			5,370
Purification Tub	with Material and Work Costs	1			25,000
Expendables and Miscellaneous Materials		1			6,196
Sewer Work Cost		1			14,360
Toilet Bowl (Western Style)	Coloured	1	set		2,120

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Toilet Bowl (Thai Style)	Coloured	4	set	500	2,000	
Urinals	Coloured	2	set	715	1,430	
Shower		1	set		4,450	
Washbasins	Coloured	3	set	1,195	3,585	
Toilet Roll Holders		5	set	260	1,300	
Mirrors		4	set	900	3,600	
Soap Holders		1	set		470	
Toilet Racks		3	set	760	2,280	
Liquid Soap Holders		3	set	690	2,070	
Water Taps		4	set	575	2,300	
Sprinklers		4	set	270	1,080	
Expendables and Miscellaneous Materials		1			1,163	
Installation		1			6,610	
Transportation		1			812	
SUB-TOTAL					254,592	
TOTAL					254,592	
GRAND TOTAL					3,768,204	

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Breakdown of Hot-Water Supply Room Construction Cost						
Lay-out		1			210	
Excavating		4.6	m^3	36	165	
Crushed Stone Foundation		2.9	m^3	250	725	
Forms		17.3	m^2	300	5,190	
Concrete Placing		5.2	m^3	2,000	10,400	
Wire Net	ϕ6 150x150	25	m^2	80	2,000	
Timber		1.63	m^3	7,000	11,410	
Carpentry		1			5,000	
Nails and Hardware		1			300	
Corrugated Slates		52	m^2	90	4,680	
Asbestos Sheets		12		195	2,340	
Sink		1			2,500	
Gas Table		1			2,000	
Electric Installation		1			5,000	
Water Supply and Sewage (Inside)		1			3,000	
Transportation		1			1,486	
TOTAL					56,406	

3. Breakdown of Glasshouse Construction Cost

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Lay-out		1			270	
Excavating		10.5	m^3	36	378	
Crushed Stone Foundation		6.9	m^3	250	1,725	
Forms		48	m^2	300	14,400	
Wire Net		54	m^2	80	4,320	
Steel Bars	Including processing	0.15	t	26,000	3,900	
Concrete Placing		13	m^3	2,000	26,000	
Mortar Floor Coating		54	m^2	70	3,780	
Mortar Low Wall Coating		23.4	m^2	100	2,340	
Brick Laying		23.4	m^2	300	7,020	
Work Tables	Concrete	2		10,000	20,000	
Work Table	Iron	1		9,000	9,000	
Steel Frames		1.1	t	13,000	14,300	
Processing and Assembly		1			12,000	
Miscellaneous Materials		1			1,500	
Installation		1			1,400	
Painting		1			7,000	
Aluminium Work		1			130,000	
Glass Work		1			98,952	
Sprinklers	with Plumbing cost	1			14,900	
Transportatin		1			6,800	
TOTAL					379,985	

4. Breakdown of Stump Storage Construction Cost

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Lay-out		1			262	
Excavating		38.4	m^3	36	1,382	
Crushed Stone Foundation		4.3	m^3	250	1,075	
Forms		61.2	m^2	300	18,360	
Concrete Placing		7.2	m^3	2,000	14,400	
Brick Laying		34.2	m^2	300	10,260	
Timber		3.1	m^3	5,000	15,500	
Work Cost		1			17,600	
Nails and Hardware		1			500	
Thatched Roof		106.2	m^2	80	8,496	
Thatched Walls		72.5	m^2	30	2,175	
Wood Doors		4		1,300	5,200	
Transportation		1			2,856	
TOTAL					98,066	

5. Breakdown of Stump Preparation House Construction Cost

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Lay-out		1			200	
Excavating		3.9	m^3	36	140	
Crushed Stone Foundation		5.7	m^3	250	1,425	
Forms		34.8	m^2	300	10,440	
Concrete Placing		8.5	m^3	2,000	17,000	
Steel Bars		0.1	t	26,000	2,600	
Wire Net	ϕ6 150x150	54	m^2	80	4,320	
Corrugated Slate Roofing		76	m^2	90	6,840	
Timber		4.4	m^3	7,000	38,290	
Plywood	for Gusset Plates	10	m^2	200	2,000	
Work Cost		1			14,000	
Nails and Hardware		1			400	
Work Tables		2		5,000	10,000	
Lighting Installation		1			5,000	
Transportation		1			2,706	
TOTAL					115,361	

6. Breakdown of Seed Strage

Included in 2.

7. Breakdown of Car Port Construction Cost

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Lay-out		1			360	
Excavating		10.5	m^3	36	378	
Crushed Stone Foundation		7.8	m^2	250	1,950	
Forms		35.2	m^2	300	10,560	
Concrete Placing		9.7	m^3	2,000	19,400	
Wire Net	for Earth Floor	72	m^2	80	5,760	
Steel Bars		0.13	t	26,000	3,380	
Timber		3.14	m^3	7,000	21,980	
Plywood	for Gusset Plates	8	m^2	200	1,600	
Corrugated Slate Roofing		101.4	m^2	90	9,126	
Work Cost		1			13,000	
Lighting Installation		1			5,000	
Transportation		1			2,373	
TOTAL					94,867	

8. Breakdown of Information Board Construction Cost

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Information Boards	Aluminium	2		34,000	68,000	at Access Point on NR.1 and Center Entrance
Work Cost		1			753	
Transportation		1			540	
TOTAL					69,293	

9. Breakdown of Tree Name Plate Cost

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Metal Plates	3cm x 5cm	500		55	27,500	
Ceramic Plates	15cm x 35cm	300		155	46,500	
TOTAL					74,000	

10. Breakdown of Public Conveniences Construction Cost

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Lay-out		1			50	
Excavating		16	m^3	36	576	
Crushed Stone Foundation		2.5	m^3	250	625	
Forms		36	m^2	300	10,800	
Concrete Placing		4.6	m^3	2,000	9,200	
Steel Bars		0.15	t	26,000	3,900	
Brick Laying		21	m^2	140	2,940	
Mortar Wall Coating	also for Well Section	63.6	m^2	100	6,360	
Mortal Floor Coating		12.5	m^2	70	875	
Timber		0.5	m^3	7,000	3,500	
Slate Roofing		18.5	m^2	90	1,665	
Carpentry		1			5,000	
Nails and Hardware		1			130	
Wood Doors		2		1,500	3,000	
Toilet Bowls	Thai Style	2		200	400	
Urinals		2		520	1,040	
Handbasins		2		300	600	
Guttering		1			1,000	
Water Tank	1.2mx1.2mx1.2m	1		4,000	4,000	
Water Taps		5		625	3,125	
Water Pipes		40	m	92	3,680	
Joints and Valves for Water Pipes		1			5,000	
Plumbing Cost		1			4,946	
Purifier	Concrete Pipes (ϕ800)	8		2,300	18,400	
Septic Tank Lid		2		750	1,500	
Sewer Pipes	ϕ100	30	m	813	24,390	
Manhole Lid	ϕ800	2		500	1,000	
Joints, etc. for Sewage System		1			325	

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Work Cost	Excavating and Plumbing for Purifier	1			14,424	
Crushed Stones		2.0	m^3	230	460	
Concrete		0.3	m^3	2,000	600	
Wire Net	ϕ6 150 x 150	1	m^2		80	
Transportation		1			3,202	
TOTAL					136,793	

11. Breakdown of Cross Open Culvert Construction Cost

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Excavating		15.24	m^3	80	1,219	
Refillng		10.07	m^3	60	604	
Crushed Stone Foundation		0.55	m^3	250	138	
Forms		19.50	m^2	300	5,850	
Concrete Placing		0.44	m^3	2,000	880	
Steel Bars	ϕ15	0.13	t	26,000	3,380	
Grating	750 x 1,000	5.00	m	1,900	9,500	
Work Cost		1.00			17,600	
Transportation		1.00			2,706	
TOTAL					41,877	

12. Breakdown of Water Supply Facility Construction Cost

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
(1) Construction of Water Tank						
Lay-out		1			80	
Excavating		43.2	m^3	36	1,555	
Crushed Stone Foundation		6	m^3	250	1,500	
Forms		162	m^2	300	48,600	
Concrete Placing		29.5	m^3	2,000	59,000	
Steel Bars		4.3	t	26,000	111,800	
Scaffolding		1			500	
Exterior Mortar Coating		81	m^2	60	4,860	
Interior Waterproof Mortar Coating		64	m^2	80	5,120	
Automatic Water Supply Unit		1			7,000	
Water Purifier	with Manhole Lid	1			19,000	
Transportation		1			7,511	
SUB-TOTAL					266,526	
(2) Plumbing of Water Supply Pipes						
Water Pump	ϕ32, Head: 76, Output 1.1K	1			92,700	
Water Pump Cable		1			7,750	
Water Pump Pipes	ϕ32	1			48,200	
Boring		1			345,800	
Excavation	with Refilling	300	m^3	80	24,000	
Water Pipes	Steel (4")	100	m	1,435	143,500	
Water Pipes	Steel (3")	125	m	990	123,750	
Water Pipes	VP (2")	910	m	235	213,850	
Generator	12, 5KVA	2		222,000	444,000	
Fule Tank		1			5,000	
Power Supply Switchover Unit		1			5,000	

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Installation and Adjustment		1			5,000	
Valves		1			21,000	
Expendables and Miscellaneous Materials		1			12,044	
Work Cost		1			42,800	
Transportation		1			36,443	
SUB-TOTAL					1,570,837	
(3) Construction of Generator Bower						
Lay-out		1			50	
Excavating		2.1	m^3	36	75	
Crushed Stone Foundation		0.5	m^3	250	125	
Concrete Placing		1.8	m^3	2,000	3,600	
Forms		19.6	m^2	300	5,880	
Steel Bars		0.04	t	26,000	1,040	
Timber		0.56	m^3	7,000	3,920	
Asbestos Cement Sheets		8		430	3,440	
Work Cost		1			500	
Transportation		1			540	
SUB-TOTAL					19,170	
TOTAL					1,856,533	

13. Breakdown of Climatic Box Construction Cost

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Climatic Box	600 x 600	1			26,000	Box only
TOTAL					26,000	

7.3 Table of General Construction Costs (Using Public Power Generation Unit)

No	Type of Work	Quantity	Cost(Baht)	Remarks
1	Land Preparation and Exterior Work	1	318,089	
2	Center Building	220m^2 (gd. fl) 120m^2 (1st fl) 26m^2(hot-water supply room)	3,604,440	56,406B for hot-water supply room
3	Glasshouse	54m^2	379,985	
4	Stump Storage	52.5m^2	98,066	
5	Stump Preparation House	40m^2	115,361	
6	Seed Storage	16m^2	0	Inside Center Building
7	Car Port	72m^2	94,867	
8	Information Board at Access Point on NR.1	1	69,293	
9	Name Plates for Trees	1	74,000	
10	Public Conveniences	10m^2	136,793	
11	Cross Open Culvert	1	41,877	
12	Water Supply Facilities (including Water Tank)	1	1,378,363	
13	Public Power Supply Extension Work Cost	1	1,505,316	
14	Climatic Box	1	26,000	
	Total Direct Cost		7,842,450	
15	Site Expenses (10% of Total Direct Cost)		784,245	
16	Miscellaneous Expenses (5% of Total Direct Cost)		392,123	
17	Taxes (3.4% of Total Direct Cost, Site Expenses and Miscellaneous Expenses)		306,640	
	Total Expenses		1,483,008	
	GRAND TOTAL		9,325,458	

7.4 Cost Breakdown Tables (Using Public Power Generation Unit)

1. Breakdown of Land Preparation and Exterior Work Costs

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
Land Preparation	Grading	1			64,000	
Building Name Plate	Wood	1			30,000	
Curb	Concrete	437	m	330	144,210	
Gravel		1,100	m^2	60	66,000	
Transportation		1			13,879	
TOTAL					318,089	

2. Breakdown of Center Building Construction Cost (including Seed Storage Cost)

Item	Summary	Quantity	Unit	Unit price	Cost	Remarks
A. Construction Work						
(1) Temporary Work						
Lay-out		1			1,100	
Scaffolding		1			81,180	
Compensation for Damaged Materials		1			20,150	
SUB-TOTAL					102,430	
(2) Grading and Excavating						
Excavating		186	m^3	36	6,696	
Backfilling		1			1,934	
Crushed Stones and Foundation		30	m^3	250	7,500	
SUB-TOTAL					16,130	
(3) Concrete Work						
Blind Concrete Placing		9	m^3	1,900	17,100	
Structural Concrete Placing		92	m^3	2,100	193,200	
Compensation for Damaged Forms		1,169	m^3	300	350,700	
SUB-TOTAL					561,000	
(4) Structural Steel Work						
Structural Steel Shapes		27.1	t	14,700	398,370	
Processing and Assembly		1			61,818	
Miscellaneous		1			6,808	
SUB-TOTAL					466,996	